

Measuring Policy Uncertainty under Climate Change

Boqiang Lin¹, Hengsong Zhao^{2*}

1 School of Management, China institute for Studies in Energy Policy, Xiamen University, Fujian, 361005, PR China

2 School of Management, China institute for Studies in Energy Policy, Xiamen University, Fujian, 361005, PR China

(Corresponding Author)

ABSTRACT

In this study, we construct a new climate change policy uncertainty based on the newspaper data for four major countries (China, India, USA and UK). We show some common features of the CPU index. The CPU index of the four countries are highly correlated. And the CPU may fluctuate with economic policy uncertainty and have counter-cyclical characteristics. Our findings can provide some insights for understanding climate policy.

Keywords: Policy Uncertainty; Climate Change; Economic Cycle

1. INTRODUCTION

Climate change has become one of the most significant and complex challenges currently facing our planet. Because climate change has the potential to significantly impact the individual welfare and the production decisions of firms, the possible macroeconomic and financial implications in the near and distant future could be substantial. And the risks of climate change is not just from the physical consequences. Governments and policymakers around the world are making various decisions with respect to climate change, and these policy actions carry risk and uncertainty as to how and when they will play out and the effect they will have. Thus, the risk and uncertainty of climate policy, together with the possible physical risks of climate change, should be a central component to any analysis of the consequences of climate change on the global economy and financial markets. Economic theory suggests that uncertainty has sizable effects to the real economy. In their seminal paper, Baker, Bloom, and Davis (2016) use contents in newspaper articles to construct Economic Policy Uncertainty indexes (EPU) for major economies.

Although there are substantial uncertainty around the attitude, implementation path and potential impact of climate change policies. Scarce empirical literature about the measurement of the climate policy uncertainty and the effects of the climate policy uncertainty on the economy activity. Engle et al. (2020), which applies textual analysis on articles from the Wall Street Journal (WSJ) and construct a climate change news index. But they don't distinguish the physical risks and policy risks. The present paper aims to measure the Climate Policy Uncertainty (CPU) based on the newspaper data. To better describe the characteristics of climate policy uncertainty, we compare the CPU with other uncertainty index. Finally, we discuss the counter-cyclical characteristics of the policy uncertainty.

This paper distinguishes previous literature in three aspects. First, we quantify the uncertainty of climate change policy which helps policy-makers investors and academics to understand the basic characteristics and evolution of climate change policies. Then, we provide more understandings about literature in the relationship of the climate policy uncertainty and economic cycle showing that the variations of economic cycle may be crucial to the climate policies. Finally, we represent some relevance of climate policy uncertainty to other uncertainties.

2. MEASURING POLICY UNCERTAINTY

The compilation strategy of the CPU index follows Baker et al.(2016). We count the number of occurrences of articles discussing climate policy uncertainty in some leading daily general interest English and Chinese-language newspapers. Specifically, We construct a monthly index for China, United States, United Kingdom and India. And we search for articles in leading daily newspaper from Access World News and WISER information. For each country, we select some

representative newspapers (Table 1). We obtain newspaper contents and search for related keywords in the digital archives. Both Access World News and WISER information platform cover important and influential papers from representative newspaper in most countries.

Country	Date	Newspaper
China	2000-2020	Beijing Youth Daily, Guangzhou Daily, Jiefang Daily, People's Daily Overseas Edition, Southern Metropolis Daily, The Beijing News, Wen Hui Daily, Yangcheng Evening News, China Energy News, China Environment News
United States	2000-2020	USA Today, Miami Herald, Chicago Tribune, Washington Post, Los Angeles Times, Boston Globe, San Francisco Chronicle, Dallas Morning News, New York Times, and Wall Street Journal
United Kingdom	2000-2020	Times, Financial Times
India	2003-2020	Financial Express, Indian Express, Hindustan Times, Economic Times, Times of India, Hindu, Statesman

Table 1. Newspaper list

For each newspaper, we search for articles which contain at least one keyword in each of the three criteria, namely (1) Climate, (2) Uncertainty, and (3) Policy. Table 2 shows the keywords in each criterion and their English translation. We scale the number of articles in each month by the number of all the articles for the same month. The series is then standardized to have a standard deviation of unity during the period. We compute the simple average of the monthly series across the selected newspapers. Lastly, the index is normalized to have an average value of 100 in the period from January 2000 to December 2020.

