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Short-run and Long-run Effects of Corruption on Economic Growth: Evidence from State-Level Cross-Section Data for the United States

Nobuo Akai
University of Hyôgo

Yusaku Horiuchi
Australian National University

Masayo Sakata
Osaka International University

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Nobuo Akai, Yusaku Horiuchi and Masayo Sakata**

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** Nobuo Akai (akai@biz.u-hyogo.ac.jp) is an Associate Professor in the School of Business Administration at the University of Hyōgo (8-2-1 Gakuen-nishimachi, Nishiku, Kōbe, 651-2197, Japan). Yusaku Horiuchi (yusaku.horiuchi@anu.edu.au) is a Lecturer in the Asia Pacific School of Economics and Government at the Australian National University. Masayo Sakata (msakata@pel.oiu.ac.jp) is a Lecturer in the Faculty of Politics, Economics and Law at the Osaka International University. Please send all correspondence to Akai.

Abstract

Theoretical studies suggest that corruption may counteract government failure and promote economic growth in the short run, given exogenously determined suboptimal bureaucratic rules and regulations. As the government failure is itself a function of corruption, however, corruption should have detrimental effects on economic growth in the long run. In this paper, we measure the rate of economic growth for various time spans—short (1998–2000), middle (1995–2000) and long (1991–2000)—using previously uninvestigated state-level cross-section data for the United States. Our two-stage least square (2SLS) estimates with a carefully selected set of instruments show that the effect of corruption on economic growth is indeed negative and statistically significant in the middle and long spans but insignificant in the short span.

1. Introduction

Concern about the negative social and economic impacts of corruption has grown rapidly in both emerging economies and advanced democracies. Major international organizations have, as a result, begun examining the sources of, and solutions for, corruption. For example, on its website, the World Bank states, "The [World] Bank has identified corruption as the single greatest obstacle to economic and social development. It undermines development by distorting the rule of law and weakening the institutional foundation on which economic growth depends".[1] Similarly, the International Monetary Fund (IMF) states, "Many of the causes of corruption are economic in nature, and so are its consequences—poor governance clearly is detrimental to economic activity and welfare".[2] Both of these organizations not only support a number of anti-corruption programs and initiatives in their over 180 member countries, but also upload working papers and data to their websites, organize seminars and conferences, and produce many publications.

Although these international organizations consistently claim that corruption hinders economic growth, economists have not necessarily agreed with the claim from theoretical standpoints. Empirical studies have also shown mixed results at best. In this paper, along this line of growing research, we first carefully review both theoretical and empirical studies in the literature, and then estimate the causal effect of corruption on

[1] The World Bank, http://www1.worldbank.org/publicsector/anticorrupt/index.cfm (accessed on 20 January 2005). Also see World Bank (2000).

[2] The IMF, http://www.imf.org/external/np/exr/facts/gov.htm (accessed on 20 January 2005).

economic growth using previously uninvestigated state-level cross-section data for the United States.

We argue that the effect of corruption on economic growth should be estimated using a relatively long span of economic growth data for theoretical and practical reasons. Theoretical studies suggest that corruption may counteract government failure and promote economic growth in the short run, given exogenously determined suboptimal bureaucratic rules and regulations. As the government failure is itself a function of corruption, however, corruption should have detrimental effects on economic growth in the long run. In practice, policymakers and economists care more about such long-term consequences of corruption than the short-term effects.

None of the existing studies, however, examined the corruption effects by carefully considering time spans, as well as two other important factors that change parameter estimates—instruments and data. In this paper, we conduct two-stage least square (2SLS) regressions with various time spans, a carefully selected set of instruments, and relatively distortion-free dataset. Specifically, we measure the level of economic growth for various time spans—short (1998–2000), middle (1995–2000) and long (1991–2000)—and separately estimate the effect of corruption on growth. Our cross-section data from a single advanced democracy can reduce the variations in cultural, historical, and institutional differences, including qualitative differences in the administrative rules and practices, which have vexed the cross-national comparisons conducted by earlier empirical studies. We also select proper instruments by testing their validity. Considering these factors, we show that the effect of corruption on economic growth is indeed negative and statistically significant in the middle and long spans but insignificant in the short span.

The rest of this paper is organized as follows. In Section 2, we review previous theoretical and empirical studies on the causal relationship between corruption and economic growth. In Section 3, we explain our data and methods for empirical estimation. Section 4 shows the results. Finally, Section 5 concludes this paper.

2. Corruption and Economic Growth

In this section, we review theoretical and empirical studies that have investigated the impact of corruption on economic growth.[3] Although the World Bank and IMF presume corruption has significantly negative effects on economic growth, our careful reading of the existing studies reveals unsettled arguments and mixed results.

2.1. Theoretical Studies

More than 30 years ago, Leff (1964) first argued that corruption might promote economic growth as it relaxes inefficient and rigid regulations imposed by government (also see Huntington (1968) for earlier arguments). Since the mid 1980s, some economists have formalized mechanisms, in which corruption enhances efficiency and promotes growth. A “queue model” proposed by Lui (1985) argues that bureaucrats, when allocating business licenses to firms, give priority to those who evaluate time at the greatest value and bribe the bureaucrats into speeding up procedures. Beck and Maher (1986) and Lien (1986) developed “auction models” arguing that bribes in a

[3] Many studies examine the effects of corruption on other economic variables, such as investment, government expenditure composition, and economic inequality, but we do not review these as they are not directly related to the topic of this paper. For a comprehensive collection of these studies, see Abed and Gupta (2002).

biding process can promote efficiency because most efficient firms are often those who can afford the highest bribe. Shleifer and Vishny (1994) modeled a bargaining process between public and private sectors, eventually echoing Leff's (1964) proposition by arguing that corruption "enables private agents to buy their way out of politically imposed inefficiencies" (Shleifer and Vishny 1994:1013). A related argument is that corruption "may make possible smaller or no salary payments to officials who, if carefully supervised, will still carry out their functions on a fee-for-service basis" (Tullock 1996:6; also see Becker and Stigler 1974).

