Problem Set 5

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1. Hypothesis Development

Policy uncertainty is the ambiguity environment caused by vague government policies including monetary and scal policies. This situation may translate itself into investors updated beliefs about the healthiness of the financial markets and into their actions taken under panic. Therefore, the build-up process of systemic event may transform into a realized financial distress. Past studies provide empirical clues on a positive relationship between policy uncertainty and individual banks systemic risk contributions. For example, Pastor and Veronesi (2012) find that stock prices decline around the announcement dates of policy changes and this adverse effect is reinforced with the uncertainty in the policy environment. This situation leads to a left-skewed distribution of stock prices around the announcements about policy changes. This effect can easily be captured by systemic risk measures, which depend mostly on tail risks of stock returns.

Uncertainty also surges the correlation among stock returns and increases stock return volatility (Bittlingmayer, 1998; Voth, 2012). Combination of increased dependency among stock returns and volatility during uncertain time periods causes derived diversification benefits across stocks to decrease since diversifiable idiosyncratic risks cannot capture increased dependency across stocks. Reason behind the decrease in these benefits can be explained mainly by the fact that market portfolio as a whole now becomes more volatile (Danielsson & Zigrand, 2008). Fortunately, this non-diversifiable risk can be captured by the systemic risk measures.

As stated in Pastor and Veronesi (2013) another potential indirect effect of policy uncertainty on systemic risk is reported through the increased equity risk premium required by the investors as a compensation for the vagueness about which policy to be implemented and policy outcomes. Any policy change may lead to two different types of equity risk premium such that one part is due to the uncertainty about the decision regarding the new policy political risk premium- and the other part is due to the uncertainty about the outcomes of the new policy impact risk premium- (Pastor & Veronesi, 2013). Moreover, Pastor and Veronesi (2012) indicate that policy changes are expected to occur more after contractionary periods compared to economic booms since there is a need to change the policy. Therefore, during weak economic conditions, the political risk premium should be higher than that of under strong economic conditions. This finding supports the logic behind the construction of systemic risk measures such that when the aggregate system is weak (i.e., undercapitalized), any policy uncertainty may lead to a bad systemic event easier than it would under strong economic conditions. Furthermore, investors may become more suspicious about the quality of their information about the firms value, profitability and prospects. Therefore, ambiguity hypothesis can be supported during the highly uncertain times such that investors avoid investing in stock markets and further reduce the already low levels of capital in the financial system (Pasquariello & Zafeiridou, 2014).

There are other channels as well that uncertainty may affect systemic risk contributions of banks. For instance, short-term TED spread, which is the difference between the three-month LIBOR rate and the three-month secondary market Treasury bill rate may increase at these times since it reflects the short-term funding liquidity risk (Adriand & Brunnermeier, 2016). These illiquidity spirals may increase the comovements of balance sheet items across banks, especially via increased fire sales of assets and increased overnight debts (repo) and asset backed commercial papers with overnight to week maturity (Acharya et al., 2017; Adrian & Brunnermeier, 2016). Banks may also breathe a little by using their Tier 1 (core) capital and/or Tier 2 buffer capital in financially distressed times.

In light of these information, economic-policy related uncertainty is expected to affect each banks contribution to systemic risk positively. The main hypothesis of this study is the following:

H1: Economic-policy related uncertainty predicts each banks contribution to systemic risk positively in U.S.

2. Variables

2.1. Systemic Risk Measures - Very Briefly

I would like to understand how economic policy uncertainty at time t-1 affects systemic risk contributions of banks at time t. Main systemic risk measures that are widely accepted and used in the literature are SRISK, DeltaCoVaR, SES, MES and LVG as mentioned in PS1. All of these measures are based on the similar idea that when the financial system as a whole is undercapitalized, even one bank's failure could be problematic. However, it is important to mention that when the aggregate capital is at least a proportion (it is accepted as 8% - Tier 1 capital - for the regulatory purposes) of aggregate assets, then a bank's failure can be overcome via bank mergers and acquisitions.

2.2. Economic-policy uncertainty

The main variable of interest in this analysis is the policy-related economic uncertainty measure constructed by Baker, Bloom and Davis (2016) which is available on their website. This index is a monthly composite measure of four dimensions of economic policy uncertainty (EPU) since 1985 for U.S. The first one (`News_EPU`) is the constructed index of normalized volume of news reporting about economic policy uncertainty by top ten newspapers in the U.S. Baker et al. (2016) listed the triple of the searched words in those newspapers as follows: economic or economy; uncertain or uncertainty; congress, deficit, Federal Reserve, legislation, regulation or White House. It is important to note that at least one word from these three categories - economy, policy and uncertainty - should be included in the same article. For each newspaper, the number of articles related to EPU is scaled by the total number of articles in ten of the newspapers each month and then standardized by its standard deviation and finally, the average for ten newspapers is calculated.

