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Does Financial Development Mitigate Negative Effects of Policy Uncertainty on Economic Growth?

by

Robert Lensink

Centre for Research in Economic Development and International Trade, University of Nottingham

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The Author

Robert Lensink is External Fellow of CREDIT and Associate Professor, Faculty of Economics, University of Groningen.

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Abstract
By performing a cross-country growth regression for the 1970-1998 period this paper finds evidence for the fact that countries with a more developed financial sector are better able to nullify the negative effects of policy uncertainty on per capita economic growth. This clearly indicates the relevance of financial sector development.

Outline

1. Introduction
2. Uncertainty, financial development and economic growth
3. The policy uncertainty measures and the indicator for financial development
4. The method and base model regression results
5. Explaining financial market development: estimates with instruments
6. Stability analysis
7. Conclusions

1. INTRODUCTION

The importance of stable and predictable macroeconomic policies for economic growth, especially for developing countries, has been debated quite extensively in the literature. Many authors state that the successful implementation of a structural adjustment program crucially depends on government policies being credible (see, *e.g.* Rodrik, 1989 and Calvo, 1988). In line with this, several studies suggest that policy uncertainty has a negative effect on aggregate investment and economic growth (see Aizenman and Marion, 1993, and Lensink, Bo and Sterken, 1999).

The literature on financial development and economic growth argues that financial intermediaries can better manage risk than individual wealth-holders. This implies that firms in countries with a more developed financial sector are better able to diversify risks, enabling them to carry out the more risky, but also more productive investment projects. This suggests that the effect of policy uncertainty on economic growth is dependent on the development of the financial sector. However, quite remarkable, there are no empirical studies available that have tried to test this. This paper partly fills this gap by examining whether a well-developed financial sector may undo the negative effects of policy uncertainty on economic growth. It investigates whether a **given** level of policy uncertainty has a different effect on economic growth in countries with a well-developed financial sector as compared to countries with a poorly developed financial sector.[1] This is done by performing a Barro (1991) -type cross-country growth regression, in which different policy uncertainty measures are included, and in which the interaction between policy uncertainty and financial development is taken into account.

Section 2 surveys relevant literature for the analysis of this paper. I do not present a formal model, but present several reasons as to why the uncertainty-growth relationship probably depends on the degree of financial market development. Section 3 explains how uncertainty and financial sector development is measured. Section 4 describes the

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[1] It may also be relevant to examine whether financial development affects the degree of uncertainty as such. However, that is not the focus point of this paper.

method, and presents regression results of a base model. Section 5 re-estimates the base model by using instruments for financial market development. This is an important issue in the new literature on financial market development and economic growth (see Levine, 1997a and Levine, Loayza and Beck, 1999). Section 6 examines the robustness of the results. Section 7 concludes.

2. UNCERTAINTY, FINANCIAL DEVELOPMENT AND ECONOMIC GROWTH

The literature on policy uncertainty and economic growth is closely connected to a now booming research theme regarding the effects of uncertainty on investment. Well-known references in this field are Lucas and Prescott (1971), Arrow (1968), Abel (1983), Bernanke (1983), Caballero (1991), Abel and Eberly (1994), Dixit and Pindyck (1994) and Leahy and Whited (1996). Lensink, Bo and Sterken (2000) present an up to date overview. The literature shows that the impact of uncertainty on investment depends on many factors, such as the risk behavior, the production technology in combination with the market structure, the degree of irreversibility and expandability of investments and the degree of capital market imperfections. Most models assume that firms are risk-neutral. Traditionally, these models argue that uncertainty has a positive effect on investment. For instance, Abel (1993) and more recently Caballero (1991), show that an increase in (price) uncertainty stimulates investment as long as the marginal revenue product of capital is a convex function of prices. This is always the case whenever firms are perfectly competitive and the production function has constant returns to scale. In the case where firms are not perfectly competitive, and/or the production function does not have constant returns to scale, the investment-uncertainty sign is not necessarily positive. It depends *e.g.* on the degree of irreversibility and expandability of investment.

The modern option approach to invest (Dixit and Pindyck, 1994) argues that investment is (partly) irreversible due to sunk costs which can not be recovered completely by selling capital when the investment has been done. In these models the “bad news principle of irreversible investment” holds. This principle implies that higher uncertainty does not symmetrically affect outcomes in the good and bad states. For instance, if demand is unexpectedly high (good state), the firm can easily increase the capital stock. However, if the demand is unexpectedly low (bad state) the firm can not undo the investment decision due to the irreversibility of investment. Therefore only bad news will affect the current investment decision and hence higher uncertainty leads to a decrease in immediate investment. Due to the close connection between investment and economic growth, an increase in uncertainty would probably have also a negative effect on economic growth.

In addition to the effect of the degree of irreversibility on the investment-uncertainty relationship, the development of the financial market matters. Early contributions to the theory of financial intermediation and economic growth are due to Schumpeter (1939) and Gurley and Shaw (1955). They have stressed that financial intermediation could contribute to economic growth by mobilizing saving and increasing the productivity of capital. The relationship between financial markets and economic growth is now one of the most important issues in development economics. There are too many studies to mention, but see Levine and Renelt (1992), King and Levine (1993), Hermes and Lensink (1996 and 1998), Levine (1997) and Levine, Loayza and Beck (1999) for some recent theoretical and empirical contributions. The recent literature argues that financial intermediaries primarily contribute to enhanced economic growth by providing a more efficient allocation of resources. Financial intermediaries have larger pools of financial resources as compared to individual wealth holders, so that they are better able to reduce the adverse impact of risks of failing projects on the total returns earned by diversifying their portfolio of investments financed. In other words, financial intermediaries are able to diversify and pool risks. Moreover, financial intermediation leads to a reduction of liquidity risks. Agents are uncertain about future liquidity needs. Therefore, agents in an uncertain world without financial intermediaries will hold a substantial part of their wealth in liquid assets, probably yielding low returns. Hence, without a well-developed financial sector, many projects with high returns in the long-run will probably not be carried out in an uncertain world. Financial intermediaries may contribute to enhanced resource allocation by agglomerating the saving of many individuals and funnel these resources to high return, low liquidity investment projects. Therefore, financial intermediaries can both reduce liquidity risks for individuals and at the same time increase investment efficiency. Moreover, in case of uncertain demand or productivity shocks in the macroeconomic environment investing in firms by individual wealth holders is highly risky, and hence will probably not take place. Since financial intermediaries, by holding diversified portfolios, are better able to reduce risks of highly fluctuating returns, a well-developed financial sector may contribute to financing a higher volume and efficiency of investment. In addition, if capital markets are imperfect, firms can not issue more equity by which risk can be absorbed (Greenwald and Stiglitz, 1990). Therefore, if capital markets are imperfect, firms will probably lower investment when uncertainty about profitability increases. Ghosal and Loungani (1997) argue that the uncertainty-investment relationship depends on the degree of capital market imperfections. Peeters (1997), in a study on investment for Belgian and Spanish firms, provides empirical evidence for the fact that financial development matters for the uncertainty-investment relationship. She shows that uncertainty only has a negative effect on investment of firms that are relatively financially constraint.