Some scholars, such as Tanzi (1998:582) and Aidt (2003:634–35), have recently refuted these arguments for various reasons. First, private firms paying a high bribe are not necessarily economically competitive firms. If a firm with potentially talented individuals engages in rent-seeking activities instead of more productive activities, such a sub-optimal use of human capital will damage macroeconomic growth (also see Baumol 1990; Lui 1996; Murphy et al. 1991). In fact, private firms are often *forced* to make side-payments to government officials to run their business in many countries, such as Indonesia (Sjaifudian 1997), Russia (Shleifer 1996) and Ukraine (Kaufmann 1997), and the cost of such corruption is particularly high for small but emerging enterprises, which can be a driving force of economic growth.

Second, corruption acts as an arbitrary tax for those giving bribes to public officials, as they have to bear the cost of searching for "partners" and negotiating with them. Because of such rent-seeking costs, Aidt (2003) argues, the auction model's claim that bribery is equivalent to competitive auction (as the same firm wins the prize at the same price under two arrangements) is invalid. Furthermore, when corrupt officials rather than the treasury collect revenues from individuals and firms, an opportunity to lower the tax burden is lost (see also Goulder et al. 1997).

Finally, government officials intentionally impose rigidities in order to extract bribes, thus officials know that the more rigidities they impose the more opportunity they have for extracting bribes. Similarly, if bribes are used to speed up procedures, bureaucrats may further slow down the administrative procedures (see also Andvig 1991; Myrdal 1968:Chapter 20).[4] In short, when corruption allows public officials to receive private benefits secretly and arbitrarily, they do not perform their expected role of fixing market failures, and instead create even more market failures. The government's fundamental role of protecting property rights is also distorted, and its accountability and transparency are diminished (see also Boycko et al. 1996; Farrell 1987).

We regard the last argument as particularly important. As some economists argue, corruption may work as the second-best solution to market distortions imposed by government procedures and policies at least in the short run. In the long run, however, corruption itself produces further market distortions and reduces market efficiency. Indeed, Lui (1996:28) writes, "corruption has two effects; (i) a positive level [short-term] effect on allocative efficiency; and (ii) a negative effect on the economy's long-term growth rate". Although the first effect still remains a matter of debate, there seems to be no theoretical disagreement for the latter. Furthermore, in practice, what policymakers and economists often care about is not the short-run effect but the long-run effect.

For this reason, theoretically motivated and practically important empirical

[4] There is a counterargument to this claim. Based on a formal model, Lui (1985) argued that government officials do not cause administrative delays to attract more bribes.

studies should focus on testing the long-run negative effect of corruption on growth. To highlight its importance and differences between short-term and long-term estimates, however, in this paper, we conduct regressions with different time spans and compare their estimates.

2.2. Empirical Studies

Below, we first introduce extant empirical estimates of corruption's effect on economic growth, and then discuss various methodological problems that are thought to cause the mixed findings in the literature.

A pioneering work by Mauro (1995) examines the impact of corruption using Business International's (1984) corruption index and growth rates of per capita GDP from 1960 to 1985 (Summers and Heston 1988). Using these variables, Mauro (1995:702–3) shows that a one-standard-deviation decrease in the corruption index significantly increases the annual growth rate of GDP per capita by 0.8 per cent (specifically, in Model 6, Table 7). As this finding is based on a simple regression with an instrumental variable (the index of ethno-linguistic fractionalization) but without control variables, it is not robust, as Mauro himself admits (1995:701). After controlling for other variables, including investment, the effect of corruption becomes insignificant (see Models 8 and 10, Table 7).

Mo (2001) also uses long-term economic growth rates of per capita real GDP from 1970 to 1985, originally prepared by Barro and Lee (1993).[5] This study shows

[5] Mo (2001:69) gives the following explanation for using the long-term growth rate: "To study the determinants of the growth rates of total factor productivity and the capital stock, we need a relatively long observation period".

originality, albeit controversial, in estimating a “direct” effect of corruption, as well as “indirect” effects of various transmission channels (i.e., investment, human capital, and political instability), through which corruption could affect economic growth. Specifically, Mo runs a regression using Transparency International’s Corruption Perceptions Index, variables measuring the three transmission channels, and other control variables. He also obtains a marginal effect of each transmission variable on corruption with three separate regressions, and defines the “total” effect of corruption as the marginal (“direct”) effect of corruption on growth plus a sum of transmission variables’ “indirect” effects, each of which is the marginal effect of each transmission variable on growth multiplied by the marginal effect of corruption on each transmission variable.[6] By using this method he shows that a one-unit increase in the corruption index reduces the growth rate by about 0.545 percentage points (i.e., the “total” effect) and that the most important channel is political instability, which accounts for 53 per cent of the “total” effect (2001:Table 6). Mo also uses instrumental variables (i.e., regional dummies and the index of ethno-linguistic fractionalization) and obtains similar negative effects (2001:Table 8). The validity of the instrumental variables is, however, not properly tested. We should also note that the “direct” effect of corruption on growth, after controlling other variables, is insignificant in both OLS and 2SLS estimations (see Model B6, Table 2, and Model AP6, Table 8, in Mo (2001:72, 77–8)).