The second dimension considers the tax-code related uncertainty that agents will face in the following years. This second component (`Tax_EPU`) employs dollar value-weighted numbers of federal tax code provisions that are planned to be ceased in the upcoming ten years. The planned federal tax code expirations are obtained from the Congressional Budget Office. The last two components reflect policy related uncertainty in macroeconomic variables by computing the standard deviation of individual professional forecasters quarterly estimates for next years consumer price index (CPI), federal expenditures and local expenditures. `CPI_EPU` indicates the uncertainty in the monetary policy whereas federal and local expenditures on goods and services (`Federal_EPU`) indicate the uncertainty in the fiscal policy. The dispersion for `CPI_EPU` is calculated with the help of interquantile ranges of quarterly inflation rate forecasts for the next four quarter. These four components are first normalized with their standard deviations and then, averages for each of the standardized components are calculated. Finally, weights are given to each average standardized component such as for the `News_EPU` and 1/6 for each of the rest of the components to calculate the overall EPU index.

2.3. Control Variables

2.3.1. Proxies for CAMELS

In order to rule out the effect of differences in bank performances on systemic risk, one has to control for the proxies of CAMELS. Capital adequacy reflects the degree of a bank can tolerate potential losses and it considers the amount of a banks capital compared to its assets. This capitalization ratio is calculated by dividing the amount of equity capital by gross total assets (GTA). Asset quality considers the state of a banks portfolio by referring to the fraction of nonperforming assets in total assets of a bank. Non-performing assets include loans that are past due for at least ninety days and loans that are not accruing interest. As the proportion of nonperforming assets in total assets increase, asset quality of a bank goes down. Management quality is indicated by negative of the number of corrective actions that were taken against bank executives by the corresponding bank regulator during the sample period 2005-2012 (FED, FDIC, and OCC). It is defined as a negative number to obtain a positive relationship between the management quality of a bank and its measure. Earnings of a bank is calculated as the ratio of the annualized net income to GTA and it may be also referred as return on assets (ROA). Liquidity of a bank is indicated as the amount of cash divided by banks total deposits. Sensitivity to market risk is measured by dividing the absolute difference between short-term assets and short-term liabilities to GTA. Measurement of these variables requires balance sheet data of banks from Bank Call

Reports available at Center for Research in Security Prices (CRSP) database.

2.3.2. Other Bank Controls

Even after controlling for the bank performances, there are still observable differences across banks in terms of the contributors to their individual systemic risks. For example, Adrian and Brunnermeier (2016) state that larger banks may represent a higher proportion of the aggregate systemic risk since they have the too-big-to-fail property. Therefore, bank size measured by the natural logarithm of bank GTA is controlled in this study. Another potential control is the age of a bank. As banks may learn how to absorb potential shocks coming to the markets and may gain a competitive advantage over the relatively new banks, age in years of a bank is also considered. With a similar logic, degree of concentration in the markets are taken into consideration with the help of Herfindahl-Hirschman Deposits Index (HHI) by utilizing data from The Federal Deposit Insurance Corporation (FDIC) Summary of Deposits. As HHI goes higher, market concentration increases. Another control for the competition conditions in different markets can be regarded as metropolitan dummy, which takes a value of one when the majority of bank deposits (at least 50%) are in metropolitan areas and 0 otherwise. Moreover, total number of branches of a bank may positively affect its competitive edge compared to the other banks. Thus, branch variable, defined as the ratio of the number of branches over GTA multiplied by 1000 is employed in the study.

Systemic risk measures rely mostly on the financial fragility hypothesis. For this reason, one has to consider the extent of internal funds that a bank can obtain. Therefore, bank-holding companies (BHCs) and merged banks may have more opportunities to absorb potential losses through internal funds from the company itself or from the enlarged internal fund pool of parent and subsidiary company. For this reason, two dummies, one for bank-holding companies and the other for merged banks are employed in this study. BHC dummy takes a value of one if it is a BHC and zero if it is a sole bank. Similarly, mergers and acquisitions dummy (M&A) takes a value of one beginning from the time period that a bank acquires another bank and zero otherwise. Measurement of these variables except HHI requires balance sheet data of banks from Bank Call Reports available at Center for Research in Security Prices (CRSP) database.

