10th MALAYSIA STATISTICS CONFERENCE 2023
Looking Beyond GDP: Toward Social Well-being and Environmental Sustainability

26th September 2023
Sasana Kijang, Bank Negara Malaysia

Using Geospatial Data for Sustainability Analysis

Unemployment rate in Selected Asian Countries: A Spatial Panel Data Analysis

Lim Bao Man[1]; Nuzlinda Abdul Rahman[2]; Zainudin Arsad[3]

[1] School of Mathematical Sciences, Universiti Sains Malaysia, 11800 USM, Pulau Pinang, Malaysia. *limbaoman94@gmail.com*
[2] School of Mathematical Sciences, Universiti Sains Malaysia, 11800 USM, Pulau Pinang, Malaysia. *nuzlinda@usm.my*
[3] School of Mathematical Sciences, Universiti Sains Malaysia, 11800 USM, Pulau Pinang, Malaysia. *zainudin.arsad@usm.my*

Abstract:
This empirical study analyses the governance quality and degree of economic freedom for the overall unemployment rate of selected Asian countries by employing static spatial panel data analysis. The data sets utilised in this analysis contain statistics on a total of 38 Asian countries the yearly overall unemployment rate of selected Asian nations from 2002 to 2018, gathered from a variety of sources, including the World Bank, the Governance Index, and the Heritage Index. There is strong evidence that there is a spatial dependence on the unemployment rate of Asian countries. Spatial dependence is a case where results in a given country seem to depend on results or other factors from another country. The results suggest that the Spatial Durbin Model Fixed Effect Model (SDM-FEM) for both effects (time and individuals) is the most appropriate for modelling regional unemployment in selected Asian countries. The case studies show that unemployment rate related initiatives should be linked to Economic freedom and Governance quality of a nation. This indicates that, for effective implementation, the importance of knowing the social circumstances of the labour market and the labour force organisation should be emphasised.
.

Keywords:
Unemployment rate; Spatial Panel Data; Economic Freedom; Governance Quality

1. Introduction:
The unemployment rate is always a concern in the economy in Asian countries. The main objective of this research is to study the relationship between the economic freedom index (EFI) and governance quality regarding the overall unemployment rate in Asian countries. It is essential to know and understand the patterns and changes of the unemployment rate in selected Asia countries. For instance, Matuzeviciute et al. (2017); Ozcelebi & Ozkan, (2017); Bayrak & Tatli, (2018); Doğan & Erdoğan, (2016); Bein & Ciftcioglu, (2017); Soylu et al., (2018); Mucuk & Demirsel, (2013) and etc. studied different factors or determinants of the labour force that affect the unemployment rate for

Asian countries. Societies in Asian have experienced dramatic and rapid changes in their economic, social and political spheres in the past few decades. Given the wide diversity, it is understandable that the manifestation, extent and impact of these charges vary from country to country (Bendini, 2015).

Cebula et al. (2014) investigated the concept that he greater a country's degree of economic freedom, the lower its unemployment rate, ceteris paribus. The framework under discussion is a dataset for member nations of the Organization for Economic Cooperation and Development (O.E.C.D.) (except Iceland) from 2003 to 2007, right before the Great Recession. The model in this exploratory study, which includes a tax burden measure, a long-term interest rate, a measure of political stability, and a measure of overall economic freedom, produces estimates indicating that the unemployment rate decreases as the overall average level of economic freedom increases. The governance quality played an important role in economic development and productivity (Kaufmann & Kraay, 2002; Makdisi et al., 2001). Many research has focused on the relationship between the Governance Quality Index and unemployment rates in recent years.

This research can help predict how Asian labour markets will change in the future. Because of the clear influence of past research on the unemployment rate, geographic panel data analytic methods will be employed in this study to evaluate the link between economic freedom, governance quality, and the overall unemployment rate for a subset of Asian nations. The study's findings will be useful in formulating workforce policies and tackling labor-market difficulties for policymakers, employers, and market players. Policymakers are responsible for developing policies, projects, and programmes.