A recent study by Pellegrini and Gerlagh (2004) applies the same decomposition method suggested by Mo (2001), but uses a longer period to measure economic growth (i.e., real GDP per capita from 1975 to 1996) and considers another

[6] His rationale for using this decomposition method is that the level of multicolinearity between corruption and these transmission variables is expected to be high.

transmission channel of trade policies.[7] They also consider the endogeneity problem and conduct a set of 2SLS regressions with a valid instrumental variable that passes the Hausman test; that is, legal origins (Fredriksson and Svensson 2003). Their conclusion is similar to Mo's (2001)—namely, in both OLS and 2SLS regressions, the transmission variables are significantly influenced by the level of corruption. We should, however, note that, while a simple OLS (Model 1, Table 1 (Pellegrini and Gerlagh 2004:434)) indicates that corruption has a significantly negative effect on growth, this negative effect becomes insignificant in a 2SLS regression (Model 13, Table 7 (Pellegrini and Gerlagh 2004:449)). Furthermore, with all control variables, the "direct" effect of corruption is insignificant in both OLS and 2SLS regressions (Model 3, Table 1 (Pellegrini and Gerlagh 2004: 434); Model 15, Table 7 (Pellegrini and Gerlagh 2004:449)) and it even shows a *positive* effect in the 2SLS regression.

There are two other related studies that do not rely on the decomposition method and conduct standard OLS regressions with control variables (but without instrumental variables). Rock and Bonnett (2004) check the robustness of the conventional argument (i.e., the negative effect of corruption on growth and investment) using four different corruption indices, and find similar negative impacts of corruption on economic growth. Yet, these effects are significant only conditional on model specification (Rock and Bonnett 2004:Tables 2–4). More interestingly, they show that corruption in the large East Asian newly industrializing economies (i.e., China, Indonesia, Korea, Thailand and Japan) significantly *promotes* economic growth (Rock

[7] Pellegrini and Gerlagh (2004:443) argue that the observation period of the dataset Mo (2001) had used is short, and that data with a longer time span "can help us to appreciate the pervasive effect of corruption on growth".

and Bonnett 2004:Table 4). The observation period in their study varies depending on "[d]ata constraints, particularly on corruption variables, [which] led to estimation of four different sets of cross-country regressions for four different time periods—1980–83, 1988–92, 1984–96 and 1994–96" (Rock and Bonnett 2004:1005).

Abed and Davoodi (2002) also run a standard multivariate regression. They use panel and cross-sectional data for 25 countries over the period 1994–98, and examine the roles of corruption in transition economies. Compared with other studies, their study uses data with a much shorter time span. The results (Abed and Davoodi 2004:Table 4) show that higher growth is associated with lower corruption in both panel and cross-sectional regressions and denoted significance at one per cent level. But this effect is insignificant with panel data when their structural reform index, which may in part measure the degree of government failure, is included.

In sum, these empirical studies show mixed results at best. Some may present unbiased estimates, while others may present biased ones. To figure out the causes of varying empirical estimates, we discuss below various possible methodological problems in the existing studies, before introducing our data and specification in the next section.

First, as we discussed earlier, any theoretically-driven and practically-relevant study should estimate the long-term effects of corruption. Abed and Davoodi (2002), however, use data for the period 1994–98. Using such short-term data presents a methodological problem; namely, economic growth in the short-term is influenced by a number of unobserved or immeasurable short-term factors, some of which may be systematic rather than stochastic. Such short-term random and non-random factors can "average out" in the long-run.

Second, theoretical models imply that we need to control for the effects of suboptimal government regulation in order to estimate the marginal effects of corruption alone on economic growth.[8] Most studies do not attempt to control this variable. An exception is Abed and Davoodi's (2002) reform index, but it may not be a valid indicator of the government failure. It is typically very difficult, if not impossible, to measure the degree to which government regulation is suboptimal.

Third, if this important control variable is immeasurable, or measurable only with serious measurement error, a standard solution is to find an appropriate instrumental variable (or a set of instrumental variables). Rock and Bonnett (2004) and Abed and Davoodi (2002), however, do not attempt to control omitted variable bias using instruments. Other studies do, indeed, run the two-stage least square (2SLS) regressions with instrumental variables, but with the exception of Pellegrini and Gerlagh (2004) do not report the validity of their instruments. Hence, their 2SLS regressions may use "weak" instruments, which produce even more serious bias and inefficiency than standard OLS regressions (Staiger and Stock 1997).

Fourth, when estimating the long-term effect of corruption on economic growth, as theoretical studies imply, we should consider the effect of corruption on government failure. To put it differently, we should note that the government failure is causally *prior* to corruption in the short run but is causally *posterior* in the long run. One may thus

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[8] Schleifer and Vishny (1994:1013) address this problem. "One way to reconcile this argument [i.e., that corruption increases efficiency] with the evidence [by Mauro (1993)] is to note that corruption goes hand in hand with the extent of political control, and hence the empirical observation that corruption is bad for growth simply reflects the fact that government regulation (omitted from the regression) is bad for growth."

argue that such *posterior*-government failure should be taken into account by adding appropriate indicators, as independent variables, in order to estimate the unbiased "direct" effect of corruption on growth. This argument is invalid, because inclusion of variables that are consequences of the key causal variable (in our case, corruption) introduces severe "post-treatment" bias (Frangakis and Rubin 2002; Greenland 2003). This recent statistics literature also implies that the decomposition method used by Mo (2001) and Pellegrini and Gerlagh (2004) is problematic as it explicitly includes independent variables that are theoretically and empirically consequences of corruption. Therefore, the "total" effect of corruption, in the long-term, should be estimated by dropping any post-treatment variables.

