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Trade Openness and Unemployment: A Panel Cointegration for the G20 Countries

Zahrah¹, Wira Hendri², Widia Febriana³

^{1,2}Departement of Management, Faculty of Economics and Business, Universitas Bumigora

²Department of Digital Business, Faculty of Economics and Business, Universitas Bumigora

¹zahrah@universitasbumigora.ac.id*, ²wire.hendri@universitasbumigora.ac.id,

³widia@universitasbumigora.ac.id

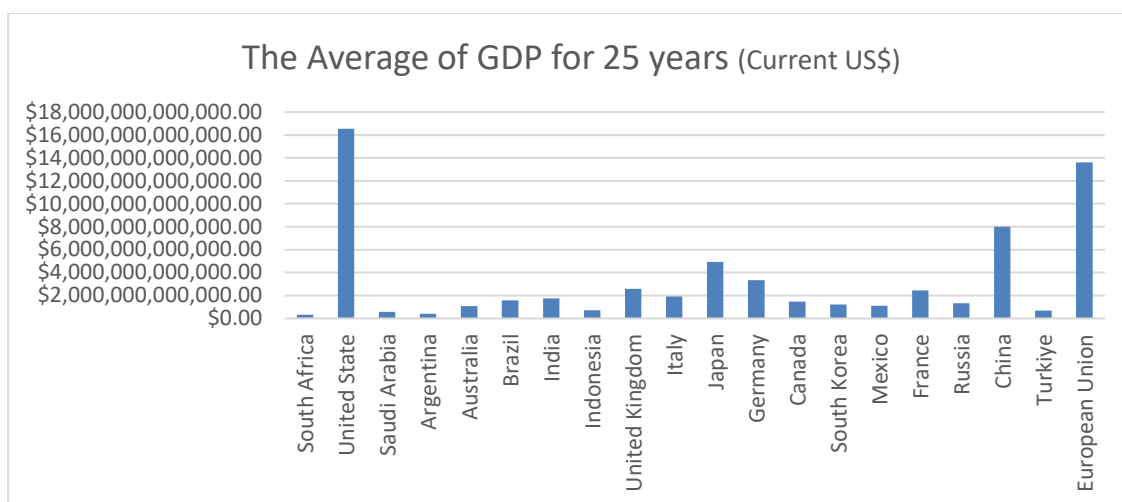
Abstract

In 1999, G20 was formed to provide a new mechanism for extending the key economic and financial policy issue and promote co-operation for gaining stable and sustainable world economic growth. The world trading system creates a new founded trade and investment working group which impact on the high productions due to the trade openness through the high job opportunities. However, there is different effects founded between trade openness and unemployment among G20 countries. A notable research gap in this study is the absence of congruence between the results of previous studies and the phenomena observed in the field, particularly in the context of a more extensive population sample, specifically the G20 countries. It urges a further examination trade openness and unemployment in order to gain a comprehensive understanding of the current state of affairs. It used the data spanning over 25 years (1999 – 2023) in G20 Countries for unemployment, trade openness, GDP, Government Expenditure in Education, Trade and Investment Freedom. The analysis of model used Panel Unit Root Test, Panel Cointegration Test as well as FMOLS and DOLS estimator. The result shows that all variables are cointegrated for the entire G20 countries in long-run relationship. However, the GDP has significant and negative effect on unemployment rate but GEE has positive relationship even it has significant effect towards unemployment rate. While trade and investment freedom have negative and insignificant effect on unemployment rate, whereas the trade openness has a positive nexus with unemployment rate. It suggests that G20 countries should prioritize increasing GDP and strengthening freedom of trade and investment to encourage a decrease in unemployment, as well as adjustments to the skill requirements of workers in order to align with the demands of the industry.

