REGULATION, INVESTMENT, AND GROWTH ACROSS COUNTRIES

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Numerous studies have explored the relationship between economic freedom and long-run economic growth across countries. See, for example, the studies cited in the recent review by Berggren (2003). One particular aspect of economic freedom that has received relatively little attention in the empirical growth literature, however, is the extent of government regulation. Determining the impact of regulation on cross-country economic performance has been virtually impossible because of the inherent difficulties in measuring the scope of regulation across countries. While a few studies investigate various aspects of specific regulations, none are able to assess the importance of a comprehensive measure of regulation on long-run economic performance in a large sample of countries.[1]

Fortunately, the recent availability of data on the scope of regulation across countries now makes such a study possible. Recent releases of the Fraser Institute's *Economic Freedom of the World* annual report include data on the regulatory environment in a large number of countries. Beginning with the 2002 release, the report's economic freedom of the world (EFW)

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[1]Some empirical work studies regulatory effects related to macroeconomic concerns. For example, using OECD data, Nicoletti and Scarpetta (2003) find that product regulation that creates barriers to entry reduces industry-level multifactor productivity growth. Alesina et al. (2003) find that such regulation reduces industrial investment. Djankov et al. (2002) construct a measure of regulation of entry in 85 countries and relate it to several country characteristics, such as the amount of corruption or the type of government. In a series of empirical papers by World Bank economists, Kaufmann, Kraay, and Zoido-Lobaton (1999, 2002) and Kaufmann, Kraay, and Mastruzzi (2003) study the ability of "perceived government effectiveness," one component of which is regulation, to explain cross-country differences in per capita income. Dawson (2006) and Dawson and Seater (2006) provide time series analyses of the relationship between federal regulation and macroeconomic performance in the U.S.

index includes regulation as one of its five major areas.[2] Within this area of the index, there are as many as 15 components covering credit market, labor market, and business regulations for which cross-country data are available. Table 1 lists these underlying components as found in Gwartney and Lawson (2005).[3]

There are no well-developed theories of how regulation should affect long-run economic performance. However, it is reasonable to think that regulation may affect an economic agent's ability to engage in voluntary exchange and the efficiency with which resources are used in an economy. Thus, we might expect that the level of regulation in a country is related to indicators of long-run economic performance such as the level of investment or per capita income growth. The line of reasoning here is similar to that relating the more broadly defined concept of economic freedom to long-run performance. Note that this discussion does not presume that the effect of regulation is either positive or negative—this is ultimately an empirical issue. As such, the analysis below will follow the same approach as has been used in the empirical growth literature where the impact of economic freedom has been addressed. The results will show whether or not regulation has economic implications beyond those related to economic freedom more generally.

This paper uses data on regulation from the Gwartney and Lawson (2005) EFW index to investigate the impact of regulation on long-run economic performance across countries. The underlying data allow the analysis to include a broad measure of regulation across countries, as well as the more narrowly focused areas of credit market, labor market, and business regulation. The paper is organized as follows. The first section presents the empirical model that will be

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[2]Other major areas of the index include (1) size of government expenditures, taxes and enterprises; (2) legal structure and security of property rights; (3) access to sound money; and (4) freedom to trade internationally. See Exhibit 1 in Gwartney and Lawson (2005) for details.

[3]Individual components are equally weighted in constructing the sub-indexes covering credit, labor, and general business regulations, and these sub-indexes are then equally weighted to construct a comprehensive index of regulation. See Gwartney and Lawson (2005) for details.

used in the analysis, discusses some methodological issues, and summarizes the data. The second section reports and discusses the empirical results. The last section concludes.

Empirical Model, Methodology, and Data

Model and Specification Issues

The cross-country empirical specification used to estimate the relationship between regulation and growth is an extension of the Solow (1956) model. For an example of the derivation of the estimating equation, see Mankiw, Romer, and Weil (1992). For a discussion of how the model can be extended to include government institutions (e.g., political liberties, economic freedom, regulation), see Dawson (1998). This general framework has been used extensively throughout the empirical growth literature. The estimating equation can be written as:

$$g_Y = a_0 + a_1 y_0 + a_2 s_K + a_3 g_{LF} + a_4 I + e, \quad (1)$$

where g_Y is the cumulative growth rate of real per capita GDP, y_0 is a measure of the initial income level, s_K is the share of gross domestic investment in GDP, g_{LF} is the growth rate of the labor force, I is an index of government institutions, and e is an error term.[4] All explanatory variables are measured as annual averages over the sample period and are entered as natural logarithms unless noted otherwise.

Many cross-country growth studies also include a measure of human capital in specifications similar to (1). Such measures were generally found to be statistically insignificant in the analysis below, and so were excluded from the model. Dawson (1998: 612) discusses the insignificance of human capital when measures of government institutions are included in cross-country growth regressions. Some recent studies have also included cross-country geographic

[4]Friedman (1992) criticizes the use of the estimated coefficient on initial income, $\hat{a}_1$, as a test for convergence. Since the focus in this paper is not on testing for convergence, (1) remains a valid specification derived from the Solow model. In addition, this specification has been used in a number of previous empirical growth studies, thus making our results directly comparable to those in the literature.

measures such as tropical location and distance to major markets. See, for example, Gwartney, Lawson, and Holcombe (2004, 2006). Such measures were generally found to be statistically insignificant in the analysis below, and so were excluded from the model. One possible explanation is the smaller sample size (relative to other studies which use these variables) which does not provide enough cross-country variation in the geographic variables to explain growth in the sample.

