The Impact of U.S. Quantitative Research Policy on Asian Macroeconomics

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Article Information	Abstract
	U.S. Quantitative Research policies significantly impact economic variables in Asia-Pacific, including inflation, interest rates, unemployment, and exchange rate depreciation, but the causal relationship remains unclear. Understanding these policies' impact is important for economic stability and growth amid global uncertainty. Using data from the World Bank and IMF, Granger's causality analysis was used to uncover the relationships between these variables. The findings show that U.S. inflation is unrelated to unemployment in the Asia-Pacific, but The Fed's interest rates correlate with inflation and unemployment in the region. Rising US interest rates could have a negative impact on unemployment, especially for countries that depend on foreign capital or have strong economic ties with the U.S. Policy recommendations include enhancing regional cooperation, implementing efficient monetary policy, diversifying the economy, investing in workforce education and training, and evaluating U.S. policies to maintain economic stability in the Asia-Pacific.

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INTRODUCTION

The world economy will now experience the worst Global Recession in the last 150 years, which is the impact of the coronavirus crisis (World Economic Forum, 2020). Related to this, there are 5.404.512 people positive confirmed cases and 343.514 people globally reported deaths related to COVID-19, and more than half of them occur in advanced economic groups with the highest number of cases of death (World Health Organization, 2020). This sentiment caused macroeconomic stability to experience a significant shock due to the crisis. Correia et al. (2020) estimate that the pandemic limited manufacturing activity by about 20%. Meanwhile, Barro & Weng (2020) estimate a negative impact on GDP of about 6-8% overall. The biggest negative impact occurred in advanced economic groups where some of these countries experienced a fairly severe spread of the COVID-19 outbreak and carried out lockdown measures that impacted global economic growth projected at -6,1% in 2020 (International Monetary Fund, 2020).

Based on the scenario International Monetary Fund (IMF) (2020), in the second quarter of 2020, the economic situation experienced the lowest growth due to the uncertainty of the economic situation in that period, but along with efforts to prevent the transmission of a more rapid and massive outbreak, with various policies consistently this condition will be controlled and stabilized in the third quarter of 2020. Advanced economies are more likely to recover quickly with a relatively stronger health situation from various aspects of capacity, such as more advanced health care and facilities, ease of international liquidity (in some cases based on exchange rates and foreign exchange reserves), and relatively easy borrowing costs. This will be key in combating the health crisis and supported by higher recovery financing.
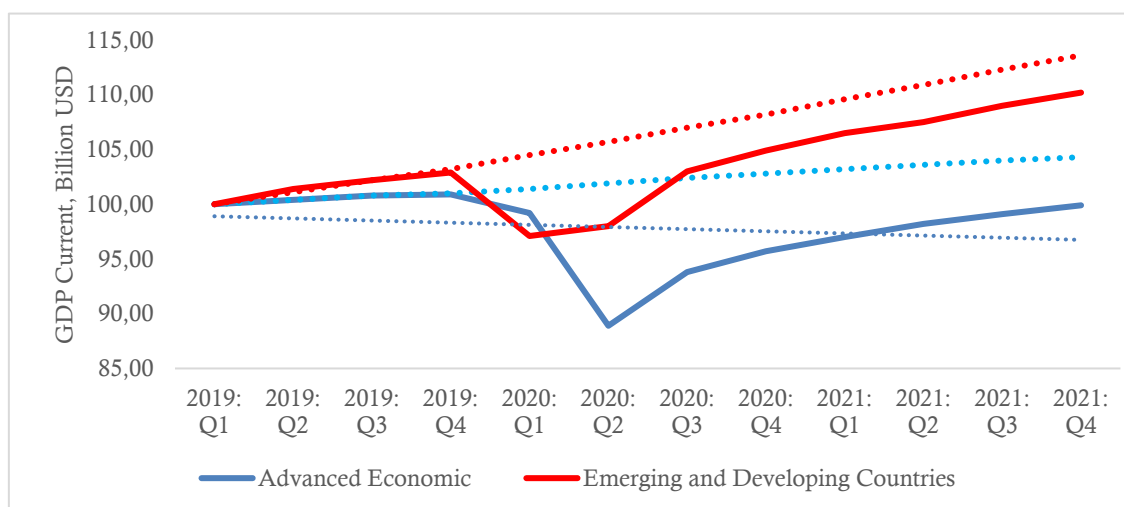

Figure 1. Quarterly World GDP
Source: International Monetary Fund, 2020 (Processed)

This is in line with Mckibbin et al. (2020), which shows that the COVID-19 pandemic significantly impacts the global economy in the short term. The real impacts of the pandemic include a sharp decline in economic activity, increased unemployment, and disruption to global supply chains. This impact is determined by the high costs of economic recovery after the pandemic subsides. They also suggested that greater investment in public health systems across countries could help mitigate the negative impacts of future pandemics. However, this strategy may be less effective in developing countries with low access to health services and population density. On the other hand, Ozili (2020) expressed a different view, pointing out that most countries are experiencing pressure in dealing with the COVID-19 pandemic. As a

result, many countries make policy decisions too quickly, which has the potential to have a broad negative impact on the economy and even result in these countries plunging into recession.

Policy patterns in each country differ depending on financing conditions in this crisis. The strength of each country's competitiveness is the key to sooner or later economic recovery. Thus, macroeconomic stability, which includes GDP, inflation, international trade, productivity, and investment, needs to be considered as a source of financing for economic recovery and an indicator of global competitiveness (Rusu & Roman, 2018). Consistent with this, the strength of global competitiveness in terms of this group's inclusive growth, innovation, and Research and Development (R&D) is stronger in the face of short-term crises (World Economic Forum, 2020b).