Keywords: Trade Openness, Unemployment, G20 Countries, Panel Cointegration

1. Introduction

In 1999, G20 was formed to provide a new mechanism for informal dialogue in the framework of the Bretton Woods institutional system, to extend the key economic and financial policy issue and promote co-operation for gaining stable and sustainable world economic growth that can be impacted beneficially for the members of G20 [1]. Since in 1999, The Asian Financial crisis was an initial reason the G20 formed where the financial crisis management can be an option to solve where there were the leaders of the G20's member countries provide quick and strong answer to the global financial crisis [2]. The political leaders respond with the novel imagination idea to seen a reassuring message to the financial markets and public opinions [3]. Canada and The United State became promoters the G20 which aimed to transform the G22 to G33 into a body which more capable for the European Countries [2]. The existence of G20 countries was able to significantly influence the global where around 54% of the land mess worldwide occupied by the G20 countries and 64% of the world's total population [4].



data processed by the author taken from world data (1999 – 2023)

Figure 1. The Average of GDP for 25 yaers (Current US\$)

The 20 countries that has been a member of G20 are the largest economic level consist of 19 countries and 1 European Union institution. G20 countries enable to generate 86% of worldwide GDP [4]. In average for 25 years (1999 – 2023), the GDP of G20 countries gained \$3.278 billion. In Figure 1, it shows that the highest average of GDP in G20 is United State as much as \$16.558 billion for 25 years, followed by the European Union as much as \$13.602 billion, however the lowest average of GDP was taken by Argentina which is \$405 billion, followed by Saudi Arabia as much as \$570 billion. in Table 1 shows that United State are the top countries of G20 that enables to gain \$17.729 billion in changes of the average of GDP in 1999 and 2023 (or increasing as much as 94 percent) while Japan is the lowest countries which reached -\$423 billion (or decreasing as much as -10 percent). It seems there is the possible influence of trade openness among G20 Countries.

Table 1. The Average of GDP of G20 Countries in 1999 - 2023

No	Countries	GDP in 1999	GDP in 2023	Δ GDP	ΔGDP %
1	South Africa	\$151,516,957,078.54	\$377,781,600,985.87	\$226,264,643,907.34	60%
2	United State	\$9,631,172,000,000.00	\$27,360,935,000,000.00	\$17,729,763,000,000.00	65%
3	Saudi Arabia	\$161,717,066,666.67	\$1,067,582,933,333.33	\$905,865,866,666.67	85%
4	Argentina	\$283,523,000,000.00	\$640,591,410,663.88	\$357,068,410,663.88	56%
5	Australia	\$389,652,212,056.65	\$1,723,827,215,334.71	\$1,334,175,003,278.06	77%
6	Brazil	\$599,642,024,319.53	\$2,173,665,655,937.27	\$1,574,023,631,617.74	72%
7	India	\$458,821,052,615.79	\$3,549,918,918,777.53	\$3,091,097,866,161.74	87%
8	Indonesia	\$140,001,351,215.46	\$1,371,171,152,331.16	\$1,231,169,801,115.69	90%
9	United Kingdom	\$1,687,830,448,147.55	\$3,340,032,380,668.04	\$1,652,201,932,520.49	49%
10	Italy	\$1,252,446,659,833.79	\$2,254,851,212,731.80	\$1,002,404,552,898.02	44%
11	Japan	\$4,635,982,224,063.88	\$4,212,945,159,781.40	-\$423,037,064,282.48	-10%
12	Germany	\$2,194,945,278,872.59	\$4,456,081,016,705.96	\$2,261,135,737,833.37	51%
13	Canada	\$678,412,196,271.12	\$2,140,085,567,791.45	\$1,461,673,371,520.33	68%
14	South Korea	\$497,514,040,642.26	\$1,712,792,854,202.37	\$1,215,278,813,560.11	71%
15	Mexico	\$631,249,359,702.39	\$1,788,886,821,046.81	\$1,157,637,461,344.42	65%
16	France	\$1,493,151,737,698.46	\$3,030,904,089,607.90	\$1,537,752,351,909.44	51%
17	Russia	\$195,907,128,350.93	\$2,021,421,476,035.42	\$1,825,514,347,684.48	90%