While growth theory is somewhat precise in terms of modeling the economic determinants of growth, it is much less instructive in modeling the role of institutions. As a result, existing studies rely on various ad hoc specifications in their empirical analysis. More specifically, it is not clear whether the level or changes in institutions, or both, should be included in the model. A number of early studies included both levels and changes in economic freedom; see, e.g., Dawson (1998) and Gwartney, Lawson, and Holcombe (1999). Subsequently, however, De Haan and Sturm (2000) reported that changes in economic freedom (and not levels) are robustly related to growth in their sensitivity analysis. Our analysis below uses the following empirical specifications:

(1A) $$g_Y = a_0 + a_1 y_0 + a_2 s_K + a_3 g_{LF} + a_4 R + e,$$

(1B) $$g_Y = a_0 + a_1 y_0 + a_2 s_K + a_3 g_{LF} + a_4 R + a_5 \Delta EF + a_6 EF + e,$$

(1C) $$g_Y = a_0 + a_1 y_0 + a_2 s_K + a_3 g_{LF} + a_4 R + a_5 \Delta EF + e,$$

where R and EF are indexes of regulation and economic freedom, respectively. Note in each specification that the level of regulation R is included to examine the effect of regulation on cross-country growth. Since regulation has tended to change relatively slowly over the sample period, there is more variation in the level of regulation (R) across countries than in the change in regulation (ΔR). Thus, differences in R are more likely to explain differences in growth rates across countries.[5]

[5]Indeed, ΔR was found to be statistically insignificant when included as an explanatory variable in the

Specification (1A) provides an estimate of regulation's influence on growth without controlling for differences in economic freedom across countries. Following the discussion above, specification (1B) includes both the level and change in economic freedom (both *EF* and ΔEF) whereas (1C) includes only the change in freedom (only ΔEF). The choice between specifications (1B) and (1C) is a difficult one. There are potential advantages and disadvantages with each specification. The use of (1B) maintains comparability with many of the early, benchmark studies which include economic freedom in a cross-country growth analysis. However, including both levels and changes in freedom has been shown to be equivalent to including levels at various points in time over the sample period. Thus, using such a specification increases the chances of finding a spurious relationship that results from reverse causation between the variables of interest; see the discussion in Dawson (2003: 481-482) for more details. In addition, the Spearman rank correlation between the indexes of economic freedom and regulation is 0.72 (with a p-value < 0.0001), thus introducing the possibility of multicollinearity if both *R* and *EF* are included as explanatory variables. The use of specification (1C) eliminates this potential problem by including only *R* and ΔEF, for which the correlation coefficient is insignificantly different from zero. Including only ΔEF (and not *EF*) is also consistent with the findings of De Haan and Sturm's (2000) sensitivity analysis noted above.

Rather than engage in a philosophical debate on which specification is correct, we will discuss the results from all three specifications. This approach should be sufficient for determining the extent to which regulation can explain cross-country differences in growth rates beyond that explained by economic freedom in general.

Some Notes on Methodology

The Solow model relates growth in income to the evolution of the labor force, capital stock, and technology over time. While this approach shows the importance of these factors in determining long-run growth rates, it does not explain why these factors themselves vary across

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analysis below.

countries. Thus, a secondary analysis that has become standard in the empirical growth literature is to discern the influence of institutions (such as economic freedom and regulation) on growth and the factors which contribute to growth (such as investment). Such an analysis amounts to determining the "direct" and "indirect" effects of institutions. The direct effect refers to the effect of institutions on growth through total factor productivity, while the indirect effect refers to the effect of institutions on investment which, in turn, influences growth.[6] Dawson (1998), for example, found that economic freedom has a positive impact on growth through both channels.

We will investigate the alternative channels through which regulation might affect long-run growth. Although various approaches have been suggested for distinguishing between the direct and indirect effects of a variable of interest, we will follow the approach recently suggested by Gwartney, Lawson, and Holcombe (2004, 2006). Their approach, as applied to the specification in (1A) above, is to first estimate a cross-country investment equation of the form:

$$s_K = b_0 + b_1 y_0 + b_2 g_{LF} + b_3 R + v. \tag{2}$$

Note that (2) includes all explanatory variables from (1A), except s_K, to explain the variation in s_K across countries. Thus, (2) estimates the influence of factors such as regulation on investment rates, even after other factors that might be related to investment, such as initial income and labor force growth, are accounted for. The estimated residual from (2), $\hat{v}$, on the other hand, represents that part of the investment rate that is not related to regulation and the other explanatory variables in (1A).