2.3.3. Controls for Macroeconomic Environment

In this study, three measures for macroeconomic conditions and two measures for the financial market conditions are employed following Pastor and Veronesi (2013), where all of these measures reflect the strong economic conditions as they increase. Three monthly controls for macroeconomic environment are used to ensure that the effect of countercyclicality of uncertainty does not reflect the impact of weak economic conditions (Gulen & Ion, 2016). The first one is a monthly composite indicator of overall economic activity in US defined by Chicago Fed and named National Activity Index (CFNAI). The second one is the negative of the recession dummy (`minus_NBER_REC`), which takes a value of one in recession months and zero otherwise, constructed by the National Bureau of Economic Research (NBER). However, the negative of financial crisis dummy, constructed in a similar with the recession dummy, is employed in this study with the help of using the data from Berger and Bouwman (2014). As the third macroeconomic indicator, industrial production growth (IPG) gathered from the Board of Governors is also used. Two measures to control for financial market conditions are utilized. Stock market conditions are measured by the cyclically adjusted price-to-earnings ratio for the aggregate stock market (CAPE), calculated by Robert Shiller. Bond market conditions are controlled by the negative of default spread (`minus_DEF`), difference between the yields of Moody's seasoned Aaa and Baa corporate bonds, gathered from the St. Louise Federal Reserve. Daily measures of this difference are aggregated at monthly level by taking the daily averages of this variable for that month.

3.Baseline OLS Model Results

The main hypothesis tested in this study is that economic policy uncertainty positively affects banks contribution to systemic risk. The coefficient of economic policy uncertainty is positive and significant at 1% level for all the model specifications (Table 1). The baseline model predicts that 1% increase in EPU in the last month will increase the NSRISK by 0.012 units. After controlling for the past performances of banks via proxies of CAMELS, this effect decreases to 0.0071 units and the model with the other bank controls predicts an increase of 0.0073 units. Yet, in the main model specification, this effect decreases to an increase of 0.0031 units. Regarding the economic significance of this effect, which can be seen through the summary statistics, one standard deviation increase in log EPU leads to a 0.09 standard deviation increase in NSRISK in the next month (while its mean is 0.13 and standard deviation 0.29).

With regards to the control variables, as capital adequacy of banks increase, their systemic risk contribution decreases significantly. This is the main variable that is controlled by the policymakers to ensure the that banks can absorb potential losses. One unit increase in capitalization ratio will decrease the NSRISK by 0.029 units. However, as the non-performing loans fraction in total assets increases by one unit, NSRISK will significantly increase by 0.16 points. Management quality is also displayed as an important dimension since 1 more corrective action against the bank executives in the last month will significantly decrease NSRISK by 0.047 units. Similarly, as earnings of a bank increases by one unit, its systemic risk contribution will decrease by 0.095 units whereas liquidity of a bank increases NSRISK significantly. Sensitivity of a bank to market risk, measured by dividing the absolute difference between short-term assets and short-term liabilities to GTA, decreases NSRISK but its effect is not significant.

The surprising results is the one regarding the bank size since large banks are expected to contribute more to systemic risk compared to small banks. Although the simple linear regression of NSRISK on bank size returns a positive and significant coefficient for bank size, there could be an interaction between bank size and other control variables. In other words, some of the control variables may already capture the information within the bank size. Or, EPUs effect on NSRISK may vary with bank size. Bank age has a negative significant impact on NSRISK with a very small coefficient. Bank holding companies are expected to contribute 0.0019 units more to systemic risk compared to commercial banks. As HHI coefficient shows, bank competition may affect NSRISK positively but it is a very small effect. The banks in the metropolitan areas are expected to contribute more to NSRISK by 0.0007 units compared to the banks in non-metropolitan areas. Also, as a bank opens 1% more branches relative to its GTA, its contribution to systemic risk will increase by 0.99 units.

All of the macroeconomic control variables are significant and negative except IPG and `minus_DEF`, which are the industrial production growth and negative of default spread in the bond markets. The coefficient of IPG is very small but the negative coefficient on the `minus_DEF` can be explained by the non-negotiability of debt in case of a systemic event. However, regarding the other macro controls, as the economic environment gets better, banks contribution to systemic risk decreases significantly.