The aforementioned literature on financial market development and economic growth suggests that the impact of uncertainty on economic growth is dependent on the development of the financial sector of a country. The reason is that a well-developed financial system can manage risks more efficiently. In the case of stock markets, the risk diversification will be direct, whereas it is indirect in the case of commercial banks. In the remainder of the paper the effect of financial market development on the policy uncertainty-economic growth relationship will be tested. The next section explains how I have measured uncertainty and financial development.

3. THE POLICY UNCERTAINTY MEASURES AND THE INDICATOR FOR FINANCIAL DEVELOPMENT

In the literature the following methods to measure uncertainty are used (see Lensink, Bo and Sterken, 2000):

1) The standard deviation of the variable under consideration;
2) The standard deviation of the unpredictable part of a stochastic process;
3) The standard deviation from a geometric Brownian process;
4) The General AutoRegressive Conditional Heteroskedastic (GARCH) model of volatility
5) The standard deviation derived from Survey Data.

The application of the third method (geometric Brownian motion) requires continuous data, which makes the method not applicable to this paper. The fifth method, based on survey data, is also almost impossible to use in this paper since the regressions are done for a cross-section of almost 100 countries. It would need an enormous amount of respondents to obtain reliable data. This leaves three possibilities. In this paper uncertainty will primarily be measured using the second method. This method is somewhat more sophisticated than the first method. Moreover, the fourth method, based on the conditional variance estimated from a General Autoregressive Conditional Heteroskedastic (GARCH)-type model, is especially relevant for high frequency data which display clustering effects. Since the data set used consists of annual observations, estimating uncertainty by the variance of the unpredictable part of a stochastic process is appropriate. In order to test the sensitivity of the results for the measurement of uncertainty, regressions are presented in which uncertainty is measured according to the first or fourth method (see Section 6).

The preferred method to measure uncertainty works as follows. First specify and estimate a forecasting equation to determine the expected part of the variable under consideration. Next, the standard deviation of the unexpected part of the variable, *i.e.* the residuals from the forecasting equation, is used as the measure of uncertainty. This approach has also been used by *e.g.* Aizenman and Marion (1993), Ghosal (1995), and Ghosal and Loungani (1996). Differences in the measurement of the uncertainty proxy mostly stem from the way in which the forecasting equation is formulated. I follow the customary approach and use a first-order autoregressive process, extended with a time trend and a constant, as the forecasting equation:

$$P_t = a_1 + a_2 T + a_3 P_{t-1} + e_t,$$

where P_t is the variable under consideration, T is a time trend, a_1 is an intercept, a_3 is the autoregressive parameters and e_t is an error term.

The above equation is estimated for all countries in the data set (see Appendix2), over the 1970-1998 period.[2] By calculating, for each country, the standard deviation of the residuals for the entire sample period, a proxy for uncertainty is derived. Two types of uncertainty can be identified to measure the credibility with regard to monetary and fiscal policies, respectively (see Appendix1 for a list of variables):

UINFL: uncertainty with respect to inflation (P variable is the yearly inflation rate)

UGOV: uncertainty with respect to government consumption (P variable is government expenditures divided by GDP)

[2] I also estimated the forecasting equation by using a second and a third order autoregressive process with trend. Results were similar. For reasons of space it is not possible to present the estimation results for all countries.

The next step consists of the construction of the financial ratio. In several papers, financial ratios are suggested to describe the size and structure of, and/or the distribution, of loans through the financial sector. These papers claim that these ratios contain information about the services provided by the financial institutions (see, among others, King and Levine, 1993). Levine, Loayza and Beck (1999) distinguish three measures: 1) Liquid liabilities of the financial system divided by GDP; 2) The ratio of commercial bank assets divided by commercial bank plus central bank assets and 3) the value of credits by financial intermediaries to the private sector divided by GDP.

Levine, Loayza and Beck (1999) prefer the third measure since it isolates credit issued to the private sector and hence gives information about the amount of loans that are directed to the private sector. I also use credit to the private sector as a percentage of GDP (*CREDPR*) as a measure for financial development. It should be noted that my measure for financial sector development differs somewhat from the

one used by Levine, Loayaza and Beck (1999). The main difference is that their measure excludes credits issued by the monetary authorities and government agencies. I do not use their measure since it is only available for a much smaller data set. Both measures are however strongly correlated (a correlation coefficient of about 90%). Moreover, in Section 6 I will present some estimates in which I use the measure developed by Levine, Loayaza and Beck in order to test the sensitivity of the results. One may argue that the financial market indicator I use does not provide much information about the quality of services of financial intermediaries. However, since there are no better financial market indicators available that deal explicitly with the quality of financial institutions, at the least for a large cross-section of countries, there was not much of a choice.

4. THE METHOD AND BASE MODEL REGRESSION RESULTS

The aim of this paper is to examine whether possible growth reducing effects of policy uncertainty may be nullified by financial sector development. A first question is whether it is more appropriate to use a pure cross-section analysis, or to do the estimates on a panel of countries. In the growth regressions literature both approaches are popular. The choice depends on several factors, such as the aim of the study, data availability and the period over which certain effects are expected to take place. If the panel technique is chosen, it is common to divide the period for which data are available in different sub-periods, usually of five years. The estimates are then performed on averages for the five year periods. For our study an argument in favor of the panel approach using five year averages would be that policies might change in short period of times. On the other hand, a strong argument for the cross-section approach is that a reasonable estimate of the uncertainty proxy needs a long estimation period. The variables used for the uncertainty measure are only available on a yearly basis. Since the uncertainty proxy is calculated by taking the standard deviation of the unpredicted part and the forecasting equation is based on an autoregressive process, a five year period would certainly be too short. For this reason I decided to perform a pure cross-country analysis using data averaged over the 1970-1998 period.