Next, Gwartney, Lawson, and Holcombe (2004, 2006) suggest re-estimating equation (1A) with the residuals, $\hat{v}$, from equation (2) substituted for s_K; i.e., estimate:

$$g_Y = c_0 + c_1 y_0 + c_2 \hat{v} + c_3 g_{LF} + c_4 R + u. \tag{3}$$

The logic of this approach is to recognize that the estimated coefficient $\hat{a}_4$ from (1A) reflects the

[6] In the context of an aggregate production function graphed in *y*-*k* space, the direct effect refers to the increase in *y* that results when an improvement in institutions (which increases total factor productivity) causes the production function to shift upward, and the indirect effect refers to the increase in *y* that results when an increase in institutions (which causes an increase in investment and, thus, *k*) causes a movement along the production function.

impact of a change in *R* after the effects of other variables, including s_K, are accounted for. As such, $\hat{a}_4$ reflects only the direct effect of *R* on growth that results from its impact on total factor productivity. But, of course, this is only part of the impact of regulation on growth. In the estimation of (3), on the other hand, the estimated coefficient for *R* and the other variables in the model will reflect both the direct and indirect impacts of these variables on growth. Thus, a comparison of the estimated coefficients on *R* from equations (1) and (3) will provide insight on the channels through which these variables affect growth. The application of this technique to specifications (1B) and (1C) is analogous.

Another issue that has been addressed in the institutions-growth literature involves the path a country takes to improve its institutions. More specifically, a country that follows a volatile path toward increased economic freedom, for example, may not experience as much of an increase in its long-run growth rate as a country that follows a smooth path toward more freedom. One possible reason for this outcome is that a more volatile path toward liberalization reduces the perceived credibility of policymakers and questions their commitment to the new regime. The seminal study in this area is Pitlik (2002), who shows that a measure of the volatility of economic freedom over time is negatively related to long-run growth rates across countries even after controlling for other factors related to growth, including the level and changes in freedom. This result shows that volatile liberalization policies depress growth even when they generally tend toward increased levels of freedom.

It is reasonable to expect that similar forces may be at work with respect to countries' policies toward regulatory reform, with a more volatile path giving rise to a more uncertain regulatory environment going forward. We investigate this possibility by including a measure of the volatility of regulation in our analysis. Pitlik shows that the appropriate measure of volatility is the standard deviation of the time series of changes in freedom (or, in our case, regulation) over the sample period. More specifically, for the time period 0,..., *T*, define:

$$SDR = \sqrt{\frac{1}{T}\sum_{t=1}^{T}\left(\Delta R_t - \frac{1}{T}\sum_{t=1}^{T}\Delta R_t\right)^2},$$

where $\Delta R = R_t - R_{t-1}$. Thus, to determine the impact of the path of regulatory reform on growth, the specification in (1A) can be extended as follows:

(4) $$g_Y = d_0 + d_1 y_0 + d_2 s_K + d_3 g_{LF} + d_4 R + d_5 SDR + w.$$

Table 3 reports Spearman rank correlations for the economic freedom and regulation measures, including the volatility measures. The correlation between the volatility of regulation and its respective level, as well as changes in the level of economic freedom, is not statistically different from zero. Thus, it will be interesting to see if the volatility of regulation provides explanatory power beyond that offered by the freedom and regulation measures in the model.

The Data

Some of the equations estimated below include both a measure of economic freedom and regulation. As such, it is important to use a measure of economic freedom that is not directly influenced by the level of regulation. In other words, the economic freedom variable should measure those aspects of freedom other than regulation. Since both the economic freedom and regulation data come from Gwartney and Lawson's EFW index, we measure economic freedom using a specially designed version of the EFW index which does not include regulation as a component in its construction. More specifically, the regulation data are taken directly from Gwartney and Lawson (2005), while the economic freedom data are obtained by recalculating the EFW index (using the Gwartney and Lawson (2005) data) with the regulation component omitted. Both the economic freedom and regulation indexes are defined on a scale from 0 to 10, with 10 indicating the "most freedom" and "least regulation," respectively. Summary statistics for the economic freedom and regulation variables used in the analysis are reported in Table 2.

Data on real per capita GDP, the labor force, and gross domestic investment come from the World Bank's *World Development Indicators* database. The initial income variable is real GDP per worker in international currency units from the Penn World Tables (Mark 5.6). For models in which private and public investment are included separately, the investment data are from Gwartney, Lawson, and Holcombe (2006).

Empirical Results

This section discusses the empirical results for the models discussed above. The sample period for all results is 1980-2000. Estimation is by ordinary least squares. Reports on statistical significance are based on White's heteroskedasticity-consistent standard errors. In all specifications, we use alternately the comprehensive index of regulation as well as indexes for the underlying areas of credit market and general business regulations.[7] A common sample of 64 countries is used in all of the models estimated below, the largest sample for which data were available for all variables.

In the interest of conserving space and not bewildering the reader with excessive results, the tables below only report results for specification (1A). Any cases in which specifications (1B) and (1C) provide qualitatively different results will be noted in the accompanying discussion. All results are available from the author upon request.