	1	2	3	4
Intercept	-5.39***	-3.10***	-3.42***	-2.03***
	(0.07)	(0.06)	(0.07)	(0.09)
Log_EPU_lag	1.20***	0.71***	0.73***	0.38***
	(0.01)	(0.01)	(0.01)	(0.02)
Capital Adequacy		-2.78***	-2.64***	-2.90***
		(0.10)	(0.10)	(0.10)
Asset Quality		16.27***	16.72***	16.83***
		(0.21)	(0.21)	(0.21)
Management Quality		4.88***	4.58***	4.71***
		(0.16)	(0.17)	(0.17)
Earnings		-10.18***	-10.12***	-9.50***
		(0.14)	(0.14)	(0.14)
Liquidity		0.03	0.02	0.05*
		(0.02)	(0.02)	(0.02)
Sensitivity		-0.06*	-0.07**	-0.02
		(0.03)	(0.03)	(0.03)
Size			0.00	-0.00
			(0.00)	(0.00)
Age			-0.00***	-0.00***
			(0.00)	(0.00)
HHI			0.00***	0.00***
			(0.00)	(0.00)
Metropolitan			0.07***	0.07***
			(0.01)	(0.01)
Branch			97.80***	98.90***
			(27.79)	(27.74)
MandA			-0.05	-0.02
			(0.03)	(0.03)
BHC			0.19***	0.19***
			(0.02)	(0.02)
CFNAI				-0.02**
				(0.01)
IPG				0.00***
				(0.00)
CAPE				-0.01***
				(0.00)
Minus_DEF				0.31***
				(0.01)
Minus_Fin_crisis				-0.08***
				(0.01)
R^2	0.10	0.36	0.37	0.39
Adj. R^2	0.10	0.36	0.37	0.39
Num. obs.	57954	56050	54670	54670
RMSE	1.03	0.87	0.87	0.86

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$

Table 1: Baseline OLS Models

4. IV - 2SLS Results

Endogeneity concerns are alleviated via an instrumental variable (IV) analysis. Table 2 indicates that our results are robust under an IV specification where a measure of political polarization in the United States Senate is utilized as an instrument for economic policy uncertainty. This measure relies on the first dimension of DW-NOMINATE scores of McCarty, Poole, and Rosenthal (1997). This dimension is considered as average differences in the Republican and Democratic Party Senate members stance on government intervention in the economy (Poole and Rosentahl 2000). Increased partisan polarization is interpreted as a slower progress in terms of passing and executing the laws and thus, increased ambiguity in policies (McCarty, 2012). Therefore, one expects a positive and meaningful correlation between political polarization and economic policy uncertainty so that this IV can satisfy the relevance condition. With regards to the exclusion restriction, any other channel than economic policy uncertainty that might work from the political disagreements in the Senate to systemic risk contributions of banks is not obvious.

The usual two-stage least-squares (2SLS) methodology is ruled out due to fact that the economic policy uncertainty and political polarization are invariant across banks and thus, repetition of their values for all banks for each month may exaggerate the correlation between them (Gulen & Ion, 2016). Therefore, in order to avoid this bias problem, the first stage regression is run as time-series with only macroeconomic control variables whereas the second stage is a panel regression with all the control variables where the main variable of interest is the log of predicted EPU coming from the first stage.

First stage regression shows that the coefficient of IV is positive and statistically significant at 1% level. Thus, our instrument satisfies the relevance condition. The model is significant as the F-statistic from this time-series regression is 48.53 which suggests our results do not suffer from weak instrument problem. Second stage panel regression results state that positive effect of EPU on NSRISK is robust to the endogeneity issues. Moreover, the effect increases from 0.38 in the OLS model to 1.22 in the 2SLS model when the endogeneity concerns are addressed.

	OLS	IV-Step1	IV-Step2
Intercept	-2.03***	5.87***	-5.99***
	(0.09)	(0.21)	(0.25)
Log_EPU_lag	0.38***		
	(0.02)		
Capital Adequacy	-2.90***		-3.10***
	(0.10)		(0.11)
Asset Quality	16.83***		16.69***
	(0.21)		(0.21)
Management Quality	4.71***		5.33***
	(0.17)		(0.17)
Earnings	-9.50***		-9.26***
	(0.14)		(0.14)
Liquidity	0.05*		0.04
	(0.02)		(0.02)
Sensitivity	-0.02		-0.07*
	(0.03)		(0.03)
Size	-0.00		-0.01*
	(0.00)		(0.00)
Age	-0.00***		-0.00***
	(0.00)		(0.00)
HHI	0.00***		0.00***
	(0.00)		(0.00)
Metropolitan	0.07***		0.07***
	(0.01)		(0.01)
Branch	98.90***		131.66***
	(27.74)		(27.77)
MandA	-0.02		-0.03
	(0.03)		(0.03)
BHC	0.19***		0.20***
	(0.02)		(0.02)
CFNAI	-0.02**	0.00	-0.02*
	(0.01)	(0.02)	(0.01)
IPG	0.00***	-0.01***	0.00***
	(0.00)	(0.00)	(0.00)
CAPE	-0.01***	-0.01***	0.00***
	(0.00)	(0.00)	(0.00)
Minus_DEF	0.31***	0.21***	0.11***
	(0.01)	(0.04)	(0.02)
Minus_Fin_crisis	-0.08***	-0.13***	-0.01
	(0.01)	(0.03)	(0.01)
log_POLAR_lag_hat		1.34***	
		(0.19)	
log_EPU_lag_hat			1.22***
			(0.05)
R^2	0.39	0.45	0.39
Adj. R^2	0.39	0.44	0.39
Num. obs.	54670	360	54670
RMSE	0.86	0.21	0.86

