Determinants of Economic Policy Uncertainty

A Thesis Submitted by

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Abstract

This thesis studies the determinants of Economic Policy Uncertainty (EPU), an index based on newspaper coverage frequency (Baker et al., 2016). In particular, the analysis focuses on the relation between EPU, size of jurisdictions, and economic development. I find that size is positively correlated with EPU both across countries and across American states. A possible channel for this relation is higher heterogeneity of political preferences in larger jurisdictions. The relations between EPU and GDP per capita is more complex: it is U-shaped across countries, while there is a negative relationship between growth rate of real GDP per capita and growth rate of EPU across American states.

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1 Introduction and Literature Review

1.1 Introduction

Economic policy uncertainty (EPU) refers to the level of unpredictability of the economic policy implemented by policymakers. Policy uncertainty has been receiving increasing attention in redent years, in the aftermath of the global financial crisis, the eurozone crisis and increasing political polarization in the United States (Baker et.al 2016). At present, most studies about policy uncertainty concentrate on how it affects economic outcomes. In general terms, these studies have identified three channels of impacts. Bernanke (1983) concluded that uncertainty induces wait and see effect, meaning that people wait for much more information and become more cautious about investment and consumption. Bloom (2009) and Balcilar, Gupta, and Segnon (2016) also find that uncertainty will cause firms to delay investment and hiring. On the other hand, Basu and Bundick (2017) argue that increasing uncertainty in the future will result in an increase in precautionary saving and a fall in consumption. However, Gillchrist et.al (2014) believe that financial friction is a channel to influence aggregate investment. This is because a sharp rise of uncertainty can lead to a rapid widening of credit spreads, making firms reduce capital spending.

Therefore, understanding the determinants of uncertainty can be very important for a large range of essential economic outcomes. This motivates this thesis, which aims to to explore factors influencing EPU. Major current articles center on the impact of elections (Julio and Yook (2012) and Baker et.al (2020)) and oil price shocks (Kang and Ratti (2013)) on EPU. However, there still remains a large unexplored area regarding the drivers of uncertainty. The central goal of this paper is to examine whether size of jurisdictions and economic development are major determinants of EPU.

The mechanism whereby size of jurisdictions may play an important role in expanding EPU is based on the hypothesis that cultural heterogeneity is the bridge connecting them. As argued by Alesina and Wacziarg (1998), larger countries tend to have greater cultural heterogeneity. To capture these effects, in my theorertical model I assume that cultural diversity implies different standards in judging those in power, increasing uncertainty about who will win the election. Consequently, the government needs to adjust policies relatively more frequently to satisfy these varied expectations of policies as much as possible.

In Chapter 2, I employ the search and matching model to theoretically examine the implications and plausibility of the above mechanism. Subsequently, I perform benchmark panel estimations using annual data from countries from 2002 to 2021 to empirically discuss the relationship between size and EPU. Size of jurisdictions is measured by real GDP, following Alesina et.al (2000). I also control for democracy index, personalism index, and government spending per person used to capture effects of government quality, and human right index, life expectancy, and misery index as measurements of life quality. Then I apply 2SLS regression where one period lag of real GDP is the instrumental variable and Difference in Difference method (DID) referred to Nunn and Qian (2011) to do robust tests of the benchmark model.

In Chapter 3, I empirically study the associations between economic development measured by real GDP per capita and EPU. I find that the impact from the level of economic development on EPU is not fixed. In contrast, it moves from a negative to a positive correlation as economic development enhances. My interpretation of this finding is the following: firstly, basic construction in early development stages will improve life quality, which is beneficial for rulers to earn public trust; plus, policies in early stages are relatively more stable and clearer to ensure healthy economic growth, reducing uncertainty. But after a certain level of development, government face more challenges, like technological innovation and economic transformation, which require governments to adjust policies flexibly in time, increasing uncertainty.

Based on the above consideration, when investigating how economic development has effects on EPU in country level, I employ bias-corrected dynamic model, following Kripfganz and

Breitung (2022) with the same database as above, where I control the quadratic term of real GDP per capita to meet changes of marginal effect of EPU. In addition to the main independent variables, I also add the same variables as above, measurements of life quality and government quality, with country fixed effect and yearly time fixed effect. And DID method is used again to test robustness.

In addition, I analyze the correlation between economic development and EPU within the United States also based on the bias-corrected dynamic model with data from 50 states and Washington D.C. from 2017 to 2022. Besides the main explanatory variables, I also control the ratio of people aged 18 and above with a high school diploma or higher and the proportion of consumption to income with both state and time fixed effects. And DID method and eliminating data from certain areas these two methods are used to do robustness test.

In sum, I find the following results. Firstly, regarding the relationship between size of jurisdictions and EPU, both theoretical and empirical results report that increased size is a driver of EPU; secondly, at the country level, based on the database of this paper, only India and China before 2010 with low real GDP per capita present a negative effect from economic development on EPU, while other countries show a positive correlation, and these two results are robust. However, within the United States, the influence from development moving from negative to positive is not robust. This can be explained by the fact that different American states have already achieved comparable levels of development, and that the determinants of EPU across different jurisdictions within a sovereign country might be quite different from the determinants of EPU across sovereign countries themselves. Interestingly, I find that the growth rate of real GDP per capita and the growth rate of EPU are a linear negative correlation through the scatterplot. Moreover, this negative association is confirmed to be significant by basic linear panel regression, and the robustness of results are proved by DID method. I conjecture that this relationship could be due to the following: speedy economic growth promotes the reelection of rulers, and quick economic growth indicates that current policies are effective and suitable to some extent, reducing uncertainty.

As a relatively new concept, economic policy uncertainty is seldom studied so far. This study sheds new light on the factors that influence economic policy uncertainty. This paper is the first to focus on the impacts from size of jurisdiction and economic development on EPU, and also the first one documenting correlations between economic development and EPU, growth rate of development and growth rate of EPU, within the United States.

The results of this analysis may provide some preliminary insights on how to reduce economic policy uncertainty, which may be valuable because EPU could be controlled to some extent, once we gain more information about the mechansisms explaining the relationships between size of jurisdictions, economic development and EPU, also the association between growth rate of development and growth rate of EPU, contributing to healthy economic growth.

The remaining parts of this thesis are as following. The rest of this Chapter 1 provides a brief review of the relevant literature. Chapter 2 discusses the impact of size of jurisdictions on EPU both theoretically and empirically. Chapter 3 presents the empirical analysis of economic development and EPU both in country level and at state level. Chapter 4 concludes.

1.2 Literature Review

The existing literature predominantly focuses on the effect of EPU. EPU has multiple influences on macroeconomic and microeconomic outcomes. Bloom (2009) employs a model with a time-varying second moment to investigate the impact of uncertainty shock based on firm-level data. This author also builds a parametrized model to simulate a macro uncertainty shock. He finds that higher uncertainty makes firms temporarily pause their investment and hiring due to the adjustment cost which then results in a drop in productivity growth. Balcilar, Gupta, and Segnon (2016) reach the same conclusion as Bloom using a mixed-frequency

Markov-switching vector autoregressive (MF-MS-VAR) model with monthly data from 1947-2014. Barrero, Bloom, and Wright (2017) believe that this impact is long range. As early as 1983, Bernanke argued that in a random changed stochastic structure environment, events whose long-term effect is uncertain could create an investment cycle by improving the return of waiting for information. Bloom (2009) and Pastor and Veronesi (2012) also suggest that residents reduce consumption and postpone investment when uncertainty is high.

