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Spatial Contagion of Global Financial Crisis

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Spatial Contagion of Global Financial Crisis

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Abstract

The global financial crisis triggered by the credit crisis in the USA as its epicenter, quickly spread across the globe. The crisis starts spreading around the world in the middle of 2007 and along the 2008, where stock markets in major economies fell, followed by collapses of large companies and leading financial institutions. In a world where economies are integrated, the spread of such crisis is unavoidable.

In this paper, we try to estimate the spill over effect of the global financial crises across borders and regions. Using spatial econometrics method we employ distance based weight matrix to estimate the spatial dependence and spatial heterogeneity of the crises.

On the sensitivity analysis, we also employ weights matrix that is corrected by the governance and the economic freedom index to shows how the virtual space of governance, economic institution and regimes affect the spread of the crises.

Keywords : *Global Financial Crises, Spillover Effect, Institutions, Globalization, Spatial Econometrics*

1. Introduction

There is still no firm consensus on the appropriate definition of financial contagion. Borrowing from epidemiological terminology, contagion is intrinsically associated with a spread of diseases, with a probability of an even more dismally consequences of death. Con-tagion was often used as a synonym for the Bubonic Plague in Europe as late as the 19th century. The term also implies, at least to some, that those who are affected by the financial crises do so through no fault of their own. However, this idea is strongly resisted by some analysts: speculators appear to discriminate in choosing the countries they attack (Dungey and Tambakis, 2003).

As a usefull benchmark, the World Bank has restrictively define financial contagion as .a cross-country transmission of shocks or the general cross-country spillover effects. This follows Eichengreen and Rose (1995) and Eichengreen, Rose and Wyplosz (1996), who propose that contagion refers to the association of excess returns in one country with excess returns in another country after controlling for the effects of fundamentals.[1]

[1] The World Bank's definitions of contagion are available on the Internet at http://www1.worldbank.org/economicpolicy/managing%20volatility/contagion/definitions.html

Meanwhile, Dornsbusch (2000) defines contagion as a significant increase in cross-market linkages after a shock to an individual country (or group of countries). This definition highlights that there are many links through which shocks are transmitted in normal times from one country to another, including trade and financial links. The way in which shocks are transmitted do seem to differ, however, during times of crises. Empirical work has helped identify the type of links and other macroeconomic conditions, which can make a country vulnerable to contagion during such crisis periods, although less is known on the importance of microeconomic conditions and institutional factors in propagating shocks. It, thus, has helped to identify those countries which are at risk of contagion and some, albeit quite general, policy interventions which can reduce the risks.

Here we define contagion as the spread of a financial crises from the ground zero country. We identify United States of America as the ground zero country and do not attempt to explain the reason of their respective crisis.

This paper tries to explore the contagion effect of financial crisis in an unconventional way relative to what has done by the previous research. The paper mainly concentrates on the correlation between market and economy using a time series analysis. Here we trace the source of contagion by the similarity of macroeconomic variables among countries. These similarities arose due to geographical similarity (i.e. European Union, Asian Pacific Rim), trade and cultural linkage. The similarity resulted in a clustering pattern between countries, as we can see in Figure 1, the impact of financial crisis calculated by the IMF around the globe shown a systemic pattern about the severity of the crisis in the northern and southern hemisphere of the globe, leaving out africa, sub-saharan africa, middle east, and some part of

