The Likelihood of Institutional Change Across Political Institutions: Evidence from Cross-Country Panel Data*

Helena Aten†

[*Preliminary and Incomplete.*]

Abstract

This paper explores whether there are systematic differences in institutional stability between democracies and non-democracies. It exploits data on 56 countries that have experienced institutional change between 1980-2007. Since the institution variable is correlated with unobservables in the determination of institutional change, a maximum likelihood estimation that does not control for this correlation will yield biased estimates. Assuming that the endogeneity operates solely through country fixed effects, I estimate the likelihood of institutional change using fixed effects probit with bias correction. Then I test the hypothesis that the endogeneity is operating through *time-variant* unobservables (in addition to time-invariant elements), and fail to find evidence that time-variant unobservables has a significant effect on institutional change once country fixed effects are controlled for.

This paper finds that having a democratic institution per se does not lead to a decrease in the likelihood of institutional change. The consistently significant factor is the interaction between democracy and the percentage of democracies in the world – the effect is significantly negative, which suggests that the interactions between democracies and non-democracies play a more important role in affecting institutional change than the institution itself. Further classification of political institutions into democracy, autocracy, and intermediate ranges yields stronger results confirming this argument.

JEL Classification: C40, D02, D74

Keywords: Institutional Change and Stability, Fixed Effects Probit, Political Institutions, Democracy vs. Autocracy.

*I would like to thank Frank Vella for repeated discussions and suggestions, and Ivan Fernández-Val for help with computing standard errors. All errors are my own.

†Department of Economics, Georgetown University, Washington DC 20057 USA. hrp3@georgetown.edu

1 Introduction

Though much studied throughout history, the value of democracy has been of especially great interest to social scientists since the twentieth century, in which we witnessed two world wars, the Cold War, and more instability across nations spurred by domestic and international conflicts. In search for what may lead to stability, prosperity, equality, and growth, many argue that democracy is a salient element, or even a "universal" criterion (Sen, 1999) towards these ends. This paper is an empirical study focusing on one specific aspect of comparative political institutions: are democracies systematically more stable than non-democracies? I explore what contributes to the stability of a political institution, and whether the choice of institution has an effect on stability, once other relevant factors are controlled for. Does democracy (the institution) itself contribute to stability, or is it the interactions across countries that impact institutional change?

The topic investigated in this paper is related to three strands of the existing literature: the empirical and theoretical literatures on democracies and political institutions, and the empirical literature on institutional change.

In the empirical literature on political institutions, there is an extensive study on the relationship between institutions and economic growth. Whether democracy is good for growth seems to depend on the methodology employed and the data or instruments used[1]. In the other direction of causality, the effect of economic factors on the likelihood of being a democracy is also far from settled. Regardless of the direction of casuality explored, the stability across various institutions is a key element in the study of comparative political systems. In the former case, stability reduces the uncertainty in economic and social environments, and minimizes destructions that often occur in the course of an institutional change. In the latter case, the question is whether economic growth reduces the probability of transition away from the institution in place, and therefore increases stability of the status quo institution.

In the theoretical literature on democracy, many have argued that democracy should be promoted because (among other benefits) it leads to greater stability within the country and across all nations[2]. The reasons range from an idealistic or moral argument for

[1]Examples include Barro (1996), Feng (1997), Rodrik, Subramanian, and Trebbi (2002), and Dollar and Kraay (2003). See also Persson and Tabellini (2009) for a brief review of the literature on the relationship between institution and economic growth.

[2]For example, Diamond (1992), Boutros-Ghali (1995), Sen (1999), and Ikenberry (1999).

democracy, to a more pragmatic strategic objective that spreading democracy minimizes conflicts and aggression among fellow democracies. In this paper I hope to identify whether the adoption of democracy itself, or spreading and having more democracies, that is more important in effecting institutional changes seen in the recent past.

Beginning perhaps from the seminal works of Douglass North[3], a strand of theoretical political economy literature studies why and how institutions persist. Recent papers include Acemoglu, Egorov, and Sonin (2008), Acemoglu and Robinson (2008), Jordan (2006), and Lagunoff (2009), in which the main focus is to characterize rules or institutions that are stable. However, to the best of my knowledge, there is no empirical paper that formally identifies factors that affect institutional stability, and whether the status quo political institution has a significant effect on it. Also, I would also like to compare the influence of foreign nations with the effect of political institution on institutional change. This will allow us to identify what aspects of democratization are important towards promoting institutional stability, and may have foreign policy implications for governments that seek to promote political stability across countries.

A major problem in evaluating the effect of institutions on institutional change is that the institution variable is correlated with the unobservables (culture, history, characteristics of the people) in determining the likelihood of institutional change. Without any controls to restore the orthogonality between the error and the institution variable, the estimates obtained in a maximum likelihood estimation will be biased. Controlling for each country's fixed effects is a reasonable first start to eliminate the endogeneity described. Unfortunately, fixed effects probit could not have been estimated correctly until relatively recently because of the incidental parameters problem[4], which results in the estimates being biased. In this paper I use the correction method proposed by Hahn and Newey (2004) to reduce this bias.

This paper uses data on 56 countries between 1980-2007. The institution variables are obtained or generated from the Polity IV dataset, and the economic variables are from the World Bank World Development Indicators. The results identified are only for countries that are in existence for the entire 28-year period and have experienced institutional change during this time. This is because the identification of the fixed effects estimates require

[3]A majority of North's work (such as North (1990) or Alston, Eggertsson, and North (1996)) includes some empirical elements, although most of the statistics are descriptive in nature.

[4]See Greene (2002) for a more detailed discussion.

that the status of the variable of interest (institutional change) changes at least once. For this reason, this paper does not explain why some political institutions have persisted for over a hundred years (for example, the United States and some European countries), but it helps us understand some of the factors that contribute to institutional change for countries that are either more prone to institutional change, or have experienced institutional change in the recent past.

Assuming that the endogeneity of the institution variable operates solely through country fixed effects, I estimate the likelihood of institutional change using fixed effects probit with bias correction. I find that having a democratic institution per se does not lead to a decrease in the likelihood of institutional change. The consistently significant factor is the interaction between democracy and the percentage of democracies in the world – the effect is significantly negative, which suggests that the interactions between democracies and non-democracies play a more important role in affecting institutional change than the institution itself. A country with a higher urban population is also associated with a lower probability of institutional change. Surprisingly, while the persistence of an institution, GDP, and levels of trade are all of the expected signs, they do not have a significant effect on the likelihood of institutional change.

Further classification of political institutions into democracy, autocracy, and intermediate ranges yields stronger results confirming the conclusions above. In particular, the presence of and interaction with democratic countries have a significant impact on the likelihood of institutional change, in that having a higher percentage of democratic institutions in the world increases the stability of democracies and reduces the stability of autocracies. Interestingly, having a higher percentage of autocracies in the world also reduces the stability of current autocracies. On the criterion of status quo institution alone, the data suggests that autocratic institutions are associated with a lower probability of institutional change than democratic institutions.

Finally I test whether the endogeneity of the institution variable is operating through time-variant or time-invariant unobservables using the Fernández-Val and Vella (2007) bias correction in a two-step estimator. The idea is to first estimate factors that determine the institution in place using fixed effects probit, then use the generalized residuals from that estimation as a regressor in the main equation (estimating institutional change). If the point estimate for the generalized residuals is significantly different from zero, it means that the institutional variable is correlated with time-variant unobservables in addition

to time-invariant fixed effects. I fail to reject the null hypothesis that the time-variant elements of the unobservables have no effect on institutional change once country fixed effects are controlled for, which means that the use of the fixed effects probit model is valid.

The rest of the paper is organized as follows: section 2 describes the econometric model estimated and the data; section 3 provides results of the fixed effects probit estimation; section 4 discusses an alternative specification and tests the robustness of the results; and finally section 5 concludes.

2 Econometric Estimation

The main objective of this paper is to identify factors that contribute to the likelihood of institutional change. In this section, I will first describe the econometric model used and the assumptions needed, and then discuss the variables that are included and the data sets from which they are obtained.

2.1 Econometric Model

Let $i = 1, ..., n$ denote the countries, and $t = 1, ..., T$ denote the time horizon. The primary equation that I would like to estimate is

$$\Delta_{it} = I\left(\beta' x_{it} + \delta' D_{it} + e_{it} > 0\right) \qquad (*)$$

where Δ_{it} is a binary variable = 1 if institutional change takes place, = 0 otherwise. The vector of explanatory variables that affects the likelihood of institutional change is given by x'_{it}; D'_{it} is a (vector of) binary variable(s) indicating the institution in place in country i at time t; and e_{it} is a random variable capturing the error and unobservables in $(*)$ that is assumed to be *i.i.d.* and normally distributed. Provided that

$$E\left[e_{it} | D_{it}, x_{it}\right] = 0 \qquad (A1)$$

$(*)$ can be estimated by probit.

There is legitimate concern that the error is correlated with the regressors in $(*)$. In particular, unobservable characteristics such as the culture, history, and the citizens'

ability to mobilize will likely affect both the likelihood of institutional change and the institution variable D_{it} (which means (A1) is violated). This leads to biased estimates of all index coefficients unless the endogeneity of D_{it} is addressed.