Criteria	English
Climate	climate change; climate risk; greenhouse gas; carbon emissions; carbon dioxide emissions
Policy	policy; regulation; legislation; carbon trade; carbon tax; renewable energy; biomass energy; wind power; photovoltaic; solar power; hydro power; nuclear power; carbon sink

Uncertainty	uncertainty; uncertain
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Table 2. Relevant keywords

We count the number of occurrences of articles discussing climate policy uncertainty in the newspapers and construct the CPU index by following steps.

$$X_{ij} = CPUN_{ij} / N_{ij} \quad (1)$$

$CPUN_{ij}$ denotes the number of articles related to the climate policy uncertainty in month i and year j . And N_{ij} denotes the number of all the articles in month i and year j .

$$Y_{ij} = X_{ij} / \sigma \quad (2)$$

σ is the standard deviation of X_{ij} .

$$CPU_{ij} = Y_{ij} * 100 / \bar{Y}_{ij} \quad (3)$$

The resulting index of four countries are plotted in Fig.1-4. The index reflects some key facts. First, The indexes of the four countries have some common characteristics. The CPU index remained low in the first five years of the 21st century. Second, the index rose sharply around 2009. Third, the uncertainty indexes of these four countries have a large correlation (Table 3), which may imply that climate policies seem to have linkages and spillover effects between countries.



Fig.1. CPU index for China

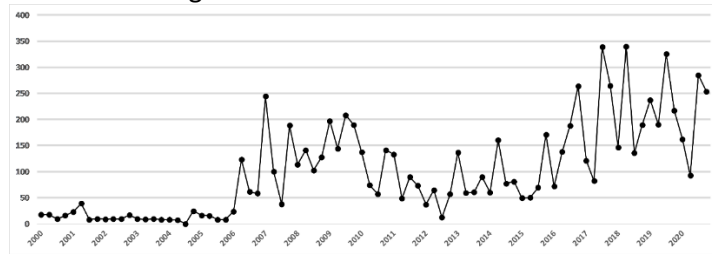


Fig.2. CPU index for United States

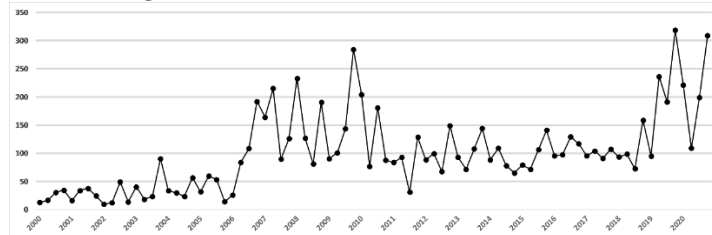


Fig.3. CPU index for United Kingdom

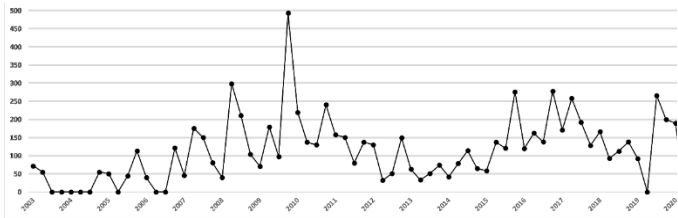


Fig.4. CPU index for Inida

	CPU_China	CPU_USA	CPU_UK	CPU_India
CPU_China	1.0000			
CPU_USA	0.6404	1.0000		
CPU_UK	0.6028	0.6167	1.0000	
CPU_India	0.6336	0.5464	0.5966	1.0000

Table 3. Correlation between four countries

3. COMPARISONS BETWEEN COUNTRIES AND TO OTHER UNCERTAINTY INDEX

We also compare our CPU index with other existing countries' indexes related to uncertainty and explore whether our CPU index has relationship with others.