18	China	\$1,094,003,874,937.34	\$17,794,781,986,104.50	\$16,700,778,111,167.10	94%
19	Turkiye	\$256,395,932,738.44	\$1,108,022,373,259.51	\$851,626,440,521.08	77%
20	European Union	\$7,925,844,560,641.68	\$18,349,388,450,765.60	\$10,423,543,890,123.90	57%

data processed by the author taken from world data (1999 – 2023)

The world trading system could be reformed initially by the G20 in order to create a new founded trade and investment working group [5]. Its commitment is not to erect new trade and investment barriers. For 25 years after G20 reform, the average of trade openness among G20 countries as much as 60.216% where the largest average of trade openness occur is in European Union (82.379%), followed by South Korea as much as 79.257% and 78.546% in Germany. In contrast, the lowest average of trade openness for 25 years is in United as much as 26.499%, followed by Brazil and Japan (27.291% and 29.494%). Increasing in trade openness means that the country has a strong good and services in their countries where they could produce more than they need in their country itself where the import can be minimized. In European Union has machinery and transport equipment as the comparative advantages which exported to the United State, accounting for 41.4% (€208 billion) of all EU goods [6]. While South Korea has semiconductor recorded \$683.8 billion in 2024 to China [7] and Germany has automotive sector as the largest contributor of German's International trade [8]. Also, their countries have created regulation that support their countries to decline their import which are common commercial policy among European Counties and providing incentive such as subsidies, low interest loans and tariff exemptions in South Korea, and provides export credit insurance in Germany. While the lowest average of trade openness in United Stated, Brazil, and Japan has regulation to decline their trade to other countries. Furthermore, investment has significant role in trade openness. It is in line with the increase of the quality chain enhancing growth where the productive capacity up since the quality of infrastructure in productivity policy perspective increase [9]. Onifade et al., (2020) emphasizes on stimulating domestic investment through providing infrastructure and financial facilities which promote the ease of business and not exacerbate the unemployment crisis. Investment on infrastructure increases the extensive margin of exports through export promoting initiative for building productive capacity.

The high productions due to the trade openness urges to be gained through the high job opportunities. It absolutely will decrease the unemployment in any countries. As we can see in figure 1, the average of unemployment that has the highest average trade openness is reached by European Union (82.379%) however the average of unemployment rate on that union is the 6th highest unemployment rate on average (8.828%). In contrast, south korea that reach the second of highest trade openness (79.257%) is on the top of the lowest unemployment rate on average (3.457%), Germany is on the 10th highest unemployment rate on average (6.398%). Looking at the countries that has the lowest trade openness reached by United Stade (26.499%) is on the 9th lowest unemployment rate on average (5.702%), Japan is on the 3th lowest unemployment rate on average (3.921%) however it is inverted on Brazil which is on the 4th highest average unemployment rate (9.611%). Related to the GDP of United State (\$14.557 billion), we can see that it correlates with the highest level of average trade openness for 25 years in G20 group and the other correlation between the highest average unemployment rate gained by South Africa has the lowest GDP for 25 years on average (\$322 billion). This shows that there are differences between countries regarding the relationship between trade openness and unemployment and its relationship with economic growth that occurs in the G20 countries. Whether it is true that the purpose of forming the G20 is the answer to overcoming unemployment through the opening of trade between G20 countries or not over the past 25 years.

The nexus between trade openness and unemployment becomes vital to be explored more since the changes of many aspects particularly in the face of global economics changes of post-pandemic which occur in all the countries of G20. The transient supply factors and condition of labor market were affected by the long-run price stability [11]. At the same time, the shock in economics happened when suspending the export temporarily and reaching the high unemployment due to the mess layoffs [12]. This necessitates a more thorough examination of the long-term relationship between open trade and unemployment, despite the numerous significant economic shocks that have impacted the global economy.