Macroeconomic policy depends on the persistence of a country in overcoming this pandemic. Several studies have discussed economic policies, especially macroeconomics. The COVID-19 pandemic has responded negatively to macroeconomic conditions; a study by Ludvigson et al. (2020) found that there were shocks in several sectors, namely industry and services. This response represents the New Keynesian model that considers the Pandemic variable as a negative shock to growth rates in productivity and technological change and traps stagnation as an Endogenous Model (Fornaro & Wolf, 2020).

The impact of various policies related to COVID-19 study by Veronica et al. (2020) considers that fiscal stimulus is less effective because there is no Keynesian multiplier effect due to the closure of various economic sectors, while from the monetary side, as long as it is not hindered by the lower limit of zero, it can have an enlarged effect so as to prevent corporate losses, but many countries carry out monetary policy through interest rate increases such as the United States which increases interest rates until September 2022 by 3,25%.

Performance global and regional macroeconomics have faced significant downward pressure throughout 2019 and 2020.

The emergence of the COVID-19 pandemic, escalating trade tensions, and an already slowing global economy have paved the way for the world's worst economic performance since the greatest economic crisis, with the value of global international trade expected to fall by 14,5% in 2020. Despite facing a sharp decline in merchandise trade, Asia-Pacific is expected to perform better than the rest of the world during 2020, with the latest estimates showing lower declines in export and import values of 9,7% and 10,3%, respectively. As a result, the region's lead in global merchandise trade is expected to rise to 2020 highs of 41,8%, world exports, and 38,2%, and global imports are expected from Asia-Pacific to increase from 39,9% and 36,9% in 2019 (United Nations ESCAP, 2021).

Macroeconomic performance will not be evenly distributed across regions. Especially China, which as a developing country has been hit hardest by the current pandemic, causing supply chain disruptions, causing their exports and imports to fall by 15,8% and 17,1%, respectively. This will have a more severe crisis impact on countries in the Asia-Pacific region, compared to poorer trade performance in developing countries due to their weak ability to implement fiscal and monetary measures to curb inflation due to supply chain disruptions in China.

In the Asia-Pacific region, South Asia experienced the worst overall trade contraction (down 21,6% and 21,4% in exports and imports, respectively). Statistically, the declining macroeconomic performance can be seen in the sector. Namely, the fuel trading sector and mining products experienced the highest decline. This is due to the continued consumer need for products with necessity while there is a significant decrease in demand for inputs, which impacts increasing unemployment (United Nations ESCAP, 2021). International trade relations and economic growth are evidenced by several studies, including the study by Fatima et al. (2020), which proves that economic openness has a positive and significant effect on economic growth. In line with this, the study by Islam (2019) finds that exports and imports are

determinants of economic growth, and every increase in net exports will increase overall economic growth.

The differences in many literature studies related to the relationship of exchange rates to economic growth include those of Morina et al. (2020), who recommend that policymakers adopt different policies to keep the exchange rate stable and boost economic growth. The results of this study are in line with research by Ybrayev (2021), who recommends that macroeconomic policies that target stable and competitive real exchange rates can be beneficial for the progress of the sector, increasing price competitiveness for manufactured goods and the service sector so that it will have positive implications for economic growth.

This study examines the impact of the global economic crisis following the COVID-19 pandemic and the United States QT policy on macroeconomic performance in Asian countries, which is believed to have a significant impact. This research also aims to examine the causal relationship between the United States QT policy and economic variables in Asian countries using the Granger causality method. It is hoped that this research will provide better insight into how the global economic crisis affects various Asian countries and help policymakers design more effective mitigation strategies in facing complex economic challenges.

This research also fills a knowledge gap in the economic literature by revealing the transmission mechanism of the United States QT policy to financial markets and Asian economies. By focusing on a highly relevant and highly impactful situation today, this research creates an update in global and regional economic research, which is expected to provide a better view of future world and regional economic developments. Hopefully, this will also help policymakers face complex economic challenges post-COVID-19. This research is divided into several parts, where part 2 discusses research methods, part 3 discusses the general description and movement of variables, model estimation and data processing stages, and economic analysis based on the results of model estimation linked to previous theory and literature.

RESEARCH METHODS

The scope of this study is to analyze the relationship between the impact of U.S. monetary policy in the form of The Fed's policy in controlling inflation on macroeconomic performance in Asian countries, as well as coherent data from 1998 to 2021. The data used in this study is time series data, a type of secondary data. The data is obtained from various legal institutions or legally recognized, namely, the World Bank. In addition, data is also obtained through literature studies from many sources, such as textbooks, journals, theses, dissertations, and other sources related to the problems discussed. The analytical technique in research is quantitative, using the Granger Causality method. Granger causality is a concept in the econometric analysis used to measure whether a one-time variable can be used in forecasting or predicting changes in another time variable.

Table 1. Variable Operational Definition

Variable	Variable Operational Definition	Data Source
Unemployment	Unemployment is the percentage of the disturbing population in Asia Pacific from 1998 to 2021.	World Bank
Interest Rate	Interest Rate is the reference value of the interest in Asia-Pacific countries from 1998 to 2021 measured in percent units.	World Bank
Inflation	Inflation is the inflation rate in Asia-Pacific countries from 1998 to 2021 measured in percent.	World Bank

Source: Author Compilation, 2023

This research uses the Granger causality analysis method to explore the cause-and-effect relationship between the United States Quantitative Research Policy and key economic indicators in Asia-Pacific countries, including inflation, interest rates, unemployment, and exchange rate depreciation. The selection of this method is based on its effectiveness in determining whether variations in one variable can function as a predictor for changes in other variables over a certain period. The Granger test steps involve formulating a hypothesis of causality between selected variables, estimating a time series regression model, and statistical testing to determine whether one variable can be used as a predictor for another variable. The results are interpreted to determine the existence and direction of the causal relationship between these variables. In addition, robustness and stability tests of the results were also carried out to ensure the consistency of the findings. With this approach, research can provide deeper insight into the cause-and-effect relationships between observed economic variables.