The Fig.5 shows the comparison with some uncertainty indexes in China. And the Table 4 shows the correlation coefficient between uncertainty indexes in China. The EPU_CN_1 is China's EPU index built by Baker, Bloom, and Davis (2016). And EPU_CN_2 is China's new EPU index built by Huang and Luk (2020). We also use trade policy uncertainty for comparative analysis. And comparisons between China's CPU and EPU show that the CPU index have close relationship with the fluctuation of economic policy and trade policy. Caldara and Iacoviello (2018) construct the geopolitical risk index by searching over a set of keywords related to geopolitical tensions. We compared the geopolitical risk index constructed using text-mining techniques on newspapers and the CPU index. The CPU index is quite different from the geopolitical risk index.

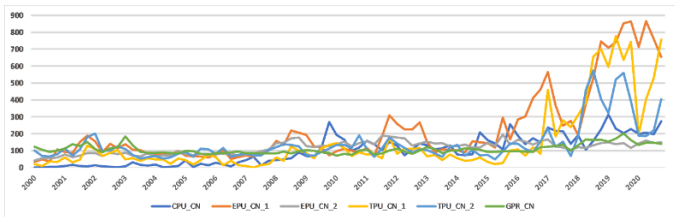


Fig.5. Comparisons of indexes for China

	EPU_C N_BBD	EPU_C N_CER	GPR_C HINA	TPU_C N_BBD	TPU_C N_CER
CPU_China	0.6813	0.6768	0.3594	0.6610	0.5204

Table 4. Correlation between uncertainty index in China

We compared CPU, EPU and TPU in the United States. The results show that CPU, EPU and TPU are

positively correlated. However, the correlation between CPU and economic policy uncertainty is relatively low.

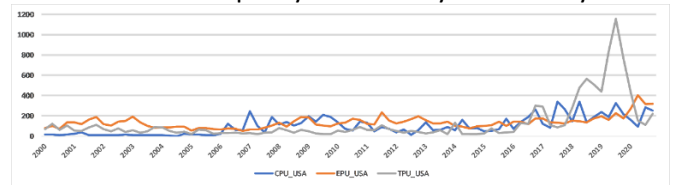


Fig.6. Comparisons of indexes for USA

	EPU_USA	TPU_USA
CPU_USA	0.3620	0.5094

Table 5. Correlation between uncertainty index in USA

The UK's climate policy uncertainty is positively correlated with EPU, but India's climate policy seems to have a weaker relationship with economic policy fluctuations.

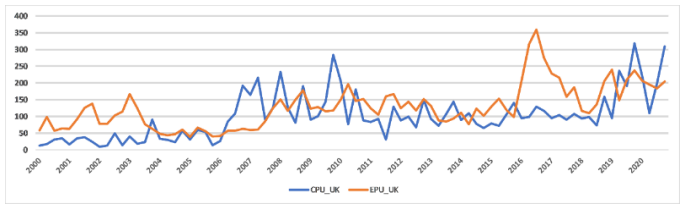


Fig.7. Comparisons of indexes for UK

	EPU_UK
CPU_UK	0.4133

Table 6. Correlation between uncertainty index in UK

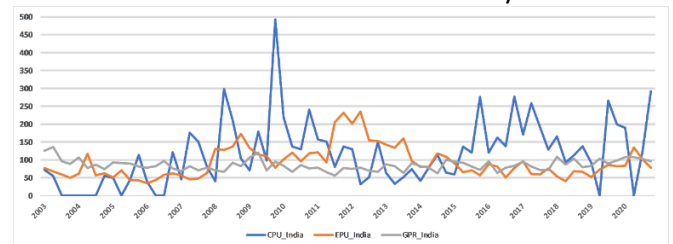


Fig.8. Comparisons of indexes for India

	EPU_India	GPR_India
CPU_India	-0.0091	-0.0903

Table 7. Correlation between uncertainty index in India

We turn to VAR models that exploit time-series variation between the CPU index and macro economy. VARs are useful for characterizing dynamic relationships. We start by fitting a VAR to quarterly data. To for four countries. Our baseline VAR specification includes three lags of EPU and GDP. The estimation results show that during the recession period, the uncertainty of climate change policy will increase.