2. Methodology:

This research studies and analyses numerous elements of Asian nations' unemployment rates and labour market performance. The data sets utilised in this analysis contain statistics on the yearly overall unemployment rate of selected Asian nations from 2002 to 2018, gathered from a variety of sources, including the World Bank, the Governance Index, and the Heritage Index. The data which is carried out annually provides statistics of unemployment rate, economic freedoms index, economic indicators and labour market determinants. A spatial autocorrelation function can be viewed as a spatial clustering function. The Moran’s I test for spatial dependence is a well-known and straightforward test (Moran, 1948, Cliff and Ord, 1973, 1981, Anselin, 1988). Moran's Indexes, both global and local, are widely used in geographical research to find global and local interdependence for a collection of spatial data. Moran (1948) developed the Moran’s I test, which Cliff and Ord (1972) proposed as a statistical test for the null hypothesis of regression residual non-correlation. Usually, spatial autocorrelation is compulsory need to be conducted before starting with the spatial panel analysis which intended to give an important theoretical for spatial econometric.

The Spatial Durbin Model (SDM) was then examined in order to provide evidence of its suitability. The SDM includes both the dependent and explanatory factors for the dependent variable spatial lags. In spatial specific effects, random or fixed effects might be observed. The Hausman's specification test was used to examine the Random Effects Model (REM) and the Fixed Effect Model (FEM) (Baltagi 2005). Akaike Information Criterion (AIC) is used to analyse the model fit and complexity in a comprehensive way.

Usually, SDM is recommended as the starting point for spatial panel modelling for statistical and theoretical reasons.

3. Result:

In Table 1, Spatial Lag Autocorrelation Test shows all hypotheses with p-values less than 0.0001 for LM (robust) of overall unemployment rate. Because the p-value is less than the significance level, the null hypotheses of the LM (robust) test are rejected. We can deduce that SDM has been chosen. While, Table 2 shows the Spatial Durbin Model (SDM) of Fixed Effect and Random Effect for Overall Unemployment rate.

Table 1: Spatial Lag Autocorrelation Test, $H_0 : \theta = 0$

Unemployment rate	Spatial Lag	Statistic	p-value
	Moran's I	1391.706	0.000
	LM Lag (Robust)	226.829	0.000

Table 2: Spatial Durbin Model (SDM) of Fixed Effect and Random Effect for Overall Unemployment rate

VARIABLES	SDM FEM	SDM FEM Wx	SDM REM	SDM REM Wx
PR	-0.0436	0.0784	-0.0676	0.0223
	(0.0576)	(0.0894)	(0.0562)	(0.0720)
GI	0.0135	0.335***	-0.0183	0.172*
	(0.0524)	(0.0967)	(0.0527)	(0.0941)
TB	-0.303	-1.012***	-0.153	-1.016***
	(0.198)	(0.355)	(0.167)	(0.271)
GS	-0.306***	0.161	-0.247***	0.223
	(0.0896)	(0.160)	(0.0884)	(0.146)
BF	-0.00385	0.00417	-0.000111	0.0477
	(0.0511)	(0.0650)	(0.0526)	(0.0644)
LF	-0.180***	0.0258	-0.114*	0.0626
	(0.0666)	(0.0997)	(0.0679)	(0.100)
MF	-0.0874	0.466*	0.0997	0.517**
	(0.141)	(0.246)	(0.134)	(0.214)
TF	-0.00922	0.218**	-0.00200	0.0758
	(0.0435)	(0.110)	(0.0438)	(0.106)
IF	-0.0176	-0.0517	-0.0163	-0.0746
	(0.0384)	(0.0598)	(0.0391)	(0.0593)
FF	0.0105	0.0124	0.0112	0.0340
	(0.0218)	(0.0365)	(0.0224)	(0.0356)
PS	-0.320***	0.347**	-0.320***	0.316**
	(0.0605)	(0.144)	(0.0623)	(0.141)
GE	-0.0752	-0.0124	-0.0929	-0.0253
	(0.0574)	(0.0713)	(0.0600)	(0.0745)
RQ	-0.00899	-0.427***	-0.0174	-0.425***
	(0.0834)	(0.135)	(0.0864)	(0.136)
RL	-0.000632	-0.0338	0.0352	-0.0374
	(0.0607)	(0.0941)	(0.0620)	(0.0950)
CC	0.333***	-0.0316	0.353***	0.0287
	(0.0791)	(0.131)	(0.0796)	(0.125)

VA	0.101	0.0186	0.0701	0.00464
	(0.0672)	(0.0885)	(0.0692)	(0.0908)
rho		0.117*		0.198***
		(0.0632)		(0.0578)
sigma2_e		0.0672***		0.0746***
		(0.00375)		(0.00431)
lgt_theta				-2.555***
				(0.140)
Constant			3.314***	
			(0.836)	
R-squared	0.000	0.000	0.001	0.001

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

One classical issue that often discussed in SDM FEM and SDM REM when both effects can be estimated. This issue can be addressed by using the Hausman Test, the results of which indicated the null hypothesis, SDM REM is more appropriate than SDM FEM. Hausman test for SDM REM and SDM FEM. It shows that the null hypothesis for Overall unemployment rate is firmly rejected since the p-value is less than 0.01. We can conclude that SDM FEM for Overall is more appropriate for analysis the data.