Cross-Country Investment Regressions

Following the discussion of direct and indirect effects above, we begin by estimating cross-country investment equations as suggested by the specification in (2). The dependent

[7]Labor market regulations were also considered individually but were consistently found to be statistically

variable is gross domestic investment as a percentage of GDP. The results are reported in Table 4. The results indicate that none of the regulation measures has a statistically significant impact on investment rates across countries. This result holds regardless of whether specification (1A), (1B), or (1C) is used as the underlying model. Taken at face value, these results suggest that regulation has no effect on growth through the investment channel. Further exploration, however, provides a different interpretation.

In their comprehensive study of investment, Gwartney, Lawson, and Holcombe (2006) find that breaking total investment into its private and public components has a significant impact on the results. More specifically, private investment rates are much more responsive to cross-country differences in economic freedom than are rates of government investment. And, correspondingly, countries with low levels of economic freedom have high rates of government investment. To verify whether these relationships also hold up with respect to differences in regulation across countries, we re-estimate (2) using Gwartney, Lawson, and Holcombe's (2006) private and public investment rates separately as dependent variables. The results are reported in Table 5.

Columns 1-3 of Table 5 report the results using private investment rates as the dependent variable. The results in column 1 indicate that the comprehensive index of regulation has a statistically significant impact on private investment rates across countries after controlling for other factors that may be related to investment. The sign of the estimated coefficient on the overall regulation variable is positive. This finding suggests that countries with less overall

insignificant, so those results will not be reported below.

regulation have higher rates of private investment.[8] The results in columns 2 and 3 also suggest that credit market and general business regulations are negatively related to private investment rates across countries.

The only exception to this result is obtained when both the level and change in economic freedom (both *EF* and ΔEF) are included as explanatory variables in the model (i.e., when specification (1B) is used as the underlying model), in which case the regulation measures are found to be statistically insignificant in explaining cross-country private investment rates. Recall, however, that the high correlation between the levels of regulation and economic freedom (*R* and *EF*) may explain this finding when both are included in the model. The regulation measures remain significant in the private investment equations when only ΔEF is included to control for economic freedom (i.e., when specification (1C) is used).

Table 5 also reports the estimated impacts of the various regulation measures on investment rates across countries. The estimated impacts are calculated using the estimated coefficients on the regulation variables in each equation assuming an increase of one standard deviation above the mean for each index.[9] The results in column 1 suggest a country with an overall regulation index one standard deviation above the mean has a 14 percentage point higher private investment-GDP ratio, holding other explanatory variables fixed over the sample period. The estimated impacts of credit market and business regulations on private investment rates are 11 and 14 percentage points, respectively. Regulation, thus, appears to have a significant economic impact on private investment rates across countries.

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[8]Recall that a higher value of the regulation index implies less regulation.

[9]Means and standard deviations for the regulation indexes are reported in Table 2. Log-levels must be used

Columns 4-6 of Table 5 report estimates of (2) when public investment rates are used as the dependent variable. The results suggest that countries with more regulation (i.e., lower values of the regulation indexes) have higher levels of government investment. This relationship holds for the comprehensive index of regulation as well as credit market and general business regulations. This result also holds when measures of economic freedom are included in the model; i.e., for specifications (1B) and (1C). In general, these results are consistent with the findings of Gwartney, Lawson, and Holcombe (2006) in that higher levels of government involvement in the economy are related to higher levels of government investment.

The estimated impacts of changes in regulation on public investment rates are also noteworthy, especially when considered alongside the estimated impacts from the private investment equations in columns 1-3. For instance, consider a one standard deviation increase in the overall regulation index (which, again, corresponds to a reduction in regulation). A resulting 14 percentage point decrease is estimated for the government investment rate. This impact is equal in magnitude, but opposite in sign, to the estimated impact on private investment rates reported in column 1. Thus, a reduction in regulation appears to cause a substitution away from government investment and in favor of private investment. The net effect on growth, of course, will depend on the relative productivity of private and public investment, an issue which we will address in the next section. Similar substitutions away from government investment and toward private investment are estimated for reductions in credit market and business regulations, as the estimated impacts reported in columns 5 and 6 are approximately equal in magnitude and opposite in sign to those reported in columns 2 and 3. The offsetting effects of regulation on private and public investment rates also explain the insignificance of the regulation variables in

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to calculate estimated impacts since all regulation variables are entered as natural logarithms.

the investment equations reported in Table 4, where total investment rates are used as the dependent variable.

Cross-Country Growth Regressions

We now turn to estimating the cross-country growth regressions suggested by the specifications in (1A) and (3). The significance of the estimated coefficients on the regulation variables in the investment equations reported in Table 5 indicates the presence of indirect effects on growth from regulation. Furthermore, the results in Table 5 indicate separate indirect effects related to private and public investment. As such, private and public investment rates must be entered separately as explanatory variables in the estimation of equations (1A) and (3). The results are reported in Table 6.

Columns 1-3 of Table 6 report the estimates of equation (1A) to measure the "direct" effects of regulation on growth. The index of business regulation is found to be statistically significant and positively related to growth. This result suggests that countries with less business regulation experience higher long-run growth rates as a result of higher total factor productivity. The estimated impact of this direct effect resulting from a one standard deviation above the mean increase in the business regulation index is a 9 percentage point increase in 20-year growth rates. There is no evidence of such a direct effect from overall and credit market regulations, as the coefficients on these measures of regulation are statistically insignificant in columns 1 and 2.