In line with most of the cross-country growth literature, the dependent variable is the growth rate of real per capita Gross Domestic Product (*GRO*). This variable is calculated from an updated series on real GDP per capita figures originally provided by Summers and Heston. I start the analysis by estimating the following equations:

$$(1)\ GRO = a_1 + a_2\,LGDPPCI + a_3 SECI + a_4 CREDPR + a_5 UGOV + a_6 UGOV{*}CREDPR + m$$

$$(2)\ GRO = a_7 + a_8\,LGDPPCI + a_9 SECI + a_{10} CREDPR + a_{11} UINFL + a_{12} UINFL{*}CREDPR + m$$

Where *GRO* is the per capita growth rate of GDP over the 1970-1998 period; *LGDPPCI* is the logarithm of the 1970 of per capita GDP; *SECI* is the 1970 secondary-school enrollment rate and m is an error term.

The interaction term is included in order to capture the importance of financial development for the effects of policy uncertainty on economic growth.[3] A closer look at equation (1) may explain matters. Differentiating (1) with respect to *UGOV* gives:

[3] The approach is in line with that of Ghosal (1991)

d (*GRO*)/d *UGOV* $= a_5 + a_6 * CREDPR$

This clearly shows that the above formulation implies that the growth effects of uncertainty depend on financial development. In line with most empirical analysis, in which it is shown that uncertainty negatively affects economic growth, I expect that $a_5 < 0$. In addition, I assume that countries with a more developed financial system are better able to insure themselves against negative uncertainty effects. Hence, I expect that $a_6 > 0$. If $a_5 < 0$ and $a_6 > 0$, the threshold level of financial development above which uncertainty has a positive effect on economic growth can be calculated by setting the first derivative equal to zero. The threshold level then equals: $-a_5/a_6$.

In order to come up with a reasonable base model I include *LGDPPCI* and *SECI* in the equations. These variables are shown to have a robust and significant impact on economic growth, and hence are included in most recent growth regression studies (see, for instance, Sala-i-Martin, 1997a and 1997b).[4] *LGDPPC* is included to account for the conditional convergence effect. The logarithmic form is suggested by theoretical derivations of the convergence rate (see Barro and Sala-i-Martin, 1995). The sign is expected to be negative. *SECI* proxies for the initial stock of human development. The sign is expected to be positive. I also include *CREDPR* since the significance of the interaction term may be the result of the omission of other variables, in particular *CREDPR* itself. Hence, it is important to include the interaction term as well as both individual terms separately in the equation. This makes it possible to jointly examine the individual as well as the interactive effects of uncertainty and financial market development on economic growth.[5]

Before presenting the regression results of the base models descriptive statistics of the main variables are given in Table 1. The table shows that for some variables the mean

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[4] It should, however, be noted that results are somewhat mixed with respect to the robustness of *SECI*.

[5] Some growth regressions include the investment to GDP ratio in the base model. However, since investment is clearly endogenous this is somewhat problematic. For that reason I do not present results in which the investment to GDP ratio is included as an additional variable.

substantially differs from the median. Hence, some variables suffer from skewness. This is a normal phenomenon in cross-section and panel studies. It signals that in estimating the models one should be cautious about nonnormality of the residuals.[6]

Table 1: Descriptive statistics main variables

	GRO	*LGDPPCI*	*SECI*	*UGOV*	*UINFL*	*CREDPR*	*ICREDPR*	*RULELAW*
Mean	1.434	7.669	32.976	1.412	118.403	38.871	34.697	0.149
Median	1.579	7.615	24.000	0.986	6.897	27.496	28.670	-0.013
Maximum	6.476	9.284	102.000	9.123	4240.660	155.216	106.880	1.939
Minimum	-4.356	5.690	1.000	0.244	1.067	2.665	-1.454	-2.153
Std. Dev	1.926	0.996	27.413	1.238	538.829	25.881	20.502	0.989
Skewness	-0.149	0.046	0.677	3.297	6.159	1.549	1.084	0.127
Kurtosis	3.939	1.864	2.178	18.972	43.661	6.878	4.538	2.023
Jarque-Bera	3.433	4.598	8.874	1057.505	6392.763	87.251	25.034	3.608
Obs.	85	85	85	85	85	85	85	85

Statistics are based on a balanced sample

The regression results of the two base models are presented as equation (1) and equation (2) in Table 2. *LGDPPCI* appears to be highly significant with the correct sign. The coefficient on *LGDPPCI* is between 1 and 1.5, which suggests that for each country the convergence to its steady state is achieved at a rate between 1% and 1.5% per year. This is in line with other cross-country studies (see Sala-i-Martin, 1997b). *SECI* is also significant with the correct sign. The coefficient is about 0.05, which is also in line with other recent growth regressions. The base regressions suggest that policy uncertainty has an individual significant negative effect on growth performance. The coefficients for *UINFL,* and *UGOVC* are highly significant with a negative sign. Most importantly are the results for the interaction terms. They are highly significant in both cases, with a positive sign. This clearly confirms the hypothesis that countries with a more developed financial sector, as measured both by *CREDPR*, are better able to undo the growth reducing

[6] For all estimates done I tested whether the residuals were normally distributed using the Jarque-Bera test statistic. According to this test, the residuals were normally distributed for all regressions.

effects of policy uncertainties. Finally, the base regressions suggest that development of the financial sector does not have an individual significant effect on economic growth: *CREDPR* is insignificant in both cases.