Figure 1. Global Financial Crises Around The World

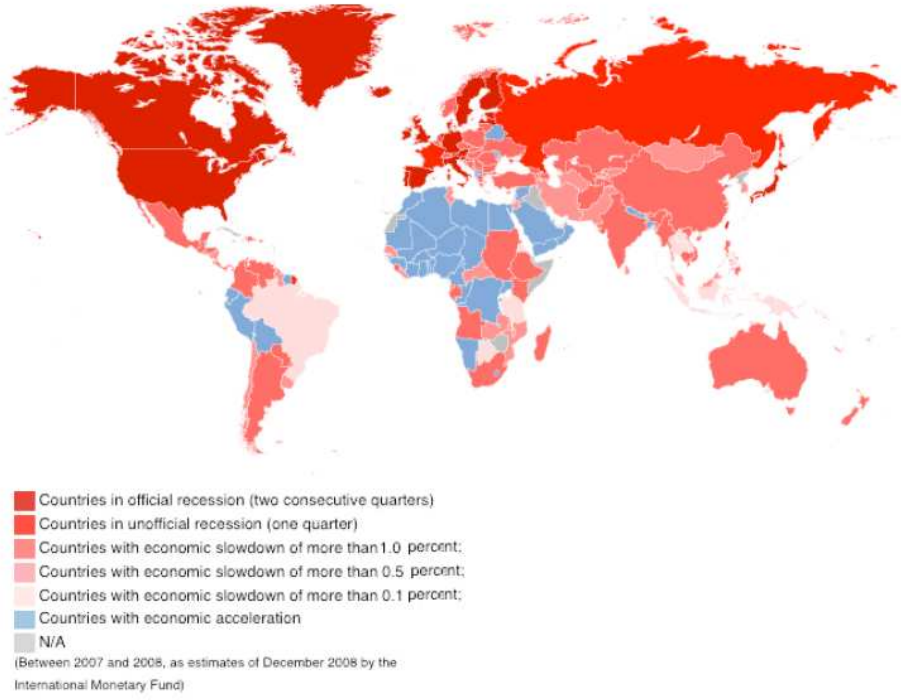


Figure by Felipe Menegaz available online at http://en.wikipedia.org/wiki/File:2007-2009_World_Financial_Crisis.svg

South East Asia.

There are several reasons why the geography-economic nexus may be characterized by spatial dependence. The substantive reasons are political and economic transmissions of government forms (Starr, 1991), interdependence of policy decisions (Brueckner, 2003), corruption (Seldadyo, 2008; Sascha B.O, 2009), policy convergence (Mukand and Rodrik, 2005), democracy, war, and peace, or economic liberty (O'Loughin et al., 1998; Ward and Gleditsch, 2002; Simmons and Elkins, 2004), which may have spatial dimension due to spillovers and diffusion-adoption processes.

2. Previous Research

The list of studies on financial crisis (most of them are EWS or Early Warning System) is long and expanding rapidly. A full list is beyond the scope of this paper. Lestano et al. (2003) has documented quite comprehensive list of research on the subject. It refers to Kaminsky, Lizondo, and Reinhart (1998) for papers on currency crises prior to the East Asian crisis, and Bustelo (2000) and Burkart and Coudert (2002) on the East Asian Crisis; Gonzales-Hermosillo (1996) and Dermirgüç-Kunt and Detragiache (1997) on banking crises; and Marchaesi's survey on debt crises (2003).

We define the global financial crisis not only as a mono-dimensional phenomenon, but also as a multidimensional crisis that consists of systemic crises of banking, stock market, currency, and economic slowdown. In order to be able to capture those elements, we use a Principal Component Analysis to identify the factors. Before we estimate the PCA of the global financial crisis, we define each crisis indicators as follows:

- Currency crises

The definition of currency crises refer to Stavarek (2007), who follows Eichengreen et al. (1994, 1995), which argues that dependency on a particular model is an undesirable feature for an EMP index. As an alternative, they proposed the following measure of speculative pressures as a model-independent approach:

(1)

$$EMP_t = \frac{\Delta e_t}{e_t} - \frac{1}{\sigma_r}\left(\frac{\Delta rm_t}{rm_t} - \frac{\Delta rm_t^*}{rm_t^*}\right) + \frac{1}{\sigma_i}(\Delta(i_t - i_t^*)$$

Where σ_t , is the standard deviation of the difference between the relative changes in the ratio of foreign reserves and money (money base) in the analyzed country and the reference country $(\Delta rm_t /rm_t - \Delta rm^*_t /rm^*_i)$ and σ_i is the standard deviation of the nominal rmt rmti interest rate differential $(\Delta(i_t - i^*_t)$. Other variables are as defined in the previous specification.