Only a few studies have focused on drivers of uncertainty up to now. Julio and Yook (2012) exploit the timing of national elections to explore the impact of political uncertainty on firms' investment behavior. This also allows them overcome partial endogeneity issues between political uncertainty and economic growth. Oil shock have also been used in this literature. Kang and Ratti (2013) discuss the influence of oil price shocks on EPU using structural VAR model. They detect that oil price shocks mainly affect EPU through aggregate demand. They argue that positive oil price shocks could give rise to increases in global real aggregate demand, thus diminishing EPU. They also find that positive oil price shocks could induce an increase in precautionary demand for crude oil which raises EPU in the United States. However, this effect is significant only in the US, but insignificant in non-US regions, according to Kang et.al (2017). Baker et.al. (2020) carry out the panel regression around national election in 23 countries, and find that compared to other months, the average value of EPU of the election month and previous month will substantially rise in the same election cycle.

Building upon existing studies regarding factors influencing EPU, there is still much left for further exploration. Unlike previous studies, this thesis will mainly examine the linkage between size, economic development and EPU. Alesina et.al (2000) study the association between openness and number and size of countries, and find that the degree of openness to world trade and number of countries are strongly positively related, so they argue that trade openness and country fragmentation go hand in hand. Besides, they also find that trade liberalization and average country size are in reverse ratio. They define the log of total GDP reflecting overall purchasing power of the economy as economic size and the log of total population as political size in the empirical analysis. Following such approach, I will use real GDP at current PPPs to measure size of jurisdictions.

Moreover, this thesis will also be focused on the relationship between economic development and EPU. Barro and McCleary (2003) discuss in their study of the effect of religion on economic growth that economic development should be measured along a spectrum of outcomes, such as real GDP per capita, education fertility and life expectancy and so on. For simplicity, in this thesis, as it is common in the literature, I will use real GDP per capita as the basic indicator to measure economic development.

2 Size of Jurisdictions and EPU

2.1 Theoretical Framework: A Search and Matching Model in Continuous Time

Suppose that there are only two conditions of EPU, which are low-level EPU and high-level EPU. Besides, define σ as the transition probability from low-level EPU to high-level EPU. I construct the Bellman equation as following to show the payoff of resident $\boldsymbol{\ell}$:

$$\Pi = -\gamma\Delta + \frac{1}{1+i\Delta}[\frac{p(\kappa)}{s}\Delta R + (1 - \frac{p(\kappa)}{s}\Delta)\Pi] \tag{1}$$

Where Δ is an operator that divides a time period t into an infinite number of points to reflect the continuous time, $\Delta \to 0$ and $\Delta \in R$. γ is the cost of expressing demands to the government, and $\frac{1}{1+i\Delta}$ is the discount factor, κ represents the demand from residents delivering to the government, and s is the size of jurisdiction, R is the revenue or benefit of resident ℓ if his/her demands are accepted by the government.

Conveying demands to the government incurs costs, whether they are monetary or time-related, and even potentially incurs social costs caused by government suppression. And these costs are not related to the outcome of delivering demands. The larger is the size of jurisdiction, the larger is variety, the more diverse are the masses' demands that will be conveyed to the government, leading to a decrease in the probability of one of these demands being satisfied. Therefore, there is a reverse relationship between probability of a demand κ being accepted and size of jurisdiction. To simplify the model, assume $\frac{p(\kappa)}{s}$ is the probability that the demand for resident ℓ is accepted under the influence of size. Also, assuming that if the demand of resident ℓ is not satisfied, they will continue to convey their demand to the government. So, $\frac{1}{1+i\Delta}[\frac{p(\kappa)}{s}\Delta R + (1-\frac{p(\kappa)}{s}\Delta)\Pi]$ represents the current value of expected payoff of the outcome that resident ℓ delivers demand. Through the uncomplicated simplification, I derive the expected payoff of resident ℓ with respect to $\frac{p(\kappa)}{s}$ and s:

$$\Pi = \frac{1}{i + \frac{p(\kappa)}{s}}[-\gamma + \frac{p(\kappa)}{s}R] \tag{2}$$

With the same logic, I construct the Bellman equation as following to show the payoff of the government:

$$V = \frac{p(\kappa)}{s}\Delta[V - \omega(\kappa)] + (1 - \frac{p(\kappa)}{s}\Delta)\frac{1}{1 + i\Delta}\alpha V \tag{3}$$

Where $\omega(\kappa)$ is the cost from accepting resident ℓ's demand. αV is the remaining payoff after rejecting demand κ, as not accepting demands of masses may results in losing public trust and backing,$\alpha \in [0, 1]$. For the simple operation, it is assumed that social loss is proportional to the government total payoff. $(1 - \frac{p(\kappa)}{s}\Delta)\frac{1}{1+i\Delta}\alpha V$ represents the present value of expected payoff that the government rejects demand κ. Then the expected payoff of the government respect to $p(\kappa)$ and s could be derived:

$$V = -\frac{1}{i - \frac{p(\kappa)(1-\alpha)}{s}} \frac{p(\kappa)}{s} \omega(\kappa) \tag{4}$$

To find a value of $p(\kappa$ to maximize the social welfare, I construct the equation (5) as following:

$$p(\kappa) = arg\ max\ \Pi^{\eta} V^{(1-\eta)} \tag{5}$$

Where $p(\kappa)$ is the probability that the demand is accepted, $\Pi^{\eta} V^{(1-\eta)}$ is total social value, which is in the form of Cobb-Douglas, and Π is defined as the payoff of resident ℓ , and V is government's payoff.

To solve the optimization problem, I derive the first order condition of equation (5) with respect to $p(\kappa)$:

$$\eta V = (1-\eta)\Pi \tag{6}$$

Combine equation (2) and equation (4), I can get:

$$\frac{1-\eta}{i + \frac{p(\kappa)}{s}} [-\gamma + \frac{p(\kappa)}{s} R] + \frac{\eta}{i - \frac{p(\kappa)(1-\alpha)}{s}} \frac{p(\kappa)}{s} \omega(\kappa) = 0 \tag{7}$$

Suppose $\Phi = \frac{1-\eta}{i + \frac{p(\kappa)}{s}} [-\gamma + \frac{p(\kappa)}{s} R] + \frac{\eta}{i - \frac{p(\kappa)(1-\alpha)}{s}} \frac{p(\kappa)}{s} \omega(\kappa)$.

Take the first order condition with respect to $p(\kappa)$, and get:

$$\frac{\partial \Phi}{\partial p(\kappa)} = \eta[\frac{s}{p(\kappa)} i - (1-\alpha)]^{-2} p(\kappa)^{-2} si + (1-\eta)[i + \frac{p(\kappa)}{s}]^{-2} s^{-1} + (1-\eta) R (\frac{s}{p(\kappa)} i + 1)^{-2} p(\kappa)^{-2} si > 0 \tag{8}$$

Similarly, derive the first order condition with respect to s:

$$\frac{\partial\Phi}{s} = -\eta[\frac{s}{p(\kappa)}i-(1-\alpha)]^{-2}p^{-1}-\gamma(1-\eta)[i+\frac{p(\kappa)}{s}]^{-2}p(\kappa)s^{-2}-(1-\eta)R[\frac{s}{p(\kappa)}i+1]^{-2}ip^{-1} < 0 \tag{9}$$

And implicitly function theory implies that:

$$\frac{\partial p(\kappa)}{\partial s} = -\frac{\partial\Phi/\partial p(\kappa)}{\partial\Phi/\partial s} > 0 \tag{10}$$

Then we can get the conclusion that the probability that resident ℓ's demands are accepted and the size of jurisdiction are positively correlated. On the other hand, higher value of $p(\kappa)$ contributes to higher value of σ, then cause high level of EPU. This is because the acceptance of demands implies the adjustment or the implement of policies, which cause an increase in EPU.