Many of the unobservable factors correlated with both the institution and institutional change are country-specific characteristics. In fact, some might argue that these characteristics that are often difficult to capture in data are more important in affecting the status quo institution and institutional change, which explains why policy advice that works for one country might not be good for another. For most of this paper, it is assumed that the endogeneity of the institution variable operates solely through time-invariant characteristics that are specific to country i (the exception is section 4, in which the validity of the assumption is tested). This assumption implies that once we control for country fixed effects (α_i), the error is no longer correlated with the regressors:

$$E\left[u_{it}|D_{it}, x_{it}, \alpha_i\right] = 0 \qquad \forall i,\ t \tag{A2}$$

We can therefore estimate the primary equation by fixed effects probit:

$$\Delta_{it} = I\left(\beta' x_{it} + \delta' D_{it} + \alpha_i + u_{it} > 0\right) \tag{**}$$

The fixed effects probit estimator maximizes the following log likelihood function by jointly choosing β, δ, and $(\alpha_i)_{i=1}^n$:

$$\mathcal{L}\left(\beta, \delta, \alpha\right) = \sum_{i=1}^{n}\sum_{t=1}^{T}\left\{\Delta_{it}\ln\left[\Phi\left(\beta' x_{it} + \delta' D_{it} + \alpha_i\right)\right] + \left(1-\Delta_{it}\right)\ln\left[1-\Phi\left(\beta' x_{it} + \delta' D_{it} + \alpha_i\right)\right]\right\}$$

It is important to note that in order for α_i to be identified, for each i, there needs to be some t in which $\Delta_{it} = 0$, and some $\hat{t}$ in which $\Delta_{i\hat{t}} = 1$. The reason for this requirement is that α_i only appears in country i's likelihood function and not any other country's. Therefore, suppose that some country i has $\Delta_{it} = 1$ for all t, then the fixed effect probit estimator chooses α_i to maximize country i's contribution to the likelihood,

$$\max \sum_{t=1}^{T}\ln\left[\Phi\left(\beta' x_{it} + \delta' D_{it} + \alpha_i\right)\right]$$

which does not have a well-defined solution for α_i. This is why the sample used in this

paper consists only of countries that have experienced institutional change during the period of study[5].

Another issue with fixed effects probit that is well noted in the econometrics literature is the incidental parameters problem first pointed out by Neyman and Scott (1948). The basic problem is that in panel data, it is much easier to increase the number of individual observations, but the number of periods in which they are observed is relatively fixed. Because the increase in sample size is mostly due to having more individuals, as we increase the sample size there is also a need to estimate an increasing number of fixed effects, which leads to bias in the fixed effects estimates. The fact that the index coefficients are estimated jointly with the fixed effects means the estimation of the former will be affected by the bias of the latter. The incidental parameter problem is most prominent with data that has a very short time horizon; in this paper the period studied is between 1980-2007, which is relatively long from the perspective of the problem. Nonetheless I employ the Hahn and Newey (2004) analytical bias correction to ensure that the estimates obtained are accurate; the standard errors will also need to be adjusted after the bias-corrected estimates are obtained[6].

2.2 Data

What are the factors that may be argued intuitively to have an impact on institutional stability? This paper explores five broad categories:

- Political institution –
  This is the key variable that motivates this paper: are democracies more stable, once all relevant factors are controlled for?

- Persistence –
  It has been argued that institutional inertia (for instance, see Coate and Morris

[5]Technically the requirement is that the sample of countries must have had the institutional change variable being both 0 and 1; however, as one can imagine the latter constraint is the one that binds, while the former is not restrictive in the data.

[6]The basic steps are to first bias-correct the index coefficients, then re-maximize each individual's log likelihood choosing only their individual fixed effects, fixing the bias-corrected estimates. The variance-covariance matrix can be obtained next by evaluating the Hessian of the log likelihood at the bias-corrected estimates and new fixed effects.

(1999)) is an important factor in the stability of an institution. While the connotation is mostly negative, persistence could be interpreted in a positive sense as well, as illustrated in Persson and Tabellini (2009).

- Economics –
  GDP is certainly a factor to be included given the extensive literature on growth and stability (see section 1); the interdependence of countries through trade may also increase (increased resource conflicts) or decrease (increased reliance on and interest in the stability of trade partners) institutional stability.

- Demographics –
  Demographic information is useful in understanding part of a country's characteristics, its policy emphasis, and the ease of information transfer among citizens.

- Foreign influence –
  Throughout history, there have been many instances in which foreign nations directly or indirectly interfere and cause institutional change within a country. It can also be argued that being exposed to more of one type of institution leads to higher acceptance, or greater realization of the benefits and costs of that institution.

The data used in this paper is obtained from two main sources: the Polity IV data set, compiled by the Center for Systemic Peace; and the World Development Indicators (WDI), compiled by the World Bank.

The Polity IV data set has information on 187 countries from 1800-2007, but most countries only have data available from 1960 onward, with missing values scattered frequently in between. WDI, on the other hand, has economic and demographic data on 209 countries only between the years of 1960 and 2008. Unfortunately, a significant percentage of countries that this paper would like to capture (having experienced institutional change) do not have WDI data until after 1980; therefore, the sample constructed merges the two data sets from 1980-2007.

The variables of interest from the two data sets are listed in Table 1. We obtain two key variables from Polity IV: *polity2* and *durable*. The institution variable is *polity2*, which ranges from -10 to 10 and describes the institution that is in place; -10 denotes the highest level of autocracy, 10 denotes the highest level of democracy. It is a composite index that evaluates, very broadly speaking, the power of the executive and the extent to which the

incumbent can be challenged. This variable is also an improvement from the variable *polity* for the purpose of data analysis, by smoothing the composite index across transition or interruption periods[7]. The variable *durable* captures the number of years since there is a three-point or more change in *polity2* over a period of three years or less.

A majority of variables used in this paper are generated from *polity2* and *durable*. First, *change* is a binary variable defined to take on value 1 if there is a change in *polity2* score of three or more from the last period; otherwise it is zero. The variable *persist* is a one-period lag of *durable*. If we use *durable* as a regressor, then whenever institutional change occurs, by definition *durable* is always reset to zero. Therefore we must use the one-period lag of *durable* to identify the impact of persistence on institutional stability. The three institution variables are $d5$, $a5$, and $d0$. The main democracy variable is $d5$, defined to be 1 if *polity2* is strictly greater than 5; otherwise it is zero. The autocracy variable $a5$ is a mirror image of $d5$: it is equal to 1 if *polity2* is strictly smaller than -5; zero otherwise. To broaden the definition of a "democracy", $d0$ is constructed to include countries that has a *polity2* score of strictly above zero. With these institution variables, we can calculate the percentage of democracies (based on either definition) and autocracies in the full set of data[8]; they are given by *pcd5*, *pcd0*, and *pca5*. Finally, to study the full extent of foreign influence on the likelihood of institutional change, it is useful to know how the impact differs across countries with different status quo institutions. To do so, I generate interactions between the institution variables and the percentages of democracies and autocracies.

There are three economic or demographic variables obtained from the WDI. The economic variables are *gdp05*, which describes the GDP per capita in 2005 international dollars, adjusting for purchasing power parity across nations; and *trade*, which describes trade as a percentage of GDP. To capture the demographic characteristics, *urban* is the percentage of urban population in a country.

As mentioned in the description of the econometric model (subsection 2.1), we can only identify fixed effects for countries that have both 0 and 1 for the institutional change variable. Also, we need to have complete data on all variables to be estimated in *Gauss*. This means that we cannot capture, for instance, the wave of institutional changes seen

[7]In the *polity* variable, a country going through a transition or interruption period often does not have data, or is given separate categories denoting transition or interruption.

[8]By full set I mean the original data before a sample with only countries that have complete data and experienced institutional change is extracted.

after the fall of the Soviet bloc, leading to the independence of countries that were previously under Soviet control. That said, there are still 56 countries in the sample; the list of countries included are given in Table 2.

The summary statistics of the original data sets and the sample evaluated is given in Table 3. As one can imagine, there is a greater percent of countries with $change = 1$ in the sample (relative to the original, full data set), and hence the average number of years in the *durable* or *persist* variable is also lower in the sample. The other significant difference to note is that the sample has on average much lower per capita income than the original data set.

Correlation among the key variables are given in Tables 4, 5, and 6. Democracies (defined by $d5$ or $d0$) appear to have a higher GDP, lower *persist*, and higher urban population than non-democracies and autocracies[9]. Interestingly, there is no marked difference in the percentage of trade across different political institutions. Among the continuous variables, *gdp05* and *urban* have a high correlation at 0.77. This might affect the standard errors of the estimates; different specifications will be used to see if the inclusion of both variables or exclusion of one or both variable(s) will change the results.

3 Results

This section describes the results obtained using fixed effects probit, discusses the differences across different specifications of the model and definitions of the institution variable(s), and analyzes the average marginal effects of the variables of interest on the likelihood of institutional change.

3.1 Fixed Effects Probit

Results of the basic model is given in Table 7. The first thing to notice that is being a democracy (having $d5 = 1$) has a negative but insignificant effect on the probability of institutional change. Persistence, though often hypothesized to play an important role, surprisingly also does not have a significant effect on the likelihood of institutional change. These results hold true regardless of the inclusion or exclusion of some of the

[9] As defined in this paper, the latter is a subset of the former.

relevant variables. Of course, they are specific to a sample of countries that have all experienced institutional change at some point in the period studied, and hence might not be representative of the full set of countries in the world.