Table 2: Base model estimates on financial development, uncertainty and economic growth

	1	2
LGDPPCI	-1.179 (-3.65)	-1.112 (-3.56)
SECI	0.046 (3.87)	0.054 (4.52)
CREDPR	0.008 (0.75)	0.014 (1.17)
UGOV	-0.781 (-2.94)	
*UGOV*CREDPR*	0.025 (2.76)	
UINFL		-0.001 (-14.86)
*UINFL*CREDPR*		4.96E-05 (8.01)
CONSTANT	8.807 (4.22)	7.813 (3.78)
Statistics		
R^2	0.38	0.32
F	12.35	9.21
Obs.	94	87

Dependent variable: *GRO*. t-Statistics between parenthesis. t-Statistics are based on White Heteroskedasticity-Consistent Standard Errors. R^2 is the adjusted R-squared.

5 EXPLAINING FINANCIAL MARKET DEVELOPMENT: ESTIMATES WITH INSTRUMENTS

An important issue in the recent literature on financial development and economic growth is the endogeneity of financial sector development. The causality between growth and financial sector development may run from growth to financial sector development, which may have important implications for the base regressions presented in the previous section. In these regressions it is implicitly assumed that the causality runs from financial market development to economic growth. A way around this problem is to use instruments for financial sector development. In this way it is possible to extract the exogenous component of financial sector development and to examine whether the exogenous component of financial intermediary development is positively correlated with economic growth. The problem is to find instruments which are uncorrelated with the error and highly correlated with the dependent variable, in this case with *CREDPR*.

Levine (1997a) and Levine, Loayza and Beck (1999) argue that indicators with respect to the legal system and the regulatory environment are appropriate instruments for financial sector development. They suggest to use indicators for the legal origin of the country and the rule of law.[7] With respect to the indicators for regulatory environment I had a choice between six measures: GRAFT, PINST, RULELAW, REGBURDEN, VOICE and GOVEFF (see Appendix1).[8] Table 3 shows that these six indicators are strongly correlated. Therefore, I only used RULELAW as instrument. The results are not affected by this choice.

Table 3: Correlation matrix aggregate governance indicators

	GRAFT	*PINST*	*RULELAW*	*REGBURDEN*	*VOICE*	*GOVEFF*
GRAFT	1.00	0.75	0.88	0.68	0.76	0.92
PINST		1.00	0.88	0.68	0.68	0.79
RULELAW			1.00	0.74	0.72	0.89
REGBURDEN				1.00	0.75	0.76
VOICE					1.00	0.77
GOVEFF						1.00

[7] Levine, Loayza and Beck use legal origin indicators for countries with predominantly English, French, German or Scandinavian legal origin.

[8] It should be noted that these indicators are not exactly the same as the indicators used by Levine, Loayza and Beck (1999). However, they are comparable. I have not used their indicators since they were only available for a much smaller data set. The set of indicators I use is available for almost all countries in the sample.

In addition to the six aggregate governance indicators, I also tested the relevance of some legal origin indicators. I examined the relevance of British, French, Scandinavian, German or Socialist legal origin. Finally, again in line with Levine (1997a) and Levine, Loayza and Beck (1999) I included *LGDPPCI* as additional instrument. In Table 4 estimation results concerning the instruments are presented. It appears that *RULELAW* and *LGDPPCI* are highly significant in all regressions with *CREDPR* as the independent variable (equations 1, 2 and 3). In the case where all legal origin indicators are included not one of them is significant (equation 2). However, when one of them is ignored *LEGGERMAN*, the dummy for countries with a German legal origin becomes significant (see equation 3). Based on these regression results I use *RULELAW*, *LGDPPCI*, *LEGGERMAN* and a constant as instruments for *CREDPR*. From this regression I obtain a fitted variable of *CREDPR*, called *ICREDPR*.

Table 4: Determination instruments for financial development

	1	2	3	4
LGDPPCI	6.782 (3.58)	6.556 (3.62)	6.477 (3.56)	12.588 (3.22)
RULELAW	13.749 (5.93)	11.708 (4.80)	11.800 (5.26)	7.843 (2.75)
LEGBRITISH		-16.475 (-1.19)		
LEGFRENCH		-19.222 (-1.42)		
LEGSOCIALIST		-28.549 (-1.58)		
LEGSCAN		-21.878 (-1.29)		
LEGGERMAN		27.152 (1.139)	46.049 (2.42)	46.513 (3.07)
CONSTANT	-19.641 (-1.38)		-18.352 (-1.33)	-67.756 (-2.27)

Statistics				
R^2	0.44	0.52	0.52	0.66
F	51.88	24.31	47.64	44.24
Obs.	131	128	128	69

Dependent variable in equation 1, 2 and 3 is *CREDPR*. In equation 4 the dependent variable is *LCREDPR*. t-Statistics between parenthesis. t-Statistics are based on White Heteroskedasticity-Consistent Standard Errors. R^2 is the adjusted R-squared.

The next step is to re-estimate the two base equations by replacing *CREDPR* by its fitted value *ICREDPR* . The results are given by equations 1 and 2 in Table 5. It appears that the main results so far still hold: uncertainty has an individual negative effect on economic growth and the negative effect of uncertainty on economic growth becomes smaller the more developed the financial sector of a country. There is one main difference with the estimates presented before: the individual effect of the exogenous component of financial sector development (*ICREDPR*) is now also significant with the correct sign.

Table 5: Estimates with instruments for financial market development

	1	2	3	4
LGDPPCI	-1.582 (-5.43)	-1.273 (-4.35)	-1.566 (-5.15)	-1.278 (-4.33)
SECI	0.027 (2.42)	0.033 (2.96)	0.028 (2.53)	0.033 (2.95)
ICREDPR	0.033 (1.80)	0.053 (2.61)	0.033 (1.78)	0.054 (2.60)
UGOV	-1.572 (-5.49)		-1.536 (-4.78)	
*UGOV*ICREDPR*	0.042 (4.46)		0.042 (4.38)	
UINFL		-0.001 (-9.07)		-0.001 (-1.68)
*UINFL*ICREDPR*		3.21E-05 (4.10)		3.12E-5 (5.36)

GOV			-0.015 (-0.47)	
INFL				0.0005 (0.21)
CONSTANT	12.026 (5.99)	8.333 (4.45)	12.042 (6.02)	8.356 (4.42)
Statistics				
R^2	0.50	0.38	0.50	0.38
F	19.20	11.42	15.88	9.40
Obs.	92	85	92	85

Dependent variable: *GRO*. t-Statistics between parenthesis. t-Statistics are based on White Heteroskedasticity-Consistent Standard Errors. R^2 is the adjusted R-squared.