2.2 Data Sources and Empirical Analysis at the Country Level

2.2.1 Data Sources

The data of Economic Policy Uncertainty (EPU) comes from Baker et.al (2016). They construct a comprehensive index to measure economic policy uncertainty based on selecting key words from leading newspapers, which include "economy", "legislation", "regulation" and so on. And the article used to build the index must contain all terminology including aspects of the economy, uncertainty and policy. They also show that this index is tightly linked to economic uncertainty and policy uncertainty, and this index will not be severely distorted by political tendencies. Therefore, I use this category-specific economic policy uncertainty benchmark index as a proxy variable to measure EPU. However, in the process of handling key words, this measurement does not rank or weight these key words. In reality, there are different impacts, so that uncertainty from different events is represented.

The data of real GDP at purchasing power parity in US dollar (PPPs) is collected from World Bank. Real GDP is used to measure the size of jurisdiction, which follows the measure of economic size of nations employed by Alesina et.al (2000). Compared with real GDP, real GDP at PPPs makes it easier to compare the actual economic scale and development level of different economies around the world.

I choose the degree of democracy, personalism index and government spending per person to control the impact from the quality of governments on economic policy uncertainty. Democracy index is from Freedom House, which ranges from 0 to 100. The larger the value, the higher degree of democracy in this political system. And the higher the level of democracy, the more political participation and monitoring citizens have, which contribute to promoting government transparency and improving government quality. I gather data of Personalism index from V-Dem (2023). In opposition to democracy index, higher personalism index along with that there is less constrains the executive has from oversight agencies, thereby make the government slack off. The data of government spending and population, which used to calculate the government spending per person, are both collected from World Bank. Government spending is applied to measure the government size many times (Kau and Rubin (1981), Grossman (1987) and so on). Therefore, government spending per person could be understood as the government's influence on each citizen.

I use human right index, life expectancy and misery index to capture the influence of citizens' life quality on EPU. The data of human right index is from V-Dem (2023), and the core of human right is economic freedom and political freedom which is also the basis of guarantying the normal quality of life. The data of life expectancy is aggregated from Human Mortality Database (2023). Larger life expectancy could reflex higher social healthcare conditions and sanitation standards that citizens are in, to a certain extent. The data of inflation rate and unemployment rate used to calculate misery index is collected from World Bank. The misery index is constructed by the geometric average between unemployment rate and inflation rate.

Based on Okun (1975), the high unemployment rate and inflation rate will generate economic and social cost, so misery index can assess the performance of average citizen.

The original data of EPU is monthly, I obtain the annual data of EPU by calculating the average of 12 months of data for each year each country. Otherwise, because the data is only updated until September 2022, which is less than a year, the data of 2022 is dropped in order to simple process. After simply merging and restricting data, the country-level data set reserves data from 22 countries from 2003 to 2021. The summary statistics are shown in Table 1.

Table 1: Descriptive Statistics, Country-Level

	(1)	(2)	(3)	(4)	(5)
VARIABLES	Mean	SD	Min	Max	Number of Observations
Economic Policy Uncertainty	135.8	75.99	27.00	542.8	418
Real GDP (trillion $)	3.355	4.585	0.212	24.94	418
Real GDP per Capita ($)	37,743	19,371	2,862	107,741	418
Democracy	81.00	23.04	9	100	418
Human Right	0.847	0.176	0.199	0.977	418
Personalism	0.158	0.235	0.008	0.931	418
Misery Index	5.126	2.388	1.283	13.75	418
Life Expectancy	78.79	4.382	64.09	84.78	418
Government Spending Per Person	0.591	0.407	0.006	1.601	418
Population (million)	184.5	365.2	3.997	1412	418

2.2.2 Empirical Analysis

From the conclusion of the theoretical model in 2.1, I expect that EPU and size of jurisdictions will be positively related. In this part, I will study the relationship between EPU and size through empirical analysis.

I build the following Benchmark model:

$$\log EPU_{i,t} = \alpha_0 + \alpha_1 \log Size_{i,t} + \alpha_3 \mathbf{X}_{i,t} + \alpha_4 t + \mu_i + \varepsilon_{i,t} \tag{11}$$

Where i and t represent country and year, respectively; $EPU_{i,t}$ is the economic policy uncertainty index of country i in year t; $Size_{i,t}$ is the size of jurisdiction of country i in year t, which is measured by real GDP at purchasing power parity at constant 2017 international prices; $\mathbf{X}_{i,t}$ is a vector that covers the control variables, including log of democracy index, personalism index, government spending per person, human right index, life expectancy and misery index; t represents the time trend term and μ represents the fixed effect of individual country; $\varepsilon_{i,t}$ is the error term.

The estimations of equation (11) are reported in Table 2. In column (1), I only control one variable of the size of jurisdictions. The results exhibit the expected positive effect from size on uncertainty, which means that 1% increase in the size of jurisdictions will lead to a 0.43% increase in economic policy uncertainty, holding other regressors constant. This empirical result is consistent with the conclusion from the theoretical model.

Based on the model in column (1), I capture the effect of government quality on EPU in column (2). I expect a negative impact from government quality on EPU. This is because a high-quality government will be able to limit inefficient policies due to corruption and bribery and disconnection from the masses, and policies that high-quality government implemented should be citizen-centric and efficient. That is why I control the variables associated with government quality. Based on the model in column (2), in column (3), I add variables pertaining to citizens' life quality. I think the relationship between life quality and EPU should also be negative. This is because the higher life quality, the less people deliver their dissatisfaction of living situation and governmental policies to governments, thereby reducing policies implemented by the government to ensure or improve the life quality which reduces uncertainty. The estimated coefficient of misery index is significantly positive, which means that 1% increase in misery index will lead to 3.99% increase in economic policy uncertainty, on average and holding other regressors constant. This also accords with the explanation above. Unemployment will reduce expected income, while inflation will make a discount of saving and expected income, both of which will lower citizens' life quality. In the long run, complaints about quality of life will impact government policies and policy uncertainty. After controlling for additional variables, the effect of size of jurisdictions on EPU continues to be significantly positive, which is also in line with the conclusions of the theoretical model.

Table 2: Benchmark Estimates, Size and Economic Policy Uncertainty, 2003-2021

	(1)	(2)	(3)
VARIABLES	Log of Economic Policy Uncertainty		
Main Explanatory Variable			
Log of Size	0.426***	0.397***	0.469***
	(0.130)	(0.120)	(0.131)
Government Quality			
Log of Democracy		-0.884***	-0.967***
		(0.222)	(0.248)
Personalism		-1.600**	-1.136
		(0.780)	(0.866)
Government Spending per Person		0.336*	0.423**
		(0.180)	(0.184)
Life Quality			
Human Right			0.740
			(0.596)
Life Expectancy			0.0194
			(0.0288)
Misery Index			0.0399***
			(0.0119)
Constant	-7.229**	-2.547	-6.693
	(3.650)	(3.757)	(4.169)
Time Fixed Effect	Yes	Yes	Yes
Country Fixed Effect	Yes	Yes	Yes
Number of Observations	418	418	418
R^2	0.690	0.709	0.717

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Real GDP is endogenous. To be more specific, real GDP is influenced by many factors. For example, Kira (2013) shows that the GDP of developing countries are mainly affected by consumption and exports. For the same reason, real GDP could also be influenced. Besides, there may be reverse causal relationship between EPU and size of jurisdiction. Panel regression could avoid the endogeneity problem caused by omitted variables that are not time-varying and related with dependent variables, but could not address the endogeneity problem due to the correlation between error term and explanatory variables. So the endogeneity problem needs to be addressed through methods such as using Instrumental Variables and Difference in Difference (DID) method.