In Granger causality analysis, this study uses equation models to estimate relationships between different economic variables. First, the Model of Estimation of Unemployment with Inflation is expressed in Equations (1) and (2). Equation (1) shows that the unemployment rate (UN) at a given time (t) is affected by inflation (IF) in the previous period (t-1), as well as unemployment in the previous period and error $\varepsilon 1t$. Equation (2) has a similar structure, but the focus is on the effect of unemployment on the inflation rate.

Next, Model Estimation of Interest Rates with Inflation (Equations 3 and 4). Equation (3) shows that the interest rate (SB) at any given time is affected by inflation in the previous period and interest rates and errors in the previous period. Equation (4) also has a similar structure but relates the interest rate to the inflation rate.

Finally, there is the Interest Rate Estimation Model with Unemployment (Equations 5 and 6). Equation (5) shows that interest rates are affected by the unemployment rate in the previous period and the interest rate

and unemployment in the previous period. Equation (6) describes the effect of the unemployment rate on interest rates, along with unemployment and interest rates in previous periods. In all equations, i refers to the amount of lag for each variable.

$$IF_t = \alpha_i + \sum_{1i} \beta\, IF_{t-1} + \sum_{1i} IF\, UN_{t-1} + \varepsilon_{1t} \dots (1)$$

$$UN_t = \alpha_{2i} + \sum_{2i} \beta\, IF_{t-1} + \sum_{2i} IF\, UN_{t-1} + \varepsilon_{2t} \quad (2)$$

$$SB_t = \alpha_i + \sum_{1i} \beta\, IF_{t-1} + \sum_{1i} IF\, SB_{t-1} + \varepsilon_{1t} \ \dots (3)$$

$$SB_t = \alpha_{2i} + \sum_{2i} \beta\, IF_{t-1} + \sum_{2i} IF\, SB_{t-1} + \varepsilon_{2t} \quad (4)$$

$$SB_t = \alpha_i + \sum_{1i} \beta\, SB_{t-1} + \sum_{1i} SB\, UN_{t-1} + \varepsilon_{1t} \quad (5)$$

$$SB_t = \alpha_{2i} + \sum_{2i} \beta\, SB_{t-1} + \sum_{2i} UNSB_{t-1} + \varepsilon_{2t} \quad (6)$$

Where, UN is the unemployment rate; SB is the interest rate; Inf is inflation, α is the intercept in the model, which represents the average value of the dependent variable when all independent variables are zero; β is a regression coefficient that describes the average change in a dependent variable for each change of one unit in the independent variable; t is time series; and i is the number of lags.

RESULTS AND DISCUSSION

This part should describe informative results of empirical research that have been written systematically and critically. Tables and figures can be presented in this part to support the discussion, for example, a table of statistics-test results, figures of model test results, etc. In general, journal papers will contain three to seven figures and tables. The same data can not be presented as tables and figures.

Discussion of results should be argumentative and point out how the findings, theories, previous studies, and empirical facts are relevant and contribute something new to knowledge of economic development.

The Quantitative Tightening (QT) policy implemented by the U.S. significantly impacts Asia-Pacific countries. One of the main impacts is changes in currency exchange rates (Caballero et al., 2017). As the Federal Reserve reduces its purchases of long-term assets and increases interest rates, the U.S. dollar tends to strengthen,

thus weakening the currencies of Asia-Pacific countries relative to the dollar (Wang & Chueh, 2013). This disrupted their exports, making their goods more expensive for the international market and profitable for imports. In addition, the impact of QT policy is on regional financial stability, increases financial market volatility, and results in fluctuations in capital flows that can affect the economies of Asia-Pacific countries. The risks associated with this policy can be greater for countries with vulnerable financial sectors and high debt.

Asia-Pacific countries have strong and flexible fiscal policies, and diversified economies can better cope with the impact of QT policies (Jha et al., 2014). To maintain their economic stability, they can respond wisely through internal policies, including interest rate setting, financial market regulation, and fiscal stimulus measures. Each country in the region will feel the impact differently depending on their dependence on the U.S., economic profile, or readiness to deal with global market volatility that may arise due to U.S. QT policies.

When QT policy is implemented in the United States, the country's macroeconomic conditions are usually characterized by several characteristics. The Federal Reserve tends to raise its benchmark interest rate and reduce purchases of long-term assets, such as government bonds and mortgages, to reduce the amount of money circulating in the market. This increased lending rates, consequently slowing economic growth and affecting sectors such as housing and investment. QT policy can also affect both stock and bond markets, potentially increasing uncertainty and volatility (Fang et al., 2017). Employment and inflation conditions are also a concern because The Fed strives to maintain price stability and achieve the inflation target while implementing QT policy. Thus, U.S. macroeconomic conditions during QT policy are often characterized by changes in interest rates, investments, and overall levels of economic activity, which can have a major impact on the global economy. In detail, you can see the monthly historical data of interest rate indicators in the U.S.A. for 1954-2022.
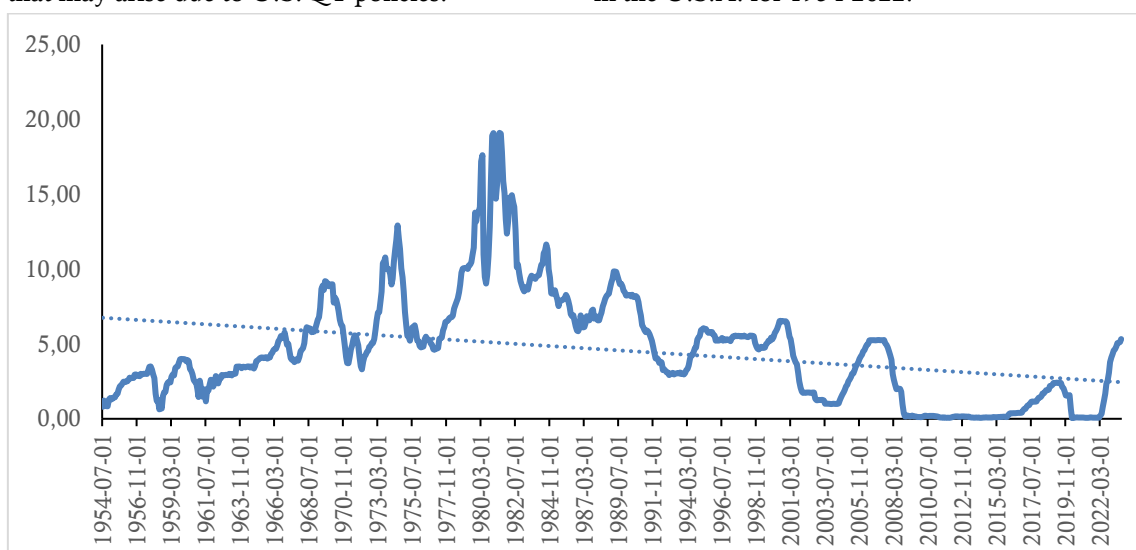

