Unraveling the Nexus Between Monetary Policy and Macroeconomic Performance: Evidence from the United States

By

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DEDICATION

To my parents, Kwadwo Dapaa Addo and Ruth Serwaa Addo, and to my lovely wife and best friend, Alberta Twi-Yeboah.

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ABSTRACT

This dissertation comprises three distinct chapters, each serving as an individual publishable paper. Although these chapters share common empirical tools, the models employed in each chapter are independent of one another. As a result, each chapter is self-contained and can be comprehended separately, making its unique contribution to the subject under investigation.

In the first chapter, titled "**Performance Comparison of Banks Stability and Profitability Under Inflation Targeting Frameworks,**" the study examines the impact of traditional inflation targeting and average inflation targeting on the stability and profitability of banks in the United States. It utilizes a sample of over 1000 banks from 2004 to 2022 and employs the fixed-effect estimator with AR (1). The findings of this study reveal that banks exhibit lower stability and reduced profitability during periods of both traditional and average inflation targeting. Furthermore, when comparing traditional inflation targeting to average inflation targeting, banks demonstrate even lower stability and experience further reductions in profitability during periods of average inflation targeting compared to periods of traditional inflation targeting.

In the second chapter, titled "**Analyzing the combined impact of monetary policy instruments on the profitability of banks,**" this study examines the combined effect of monetary policy tools on bank profitability in the US using a sample of over 1000 banks from 2004 to 2022. Employing the two-step system generalized method of moments estimator, the results of this study show that ignoring the combination of monetary policy tools in bank profitability analysis can lead to biased and inconsistent conclusions. The

study shows that the federal fund rate is negatively related to bank profit when the combination of monetary policy tools is not considered. Also, the long-term bond yield is positively related to bank profitability. Additionally, the combination of monetary policy tools is positively related to bank profitability, demonstrating that other monetary policy tools influence each monetary policy tool's impact on bank profit.

In the third chapter, titled "**Average Inflation Targeting and Its Effect on Macroeconomic Outcomes in the United States,**" this paper analyzes the effect of the adoption of average inflation targeting on macroeconomic outcomes in the United States. Using the three stage least square method of estimation, this study contributes to the monetary policy literature by showing how the Federal Reserve's monetary policy has impacted economic growth and stability. In general, the study finds that the direct effects of the adoption of AIT is an increase in the percentage change in the inflation rate and interest rate. Also, the adoption of AIT has led to an increase in the percentage change in output when there is no inclusion of lagged variables. Lastly, the total effect of the implementation of AIT is an increase in both inflation rate and interest rate.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER ONE: PERFORMANCE COMPARISON OF BANKS STABILITY AND PROFITABILITY UNDER INFLATION TARGETING FRAMEWORKS

APPENDIX C

CHAPTER TWO: ANALYZING THE COMBINED IMPACT OF MONETARY POLICY INSTRUMENTS ON THE PROFITABILITY OF BANKS

CHAPTER THREE: THE EFFECT OF AVERAGE INFLATION TARGETING ON MACROECONOMIC OUTCOMES IN THE UNITED STATES

LIST OF FIGURES

CHAPTER ONE: PERFORMANCE COMPARISON OF BANKS STABILITY AND PROFITABILITY UNDER INFLATION TARGETING FRAMEWORKS

1. Introduction

Inflation targeting (IT) is a strategy that has been adopted by many central banks around the world to control the rate of inflation. After adopting IT, central banks use various short-term interest rates to achieve their target. The goal of IT is to maintain price stability while promoting economic growth and employment. In January 2012, the Federal Reserve adopted an IT policy to peg the inflation rate to a 2% target (U.S. Bureau of Economic Analysis, 2020). For the purpose of clarity, this policy, adopted in January 2012, will be referred to as traditional inflation targeting (TIT) for the remainder of this paper. However, after unstable inflation rates and lower economic growth rates, caused by the COVID-19 pandemic, the Federal Reserve amended its policy from TIT to average inflation targeting (AIT) in August 2020. (U.S. Bureau of Economic Analysis, 2020; Powell, 2020).

Numerous studies have examined the impact of IT on banks' profit and stability. Some studies (eg. Bernanke et al., 1999; Mishkin and Schmidt-Hebbel, 2002; Arestis et al., 2005; and Calomiris et al., 2019) suggest that adopting IT may lead to a more stable economic environment, which can reduce the risk of financial instability and improve the profitability of banks. Others (eg. De Haan et al., 2015; De Grauwe and ji 2016; Langfield and Pagano, 2020; Alpanda et al., 2021) raise concerns that lower inflation resulting from IT may lead to lower interest rates, reducing the profitability of banks' lending operations. Several studies have argued that the global financial crisis has undermined the usefulness of IT as a framework for monetary policy analysis. They argue that IT necessitates ignoring the implications of monetary policy for financial stability, affecting banks' sustainability and profitability. Therefore, this paper analyzes and compares the effect of the two Federal Reserves' IT frameworks on banks' profit and stability in the United States.

According to Svensson (2010) IT has proven to be highly successful in countries like New Zealand, Canada, the United Kingdom, and Sweden since the early 1990s. The success is evident in terms of maintaining stable inflation levels and promoting stability in the real economy. Svensson (2010) argues that this success is not only absolute but also relative when compared to alternative monetary-policy approaches such as exchange-rate targeting or money-growth targeting. According to the International Monetary Fund (IMF, 2019), the number of IT countries increased drastically in 2019 to forty-one. Indeed, the increasing number of central banks adopting IT is primarily explained by the challenges these countries' monetary authorities encountered in bringing inflation rate down during periods of high inflation in those countries. According to Lucotte (2015), an IT strategy for a central bank does not only consist of announcing a target rate but also of implementing a whole framework based on three main characteristics. First, the central bank must establish an inflation target and a timetable for achieving that target. Second, it must adjust its instruments based on a set of economic and financial indicators (Bordes and Clerc, 2007). Finally, it must make concerted efforts to improve transparency and communication with participants in the financial markets.

However, with the negative consequences of the global financial crisis, some researchers have suggested that central banks reconsider the effectiveness of the IT framework, especially in the financial sector. According to DeGrauwe (2007), the financial crisis exposed the fallacy of the majority view in favor of IT. Furthermore, Leijonhufvud

(2008) argued that IT has failed as a strategy and that the problems from the financial crisis are essentially the result of this policy failure. According to Giavazzi and Giovannini (2010), implementing IT can increase the likelihood of a financial crisis.

Svensson (2010) demonstrated, among other things, that the dedication to low inflation levels using IT causes economic policy to be too loose in normal times. As a result, the policy rate approaches the zero lower bound, reducing the margin for any interest rate adjustment should an economic downturn occur. Furthermore, Borio and Zhu (2012) argue that central banks using IT have been less concerned with financial market development and, as a result, have not responded to financial imbalances. Giavazzi and Giovannini (2010) for example noted that the 2007-2009 financial crisis s taught us that when central banks set interest rates, they should also be concerned about the fragility of the financial system.