I firstly use one period lag of real GDP as the instrumental variable of real GDP to capture the causal effect from real GDP on EPU. I find that real GDP per capita is significantly correlated with the previous value through the basic regression (results are showing in Table 3); secondly, without a doubt, real GDP in period t-1 is not affected by activities occurring in next period. So that this IV is reasonable and available. And the model is built as following:

First stage:

$$\log Size_{i,t} = \beta_0 + \beta_1 \log Size_{i,t-1} + \beta_3 \mathbf{X}_{i,t,} + \beta_4 t + \delta_i + \sigma_{i,t} \tag{12}$$

Second stage:

$$\log EPU_{i,t} = \tau_0 + \tau_1 \log Size_{i,t} + \tau_3 \mathbf{X}_{i,t} + \tau_4 t + \varphi_i + \omega_{i,t} \tag{13}$$

Where t represents the time trend term and δ_i and φ_i represent the fixed effect of individual country i; $\sigma_{i,t}$ and $\omega_{i,t}$ are error terms.

The first-stage regression results are shown in Table 4, and the second-stage regression results are reported in Table 5. After continuously adding variables similarly with Benchmark regression, the p-value of *Kleibergen-Paap rk LM* is always zero, which means that there is no problem of insufficient identification of instrumental variable, so that this instrumental variable is valid. After considering the endogeneity problem, we can get the conclusion from Table 5 that the sign and significance of estimated coefficients of size are consistent with Benchmark regression results, and there is no significant difference in numerical values. Therefore, the Benchmark regression is robust.

Table 3: AR (1) Process of real GDP

	(1)
VARIABLES	Real GDP
One Period Lag of Real GDP	1.029***
	(0.00429)
Constant	8.622e+09
	(3.583e+10)
Observations	396

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

In addition to the instrumental variable method, I also create a DID model for robustness testing. Nunn and Qian (2011) construct a model with the same logic of Difference in Difference when studying the impact of the introduction of potatoes on population and urbanization of Old World. Compared with standard DID models, they use continuous measure of the intensity of treatment, which is proportion of area suitable for potato growing. So that they can capture more variations of data. This approach follows Nunn and Qian (2011), building the DID model as following:

$$\log EPU_{i,t} = \gamma \log Size_{i,t} year_t + \sum_{j=2003}^{2021} \mathbf{X}' I_t^j \Phi_j + \sum_c \theta_c I_i^c + \sum_{j=2003}^{2021} \theta_j I_t^j + \varphi_{i,t} \tag{14}$$

Where i indexes countries and t indexes yearly time periods, which from 2003 to 2021. The variable $\log Size_{i,t}$ is the natural log of size of country i in year t, and $year_t$ is a dummy variable that equals to 1 for year after 2008 when the Financial Crisis happened. $\sum_c \theta_c I_i^c$ and $\sum_{j=2003}^{2021} \theta_j I_t^j$ are country fixed effects and time fixed effects, and $\sum_{j=2003}^{2021} \mathbf{X}' I_t^j \Phi_j$ capture the interacted effect from time fixed effect and characters influencing EPU, which include the degree of democracy, human right and government spending per person. $\varphi_{i,t}$ is the error term.

Estimations of equation (14) are shown in Table 6. The γ in equation (14) is the estimated

Table 4: 2SLS Estimations - First Stage Regression Results

	Benchmark with IV		
	(1)	(2)	(3)
VARIABLES	Log of Economic Policy Uncertainty		
Instrument Variable			
Log of One Period Lag of Size	0.964***	0.972***	0.959 ***
	(0.011)	(0.011)	(0.012)
Government Quality			
Log of Democracy		0.021	0.034**
		(0.017)	(0.234)
Personalism		-0.120***	-0.157***
		(0.056)	(0.060)
Government Spending per Person		-0.022	-0.043
		(0.018)	(0.018)
Life Quality			
Human Right			-0.040
			(0.050)
Life Expectancy			-0.001
			(0.002)
Misery			-0.006***
			(0.001)
Constant	1.031***	0.735***	1.163***
	(0.314)	(0.332)	(0.371)
Time Fixed Effect	Yes	Yes	Yes
Country Fixed Effect	Yes	Yes	Yes
First-Stage F-value	7072.87	7468.31	6086.89
Kleibergen-Paap rk LM Statistics			
χ^2	61.04	62.40	58.04
Corresponding P Value	0.000	0.000	0.000
Number of Observations	396	396	396
Centered R^2	0.712	0.731	0.741

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

effect of the financial crisis on the relationship between size of jurisdiction and EPU. Otherwise, the γ also indicates the impart from size of jurisdiction on EPU from 2008 to 2021. So that in Table 6, finding that, compared with the period before the Financial Crisis, this great recession makes that the effect of size on EPU significantly increases by 7.02%, on average. Also, from 2008 to 2021, 1% increase in size of jurisdiction will lead to 7.02%

Table 5: 2SLS Estimations - Second Stage Regression Results

	Benchmark with IV		
	(1)	(2)	(3)
VARIABLES	Log of Economic Policy Uncertainty		
Main Explanatory Variable			
Log of Size	0.432***	0.349***	0.479 ***
	(0.136)	(0.128)	(0.136)
Government Quality			
Log of Democracy		-0.951***	-0.967***
		(0.218)	(0.234)
Personalism		-1.758**	-1.136
		(0.770)	(0.816)
Government Spending per Person		0.357**	0.508**
		(0.171)	(0.179)
Life Quality			
Human Right			0.753
			(0.543)
Life Expectancy			-0.00395
			(0.0240)
Misery			0.0475***
			(0.0113)
Constant	-7.667**	-1.330	-5.037
	(3.736)	(3.975)	(4.399)
Time Fixed Effect	Yes	Yes	Yes
Country Fixed Effect	Yes	Yes	Yes
Number of Observations	396	396	396
Centered R^2	0.712	0.731	0.741

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

significant increase in economic policy uncertainty, on average and holding other regressors constant, which can prove that the Benchmark regression is robust. Considering that the United States is the epicenter of the financial crisis, I exclude the data from the United States in the estimation of Table 7, and the results remain consistent.

However, results in part of estimation using IV are biased due to ignoring that EPU is associated with previous value (results are presented in Table 8). Under this circumstance, endogeneity problems remain unresolved using lag of real GDP as the IV.