The institution-based variable that seems significant in its impact on the likelihood of institutional change is the interaction between $d5$ and $pcd5$. The effect is negative, which means that having a higher percentage of democracies reduces the likelihood of institutional change among democracies. The significance of this coefficient, however, depends on model specification. On the whole, it seems to be significant whenever the variable *persist* (which itself is not significant) is excluded from the estimation. For non-democracies, the effect of having a higher percentage of democracies is not significantly different from zero.

Among economic and demographic variables, *urban* is the only variable that has a significant effect on the likelihood of institutional change. Increasing the percentage of urban population lowers the probability of institutional change, though occasionally the effect is not statistically different from zero. GDP and trade, while both having expected negative signs, are not significant regardless of the model specified.

To illustrate the importance of using fixed effects, the result of probit estimations *without* fixed effects is shown in Table 8. We can see that when time-invariant, country-specific characteristics are not controlled for, the coefficient on democracy is significant and negative, while most of the other variables are not (the only exceptions were the trade and interaction variables, which were significant in one model specification each). The difference in results between probit and fixed effects probit suggests that these time-invariant country-specific characteristics are important in affecting the likelihood of institutional change, and therefore cannot be ignored. Though not shown in the paper[10], the fixed effects obtained in the estimations are in fact mostly significant.

It is important to ask whether the results obtained above is specific to the definition of democracy used in this paper. To test the hypothesis, I widen the definition of democracy to include all countries that have a *polity2* score of above 0. The results of the fixed effects probit estimations are given in Table 9. I find that while the general features of the results are the same whether we use $d5$ or $d0$ as the institution variable – the only variables that are significant are *urban* and the interaction, both having negative signs as before –

[10] Available from the author upon request.

the significance of the interaction between institution ($d0$) and percentage and democracy ($pcd0$) is much weakened when we take a more inclusive definition of democracy.

Finally, I classify the institution variable into three categories – democracy ($d5 = 1$ as before), autocracy ($a5 = 1$), and the intermediate range ($d5 = a5 = 0$). The idea is the obtain a more detailed understanding of how the institution and interaction variables affect the likelihood of institutional change. Accordingly, I also include the percentage of autocracies, and allow for both own and cross interactions between the institutions and the percentages of different institutions in the estimations.

With a slightly finer classification of political institutions, we can see that the two ends of the *polity2* spectrum ($d5 = 1$ and $a5 = 1$) are both associated with having a lower likelihood of institutional change relative to the intermediate range. The coefficient of $a5$ is always significant, while the coefficient of $d5$ is significant only for some model specifications. The more interesting results come from the added interaction variables, which gives a richer description of the interactions among *and across* political institutions. For instance, increasing the percentage of democracies on average lowers the likelihood of institutional change among democracies; however, it also leads to an increase in the likelihood of institutional change among autocracies. Increasing the percentage of autocracies, on the other hand, has no significant impact on the probability of institutional change among democracies, but it has a significant and *positive* effect among current autocracies.

Results on the other variables are largely consistent with what is found earlier – *urban* is the only variable shown to have a significant negative effect on the likelihood of institutional change, while GDP, persistence, and trade are not significant. In fact, the signs of $gdp05$ are both negative as well as positive, depending on the particular specification of the model.

3.2 Marginal Effects

In this subsection I look at the marginal effect of each of the variables on the likelihood of institutional change. In most econometric estimations, it is useful (and in fact often of primary interest) to evaluate the effect of an increase or decrease in the explanatory variable on the response variable. Unfortunately, the point estimates in non-linear models are not informative about the effect of the regressor on the response variable beyond their signs (positive or negative). The marginal effect analysis in non-linear models requires

the specification of the levels of the explanatory variables and fixed effects at which the marginal effect is evaluated.

For the purpose of this subsection, the vector of regressors (x'_{it}) includes the institution variable(s) (D'_{it}) that was separately listed before.

There are two ways to evaluate the marginal effect $m(\cdot)$. The first is to look at the average marginal effect of an observation randomly drawn:

$$\frac{1}{nT}\sum_{t=1}^{T}\sum_{i=1}^{n} m\left(x'_{it}\beta + \alpha_i\right)$$

The second is to look at the marginal effect of an observation with average characteristics:

$$m\left(\frac{1}{nT}\sum_{t=1}^{T}\sum_{i=1}^{n}\left[x'_{it}\beta + \alpha_i\right]\right)$$

In panel data, especially when fixed effects are used, it is unclear how an observation with average characteristics (including fixed effects) should be interpreted. Therefore, what this subsection evaluates is the average marginal effect over the sample.

The evaluation of marginal effect depends on the nature of the variable of interest. Fernández-Val (2009) has an interesting discussion on how to evaluate the marginal effect based on the variable or situation. Suppose we are interested in the marginal effect of variable x^k on the likelihood of institutional change (Δ_{it}). If x^k is continuous, then the marginal effect is typically the derivative of the error distribution $\Phi(\cdot)$ with respect to x^k, evaluated at some $\bar{x}_{it} = (\bar{x}^k_{it}, \bar{x}^{(-k)\prime}_{it})$ of interest:

$$m(\bar{x}_{it}, \beta, \alpha_i) \equiv \frac{\partial \Phi\left(\bar{x}^k_{it}\beta^k + \bar{x}^{(-k)\prime}_{it}\beta^{(-k)} + \alpha_i\right)}{\partial x^k} = \beta^k \phi\left(\bar{x}^k_{it}\beta^k + \bar{x}^{(-k)\prime}_{it}\beta^{(-k)} + \alpha_i\right)$$

If the variable is binary or discrete, then the marginal effect is the difference in $\Phi(\cdot)$ with a one unit change in x^k at $\bar{x}_{it}$:

$$\tilde{m}(\bar{x}_{it}, \beta, \alpha_i) \equiv \Phi\left((\bar{x}^k_{it}+1)\beta^k + \bar{x}^{(-k)\prime}_{it}\beta^{(-k)} + \alpha_i\right) - \Phi\left(\bar{x}^k_{it}\beta^k + \bar{x}^{(-k)\prime}_{it}\beta^{(-k)} + \alpha_i\right)$$

To calculate the average marginal effect of a binary variable, we only sum over the subsample with the value of the binary variable at which we are evaluating. For instance, the

"average treatment effect on the treated" (Fernández-Val, 2009, p.76) is given by

$$\frac{1}{N_1}\sum_{t=1}^{T}\sum_{i=1}^{n}\tilde{m}((0,\bar{x}_{it}^{(-k)})',\beta,\alpha_i)\mathbb{1}\left[x_{it}^k=1\right]$$

where $N_1=\sum_{t=1}^{T}\sum_{i=1}^{n}\mathbb{1}\left[x_{it}^k=1\right]$.

There are additional issues with evaluating the marginal effect of a binary or continuous variable that has an associated interaction with another variable. This is not discussed in Fernández-Val (2009), however, given the importance of interactions between variables in this paper, I will elaborate on how these marginal effects should be interpreted. For this purpose, let $x_{it}=(x_{it}^k,(x_{it}^\ell)',(x_{it}^L)')$, where x_{it}^k is the variable of interest as before, $(x_{it}^\ell)'$ is a vector of interaction variables associated with x^k, and $(x_{it}^L)'$ is a vector of the remaining regressors. If x_{it}^k is a binary variable, then the overall marginal effect for the treated (the set $\{i:x_{it}^k=1\}$) evaluated at $\bar{x}_{it}$ is

$$\frac{1}{N_1}\sum_{t=1}^{T}\sum_{i=1}^{n}\left[\Phi\left(\beta^k+(\bar{x}_{it}^\ell)'\beta^\ell+(\bar{x}_{it}^L)'\beta^L+\alpha_i\right)-\Phi\left((\bar{x}_{it}^L)'\beta^L+\alpha_i\right)\right]\mathbb{1}\left[x_{it}^k=1\right]$$

If the variable of interest x_{it}^k is a continuous variable interacted with other binary variables, we will have to evaluate the marginal effect of the continuous variable for each possible realization of the binary (or discrete) variables, and as before only sum over the subsample whose effect we are capturing. Suppose x_{it}^k is interacted with a vector of binary variables $(x_{it}^q)'$ to form interactions $(x_{it}^\ell)'$ (so now $x_{it}=(x_{it}^k,(x_{it}^q)',(x_{it}^\ell)',(x_{it}^L)')$). Then the marginal effect of x_{it}^k for subsample $\{i:x_{it}^q=1\ \forall q\}$ evaluated at $\bar{x}_{it}$, for instance, will be given by

$$\frac{1}{N_q}\sum_{t=1}^{T}\sum_{i=1}^{n}\left[\left(\beta^k+\sum_\ell\beta^\ell\right)\phi\left(\sum_q\beta^q+\bar{x}_{it}^k\beta^k+(\bar{x}_{it}^\ell)'\beta^\ell+(\bar{x}_{it}^L)'\beta^L+\alpha_i\right)\right]\mathbb{1}\left[x_{it}^q=1\ \forall q\right]$$

where $N_q=\sum_{t=1}^{T}\sum_{i=1}^{n}\mathbb{1}\left[x_{it}^q=1\ \forall q\right]$; whereas the marginal effect of x_{it}^k for subsample $\{i:x_{it}^q=0\ \forall q\}$ evaluated at $\bar{x}_{it}$ is

$$\frac{1}{N_{q'}}\sum_{t=1}^{T}\sum_{i=1}^{n}\left[\beta^k\phi\left(\bar{x}_{it}^k\beta^k+(\bar{x}_{it}^L)'\beta^L+\alpha_i\right)\right]\mathbb{1}\left[x_{it}^q=0\ \forall q\right]$$

where $N_{q'}=\sum_{t=1}^{T}\sum_{i=1}^{n}\mathbb{1}\left[x_{it}^q=0\ \forall q\right]$. The case where the binary variables assume different values can be evaluated similarly.