Fifth, all existing studies use cross-national data, making it difficult to control for a number of cultural, historical, and institutional differences, including qualitative differences in administrative rules and practices, across observations.

Finally, our review of the theoretical literature implies that we should carefully distinguish between the short-term vs. long-term effects of corruption on economic growth when empirically estimating the causal effects of corruption on economic growth. No study has yet been conducted comparing the causal effects of corruption for different time spans, so the possible varying effects of corruption over time have not yet been analysed.

3. Data and Methods

We consider the theoretical implications and methodological problems discussed in the previous section and take the following approach. First, we use state-level, cross-section data for the United States to minimize unobservable but non-stochastic differences across observations. Second, we measure economic growth using three different time spans and compare the results. Third, we carefully use instrumental variables and test their validity. Finally, we do not use the problematic decomposition method, exclude variables that are consequences of corruption, and measure the "total" effect of corruption on growth. We explain our data and variables in detail below. Descriptive statistics of all variables are shown in Table 1.

The total number of observations in our cross-state data for the United States is 46. Massachusetts, New Hampshire, and New Jersey are dropped because the value of our key independent variable (i.e., corruption) is missing for these states. Louisiana is also dropped due to missing data on an instrumental variable (i.e., political competition). The descriptive statistics introduced in this section (Table 1) are based on 46 observations.

The dependent variable, **GSP Growth Rate**, is measured by the annual growth rate of the real Gross State Product (GSP) per capita for various time spans—short (1998–2000), middle (1995–2000) and long (1991–2000).[9] The average across states is 1.3 per cent (1998–2000), 2.4 per cent (1995–2000), and 2.2 per cent (1991–2000). The states with the highest and lowest economic growth rates are Alaska and Oregon, respectively—in Alaska growth averaged –0.4 per cent (1998–2000), –1.7 per cent (1995–2000), and –1.1 per cent (1991–2000); and in Oregon 3.6 per cent (1998–2000), 5.9 per cent (1995–2000), and 4.6 per cent (1991–2000).

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[9] We obtain GSP data from the *Statistical Abstract of the United States* published by the US Department of Commerce. The growth rate is defined as $(1/T)\cdot\ln(Y_{i,t}/Y_{i,t-T})$, which is used in Barro and Sala-i-Martin (1995), where $Y_{i,t-T}$ is the real GSP per capita of *i*-th state in the initial year.

The key causal variable is **Corruption Index**. The cross-state index of corruption is obtained from Boylan and Long (2002), who conducted a survey of state house reporters' perceptions of public corruption in their state in 1998. State house reporters were asked to rate the level of corruption among all employees in the state government (including elected officials, political appointees, and civil servants) on a scale from one to seven (least corrupt to most corrupt). The average of such "local" reporters' opinions is used as a measure of corruption in each state.[10] The states with the lowest Corruption Index value in log (0.41) include Colorado, North Dakota and South Dakota; Rhode Island is found to be the most corrupt state (1.71). The mean of 46 states is 1.18 and the standard deviation is 0.36.

Note that the Corruption Index is measured in 1998, whereas GSP Growth Rate is the annual growth for the periods between 1998 and 2000, 1995 and 2000, and 1991 and 2000. Conceptually, what we ought to measure is the "stock" level of corruption in each state during the period of investigation. Practically, however, the Corruption Index is measured only once in a particular year during the period of investigation. This measurement error in the key causal variable is one of the two reasons why we must carefully find instrumental variables.

We consider, however, that using our Corruption Index is not a critical problem for two reasons. First, this index is based on state house reporters' perceptions, which may be shaped by observations and experiences over more than any particular year. More importantly, using the same independent variable while measuring the dependent variable (i.e., GSP Growth Rate) in multiple ways depending on time spans, allows us to

[10] We acknowledge problems of using a survey-based measure of corruption and, in the concluding section, discuss an alternative measure for our future research.

compare how the same variable could have different consequences on economic growth.

Based on the existing empirical studies of economic growth, we also use a set of control variables. All variables are taken from the *Statistical Abstract of the United States* published by the US Department of Commerce. The initial **real GSP per capita** is used to account for difference in state's economic development level and to capture plausible convergence effects (Barro 1991; Barro and Sala-i-Martin 1995). **Education** (the number of enrolments in public elementary and secondary schools as a proportion of the total number of persons aged 5–17) is a proxy for the level of human capital stock. **Investment** (nominal domestic investment as a proportion of nominal GSP) estimates the effect of investment on economic growth, while **government expenditure** (state and local governments' consumption expenditure as a proportion of nominal GSP) to estimate the effect of government consumption expenditure on economic growth.[11] Finally, **metropolitan population** (the share of state population living in metropolitan areas) estimates the effect of urbanization on economic growth. To avoid post-treatment bias, all these variables are measured in the initial year—1991, 1995 or 1998. Note that all independent variables, including the Corruption Index, are in log, thus we can directly compare the magnitude of these variables' effects. In our semi-log functional form, the slope coefficient measures the absolute change in GSP Growth Rate (i.e., percentage point change) for a given relative change in an independent variable.[12]

As we discussed earlier, however, theoretical studies suggest the existence of

[11] The total expenditure of both state and local governments excludes their education expenditure.

[12] Note that the elasticity estimate is the slope coefficient multiplied by the value of the GSP Growth Rate, indicating that the elasticity is variable.

another important variable, which is nevertheless difficult, if not impossible, to measure—each state's level of government failure and resultant suboptimal rules and regulations. Controlling this potential omitted variable bias is another important reason to find appropriate instrumental variables.