Figure 2. Federal Funds Effective Rate 1954-2022
Source: Board of Governors of the Federal Reserve System (U.S.), 2023

Based on Figure 2, the interest rate of the United States during the period 1954-2022 has fluctuated for decades. Fed interest rates were lowest in the early 1950s, with several increases and decreases over the following years. In the 1970s, there was a significant increase in interest rates, especially during the oil crisis of the 1970s. The highest peak occurred in the early 1980s, with interest rates reaching almost 20%. The specific action taken by the Federal Reserve in 1982 to raise interest rates was part of a broader strategy to reduce inflation.

After that, interest rates declined gradually during the 1980s and 1990s. Then, there were some fluctuations in the early 2000s, with interest rates reaching low levels in the early 2000s. In 2008, a global financial crisis led to a drastic drop in interest rates. Furthermore, the Federal Reserve and the US government stabilized the economy, lowering interest rates to near zero in 2008-2009.

When the COVID-19 pandemic began to spread in the United States in early 2020, the Federal Reserve responded swiftly to mitigate its economic impact. One of the steps taken was to reduce benchmark interest rates, including the Federal Funds Rate, to a level close to zero. These steps were taken to encourage loans and investment, as well as to strengthen economic growth disrupted by the pandemic. Along with the benchmark interest rate reduction, the Federal Funds Effective Rate (FFER) also fell to a very low level. This happens because banks have more incentives to lend their funds to each other at lower interest rates, which affects the FFER.

From January 2021 to August 2023, interest rates showed a significant upward trend. At the beginning of 2021, interest rates were at low levels, ranging from 0,06 to 0,10. However, around March 2022, there was a drastic change, with interest rates starting to rise rapidly. This increase continued into August 2022, with the rate rising from 0,10% to over 2,33. This indicates the presence of tight monetary policy and other factors that cause interest rate increases.

After August 2022, interest rates increased significantly, reaching more than 5% in August 2023. This increase indicates major changes in economic policy, inflation, and other factors affecting interest rates. During this period, increases occur, and fluctuations in interest rates also occur. These changes can affect various aspects of the economy, such as investments, loans, and individual and business financial decisions. This reflects the decades-long history of fluctuations in U.S. interest rates and their role in dealing with economic challenges such as inflation, energy crises, and financial crises. Interest rates are an important monetary policy tool monetary authorities use to control inflation and stimulate economic growth.

From 2015 to 2019, the United States experienced a relatively stable and moderate inflation rate, with the highest rate reaching 2,44% in 2018. This inflation rate is generally considered healthy for emerging economies, leaving room for the Federal Reserve to keep its interest rate policy relatively stable. During this period, The Fed's monetary policy tools are likely to be focused on supporting economic growth and bringing inflation down to around 2%.
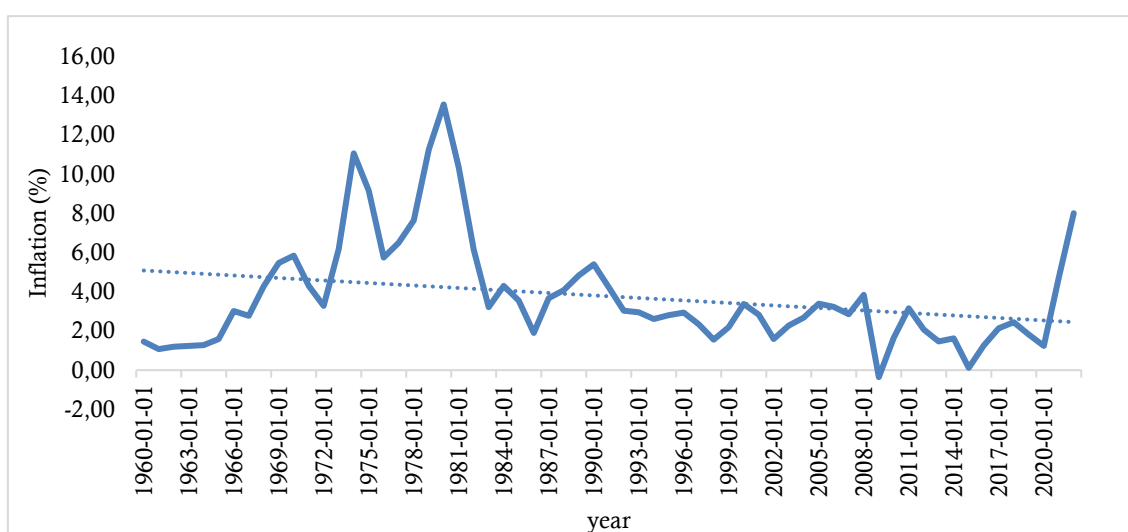