Table 3: Hausman test for SDM FEM and REM

Unemployment rate	Chi-square	P-value
Overall	500.82	0.0000

The SDM Fixed effects is classified into three as follows: (1) for time fixed effect with time, (2) for individual (Spatial) fixed effects, (3) for time and individual fixed effect (both). To ensure the best appropriate model, the smallest AIC value will be chosen which is shown in Table 4.

Table 4: AIC Test for SDM Fixed effect

Unemployment rate	AIC for SDM FEM Time effect	AIC for SDM FEM Spatial effect	AIC for SDM FEM Both effect
Overall	185.8119	1390.455	159.2425

Based on the results of AIC, SEM for both effect (time and individuals) of Overall unemployment rate produced the lowest value which give an indication that this model is the best suited model to describe the overall unemployment rate in selected Asian countries that has been considered in this study.

4. Discussion and Conclusion:

This study illustrates the relationship between the Economic Freedom and Governance quality with overall unemployment rate in Asian countries. Spatial panel data is used in regional and inter-regional studies to provide researchers with more options in their decision-making processes and aid in the incorporation of spatial autocorrelations among observations into models. All the test results indicate that SDM FEM for both effect (time and individuals) of overall unemployment rate are the most appropriate models to described the overall unemployment rate in Asian countries. The presence of spatial contiguity has been statistically demonstrated in this section using the spatial weight matrix. Global Moran's I provided positive spatial autocorrelation and produced significant spatial dependencies between the overall unemployment rate of various

Asian countries and explained geographical proximity and economic linkages in unemployment rate among the Asian countries. Furthermore, by referring the results of SDM FEM in Table 2, the factors influence the overall unemployment rate for each country has the spatial effect. The Spatial Durbin Model (SDM) of Fixed Effect for overall unemployment rate shows that the explanatory variables for intra-country unemployment such as Government Spending, Labour Freedom, Political Stability No Violence, and Control of Corruption are statistically significant. Meanwhile, Wx_Government Integrity, Wx_Tax Burden, Wx_Monetary Freedom, Wx_Trade Freedom, Wx_Political Stability No Violence, and Wx_Regulatory Quality are the explanatory variables for inter-countries of unemployment rate that affect the overall unemployment rate of selected Asian countries.

One of the empirical finding conducted by Tran (2019) shows that higher trade freedom reduces economic growth in ASEAN countries. By theoretical, the lowers the economic growth will lead to higher unemployment rate. One of the argument for this is due to domestic businesses have inadequate management, technology, and money. They are impediments to competing with international rivals. In a highly competitive market, the performance of both foreign rivals and domestic companies might be negatively impacted, resulting in poorer economic growth. According to the International Labour Organization World Employment and Social Outlook Trends 2020, economic and political factors in the short and long run have a significant impact on labour markets. Due to the extreme high level of uncertainty on about how trade and geopolitical conflicts will influence company and consumer confidence, and hence job creation, it is impossible to anticipate how various metrics of labour underutilization will change in future (Regional Economic and Social Analysis Unit, 2018).

Theoretically, a lower unemployment rate in each country will result from improved governance, stable economic conditions, good management on government spending, and other factors. Maintaining the integration of democracy in a nation depends heavily on political stability. It is a requirement for a country's legal system, social stability, economic growth, and low unemployment rate. In short, the political stability of the specific political systems should be taken into consideration when international organisations try to convince governments to reform their labour market institutions.

This model is easily adaptable to additional states or nations. The best way to further this study would be to examine international policies. These findings are only preliminary. More study is clearly required, including the use of alternative data, extra years and variables, alternative specifications, and, eventually, data for the selected Asian countries. As a result, while these findings appear to point to a link between unemployment rates and various forms of economic freedom and governance quality, this link requires further examination and formal inquiry.