A more detailed analysis of the extant literature reveals several studies conducted by previous researchers. A different effect trade openness in advanced and developing countries is not undebatable which influence unemployment indirectly. The dependent of the income level of each country effects on the relationship between trade liberalization and unemployment [13]. In advanced economies, trade openness influences the inequality and income concentration since they have capital and skilled labor are relatively abundant [17]. Many labor that has

unskilled might be left and influence another unemployment compared to the skilled labor, bargaining power of less-skilled workers and the wages are declined. However, in developing countries, unskilled labors tend to benefit from trade openness because their increase in wages and income through highly used in local productions [17]. It absolutely reduces the unemployment for unskilled labor where the offshoring and outsourcing activities might be relatively skill-intensive. In terms of different abundant countries, there are a significant different results both in the long run. Trade openness influences a significantly positive impact on unemployment in case of capital-abundant countries which is in line with the positive impact related with population growth however it inverses with the case of labour-abundant countries where the trade openness has significant negative impact on unemployment which is in line with inflation rate and institutional quality [19]. Another found that the trade openness can create more job opportunities which declines unemployment [13].

Since the inconsistent results found by researchers related the effect of trade openness on unemployment, it urges to conduct a further examination of occurrences within the G20 nations is necessary in order to gain a comprehensive understanding of the current state of affairs. Furthermore, it employs a more sophisticated approach than preceding studies by utilizing a Panel Cointegration. The Panel Cointegration has been found to be highly effective in identifying the long-run relationship with the ability to account for both cross-country and time dimensions. Recent studies have demonstrated the efficacy of this approach in capturing complex and heterogeneous dynamics across countries, as evidenced by the works of Bhat & Beg [16] and Dritsakis & Stamatiou [17]. Consequently, this approach furnishes a robust empirical foundation for the formulation of contextual and long-term economic policies grounded in empirical evidence.

2. Research Methods

This study examined the countries where were included in G20 which the data spanning over 25 years (1999 – 2023) considering G20 was first formed in 1999. As for the countries that are included in the G20, namely Argentina, Australia, Brazil, Canada, China, European Union, France, Germany, India, Indonesia, Italy, Japan, Korea, Russia, Saudi Arabia, South Africa, South Mexico, Türkiye, United Kingdom, and United States.

The data both percentages of unemployment, trade openness, GDP, GEE were taken from the world bank data. While the data of Trade Freedom and Investment Freedom were taken by The Heritage Foundation. There are 500 data are collected from 1999 to 2023 for 20 members of G20. It is explained clearly in the Table 1. Below:

Table 2. Description of Variables

Variable	Unit of Measures	Definition
Unemployment	Percentage	The proportion of the labour force that has no work but is available for and seeking employment.
Trade Openness (Trade Freedom)	Percentage	The aggregate of exports and imports of goods and services, expressed as a proportion of gross domestic product (GDP).
Gross Domestic Product (GDP)	Ln (Current \$)	the sum of gross value added by all resident producers in the economy, excluding any product taxes, and minus any subsidies not included in the value of the products.
Government Education Expenditure	Percentage	The percentage of GDP that is represented by general government expenditure on education (current, capital and transfers) is a key indicator of the commitment to education from the government.
Trade Freedom	Percentage	Investment imposing through a variety of regulatory restrictions.
Investment Freedom	Percentage	A composite index of tariff and non-tariff barriers affecting the import and export of goods and services.

Source: World Bank and The Heritage Foundation

In order to investigate the effect of trade openness on Unemployment in the G20 Countries, the model specification that it was used is

$$UE_{it} = \alpha_i + \beta TO_{it} + \beta \ln GDP_{it} + \beta GEE_{it} + \beta TF_{it} + \beta IF_{it} + \mu_{it} \quad (1)$$

where the UE refers to the Unemployment; α is the constant; β is the slope; TO refers to the Trade Openness, GDP refers to the Gross Domestic Product, GEE refers to the Government Education Expenditure, TF refers to the Trade Freedom, IF refers to the Investment Freedom, μ refers to error, i refers to the country, t refers to the time.