Several other of the estimated coefficients in (1A) provide some interesting insight. The estimated coefficients on private and public investment rates suggest that a one percentage point increase in the investment rate is more productive in the case of private investment than for public investment. Specifically, the estimates in column 3 suggest a one percentage point increase above the mean in the private investment rate will increase growth rates by 4.5

percentage points over a 20 year period, while the corresponding figure for public investment is only 2.8 percentage points. This result is consistent with results reported in Gwartney, Lawson, and Holcombe (2006) which suggest that private investment is more productive than public investment.

The results reported in columns 1-3 of Table 6 only measure the direct effect of regulation on growth. The cross-country investment equations reported in Table 5 also suggest that indirect effects of regulation on growth are present. Following the discussion in the previous section, both the direct and indirect effects can be estimated using the specification in (3). We now turn to these results, as reported in columns 4-6 of Table 6. The results indicate that overall regulation, credit market regulations, and business regulations are statistically significant and negatively related to growth. The estimated impact on growth from business regulation, as reported in column 6, is now 16 percentage points over the 20-year sample period. This impact is larger than that reported in column 3. Similarly, overall regulation and credit market regulation, which were found to be statistically insignificant in columns 1 and 2, now have a significant impact on growth, with an estimated impact of 13 and 8 percentage points, respectively, over a 20-year period. These larger estimates reflect the fact that both direct and indirect effects are accounted for in the estimation of equation (3). In addition, since private and public investment rates are entered separately in the model, the estimates of the indirect effect correctly account for the difference in productivity between private and public investment.

Taken together, the results in Table 6 suggest that regulation—as measured by all three of the regulation indexes—has a significant impact on growth when both direct effects (through total factor productivity) and indirect effects (through investment) are estimated. The comprehensive measure of regulation and credit market regulations affect growth primarily

through the investment channel—a plausible result in the case of credit market regulations given the importance of credit markets in directing investment to productive outcomes. Business regulation has a significant effect on growth via the total factor productivity channel as well. Furthermore, even though reductions in regulation tend to reduce government investment rates and increase private investment rates by roughly equal amounts, the net effect on growth through the investment channel is positive, due to the productivity differential of private investment over public investment.

The model estimated in Table 6 does not control for economic freedom. Specifications (1B) and (1C) can be used to determine whether the results with respect to regulation hold once economic freedom is included in the model. (1B) includes measures of both the level and change in economic freedom along with the regulatory measures in the model. Although the results are not reported, the regulatory measures are found to be statistically insignificant when specification (1B) is used as the underlying model. Recall that a possible explanation for this result is the high correlation between the levels of economic freedom and regulation (*EF* and *R*). In other words, the levels of economic freedom and regulation are so highly correlated that it is impossible for the regression to determine whether freedom or regulation is more important in explaining cross-country growth rates when both are included in the model.

An alternative approach to controlling for economic freedom is to include only ΔEF in the model, as suggested by specification (1C). When specification (1C) is used as the underlying model, all of the results reported in Table 6 hold; that is, the regulation measures remain statistically significant. In fact, the comprehensive measure of regulation is found to be statistically significant in the estimation of (1C), thus suggesting the overall regulation measure has a significant effect on growth through the direct effect as well as the indirect effect. Recall

that the estimates of specification (1A) suggested the comprehensive measure of regulation affected growth primarily through the indirect effect, as reported in columns 1 and 4 of Table 6. Since the correlation between R and ΔEF is insignificantly different from zero, we can conclude that regulation has a statistically significant effect on growth (along the lines reported in Table 6) even when changes in economic freedom are included in the model.

The Impact of Volatility in the Regulatory Regime

We now turn to estimation of the specification in (4), which incorporates a measure of the volatility of countries' overall regulatory programs in the model. The first step, however, is to include the volatility measure in investment equations similar to those reported in Tables 3 and 4 in order to determine if indirect effects with respect to the volatility measure are present. The results are not reported, but the volatility measure is found to be statistically insignificant in the investment equations. Nevertheless, residuals from the investment equations must be used (in place of the private and public investment rates) in the estimation of (4) in order to capture both the direct and indirect effects associated with the level of regulation. Table 7 reports the results.

The specification estimated in column 1 of Table 7 uses private and public investment rates as explanatory variables, and thus measures only the direct effect associated with the level of regulation. The volatility measure is statistically significant and negatively related to growth. The negative sign on the volatility measure indicates that countries with a more stable regulatory environment experience higher long-run growth rates. Note that the level of regulation remains insignificant when the volatility measure is included. This is consistent with the results reported in Table 6.

The model reported in column 2 uses residuals from private and public investment equations as explanatory variables in order to capture both the direct and indirect effects

associated with the level of regulation. The volatility of regulation remains statistically significant and negatively associated with growth, however, the estimated coefficient on the volatility measure does not increase in magnitude. In addition, the level of regulation is now statistically significant. Taken together, the results in columns 1 and 2 suggest that volatility's impact on growth is a direct effect, and the impact of the level of regulation is an indirect effect. That is, volatility affects growth through the total factor productivity channel, while the level of regulation affects growth through the investment channel.