Finally, I include the average government expenditures to GDP ratio (*GOV*) and the average inflation rate *(INFL*) in the equations containing *UGOV* and *UINFL* respectively. These results are given by equations 3 and 4 in Table 5. The inclusion of *GOV* appears to have no effect on the regression results. It is remarkable that *GOV* is insignificant, whereas *UGOV* is strongly significant with a negative sign. This indicates that absence of credibility with respect to fiscal policy in the form of government expenditures is much more negative for economic growth than an increase in government expenditures as such. In the case where *INFL* is added to the model, the significance of *UINFL* drops substantially. This suggests that the variability of inflation is strongly correlated with the level of the inflation rate, which is a well-known phenomenon.

6. STABILITY ANALYSIS

To test the reliability of the above results, I conduct several stability tests. I start by testing whether the results are sensitive to the use of *CREDPR* as financial sector indicator. I replace *CREDPR* by *LCREDPR*, which is the preferred indicator for financial sector development of Levine, Loyaza and Beck (1999). As explained before, the main difference concerns the exclusion of credit issued by the monetary authorities and government agencies. The disadvantage of using *LCREDPR* is that it is not available for the entire group of countries in the cross-section I use. In line with the analysis before, I use instruments for financial sector development. This comes down to replacing *LCREDPR* by its fitted value, *LICREDPR*, from an equation in which *LGDPPCI*, *RULELAW* and *LEGGERMAN* are used as instruments (see equation 4 in Table 4). The results of the regressions using *LICREDPR* in stead of *ICREDPR* are presented in Table 6. The message which comes out of these regressions is the same as before: policy uncertainty has a negative individual effect on growth and a more developed financial sector may partly undo the negative effects of policy uncertainty on economic growth.

Table 6: Estimates using an alternative measure for financial development

	1	2	3	4
LGDPPCI	-1.999 (-5.30)	-1.493 (-3.24)	-1.990 (-5.23)	-1.535 (-3.29)
SECI	0.030 (2.25)	0.036 (2.43)	0.027 (1.74)	0.037 (2.47)
LICREDPR	0.015 (0.92)	0.043 (1.87)	0.016 (0.93)	0.044 (1.87)
UGOV	-2.581 (-7.60)		-2.599 (-7.84)	
*UGOV*LICREDPR*	0.062 (7.65)		0.060 (6.45)	
UINFL		-0.001 (-9.24)		-0.002 (-3.70)
*UINFL*LICREDPR*		3.46E-05 (3.70)		3.22E-05 (3.35)
GOV			0.018 (0.50)	
INFL				0.002 (1.20)
CONSTANT	16.370 (6.06)	10.413 (3.42)	16.177 (5.87)	10.649 (3.46)
Statistics				
R^2	0.62	0.42	0.62	0.41
F	19.25	8.98	15.81	7.44
Obs.	56	56	56	56

Dependent variable: *GRO*. t-Statistics between parenthesis. t-Statistics are based on White Heteroskedasticity-Consistent Standard Errors. R^2 is the adjusted R-squared.

Next, I test whether the results are sensitive to the measurement method of policy uncertainty. I proxy uncertainty using two alternative methods. First, I estimate uncertainty by using a GARCH approach. The uncertainty proxies are then defined as *UGOV1* and *UINFL1*. More specifically, I re-estimate the forecasting equation presented in Section 2 by a GARCH(1,1) model. A GARCH model assumes that the variance of the error terms is not constant over time. The technique comes down to taking into account an additional equation for the conditional variance which depends on a lagged value of the squared error terms and a lagged value of the conditional variance. The model is estimated using the maximum-likelihood technique. As proxy for uncertainty I use, for all countries in the data set, the standard deviation of the residuals of the forecasting equation for the entire sample period.[9] Note that the forecasting equation is called the mean equation in case of a GARCH model. Moreover, as an alternative sensitivity test, I proxy uncertainty by the standard deviation of government expenditures over GDP and the inflation rate, respectively. These proxies are defined as *UGOV2* and *UINFL2*. The results using the alternative estimates for uncertainty are presented in Table 7. It appears that the main conclusion still holds. The use of a GARCH model to determine the uncertainty proxy does not seem to affect the results. This can be explained by the fact that the sample is based on yearly data for which no clustering effects are expected.

Table 7: Alternative measures for uncertainty

	1	2	3	4
LGDPPCI	-1.588 (-5.53)	-1.329 (-4.53)	-1.275 (-4.34)	-1.279 (-4.35)
SECI	0.029 (2.56)	0.024 (2.25)	0.033 (2.95)	0.033 (2.96)
ICREDPR	0.033 (1.76)	0.047 (1.93)	0.053 (2.62)	0.053 (2.62)
UGOV1	-1.471 (-5.03)			
*UGOV1*ICREDPR*	0.042 (4.22)			
UGOV2		-0.509 (-3.26)		

9 Alternatively one could argue that it would also be appropriate to use the mean or the median of the conditional variances over the sample period as the proxy for uncertainty.

*UGOV2*ICREDPR*		0.009 (1.91)		
UINFL1			-0.0008 (-8.89)	
*UINFL1*LICREDPR*			2.35E-05 (2.55)	
UINFL2				-0.0011 (-9.01)
*UINFL2*LICREDPR*				3.45E-05 (3.62)
CONSTANT	11.877 (5.99)	9.848 (4.93)	8.336 (4.44)	8.367 (4.44)
Statistics				
R^2	0.48	0.40	0.38	0.38
F	18.00	13.14	11.33	11.32
Obs.	92	92	85	85

Dependent variable: *GRO*. t-Statistics between parenthesis. t-Statistics are based on White Heteroskedasticity-Consistent Standard Errors. R^2 is the adjusted R-squared.

I also test the sensitivity of the outcomes for different samples of countries. Table 8 presents estimation results with respect to *UGOV* for two different split-ups of the entire sample. The first equation gives estimates for all countries having a value of *LGDPPCI* below the median value of *LGDPPCI* (see Table 1). The second equation refers to the estimates for the countries having a value of *LGDPPCI* higher than the median value. The third and fourth equations refer to estimates for only developing countries (LDC) or only developed countries (DC), respectively. Table 9 present comparable results for *UINFL*.