Since the fixed effects have to be re-estimated after the index coefficients are bias-corrected, α_i depends on β even if evaluated at the true value of β. The slow convergence of the index coefficients also adds to the bias of the asymptotic distribution of the marginal effects (Fernández-Val, 2009, p.76). Therefore, the marginal effects need to have corrections made in addition to using the bias-corrected estimates for β and α_i. For consistency with subsection 3.1, I use the bias correction of Hahn and Newey (2004) to calculate the bias-corrected marginal effect of each variable.

The average marginal effects are shown in Tables 12 and 13. The ranges described below denote the marginal effect across different specifications of the model. When only $d5$ is used as the institution variable, increasing the percentage of democracies by one standard deviation (10.3%) leads to a $1.9 - 2.1\%$ decrease in the probability of institutional change among democracies on average. Increasing the percentage of urban population by one standard deviation (20.2%) is expected to reduce the probability of institutional change by $13.7 - 25.6\%$. Being a democracy ($d5 = 1$) on average results in a $2.8 - 7.5\%$ decrease in the likelihood of institutional change, though the effect is not significant.

When the institution variables are divided into democracy ($d5 = 1$), autocracy ($a5 = 1$), and the intermediate range ($d5 = a5 = 0$), the results are similar to only having $d5$. Increasing the percentage of democracies by one standard deviation is expected to yield a $1.4 - 6\%$ decrease and a $6.3 - 30.1\%$ increase in the likelihood of institutional change in democracies and autocracies respectively. Interestingly, increasing the percentage of autocracies (by one standard deviation, or 16.5%) does not significantly impact democracies, but results in a $4.1 - 19\%$ *increase* in the probability of institutional change among autocracies on average. Increasing the percentage of urban population by one standard deviation yields a similar effect as before, an average $6.7 - 21.6\%$ decrease in the probability of institutional change. Finally, being a democracy and autocracy on average leads to a $2.7 - 8.3\%$ and $14.9 - 34.7\%$ decrease in the likelihood of change over the intermediate group respectively.

While the magnitudes of marginal effect described above do not appear to be too large, bear in mind that instances of institutional change are not frequent in this time period. Of all countries in the world with data between 1980-2007, the instances of institutional change constitute only 4.6% of total observations; even for the sample analyzed in this paper, in which each country has experienced at least one instance of institutional change, instances of institutional change are still only 8.0% of total observations. For some of the

variables, the marginal effects could imply possibly doubling the probability of institutional change over the current level.

4 Source of Endogeneity

An important assumption used thus far is that the endogeneity of the institution variable D_{it} operates solely through time-invariant, country-specific fixed effects. However, it may be argued that there are time-variant unobservables that may affect both the status quo institution and the likelihood of institutional change. Examples of these unobservables include a global or regional financial crisis, an important technological invention, or a regional or world political event that has a domino effect on all related countries. If the endogeneity of D_{it} does in fact operate through time-variant unobservables as well, then assumption (A2) is violated, and the estimates obtained in fixed effects probit will still be biased. In this section, I investigate whether the time-variant unobservables constitute part of the endogeneity of the institution variable.

Consider, in addition to the primary equation $(**)$, the following equation that determines the institution in place:

$$D_{it} = I\left(\psi D_{i(t-1)} + \gamma' x_{it} + \eta_i + v_{it} > 0\right) \qquad (\diamondsuit)$$

where D_{it} now is just a single binary variable (instead of possibly a vector as before) with $D_{it} = 1$ indicating a democracy and $D_{it} = 0$ indicating a non-democracy. We assume that u_{it} and v_{it} are jointly normally distributed but possibly correlated, and

$$E\left[u_{it}|x_{it}, D_{it}, D_{i(t-1)}, \alpha_i, \eta_i\right] = E\left[v_{it}|x_{it}, D_{it}, D_{i(t-1)}, \alpha_i, \eta_i\right] = 0 \quad \forall i,\ t \qquad \text{(A3)}$$

The endogeneity of D_{it} is therefore due to the correlation of the errors and the correlation of fixed effects in $(**)$ and $(\diamondsuit)$ (Fernández-Val and Vella, 2007, p.6).

Given the environment described above, the idea is to first estimate $(\diamondsuit)$, then use the generalized residual of $(\diamondsuit)$ as an additional regressor in $(**)$ as a proxy for the time-varying element of the endogeneity. An important identification assumption required for this two-step estimation is the exclusion restriction in $(\diamondsuit)$ – there must be at least one variable that is *only* in $(\diamondsuit)$ and *not* in $(**)$. The reason for this requirement is that

without exclusion restriction, the residual obtained in the first stage will be a combination of only D_{it} and x_{it}, and therefore we will not be able to separately identify the coefficient for the residual. So for the two-step estimation to be valid, we need $\psi \neq 0$. I use the one-period lag of the institution variable as the exclusion restriction; this means that while the political institution yesterday has a significant effect on the political institution today, it does not have a significant effect on the likelihood of institutional change, once we control for the political institution today.

It is important to note that while a t-test on the coefficient of the generalized residual is valid for testing whether the endogeneity of D_{it} operates through time-variant components (Rivers and Vuong, 1988), the point estimates obtained in the second step are biased and cannot be used for inference. The reason is that the generalized residual is non-linear coming from the first step (probit), and since it is only estimated, the error in the second step contains the difference between the estimated and true generalized residuals. The non-linearity of the error term in the second stage implies that the normality assumption will no longer hold. As is well-known, maximum likelihood methods are very sensitive to whether the model is correctly specified, and therefore the violation of normality will result in biased point estimates when using fixed effects probit in the second stage.

As in the case of fixed effects probit, we need to do bias correction in each of the two steps to reduce possible bias stemming from the incidental parameters problem. In the first step, I use the Hahn and Newey (2004) bias correction as in subsection 2.1. In the second step, however, there are additional sources of bias that is not accounted for in the Hahn and Newey (2004) bias correction. These sources include the correlation of the fixed effects in the two steps, the asymptotic bias of the generalized residual, and the non-linearity of the second step (Fernández-Val and Vella, 2007, p.11). Fernández-Val and Vella (2007) proposes an analytical bias correction specific to two-step estimators for models with both time-variant and time-invariant heterogeneity. This is used in the second step of the estimation.

The procedure of the two-step control function estimator is as follows:

1. Estimate ($\diamondsuit$) using fixed effects probit, then use the Hahn and Newey (2004) bias correction to obtain $\widehat{\psi}$ and $\widehat{\gamma}$.
2. Fixing $\widehat{\psi}$ and $\widehat{\gamma}$, maximize each individual's log likelihood $\mathcal{L}_i\left(\eta_i, \widehat{\psi}, \widehat{\gamma}\right)$ choosing η_i. This yields a vector $\widehat{\eta}\left(\widehat{\psi}, \widehat{\gamma}\right)$.

3. Compute the generalized residual of ($\diamondsuit$), $\widehat{\lambda}\left(\widehat{\eta},\widehat{\psi},\widehat{\gamma}\right)$, using $\widehat{\eta},\widehat{\psi}$, and $\widehat{\gamma}$.

4. Estimate
$$\Delta_{it} = I\left(\beta' x_{it} + \delta D_{it} + \alpha_i + \theta\widehat{\lambda}_{it} + \widetilde{u}_{it} > 0\right)$$
with fixed effects probit, and use the Fernández-Val and Vella (2007) bias correction to obtain $\widehat{\beta}$, $\widehat{\delta}$, and $\widehat{\theta}$.

5. Repeat[11] step 2 with the corresponding parameters to obtain $\widehat{\alpha}\left(\widehat{\beta},\widehat{\delta},\widehat{\theta}\right)$.

The results of the two-step fixed effects probit are listed in Table 14. The main interest is the coefficient of the generalized residual obtained in the first step. If the coefficient is significant, it means that country-specific fixed effects alone are not sufficient in solving the endogeneity problem of the institution variable, therefore time-variant unobservables must be accounted for as well. As we can see, across the various model specifications, the coefficient of the generalized residual is never significant. This suggests that fixed effects probit is a valid estimation method for ($**$). We can also see that the key determinant of the political institution today is the political institution yesterday; once that is controlled for, other variables does not have a significant impact on the status quo institution. This result is perhaps not too surprising, and supports the possibility of at least very short-term (one-period) persistence, if nothing else because institutional change is very infrequently observed.

5 Conclusion

Institutional stability is undoubtedly an important topic for social scientists. On the empirical front, there has been extensive research on the effect of political stability on economic variables, and the causes and effects of different political institutions on growth. However, there has not been an empirical study formally linking the impact of political institutions on institutional stability, even though the relationship has been explored widely in political science and theoretical political economy. This paper attempts to fill this gap in the literature, and explores whether there are systematic differences in institutional stability between democracies and non-democracies.

[11] The standard errors in each step are obtained in the same way as described in footnote 6.