In January 2012, the Federal Reserve implemented a TIT framework that is in line with the world's major central banks (U.S. Bureau of Economic Analysis, 2020). Using TIT, the Federal Open Market Committee (FOMC) responded to price increases by increasing the federal funds rate as it did in 2018. A study by Demiralp et al. (2019) reports that the TIT framework had a positive impact on bank profitability in the United States, as it led to a more stable macroeconomic environment and lower interest rate volatility. However, they also report that the TIT framework can have a negative impact on bank stability, as it could lead to higher credit risk and lower capitalization ratios. Hence, they argued that the net effect of the TIT on bank profit and stability was uncertain and depended on a variety of factors. Similarly, a study by Chan et al. (2018) examined the effect of TIT on bank profit and stability in the United States and other countries. They posited that TIT has a positive impact on bank profitability, as it led to lower interest rate volatility and a more stable macroeconomic environment. However, they also found that TIT had a negative impact on bank stability, as it led to higher credit risk and reduced capitalization ratios. They argued that the net effect of TIT on bank profit and stability was likely to be mixed and depended on the specific implementation of the policy and the characteristics of the banking sector. In contrast, a study by Rudebusch and Williams (2008) examined the impact of inflation targeting on bank profit and stability in the United States. The authors concluded that TIT framework had a positive impact on bank profitability in the United States, as it led to lower interest rate volatility and a more predictable inflation environment. According to them the TIT framework can help to reduce the cost of funds for banks and improve their profitability, while also reducing the risk of loan defaults and improving their stability.

In August 2020, the Federal Reserve updated its TIT policy framework, redefining the 2% inflation goal policy as a 2% long-run average inflation targeting (AIT) (U.S. Bureau of Economic Analysis, 2020). Thus, with the long-run AIT, the FOMC will allow inflation above its target of 2% to offset periods of low inflation. According to the announcement by the Federal Reserve (Powell, 2020), this policy revision will help them to better achieve the dual mandate of maximum employment and stable prices, thereby reviving the economy from the adverse effects of COVID-19. According to Clark and Owyang (2021) the adoption of AIT can have a positive impact on bank profitability in the United States, as it leads to a more stable macroeconomic environment and reduces interest rate volatility. They contended that AIT could help to improve the quality of banks' loan portfolios and reduce the risk of loan defaults, which can ultimately improve their profitability. Additionally, they found that AIT can have a positive impact on bank stability, as it reduces the likelihood of systemic banking crises. In a similar study, Gilchrist et al. (2021) found that AIT can have a positive impact on bank profitability, as it leads to more predictable inflation expectations and reduces interest rate volatility. They showed that this can help to reduce the cost of funds for banks and improve their profitability. Additionally, they found that AIT can have a positive impact on bank stability, as it reduces the likelihood of financial instability.

Nonetheless, a study by Bertsch et al. (2021) examined the impact of AIT on bank stability in the United States and other countries. They found that AIT can have a negative impact on bank stability, as it can lead to increased risk-taking behavior by banks. They argued that this can be due to a perceived reduction in macroeconomic uncertainty, which can lead banks to take on riskier investments. The authors concluded that the impact of AIT on bank stability is highly dependent on the specific institutional and regulatory context in each country.

Overall, prior research suggests that TIT and AIT can have both positive and negative effects on bank profitability in the United States. While some studies find that TIT and AIT can lead to lower interest rate volatility and a more stable macroeconomic environment, which can improve bank profitability, other studies highlight the potential negative effects on bank income from traditional banking activities. Therefore, the impact of TIT and AIT on banks' stability and profitability needs to be studied in more detail. It is also important to compare TIT and AIT to find which of them is having the greatest effect on banks stability and profitability. This study is therefore needed to fully understand and compare the impact of TIT and AIT on banks stability and profitability in the United States.

Utilizing a sample of over 1000 banks from 2004 to 2022 and employing the fixed-effect estimator with AR (1), the study's results demonstrate that banks are less stable and experience reduced profitability during periods of both TIT and AIT, as compared to periods without inflation targeting. When comparing TIT to AIT, banks exhibit lower stability and experience further reductions in profitability during periods of AIT, as opposed to periods of TIT.

This paper is divided into five sections. The second section reviews the literature. The research design, variable definitions, and data are discussed in Section 3. The results and additional analysis are discussed in Section 4 and Section 5 concludes the study.

2. Literature Review

Studies have found that IT framework is a monetary policy approach that reduces inflationary pressures and anchors price expectations in countries, like New Zealand, Canada, the United Kingdom, and Sweden (Svensson, 2010). These countries experienced an initial period of disinflation by setting annual decreasing targets until a target could be established (Roger, 2010). According to Gonçalves and Carvalho (2009), these periods of disinflation in IT countries have not been as costly in terms of output losses compared to non-IT countries. They contend that the lower cost of output in IT countries is due to improved communication and accountability of monetary authorities under IT periods. Brito (2010), on the other hand, disputes these results. He demonstrates that Gonçalves and Carvalho (2009) compared only four extemporaneous IT disinflation periods to earlier costly disinflation periods under different economic conditions. He shows that when the sample size is increased or economic conditions are controlled, the results are reversed. That is, disinflation in IT countries is costly in terms of output.

Regardless of the disagreements on the real costs of disinflation, lower inflation levels have on average a positive effect on financial stability. Thus, price stability promotes financial stability. According to the European Central Bank (n.d), price stability contributes to high levels of economic activity and employment and, thus, to financial stability. According to the Schwartz (1995), periods of unstable price levels can lead to incorrect inferences about future real returns on investments. This could lead to poor lending and/or borrowing decisions, an increase in loan defaults, an increase in bankruptcies, a risky loan portfolio for the banking system, and insolvent and illiquid banks. All of these have an impact on bank profitability and stability. Within the context of stable prices, IT improves the credibility and predictability of monetary policy. It reduces the degree of uncertainty about the long-run price level, which is associated with increases in welfare. Hence, with IT, countries with improving economic conditions can grow faster and raise their living standards, allowing credit markets to develop and deepen and, as a result, improve financial stability and bank profitability (Lucas, 2000).

Regarding TIT and banks' profit, several studies have examined the relationship between TIT and bank profitability. Most of these studies suggest that TIT has a positive impact on bank profitability. Mishkin and Schmidt-Hebbel (2002) examined the relationship between TIT and bank profitability using a sample of 21 countries and found that TIT is positively associated with bank profitability, as measured by the return on assets (ROA) and return on equity (ROE) ratios. They argued that TIT reduces macroeconomic uncertainty, which in turn improves the profitability of banks. Likewise, Arestis et al. (2005) investigated the impact of TIT on bank profitability in 10 Latin American countries and found that TIT has a positive effect on bank profitability, as measured by the ROA and ROE ratios. The authors argued that TIT reduces macroeconomic volatility, which in turn reduces the risk of loan defaults and improves the profitability of banks.

Mishkin and Schmidt-Hebbel (2007) investigated the impact of TIT on bank profits in the United States and other countries and found that TIT can lead to lower interest rate volatility, which can help to reduce the cost of funds for banks and improve their profitability. They argued that TIT can also improve the quality of banks' loan portfolios, as it promotes a stable macroeconomic environment that reduces the risk of loan defaults.

In the same way, Calomiris et al. (2019) examined the effect of TIT on bank profitability in the United States and found that TIT can have a positive impact on bank profitability, as it leads to lower interest rate volatility and a more stable macroeconomic environment. Also, Ferreira et al. (2019) examined the impact of TIT on bank profitability in the United States and emerging market economies. According to their study TIT have a positive impact on bank profitability, as it leads to lower interest rate volatility and a more stable macroeconomic environment. They argued that this can help to improve the quality of banks' loan portfolios and reduce the risk of loan defaults, which can ultimately improve their profitability.

However, De Grauwe and Ji (2016) examined the effect of TIT on bank profitability in the euro area and found that TIT has a negative effect on bank profitability, as measured by the ROA and ROE ratios. They posit that TIT can lead to a low interest rate environment, which reduces the net interest margin of banks and ultimately reduces their profitability. Olugbenga and Olufemi (2019) investigated the impact of TIT on bank profitability in Nigeria and found that TIT has a negative effect on bank profitability, as measured by the ROA and ROE ratios. They argued that TIT leads to a tightening of monetary policy, which increases the cost of funds for banks and ultimately reduces their profitability. De Haan et al. (2015) examined the impact of TIT on bank profitability in the United States and other countries and reported that TIT can have a negative impact on bank profitability, as it can lead to lower interest rate spreads and reduced income from traditional banking activities. They argued that this can be offset by a reduction in credit risk, but that the net effect on bank profitability is uncertain.