Table 7 also reports the estimated impacts on growth from changes in the level and volatility of regulation. Together, a one standard deviation above the mean increase in the comprehensive regulation index (which implies less regulation) along with a one standard deviation reduction in the volatility of regulation increases growth rates by 20 percentage points over the 20-year sample period. Note that this estimate is considerably larger than the 13 percentage point increase in growth estimated from reducing just the level of regulation (as reported in column 4 of Table 6). Thus, reducing uncertainty in the regulatory program also appears to be an important part of an effective policy toward regulatory reform. In addition, even after a country succeeds in reducing regulation to a relatively low level, continued gains are possible from maintaining a more certain regulatory environment over time.

The results reported in Table 7 with respect to the volatility measure hold even when specifications (1B) and (1C) are used as the underlying model. Thus, volatility in the regulatory environment is found to be negatively related to growth even when the level of economic freedom is included in the model. The level of regulation remains insignificant when the level of economic freedom is included as an explanatory variable (i.e., when specification (1B) is used). This finding is consistent with the results discussed in the previous section concerning

specification (1B).

Conclusion

This paper uses cross-country data on regulation to estimate the relationship between regulation, investment, and long-run economic growth in a large sample of countries. The results suggest a statistically significant negative relationship between a broad measure of regulation and growth. Similar results are found when measures of credit market and business regulations are used. The results are mixed when measures of economic freedom are included in the model. The measures of regulation become statistically insignificant when the level of freedom is included, a result that is likely attributable to the high correlation between levels of freedom and regulation. When changes in freedom are included, however, the regulatory measures remain significant and negatively related to growth.

Regulation is also found to be statistically significant in explaining cross-country rates of private and public investment. More regulation is negatively related to private investment, and positively related to government investment. These results, combined with those from the growth regressions, suggest that reducing regulation has a positive impact on growth through both the investment channel (i.e., the so-called "indirect" effect) and the total factor productivity channel (the "direct" effect). This result applies to the measure of general business regulations. Credit market regulation and the broad measure of regulation are found to affect growth primarily through the investment channel. The magnitude of regulation's effect is also significant. For example, a one standard deviation decrease in the measure of business regulation is estimated to increase growth rates by 16 percentage points over a 20-year period.

Measures of the volatility of regulation are also used in cross-country growth regressions.

The results indicate that uncertainty in the regulatory environment has a negative impact on growth even when the level of regulation and a broader measure of economic freedom are taken into account. The results also suggest that volatility affects growth through the total factor productivity channel, while the level of regulation affects growth through the investment channel. Again, the size of the estimated impact is economically significant. The combined effect of reducing both the level and volatility of regulation is estimated to be 20 percentage points on growth rates over a 20-year period. Thus, a policy of steadily reducing regulation and then maintaining a stable regulatory program appears to be optimal with respect to promoting future economic growth.

References

Alesina, A.; Ardagna, S.; Nicoletti, G.; and Schiantarelli, F. (2003) "Regulation and Investment." NBER Working Paper #9560. Cambridge, MA: National Bureau of Economic Research.

Berggren, N. (2003) "The Benefits of Economic Freedom." *The Independent Review* 8: 193-211.

Dawson, J.W. (1998) "Institutions, Investment, and Growth: New Cross-Country and Panel Data Evidence." *Economic Inquiry* 36: 603-19.

Dawson, J.W. (2003) "Causality in the Freedom-Growth Relationship." *European Journal of Political Economy* 19: 479-95.

Dawson, J.W. (2006) "Regulation and the Macroeconomy." Working Paper. Boone, NC: Appalachian State University.

Dawson, J.W., and Seater, J.J. (2006) "The Macroeconomic Effects of Federal Regulation." Working Paper. Boone, NC: Appalachian State University.

De Haan, J., and Sturm, J.-E. (2000) "On the Relationship Between Economic Freedom and Economic Growth." *European Journal of Political Economy* 16: 215-41.

Djankov, S.; LaPorta, R.; Lopez-de-Silanes, F.; and Schleifer, A. (2002) "The Regulation of Entry." *Quarterly Journal of Economics* 117: 1-37.

Friedman, M. (1992) "Do Old Fallacies Ever Die?" *Journal of Economic Literature* 30: 2129-32.

Gwartney, J.D., and Lawson, R.A. (2005) *Economic Freedom of the World: 2005 Annual Report*. Vancouver, BC: The Fraser Institute.

Gwartney, J.D.; Lawson, R.A.; and Holcombe, R.G. (1999) "Economic Freedom and the Environment for Economic Growth." *Journal of Institutional and Theoretical Economics* 155: 643-663.

Gwartney, J.D.; Lawson, R.A.; and Holcombe, R.G. (2004) "Economic Freedom, Institutional Quality, and Cross-Country Differences in Income and Growth." *Cato Journal* 24: 205-233.