For the practical calculation, Stavarek (2007) takes an inspiration from Sachs et al. (1996) and made some modifications to the EMP formula. He changed the weighting scheme to avoid the EMP pressure being driven by the most volatile component and abandoned the relation between foreign reserves and money in home and reference country. Consequently, the EMP formula based on the model-independent approach can be written as follows:

$$EMP_t = \left(\frac{1/\sigma_e}{((1/\sigma_e) + (1/\sigma_{rm}) + (1/\sigma_i))}\right)\frac{\Delta e_t}{e_{t-1}} - \left(\frac{1/\sigma_{rm}}{((1/\sigma_e) + (1/\sigma_{rm}) + (1/\sigma_i))}\right)\frac{\Delta rm_t}{rm_{t-1}}$$

$$+\left(\frac{1/\sigma_i}{((1/\sigma_e)+(1/\sigma_{rm})+(1/\sigma_i))}\right)(\Delta i_t - i_t^*) \quad (2)$$

Where σ_e is the standard deviation of the rate of change in exchange rate ($\Delta_t e_t/e_{t-1}$) and other variables are consistent with equation (1).

• Stock Market Crises

To depict crisis in the stock market, we use the changes in stock market prices index:

$$SMC_t = -\left(\frac{SM_t - SM_{t-1}}{SM_{t-1}}\right)$$

Where, SMC_t refers to stock market crises, with higher values of SMC implying increase in the severity of the crisis.

- Banking Crisis

Lack of precise definition of a Banking crisis brings difficulties in implementing certain identification process. Recent studies on the banking crisis show important differences regarding crisis episodes. Lestano (2003) brings a list of most cited studies for dating the banking crises as follows:

- Caprio and Klingebiel (1996) starts from a sample of 69 countries for which information on bank insolvencies is available since the mid-1970s to 1998. Episodes of systemic banking crisis are identified as a period where a country experiences an erosion of bank capital and the estimated costs of resolving it is high. Their data is based on published sources and interview with country economists.
- Lindgren, Garcia, and Saal (1996) draws a distinction between banking crises (systemic episodes) and banking problems, defined as "significant and extensive unsoundness sort of crises" (localized crises or non-systemic episodes).
- Dermirgüç-Kunt and Detragiache (1997) defines a banking crisis as an episode of banking distress in which the ratio of non-performing assets to total bank assets exceeds 10 percent and the cost of rescue operations exceeds 2 percent of GDP. Banking crises are also frequently identified by events such as bank failures, large scale bank nationalization, deposit freezes, prolonged bank holidays and bank shutdowns or mergers. They use a sample of 65 countries from 1980 to 1995.
- Kaminsky and Reinhart (1999) marks the start of banking crises by events that points at (i) bank runs that lead to closure, mergers or takeovers by the public sector of one or more financial institutions, or (ii) a large-scale government bail-out of one or more financial institutions that is followed by more bail-outs. A banking crisis ends when government's assistance stops. Their sample has 20 countries for the period of 1970-1995.

Due to data limitation, we use NPL obtained from the IMF's Global Financial Stability Report and the Central Banks of each of the specific countries as the proxy for the banking crisis.

- Debt crises

Due to data limitation, we cannot include debt crises in our PCA analysis.

2.1 The **Principle Component Analysis**

The Principal Component Analysis is a multivariate choice method. This approach develops a composite index by defining a real valued function over the relevant variables objectively.

Given these general assumptions, the composite index is defined as,

$$C_i = W_1 x_{11} + W_2 x_{12} + W_3 x_{13} + \ldots\ldots\ldots + W_n x_{1n}$$

or

$$C_i = \Sigma W_i x_{ij} \tag{4}$$

where C_i is the composite index for the *i*-th observation, W_j is the weight assigned to the *j*-th indicator and x_{ij} is the observation value. Using components from section 2.1 (exchange market pressure index, stock market crises, and banking crises), we construct an index C_i as the proxy for financial crises.

2.2 Economic Slowdown

We define economic slowdown as the difference in growth rate between years for each country *i*. To give a more intuitive interpretation, we transform the variable to an inverse form as follows:

$$ESt = -(GDPGrowtht - DPGrowtht-1) \tag{5}$$

Where *ESt* refers to economic slowdown of country *i*, higher *ES* leads to a more severe economic slowdown. More over, we use economic slowdown as the dependent variable to describe contagion of financial crisis and its impact on economic activity of the world.

2.3 Indicators of Financial Crises

Following Lestano (2007), variables are grouped into four different indicators of financial crises. (i) External sector (ii) Financial sector (iii) Domestic real and public sector (iv) Global economy. Constrained by the availability of our data set, we limit our determinants and classified them as follows:

- External sector
  - Term of Trade
  - Current Account as % to GDP
- Financial sector
  - M2 Growth
  - Market Capitalization at $t-1$ as % to GDP
- Domestic Real and Public Sector
  - Government Fiscal Balance
  - Inflation

On the next part of this paper, from a list of indicators above together with the crises index resulted from section 2.1, we formulate equation (10) to be estimated using an OLS approach for benchmarking and a spatial lag model.