A standard probit estimation on the likelihood of institutional change (without time-variant or time-invariant controls) will be biased, since the institution variable is correlated with unobservables in the primary equation. For most of the paper, I assume that this endogeneity is driven solely by time-invariant country fixed effects. Therefore, I estimate the model using fixed effects probit, and use the bias correction of Hahn and Newey (2004) to mitigate the incidental parameters problem. Using data from Polity IV and the World Bank WDI, I find that having a democratic institution does not lead to a decrease in the probability of institutional change, once other relevant parameters are controlled for. A more consistent factor affecting the likelihood of institutional change is the interaction between the institution variable and the percentage of each political institution in the world. This suggests that foreign influence, varying based on a country's own status quo institution, more effectively affects institutional stability (or instability) than the political institution itself.

This paper finds that increasing the percentage of democracies by one standard deviation (10.3%) is expected to result in a $1.4 - 6\%$ decrease in the likelihood of institutional change among fellow democracies. However, it is also expected to increase the likelihood of institutional change among autocracies by $6.3 - 30.1\%$. Surprisingly, increasing the percentage of autocracies by one standard deviation (16.5%) leads to a $4.9 - 19\%$ *increase* in the probability of institutional change among autocracies on average, but has no significant impact among democracies. The percentage of urban population has a significant negative effect on the likelihood of institutional change; however, economic variables such as GDP and the level of trade do not appear to have a significant impact on stability. I also tested the assumption on the source of endogeneity using a two-step estimator with bias correction, and failed to find evidence suggesting that time-*variant* unobservables that is correlated with the institution have a significant impact on the likelihood of institutional change, once fixed effects are used.

This paper is a first attempt at evaluating the effect of political institution on institutional stability. Admittedly the proxy for institution is crude due to data limitations; however, I believe this paper opens up a number of interesting avenues that can be explored in future work. First, it will be interesting to study whether there are specific aspects within the democratic or autocratic institution that impacts institutional stability, and compare the effect of each. Second, it will be useful to distinguish between the types of institutional change – whether it be due a coup or revolution, civil or foreign-based wars, conflict or peaceful transitions – and whether the change was dramatic or gradual.

The causes of the different kinds of change are likely going to be different; separating these effects will give us a better understanding of the mechanics of the various kinds of institutional change. Third, it is instructive to identify the factors captured by the percentages of democracies and autocracies. Is it the strategic decisions by foreign nations to interfere that cause institutional change, or is it the mere presence of more democracies that leads to higher acceptance of democratic values, and appreciation of the benefits and costs of the various systems?

Finally, it may be important to relax the assumption on the distribution of error in determining institutional change. Figure 5 shows the distribution of fixed effects when fixed effects probit is estimated and the estimation includes all variables proposed (including $d5$, $a5$, and all the corresponding interactions with $pcd5$ and $pca5$). While the fixed effects have a bell-shaped distribution, the distribution of the *polity2* variable is bimodel (see Figure 6). *A priori*, it is unclear what distribution the unobservables have, and whether the normality assumption made in this paper is valid. This may call for a need to exploit semi-parametric methods of estimation that allow us to relax distributional assumptions on the errors or unobservables, and verify whether the estimates obtained will be different.

References

Acemoglu, D., G. Egorov, and K. Sonin (2008): "Dynamics and Stability of Constitutions, Coalitions, and Clubs," Mimeo, Department of Economics, MIT.

Acemoglu, D., S. Johnson, J. A. Robinson, and P. Yared (2008): "Income and Democracy," *American Economic Review*, 98 (3), 808–842.

Acemoglu, D., and J. A. Robinson (2005): *Economic Origins of Dictatorship and Democracy*. Cambridge University Press, New York.

——— (2008): "Persistence of Power, Elites, and Institutions," *American Economic Review*, 98 (1), 267–293.

Alston, L. J., T. Eggertsson, and D. C. North (1996): *Empirical Studies in Institutional Change*. Cambridge University Press, New York.

Barro, R. (1996): "Determinants of Economic Growth: A Cross-Country Empirical Study," *NBER Working Paper*, # 5698.

——— (1997): "The Determinants of Democracy," *Journal of Political Economy*, 107 (6), S158–S183.

Boutros-Ghali, B. (1995): "Democracy: A Newly Recognized Imperative," *Global Governance*, 1, 3–11.

Chamberlain, G. (1984): "Panel Data," in *Handbook of Econometrics, Vol. II*, ed. by Z. Griliches, and M. D. Intriligator. Elsevier Science Publishers, New York.

Coate, S., and S. Morris (1999): "Policy Persistence," *American Economic Review*, 89 (5), 1327–1336.

Diamond, L. (1992): "Promoting Democracy," *Foreign Policy*, 87, 25–46.

Dollar, D., and A. Kraay (2003): "Institutions, Trade, and Growth," *World Bank Policy Research Working Paper*, # 3004.

Feng, Y. (1997): "Democracy, Political Stability and Economic Growth," *British Journal of Political Science*, 27, 391–418.

Fernández-Val, I. (2009): "Fixed Effects Estimation of Structural Parameters and Marginal Effects in Panel Probit Models," *Journal of Econometrics*, 150, 71–85.

Fernández-Val, I., and F. Vella (2007): "Bias Corrections for Two-Step Fixed Effects Panel Data Estimators," *IZA Discussion Paper*, no. 2690.

Greene, W. (2002): "The Behavior of the Fixed Effects Estimator in Nonlinear Models," Mimeo, Department of Economics, Stern School of Business, NYU.

Hahn, J., and W. Newey (2004): "Jackknife and Analytical Bias Reduction for Nonlinear Panel Models," *Econometrica*, 72 (4), 1295–1319.

Ikenberry, G. J. (1999): "Why export democracy? The "hidden grand strategy" of American foreign policy is reemerging into plain view after a long Cold War hibernation," *The Wilson Quarterly*, 23 (2), 56.

Jordan, J. (2006): "Pillage and Property," *Journal of Economic Theory*, 131 (1), 26–44.

Lagunoff, R. (2009): "Dynamic Stability and Reform of Political Institutions," *Games and Economic Behavior*, XX (forthcoming), XX–XX.

Neyman, J., and E. L. Scott (1948): "Consistent Estimates Based on Partially Consistent ObservationsConsistent Estimates Based on Partially Consistent Observations," *Econometrica*, 16 (1), 1–32.

North, D. C. (1990): *Institutions, Institutional Change, and Economic Performance*. Cambridge University Press, New York.

Persson, T., and G. Tabellini (2009): "Democratic Capital: The Nexus of Political and Economic Change," *American Economic Journal: Macroeconomics*, 1 (2), 88–126.

Rivers, D., and Q. H. Vuong (1988): "Limited Information Estimators and Exogeneity Eests for Simultaneous Probit Models," *Journal of Econometrics*, 39 (3), 347–366.

Rodrik, D., A. Subramanian, and F. Trebbi (2002): "Institutions Rule: The Primacy of Institutions over Geography and Integration in Economic Development," *NBER Working Paper*, # 9305.

Sen, A. (1999): "Democracy as a Universal Value," *Journal of Democracy*, 10 (3), 3–17.

Wooldridge, J. M. (2002): *Econometric Analysis of Cross Section and Panel Data*. MIT Press, Cambridge.

Appendix

Table 1: Variables of interest from Polity IV & World Bank WDI.

Source	Variable	Notes
Polity IV	*polity2*	Integer ranges from -10 (autocracy) to 10 (democracy)
	durable	No. of years since last change of ≥ 3 in *polity2* over three years or less
WDI	*gdp05*	GDP per capita, PPP (constant 2005 international $)
	urban	Urban Population (% of total)
	trade	Trade (% of GDP)
Generated	*change*	$= 1$ if *polity2* change from last period is 3 points or more
	d5	$= 1$ if *polity2* > 5 ; 0 otherwise
	d0	$= 1$ if *polity2* > 0 ; 0 otherwise
	a5	$= 1$ if *polity2* < -5 ; 0 otherwise
	persist	No. of years (as of last year) since last change of ≥ 3 in polity2 over three years or less; it is also a one-period lag of variable *dura*
	pcd5	% of countries (for full sample) with $d5 = 1$
	pcd0	% of countries (for full sample) with $d0 = 1$
	pca5	% of countries (for full sample) with $a5 = 1$
	*d5*pcd5*	Interaction between *d5* and *pcd5*
	*d0*pcd0*	Interaction between *d0* and *pcd0*
	*a5*pca5*	Interaction between *a5* and *pca5*
	*d5*pca5*	Interaction between *d5* and *pca5*
	*a5*pcd5*	Interaction between *a5* and *pcd5*

Table 2: Countries with Complete Data that Experienced Institutional Change between 1980-2007.

Albania	Iran
Algeria	Ivory Coast
Argentina	Jordan
Bangladesh	Kenya
Bhutan	Korea South
Bolivia	Lesotho
Brazil	Madagascar
Bulgaria	Malawi
Cameroon	Mali
Central African Republic	Mauritania
Chad	Mexico
Chile	Mozambique
Comoros	Nepal
Congo Brazzaville	Nicaragua
Congo Kinshasa	Nigeria
Dominican Republic	Pakistan
Ecuador	Panama
Egypt	Paraguay
Fiji	Peru
Gabon	Philippines
Gambia	Senegal
Ghana	Sierra Leone
Guatemala	Sudan
Guinea	Thailand
Guinea-Bissau	Tunisia
Honduras	Turkey
Hungary	Uruguay
Indonesia	Zambia

Table 3: Summary Statistics.