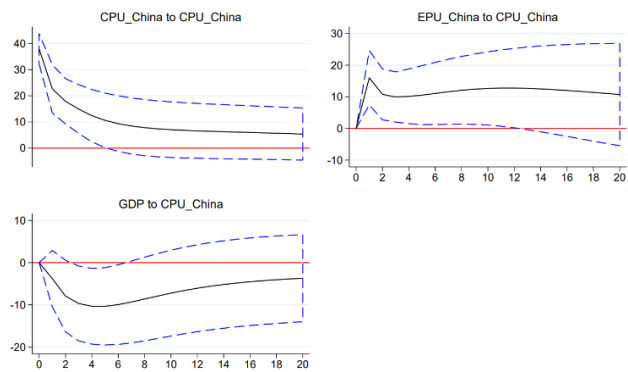


Fig.9.CPU responses to EPU and GDP shock in China

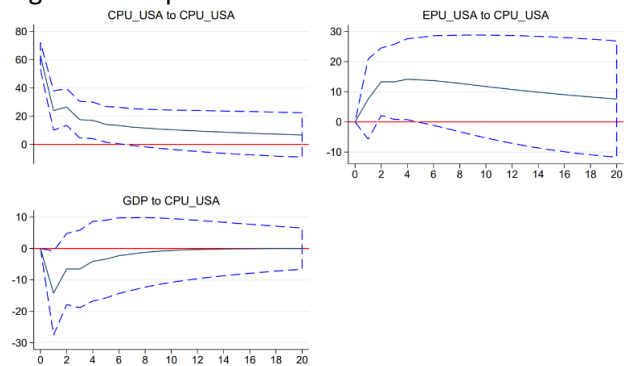


Fig.10.CPU responses to EPU and GDP shock in USA

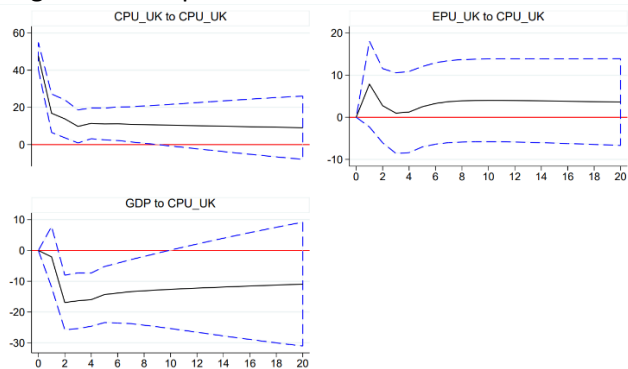


Fig.11.CPU responses to EPU and GDP shock in UK

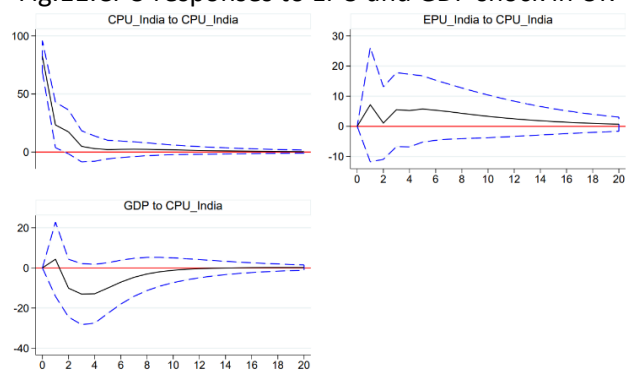


Fig.12.CPU responses to EPU and GDP shock in India

similarities in the time series. However, the indexed also indicates some notable differences. For example, India CPU index fluctuated at high levels while UK CPU index stay in lower levels. There may be a correlation between the country's CPU index and economic policy uncertainty. The VAR model shows that the positive impact of economic policy uncertainty may cause the CPU index to rise. And the CPU index also shows counter-cyclical character.

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4. Conclusion

We construct a climate policy uncertainty index through textual analysis of newspapers for four major economies. Indexes for four major economies exhibit