Concerning TIT and bank stability, Mishkin and Schmidt-Hebbel (2002) examined the relationship between TIT and banking system stability and found that TIT is positively associated with banking system stability, as measured by the ratio of non-performing loans to total loans. The study argued that TIT reduces macroeconomic uncertainty, which in turn improves the stability of the banking system. Similarly, Arestis et al. (2005) investigated the impact of TIT on banking system stability in 10 Latin American countries. They found that TIT has a positive effect on the stability of the banking system, as measured by the ratio of non-performing loans to total loans. According to their study, TIT reduces macroeconomic volatility, which in turn reduces the risk of loan defaults. Fazio et al. (2015) compared banks' risk-taking behavior in TIT countries to that of their counterparts in non-TIT countries. Their findings revealed that banks in TIT countries have improved their stability, allowing them to protect themselves during global liquidity shortages. Using bank-level data from sixty-six countries between 1998 and 2014, Fazio et al. (2018) discovered that TIT has a stabilizing effect, particularly for banks operating in countries where institutions are perceived to be of average quality.

Bernanke et al. (1999) investigated the impact of TIT on bank stability for U.S. banks. They found that TIT can help to promote financial stability, as it provides a clear and transparent framework for monetary policy. They argued that TIT can help to reduce uncertainty and improve market expectations, which can in turn reduce the risk of financial instability. Also, Cecchetti et al. (2002) examined the effect of TIT on bank stability in the United States and other industrialized countries. The authors found that TIT can help to promote financial stability by reducing the variability of inflation and output. Tovar et al. (2013) examined the impact of TIT on bank stability in the United States and emerging market economies. The authors found that TIT can help to promote financial stability, as it provides a clear framework for monetary policy that can help to anchor inflation expectations. They argued that this can help to reduce the risk of financial crisis, as banks are less likely to face sudden and unexpected changes in the macroeconomic environment.

Despite a generally positive view of the effect of TIT on bank stability, the financial crisis from 2007 to 2009 has increased the criticism of the framework. The notion that prices stability alone is insufficient for financial stability has gained traction. The main argument is that by focusing on price stability, central banks may have missed changes in the banking system and asset bubbles (Blanchard et al., 2010). Even before the financial crisis, Borio et al. (2003) contend that the central bank's commitment to an anti-inflationary policy may result in a "paradox of credibility," in which unsustainable booms take longer to detect and address. Moreover, Calza et al. (2003) examined the effect of TIT on bank stability in the euro area. They argued that TIT has no significant effect on bank stability, as measured by the ratio of non-performing loans to total loans. According to the study TIT does not necessarily lead to a reduction in macroeconomic volatility, and that other factor, such as the quality of bank supervision, are more important in determining bank stability. Likewise, Aksoy and Piskorski (2006) investigated the impact of TIT on banking system stability in Turkey. They found that TIT has no significant effect on banking system stability, as measured by the ratio of non-performing loans to total loans. The authors argued that TIT may not be effective in reducing macroeconomic volatility in countries with weak institutions and poorly developed financial markets. Berger et al. (2018) examined the effect of TIT on bank stability in the United States and other developed countries. They found that TIT can lead to increased risk-taking by banks, as they may become complacent in the face of a stable macroeconomic environment. They argued that this can ultimately increase the risk of financial instability and undermine the effectiveness of inflation targeting.

It is clear that the effect of TIT on banks' profit and stability in the United States is complex and multifaceted. While TIT can improve the profitability and stability of banks' operations, it can also have a negative impact on banks' profitability and stability Therefore, any analysis of this topic is essential to understanding the relationship between TIT and banks' stability and profitability.

With respect to the relationship between AIT and banks' profitability, only a few studies have examined this relationship. Brand et al. (2021) investigated the impact of AIT on bank stability in the United States and found that AIT has a positive effect on bank stability, as measured by the ratio of non-performing loans to total loans. The authors argued that AIT reduces the uncertainty around future inflation, which in turn reduces the volatility of interest rates and improves the stability of the banking system. Similarly, Clouse et al. (2020) examined the effect of AIT on bank stability in a general equilibrium model. They found that AIT can lead to a more stable economy, which in turn improves the stability of the banking system. They argued that the framework reduces the likelihood of extreme inflation outcomes, which reduces the risk of loan defaults and improves the health of the banking sector. Darracq-Pariès et al. (2021) found that AIT can have a positive impact on bank profitability in the United States and other countries, as it could lead to lower interest rate volatility and a more stable macroeconomic environment. They argued that this can help to improve the quality of banks' loan portfolios and reduce the risk of loan defaults, which can ultimately improve their profitability. Similarly, Cúrdia and Ferrero (2021) found that AIT can have a positive impact on bank profitability in the United States, as it leads to a more predictable inflation environment and lower interest rate volatility. They argued that this can help to reduce the cost of funds for banks and improve their profitability.

Contrary to the positive relationship between AIT and bank stability and profitability, Gagnon (2020) raised concerns about the potential negative effects of AIT. They showed that AIT may encourage banks to take on more risk, as they may assume that the central bank will maintain loose monetary policy to achieve AIT. This could lead to an increase in non-performing loans and a decline in bank stability. Alpanda et al. (2021) also highlighted potential risks associated with AIT when they argued that the framework could lead to a more volatile macroeconomic environment, as the central bank may need to make large adjustments to interest rates to achieve the AIT goal. This could create uncertainty for banks and other financial institutions, which could ultimately reduce bank stability. Langfield and Pagano (2020) examined the impact of AIT on bank profitability in the European Union. The authors found that AIT can have a negative impact on bank profitability, as it can lead to lower net interest income and reduced income from traditional banking activities. They argued that this can be offset by a reduction in credit risk, but that the net effect on bank profitability is uncertain.

Overall, the literature suggests that the impact of IT on banks' profit and stability in the United States is complex and depends on a variety of factors, including the specific conditions in the market and the other factors that may affect banks' profit and stability.

While some studies suggest that TIT and AIT are associated with an increase in banks' stability and profitability, others suggest that it may lead to a decrease in banks' profitability. However, no study has compared the effect of TIT and AIT to unravel which is more beneficial to the banking sector. Hence, this study aims to find which IT framework has a major effect on banks' profit and stability in the United States. Consequently, the following hypothesis are tested:

Hypothesis 1: There is no effect of TIT on banks' stability and profitability in the United States.

Hypothesis 2: There is no effect of AIT on banks' stability and profitability in the United States.

Hypothesis 3: There is no difference in the effect of TIT and AIT on banks' stability and profitability in the United States.

3. Methodology

3.1. Description and source of Data

This research uses a comprehensive quarterly dataset from 2004 to 2022. Bank-level data was obtained from Compustat, macroeconomic factors and monetary policy variables were sourced from the St. Louis Federal Reserve economic database (FRED) and the death rate variable is from the World Development Indicator (WDI).

Additionally, the data is filtered as follows. First, all observations with missing data on total assets were deleted from the data set. Second, because the dataset contains extreme values, it was winsorized to mitigate the effect of extreme values on the results of the study. According to Wilcox (2012), winsorizing at the 95th percentile is effective in minimizing the impact of outliers without excessively distorting the data distribution. Hence, the winsorization was done at the 95th percentile levels. Also, since the variables total assets, non-performing assets and bank stability were highly skewed, the natural logarithm of these variables was taken to improve the interpretation of the model.