Lestano (2007) also summarizes a quite comprehensive list of literature regarding currency crisis and banking crisis. The literature is listed as follows (CC stand for Currency Crises and BC stand for Banking Crises):

Indicator	Interpretation	CC	BC	Reference(s)
External sector (current account)		+	+	
Real exchange rate	A measure for the change in international competitiveness and a proxy for over(under)valuation. Overvalued real exchange rate is expected to produce higher probability of financial crisis.			Kaminsky et al. (1998); Berg and Pattillo (1999); Kamin et al. (2001); Edison (2003); Dermirgüç-Kunt and Detragiache (2000); Eichengreen and Arteta (2000)
Export growth	An indicator for a loss of competitiveness in international good market. Declining export growth may be caused by an overvalued domestic currency and hence a proxy for currency overvaluation. On the other hand, if export growth slows due to reasons unrelated to the exchange rate, this may cause devaluation pressure. In both cases, declining export growth can be a leading indicator for a sizeable devaluation.	-	-	Kaminsky et al. (1998); Berg and Pattillo (1999); Edison (2003); Marchesi (2003)
Import growth	Weak external sector is part of currency crises. Enormous import growth could lead to worsening in the current account and have been often related with currency crises.	+		Kaminsky et al. (1998); Berg and Pattillo (1999); Edison (2003)
Terms of trade	Increases in terms of trade should strengthen a country's balance of payments position and hence lower the probability of crisis. Terms of trade deteriorations may precede currency crisis.	-	-	Kaminsky et al. (1998); Berg and Pattillo (1999); Kamin et al. (2001); Dermirgüç-Kunt and Detragiache (2000); Lanoie and Lemarbre (1996)

Indicator	Interpretation	CC	BC	Reference(s)
Ratio of the current account to tal	A rise in this ratio is generally associated with large external capi- inflows that are intermediated by the domestic financial system GDP and could facilitate asset price and credit booms. Increases in the current account surplus are expected to indicate a diminished probability to devalue and thus to lower the probability of a crisis.	-	-	Berg and Pattillo (1999); Kamin et al. (2001); Eichengreen and Arteta (2000); Lanoie and Lemarbre (1996); Marchesi (2003)
External sector (capital account)				
Ratio of M2 to foreign exchange reserves	Captures to what extent the liabilities of the banking system are backed by foreign reserves. In the event of a currency crisis, individuals may rush to convert their domestic currency deposits into foreign currency, so that this ratio captures the ability of the central bank to meet their demands.	+	+	Kaminsky et al. (1998); Berg and Pattillo (1999); Kamin et al. (2001); Edison (2003); Dermirgüç-Kunt and Detragiache (2000); Eichengreen and Arteta (2000)
Growth of foreign exchange reserves	Declining foreign reserves is a reliable indicator that a currency is under devaluation pressure. A drop in reserves is not necessarily followed by devaluation, central bank may be successful in defending a peg, spending large amounts of reserves in the process. On the other hand, most currency collapses are preceded by a period of increased efforts to defend the exchange rate, which are marked by declining foreign reserves. Total value of foreign reserves are also used as indicators of a country's financial difficulty dealing with debt repayment.	-	-	Kaminsky et al. (1998); Berg and Pattillo (1999); Edison (2003); Marchesi (2003)
Financial Sector				
M1 and M2 growth	These indicators are measures of liquidity. High growth of these indicators might indicate excess liquidity which may fuel speculative attacks on the currency thus leading to a currency crisis.	+		Kaminsky et al. (2001)