To find valid instruments, we reviewed studies examining determinants of corruption. For example, Tanzi (1998) summarizes the causes, consequences, and scope of corruption, and discusses possible corrective actions, from a cross-national perspective. Treisman (2000) presents several hypotheses regarding the determinants of corruption and empirically tests them using cross-national data. While these studies use cross-national data, Meier and Holbrook (1992) and Alt and Lassen (2003) estimate the determinants of political corruption using cross-section data for the United States.

Based on these studies and our preliminary empirical tests, we choose to use the following two variables. The first is a dummy variable for a region with the lowest average corruption level. That is **Plains Dummy**, which is one for Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota.[13] These states may have some institutional, cultural or historical factors preventing corruption, but these state-specific factors may not necessarily have direct effects on economic growth. The second instrumental variable is **Political Competition** (in log), which is taken from Holbrook and van Dunk (1993). This measure, which ranges from 0 to 100 (before taking a log), is based on district-level state legislative election results from 1982 to 1986; high values on this index indicate high levels of competition. Political competition is considered an outcome of political institutions and campaign finance

[13] Our division of states into regions is that used in *Statistical Abstract of the United States.*

restrictions, and is found to be an important predictor of corruption (Alt and Lassen 2003). This political variable is also expected to influence the level of economic growth, but only indirectly through corruption.

4. Regression Results

The results of 2SLS regressions (second stage) and specification tests for the validity of instrumental variables are summarized in Table 2. The results of the first-stage regressions are presented in Table 3.

Before examining the estimated marginal effects of our causal variable, we discuss the appropriateness of our model specification. First, we examine potentially high levels of collinearity among independent variables, by calculating VIF (variance inflation factors) of each independent variable (not-reported). Since the mean VIF is quite low (about 1.3) for each regression, we do not need to be concerned about multicolinearity. The adjusted R-squared statistic is 0.15 in the short-term (1998–2000), 0.34 in the middle-term (1995–2000), and 0.41 (1991–2000) in the long-term. The longer the data period, the higher the adjusted R-squared statistic, which is consistent with our expectation, as stochastic and non-stochastic factors tend to average out in the longer period. The low F-statistics (i.e., the high P-value) in the regression using short-term data implies that the model has no overall explanatory power. As we discussed, this is one of the methodological reasons why we emphasize the importance of estimating the long-term determinants of economic growth.

Table 2 also presents two types of test statistics for instrumental variables. The high value of the F-statistic (i.e., the low P-value) rejects the null hypothesis that a set of instruments is jointly zero in the first-stage regression. In the nR-squared test proposed by Hausman (1983)—a more appropriate test for assessing the validity of instruments if more than one instrument is used—the low value of Chi-squared statistic (i.e., the high P-value) suggest that a set of instrumental variables can predict corruption and be excluded in a model explaining the level of economic growth. All three regressions pass these tests, suggesting the validity of using Political Competition Index and Plains Dummy as the instruments of Corruption Index.

The most important findings in Table 2 are that the sign of Corruption Index is negative in each of these three regressions (but the effect is small and insignificant in the short-run) and that the magnitude of the effect is more than double in the middle and long run. Figure 1 summarizes our findings graphically. Each panel shows the estimated marginal effect of Corruption Index (on the vertical axis, ranging from the minimum value to the maximum value, not in log) on GSP Growth Rate (on the horizontal axis, in per cent), while holding all the other independent variables constant at their means. A dot and a vertical line show the mean and 95 per cent confidence interval of prediction. It clearly shows that the marginal effects are large in the middle and long spans. When the level of corruption changes from the minimum (1.5) to the maximum (5.5), the GSP Growth Rate will decline by 2.4 percentage points in the long-run and 2.6 percentage points in the middle-run. These are quite large effects. In the short-run, the magnitude of the effect is smaller and the level of uncertainty is larger. This figure also suggests that the confidence intervals of predictions are narrower in the long-run than in the middle-run. These results suggest that the longer the period, the larger the negative effect and the more confident our prediction becomes. These empirical findings are consistent with theoretical arguments—whether corruption promotes growth *given* the government failures (in the short run) is still controversial, but there is no theoretical disagreement that it hinders growth in the longer period as corruption creates further government failures.

Table 2 also shows some other interesting findings. Real GSP per capita in the initial year is negative and significant in the middle and long runs. They confirm Barro's "convergence" theory of economic growth. Among all independent variables in these regressions, the initial income has the largest absolute effect (–2.92 in the middle run and –3.16 in the long run). The positive effects of Metropolitan Population are also significant in the middle and long runs. This result implies that urbanization and the resultant concentration of resources have been an important driving force of economic growth in US states. The initial amount of investment (measured by Investment) and the level of human capital stock (measured by Education) are found to be insignificant. The government expenditure also has no effect.

The results of the first-stage regressions (Table 3) are also worth close attention and interpretation. They show that the two instrumental variables, Political Competition Index and Plains Dummy, are significantly negative at the conventional level. The only exception is the estimate of Political Competition Index in the middle run. As Alt and Lassen (2003) argue, the high level of political competition lowers the level of corruption. As we discussed, region specific factors reduce the corruption problems in the Plains states.

What is equally important and interesting is that Metropolitan Population has a significantly *positive* effect on corruption. Note that it also has a significantly *positive* effect on economic growth. On the one hand, as Meier and Holbrook (1992) argue, urbanization fosters conditions conducive to corruption because government programs and resources are concentrated in the cities. On the other hand, such urban environments foster economic growth. These results suggest that we may estimate a *positive* effect of corruption on economic growth if the effect of urbanization on growth is not properly controlled. The omission of the urbanization variable may be another reason why the existing studies show unstable and mixed estimated effects of corruption on growth.