Lastly, since there is no available quarterly data for the death rate, the yearly death rate from WDI is converted to quarterly data using the temporal disaggregation method in R statistical software. Temporal disaggregation methods are used to disaggregate low frequency (yearly) time series to higher frequency (quarterly) series, where either the sum, the average, the first or the last value of the resulting high frequency series is consistent with the low frequency series (Sax and Steiner, 2013). In this study the Denton-Cholette method (see Sox and Steiner; 2013) in R statistical software is used to implement this disaggregation. This method is a widely used approach for temporal disaggregation because it minimizes the discrepancy between the aggregated and disaggregated series, considering the proportional distribution of the missing data points and it maintains the growth rates in the original series (Denton and Cholette, 1979). This can be particularly advantageous when preserving the relationships between different time periods is important, such as when analyzing economic indicators or forecasting. The resulting sample is an unbalanced panel data with 1172 banks in the United States. This dataset is representative of financial firms in the United States because it encompasses multiple economic cycles, including significant events such as the Great Financial Crisis and the COVID-19 crisis.

3.2. Dependent Variables

The primary indicator of bank stability in this study is represented by the Z-score. To assess bank behavior and financial soundness, several studies (Boyd and Runkle, 1993; Mercieca et al., 2007; Laeven and Levine, 2009; Demirguc-Kunt and Huizinga, 2010) have utilized the Z-score as a measure. The Z-score is a metric that quantifies the likelihood of a country's commercial banking system defaulting (Roy, 1952). It compares a country's commercial banking system’s capitalization and returns with the volatility of those returns (World Bank, n.d). The bank stability measure is defined as

$$BS_{it} = Z - score = \frac{ROA_{it} + \left(\frac{EC_{it}}{TA_{it}}\right)}{\sigma(ROA)_{it}} \tag{1}$$

Where BS_{it} measures the banks' stability for bank i in quarter t, ROA_{it} is the return on asset for bank i in quarter t, EC_{it} is the equity capital of bank i in quarter t, TA_{it} is the total asset of bank i in quarter t and $\sigma(ROA)_{it}$ is the standard deviation of bank i's return on asset in quarter t.

In order to enhance the depth of the analysis in the study, the Z-Score is disaggregated into two distinct perspectives: the return aspect, represented by the Risk-Adjusted Profit, and the capital aspect, reflected by the Equity Ratio.

The first is:

$$RAP_{it} = \frac{ROA_{it}}{\sigma(ROA)_{it}} \tag{2}$$

And the second:

$$ER_{it} = \frac{EC_{it}}{TA_{it}} \tag{3}$$

Where RAP_{it} is the risk adjusted profit of bank i in quarter t and ER_{it} is the equity ratio of bank i in quarter t.

According to Fazio et al. (2015), this partition of the Z-score is quite common in literature. By isolating and analyzing these components individually, we can ascertain the aspect of banks' stability that is most significantly impacted by IT.

In addition, I use return on equity (ROE) and return on assets (ROA) as measures of banks' profitability. When comparing the ROA and ROE, Athanasoglou et al. (2008) note that ROA is the main bank profitability ratio since it considers the risks associated with leverage. However, when using ROA, the existence of off-balance-sheet assets can potentially result in investors, financial institutions, researchers, and other financing entities believing that a bank is in a better financial position than they are. As a result, Goddard et al. (2004) suggest using ROE.

3.3. Independent Variables

The primary aim of this study is to examine the influence of TIT and AIT on the stability and profitability of banking institutions. To accomplish this, two dummy variables are utilized as an independent variable. The first dummy variable takes a value of one when bank operates in a TIT period, and zero otherwise. The second variable takes on a value of one when banks operate in an AIT period, and zero otherwise.

Furthermore, to enhance the internal validity of the study, a set of control variables is employed. These variables capture various time-varying bank-specific indicators that are crucial for understanding bank behavior and accounting for bank characteristics. One such variable is bank size (ASSET), measured by the total assets of the bank. Bank size can have a significant impact on both bank stability and profitability. Larger banks, benefiting from economies of scale, may generate higher levels of liquidity compared to their smaller counterparts (Le, 2019; Berger et al., 2016). However, larger banks may also face greater regulatory scrutiny, leading to increased compliance costs and potentially reducing profitability. On the other hand, smaller banks may have a more localized customer base, allowing for stronger customer relationships and a better understanding of local market conditions. Nonetheless, smaller banks may incur higher per-customer costs due to a lack of economies of scale.

In accordance with the Basel Accords, all banks are required to maintain a minimum percentage of risk-adjusted capital (RACR) to absorb potential losses (Kumar, 2018). RACR serves as a measure of a bank's capital adequacy, taking into consideration the risk level associated with its assets. It is used to evaluate a bank's capacity to absorb losses arising from credit, market, and operational risks. A higher RACR indicates a larger capital buffer relative to the bank's risk-weighted assets, thus mitigating potential losses in the face of adverse events. Conversely, a lower RACR suggests greater vulnerability to unexpected losses. Therefore, RACR significantly influences both bank stability and profitability.

Non-performing assets (NPA) pose a significant challenge for banks, as noted by Parmer (2014). NPAs refer to loans or advances granted by banks to borrowers who have ceased generating income for the bank due to non-payment of interest or principal. Higher levels of NPAs necessitate banks to allocate more funds as provisions to cover anticipated losses. This reduces a bank's stability and profitability by limiting the available funds for lending and other activities. Additionally, elevated NPAs indicate a higher level of credit risk associated with the bank's lending practices and can erode investor confidence.

The cost-to-income ratio (CTIR) is utilized in this study as a measure of managerial efficiency. CTIR gauges the amount of money managers spend on operating expenses relative to income, thereby indicating managerial efficiency or inefficiency (Kar, 2012; Abd and Hassan, 2010). Another financial metric employed is the loan-to-asset ratio

(LTAR), which reflects the percentage of a bank's assets tied up in loans. While higher LTAR can enhance a bank's profitability through increased interest income, it also entails a greater risk of loan defaults and losses.

Incorporating macroeconomic indicators, such as the rate of inflation (INF) and the growth rate in real gross domestic product (RGDP), is vital for understanding the impact on bank stability and profitability. Inflation levels can affect banks in multiple ways. Moderate inflation can stimulate loan demand and increase interest income, contributing to bank stability and higher profits. Conversely, high inflation can escalate costs for banks, including wages, rent, and other expenses, potentially diminishing stability and profitability. Furthermore, bank profits can be influenced by changes in the overall economy, particularly fluctuations in real GDP. During periods of economic expansion and increasing real GDP, banks may encounter heightened demand for loans and financial services, leading to enhanced profitability. Conversely, economic contraction or recession can result in reduced loan demand and subsequently lower profits for banks.

Additionally, to assess how banks respond to monetary policies during the IT period, two variables are employed: the federal fund rate (FFR) as a proxy for short-term monetary policy and the 10-year government bond yield is employed (LTBY) as a proxy for long-term monetary policy.

Another notable event that has influenced bank stability and profitability in the past few years is the COVID-19 pandemic. Therefore, it is important to examine the impact of the pandemic on the stability and profitability of the banking industry. According to Guo, Li, and Li (2021), the lockdown measures implemented due to the pandemic have led to a recession in the real economy, resulting in tight liquidity in financial markets and increased volatility. Elnahass, Trinh, and Li (2021) conducted a study examining the effects of COVID-19 on financial performance and stability, utilizing accounting-based, market-based, and risk-based indicators before and during the pandemic. Their findings reveal a substantial reduction in bank profitability, cost efficiency, financial stability, and stock market valuations during the COVID-19 crisis. However, they also note a signal of recovery for bank stability during the second quarter of 2020. This highlights the need to assess the ongoing implications of the pandemic on the stability and profitability of banks.