Indicator	Interpretation	CC	BC	Reference(s)
M2 money multiplier	An indicator associated with financial liberalization. Large increases in the money multiplier can be explained by draconian reductions in reserve requirements.	+		Kaminsky et al. (1998); Berg and Pattillo (1999); Edison (2003)
Ratio of domestic credit to GDP	Very high growth of domestic credit may serve as a crude indicator of the fragility of the banking system. This ratio usually rises in the early phase of the banking crisis. It may be that as the crisis unfolds, the central bank may be injecting money to the bank to improve their financial situation.	+	+	Kaminsky et al. (1998); Berg and Pattillo (1999); Edison (2003); Dermirgüç-Kunt and Detragiache (2000); Eichengreen and Arteta (2000)
Excess real M1 balance	Loose monetary policy can lead to currency crisis.	+		Kaminsky et al. (1998); Berg and Pattillo (1999); Edison (2003)
Domestic real interest rate	Real interest rate can be considered as proxy of financial liberalization, in which the liberalization process itself tends to lead to high real rates. High real interest rates signal a liquidity crunch or have been increased to fend off a speculative attack.	+	+	Kaminsky et al. (1998); Berg and Pattillo (1999); Edison (2003); Dermirgüç-Kunt and Detragiache (2003)
Lending and deposit rate spread	An increase of this indicator above some threshold level possibly reflects a deterioration in credit risk as banks are unwilling to lend or decline in loan quality.	+		Kaminsky et al. (1998); Berg and Pattillo (1999); Edison (2003)
Commercial bank deposits	Domestic bank run and capital flight occur as crisis unfolds.	-		Kaminsky et al. (1998); Berg and Pattillo (1999); Edison (2003)
Ratio of bank reserves to bank as-	Adverse macroeconomic shocks are less likely to lead to crises in countries where the banking system is liquid.		-	Dermirgüç-Kunt and Detragiache (1997)

Indicator	Interpretation	CC	BC	Reference(s)
Domestic real and public sector				
Ratio of fiscal balance to GDP	Higher deficits are expected to raise the probability of crisis, since the deficits increase the vulnerability to shocks and investor's confidence.		+	Dermirgüç-Kunt and Detragiache (2000); Eichengreen and Arteta (2000)
Ratio of public debt to GDP	Higher indebtedness is expected to raise vulnerability to a reversal in capital inflows and hence to raise the probability of a crisis.	+	+	Kamin et al., (2001); Lanoie and Lemarbre (1996); Eichengreen and Arteta (2000)
Growth of industrial production	Recessions often precede financial crises.	-		Kaminsky et al. (1998); Berg and Pattillo (1999); Edison (2003)
Changes in stock prices	Burst of asset price bubbles often precede financial crises.	-		Kaminsky et al. (1998); Berg and Pattillo (1999); Edison (2003)
Domestic real and public sector				
Inflation rate	The inflation rate is likely to be associated with high nominal interest rates and may proxy macroeconomic mismanagement which adversely affects the economy and the banking system.		+	Dermirgüç-Kunt and Detragiache (1997); Lanoie and Lemarbre (1996); Marchesi (2003)

Indicator	Interpretation	CC	BC	Reference(s)
GDP per capita	High income countries may be less likely to reschedule their debt than poorer countries since the costs of rescheduling would tend to be more onerous for more advanced economies. Deterioration of the domestic economic activity are expected to increase the likelihood of a banking crisis.		-	Dermirgüç-Kunt and Detragiache (1997); Eichengreen and Arteta (2000); Lanoie and Lemarbre (1996); Marchesi (2003)
National saving growth	High national savings may be expected to lower the probability of debt rescheduling.	-		Lanoie and Lemarbre (1996)
Global economy				
Growth of world oil prices	High oil prices are associated with recessions.	+		Edison (2003)
US interest rate	International interest rate increases are often associated with capital outflows.	+	+	Edison (2003); Kamin et al. (2001); Eichengreen and Arteta (2000)
OECD GDP growth	Higher foreign output growth should strengthen exports and thus reduce the probability of a crisis.	-	-	Edison (2003); Kamin et al. (2001); Eichengreen and Arteta (2000)

3. Data

Our analysis is based on cross-sectional data for 52 countries (due to data limitation on the world stock market, we limit our observation to the member of the World of Exchange). The data is mostly extracted from the IMF's International Financial Statistics Online and the World of Exchange. Other sources of data are from the OECD Statistics, the UN COMTRADE Database, the Latin-Focus, the African Development Bank, the Asian Development Bank, the ECONstat and each of the country specific central banks and statistical bureaus.