	Original Set (those with data) (1980-2007)	Sample Estimated (56 countries) (1980-2007)
polity2	1.42	0.379
	(7.34)	(6.64)
durable	23.37	11.57
	(29.34)	(13.66)
gdp05	9290.60	3865.48
	(11222)	(3717.37)
urban	52.68	45.38
	(24.69)	(20.21)
trade	82.66	65.45
	(47.72)	(32.67)
change	0.046	0.080
	(0.210)	(0.271)
d5	0.451	0.372
	(0.500)	(0.484)
d0	0.540	0.482
	(0.498)	(0.500)
a5	0.319	0.318
	(0.466)	(0.466)
persist	23.20	11.62
	(29.20)	(13.79)
pcd5	0.439	0.439
	(0.103)	(0.103)
pcd0	0.524	0.524
	(0.128)	(0.128)
pca5	0.334	0.334
	(0.165)	(0.165)
no. obs.	varies by var.	1568

Standard deviation in parentheses.

Table 4: Correlations among Continuous Variables.

	persist	*gdp05*	*urban*	*trade*	*pcd5*	*pcd0*	*pca5*
persist	1						
gdp05	−0.0073	1					
urban	−0.1092	0.7723	1				
trade	0.0869	0.1096	0.0883	1			
pcd5	−0.1107	0.1093	0.1951	0.2345	1		
pcd0	−0.1144	0.1040	0.1934	0.2267	0.9917	1	
pca5	0.1181	−0.0982	−0.1889	−0.2193	−0.9762	−0.9913	1

Table 5: Correlations across Continuous and Binary Variables.

	persist	*gdp05*	*urban*	*trade*
$change = 0$	11.77	3913.35	45.65	65.96
	(13.78)	(3765.58)	(20.40)	(32.89)
$change = 1$	9.92	3312.92	42.24	59.51
	(13.81)	(3065.97)	(17.69)	(29.57)
$d0 = 0$	15.93	3127.88	40.21	63.00
	(16.97)	(3325.73)	(18.44)	(31.26)
$d0 = 1$	6.99	4657.73	50.94	68.08
	(6.63)	(3947.97)	(20.57)	(33.96)
$d5 = 0$	13.81	3063.33	40.25	63.33
	(16.29)	(3183.45)	(17.85)	(30.41)
$d5 = 1$	7.93	5217.05	54.02	69.02
	(6.46)	(4139.94)	(21.02)	(35.92)
$a5 = d5 = 0$	6.00	3248.91	43.89	65.70
	(7.87)	(3298.55)	(18.06)	(30.64)
$a5 = 0$	7.06	4324.12	49.42	67.52
	(7.20)	(3904.83)	(20.36)	(33.65)
$a5 = 1$	21.40	2882.96	36.72	61.02
	(18.62)	(3059.97)	(16.93)	(30.03)

Standard deviation in parentheses.

Table 6: Correlations among Binary Variables.

	$change$		$d0$		$d5$		$a5$		$a5 = d5$
	0	1	0	1	0	1	0	1	0
$change = 0$			52.32%	47.68%	61.95%	38.05%	66.46%	33.54%	28.41%
$change = 1$			45.60%	54.40%	72.00%	28.00%	88.00%	12.00%	60.00%
$d0 = 0$	92.98%	7.02%			100%	0%	38.55%	61.45%	38.55%
$d0 = 1$	91.01%	8.99%			22.75%	77.25%	100%	0%	22.75%
$d5 = 0$	90.85%	9.15%	82.52%	17.48%			49.29%	50.71%	49.29%
$d5 = 1$	94.01%	5.99%	0%	100%			100%	0%	0%
$a5 = 0$	89.71%	10.29%	29.28%	70.72%	45.37%	54.63%			45.37%
$a5 = 1$	96.99%	3.01%	100%	0%	100%	0%			0%
$a5 = d5 = 0$	84.54%	15.46%	64.54%	35.46%	100%	0%	100%	0%	

Percentages sum across each cell to 100 (except $a5 = d5 = 0$).

Figure 1: Democratization between 1980-2007.

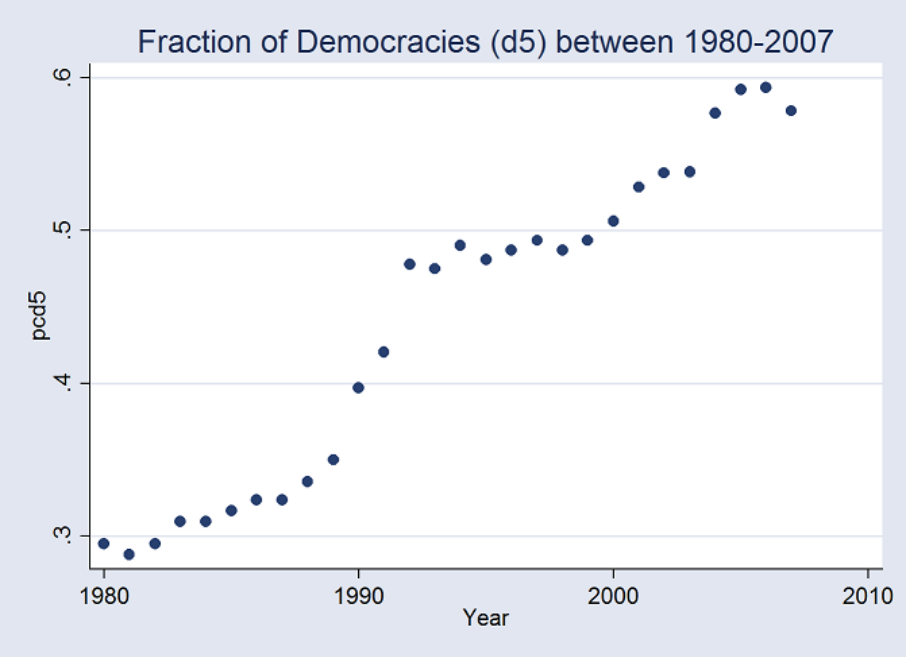

Figure 2: Fraction of Institutional Change observed in Sample between 1980-2007.

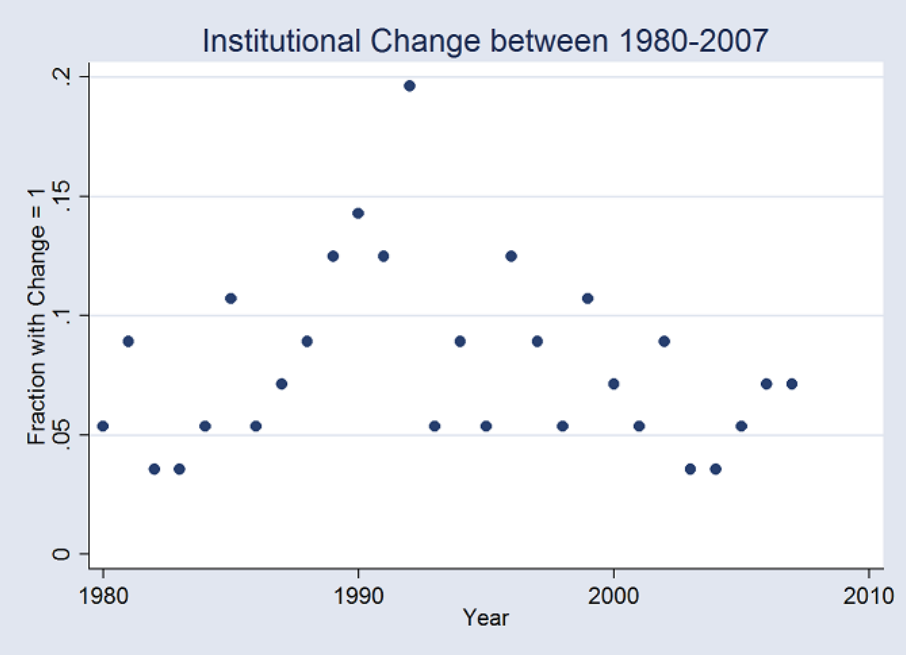

Figure 3: Fraction of Institutional Change among Democracies in Sample.

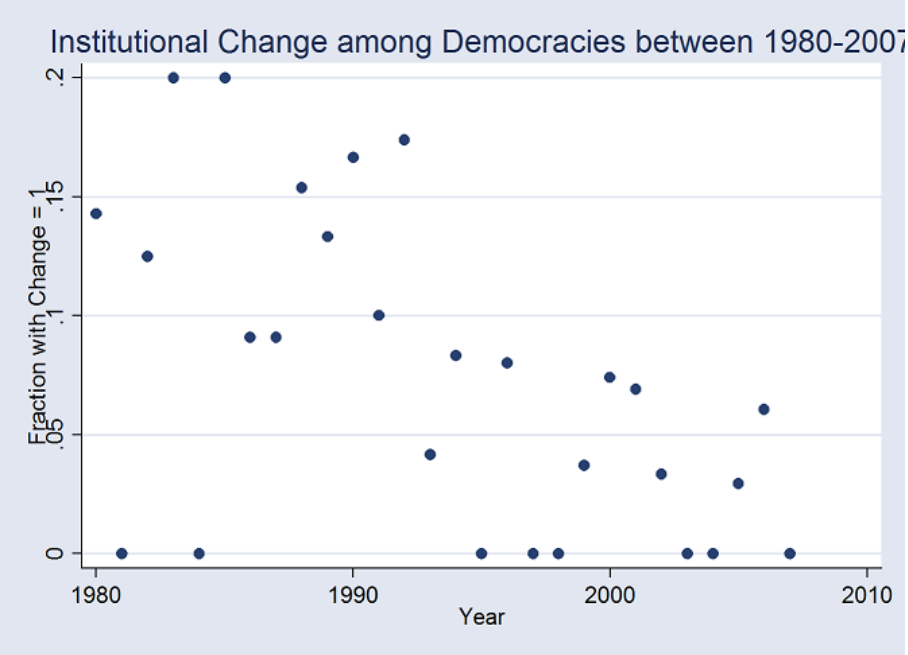

Figure 4: Fraction of Institutional Change among Autocracies in Sample.