Figure 3. Inflation Rate in the United States 1960-2022
Source: Board of Governors of the Federal Reserve System (U.S.), 2023

The annual inflation rate in the United States from 1960 to 2022 is shown in Figure 3. At first, from the 1960s to the early 1970s, inflation seemed relatively stable, but it began to rise dramatically in the mid-1970s. This era is known as stagflation, where high inflation and unemployment rates occur together. This surge in inflation peaked in the early 1980s, with inflation of over 13% in the 1980s. The global financial crisis began in 2008, leading to a decline in inflation and even deflation of -0.36% in 2009. In response, the Federal Reserve implemented a policy of very low interest rates and quantitative easing to stimulate the economy. Consequently, inflation began to recover but remained moderate over the following years.

After peaking in the early 1980s, inflation entered a period of decline, reaching more moderate and stable levels during the 1990s and early 2000s. Over the past two decades, the Federal Reserve's monetary policy has successfully maintained inflation within the target range, generally around 2%. This relatively stable inflation rate allows for more predictable interest rate policies and overall economic stability.

During the COVID-19 pandemic, inflation movements in the United States significantly impacted Asian countries. The decline in U.S. inflation in 2020 reflected a slowdown in global economic activity, which was also felt by many Asian countries. These countries experienced a drop in export demand from the U.S. and other pandemic-affected nations, contributing to a decline in domestic inflation. However, as U.S. inflation began to rise in 2021 and 2022, Asian countries also felt the impact. An increase in U.S. inflation can cause a rise in import prices for Asian countries that depend on U.S. imports, such as consumer goods, commodities, and capital goods. This may increase domestic production costs and create domestic inflationary pressures in Asian countries.

Additionally, The Fed's monetary policy, such as raising interest rates, could impact Asian countries. An increase in U.S. interest rates could attract capital from Asian financial markets to the U.S., exerting pressure on domestic currencies and dampening economic growth in the region. Therefore, inflation movements in the United States during the COVID-19 pandemic have had a far-reaching impact on the economies of Asian countries, affecting their price levels and economic stability. This underscores the importance of economic policy coordination between the U.S. and Asian countries to manage the impact of inflation and monetary policy changes.
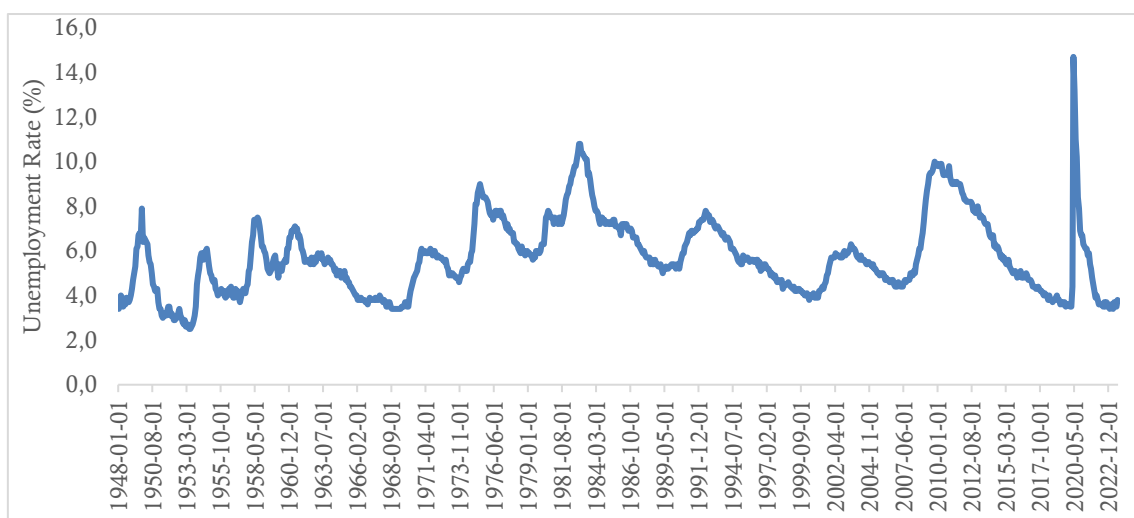

Figure 4. Unemployment Rate in the United States 1948-2022
Source: Board of Governors of the Federal Reserve System (U.S.), 2023

The decision to raise interest rates is not taken easily. Raising interest rates risks slowing economic growth and affecting the job market. In addition, it can increase the burden of loans for consumers and businesses. Therefore, The Fed must consider the trade-off between controlling inflation and maintaining healthy economic growth. The ideal strategy for The Fed is to take a cautious approach to raising interest rates while monitoring other economic indicators. This allows the central bank to respond quickly if inflation does not abate or if the economy shows significant signs of slowdown. Flexibility in monetary policy is key in monitoring this uncertain economic environment.

As we enter the 21st century, the world is changing rapidly. The dot-com bubble burst in the early 2000s, and the terrorist attacks on September 11, 2001, added to the uncertainty. Alan Greenspan, who headed The Fed then, responded by cutting interest rates. Lowering interest rates was a successful decision to lower unemployment, but it also triggered a housing bubble. Then, the global financial crisis occurred in 2008, launching a series of expansionary monetary policies, including quantitative easing, to save the economy. Unemployment is rising, but The Fed's policies are helping to prevent a more severe recession.

In the 2010s, the economy began to recover. Janet Yellen and then Jerome Powell began normalizing monetary policy by gradually raising interest rates. The unemployment rate continues to decline, but The Fed must be careful not to stoke inflation. Then, the COVID-19 pandemic caused job losses and the unemployment rate to soar. The Fed, now under Powell's control, acted quickly. Interest rates were cut drastically, and quantitative easing was implemented to stabilize the economy. The unemployment rate began to improve within months, although the road to a full recovery was still long.