Table 8: Different samples of countries. Estimates for *UGOV*

	LGDPPCI<7.615	*LGDPPCI*>7.615	*LDC*	*DC*
LGDPPCI	-1.867 (-3.60)	-2.533 (-5.09)	-1.731 (-5.81)	-2.567 (-4.68)
SECI	0.053 (2.21)	0.014 (1.10)	0.037 (2.73)	-0.020 (-1.80)
ICREDPR	0.035 (1.80)	0.011 (0.46)	0.059 (3.60)	-0.022 (-0.97)
UGOV	-1.452 (-4.17)	-3.501 (-2.48)	-1.204 (-3.77)	-5.338 (-1.59)
*UGOV*ICREDPR*	0.045 (3.76)	0.073 (2.39)	0.031 (2.89)	0.102 (1.51)
CONSTANT	13.112 (3.87)	22.741 (5.277)	12.024 (5.64)	27.694 (5.23)
Statistics				

R^2	0.55	0.50	0.53	0.67
F	12.32	9.63	15.86	10.53
Obs.	48	44	68	24

Dependent variable: *GRO*. t-Statistics between parenthesis. t-Statistics are based on White Heteroskedasticity-Consistent Standard Errors. R^2 is the adjusted R-squared.

Table 9: Different samples of countries. Estimates for *UINFL*

	LGDPPCI<7.615	*LGDPPCI*>7.615	*LDC*	*DC*
LGDPPCI	-1.774 (-2.87)	-2.287 (-4.22)	-1.506 (-5.07)	-2.157 (-4.40)
SECI	0.082 (2.01)	0.026 (2.22)	0.047 (2.84)	-0.021 (-1.25)
ICREDPR	0.064 (2.90)	0.042 (1.79)	0.081 (5.18)	-0.007 (-0.95)
UINFL	-0.0009 (-7.19)	-0.002 (-1.55)	-0.0009 (-8.44)	-0.495 (-1.78)
*UINFL*ICREDPR*	2.39E-05 (3.81)	2.28E-05 (0.60)	2.16E-05 (2.41)	0.0097 (1.73)
CONSTANT	10.686 (2.68)	18.174 (4.36)	9.006 (4.60)	23.424 (5.57)
Statistics				
R^2	0.46	0.40	0.44	0.65
F	8.05	6.41	10.74	9.03
Obs.	43	42	62	23

Dependent variable: *GRO*. t-Statistics between parenthesis. t-Statistics are based on White Heteroskedasticity-Consistent Standard Errors. R^2 is the adjusted R-squared.

Table 8 and Table 9 show that the main result concerning the effect of financial sector development on the uncertainty-economic growth relationship holds for the relatively low-income groups. Both for the group of countries having a *LGDPPCI* below the median value as well as the group of LDCs the individual uncertainty terms are negative and significant, whereas the interactive terms are positive and significant. The results for the more developed income groups are somewhat mixed. In some cases the main result still holds. This is, for instance, the case for effects of *UGOV* on countries having a *LGDPPCI* above the median value. In other cases, the uncertainty term as well as the interactive term becomes insignificant. The reason might be that for richer countries the specification of the model is not appropriate. It may also be the case that the sample becomes too small to get reliable results. This especially holds for the estimates in which the sample consists of only the group of developed countries

Finally, I test whether the coefficients for the variables of interest (in our case, the coefficients for the uncertainty measure and the interaction term) are robust when some additional variables are taken into account in the base regressions. The analysis starts by defining a group of variables that are usually found to be important in growth regressions. From this group additional variables to be included in the regressions are drawn. I use the following set of variables:

an indicator for ethnic diversity (ETHFRAC); the number of assassinations per million inhabitants (ASSASSINATION); the black market premium (LBMP); the number of coups (COUPS); the longitude (LONGITUDE); an index of political rights (PRIGHTS); an indicator for trade openness (TRADE); tax receipts divided by GDP (TAX); the number of revolutions (REVOLUTION); an indicator for perception of corruption (GRAFT); the value of government consumption as a percentage of GDP (GOV) and the inflation rate (INFL).

Next, I determine all possible combinations of three of the above-presented set of 12 variables and perform regressions in which the base variables are included as well as 3 additional variables. This implies that, for all base models, 12!/(9!3!) = 220 variants (models *j*) are estimated. Per regression 9 independent variables are taken into account (the constant, *LGDPPC*, *SECI*, *ICREDPR*,*UGOV* or *UINFL*, the interaction term, and 3 additional variables from the pool of 12).

I start by conducting an extreme bound analysis (EBA) in line with Levine and Renelt (1992). The procedure is as follows. For each regression *j* an estimate for the coefficient and the standard error of the variable under concern is obtained. The lower extreme bound is the lowest value of the coefficient minus two times the standard error. The upper bound is the highest value of the coefficient plus two times the standard error. If the signs of the upper and lower extreme bounds differ, the variable is not robust according to the EBA analysis. The extreme bounds are given in Table 10 in the columns High and Low.

According to this sensitivity test, *UGOV* and the interaction term between *UGOV* and *ICREDPR* are robust. Inflation uncertainty and the interaction term between inflation uncertainty and financial market development are not robust.

The EBA analysis is criticized for being too strict a robustness test. If only in one of the 220 regressions the variable under concern is not significant, the test concludes that the variable is not robust. Therefore, I also perform a stability analysis in line with Sala-i-Martin (1997a). The stability test entails to looking at the distribution of these coefficients, and calculating the fraction of the cumulative distribution function lying on each side of zero. By assuming that the distribution of the estimates of the coefficients is normal and calculating the mean and the standard deviation of this distribution, the cumulative distribution function (*CDF*) can be calculated.

More precisely, if b_j is the coefficient for the variable in variant (model) *j*, and s_j is the standard error of the coefficient b_j, I proxy the mean and the standard deviation of the distribution by:

$$\overline{b} = \frac{\Sigma b_j}{n}$$

$$\overline{s} = \frac{\Sigma s_j}{n}$$

where n =220.

In Table 10, the mean estimate is given by the column Average Coefficient. The mean standard deviation by the column Average Standard Error.