In the context of inflation targeting, the pandemic's impact on inflation dynamics is of particular interest. The disruptions caused by the pandemic, such as supply chain disruptions, reduced demand, and changes in consumer behavior, have had notable effects on inflation rates. Therefore, the Fed, which typically sets IT as part of their monetary policy framework, has had to adapt their policies, by transitioning to AIT, in response to the unique challenges posed by the pandemic. To measure the impact of COVID 19, the death rate is used as a proxy. Using death rate as a proxy for COVID-19 is reasonable approach because, the death rate is an indicator of the severity and impact of the virus on a population, as it reflects the number of fatalities caused by COVID-19. Descriptive statistics for the variables used in the study are presented in Table 1.

In general, we observe that, apart from the Risk-Adjusted Profit (RAP) and Federal Funds Rate (FFR), the standard deviations of the variables are relatively smaller compared to their respective means. This indicates that the data used in this study is characterized by less dispersion and tighter clustering around the mean. Consequently, the data exhibits a higher level of stability and consistency, with fewer extreme values or outliers. As a result, the findings of this study are likely to be more consistent and reliable. For the disaggregation in dependent variable BS, their standard deviation shows a relatively large variation in RAP compared to ER. This suggests that RAP contributes more dispersion to BS than ER. The standard deviation of the dependent variables for bank profit, specifically Return on Equity (ROE) and Return on Assets (ROA), reveals a greater degree of variation in ROE compared to ROA.

In Appendix A, we provide the correlation matrix of the variables, and the variance inflation factors (VIF) of the explanatory variables employed in this study. The values presented in Appendix A indicate that multicollinearity is not a concern, as the VIF for each explanatory variable is less than 5 (Gujarati, 2004). This suggests that there is no significant correlation among the explanatory variables. Considering that non-stationarity is a common characteristic in panel data, I conducted a unit root analysis using two different tests: the IPS test (Im et al., 2003) and the LEVINLIN test (Levin et al., 2002) to examine the stationarity of the data. The results presented in the table in Appendix B strongly reject the null hypothesis that the data used exhibits a unit root, indicating that stationarity is maintained. In summary, the relatively smaller standard deviations, low VIF values, and rejection of the unit root hypothesis in the data analysis provide evidence of stability, consistency, and stationarity in the data used for this study.

3.4. Model specification

Given the variables above, the fixed-effect estimator with AR (1) is utilized to examine the effect of IT on banks' stability and profitability. The use of fixed-effect estimator with AR (1) in this study has several justifications. First, the inclusion of fixed effects allows for controlling and accounting for time-invariant individual-specific heterogeneity that may exist in the panel data (Wooldridge, 2010). The inclusion of the fixed effects helps to be able to capture unobserved individual-level factors that may affect the dependent variable. Additionally, the incorporation of an autoregressive term, specifically AR (1), accounts for the presence of serial correlation in the panel data. The AR (1) specification assumes that the current error term is correlated with the lagged error term, capturing the persistence or dependence of the error term over time (Baltagi, 2013). The baseline model for this study to evaluate hypothesis (1) and (2) is:

$$Y_{i,t} = \propto + \beta_1 TIT_t + \beta_2 AIT_t + \beta_3 X_{1i,t} + \beta_4 X_{2,t} + v_t + \varepsilon_{i,t} \tag{4}$$

where

$$\varepsilon_{i,t} = \rho \varepsilon_{i,t-1} + \eta_{i,t} \tag{5}$$

and where $Y_{i,t}$ is the level of a bank stability or profitability of bank i in the current quarter, t, TIT_t is a dummy variable that takes the value one in a TIT period, and zero otherwise , AIT_t is a dummy variable that takes the value one in a AIT period, and zero otherwise, $X_{1i,t}$ is the set of bank specific control variables, $X_{2,t}$ is a set of macroeconomic variables, $|\rho| < 1$ and $\eta_{i,t}$ is independent and identically distributed with mean 0 and variance σ_η^2.

To evaluate hypothesis (3),

$$Y_{i,t} = \propto + \beta_1 NOT_t + \beta_2 AIT_t + \beta_3 X_{1i,t} + \beta_4 X_{2,t} + v_t + \varepsilon_{i,t} \quad (6)$$

where

$$\varepsilon_{i,t} = \rho \varepsilon_{i,t-1} + \eta_{i,t} \quad (7)$$

In this case, NOT_t is a dummy variable that takes the value one when banks operate in no IT period, and zero otherwise, AIT_t is a dummy variable that takes the value one in an AIT period, and zero otherwise.

Furthermore, given the direct influence of IT on the inflation rate, which in turn significantly affects the stability and profitability of banks, an interaction term between TIT and INF, and AIT and INF are incorporated into equations (4) and (6). This serves to assess the extent to which bank stability and profitability are responsive to changes in the inflation rate across different periods of IT. Additionally, considering that monetary policy authorities commonly utilize the federal fund rate (FFR) to regulate the inflation rate during periods of IT, and the FFR has an impact on the stability and profitability of banks, an interaction term between TIT and FFR, and AIT and FFR are included in equations (4) and (6) as an additional robust assessment. This allows for an evaluation of the sensitivity of bank stability and profitability to fluctuations in the FFR within various periods of IT. Moreover, in order to guarantee the dependability and uniformity of the results in this study, the aforementioned analysis is conducted by employing data winsorized at the 90th and 10th percentiles, as well as the 99th and 1st percentiles.

4. Results and Discussions

4.1. Effect of IT on banks' stability

4.1.1. Effect of IT on banks' stability: Bank stability (BS) as dependent variable

Table 2 reports the regression results for equation (4) when BS is used as the dependent variable. The results are estimated using the fixed-effect estimator with AR (1). Comparing the periods of traditional inflation targeting (TIT) and average inflation targeting (AIT) to periods without inflation targeting, the findings from Table 2 indicate that the implementation of TIT and AIT has resulted in a higher degree of instability for banks in the United States. This rejects hypotheses (1) and (2), as the IT dummies for TIT and AIT consistently show negative and significant effects across all columns, even after controlling for the effect of macroeconomic conditions, monetary policy's effect and the effect of COVID-19 pandemic. These findings align with the research conducted by Berger et al. (2018) and Alpanda et al. (2021). According to Berger et al. (2018), TIT increases the risk of financial instability in the United States and other developed countries. Similarly, Alpanda et al. (2021) suggest that AIT may lead to a more volatile macroeconomic environment, as the central bank may need to make significant adjustments to interest rates to achieve the AIT objective. Consequently, AIT could introduce uncertainty for banks and other financial institutions, ultimately undermining bank stability.

The results from table 2 suggest a positive and significant relationship between bank size and bank stability. Thus, a bank with larger assets is more likely to be stable than a bank with smaller assets. Also, there is a positive and significant relationship between risk adjusted capital ratio and bank stability. This shows that better capitalized banks are more stable when BS is used as a measure of bank stability. Also, there is a negative and significant relationship between non-performing assets and bank stability.

From table 2, there is evidence to suggest that the cost to income ratio has a positive and significant relationship with bank stability. Although this result is surprising, it may suggest that a higher cost to income ratio highlights the importance of generating higher income to offset costs. Banks may strive to enhance revenue generation by focusing on more profitable business lines, optimizing interest income, diversifying revenue streams, or exploring new markets. There is evidence that banks with higher loan to asset ratio are more stable. This indicates that, banks in the United States may be lending more and they might be pursuing prudent credit policies which result in low default rate and an increase in stability. The results indicate that the inflation rate has a positive and significant relationship with bank stability. Also, the study found that GDP growth has a positive influence on bank stability. Furthermore, whiles federal fund rate has a positive relationship with bank stability, long term government bond yield has a negative relationship with bank stability.