During the COVID-19 pandemic, the unemployment rate in the United States experienced significant fluctuations, which in turn impacted the macroeconomy in Asia. At the start of the pandemic, there was a dramatic spike in unemployment rates in the US as businesses and industries had to close or reduce their operations in response to lockdowns and social restrictions imposed to slow the spread of the virus. The high unemployment rate in the U.S. is affecting the export and import activities of Asian countries as demand for exported goods and services decreases drastically.

However, as the economy gradually recovers, the unemployment rate in the U.S. has also begun to decline. The U.S. government responded by enacting economic stimulus and other support programs to help restore jobs and increase domestic consumption. The decline in the unemployment rate in the U.S. has had a positive impact on the Asian economy because demand for Asian goods and services has increased along with the economic recovery in the U.S.

However, the U.S. unemployment rate still negatively impacts the Asian economy. For example, a decline in U.S. consumer purchasing power could reduce demand for imported products from Asian countries, especially in the manufacturing and technology industries. Additionally, labor market uncertainty in the US may reduce foreign direct investment into Asian countries, as U.S. companies may be more cautious about expanding internationally and making long-term commitments.

Conducting a unit root or stationarity test is the initial stage before estimating a time series model. Unit root tests are performed using the Augmented Dickey-Fuller (ADF) test at a significance level of five percent. Data stationarity can be observed from individual and overall (common) values.

Table 2. Common Unit Root Test

Variable	Level		First Difference		Second Difference	
	T-Statistics	Probability	T-Statistics	Probability	T-Statistics	Probability
IF	0.69983	1.0000	87.0634	0.0000	136.452	0.0000
UN	281.769	0.0000	325.440	0.0000	154.383	0.0000
SB	40.0311	0.0021	117.792	0.0000	137.458	0.0000

Source: Data Processed, 2023

In Table 2, ADF tests conducted at the level level show that the Inflation variable is not stationary at the level with a probability greater than the real level of 5% or equal $(1,000 > 0,05)$. In the first and second difference tests, all variables are declared significant, so it can be stated that IF, UN, and SB are stationary at that level. Further analysis of individual Unit Root Test testing is described in Table 3.

Table 3. Individual Unit Root Test

Crossection	Individual Unit Root Test								
	IF			UN			SB		
	(Level, First, Second)			(Level, First, Second)			(Level, First, Second)		
1	0.9605	0.0049	0.0003	0.9989	0.7660	0.0010	0.3656	0.1499	0.0113
2	0.9737	0.0151	0.0020	0.0000	0.0000	0.0000	0.6115	0.0017	0.0012
3	0.9930	0.0194	0.0009	0.1398	0.0297	0.0023	0.0014	0.0001	0.0002
4	0.9489	0.0031	0.0003	0.4835	0.0118	0.0050	0.1809	0.0000	0.0000
5	0.9739	0.0066	0.0002	0.2608	0.9134	0.6370	0.3375	0.0221	0.0231
6	0.9508	0.0051	0.0006	0.1415	0.0085	0.0002	0.0228	0.0006	0.0001
7	0.9790	0.0492	0.0017	0.1763	0.0104	0.0027	0.0186	0.0030	0.0016
8	0.8885	0.0026	0.0003	0.2343	0.0002	0.0000	0.3312	0.0002	0.0000
9	0.9931	0.0065	0.0002	0.9931	0.0065	0.0002	0.7471	0.0058	0.0052

Source: Data Processed, 2023

Based on Table 3, the nine crosssection data individually show that at the level level inferred as a whole on the variable, IF shows a value greater than the level of significance. Cointegration tests are carried out to determine the long-term relationship between variables. Variables that are not stationary in the long run are likely to be cointegrated. The relationship between mutual influences can be seen from the cointegration between variables. The cointegration process requires that all variables must be stationary to the same degree.

Based on Table 4, all variables have a probability smaller than 0,05. This means that all variables have a long-term linear relationship.

Further testing is carried out on cointegration testing between variables at the individual level, which can be seen in Table 5.

Based on Table 5, the results of cointegration testing between individuals show results that vary between individuals, proving the difference in long-term relationships between variables at the individual level. Based on the hypothesis of the absence of cointegration, most results at the individual level accept the hypothesis. However, several individual probability values are smaller than 0,05, namely the 2nd individual, 3rd individual, 4th individual, 6th individual, and 7th individual, proving that there is no cointegration between variables in individuals.

Table 4. Common Cointegration Test

Hypothesized No. of CE(s)	Fisher Stat.* (from trace test)	Prob.	Fisher Stat.* (from max-eigen test)	Prob.
None	350.6	0.0000	318.1	0.0000
At most 1	54.37	0.0000	40.33	0.0019
At most 2	34.18	0.0120	34.18	0.0120