Gwartney, J.D.; Lawson, R.A.; and Holcombe, R.G. (2006) "Institutions and the Impact of Investment on Growth." *Kyklos* 59: 255-273.

Kaufmann, D.; Kraay, A.; and Mastruzzi, M. (2003) "Governance Matters." Working Paper #3106. Washington, DC: The World Bank.

Kaufmann, D.; Kraay, A.; and Zoido-Lobaton, P. (1999) "Governance Matters." Working Paper #2196. Washington, DC: The World Bank.

Kaufmann, D.; Kraay, A.; and Zoido-Lobaton, P. (2002) "Governance Matters II." Working Paper #2772. Washington, DC: The World Bank.

Mankiw, N.G.; Romer, D.; and Weil, D.N. (1992) "A Contribution to the Empirics of Economic Growth." *Quarterly Journal of Economics* 107: 407-37.

Nicoletti, G., and Scarpetta, S. (2003) "Regulation, Productivity, and Growth: OECD Evidence." *Economic Policy* (April): 9-72.

Pitlik, H. (2002) "The Path of Liberalization and Economic Growth." *Kyklos* 55: 57-80.

Solow, R.M. (1956) "A Contribution to the Theory of Economic Growth." *Quarterly Journal of Economics* 70: 65-94.

Table 1
Components of the EFW Regulation Index

Regulation of Credit, Labor, and Business

A. Credit market regulations

i. Ownership of banks: percentage of deposits held in privately owned banks
ii. Competition: domestic banks face competition from foreign banks
iii. Extension of credit: percentage of credit extended to private sector
iv. Avoidance of interest rate controls and regulations that lead to negative real interest rates
v. Interest rate controls: interest rate controls on bank deposits an/or loans are freely determined by the market

B. Labor market regulations

i. Impact of minimum wage: the minimum wage, set by law, has little impact on wages because it is too low or not obeyed
ii. Hiring and firing practices: hiring and firing practices of companies are determined by private contract
iii. Share of labor force whose wages are set by centralized collective bargaining
iv. Unemployment benefits: the unemployment benefits system preserves the incentive to work
v. Use of conscripts to obtain military personnel

C. Business regulations

i. Price controls: extent to which businesses are free to set their own prices
ii. Administrative conditions and new businesses: administrative procedures are an important obstacle to starting a new business
iii. Time with government bureaucracy: senior management spends a substantial amount of time dealing with government bureaucracy
iv. Starting a new business: starting a new business is generally easy
v. Irregular payments: irregular, additional payments connected with import and export permits, business licenses, exchange controls, tax assessments, police protection or loan applications are very rare

SOURCE: Gwartney and Lawson (2005)

Table 2
Cross-Country Summery Statistics

Variable	Mean	Std. Dev.	Minimum	Maximum
Economic Freedom	6.14	1.17	3.62	8.83
Regulation	5.74	0.92	3.30	7.74
Labor Market Regulation	5.32	1.27	3.30	8.23
Credit Market Regulation	6.78	2.02	1.06	9.56
Business Regulation	6.25	1.30	4.00	8.95
Change in Econ. Freedom	0.39	0.27	−0.30	0.93
Regulation Volatility	0.61	0.34	0.13	2.02
Total Investment Share	22.91	4.67	14.50	38.60
Private Investment Share	14.74	4.13	6.92	27.73
Public Investment Share	6.98	3.33	1.24	19.73

Notes: Statistics are calculated for the 64-country sample used in all estimated models. Freedom and regulation variables are country averages over the 1980-2000 period. Volatility measure is the standard deviation of changes in the regulation index over the 1980-2000 period. The economic freedom index is based on a scale from 1 to 10, with 10 representing the "most freedom." The regulation indexes are based on a scale from 1 to 10, with 10 representing the "least regulation."

Table 3
Cross-Country Spearman Rank Correlations

Variable	Economic Freedom	Regulation	Credit Market Regulation	Labor Market Regulation	Business Regulation	Change in Economic Freedom	Regulation Volatility
Economic Freedom	1.00						
Regulation	0.72***	1.00					
Credit Market Regulation	0.80***	0.84***	1.00				
Labor Market Regulation	0.06	0.51***	0.09	1.00			
Business Regulation	0.64***	0.66***	0.65***	0.13	1.00		
Change in Econ. Freedom	−0.34***	−0.07	−0.20	0.07	0.09	1.00	
Regulation Volatility	−0.09	−0.11	−0.08	0.01	0.13	0.06	1.00

Notes: Statistics are calculated for the 64-country sample used in all estimated models. Freedom and regulation variables are country averages over the 1980-2000 period. Volatility measure is the standard deviation of changes in the regulation index over the 1980-2000 period. The economic freedom index is based on a scale from 1 to 10, with 10 representing the "most freedom." The regulation indexes are based on a scale from 1 to 10, with 10 representing the "least regulation." *,**, and *** indicates significance at the 10%, 5%, and 1% levels, respectively.