If the data are generated from panel unit root processes, and the residuals of all of models are a stationary process ($\mu_{it} \sim I(0)$), then the model is a panel cointegration model. Hence the panel vector error correction models (PVECM) are

$$UE_{it} = \varphi_1 ecm_{i,t-1} + \delta_{11} \Delta TO_{it} + \delta_{11} \Delta \ln GDP_{it} + \delta_{11} \Delta GEE_{it} + \delta_{11} \Delta TF_{it} + \delta_{11} \Delta IF_{it} + \zeta_{it} \quad (2)$$

where the $ecm_{i,t-1}$ is the residual cointegration model; φ_1 is the short-term adjustment effect, and it represents the effect of long-term (stability or equilibrium) relationship among unemployment and trade openness; Δ implies first difference of variables [18].

In order to examine the models, there are several steps that might be conducted:

1) Panel Unit Root Testing

In order to assess the stationarity properties of each variable in the panel data, it is necessary to first determine whether the variables are non-stationary at the level but stationary at the first difference (i.e., $I(1)$). This is because cointegration analysis requires variables to be non-stationary at the level but stationary at the first difference (i.e., $I(1)$). Statistic test of this study used is Fisher-PP tests.

H_0 : Non-Stationary: Probability < 0.05

H_1 : Stationary: Probability > 0.05

2) Panel Cointegration Testing

The objective is to establish the existence of a long-run equilibrium relationship among the non-stationary variables. It used Johansen-Fisher Panel Cointegration Test as a Statistic test.

H_0 : Has no cointegration (has no long-run relationship): at least one variable has probability value less than 0.05

H_1 : Has cointegration (has long-run relationship): at least one variable has probability value more than 0.05

3) Panel Cointegration Estimation

The purpose of the present study was to estimate the cointegrating vector and to evaluate the magnitude and direction of the long-run effects. Statistic test used is Fully Modified Ordinary Least Squares (FMOLS) and Dynamic Ordinary Least Squares (DOLS). The FMOLS method is employed to generate reliable and effective estimates by reducing the occurrence of endogeneity and serial autocorrelation issues in the cointegration regression model. This can be achieved through the implementation of a non-parametric approach [19]. Conversely, the DOLS method has been demonstrated to effectively address the challenges posed by endogeneity and short-term dynamics. This efficacy is attributed to its parametric nature, which allows for the incorporation of lags and leads from changes in independent variables [19].

H_0 : Significant : p-value < 0.05

H_1 : Insignificant : p-value < 0.05

3. Results and Discussions

A. Descriptive Statistics Result

Table 3. Descriptive Statistics Results

	Y_EU	LNGDP	X1_TO	X3_GEE	X4_TF	X5_IF
Mean	7.861617	12.23749	51.82408	4.594390	76.34742	60.52057
Median	7.048700	12.22867	51.48027	4.648830	79.60000	65.00000
Maximum	28.83800	13.37280	99.88034	7.718870	90.00000	90.00000
Minimum	2.351000	10.99000	18.12563	0.863943	19.60000	20.00000
Std. Dev.	4.572864	0.509862	17.85652	1.041773	11.40734	18.54146
Skewness	2.112827	0.154206	0.277596	-0.577289	-2.015883	-0.271246
Kurtosis	8.210383	2.671480	2.529127	4.470379	8.883129	2.007747
Jarque-Bera Probability	780.0735 0.000000	3.519424 0.172094	9.185979 0.010123	60.58110 0.000000	881.6835 0.000000	22.16697 0.000015
Sum	3270.432	5090.797	21558.82	1911.266	31760.53	25176.56
Sum Sq. Dev.	8678.100	107.8832	132325.0	450.3959	54002.87	142671.1
Observations	416	416	416	416	416	416