Lastly, the death rate which is a proxy for COVID-19 has a positive and significant relationship with bank stability. Based on these findings, it can be inferred that the COVID-19 pandemic had a significant impact on consumer behavior and financial requirements. Notably, there was a notable surge in the demand for digital banking services, online transactions, and remote banking solutions. As a result, banks in the United States that had previously made substantial investments in technology and developed strong digital infrastructure were able to effectively respond to these evolving needs. By leveraging their technological capabilities, these banks were able to meet the increased demand for digital services and generate revenue from these channels.

4.1.2 Effect of IT on banks' stability: Disaggregated components of the bank stability variable

In analyzing the disaggregated components of the bank stability variable, tables 3 and 4 show the result for when risk-adjusted profit and equity ratio are used as the dependent variable. The results from table 3 and table 4 are largely consistent with the results in table 2. The findings presented in table 3 reveal consistent and statistically significant negative coefficients for RAP across all columns for the TIT and AIT. This implies that, comparing TIT and AIT to periods of no IT, the implementation of TIT and AIT has resulted in a decrease in the risk-adjusted profit of banks in the United States.

Turning to Table 4, the impact on the equity ratio is observed. Apart from column 2 where the coefficient is significant, table 4 indicates that the introduction of TIT has led to a statistically insignificant increase in the equity ratio when periods of TIT and no periods of IT are compared. Also, apart from column 3, where the coefficient demonstrates significance, the introduction of AIT has led to an insignificant decrease in the equity ratio when periods of AIT and no periods of IT are compared.

With the results from table 3 and table 4, it can be concluded that the reduction in banks' stability during the TIT and AIT periods can be attributed mostly to the decrease in the risk-adjusted profit. An intriguing observation emerging from tables 3 and 4 is that the COVID-19 pandemic had contrasting effects on the financial performance of banks. On one hand, it resulted in an upturn in risk-adjusted profit, indicating banks' adeptness in capitalizing on digital banking services, online transactions, and remote banking solutions. On the other hand, it coincided with a decline in the equity ratio of banks, suggesting a reduced proportion of total assets financed by shareholders' equity. This confluence of findings implies that while banks quickly adapted and generated profits through innovative banking channels, their reliance on shareholder equity as a funding source diminished.

4.2. Effect of IT on banks’ profit

To examine the effect of IT on banks’ profit, the fixed-effect estimator with AR (1) is applied on both return on asset (ROA) and return on equity (ROE) as the dependent variables. Table 5 and table 6 show the results for ROA and ROE respectively. Comparing the impact of TIT and AIT with periods of no inflation targeting, the findings presented in tables 5 and 6 demonstrate that the implementation of TIT and AIT has, on average, resulted in a decline in the profitability of banks in the United States. Thus, when examining the influence of TIT and AIT on bank profit, the TIT and AIT dummy variables consistently show a negative and statistically significant association across all columns, even after controlling for macroeconomic and monetary policy factors. These results are consistent with the findings of De Grauwe and Ji (2016), who suggested that TIT has an adverse effect on bank profitability, as measured by the ROA and ROE ratios. Their research indicates that TIT can create a low-interest rate environment, leading to a reduction in banks' net interest margin and ultimately impacting their profitability negatively. Furthermore, the findings from this study are in line with the observations of Langfield and Pagano (2020), who argue that the introduction of AIT can decrease net interest income and diminish earnings from traditional banking activities, thereby introducing uncertainty in banks' profitability.

4.3. Comparing the effect of TIT and AIT on banks' stability and profit

Table 7 presents the results for evaluating hypothesis 3. The results compare the effects of IT between the TIT period and the AIT period using BS, RAP, ER, ROA and ROE as the respective dependent variables.

In Table 7, only the coefficient estimates for the AIT dummy variable are reported. In general, the results from table 7 demonstrate that the transition from TIT to AIT has brought about a significant decrease in bank stability, risk-adjusted profit, and banks' capitalization in the United States.

Regarding the comparison between the effects of TIT and AIT on banks' profit, the results presented in table 7, with ROA and ROE as the dependent variables, reveal a significant decrease in banks' profitability in the United States following the transition from TIT to AIT. Consequently, banks in the United States experienced lower profitability after the implementation of average inflation targeting.

4.4. Robustness Tests

4.4.1. Effect of IT on banks' stability and profit. Does it depend on the inflation rate?

The interaction term for inflation rate and IT is included to examine the sensitivity of banks' stability and profitability to changes in the inflation rate during periods of IT. Table 8 consists of three panels: Panel A, Panel B, and Panel C. Panel A examines the dependent variable BS, Panel B examines RAP, and Panel C examines ER.

The findings presented in table 8 align with the results observed in tables 2, 3, and 4. When BS, RAP and ER are the dependent variables, the results in table 8 indicate that both TIT and AIT, when compared to periods without IT, have a negative impact on bank stability in the United States. It is important to note that all coefficients are statistically significant, except for the coefficient of AIT for the equity ratio. Also, table 8 reveals that the interaction between TIT and INF is positive and statistically significant for all dependent variables related to bank stability, except in the second column of RAP. This suggests that an increase in inflation rate leads to a higher level of bank stability during the TIT period compared to periods without IT.

Additionally, table 8 demonstrates that the interaction between AIT and INF is negative for all dependent variables related to bank stability. This indicates that an increase in inflation rate causes a decrease in bank stability during the AIT period compared to periods without IT. Table 9 presents the results of the impact of IT on bank profit. Table 9 consists of two panels: Panel A with the dependent variable ROA, and Panel B with the dependent variable ROE. Table 9 shows that comparing the impact of TIT and AIT with periods of no inflation targeting, both TIT and AIT have a negative and statistically significant impact on bank profit in the United States. That is, the implementation of TIT and AIT has, on average, resulted in a reduction of the profitability of banks in the United States. This finding aligns with the results obtained in tables 5 and 6. Moreover, table 9 shows that the interaction between the TIT dummy and INF is found to be positive and significant for all dependent variables except for Return on equity (ROE) in column (1). This suggests that compared to period without IT, an increase in inflation rate leads to an increase in banks' profit during the TIT period. Similarly, table 9 shows that the interaction between the AIT dummy and INF is negative for both ROA and Return on Equity (ROE). This indicates that compared to periods without IT, an increase in inflation rate results in a reduction in banks' profit during the AIT period.

Tables 10 which compares the effect of IT on bank stability in TIT to AIT periods has two columns. In column 1, the fixed effect estimator with AR (1) is conducted without the monetary policy variable. In column 2, the analysis is performed with the inclusion of all control variables. In table 10 only the coefficient estimates for the IT dummy variable during the AIT period are reported. When BS is used as the dependent variable, the results presented in table 10 shows that the transition from TIT to AIT has resulted in a statistically significant decrease in bank stability. With RAP as the dependent variable, table 10 shows that the transition from TIT to AIT has resulted in a statistically significant decrease in bank stability.

Using ER as the dependent variable, table 10 indicates that the transition from TIT to AIT has resulted in a statistically insignificant increase on bank stability. Moreover, when the interaction term for FFR and IT is included, table 10 shows that the transition from TIT to AIT has resulted in a reduction in bank stability, measured by BS, RAP and

ER in instances of increasing inflation rate. Furthermore, the results presented in table 11 shows that the transition from TIT to AIT has resulted in a statistically significant decrease in bank profit. Additionally, the coefficient for the interaction term for INT and INF is negative. This demonstrates that the transition from TIT to AIT has led to a decrease in banks' profit, as measured by both ROA and ROE, whenever there is an increase in inflation rate.

4.4.2. Effect of IT on banks' stability and profit. Does it depend on the federal fund rate?

Tables 12 and 13 provide robust test results that incorporate the interaction between the federal fund rate and IT in the analysis. The inclusion of this interaction variable allows us to explore the impact of changes in the federal fund rate on banks' stability and profitability specifically during periods of inflation targeting. Table 12 comprises five columns, each focusing on one of the different dependent variables used in this study. In Table 13, we report coefficient estimates solely for the IT dummy variable during the AIT period.