References:

1. Baltagi, B. H. (2005). Econometric analysis of panel data. John Wiley& Sons., 3 edition.
2. Bayrak, R., & Tatli, H. (2018). The determinants of youth unemployment: A panel data analysis of OECD countries. European Journal of Comparative Economics 15(2), 231–248. Available from World Wide Web: https://doi.org/10.25428/1824-2979/201802-231-248
3. Bein, M. A., & Ciftcioglu, S. (2017). The relationship between the relative GDP

share of agriculture and the unemployment rate in selected. Journal of Agriculture Economic 63(7), 308–317. Available from World Wide Web: https://doi.org/10.17221/372/2015-AGRICECON

4. Bendini, R. (2015). Exceptional Measures: The Shanghai Stock Market Crash and the Future Of The Chinese Economy. In Directorate-General for Externalpolicies Policy Department In-Depth. Available from World Wide Web: http://www.europarl.europa.eu/RegData/etudes/IDAN/2015/549067/EXPO_IDA(2015)549067_EN.pdf
5. Cebula, R. J., Foley, M., & Capener, D. (2014). the Impact of Economic Freedom on the Unemployment Rate in O.E.C.D. Nations: an Exploratory Study Accepting the Validity of Okun'S Law. Economia Internazionale / International Economics 68(4), 423–436. Available from World Wide Web: https://www.researchgate.net/publication/289672223
6. Cliff, A. D. & Ord, J. K. (1972). Testing for spatial autocorrelation among regression resiuals. Geographical analysis 4(3): 267-284.
7. Cliff, A. D., & Ord, J. K. (1981). Spatial Processes, Models and Applications. London: Pion.
8. Cliff, A. D., and Ord, J. K. (1973). Spatial Autocorrelation. London: Pion.
9. Doğan, C., & Erdoğan, S. (2016). An Empirical Analyses of Unemployment Hysteresis and Natural Rate of Unemployment Approaches for MENA Countries. Optimum Journal of Economics and Management Sciences 3(2), 41–50.
10. Kaufmann, D., & Kraay, A. (2002). Growth without Governance. Policy Research Working Paper 2928, **3**(1), 169–229. Available from World Wide Web: https://doi.org/10.1353/eco.2002.0016
11. Makdisi, Samir & Limam, I. (2003). Chapter 2 Determinants of Growth in the MENA Countries. Contributions to Economic Analysis. 278. Available from World Wide Web: https://doi.org/10.1016/S0573-8555(06)78002-6.
12. Matuzeviciute, K., Butkus, M., & Karaliute, A. (2017). Do technological innovations affect unemployment? Some empirical evidence from European countries. Journal of Economies MDPI 5(4), 1–19. Available from World Wide Web: https://doi.org/10.3390/economies5040048
13. Moran, P. A. (1948). The interpretation of statistical maps. Journal of the Royal Statistical Society. Series B (Methodological)10(2):243-251.
14. Mucuk, M., & Demirsel, M. T. (2013). The Effect of Foreign Direct Investments on Unemployment. Journal of Business, Economics & Finance, 2(3), 53–66.
15. Ozcelebi, O., & Ozkan, S. (2017). Economic factors influencing the dynamics of unemployment in the G10 countries: empirical evidence from panel data modeling. Journal of Business, Economics and Finance (JBEF), 6(1), 17–30. Available from World Wide Web: https://doi.org/10.17261/pressacademia.2017.382
16. Regional Economic and Social Analysis Unit. (2018). Asia-Pacific Employment and Social Outlook 2018. In The Financial Daily. International Labour Office enjoy. Available from World Wide Web: https://www.ilo.org/wcmsp5/groups/public/---asia/---ro-bangkok/---sro-bangkok/documents/publication/wcms_649885.pdf
16. Soylu, Ö. B., Çakmak, İ., & Okur, F. (2018). Economic growth and unemployment issue: Panel data analysis in Eastern European Countries. Journal of International Studies 11(1), 93–107. Available from World Wide Web: https://doi.org/10.14254/2071-8330.2018/11-1/7

17. Tran, D. V. (2019). A study on the impact of economic freedom on economic growth in ASEAN countries. *BEH - Business and Economic Horizons* 15(3), 423–449.

NOTE: THE REQUIRED NUMBER OF PAGES FOR PAPER IS SIX PAGES