Source: data processed by the author

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Based on Table 3. It shows that the average of logarithm of Gross Domestic Products of G20's Countries is 12.2 % meaning that the G20 Countries has reached more than \$1 Billion in average. However, in 2023, two countries have left behind were South Africa and Argentina where generate the GDP below \$1 Billion as much as \$377 million and \$640 million. Many reasons found such as Significant income inequality within the South Africa Country, the high inflation, and business performance generally is down [20]. These circumstances impact also on unemployment in South Africa which continues to increase as much as 28% in 2023 (the highest unemployment rate among G20 Countries), but the trade openness in South Africa reaches 65% which is the upper the average of trade openness as much as 53% in G20 Countries. The high trade openness is supported by the good quality domestic institutions including government effectiveness, regulatory quality, and the rule of law that can reduce bureaucratic barriers and increase investor confidence [21]. Meanwhile, Argentina produces GDP twice as much as Africa's GDP (\$640 million in 2023) although it is still below the average GDP in the G20 countries. The low GDP in Argentina is caused by weak political institutions, inconsistent economic policies, low productivity, and corruption problems [22][23][24]. Another, the low GDP also caused by the declining trade openness which is only 27% below the average of trade openness in G20 Countries (51%) but this low trade openness can hold the unemployment rate in Argentina (6.2% in 2023) below the average of the unemployment rate in G20 Countries (7%).

In terms of Trade Freedom and Investment Freedom, it reached 76% and 60 % in average gained by a half of the G20 countries will still have below the average of trade freedom in 2023, meaning that there are still many barriers in place in half of the G20 member countries. India became the first country of G20 members has the lowest Trade Freedom (24%) and Investment Freedom (30%) in 2023 due to complex regulations, protectionist policies, high tax burdens, corruption, legal uncertainty, and public sector dominance [25] [26] [27]. While, Mexico, Italy, United Kingdom, United State, Australia and Germany are in a high position on average in the trade freedom and investment freedom index. It is caused by policies that support free markets, strong property rights protection, political stability [28], [29], [30], [31].

Related to government expenditure in education, Indonesia, Turkey and Japan have the index (0.9%, 2.6%, 3.2% of GDP) below average of government expenditure in education of G20 countries in 2022 (4.5%). In Indonesia, the low of government expenditure in education is occurred by the different Spending Priorities such as a free school lunch program, the government allocated \$28 billion for which required budget cuts in other sectors, including higher education [32]. In Turkey, the low education expenditure is caused by government budget priority which dominated by the infrastructure, defense, or health, and also the the limited financial resources [33] While in Japan, efficient and structured education system is already working well, the low public school fees and considered a long-term investment in infrastructure projects and policies [34]. In contrast, there are South Africa, Australia, and United Kingdom have a huge government expenditure in education which are above of the average (6.2%, 5.2%, and 5.0%). Those countries are focused on reducing the disparities between urban and rural areas as well as ensuring an equal opportunity to access education (in South Africa) [35], improving teaching and learning quality through educational innovation and technology (In Australia) [36], and investing significantly in education infrastructure including research facilities for high-quality research (in United Kingdom) [37].

B. Panel Data Analysis Result

a) Panel Unit Root Test Result

Table 4. Panel Unit Root Test Results

Method	statistic	Prob.
<u>Null: Unit Root (assume common unit root process)</u>		
Levin, Lin & Chu t*	-67.5403	0.0000
<u>Null: Unit Root (assume common unit root process)</u>		
Im, Pesaran and Shin W-stat	-58.002	0.0000
ADF - Fisher Chi-square	977.046	0.0000
PP - Fisher Chi-square	977.961	0.0000

Source: data processed by the author

At first, panel unit root tests must be executed earlier than further analysis. It aims to identify the integration of each variable. All the variable tests for the level and first difference. This paper used Phillips-Perron test statistics using PP-Fisher Chi-square method, it is known that the null hypothesis assuming common and individual unit root process (non-stationary), while the alternative hypothesis indicating the data has no unit root or it is stationary. Based on the Table 4. It found that the five variables used in this study has probability (0.0000) less than 0.05 meaning that the variables are stationary which is the null hypothesis cannot be accepted and the panel data is stationary. Thus, it needs to be further analyzed.

b) Panel Cointegration Test Results

Table 5. Panel Cointegration Results

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.147617	117.7827	83.93712	0.0000
At most 1 *	0.091539	60.60322	60.06141	0.0450
At most 2	0.059373	26.23402	40.17493	0.5720
At most 3	0.006732	4.321345	24.27596	0.9994
At most 4	0.004598	1.903264	12.32090	0.9575
At most 5	0.000707	0.253259	4.129906	0.6741