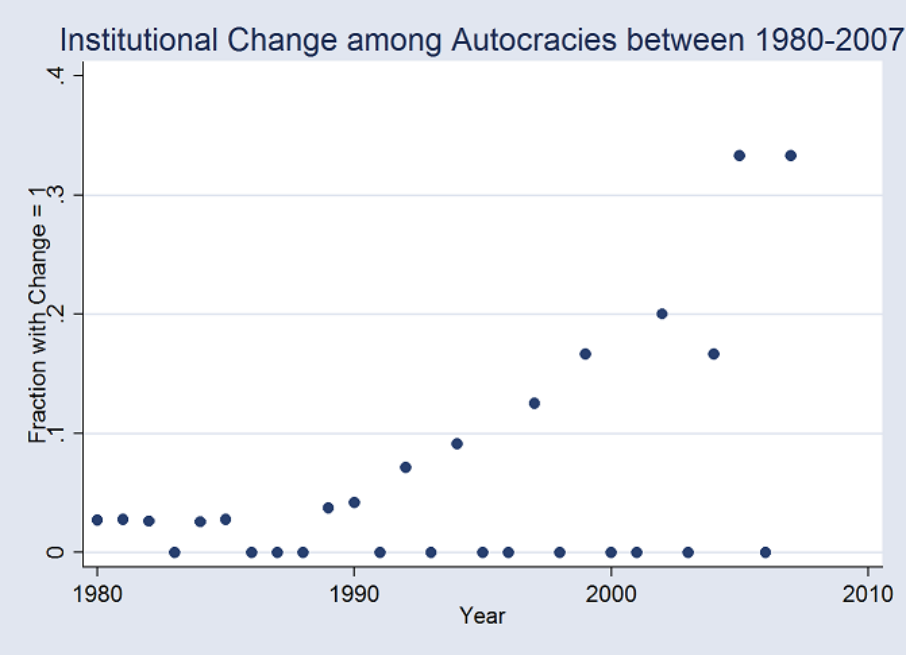

Table 7: Fixed Effects Probit with Bias Correction ($d5$ only).

	[1]	[2]	[3]	[4]	[5]	[6]	[7]
d5	−0.250	−0.221	−0.263	−0.283	−0.226	−0.275	−0.267
	(0.330)	(0.305)	(0.327)	(0.308)	(0.303)	(0.276)	(0.276)
persist	−0.152		−0.107	−0.150			
	(0.794)		(0.787)	(0.758)			
gdp05	−0.373	−0.228		−0.245		−0.141	
	(0.468)	(0.445)		(0.442)		(0.415)	
urban	−0.962	−0.942*	−1.17**	−0.797	−1.10*	−0.872*	−1.04**
	(0.590)	(0.558)	(0.591)	(0.556)	(0.560)	(0.519)	(0.526)
trade	−0.166	−0.201	−0.178		−0.211		
	(0.556)	(0.523)	(0.552)		(0.521)		
pcd5	0.316	0.456	0.306	0.245	0.463	0.407	0.410
	(0.642)	(0.594)	(0.637)	(0.597)	(0.592)	(0.544)	(0.545)
*d5*pcd5*	−0.199	−0.603**	−0.201	−0.177	−0.624**	−0.630**	−0.652**
	(0.298)	(0.293)	(0.299)	(0.274)	(0.291)	(0.264)	(0.264)

Dependent Variable: Institutional Change.
Standard errors in parentheses.
Country Fixed Effects included in all estimations (not shown).
Significance: * 10% significance ** 5% significance *** 1% significance

Table 8: Probit Estimation. Dependent Variable: Institutional Change

	[1]	[2]	[3]	[4]	[5]	[6]
d5	−0.234**	−0.206*	−0.234**	−0.242**	−0.215**	−0.229**
	(0.109)	(0.108)	(0.109)	(0.109)	(0.107)	(0.109)
persist	−0.082		−0.083	−0.078	−0.083	−0.081
	(0.051)		(0.051)	(0.051)	(0.051)	(0.051)
gdp05	−0.005	−0.021		−0.056	−0.014	−0.011
	(0.084)	(0.079)		(0.053)	(0.066)	(0.079)
urban	−0.065	−0.049*	−0.068		0.025	−0.051
	(0.080)	(0.079)	(0.051)		(0.075)	(0.077)
trade	−0.061	−0.075	−0.061	−0.068		−0.096*
	(0.065)	(0.065)	(0.065)	(0.064)		(0.052)
pcd5	0.046	0.051	0.047	0.042	0.012	0.045
	(0.051)	(0.051)	(0.051)	(0.050)	(0.051)	(0.051)
*d5*pcd5*	−0.096	−0.090	−0.097	−0.079	−0.206*	
	(0.109)	(0.109)	(0.108)	(0.106)	(0.105)	
constant	−1.34***	−1.35***	−1.34***	−1.34***	−1.31***	−1.34***
	(0.059)	(0.059)	(0.059)	(0.059)	(0.059)	(0.059)

Standard errors in parentheses.
Country Fixed Effects included in all estimations (not shown).
Significance: * 10% significance ** 5% significance *** 1% significance

Table 9: Fixed Effects Probit with Bias Correction ($d0$ only).

	[1]	[2]	[3]	[4]	[5]	[6]
d0	0.183	0.123	0.190	0.246	0.148	0.108
	(0.432)	(0.403)	(0.433)	(0.446)	(0.400)	(0.378)
persist	0.200		0.150	0.193	0.204	
	(0.804)		(0.797)	(0.759)	(0.764)	
gdp05	−0.459	−0.205		−0.712	−0.335	
	(0.475)	(0.446)		(0.483)	(0.441)	
urban	−0.971	−1.01*	−1.20**		−0.835	−1.15**
	(0.600)	(0.561)	(0.603)		(0.559)	(0.537)
trade	−0.137	−0.179	−0.160	−0.137		
	(0.572)	(0.532)	(0.569)	(0.581)		
pcd0	0.247	0.447	0.240	0.083	0.180	0.421
	(0.658)	(0.599)	(0.655)	(0.649)	(0.601)	(0.560)
*d0*pcd0*	−0.213	−0.540	−0.214	−0.182	−0.024	−0.598*
	(0.370)	(0.371)	(0.373)	(0.386)	(0.339)	(0.348)

Dependent Variable: Institutional Change.
Standard errors in parentheses.
Country Fixed Effects included in all estimations (not shown).
Significance: * 10% significance ** 5% significance *** 1% significance

Table 10: Fixed Effects Probit with Bias Correction ($d5$ and $a5$).

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
$d5$	−0.484*	−0.478	−0.483	−0.400	−0.507**	−0.485*	−0.480	−0.475
	(0.290)	(0.293)	(0.294)	(0.299)	(0.252)	(0.267)	(0.316)	(0.309)
$a5$	−1.12***	−0.831***	−1.13***	−1.06***	−1.11***	−0.830***	−1.41***	−1.12***
	(0.303)	(0.285)	(0.312)	(0.251)	(0.249)	(0.250)	(0.333)	(0.302)
persist	0.419		0.408	0.413	0.406		0.422	
	(0.763)		(0.768)	(0.701)	(0.719)		(0.771)	
gdp05	0.101	0.132		−0.350	0.253		−0.178	−0.094
	(0.414)	(0.416)		(0.412)	(0.373)		(0.437)	(0.432)
urban	−1.40***	−1.37***	−1.50***		−1.24***	−1.29***	−1.18**	−1.07**
	(0.529)	(0.523)	(0.539)		(0.471)	(0.489)	(0.557)	(0.541)
trade	−0.238	−0.210	−0.239	−0.176			−0.238	−0.219
	(0.472)	(0.476)	(0.480)	(0.472)			(0.510)	(0.500)
pcd5	0.191	0.098	0.193	−0.088	0.095	0.002	0.088	0.044
	(0.537)	(0.533)	(0.546)	(0.505)	(0.466)	(0.488)	(0.586)	(0.568)
pca5	0.105	0.064	0.108	0.026	0.102	0.047	−0.024	−0.053
	(0.544)	(0.538)	(0.553)	(0.512)	(0.474)	(0.494)	(0.589)	(0.570)
*d5*pcd5*	−0.544*	−0.408	−0.581**	−0.339	−0.597**	−0.461*		
	(0.278)	(0.279)	(0.282)	(0.281)	(0.241)	(0.254)		
*a5*pca5*	1.20***	1.10***	1.16***	1.05***	1.19***	1.07***		
	(0.318)	(0.303)	(0.328)	(0.256)	(0.256)	(0.265)		
*d5*pca5*	−0.166	−0.160	−0.224	−0.079	−0.096	−0.125		
	(0.276)	(0.276)	(0.278)	(0.284)	(0.245)	(0.255)		
*a5*pcd5*	1.88***	1.83***	1.85***	1.64***	1.88***	1.82***		
	(0.303)	(0.291)	(0.312)	(0.245)	(0.246)	(0.256)		

Dependent Variable: Institutional Change.
Standard errors in parentheses.
Country Fixed Effects included in all estimations (not shown).
Significance: * 10% significance ** 5% significance *** 1% significance

Table 11: Fixed Effects Probit with Bias Correction and Lag Explanatory Variables.