Table 6: DID Estimations of Size, 2008 Financial Crisis

VARIABLES	Log of EPU
$Log\ of\ Size \times time$	0.074**
	(0.024)
Government Quality	
$Log\ of\ Democracy \times time$	Yes
$Personalism \times time$	Yes
$Government\ Spending\ per\ Person \times time$	Yes
Life Quality	
$Human\ Right \times time$	Yes
$Life\ Expectancy \times time$	Yes
$Misery\ Index \times time$	Yes
Constant	-2.954
	(3.297)
Time Fixed Effect	Yes
Country Fixed Effect	Yes
Number of Observations	418
Adjusted R^2	0.721

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

3 Economic Development and EPU

It is reasonable to expect that economic development at different levels may have different marginal effects on EPU. For example, it is possible that, at early stages of development, when capital is scarce, economic growth may be mainly driven by infrastructure construction and other investments that have large marginal effects on standards of living. This might help rulers strengthen the social contract, therefore reducing uncertainty about who holds the reins of policymaking. Thus, in these stages, the government will carry out relatively stable and clear strategies, diminishing uncertainty about what and when economic policies will be taken. With the development of the economy, governments may face more challenges, such as economic transformation, globalization and so on. Such challenges may require governments to adjust policies and be more flexible. So the number of economic policies and the frequency of policy changing may rise, increasing EPU.

Table 7: DID Estimations of Size, 2008 Financial Crisis, Excluding U.S.

VARIABLES	Log of EPU
Log of Size × *time*	0.106***
	(0.034)
Government Quality	
Log of Democracy × *time*	Yes
Personalism × *time*	Yes
Government Spending per Person × *time*	Yes
Life Quality	
Human Right × *time*	Yes
Life Expectancy × *time*	Yes
Misery Index × *time*	Yes
Constant	-2.214
	(3.671)
Time Fixed Effect	Yes
Country Fixed Effect	Yes
Number of Observations	399
Adjusted R^2	0.718

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8: AR (1) Process of EPU

VARIABLES	EPU
One Period Lag of EPU	0.842***
	(0.0304)
Constant	24.90***
	(4.651)
Observations	396

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

In this section, I start with focusing on the correlation between economic development and EPU across countries, and then conduct an intensive study of their relationship within the United States, the world's largest economy, at the state level.

3.1 Data Sources

3.1.1 Country-Level Data

The database used to examine the association between real GDP per capita and EPU is same as the one in Section 2. And the data of population used to calculate real GDP per capita comes from World Bank. The summary statistics of population are also shown in Table 1.

3.1.2 US State-Level Data

The annual data of real GDP in chained dollars and population used to calculate state-level per capita real GDP respectively comes from Bureau of Economic Analysis (BEA) and U.S. Census Bureau. The reasons for choosing real GDP in chained dollars are that it is inflation-adjusted real dollar amount which benefits to reflect the real situation of economies and do comparisons in different years. And these data is available for 2017 through 2022.

To construct a more completed model, I also control for variables measuring education level and life quality. As mentioned in the literature review, Barro and McCleary (2003) believe that the economic development should be measured along multiple dimensions, including education. In this analysis, the ratio of people aged 18 and above with a high school diploma or higher is used to measure the education level. And the annual data from 2006 and 2022 is collected from U.S. Census Bureau.

The proportion of consumption to income can reflect the life quality to some extent. And the lower the ration, the higher the saving rate, and then the greater the ability to mitigate risks ahead. The data of real personal income and consumption used to calculate the ratio is both generated from BEA. Among these, estimations of real personal income are divided by the regional purchase power, divided by personal consumption expenditures (PCE) price index, which is ranging between 1998 to 2022; and personal consumption expenditure by major type of product are estimated in current dollars, from 1997 to 2022.

Owing to the year limit of real GDP per capita data, finally merged state-level data set includes the yearly data from 50 states in the United States and Washington D.C. running from 2017 to 2022. And summary statistics are presented in Table 9.

Table 9: Descriptive Statistics, State-Level

	(1)	(2)	(3)	(4)	(5)
VARIABLES	Mean	SD	Min	Max	Number of Observations
Economic Policy Uncertainty	235.4	156.3	60.31	887.7	306
Real GDP (trillion $)	0.403	0.518	0.032	3.167	306
Population (million)	6.461	7.306	0.578	39.500	306
Education Level	90.38	2.588	83.30	95	306
Real GDP per Capita ($)	61,462	22,768	36,875	214,666	306
Ratio of Consumption to Income	0.814	0.0875	0.647	1.170	306
Growth Rate of EPU	0.0716	0.688	-1.396	1.909	255
Growth Rate of Real GDP per Capita	0.0115	0.0312	-0.136	0.0820	255

3.2 Empirical Analysis

3.2.1 Country-Level Analysis

In order to solve the problem of biased estimation, when I study the effect from real GDP per capita in this section, I construct a bias-corrected estimation of liner dynamic panel data model which refers to Kripfganz and Breitung (2022), because this model can not only correct the bias by adjusting moment conditions in case of knowing the form of the bias, but also adjust standard errors to be robust which is helpful to reduce partial heteroscedasticity problem. The reason why I control the quadratic term of real GDP per capita is that I believe the marginal effect of per capita real GDP will change with the level of economic development. And the specific model is as following:

$$\log EPU_{i,t} = \lambda_0 + \lambda_1 \log EPU_{i,t-1} + \lambda_2 \log RealGDPperCapita_{i,t} + \lambda_3 [\log RealGDPperCapita]^2_{i,t} + \mathbf{X}_{i,t}\theta + \alpha_i + \xi_t + u_{i,t} \tag{15}$$

Where α_i and ξ_t represent country fixed effect and time fixed effect. The estimation results are shown in Table 10.

From column (1) in Table 10, the results show that EPU in last period significantly positively affects current EPU. Other information I could get is that given an initial value of economic development $G = G_0$, a marginal increase in economic development will lead to a change in EPU of $-1.729 + 0.190 \log G_0$[1], on average and holding other regressors constant. To be more specific, if $G_0 > \$8955.30$, economic development will have a significantly positive impact on EPU, while if $G_0 < \$8955.30$, the relationship between development and EPU would be negative. And evaluated at economic development and EPU both equal to means, the short run elasticity is 0.238, which means that a temporary, one period 1% increase in economic development will cause a change in EPU of 0.238%[2] in the same period, on average. While the long run elasticity is 1.414[3], which means that a permanent 1% increase in economic development will lead to a 1.414% increase in EPU in the long run, on average. The reason of using the mean to calculate elasticities is that above 50% countries' per capita real GDP in this thesis are above the mean, but it cannot ignore relatively low-development countries. When calculate elasticities based on 5% left tail of real GDP per capita, there are opposite results. To put it more accurately, for countries with low development level, short run elasticity is -0.063, and corresponding long run elasticity is -0.374. Similar with the marginal effect, there will be different impact of economic development on EPU in countries with low, average and higher development level.

[1]Marginal effect of economic development on EPU is $\lambda_2 + 2\lambda_3$ log of economic development. The marginal effect of economic growth will be zero when the log of per capita real GDP is at 9.1, with corresponding per capita real GDP is at 8955.30.

[2]In this model, short run elasticity is the same with the marginal effect of economic development, and the elasticity is 0.2375 after substituting the mean of per capita real GDP.

[3]The long run elasticity is the ratio between short run elasticity and $1 - \lambda_1$, so the result of long run elasticity in column (1) is 1.414.