Table 10: Robustness test

	Average Coefficient	Average Standard Error	High	Low	CDF	Average R^2	Robust1	Robust2
Results for equation containing *UGOV*								
ICREDPR	0.024	0.017	0.065	-0.019	0.924	0.51	No	No

UGOV	-1.589	0.302	-0.611	-2.728	1	0.51	Yes	Yes
*UGOV*ICREDPR*	0.043	0.010	0.085	0.011	1	0.51	Yes	Yes
Results for equation containing UINFL								
ICREDPR	0.048	0.020	0.097	-0.005	0.993	0.38	No	Yes
UINFL	-0.141	0.077	0.442	-1.047	0.963	0.38	No	Yes
*UINFL*ICREDPR*	0.005	0.003	0.041	-0.022	0.955	0.38	No	Yes

Average coefficient: the average coefficient of all equations estimated; Average Standard Error: the average standard error of all equations estimated. High (low) is the highest (lowest) coefficient from the entire group of estimates (calculated as coefficient plus or minus 2 times the standard error). CDF: cumulative distribution function. Average R^2: the average adjusted R-squared for al equations estimated. Robust1: robust according to EBA analysis; Robust2: robust according to the robustness test of Sala-i-Martin. For both sets of estimates 220 equations are estimated.

By using a table for the (cumulative) normal distribution, I am able to calculate which fraction of the cumulative distribution function is on the right or left-hand side of zero. The test statistic I use is defined as the mean over the standard deviation of the distribution. In Table 10 *CDF* denotes the larger of the two areas. If *CDF* is above 0.95, I conclude that the variable under consideration has a robust effect on economic growth. It appears that both inflation uncertainty and uncertainty with respect to government expenditures have a robust negative effect on economic growth. Most importantly, for both variables the interaction term has a robust positive effect on economic growth. This once again suggests that the policy uncertainty-economic growth relationship is dependent on the development of the financial sector. The results with respect to the individual term for financial sector development are mixed. The model testing inflation uncertainty suggests that financial sector development has an individually robust and positive effect on economic growth. However, the model testing the effects of uncertainty with respect to government expenditures concludes the opposite.

As explained in Section 4, it is possible to calculate a threshold value of the financial development indicator above which policy uncertainty starts to have a positive effect on economic growth. This can be done by dividing the coefficient for the interactive term by the absolute value of the coefficient for the individual uncertainty variable. For instance, if the estimates presented in Section 5 with respect to *UGOV* are considered (Table 5 equation 1), it can be easily calculated that the threshold value of *ICREDPR* equals about 37% (1.572/0.042). It should be noted that the outcome of this exercise should not be taken too literally since confidence intervals for the variables are not taken into account. Since the estimate of the threshold is based on two coefficients it is somewhat arbitrary to calculate a confidence interval. The highest value of the threshold could be obtained by dividing the coefficient for the interactive term plus two times the corresponding standard error by the coefficient for the individual uncertainty term minus two times the standard error of this term.[10] This would result in an upper value of the threshold of 2.145/0.023 = 92%. The lower extreme is found by dividing the coefficient for the interactive term minus two times the standard error by the coefficient for the individual term plus two times the standard error. This would result in a lower extreme of 0.999/0.061 = 16%. Since this interval is very large, it is a dangerous exercise to determine the set of countries for which a rise in policy uncertainty will probably have a positive effect on economic growth. The more important result of this paper is that it strongly suggests that countries with a more developed financial sector are better able to undo negative policy uncertainty effects than countries with a poorly developed financial sector.

7. CONCLUSIONS

In this paper, I examine whether financial sector development may partly undo growth-reducing effects of policy uncertainty. By performing a standard cross-country growth regression for the 1970-1998 period I show that policy uncertainty has a robust and negative individual effect on per capita economic growth. More importantly, I find some strong evidence that countries with a more developed financial sector are better able to nullify the negative effects of policy uncertainty on per capita economic growth.

The results of this paper point at two important policy conclusions. First, especially for developing countries where the financial sector is often very rudimentary, a stable and credible government policy appears to be of utmost importance. Second, a well-developed financial sector is an important means by which growth reducing effects of policy uncertainties can be undone. This clearly indicates the relevance of financial sector development.

[10] Standard errors are calculated by dividing the coefficient by the t-value.

Appendix1: List of Variables and sources

ASSASSINATION = The average number of assassinations per million inhabitants for the 1970-1993 period. Source: Easterly and Yu (1999). Original source:Banks Cross national time-series data archive.

BMP = the average black market premium (%) for the 1970-1997 period. Source: Easterly and Yu (1999).

COUPS = The average number of coups for the 1970-1988 period. Source: Easterly and Yu (1999). Original source Banks Cross national time-series data archive.

CREDPR = The average value of credit to the private sector as a percentage of GDP for the 1970-1997 period. Source: World Bank (1999)

DC = Developed countries.

ETHFRAC = Indicator for ethnic diversity. Source: Easterly and Yu (1999).

GOV = The average value of government consumption as a percentage of GDP for the 1970-1997 period. Source: World Bank (1999)

GRO = The average real per capita growth rate over 1970-1998 period . Calculated from real GDP *per capita* data in constant dollars. Source: Easterly and Yu (1999). Original source: Penn World Table 5.6 (Summers-Heston data). Missing data calculated from 1985 GDP *per capita* and GDP *per capita* growth rates (Global Development Finance & World Development Indicators).

ICREDPR = The forecasted value of *CREDPR* based on an estimate in which *CREDPR* is explained by *LGDPPCI*, *LAWRULE*, *LEGGERMAN* and a constant.

INFL = The average inflation rate over the 1970-1998 period. Source: Easterly and Yu (1999). Original source: Global Development Finance & World Development Indicators.

LBMP = Log *(1+BMP)*

LDC = Developing countries

LGDPPCI = The logarithm of the 1970 value of real GDP *per capita* in constant dollars (international prices, base year 1985). Source: Easterly and Yu (1999). Original source: Penn World Table 5.6.