Source: Data Processed, 2023

Table 5. Individual Cointegration Test

Cross Section	Trace Test Statistics	Prob.**	Max-Eign Test Statistics	Prob.**
The hypothesis of no cointegration			
1	39.2934	0.0171	21.9186	0.0564
2	117.0592	0.0000	96.4620	0.0000
3	61.8067	0.0000	31.4079	0.0020
4	49.5533	0.0008	31.6491	0.0019
5	31.8760	0.1092	14.1981	0.4440
6	46.5014	0.0020	26.2922	0.0131
7	49.3440	0.0008	26.1557	0.0138
8	23.5712	0.4906	12.5651	0.5993
9	40.7028	0.0115	19.2857	0.1251
The hypothesis of at most 1 cointegration relationship			
1	17.3747	0.1191	10.7848	0.2682
2	20.5972	0.0450	11.5985	0.2105
3	30.3988	0.0014	22.5066	0.0039
4	17.9042	0.1022	12.5793	0.1548
5	17.6779	0.1092	11.6993	0.2041
6	20.2091	0.0508	14.6071	0.0787
7	23.1883	0.0192	16.9028	0.0346
8	11.0060	0.5415	7.6961	0.5843
9	21.4171	0.0345	12.5392	0.1568
The hypothesis of at most 2 cointegration relationship			
1	6.5899	0.1498	6.5899	0.1498
2	8.9988	0.0537	8.9988	0.0537
3	7.8922	0.0867	7.8922	0.0867
4	5.3249	0.2497	5.3249	0.2497
5	5.9786	0.1924	5.9786	0.1924
6	5.6021	0.2238	5.6021	0.2238
7	6.2855	0.1698	6.2855	0.1698
8	3.3099	0.5244	3.3099	0.5244
9	8.8779	0.0567	8.8779	0.0567

Source: Processed Data, 2023

Based on Table 4, the results of cointegration testing between individuals show results that vary between individuals, proving the difference in long-term relationships between variables at the individual level. Based on the hypothesis of the absence of cointegration, most results at the individual level accept the hypothesis. However, there are several individual probability values smaller than 0,05, namely the 2nd individual, 3rd individual, 4th individual, 6th individual, and 7th individual, proving that there is no cointegration between variables in individuals.

The final procedure is determining how long the lag (optimal lag) is in the model causality. Table 6 shows the optimal Lag test results, showing that the determination of lag length uses the estimated Optimum Lag. Table 5 shows the data for estimating Granger's causality: lag one and lag two for 3 variables. The statistical results show the same estimate between lags 1 and two. Thus, further testing was carried out using the Lag Length Criteria. Determination of Optimum Lag in a VAR Panel system is important. The determination of optimum lag using lag length criteria is based on the values of Akaike Information Criteria (AIC), Final Prediction Error (FPE), Hannan-Quinn Information Criterion (HQ), and Schwarz Information Criterion (SC)with detailed results that can be seen in Table 6.

Table 6. Lag Lenght Criteria Test

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-6946.096	NA	6.85e+29	77.21218	77.26540	77.23376
1	-6209.435	1440.583*	2.11e+26*	69.12705*	69.33992*	69.21336*

Source: Data Processed, 2023

Table 7. Individual Coefficient Test

Null Hypothesis:	z-Statistic	Prob.	Information
IF does not Granger Cause UN	0.21403	0.1209	No Causality
UN does not Granger Cause IF	2.08001	0.1102	Relationship
SB does not Granger Cause IF	2.28999	0.0510	Causality Relationship
SB does not Granger Cause IF	3.08538	0.0010	Two-Way
SB does not Granger Cause UN	2.34087	0.0262	No Causality
SB does not Granger Cause UN	2.54945	0.0023	Relationship

Source: Data Processed, 2023

The amount of lag chosen in this study is the lag that produces the smallest value seen from the most (*) signs. Based on Table 6, it can be seen that the most signs (*) in the Causality model are lag 1. This indicates that the optimal lag in the model, according to the sign (*), is highest in lag one.

Granger causality testing in panel data describes two approaches: the Individual overall coefficient approach (crosssection). The initial stages of initial testing are described based on individual testing, which are described in detail in Table 6.

Table 7 shows that the z-static Probability value is greater than the significance level of α (0,1209 and 0,1102 > 0,05); thus, the Null Hypothesis is accepted. Therefore, it can be concluded that American inflation cannot affect the unemployment rate in Asia-Pacific countries and vice versa. Unemployment in the United States cannot affect the inflation rate in Asia-Pacific countries.

While the Causality test between interest rates and inflation individually shows a relationship between the two seen from the z-statistical probability value of the model is

smaller than the level of significance of α (0,0510 and 0,0010 < 0,05); thus, the Null Hypothesis is rejected which can be concluded that individually the interest rate of the United States affects the inflation rate in Asia-Pacific countries and vice versa United States inflation affects interest rate policy in Asian countries Pacific.

The last individual model test also showed a direction in line with that indicated by z-statistic probability values smaller than the significance level at α level (10%) (0,026 and 0,0023 < 0,05); thus, the Null Hypothesis was rejected. American interest rates can affect the unemployment rate in Asia-Pacific countries and vice versa. Unemployment in America affects unemployment in Asia-Pacific countries.

Given the view that inflation in the United States may not significantly impact unemployment rates in Asia-Pacific countries, the link between inflation and unemployment tends to be stronger domestically than between countries (Pham & Sala, 2022; Blanchflower et al., 2014). This indicates that the inflation rate in the United States does not directly affect the unemployment rate in Asia-Pacific due to the indirectness of international markets (Lin et al., 2023). Countries in the Asia-Pacific have diverse monetary policies and different inflation rates, which can result in mixed responses to changes in inflation rates in the United States (Kisswani & Nusair, 2014). In addition, domestic economic factors and international trade can significantly determine the unemployment rate (Auboin & Ruta, 2013). In a global framework full of uncertainty, such as the global financial crisis or changes in international trade policy, the impact on unemployment rates in the Asia-Pacific may be greater than the impact of changes in inflation in United States.

The effects of inflation and unemployment tend to be stronger domestically than between countries. The Phillips theory, first proposed by A.W. Phillips in 1958, focuses on the strong relationship between inflation and unemployment at the national level (Bhattarai, 2016). Although the theory has been empirically tested and expanded, the core concepts of the theory conclude that there is a domestically observable trade-off relationship between the inflation rate and the unemployment rate (Orji et al., 2015). However, the inflation rate in the United States may not have the same direct impact on the unemployment rate in Asia-Pacific countries due to market indirectness and other factors.