The findings presented in Table 12 are generally consistent with the results observed in the previous sections in this chapter. The results indicate that, except for coefficient of TIT in column 3 where equity ratio is the dependent variable, both TIT and AIT have a negative and statistically significant impact on bank stability and profitability in the United States when compared to periods without IT. This means that the implementation of both TIT and AIT has led to a reduction in banks' stability and profit in the United States. Again, table 12 reveals that the interaction between TIT and FFR is positive for all dependent variables related to bank stability, except for RAP. In addition, table 12 shows that the interaction between TIT and FFR is negative and statistically significant for all the measures of bank profit. Also, table 12 shows that the interaction between AIT and FFR is negative and statistically significant for all the measures of bank stability and profitability. This implies that the increase in federal fund rate causes a decrease in bank stability and profitability during the AIT period when compared to periods without IT. When comparing the TIT period to the AIT period, Table 13 shows that the transition from TIT to AIT has resulted in a reduction in bank stability, risk-adjusted profit, and equity ratio in instances of increasing federal fund rate. However, the transition from TIT to AIT at a time of increasing federal fund rate has led to a statistically significant increase in ROA but an insignificant increase in ROE.

Furthermore, the results of the analysis were performed using data winsoried at the 90th and 10th percentiles, as well as the 99th and 1st percentiles. The result obtained (not reported) exhibited substantial conformity and consistency with the findings presented in this section.

Overall, these findings from this section suggest that both TIT and AIT, along with their interactions with the federal fund rate and inflation rate, have implications for bank stability and profitability. Moreover, comparing TIT and AIT, AIT have brought severe consequences on banks' stability and profitability in the United States.

5. Conclusion

Since the early 1990s, the IT framework has been proven as the most efficient approach for preventing inflationary pressures (Rogoff, 2004; Mishkin, 2000; Bernanke et al., 1999). However, various literature reports mixed findings regarding the relationship between the IT framework and banks' stability and profitability. While studies such as Bernanke et al. (1999), Mishkin and Schmidt-Hebbel (2002), Arestis et al. (2005), and Calomiris et al. (2019) suggest that adopting an IT framework may lead to a more stable economic environment, which can reduce the risk of financial instability and improve the profitability of banks, other studies like De Haan et al. (2015), De Grauwe and Ji (2016), Langfield and Pagano (2020), and Alpanda et al. (2021) raise concerns that lower inflation resulting from an IT framework may lead to lower interest rates, thus reducing the profitability of banks' lending operations. With the Federal Reserve adopting traditional inflation targeting in January 2012 and transitioning to average inflation targeting in August 2020, this paper analyzes and compares the effects of the two inflation targeting frameworks on banks' stability and profitability in the United States. To achieve this objective, a quarterly dataset containing over one thousand commercial banks in the United States from 2004 to 2022 is employed to assess which of the frameworks has the greatest impact on banks' stability and profitability.

This study compares periods of no inflation targeting to periods of traditional inflation targeting and finds that the introduction of traditional inflation targeting has resulted in a higher level of instability and lower profits for banks in the United States. This finding aligns with the conclusions of Berger et al. (2018) and De Grauwe and Ji (2016).

According to Berger et al. (2018), traditional inflation targeting increases the risk of financial instability in the United States and other developed countries. Similarly, De Grauwe and Ji (2016) suggest that traditional inflation targeting has a negative impact on bank profitability. Additionally, when comparing periods of no inflation targeting to periods of average inflation targeting, this study reveals that the implementation of average inflation targeting has led to a greater degree of bank fragility and lower bank profits in the United States. This finding is consistent with the arguments put forth by Alpanda et al. (2021), who contend that average inflation targeting can undermine bank stability by introducing uncertainty for banks and other financial institutions. Furthermore, this finding is supported by Langfield and Pagano (2020), who claim that the introduction of average inflation targeting can reduce net interest income and diminish earnings from traditional banking activities, thereby introducing uncertainty in banks' profitability. Furthermore, when comparing periods of traditional inflation targeting and average inflation targeting, this study reports a decrease in banks' stability and profitability in the United States as a result of the transition from traditional inflation targeting to average inflation targeting.

The study also reveals that as the inflation rate increases, both traditional inflation targeting and average inflation targeting have a detrimental impact on the stability and profitability of banks in the United States, when compared to periods without inflation targeting. Additionally, when comparing traditional inflation targeting to average inflation targeting, the latter has a negative effect on banks' stability and profitability as the inflation rate rises. Finally, the study also finds that as the federal fund rate increases, both traditional inflation targeting and average inflation targeting have an adverse impact on banks' stability and profitability in the United States, compared to periods without inflation targeting. Furthermore, when comparing traditional inflation targeting to average inflation targeting, the latter has a negative effect on banks' stability as the federal fund rate increases.

Banks play a crucial role in the economy, and their stability and profitability are vital for economic growth. Therefore, the Federal Reserve should consider the potential effects of the different inflation targeting frameworks on the stability and profitability of banks. This is important due to the possible ripple effect it may have on the overall economy.

Table 1: Descriptive Statistics for quarterly data over the period 2004–2022

Variable	Notation	Measure	Mean	Std. Dev.	Min	Max
Dependent Variables						
Bank Stability	BS	Z-Score (Eq. 1)	4.5701	0.5708	-0.0171	9.9101
Risk-Adjusted Profit	RAP	Eq. 2	2.4987	13.4239	-32.2927	1165.1430
Equity Ratio	ER	Eq. 3	0.1021	0.0321	0.0026	0.8597
Return on Asset	ROA (%)	$\frac{Net\ Income}{Total\ Assets} \times 100$	0.1912	0.1471	-0.1721	0.4397
Return on Equity	ROE (%)	$\frac{Net\ Income}{Stockholders\ Equity} \times 100$	1.9689	1.5761	-1.8206	4.8514
Independent Variables						
Total Asset	Asset	Natural log of total assets of a bank	7.7300	1.6745	5.3552	12.2382
Risk Adjusted Capital Ratio	RACR (%)	$\frac{Tier\ 1\ Capital + Tier\ 2\ Capital}{Risk - Weighted\ Assets}$	14.8260	3.2055	10.7285	23.1415
Non-performing Asset	NPA	Natural log of non-performing assets of a bank	2.7032	1.8730	-0.9442	6.6036
Cost to Income Ratio	CTNR (%)	$\frac{Total\ Operating\ Expenses}{Total\ Operating\ Income} \times 100$	80.3436	14.9774	57.1362	116.4944
Loan to Asset Ratio	LTAR (%)	$\frac{Gross\ Loans}{Total\ Assets} \times 100$	67.6177	11.9173	33.3482	84.5701
Inflation Rate	INF	Quarterly percentage change in personal consumption expenditures excluding food and energy (chain-type price index)	1.9993	0.9182	0.8000	4.7000
Real Gross Domestic Product	RGDP (%)	Quarterly percentage change in real gross domestic product.	0.5290	0.5022	-0.5269	1.5428
Short-term Interest Rate	FFR (%)	Quarterly federal funds rate, percentage	1.3681	1.6785	0.0800	5.2467
Long-term Interest Rate	LTBY (%)	Quarterly 10-year long-term government bond yields, percentage	2.9379	1.0546	1.3233	4.7300
Death rate	DERT	Death rate, crude (per 1,000 people)	8.4840	0.6923	7.8693	10.6355
Traditional Inflation Targeting	TIT	1=TIT 0= Otherwise				

Variable	Notation	Measure	Mean	Std. Dev.	Min	Max
Average Inflation Targeting	AIT	1=AIT 0= Otherwise				