LCREDPR = The value of credits by financial intermediaries to the private sector divided by GDP. It excludes credits issued by the monetary authorities and government agencies (which are included in CREDPR). See Levine, Loayaza and Beck (1999). The data come from the Levine-Loaza-Beck Data Set (available on internet: http:/www.worldbank.org/html/prdmg/grthweb/llbdata.html)

LICREDPR = The forecasted value of *LCREDPR* based on an estimate in which *LCREDPR* is explained *by LGDPPCI, LAWRULE, LEGGERMAN* and a constant.

LONGITUDE = Longitude. Source: Easterly and Yu (1999.

PRIGHTS = Average value of an index of political rights for the 1970-1990 period (from 1 to 7; 1 is most political rights). Source: the Barro-Lee (1994) data set.

REVOLUTION = The average number of revolutions for the 1970-1993 period. : Easterly and Yu (1999). Original source: Banks Cross national time-series data archive.

SECI = The 1970 secondary school enrollment rate. Source: Easterly and Yu (1999). Original source: Global Development Finance & World Development Indicators.

TAX = The average value of total tax revenue as a percentage of GDP for the 1970-1997 period. Source: World Bank (1999).

TRADE = The average value of exports plus imports divided by GDP for the 1970-1997 period. Source: World Bank (1999). This variable measures the degree of openness.

UGOV = Indicator which measures uncertainty concerning the government consumption to GDP ratio. It is calculated by taking the standard deviation of the unexplained part. The expected government consumption is measured by using the ordinary least squares technique.

UGOV1 = Indicator which measures uncertainty concerning the government consumption to GDP ratio. It is calculated by taking the standard deviation of the unexplained part. The expected government consumption is measured by using a GARCH approach.

UGOV2 = Indicator which measures uncertainty concerning the government consumption to GDP ratio. It is calculated by taking the standard deviation of the original series.

UINFL = Indicator which measures uncertainty concerning the inflation rate. It is calculated by taking the standard deviation of the unexplained part. Expected inflation is measured by using the ordinary least squares technique.

UINFL1 = Indicator which measures uncertainty concerning the inflation rate. It is calculated by taking the standard deviation of the unexplained part. Expected inflation is measured by using a GARCH approach.

UINFL2 = Indicator which measures uncertainty concerning the inflation rate. It is calculated by taking the standard deviation of the original series.

GOVERNANCE INDICATORS

The six aggregate governance indicators described below are kindly provided by Pablo Zoido-Lobaton. See Kaufmann, Kraay and Zoido-Lobaton (1999) for an extensive description. Governance is measured on a scale of about -2.5 to 2.5 with higher values corresponding to better outcomes. The data are based on data for 1997 and 1998.

1) *GOVEFF* = An indicator of the ability of the government to formulate and implement sound policies. It combines perceptions of the quality of public service provision, the quality of the bureaucracy, the competence of civil servants. the independence of the civil

service from political pressures, and the credibility of the government's commitment to policies into a single grouping.

2) *GRAFT* = This indicator measures perception of corruption: the exercise of public power for private gain.

3*) LAWRULE* = Indicator which measures the extent to which agents have confidence in and abide by the rules of society. These include perceptions of the incidence of both violent and non-violent crime, the effectiveness and predictability of the judiciary, and the enforceability of contracts. See Kaufmann, Kraay and Zoido-Lobaton (1999) for an extensive description. Data obtained from the authors.

4) *PINST* = This index combines indicators which measure perceptions of the likelihood that the government in power will be destabilized or overthrown by possibly unconstitutional and/ or violent means.

5) *REGBURDEN*= An indicator of the ability of the government to formulate and implement sound policies. It includes measures of the incidence of market-unfriendly policies such as price controls or inadequate bank supervision, as well as perceptions of the burdens imposed by excessive regulation in areas such as foreign trade and business development.

6) *VOICE* = This index includes indicators which measure the extent to which citizens of a country are able to participate in the selection of governments.

LEGAL ORIGIN INDICATORS

The five legal system indicators are obtained from Easterly and Yu (1999). They are zero-one dummies.

1) *LEGBRITISH* = National legal system from British origin.
2) *LEGFRENCH* = National legal system from French origin.
3) *LEGGERMAN* = National legal system from German origin.
4) *LEGSCAN* = National legal system from Scandinavian origin.

5) *LEGSOCIALIST* = National legal system from Socialist origin

Appendix2: Countries in data set

Countries in the sample

Algeria	Costa Rica	Indonesia	Netherlands	Sudan
Angola	Cote d'Ivoire	Ireland	New Zealand	Swaziland
Argentina	Denmark	Israel	Niger	Sweden
Australia	Dominican Republic	Italy	Nigeria	Syrian Arab Republic
Austria	Ecuador	Jamaica	Norway	Tanzania
Belgium	Egypt, Arab Rep.	Japan	Pakistan	Togo
Benin	El Salvador	Kenya	Panama	Trinidad and Tobago
Bolivia	Ethiopia	Korea, Rep.	Paraguay	Tunisia
Botswana	Finland	Lesotho	Peru	Uganda
Brazil	France	Luxembourg	Philippines	United Kingdom
Burkina Faso	Gabon	Madagascar	Poland	Uruguay
Burundi	Gambia, The	Malaysia	Portugal	Venezuela
Cameroon	Ghana	Mali	Romania	Zambia
Canada	Greece	Malta	Rwanda	Zimbabwe
Central African Republic	Guatemala	Mauritania	Saudi Arabia	
Chile	Guinea	Mauritius	Senegal	
China	Guinea-Bissau	Mexico	Sierra Leone	
Colombia	Hong Kong, China	Morocco	Singapore	
Comoros	Iceland	Mozambique	South Africa	
Congo, Dem. Rep.	India	Nepal	Spain	

The base model with *UGOV* contains the 94 countries shown in the table. Due to taking instruments, the Central African Republic and the Comoros drop out of the sample (no data available for *RULELAW*). Hence, estimates with *UGOV* and instruments contain 92 countries. If *UINFL* is included the following countries drop out of the sample: Angola, Benin, Comoros, Guinea, Hong Kong, Mali, Romania and Swaziland. On the other hand, Taiwan is included in addition to the countries in the table shown above (no data available for GOV). The group of developed countries (DC) contains: Australia, Austria, Belgium, Canada, Denmark, France, Finland, Greece, Hong Kong, Iceland, Ireland, Israel, Italy, Japan, Luxembourg, Malta, Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden and the United Kingdom.

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