Asia-Pacific countries have diverse monetary policies, each with different inflation rates. This diversity in monetary policy can produce different responses to changes in inflation rates in the United States (Reifschneider et al., 2015). Some countries may have tighter monetary policies to maintain price stability, while others may focus more on economic growth and employment. In addition, Asia-Pacific countries have control over factors in their economies that can offset the impact of external inflation. For example, they can set fiscal and monetary policies and have flexibility in adjusting trade policies to reduce dependence on imports affected by external inflation.

Global economic uncertainty, including global events such as the financial crisis or changes in international trade policies, has a greater impact on unemployment rates in Asia-Pacific countries than changes in inflation rates in the United States (Rashid et al., 2017). Asia Pacific countries often depend highly on international trade and foreign capital, making them vulnerable to global economic turmoil. In addition, global uncertainty can affect investor confidence and disrupt regional capital flows, affecting economic growth and unemployment levels. Therefore, in facing global economic uncertainty, Asia-Pacific countries must adopt proactive and adaptive policies to maintain economic stability and reduce the impact of unexpected external changes.

According to economic theory, rising interest rates in the United States tend to reduce investment and home consumption as borrowing costs increase (Lusardi & Scheresberg, 2013). If Asia-Pacific countries have strong economic ties to the United States and have dollar-denominated loans, rising interest rates could result in higher interest expenses and reduced economic activity (Gertler & Karadi, 2015). This could slow economic growth and reduce demand, affecting the inflation rate.

Rising interest rates in the United States can strengthen the value of the U.S. dollar (Caballero et al., 2017). Rising interest rates can affect the exchange rates of Asia-Pacific countries and impact import and export prices (Thuy & Thuy, 2019). Changes in currency exchange rates can directly impact the inflation rate (Forbes et al., 2018). Asian countries have a fairly high dependence on international trade (Lenzen et al., 2013). Several countries responded to rising interest rates in the United States with tight monetary policies to maintain the stability of their currencies (Cukierman, 2013).

This could result in reduced economic growth and lower inflation. However, such policy reactions vary between Asia-Pacific countries. In addition to monetary policy, fiscal and structural policy factors can influence how Asia-Pacific countries respond to changes in interest rates in the United States (Mauro et al., 2015). Fiscal measures, such as government spending, tax changes, and structural reforms, can play a role in stabilizing the economy and controlling inflation. Global factors, including uncertainty over international trade, the global financial crisis, or changes in U.S. foreign policy, also affect how Asia-Pacific countries respond to changes in interest rates. Such uncertainty can have a significant effect on inflation rates and economic growth.

When the United States cut interest rates to respond to the economic impact of the pandemic, several Asia-Pacific countries followed suit by cutting their domestic interest rates to stimulate economic growth and maintain financial stability (Barua, 2020). This action aims to reduce inflationary pressures and reduce borrowing costs for consumers and companies. However, not all Asia Pacific countries have adopted the same strategy. Some countries may choose to maintain or even increase interest rates to maintain the stability of their currencies and avoid potentially excessive inflationary pressures. This policy can be influenced by the domestic economic and financial conditions of each country, including the level of inflation that existed before the pandemic and the availability of fiscal policies to respond to the crisis.

In addition, economic uncertainty caused by the COVID-19 pandemic may also influence market expectations regarding the next policy steps from the United States and Asia-Pacific countries (Huynh et al., 2021). Global financial market fluctuations during the pandemic can cause volatility in exchange rates and capital flows, affecting inflation rates in Asia-Pacific countries. Thus, Asia-Pacific's response to the relationship between U.S. interest rates and inflation during COVID-19 reflects the region's diversity of policies and economic conditions. Efforts to maintain economic stability and reduce inflationary pressures are often a primary focus, but the strategies adopted can vary depending on each country's economic and financial context.

Rising interest rates in the United States can reduce corporate investment and economic growth in Asia-Pacific countries (Summers, 2016). Higher interest rates can make borrowing more expensive, hamper investment projects, and reduce business activities (Dell'Ariccia et al., 2014). This has a negative impact on the rate of job creation and results in an increase in unemployment (Hall, 2013). Rising interest rates in the United States tend to strengthen the value of the U.S. dollar (Engel, 2016). Thus, the

export competitiveness of Asia-Pacific countries is reduced as their goods become more expensive for foreign customers. A decrease in export demand can disrupt economic activity and decrease production, which can impact the unemployment rate.

CONCLUSION

The estimates show that U.S. inflation has no relation to unemployment in Asia-Pacific countries. The absence of this relationship is due to the indirectness of international markets and national economic policies. The interest rate of the United States is related to the inflation rate in Asia Pacific countries and vice versa. Rising U.S. interest rates can directly affect The estimation results, showing that U.S. interest rates are related to unemployment rates in Asia Pacific countries and vice versa. Rising U.S. interest rates have a negative impact on unemployment rates in Asia-Pacific countries, especially if they are highly dependent on foreign capital or have strong economic ties to the United States.

The conclusion of the research on the impact of the U.S. Quantitative Tightening (QT) policy on macroeconomic performance in Asia Pacific countries is that these countries need to take various actions to manage risks that may arise due to changes in U.S. monetary policy. While there is no significant link between U.S. inflation and unemployment in the Asia-Pacific, rising U.S. interest rates directly affect it. Therefore, it is advisable to anticipate the impact of QT by increasing regional cooperation, helping to deal with financial volatility, adopting efficient monetary policies, and increasing economic diversification and investment in education and workforce training. In addition, evaluating the impact of U.S. policies will assist Asia-Pacific countries in maintaining their economic stability and minimizing risks that may arise from unexpected external changes. With these measures, Asia-Pacific countries can better manage the impact of U.S. QT and maintain balanced macroeconomic performance amid global economic uncertainty.

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