Figure 2 displays every country's economic slowdown against the distance to the ground zero country (in this case USA). The distances are measured using Euclidian Distance methods (explained below). The figures showed that the further it was from USA, the less likely they will suffer from severe economic slowdown. The slope, however, is not steep enough to represent strong spatial relationship between countries.

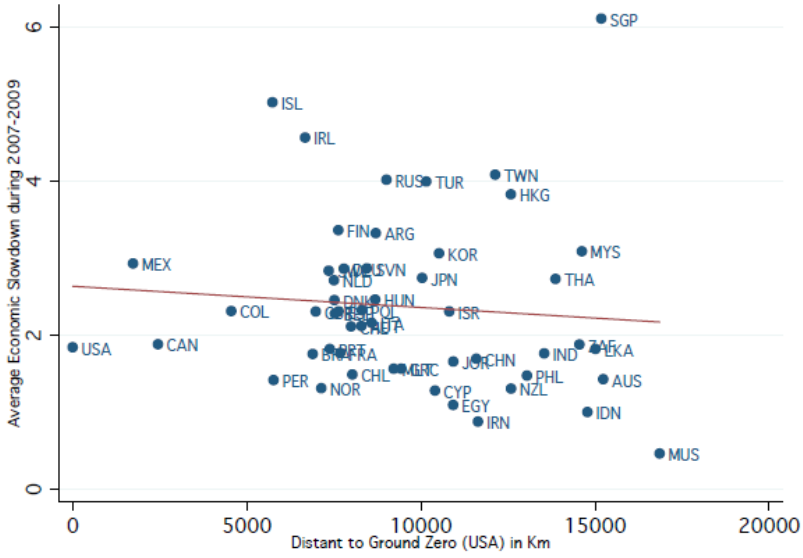
4. Econometrics Modeling

The main purpose of this paper is to identify possible contagious effect of the global financial crisis across regions. This calls for an econometric model that allow for cross-sectional interdependence. One class of the model which supports such interdependence is referred to as a spatial econometric model.

Spatial econometric methods for data with cross-sectional interdependence require an assumption about the channel of interdependence. In most applications, geographers, economists, and political scientists assume that the interdependence is generally related to geography and space and, more specifically, increases with adjacency or declines with distance (hence the term spatial econometrics), Becker, S.O., et al. (2009).

The first spatial weight matrix that we use (W^1) is based on kilometer-converted Euclidean Distance (d_{ij}) between districts (i and j) on the sphere:

Figure 2. Distant to Ground Zero (USA)



$$d_{ij} = \arccos[(\sin\phi i \sin\phi j) + (\cos\phi i \cos\phi j \cos|\delta\gamma|)] \quad (6)$$

Where ϕ_i dan ϕ_j are the centroid's latitude of district *i* and *j*, respectively, and $|\delta\gamma|$ denotes the absolute value of the difference in longitude between *i* and *j*. Converting it to continuous distance-decay function, the distance is substituted into the form:

$$w^1_{ij} = (d_{ij})^{-1} \quad (7)$$

In the second matrix (*W*2), we also takes the countries' economic institution into account:

$$w^2_{ij} = e^{-|r\,fi - r\,fj|}(d_{ij})^{-1} \quad (8)$$

For this purpose, we use the economic freedom index to define similarity between countries' economic institution. In this index, free countries tend to cluster among similar country.

In the third matrix (*W*3), as a benchmark to the second one, we use the globalization index from the KOF Swiss Economic Institute.

$$w^3_{ij} = e^{-|rgi - rgj|}(d_{ij})^{-1} \quad (9)$$

In the context of this paper, the inclusion of spatial lag implies that the level of the crisis in some country *i*'s disturbance term in the econometric model is an adjacency (i.e. common land border-related) or inverse-distance-related function of the other economies disturbance.

Formally, the model may be written as :

$$ESi = \alpha + \lambda W + \alpha CI + \mathbf{X}\beta + \mu;$$

$$\mu = \rho W\mu + \upsilon \quad (10)$$

Where ES_t is the economic slowdown, *W* is spatial weight matrix, *CI* is crises index resulted from PCA explained in the previous part of this paper, ***X*** is a vector consisting factors that determine economic slowdown, and ρ is the spatial lag coefficient of our model.