5. Conclusion

Although international organizations, such as World Bank and IMF, now presume the negative effect of corruption on economic growth, our careful readings of existing studies suggest that theoretical models show different implications and empirical findings are mixed. In this paper, using a previously uninvestigated, but relatively distortion free, dataset for the United States with various time spans and valid instruments, we re-estimated the effects and confirmed the significantly negative effect, especially in the long and middle spans. Corruption is indeed one of the "greatest obstacles to long run economic and social development".[14]

We believe our estimates are less biased than previous estimates, but acknowledge some further ways to improve analysis. First, we should seek an alternative measure of corruption at the subnational level in the United States. As Golden and Picci (2005) argue, survey-based measures of corruption have some intrinsic measurement problems because these measures are often based on perceptions of corruption rather than experiences of it. They are also problematic because respondents may have an incentive to underreport the level of corruption if they are involved in it. The selection of "experts" on each country/state's government–business

[14] The World Bank, http://www1.worldbank.org/publicsector/anticorrupt/index.cfm (accessed on 20 January 2005). Also see World Bank (2000).

relationships may also be biased. As a possible alternative that minimizes these potential sources of invalidity and unreliability, we plan to measure the Golden–Picci index of corruption for the United States.[15] This measure is based on the difference between the amounts of physical public capital and the amounts of investment cumulatively allocated for these public works. Examining whether our estimates are different from those based on this alternative measure is one of the top priorities for future research.

We also hope to create the same corruption measure for other countries, such as Japan. Compared with the perceptions-based cross-national measures commonly used in previous studies, these subnational-level corruption measures for various countries are expected to improve greatly our understanding of the causes and consequences of corruption.

References

Aidt, S.T., 2003. 'Economic analysis of corruption: a survey', *Economic Journal*, 113(491):632–52.

Abed, G.T. and Davoodi, H.R., 2002. 'Corruption, structural reforms, and economic performance in the transition economies', in G.T. Abed and S. Gupta (eds), *Governance, Corruption and Economic Performance*, International Monetary Fund, Washington, DC.

Abed, G.T. and Gupta, S., 2002. *Governance, Corruption and Economic Performance*, International Monetary Fund, Washington, DC.

Alt, J.E. and Lassen, D.D., 2003. 'The political economy of institutions and corruption

[15] Golden and Picci (2005) created this measure for Italy's 95 provinces and 20 regions as of the mid-1990s.

in American States', *Journal of Theoretical Politics*, 15(3):341–65.

Andvig, J.C., 1991. 'The economics of corruption: a survey', *Studi Economici*, 43(1):57–94.

Barro, R.J., 1991, 'Economic growth in a cross section of countries', *Quarterly Journal of Economics*, 106(2):407–43.

Barro, R.J. and Lee, J.W., 1993. 'International comparisons of educational attainment', *Journal of Monetary Economics*, 32(3):363–94.

Barro, R.J. and Sala-i-Martin, X., 1995. *Economic Growth*, McGraw-Hill, New York.

Baumol, W.J., 1990. 'Entrepreneurship: productive, unproductive, and destructive', *Journal of Political Economy*, 98(5):893–921.

Beck, P. and Maher, M.W., 1986. 'A comparison of bribery and bidding in thin markets', *Economic Letters*, 20(1):1–5.

Becker, G.S. and Stigler, G.J., 1974. 'Law enforcement, malfeasance, and compensation for employees', *Journal of Legal Studies*, **VOL?**(3):1–18.

Boycko, M., Shleifer, A. and Vishny, R., 1996. 'A theory of privatization', *Economic Journal*, 106(435):309–19.

Boylan, R.T. and Long, C.X., 2002. A Survey of State House Reporters' Perception of Public Corruption, Washington University in St. Louis, St. Louis, Missouri, mimeo.

Business International, 1984. Introduction to the Country Assessment Service, Business International Corporation, New York.

Farrell, S., 1987. 'Information and the Coase theorem', *Journal of Economic Perspectives*, 1(2):113–29.

Frangakis, C.E. and Rubin, D.B., 2002. 'Principal stratification in causal inference', *Biometrics*, 58(1):21–29.

Fredriksson, P.G. and Svensson, J., 2003. ‘Political instability, corruption and policy formation: the case of environmental policy’, *Journal of Public Economics*, 87(7–8):1383–405.

Golden, M.A. and Picci, L., 2005. ‘Proposal for a new measure of corruption, illustrated with Italian data’, *Economics & Politics*, 17(1):37–75.

Goulder, L.H., Parry, I.W.H. and Burtraw, D., 1997. ‘Revenue-raising vs. other approaches to environmental protection: the critical significance of pre-existing tax distortions’, *Rand Journal of Economics*, 28(4):708–31.

Greenland, S., 2003. ‘Quantifying biases in causal models: classical confounding vs. collider-stratification bias’, *Epidemiology*, 14(3):300–6.

Hausman, J. 1983. ‘Specification and estimation of simultaneous equation models’, in Z. Griliches and M. Intriligator (eds), *Handbook of Econometrics*, North-Holland, Amsterdam.

Holbrook, T.H. and van Dunk, E., 1993. ‘Electoral competition in the American states’, *American Political Science Review*, 87(4):955–62.

Huntington, R.E., 1968. *Political Order in Changing Societies*, Yale University Press, New Haven, Connecticut.