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$

Table 2: OLS and 2SLS Models

5. Panel Regression Results with Fixed Effects

The coefficient of economic policy uncertainty is positive and significant at 1% level for all the model specifications (Table 3). The baseline model predicts that 1% increase in EPU will increase the NSRISK by 0.014 units. After controlling for the CAMELS, this effect decreases to 0.0067 units and the final model predicts an increase of 0.0031 units. Regarding the economic significance of this effect, one standard deviation increase in log EPU leads to a 0.08 standard deviation increase in NSRISK in the next month (while its mean is 0.13 and standard deviation 0.29).

With regards to the control variables, as capital adequacy of banks increase, their systemic risk contribution decreases significantly. This is the main variable that is controlled by the policymakers to ensure the that banks can absorb potential losses. One unit increase in capitalization ratio will decrease the NSRISK by 0.039 units. However, as the non-performing loans fraction in total assets increases by one unit, NSRISK will significantly increase by 0.16 points. Management quality is also displayed as an important dimension since 1 more corrective action against the bank executives in the last month will significantly decrease NSRISK by 0.046 units. Similarly, as earnings of a bank increases by one unit, its systemic risk contribution will decrease by 0.082 units whereas liquidity of a bank increases NSRISK significantly. Sensitivity of a bank to market risk, measured by dividing the absolute difference between short-term assets and short-term liabilities to GTA, decreases NSRISK significantly.

The surprising results is the one regarding the bank size since large banks are expected to contribute more to systemic risk compared to small banks. Although the simple linear regression of NSRISK on bank size returns a positive and significant coefficient for bank size, there could be an interaction between bank size and other control variables. In other words, some of the control variables may already capture the information within the bank size. Or, EPUs effect on NSRISK may vary with bank size. Bank age has a positive significant impact on NSRISK with a very small coefficient. Bank holding companies are expected to contribute 0.0071 units more to systemic risk compared to commercial banks. As HHI coefficient shows, bank competition may affect NSRISK negatively but it is a very small effect. The rest of the bank controls are not statistically significant.

All of the macroeconomic control variables are significant and negative except `minus_DEF`, which is the negative of default spread in the bond markets. This can be explained by the non-negotiability of debt in case of a systemic event. However, regarding the other macro controls, as the economic environment gets better, banks contribution to systemic risk decreases significantly.

	1	2	3	4
Log_EPU_lag	1.14***	0.67***	0.65***	0.31***
	(0.01)	(0.01)	(0.01)	(0.02)
Capital Adequacy		-3.42***	-3.97***	-3.86***
		(0.12)	(0.14)	(0.13)
Asset Quality		16.55***	16.65***	16.00***
		(0.22)	(0.22)	(0.23)
Management Quality		4.30***	4.66***	4.55***
		(0.17)	(0.17)	(0.17)
Earnings		-8.73***	-8.79***	-8.18***
		(0.13)	(0.14)	(0.14)
Liquidity		0.04	0.04	0.06*
		(0.03)	(0.03)	(0.03)
Sensitivity		-0.14***	-0.08**	-0.13***
		(0.03)	(0.03)	(0.03)
Size			-0.03***	-0.02***
			(0.00)	(0.00)
Age			0.00***	0.00***
			(0.00)	(0.00)
HHI			-0.00***	-0.00***
			(0.00)	(0.00)
Metropolitan			-0.02	-0.03*
			(0.01)	(0.01)
Branch			34.80	33.71
			(29.62)	(29.27)
MandA			-0.01	0.01
			(0.03)	(0.03)
BHC			0.17	0.71
			(0.39)	(0.39)
CFNAI				-0.01*
				(0.01)
IPG				-0.01***
				(0.00)
CAPE				-0.00
				(0.00)
Minus_DEF				0.27***
				(0.01)
Minus_Fin_crisis				-0.09***
				(0.01)
R^2	0.11	0.33	0.33	0.35
Adj. R^2	0.10	0.32	0.33	0.35
Num. obs.	57954	56050	54670	54670

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$

Table 3: Within Fixed Effects Models