As explained at the beginning, government quality and life quality affect EPU also, so these influences are controlled in column (2) and column (3) to enhance the completeness of the model. The information got from column (2) is that same with the results in column (1), EPU has long-lasting impact, and previous increase in EPU will result in a rise in contemporary EPU; otherwise, paying attention to the estimated coefficient of real GDP per capita, find that based on an initial value of economic development equals to G_0, a marginal increase in economic development will lead to a change in EPU of $-1.568+0.170\log G_0$, on average and other regressors held constant. Same with the method used to analysis results in column (1), G_0 equaling \$10,097.06 is the boundary that economic development may give rise to totally inverse impacts on EPU. Given real GDP per capita and EPU equal to the mean, one period 1% increase in economic development will temporarily lead to a change in EPU of 0.191% in the same period, and a permanent 1% increase in economic development will lead to a 1.035% increase in EPU in the long run, on average. In column (3), the enduring effects of EPU so not make a large difference with the results showing in the first two columns. A marginal increase in economic development will lead to a change in EPU of $-1.460 + 0.170\log G_0$, on average and holding other regressors constant. The positive or negative influences from economic development on EPU depend on whether G_0 is greater than \$5368.13. Calculating the elasticity using the mean of real GDP per capita and EPU, get the conclusion that one period 1% increase in economic development will temporarily lead to a change in EPU of 0.30% in the same period, and a permanent 1% increase in economic development will lead to a 1.50% increase in EPU in the long run, on average.

I observe that there is only a negative impact from economic development on EPU in India and China before 2010, in used database. The suppose of this situation is that these two countries are both in demographic and geographic scale, with abundance in natural wealth. Under these advantages, their agriculture, industry, and service sector have a steady development. All industries are flourishing, and this diverse development contributes to less relying on import and export which is also consistent with Alesina et.al (2005). These foundations make them be less interrupted by global economic fluctuations and ensure conditions and space for self-buffering and recovery, which is helpful to lower the influence of uncertainty caused by instability of global economy.

Table 10: Country-Level Bias-corrected estimation, Real GDP Per Capita and EPU

	(1)	(2)	(3)
VARIABLES	Log of Economic Policy Uncertainty		
Main Explanatory Variables			
One Period Lag of EPU	0.832***	0.815***	0.800***
	(0.0391)	(0.0350)	(0.0394)
Log of Real GDP per Capita	-1.729**	-1.568*	-1.460**
	(0.814)	(0.889)	(0.728)
$(Log\ of\ Real\ GDP\ per\ Capita)^2$	0.0950**	0.0849*	0.0852**
	(0.0396)	(0.0439)	(0.0378)
Government Quality			
Log of Democracy		-0.184**	-0.260***
		(0.0917)	(0.0735)
Personalism		0.0359	0.335
		(0.313)	(0.376)
Government Spending Per Person		0.122	0.167
		(0.117)	(0.118)
Life Quality			
Human Right			0.502**
			(0.212)
Life Expectancy			-0.0191*
			(0.00991)
Misery Index			1.291
			(0.962)
Constant	8.222*	8.455*	8.627**
	(4.195)	(4.682)	(3.863)
Time Fixed Effect	Yes	Yes	Yes
Country Fixed Effect	Yes	Yes	Yes
Number of Observations	396	396	396
Number of Countries	22	22	22

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

I apply the Difference in Difference method to do the robustness test, and create the model as following which is similar to Nunn and Qian'(2011):

$$\begin{aligned}\log EPU_{i,t} &= \gamma_0 + \gamma_1 \log RealGDPperCapita_{i,t} \times year_t \\ &+ \gamma_2 (\log RealGDPperCapita_{i,t})^2 \times year_t \\ &+ h \log EPU_{i,t-1} + \sum_{j=2003}^{2021} X' I_t^j \Phi_j + \sum_c \theta_c I_i^c + \sum_{j=2003}^{2023} \theta_j I_t^j + \varphi_{i,t}\end{aligned} \tag{16}$$

The estimated results are presented in Column (1) of Table 11, which indicates that compared with the period before the great recession in 2008 and given an initial value of economic development$G = G_0$, a marginal increase in economic development will contribute to a change in EPU of $-1.584 + 0.158G_0$. To expand on this point, if $G_0 > \$22,591.22$, the impact of economic development on EPU is significantly magnified after the financial crisis; on the contrary, if $G_0 < \$22,591.22$, this effect will be diminished.

The results in Column (1) of Table 11 could also be explained as that based on capturing the influence of government quality and life quality, investigating the link between economic development and EPU. The statistical analysis is same with the last paragraph. These results are consistent with the results of bias corrected dynamic panel data estimation, which is because they get the same conclusion that after achieving a certain value of real GDP per capita, EPU responds positively to economic development; otherwise, there is a negative correlation. Similarly, after eliminating the data from the United States, estimated results (Column (2) in Table 11) remain consistent.

3.2.2 US State-Level Analysis

Analogously to the results that were obtained at the country-level, when considering the United States, we have that, as economic development increases, so does EPU, which can also be understood as results of the data aggregation of 50 states in the U.S. and Washington D.C.

Now in this part, I will do further exploration of the connection between economic develop-

Table 11: DID Estimations of Economic Development, 2008 Financial Crisis

VARIABLES	Log of EPU With U.S.	Log of EPU Without U.S.
Main Variables		
One Period Lag of EPU	0.713***	0.718***
	(0.054)	(0.054)
$Log\ of\ Economic\ Development \times time$	-1.584**	-1.606**
	(0.812)	(0.854)
$(Log\ of\ Economic\ DevelopmentImage)^2 \times time$	0.079***	0.080***
	(0.039)	(0.041)
Government Quality		
$Log\ of\ Democracy \times time$	Yes	Yes
$Personalism \times time$	Yes	Yes
$Government\ Spending\ per\ Person \times time$	Yes	Yes
Life Quality		
$Human\ Right \times time$	Yes	Yes
$Life\ Expectancy \times time$	Yes	Yes
$Misery\ Index \times time$	Yes	Yes
Constant	9.241	10.636
	(4.309)	(4.495)
Time Fixed Effect	Yes	Yes
Country Fixed Effect	Yes	Yes
Number of Observations	396	378
$AdjustedR^2$	0.867	0.868

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

ment and EPU within the United States. Based on the data of 50 states and Washington D.C., I employ a similar model with country-level (as shown below) to do estimations:

$$\begin{aligned} \log EPU_{i,t} = \alpha_0 + \alpha_1 \log EPU_{i,t-1} + \alpha_2 \log EconomicDevelopment_{i,t} \\ + \alpha_3 (\log EconomicDevelopment)^2_{i,t} + \mathbf{X}_{i,t}\theta + \beta_i + \xi_t + u_{i,t} \end{aligned} \quad (17)$$

Where $\mathbf{X}_{i,t}$ is a vector that contains variables of education level and life quality, and β_i, ξ_t respectively capture state fixed effect and time fixed effect. And the estimation results of this model are displayed in Table 12.

From estimated results in column (1) of Table 12, continually given an initial value of economic development $G = G_0$, a marginal increase in per capita real GDP will cause a change in EPU of $-35.72 + 3.16 \log G_0$, on average and holding other regressors constant. To discuss in detail, economic development plays a positive driver of EPU when $G_0 > \$81,129.14$, otherwise it will negatively influence EPU. Supposing on the basis of mean of real GDP per capita, short run elasticity is -20.59, meaning that briefly 1% increase in economic development will make 20.59% decrease in EPU in the same period; corresponding long run elasticity is -59.16, which implies that permanently 1% increase in economic development will contribute to averagely 59.19% diminishment in EPU in the long run. These discussions are about states at an average level of development. However, in case of high-level development states, taking the top 5% as an example, short run elasticity and long run elasticity are 0.038 and 0.109. In these states, no matter long-term or short-term impacts from economic development on EPU are positive.