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.147617	57.17947	36.63019	0.0001
At most 1 *	0.091539	34.36920	30.43961	0.0153
At most 2	0.059373	21.91267	24.15921	0.0978
At most 3	0.006732	2.418080	17.79730	0.9997
At most 4	0.004598	1.650006	11.22480	0.9564
At most 5	0.000707	0.253259	4.129906	0.6741

Source: data processed by the author

Panel Cointegration Test is used for determining how the variable has a long run relationship even the variables or not even the data is known stationary. This paper used first differences in lags interval. The null hypothesis presents no co-integration among the variables which rejected if the probability is less than the significant level (0.05). Table 5 shows the panel cointegration test result, it concluded that the variables have a stable long-term relationship since there are two the probability value is less than the significant level (0.05). It also seems at both Trace statistic value and Max-Eigen Statistic Value are greater than Critical Value 0.05 which means that the null hypothesis cannot be accepted.

c) Panel Cointegration Estimation

Table 6. The Result of Panel Cointegration Estimation using FMOLS and DOLS

Variables	FMOLS		DOLS	
	Coefficient	Prob.	Coefficient	Prob.
C	48.53231	0.0000*	48.01335	0.0002*
X1_TO	0.019051	0.4774	0.033381	0.2787
X2_lnGDP	-3.598031	0.0001*	-3.558612	0.0007*
X3_GEE	1.472336	0.0015*	1.473032	0.005*
X4_TF	-0.023615	0.6191	-0.024938	0.6792
X5_IF	-0.036455	0.2485	-0.042376	0.2642

Source: data processed by the author

To explore more about the long-run cointegration vector between trade openness and unemployment, it used the panel FMOLS and DOLS methods where the assumption of one lag and one lead changing the regressors. Table 6 shows the results of panel cointegration estimations using FMOLS and DOLS which concluded that there are three of all variables having not significant effect on unemployment at G20 Countries namely Trade Openness, Trade Freedom, and Investment Freedom at the 5% level of significance. While both GDP and GEE are significant influencing the unemployment at G20 Countries.

In terms of the significant effect of GDP and GEE, those have different relations towards unemployment in G20 Countries. Based on Table 6, GDP has a negative relationship on unemployment meaning that the higher GDP of a country in G20 group, the lower Unemployment Rate in G20 Countries. If there is an increase 1% in GDP, it will decrease the unemployment rate as much as 3.56%. From the beginning in 1999 to 2023, United State generated the highest GDP reached from \$9.631 billion to \$27.360 billion of GDP has succeed a low of unemployment rate at the level 4% which is below the average of G20 Countries Unemployment Rate while in South Africa as lowest GDP producer of G20 Countries in 1999 to 2023 (\$151 billion and \$377 Billion) where found the highest unemployment rate at the level 19% and 28%. Generally, it is caused by the GDP increases influencing productivity and economic activity will also increase which encourages the companies to employ more workers in order to find the increasing demand [38]. In addition, it is similar findings founded by [39] which the rise of economic growth will decrease the poverty meaning that unemployment rate can be minimized and [40] which increase employment. In contrast, the GEE shows an inverse relationship towards unemployment where the GEE has positive impact on unemployment. If there is an increase 1% in GEE, it also will increase unemployment as much as 0.01% (FMOLS) or 0.03% (DOLS) meaning that the higher GEE, the higher unemployment rate in G20 Countries. It is due to the fact that mismatch between the workforce produced and market needs which cause intellectual unemployment[38]. An increase in the number of graduates with higher education without a commensurate increase in employment opportunities[41]. This happened at South Africa where it has a high level of government expenditure in education (6.2% of GDP) cannot decrease the unemployment rate that reached 28% in 2022. A quality education system has been issued at South Africa. Australia can be a success example in G20 Countries where its focused on enhancing teaching and learning quality through educational innovation and technology [36] which can decrease the unemployment rate at the level of 3%. However it is in contrast with the finding conducted by Alkhateeb et al which found that the Expenditure in Education by Government has positive impact on employment meaning that decreasing unemployment in short-run[40].