Kaufmann, D., 1997. ‘The missing pillar of a growth strategy for Ukraine: reforms for private sector development’, in P. Cornelius and P. Lenain (eds), *Ukraine: accelerating the transition to market*, International Monetary Fund, Washington, DC.

Leff, N., 1964. ‘Economic development through bureaucratic corruption’, *American Behavioral Scientist*, 8(2):8–14.

Lien, D.D., 1986. ‘A note on competitive bribery games’, *Economics Letters*, 22(4):337–41.

Lui, F.T., 1985. ‘An equilibrium queuing model of bribery’, *Journal of Political Economy*, 93(4):760–81.

Lui, F.T., 1996. ‘Three aspects of corruption’, *Contemporary Economic Policy*, 14(3):26–29.

Mauro, P., 1993. Essays on Country Risk, Asset Markets and Growth, PhD thesis, Harvard University, Cambridge, Massachusetts.

Mauro, P., 1995. ‘Corruption and growth’, *Quarterly Journal of Economics*, 110(3):681–712.

Meier, K.J. and Holbrook, T.K., 1992. ‘I seen my opportunities and I took ‘em: political corruption in the United States’, *Journal of Politics*, 54(1):135–55.

Mo, P.H., 2001. ‘Corruption and economic growth’, *Journal of Comparative Economics*, 29(1):66–79.

Murphy, K.M., Shleifer, A., Vishny, R.W., 1991. ‘The allocation of talent: implications for growth’, *Quarterly Journal of Economics*, 106(2):503–30.

Myrdal, G., 1968. *Asian drama: an inquiry into the poverty of nations*, Pantheon, New York.

Pellegrini, L. and Gerlagh, R., 2004. ‘Corruption’s effect on growth and its transmission channels’, *Kyklos*, 57(3):429–56.

Rock, M.T. and Bonnett, H., 2004. ‘The comparative politics of corruption: Accounting for the East Asian paradox in empirical studies of corruption growth and investment’, *World Development*, 32(6):999–1017.

Shleifer, A. and Vishny, R.W., 1994. ‘Politicians and firms’, *Quarterly Journal of*

Economics, 109(4):995–1026.

Shleifer, A., 1997. 'Government in transition', *European Economic Review*, 41(3):385–410.

Sjaifudian, S., 1997. 'Graft and the small business', *Far Eastern Economic Review*, 16 (October):32.

Staiger, D. and Stock, J.H., 1997. 'Instrumental variables regression with weak instruments', *Econometrica*, 65(3):557–86.

Summers, R. and Heston, A., 1988. 'A new set of international comparisons of real product and price levels estimates for 130 countries, 1950–1985', *Review of Income and Wealth*, 34(1):1–25.

Tanzi, V., 1998. 'Corruption around the world: causes, consequences, scope, and cures', *IMF Staff Papers*, 45(4):559–94.

Treisman, D., 2000. 'The causes of corruption: a cross-national study', *Journal of Public Economics*, 76(3):399–457.

Tullock, G., 1996. 'Corruption theory and practice', *Contemporary Economic Policy*, 14(3):6–13.

World Bank, 2000. *The Anticorruption in Transition: a contribution to the policy debate*, World Bank, Washington, DC.

Table 1: Descriptive Statistics

Variable	Period	Mean	Std. Dev.	Min	Max
GSP Growth	1998–2000	1.289	0.677	–0.400	3.600
	1995–2000	2.433	1.106	–1.700	5.900
	1991–2000	2.241	0.934	–1.100	4.600
Corruption Index	1998	1.177	0.362	0.405	1.705
Real GSP Per Capita	1998	3.363	0.156	3.036	3.715
	1995	3.276	0.162	2.998	3.775
	1991	3.198	0.191	2.872	3.784
Investment	1998	–1.230	0.210	–1.801	–0.846
	1995	–1.279	0.210	–1.789	–0.933
	1991	–1.225	0.248	–1.942	–0.835
Government Expenditure	1998	–1.905	0.178	–2.284	–1.300
	1995	–1.852	0.365	–2.321	0.274
	1991	–1.983	0.168	–2.319	–1.419
Education	1998	4.519	0.035	4.441	4.584
	1995	4.523	0.036	4.438	4.594
	1991	4.526	0.040	4.432	4.616
Metropolitan Population	1998	4.139	0.356	3.329	4.572
	1995	4.120	0.384	3.170	4.572
	1991	4.091	0.391	3.161	4.557
Political Competition Index	1998	3.612	0.368	2.226	4.036
Plains Dummy	All years	0.152	0.363	0	1