Table 4
Cross-Country Investment Equations, 1980-2000
Estimation of Equation (2) in the text

Variable	**1**	**2**	**3**
Intercept	3.41***	3.48***	3.52***
Initial Income	−0.08**	−0.06	−0.11***
Labor Force Growth	−0.16	−0.10	−0.09
Regulation	0.02	---	---
Credit Market Regulation	---	−0.06	---
Business Regulation	---	---	0.21
Adjusted-R^2	0.04	0.05	0.06
Number of Observations	64	64	64

Notes: The dependent variable is the natural logarithm of the 1980-2000 average investment share in GDP. All explanatory variables except initial income are country averages for the 1980-2000 period; all are entered as natural logarithms except. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively, using White's robust standard errors. Estimated impact is the change in the dependent variable that results from a one standard deviation increase above the mean in the relevant index. See means and standard deviations in Table 2.

Table 5
Private and Public Investment Regressions, 1980-2000
Estimation of Equation (2) in the text

	Dependent Variable: Private Investment			Dependent Variable: Public Investment		
Variable	**1**	**2**	**3**	**4**	**5**	**6**
Intercept	0.66	1.45***	2.08***	4.93***	4.21***	3.60***
Initial Income	0.01	−0.01	0.03	−0.21***	−0.18**	−0.24***
Labor Force Growth	−0.10	−0.21	0.37	−0.18	0.04	−0.61
Regulation	0.96***	---	---	−0.91***	---	---
Credit Market Regulation	---	0.42***	---	---	−0.45***	---
Business Regulation	---	---	0.73***	---	---	−0.64***
Adjusted-R^2	0.29	0.30	0.22	0.29	0.31	0.26
Number of Observations	64	64	64	64	64	64
Estimated Impact: Regulation	+0.14	+0.11	+0.14	−0.14	−0.12	−0.12

Notes: The dependent variables are the natural logarithm of the 1980-2000 average private and public investment shares in GDP. All explanatory variables except initial income are country averages for the 1980-2000 period; all are entered as natural logarithms. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively, using White's robust standard errors. Estimated impact is the change in the dependent variable that results from a one standard deviation increase above the mean in the relevant index. See means and standard deviations in Table 2.

Table 6
Cross-Country Growth Regressions, 1980-2000
Estimation of Equations (1A) and (3) in the text

	Equation (1A): Direct Effects			Equation (3): Direct and Indirect Effects		
Variable	**1**	**2**	**3**	**4**	**5**	**6**
Intercept	−3.06***	−2.66***	−2.34***	−1.53**	−0.73	−0.16
Initial Income	−0.14**	−0.12**	−0.15**	−0.18***	−0.17***	−0.18***
Private Investment Share	0.67***	0.72***	0.68***	---	---	---
Private Investment Residuals	---	---	---	0.67***	0.59***	0.68***
Public Investment Share	0.22**	0.21**	0.21**	---	---	---
Public Investment Residuals	---	---	---	0.22**	0.21**	0.21**
Labor Force Growth	−0.63***	−0.61**	−0.38*	−0.74***	−0.76***	−0.26
Regulation	0.45	---	---	0.89***	---	---
Credit Market Regulation	---	0.10	---	---	0.31***	---
Business Regulation	---	---	0.45**	---	---	0.82***
Adjusted-R^2	0.37	0.35	0.38	0.37	0.35	0.38
Number of Observations	64	64	64	64	64	64
Estimated Impact: Regulation	---	---	+0.09	+0.13	+0.08	+0 .16

Notes: The dependent variable is the cumulative growth rate of real GDP per worker over the period 1980-2000. All explanatory variables except initial income are country averages for the 1980-2000 period; all except investment residuals are entered as natural logarithms. Investment residuals are from the estimation of cross-country investment equations similar to Equation (2) in the text; see the accompanying discussion in the text for details. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively, using White's robust standard errors. Estimated impact is the change in the dependent variable that results from a one standard deviation increase above the mean in the relevant index. See means and standard deviations in Table 2.

Table 7
Cross-Country Growth Regressions, 1980-2000
Estimation of Equation (4) in the text

Variable	**1**	**2**
Intercept	−2.47***	−1.09
Initial Income	−0.12*	−0.16***
Private Investment Share	0.69***	---
Private Investment Residuals	---	0.69***
Public Investment Share	0.19**	---
Public Investment Residuals	---	0.19**
Labor Force Growth	−0.53**	−0.63***
Regulation	0.27	0.77***
Regulation Volatility	−0.19*	−0.19**
Adjusted-R^2	0.39	0.39
Number of Observations	64	64
Est. Impact: Regulation	---	+0.12
Est. Impact: Regulation Volatility	−0.08	−0.08

Notes: The dependent variable is the cumulative growth rate of real GDP per worker over the period 1980-2000. All explanatory variables except initial income are country averages for the 1980-2000 period; all except investment residuals and regulation volatility are entered as natural logarithms. Investment residuals are from the estimation of cross-country investment regressions similar to Equation (2) in the text; see the accompanying discussion in the text for details. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively, using White's robust standard errors. Estimated impact is the change in the dependent variable that results from a one standard deviation increase above the mean in the relevant explanatory variable. See means and standard deviations in Table 2.