4.1 Estimation Result

This section reports our findings for spatial contagion of financial crises. The first table shows the result of the OLS

Table 1. OLS Estimation of Economic Slowdown

Determinants	2007		2008		2009	
Crises Index$_{t-1}$	-0.0015	**	0.0034	**	0.0116	
External Sector :						
Term of Trade	-0.0165		0.6677		0.1231	
Current Account (% to GDP)	-0.0296		0.0351		0.1703	***
Financial Sector:						
M2 Growth	-0.0233		-0.0478		0.0831	*
Market Capitalization$_{t-1}$	0.1132		-0.0218		0.2776	
Domestic Real and Public Sector						
Government Fiscal Balance	0.0296		-0.0836		-0.1127	
Inflation	0.0566		-0.0807		0.0543	
Constant	0.0477		2.4826	**	2.3935	*
R^2	0.1688		0.2338		0.3823	

***, **, and *: Significant at 1%, 5%, and 10%

Table 2 Spatial Lag Model using W[1]

Determinants	2007		2008		2009	
Crises Index$_{t-1}$	-0.0015	**	0.0036	**	0.1220	*
External Sector :						
Term of Trade	-0.0069		0.6826		0.2539	
Current Account (% to GDP)	-0.0239		0.0426		0.1777	***
Financial Sector:						
M2 Growth	-0.0233		-0.0467		0.0773	**
Market Capitalization	0.1163		-0.0079		0.2890	*
Domestic Real and Public Sector						
Government Fiscal Balance	0.0291		-0.0904		-0.1091	**
Inflation	0.0572		-0.0865	*	0.0534	
Constant	0.0239				6.8357	**
ρ	0.0856		-0.5673		-0.9093	
(Pseudo) R^2	0.170		0.255		0.425	
Log Likelihood	-70.182		-97.271		-101.029	
LM_ρ	0.024		0.498		1.178	
LM_ρ^r	0.022		1.315		0.123	

***, **, and *: Significant at 1%, 5%, and 10%

estimator of the model without the spatially lagged dependent variable of a spatially autocorrelated error term. This OLS model is used as a benchmark. Table 2, Table 3, and Table 4 represent the estimation results for W^1, W^2, and W^3, respectively. From the result in Table 1, we can see that the coefficient of the crisis reach it's peak at 2009, but yet lack of robustness both in consistency and statistical significance of the coefficient.

In Table 2, Table 3, and Table 4 at least one proxy in each sector plays a significant role in determining the economic slowdown. Proportion of Current Account to GDP, M2 Growth, and Government fiscal balance turns out to be robust variables in explaining economic slowdown in every weight matrix scenario. Yet, the main purpose to observe spatial contagion could not be satisfied. The estimations are unable to deliver robust ρs as the coefficient of spatial autocorrelation and LM^r_ρ in every weight matrix scenario.

Table 3 Spatial Lag Model using W[2]

Determinants	2007		2008		2009	
Crises Index$_{t-1}$	-0.0016	**	0.0034	**	0.0115	
External Sector :						
Term of Trade	-0.0420		0.5668		0.1327	
Current Account (% to GDP)	-0.0276		0.0382		0.1704	***
Financial Sector:						
M2 Growth	-0.0230		-0.4477		0.0833	**
Market Capitalization	0.1082		-0.0300		0.2737	*
Domestic Real and Public Sector						
Government Fiscal Balance	0.0267		-0.0796		-0.1156	*
Inflation	0.0590		-0.761		0.0547	
Constant	0.0689		2.8572	**	2.5092	*
ρ	-0.109		-0.109		-0.023	
(Pseudo) R^2	0.188		0.242		0.383	
Log Likelihood	-69.6065		-97.446		-102.114	
LM_ρ	1.640		0.291		0.205	
LM_ρ^r	0.258		0.028		0.483	