Looking at the effect of trade and investment freedom, we can see that both of them has negative nexus towards unemployment rate in G20 Countries. Both in the results of Panel Cointegration Estimation using FMOLS and DOLS, the increase 1% of trade freedom and investment freedom will reduce the unemployment rate as much as 0.02% and 0.04% in G20 Countries. It seems at the Germany, Australia and Japan where they have the highest Trade Freedom indexed reached 79% (3 percents above the average trade freedom of G20 members) have the low unemployment rate approximately from at the level of 2% – 3% in 2023. It is caused by expanding the operations and export goods among G20 Countries which leads to increase the demand of workers filling the increase of products [42]. This is also in line with the growing freedom to invest in Germany and Australia (70%), which will create more opportunities to boost a country's productivity through active in free trade agreements which aim to reduce tariffs and non-tariff barriers. it will increase the demand for workers and reduce unemployment rate at level of 3% [38]. This finding is in line with Nwaka et al research [43].

To be specific on the relationship between trade openness and unemployment, both using FMOLS and DOLS show that the positive nexus. The increase of trade openness cannot reduce the unemployment rate in G20 Countries. If the increase 1% in trade openness, it will also increase the unemployment rate as much as 0.01% (FMOLS) or 0.03% (DOLS). It happened in European Union where it has the high trade openness index as much as 97.2% but might also increase in unemployment rate at the level of 6% in 2023 which is contrast to Germany. It is caused by the local companies having difficulties in competing with the foreign companies such as the enhancing product quality, diminishing costs, or augmenting innovation which influence the reduction of the number of employees that can lead to unemployment [44]. Also, it found that the relocation of workers with the lower labor cost and regional imbalances. This finding is in line with study conducted by some researchers [15] [45] [43] [46] [47] [43], however it is in contrast with the finding conducted by Alkhateeb et al which found that the trade openness has positive impact on employment meaning that decreasing unemployment in short-run[40].

The study's notable strength lies in its emphasis on the stable long-term relationship between free trade and unemployment in G20 countries with heterogeneous dynamics across countries. This emphasis is achieved by employing the co-integration method and utilizing the FMOLS and DOLS estimators. However, this study is subject to certain limitations due to the limited data available on the GEE variable. These limitations arise from the fact that separate tests are required for each country in the G20, which may lead to variations in results. Additionally, the model is constrained by several variables that may affect its performance, particularly the interaction between open trade and the free trade freedom index, as well as the investment freedom index and the political conditions index in each G20 country.

4. Conclusion

In this paper, the long-run relationship between trade openness and unemployment, GDP, Government Expenditure in Education, Trade Freedom, Investment Freedom as the variable controls during 1999-2023 for G20 Countries using the panel cointegration test. The panel cointegration test result shows that unemployment and all variables are cointegrated for the entire G20 countries. However, the different results of the panel cointegration estimation using FMOLS and DOLS estimator for each variable. It demonstrates the GDP has significant and negative effect on unemployment rate but GEE has positive relationship even it has significant effect towards unemployment rate. While trade and investment freedom have negative and insignificant effect on unemployment rate, whereas the trade openness has a positive nexus with unemployment rate. These findings underscore the imperative for strategic investment in inclusive economic growth and reforms in education and vocational training to better align with industry demands. Also, the employment implications of trade liberalization are a subject of ongoing debate, and the application of FMOLS and DOLS estimators contributes to this discourse by challenging the assumption that openness always leads to job creation. This finding suggests that countries in the G20 should prioritize increasing national income (GDP) and strengthening freedom of trade and investment to encourage a decrease in unemployment. It is imperative for policymakers to integrate trade policy with education and labor strategies, promote re-skilling initiatives, and evaluate training programs to ensure workforce adaptability in an increasingly open economy.

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