I find that there is no significant change in the estimation of real GDP per capita after capturing the effects of education level and life quality, but it is only significant at 10% level. This indicates that, within the United States, the influence of economic development on EPU is not as strong as at the country level.

In order to test the robustness of this model, DID method is still used. Different from the country level, the occurrence and spread of the COVID-19 are chosen as the time division. The DID model is as following:

$$\begin{aligned}\log EPU_{i,t} = \beta_0 + \beta_1 \log EconomicDevelopment_{i,t} I_t^{COVID} \\ + \beta_2 (\log EconomicDevelopment)_{i,t}^2 I_t^{COVID} + h \log EPU_{i,t-1} \\ + \sum_{j=2017}^{2022} \mathbf{X}' I_t^j \phi_j + \sum_c \theta_c I_i^c + \sum_{j=2017}^{2022} \theta_j I_t^j + \varepsilon_{i,t}\end{aligned} \tag{18}$$

Where I_t^{COVID} is an indicator variable which equals one in 2019 and 2020, otherwise equals zero; $\sum_c \theta_c I_i^c$ and $\sum_{j=2017}^{2022} \theta_j I_t^j$ are country fixed effect and year fixed effect; $\sum_{j=2017}^{2022} \mathbf{X}' I_t^j \phi_j$ are variables correlated with EPU interacted with year fixed effect, and these variables include education level and the ratio of consumption to income. And estimations of this model are presented in Table 13.

For the results in Table 13, it can be interpreted as during the two years severely disrupted by the COVID-19 epidemic, the marginal impact of economic development on EPU is $10.497 - 0.962 \log \textit{Real GDP per Capita}$. Contrary to the bias-corrected dynamic analysis, now the influence of development turns negative when real GDP per capita is greater than the critical value \$54,810.79. So that the robustness test failed.

In addition, I try to test the robustness by eliminating data from certain areas. The data from Hawaii, Alaska and Washington D.C. are excluded because Hawaii, Alaska are not located in the mainland of the United States, and per capita real GDP of Washington D.C. substantially exceeds that in other states, and Washington D.C. is not an American state juridically. Then I still conduct estimations of model (17), and display results in Table 14. The results are insignificant as before, which also indicates that estimation results in Table 12 are widely impacted by outliers. Furthermore, the estimation of model (17) is not robust. Figure 1 and Figure 2 provide a more visual description that the link between real GDP per capita and EPU is not clear at all.

The underlying for this occurrence might be the vast territory of the United States with large regional differences and cultural diversity between states. For example, the backbone of Hawaii' s economy is tourism, while finance is the mainstay of New York's economy. Each state government take different economic policy actions based on its own situation, yielding variable impacts on uncertainty. Furthermore, the barriers between states are smaller than those between countries, and the mutual influences between states cannot be ignored.

However, there seems to exist a linear correlation between the growth rate of economic development and EPU (Figure 3). The mechanism behind this phenomenon may be that rapid growth of economy favors rulers' reelection, due to more gains of the masses' supports, and this is conductive to reduce the uncertainty about who will decide on economic policies; additionally, rapid economic growth is often accompanied by more employment opportunity, increased firms' income, increased government tax revenue and so on. This may lower uncertainty about the impacts of present and future economic strategies, because these may also indicate that the government carries out correct policies and both the public and rulers hold a optimistic attitude towards these policies. And the fall in the effect of uncertainty about these two aspects dominates the effect of uncertainty about what and when economic policies will be implemented.

About their linear association, the following basic model is set up and tested:

$$g_{w_{i,t}} = \theta_0 + \theta_1 g_{y_{i,t}} + \theta_2 g_{w_{i,t-1}} + \mathbf{X}_{i,t}\beta + I_i + \xi_t + e_{i,t} \tag{19}$$

Where$g_{w_{i,t}}$ is the growth rate of EPU and $g_{y_{i,t}}$ is the growth rate of per capita real GDP; and $\mathbf{X}_{i,t}$ is a vector controlling the effect from education level and life quality; I_i and ξ_t are state fixed effect and year fixed effect. And results are shown in Table 15.

Focusing on Table 15, the short run elasticity, derived from the average value of growth rates of economic growth and EPU, equals to -0.624, In addition, the long run elasticity is -3.25. Whether in short run or long term, economic growth will decelerate the expansion of EPU. After controlling for education level and the proportion of personal consumption to income at a time, estimations of real GDP per capita do not present great changes in both level and significance.

The robustness test of this part also employs the DID model:

$$GEPU_{i,t} = \theta_0 + \theta_1 EG_{i,t} I_t^{COVID} + \theta_2 GEPU_{i,t-1} + \sum_{j=2017}^{2022} X' I_t^j \phi_j + \sum_c \theta_c I_i^c + \sum_{j=2017}^{2022} \theta_j I_t^j + e_{i,t} \quad (20)$$

Where $GEPU_{i,t}$ is the growth rate of EPU and $EG_{i,t}$ indicates the growth rate of economic development.

With the same logic, there are two layers of considerations of Table 16. Firstly, the COVID-19 epidemic has reduced the impact of the growth rate of economic development on the growth rate of EPU; secondly, it can also be interpreted as that growth rate of development and the growth rate of EPU are reversely correlated in 2020 and 2021. These results are consistent with results in Table 15, meaning that model (19) is robust.

Table 12: State-Level Bias-Corrected Dynamic Panel Data Estimates, 2017-2022

	(1)	(2)	(3)
VARIABLES	Log of Economic Policy Uncertainty		
Main Explanatory Variables			
One Period Lag of EPU	0.652***	0.653***	0.649***
	(0.133)	(0.133)	(0.134)
Log of Economic Development	-35.72**	-36.03**	-35.00*
	(16.25)	(16.32)	(18.47)
$(\log Economic\ Development)^2_{i,t}$	1.580**	1.593**	1.545*
	(0.724)	(0.726)	(0.831)
Educational Level			
High School Degree or Above		0.00624	0.00546
		(0.0499)	(0.0504)
Life Quality			
Proportion of Consumption to Income			0.154
			(0.818)
Constant	203.4**	204.6**	199.1*
	(90.94)	(90.97)	(102.2)
Time Fixed Effect	Yes	Yes	Yes
State Fixed Effect	Yes	Yes	Yes
Number of Observations	255	255	255
Number of States	50	50	50

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
The dataset contains the data from 50 states and Washington, D.C.

Figure 1: Relationship between EPU and Economic Development

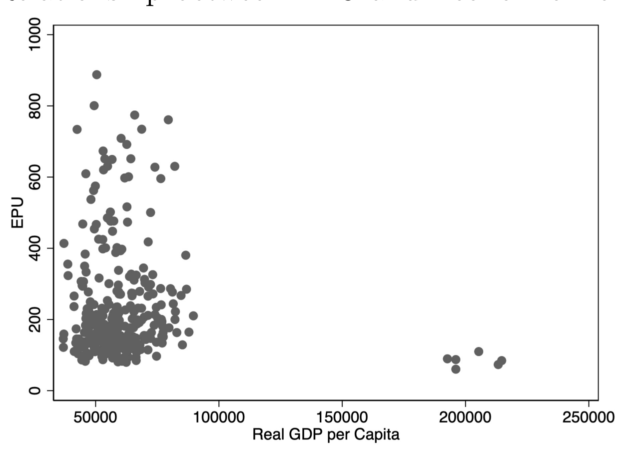
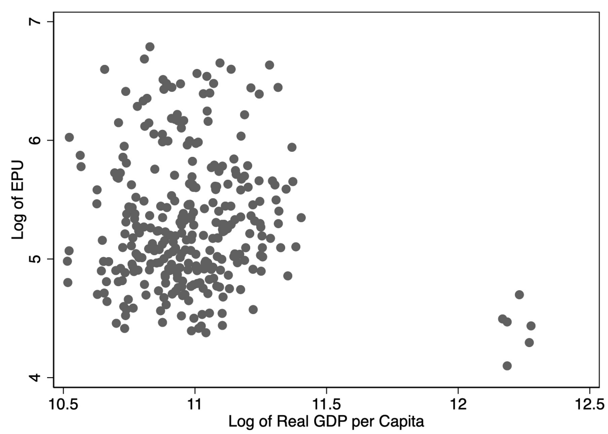