***, **, and *: Significant at 1%, 5%, and 10%

Table 4 Spatial Lag Model using W^3

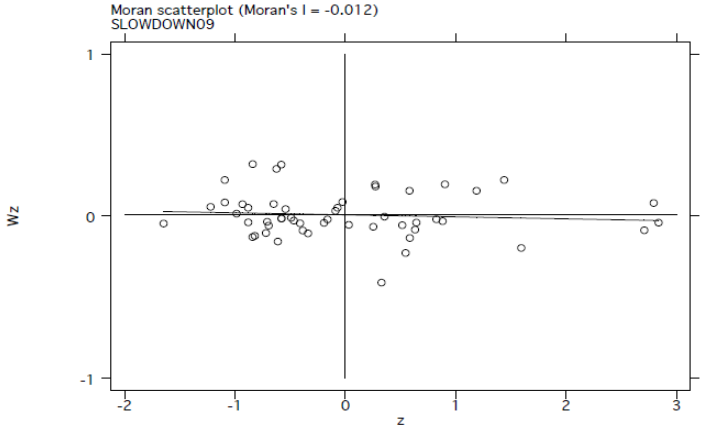
Determinants	2007		2008		2009	
Crises Index$_{t-1}$	-0.0016	**	0.0035	**	0.0102	
External Sector :						
Term of Trade	-0.0786		0.7525		-0.0529	
Current Account (% to GDP)	-0.0251		0.0279		0.1849	***
Financial Sector:						
M2 Growth	0.0196		-0.0555	**	0.0886	**
Market Capitalization	0.1053		-0.0145		0.2635	*
Domestic Real and Public Sector						
Government Fiscal Balance	0.0275		-0.0780		-0.1160	**
Inflation	0.0599		-0.0895	*	0.0647	
Constant	0.0315		3.1202	***	2.9854	**
ρ						
(Pseudo) R^2	0.195		0.260		0.390	
Log Likelihood	-69.397		-96.901		-101.865	
LM_ρ	2.597		0.573		0.544	
LM_ρ^r	2.109		0.800		0.094	

***, **, and *: Significant at 1%, 5%, and 10%

4.2 Local Indicators of Spatial Autocorrelation

Beside the global spatial model, we also want to test the spatial heterogeneity. Using local Moran's I_i and local Geary's c_i (i = 1, ..., n), in order to identify country's specific contribution to the overall pattern of spatial dependence. Figure 3 graphs these statistics in a four quadrant scatter plot, each quadrant represent the nature of each country's local spatial autocorrelation. In the four quadrant graphic, quadrant I represents countries with high local spatial autocorrelation and they have surrounded also with other countries that have high local spatial autocorrelation, quadrant II represents countries with a high local spatial autocorrelation gather with countries with low local spatial autocorrelation, quadrant III represents the cluster of countries with low local spatial, and quadrant IV consists of countries with low spatial autocorrelation gathered with countries having high local spatial autocorrelation. In Figure 3, we observe that the number of countries with highly positive spatial autocorrelation is substantially low.

Figure 2 Moran's Scatterplot of Economic Slowdown



5. Conclusion

As a preliminary point, this paper wants to show the existence of spatial dependence in the recent economic crisis. Constrained by the quantity and quality of the data, the robustness of estimations in this paper still left to be questioned. Further research with better data retrievement would be an advantage on this field of research regarding regional aspect of financial crises.

Nevertheless, this paper found that certain variable were robust in explaining the factors that determine the financial crises i.e. Government Fiscal Balance as a fiscal tools of governance around the world. Governments Deficits has negative relationship with the severity of crises in this case is economic slow down, this recalls for government intervention to ease the severity of the crises. Local/domestic and financial factors such as CPI (Inflation), Domestic Market Capitalization also have a strong influence toward economic slowdown. Market Capitalization tends to increase the severity of the economic slowdown when crises hit specific countries.

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Appendix 1. Data Source

Variable	Source
Crises Index	
- Stock Market Index	World of Exchange
- Non Performing Loan	Global Financial Stability Report 2008, IMF
- Exchange Market Pressure Index	
* Interest Rate	Country's Specific Central Bank, Latin Info, International Financial Statistics
* Exchange Rate	Country's Specific Central Bank, Latin Info, International Financial Statistics
Term of Trade	Calculated from UNCOMTRADE Data
Current Account (% to GDP)	International Financial Statistic, Asian Development Bank, OECD Database
M2 Growth	Dollar Haze, International Financial Statistic, Country's Specific Central Bank
Market Capitalization	World of Exchange
Domestic Real and Public Sector	International Financial Statistic, Asian Development Bank, OECD Database
Government Fiscal Balance	International Financial Statistic, Asian Development Bank, OECD Database
InSSation	International Financial Statistic
Economic Freedom Index	The Heritage Foundation & Wall Street Journal
Globalization Index	KOF Swiss Economic Institute