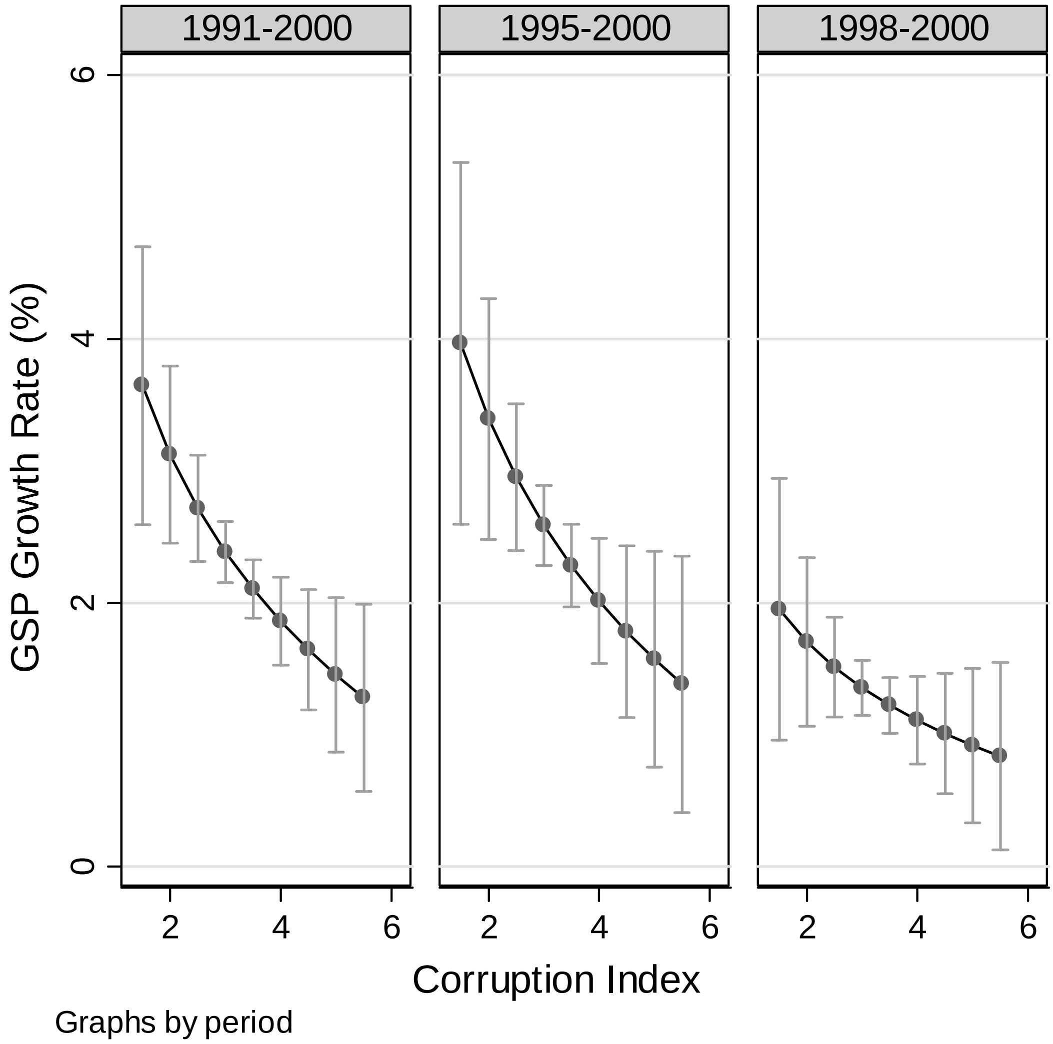
Note: GSP Growth is in per cent. All other variables except Plains Dummy are in natural log. The number of observations is 46.

Table 2: 2SLS Regression Results (Second Stage)

	1998–2000	1995–2000	1991–2000
Corruption Index	–0.86	–1.99	–1.82
	(–1.45)	(–2.45)	(–2.80)
Real GSP Per Capita	–0.14	–2.92	–3.16
	(–0.18)	(–2.99)	(–4.71)
Investment	0.33	0.20	0.71
	(0.68)	(0.27)	(1.31)
Government Expenditure	–0.32	–0.35	–0.40
	(–0.55)	(–0.89)	(–0.60)
Education	–0.90	–2.20	–0.24
	(–0.31)	(–0.51)	(–0.08)
Metropolitan Population	0.63	1.89	1.53
	(1.33)	(3.46)	(3.58)
Constant	3.99	16.10	9.35
	(0.29)	(0.79)	(0.65)
Number of observations	46	46	46
F(6, 39)	0.79	2.99	6.31
Probability > F	0.58	0.02	0.00
R-squared	0.26	0.43	0.49
Adjusted R-squared	0.15	0.34	0.41
Root MSE	0.62	0.90	0.72
F Test			
F(2, 38)	6.35	7.45	7.33
Probability > F	0.00	0.00	0.00
nR-squared Test			
Chi-squared(2)	1.77	2.36	1.53
Probability > Chi-squared	0.18	0.12	0.22

Note: The numbers in parentheses are t-statistics. Instrumental variables are Political Competition Index and Plains Dummy.

Figure 1: Estimated Marginal Effect of Corruption on GSP Growth Rate



Note: A dot and a vertical line indicate the mean and 95 per cent confidence interval of prediction. All the other independent variables are held constant at their means.

Table 3: 2SLS Regression Results (First-Stage)

	1998–2000	1995–2000	1991–2000
Political Competition	–0.30	–0.23	–0.32
	(–2.12)	(–1.68)	(–2.32)
Plains Dummy	–0.32	–0.39	–0.34
	(–2.34)	(–3.01)	(–2.38)
Real GSP Per Capita	–0.16	–0.04	–0.02
	(–0.45)	(–0.13)	(–0.06)
Investment	0.04	0.13	0.12
	(0.18)	(0.55)	(0.58)
Government Expenditure	0.28	–0.14	0.22
	(0.98)	(–1.10)	(0.71)
Education	–1.65	–2.02	–1.97
	(–1.16)	(–1.40)	(–1.49)
Metropolitan Population	0.43	0.26	0.30
	(2.63)	(1.79)	(2.20)
Constant	9.14	10.17	10.70
	(1.34)	(1.47)	(1.68)
Number of observations	46	46	46
F(7, 38)	4.23	4.76	4.75
Probability > F	0.00	0.00	0.00
R-squared	0.44	0.47	0.47
Adjusted R-squared	0.33	0.37	0.37
Root MSE	0.30	0.29	0.29

Note: The numbers in parentheses are t-statistics.