	[1]	[2]	[3]	[4]	[5]	[6]
l.d5	−1.24***	−1.09***	−1.23***	−1.10***	−1.23***	−1.09***
	(0.222)	(0.225)	(0.226)	(0.208)	(0.222)	(0.228)
l.a5	−0.278	−0.050	0.283	−0.288	−0.282	0.038
	(0.400)	(0.387)	(0.401)	(0.353)	(0.397)	(0.387)
persist	0.361		0.408	0.346	0.362	
	(0.798)		(0.768)	(0.751)	(0.797)	
l.gdp05	−0.004	0.017		−0.299	−0.016	
	(0.446)	(0.443)		(0.429)	(0.442)	
l.urban	−1.12**	−1.06*	−1.20**		−1.13**	−1.10**
	(0.562)	(0.555)	(0.565)		(0.561)	(0.557)
l.trade	−0.019	−0.001	−0.020	0.016		
	(0.530)	(0.530)	(0.532)	(0.516)		
l.pcd5	−0.690	−0.656	−0.693	−0.861	−0.678	−0.650
	(0.586)	(0.576)	(0.588)	(0.534)	(0.583)	(0.578)
l.pca5	−0.755	−0.712	−0.761	−0.790	−0.755	−0.713
	(0.599)	(0.586)	(0.600)	(0.545)	(0.595)	(0.588)
*l.d5*l.pcd5*	1.12***	1.12***	1.06***	1.20***	1.12***	1.09***
	(0.229)	(0.231)	(0.231)	(0.218)	(0.229)	(0.232)
*l.a5*l.pca5*	1.10**	0.907**	1.07**	0.946**	1.09**	0.888**
	(0.430)	(0.415)	(0.431)	(0.369)	(0.426)	(0.416)
*l.d5*l.pca5*	1.17***	1.11***	1.11***	1.26***	1.17***	1.08***
	(0.211)	(0.212)	(0.214)	(0.203)	(0.211)	(0.214)
*l.a5*l.pcd5*	1.62***	1.44***	1.61***	1.48***	1.62***	1.43***
	(0.409)	(0.397)	(0.409)	(0.350)	(0.405)	(0.397)

Dependent Variable: Institutional Change.
Standard errors in parentheses.
Country Fixed Effects included in all estimations (not shown).
Significance: * 10% significance ** 5% significance *** 1% significance

Table 12: Average Marginal Effects on Institutional Change for Country Randomly Drawn from Sample ($d5$ only).

	[1] All included	[2] *persist* excluded	[3] *gdp05* excluded	[4] *trade* excluded	[5] *persist*, *gdp05* excluded	[6] *persist*, *trade* excluded	[7] *persist*, *gdp05*, *trade* excluded
$d5$	−0.044	−0.075	−0.047	−0.028	−0.075	−0.069	−0.068
persist	0.033		0.024	0.030			
gdp05	−0.081	−0.047		−0.050		−0.022	
urban	−0.210	−0.193*	−0.256**	−0.161	−0.221*	−0.137*	−0.165**
trade	−0.036	−0.041	−0.039		−0.043		
pcd5 for $d5 = 1$	0.017	−0.019**	0.016	0.009	−0.020**	−0.019**	−0.021**
pcd5 for $d5 = 0$	0.079	0.098**	0.076	0.056	0.099	0.074	0.074

Significance of Point Estimate: * 10% significance ** 5% significance *** 1% significance
Continuous variables: average marginal effect of increasing variable by one standard deviation.

Table 13: Average Marginal Effects on Institutional Change for Country Randomly Drawn from Sample ($d5$ and $a5$).

	[1] All included	[2] *persist* excluded	[3] *gdp05* excluded	[4] *trade* excluded	[5] *persist*, *gdp05*, *trade* excluded
$d5$	−0.084*	−0.078	−0.082	−0.027**	−0.056*
$a5$	−0.342***	−0.278***	−0.347***	−0.149**	−0.190***
persist	0.065		0.070	0.022	
gdp05	0.016	0.021		0.014	
urban	−0.216***	−0.216***	−0.257***	−0.067***	−0.130***
trade	−0.037	−0.033	−0.041		
pcd5 for $d5 = 1$	−0.041*	−0.036	−0.060**	−0.014**	−0.033*
pcd5 for $a5 = 1$	0.291***	0.269***	0.308***	0.063***	0.123***
pcd5 for $d5 = a5 = 0$	0.041	0.022	0.041	0.010	0.0003
pca5 for $d5 = 1$	−0.007	−0.011	0.018	0.0002	−0.006
pca5 for $a5 = 1$	0.184***	0.162***	0.191***	0.041***	0.075***
pca5 for $d5 = a5 = 0$	0.023	0.014**	0.023	0.011	0.008

Significance of Point Estimate: * 10% significance ** 5% significance *** 1% significance
Continuous variables: average marginal effect of increasing variable by one standard deviation.

Table 14: Two-Step Fixed Effects Probit with Bias Correction.

	[1]	[2]	[3]	[4]	[5]
First Stage – Dependent Variable: *d5*					
ld5	2.92***	2.92***	2.92***	2.92***	2.91***
	(0.379)	(0.379)	(0.379)	(0.379)	(0.335)
gdp05	0.346	0.346	0.346	0.346	
	(0.468)	(0.468)	(0.468)	(0.468)	
urban	−0.356	−0.356	−0.356	−0.356	−0.135
	(0.519)	(0.519)	(0.519)	(0.519)	(0.496)
trade	0.355	0.355	0.355	0.355	
	(0.468)	(0.468)	(0.468)	(0.468)	
pcd5	0.493	0.493	0.493	0.493	0.431
	(0.443)	(0.443)	(0.443)	(0.443)	(0.456)
Second Stage – Dependent Variable: Institutional Change					
d5	−2.14***	−2.55***	−1.90***	−2.26***	−1.10***
	(0.235)	(0.209)	(0.247)	(0.266)	(0.252)
persist	−0.096	−0.175			
	(0.783)	(0.756)			
gdp05	−0.242	−0.323	−0.491	−0.705	
	(0.502)	(0.493)	(0.466)	(0.484)	
urban	−0.625	−0.648	−1.53***	−1.61***	−1.28***
	(0.605)	(0.602)	(0.592)	(0.612)	(0.552)
trade	−0.255	−0.309	−0.396	−0.471	
	(0.588)	(0.574)	(0.532)	(0.554)	
pcd5	0.104	−0.033	0.414	0.283	0.486
	(0.681)	(0.671)	(0.641)	(0.671)	(0.575)
*d5*pcd5*	−1.33***		−1.02***		−0.607**
	(0.236)		(0.235)		(0.242)
gen resid	0.280	0.230	0.317	0.269	0.487
	(0.418)	(0.425)	(0.415)	(0.414)	(0.384)

Standard errors in parentheses.
Country Fixed Effects included in all estimations (not shown).
Significance: * 10% significance ** 5% significance *** 1% significance

Figure 5: Distribution of Fixed Effects from Fixed Effects Probit Estimation.

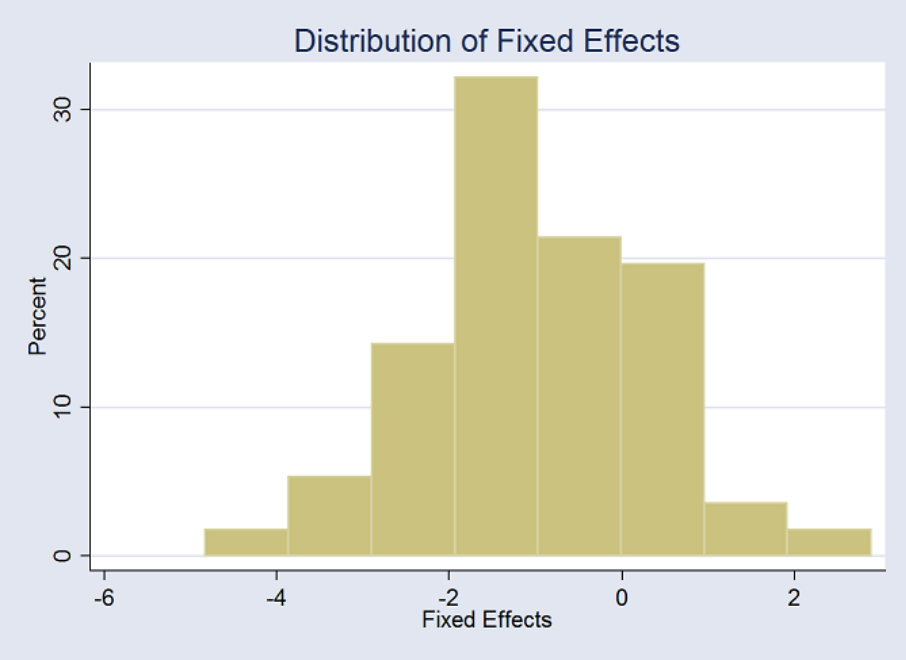

Figure 6: Distribution of Institution Variable *polity2*.