Table 13: State-Level DID estimations of Economic Development, COVID-19, 2020-21

VARIABLES	Log of EPU
Main Explanatory Variables	
$Log\ of\ Economic\ Development \times time$	10.497**
	(5.054)
$(Log\ of\ Economic\ Development)^2 \times time$	-0.481**
	(0.222)
One Period Lag of EPU	0.207**
	(0.082)
Educational Level	
$High\ School\ Degree\ or\ Above \times time$	Yes
Life Quality	
$Personal\ Consumption\ per\ Capita \times time$	Yes
Constant	-3.059
	(7.666)
Time Fixed Effect	Yes
Country Fixed Effect	Yes
Number of Observations	255
$Adjusted R^2$	0.811

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 2: Link between $\log EPU$ and $\log Economic\ Development$



4 Conclusions

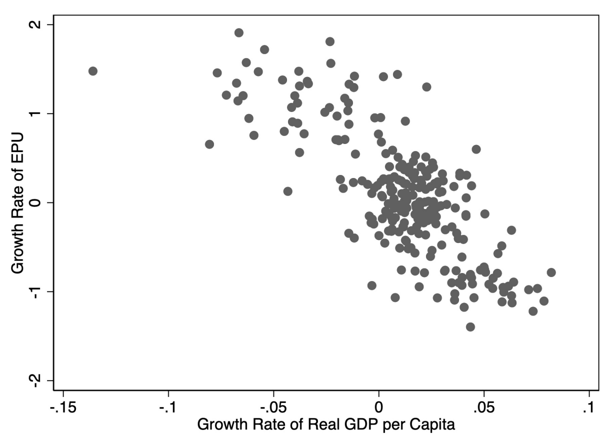
In this paper, I explore the relationship between size of jurisdictions and EPU. I first present a search and matching model to capture how size may affect EPU through heterogeneity of

Table 14: State-Level Bias-Corrected Dynamic Estimations of Economic Development

	(1)	(2)	(3)
	Log of Economic Policy Uncertainty		
VARIABLES	Exclude Hawaii, Alaska and Washington D.C.		
Main Explanatory Variables			
One Period Lag of EPU	0.575***	0.574***	0.569***
	(0.132)	(0.132)	(0.129)
Log of Economic Development	-26.25	-24.74	-24.48
	(34.31)	(35.08)	(35.16)
$(Log\ of\ Economic\ Development)^2$	1.168	1.101	1.085
	(1.553)	(1.587)	(1.592)
Educational Level			
High School Degree or Above		-0.0110	-0.0129
		(0.0508)	(0.0513)
Life Quality			
Consumption Proportion			0.284
			(0.975)
Constant	149.5	142.0	140.9
	(189.6)	(193.1)	(193.4)
Time Fixed Effect	Yes	Yes	Yes
State Fixed Effect	Yes	Yes	Yes
Number of Observations	240	240	240
Number of States	48	48	48

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 3: Growth Rate of EPU and Growth Rate of Real GDP per Capita



policy preferences related to cultural diversity. Secondly, I estimate the benchmark panel model with data from 22 countries from 2003 to 2021, and verify the robustness of the

Table 15: Estimations of Growth Rate of EPU and per Capita Real GDP

	(1)	(2)	(3)
VARIABLES	Growth Rate of EPU		
Main Explanatory Variables			
One Period Lag of EPU	-0.192***	-0.196***	-0.197***
	(0.0662)	(0.0672)	(0.0684)
Growth Rate of Real GDP per Capita	-3.888***	-3.916***	-3.882***
	(1.221)	(1.232)	(1.267)
Educational Level			
High School Degree or Above		0.0303	0.0323
		(0.0545)	(0.0556)
Life Quality			
Consumption Proportion			-0.387
			(1.274)
Constant	0.192***	-2.535	-2.409
	(0.0338)	(4.907)	(4.853)
Time Fixed Effect	Yes	Yes	Yes
State Fixed Effect	Yes	Yes	Yes
Number of Observations	204	204	204
Number of States	50	50	50

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
The dataset contains the data from 50 states and Washington, D.C.

relations by applying 2SLS method where one period lag of real GDP as the instrumental variable and DID method. Both theoretical and empirical results point to a positive effect of size on EPU.

Moreover, I consider how the marginal effects of EPU may change with economic development. This may happen when policies at the early stages of economic development are relatively stable, and infrastructure construction will be conductive for rulers to win the public's hearts and minds, reducing uncertainty; but, after the economy has develops above a given threshold in terms of income per capita, the government may need to adjust policies more frequently when facing more challenges and more complexity, increasing uncertainty. Then, I use the same database as mentioned above to examine the relationship between the variables of interest using the bias-corrected dynamic model, and the DID model is created to test the robustness. The results show that, at the country level, the impact of economic

Table 16: DID Estimations of Economic Development Growth, COVID-19, 2020-21

VARIABLES	Log of EPU
Main variables	
One Period Lag of Growth Rate of EPU	-0.363***
	(0.077)
Growth Rate of Real GDP per Capita × *time*	-3.223**
	(1.513)
Educational Level	
High School Degree or Above × *time*	Yes
Life Quality	
The Ratio of Consumption on Income × *time*	Yes
Constant	0.100
	(6.409)
Time Fixed Effect	Yes
Country Fixed Effect	Yes
Number of Observations	204
Adjusted R^2	0.865

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

development on EPU moves from negative to positive with an increase in real GDP per capital.

Finally, I explore whether similar correlations between size, economic development, and EPU exist within the United States. Again, these analyses are conducted, using bias-corrected dynamic model. I find that size and EPU are positively correlated among American states as well. However, I do not find a U-shaped relationship between income per capita and EPU across American states, possibly because of their similar levels of development and the different nature of economic policy uncertainty across and within sovereign jurisdictions. Interestingly, there is a significant linear negative relationship between the growth rate of real GDP per capita and growth rate of EPU at the state level.

It is worth noting that, although the results of my empirical analysis of the relation between size of jurisdictions and EPU are statistically significant and robust, there is a source of bias in both the benchmark regression and the 2SLS estimation, coming from ignoring the correlation between EPU and its previous value. More broadly, it is possible that issues of endogeneity may continue to be pervasive in these empirically exercises, in spite of the use of IV and DID approaches. In further work, it will be interesting and valuable to build a more reasonable and complete model and find more convincing instrument variables to explore the causal relationship between size and EPU.

Another possible limitation of the analysis stems from the way EPU is constructed. When constructing their index of EPU, Baker et.al (2016) processing keywords on newspapers, whereby each keyword is assigned the same weight. However, it is plausible to expect that not all events should affect the uncertainty scale in the same way and to the same degree. Thus, further insights might be gained in the future by developing more general and flexible measures of EPU.

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