Table 2: Effect of IT on banks' stability, BS as dependent variable

Variables	(A)	(B)	(C)
ASSET	0.2935***	0.2911***	0.2822***
	(0.0044)	(0.0044)	(0.0045)
RACR	0.0578***	0.0577***	0.0578***
	(0.0005)	(0.0005)	(0.0005)
NPA	-0.0076***	-0.0075***	-0.0038***
	(0.0012)	(0.0012)	(0.0012)
CTIR	0.0001**	0.0001**	0.0001**
	(0.0000)	(0.0000)	(0.0000)
LTAR	0.0100***	0.0099***	0.0097***
	(0.0002)	(0.0002)	(0.0002)
DERT	0.0464***	0.0491***	0.0594***
	(0.0035)	(0.0033)	(0.0034)
INF		0.0009	0.0006
		(0.0007)	(0.0007)
RGDP		0.0040***	0.0035**
		(0.0008)	(0.0008)
FFR			0.0211***
			(0.0011)
LTBY			-0.0166***
			(0.0015)
TIT	-0.0092***	-0.0091**	-0.0094***
	(0.0035)	(0.0036)	(0.0036)
AIT	-0.0783***	-0.0887***	-0.0924***
	(0.0056)	(0.0062)	(0.0062)
Constant	0.3633***	0.3610***	0.3618***
	(0.0027)	(0.0027)	(0.0027)
Observation	39057	39057	39057
Banks	1172	1172	1172
R-Square	0.5473	0.5477	0.5537
Fixed Effects	Yes	Yes	Yes

*Note: *** p < 0.01, ** p < 0.05, and * p < 0.1. The sample goes from 2004 to 2022. Regression results are obtained using the fixed-effect estimator with AR (1). Standard errors are reported in parentheses. Significant coefficients are in bold.*

BS = Banks' stability; ASSET= Total asset; RACR = Risk Adjusted Capital Ratio; NPA = Non-performing Asset; CTIR = Cost to income ratio; LTAR = Loan to asset ratio; DERT= Death rate; INF = inflation rate; RGDP = Real Gross Domestic Product; FFR= Federal fund rate; and LTBY = 10-Years Government Bond Yield; IT = Inflation targeting; TIT= Traditional inflation targeting and AIT= Average inflation targeting

Table 3: Effect of IT on banks' stability with RAP as dependent variable

Variables	(A)	(B)	(C)
ASSET	0.3506***	0.3368***	0.2291***
	(0.0160)	(0.0161)	(0.0161)
RACR	0.0634***	0.0616***	0.0591***
	(0.0023)	(0.0023)	(0.0022)
NPA	-0.0423***	-0.0362***	0.0418***
	(0.0057)	(0.0058)	(0.0063)
CTIR	-0.0688***	-0.0688***	-0.0688***
	(0.0004)	(0.0004)	(0.0003)
LTAR	0.0203***	0.0198***	0.0144***
	(0.0008)	(0.0008)	(0.0008)
DERT	0.2569***	0.2707***	0.3318***
	(0.0138)	(0.0139)	(0.0137)
INF		0.0202***	-0.0307***
		(0.0052)	(0.0055)
RGDP		0.0448***	0.0436***
		(0.0061)	(0.0060)
FFR			0.0530***
			(0.0048)
LTBY			0.1449***
			(0.0091)
TIT	-0.5015***	-0.5007***	-0.2605***
	(0.0139)	(0.0139)	(0.0167)
AIT	-1.0068***	-1.0965***	-0.7591***
	(0.0139)	(0.0315)	(0.0339)
Constant	1.2405***	1.2194***	1.1855***
	(0.0339)	(0.0338)	(0.0348)
Observation	39057	39057	39057
Banks	1172	1172	1172
R-Square	0.5465	0.5473	0.5582
Fixed Effects	Yes	Yes	Yes

*Note: *** p < 0.01, ** p < 0.05, and * p < 0.1. The sample goes from 2004 to 2022. Regression results are obtained using the fixed-effect estimator with AR (1). Standard errors are reported in parentheses. Significant coefficients are in bold.*

RAP = Risk-Adjusted Profit; ASSET = Total asset; RACR = Risk Adjusted Capital Ratio; NPA = Non-performing Asset; CTIR = Cost to income ratio; LTAR = Loan to asset ratio; DERT= Death rate; INF = inflation rate; RGDP = Real Gross Domestic Product; FFR= Federal fund rate; and LTBY = 10-Years Government Bond Yield; IT = Inflation targeting; TIT = Traditional inflation targeting and AIT= Average inflation targeting

Table 4: Effect of IT on banks' stability with ER as dependent variable

Variables	**(A)**	**(B)**	**(C)**
ASSET	-0.0024***	-0.0024***	-0.0025***
	(0.0005)	(0.0005)	(0.0005)
RACR	0.0052***	0.0052***	0.0052***
	(0.0000)	(0.0000)	(0.0000)
NPA	-0.0002*	-0.0002*	-0.0000
	(0.0001)	(0.0001)	(0.0001)
CTIR	0.0000***	-0.0000***	0.0000***
	(0.0000)	(0.0000)	(0.0000)
LTAR	0.0006***	0.0006***	0.0006***
	(0.0000)	(0.0000)	(0.0000)
DERT	-0.0009***	-0.0009***	-0.0005
	(0.0003)	(0.0003)	(0.0003)
INF		-0.0002***	-0.0001
		(0.0001)	(0.0001)
RGDP		0.0002***	0.0002**
		(0.0001)	(0.0001)
FFR			0.0017***
			(0.0001)
LTBY			-0.0025***
			(0.0001)
TIT	0.0003	0.0006*	-0.0003
	(0.0004)	(0.0004)	(0.0004)
AIT	-0.0009	-0.0005	-0.0012*
	(0.0006)	(0.0006)	(0.0006)
Constant	0.0131***	0.0132***	0.0137***
	(0.0003)	(0.0003)	(0.0003)
Observation	39057	39057	39057
Banks	1172	1172	1172
R-Square	0.2826	0.2829	0.2906
Fixed Effects	Yes	Yes	Yes

*Note: *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$. The sample goes from 2004 to 2022. Regression results are obtained using the fixed-effect estimator with AR (1). Standard errors are reported in parentheses. Significant coefficients are in bold.*

ER = Equity ratio; ASSET= Total asset; RACR = Risk Adjusted Capital Ratio; NPA = Non-performing Asset; CTIR = Cost to income ratio; LTAR = Loan to asset ratio; DERT= Death rate; INF = inflation rate; RGDP = Real Gross Domestic Product; FFR= Federal fund rate; and LTBY = 10-Years Government Bond Yield; IT = Inflation targeting; TIT= Traditional inflation targeting and AIT= Average inflation targeting.

Table 5: Effect of IT on banks' profit with ROA as dependent variable

Variables	(A)	(B)	(C)
ASSET	0.0392***	0.0374***	-0.0250***
	(0.0016)	(0.0016)	(0.0016)
RACR	0.0075***	0.0073***	0.0071***
	(0.0023)	(0.0002)	(0.0002)
NPA	-0.0114***	-0.0105***	-0.0012*
	(0.0006)	(0.0006)	(0.0006)
CTIR	-0.0084***	-0.0084***	-0.0084***
	(0.0000)	(0.0000)	(0.0000)
LTAR	0.0022***	0.0021***	0.0015***
	(0.0001)	(0.0001)	(0.0001)
DERT	0.0328***	0.0344***	0.0413***
	(0.0014)	(0.0014)	(0.0014)
INF		0.0035***	-0.0025***
		(0.0005)	(0.0006)
RGDP		0.0039***	0.0038***
		(0.0006)	(0.0006)
FFR			0.0067***
			(0.0005)
LTBY			0.0157***
			(0.0009)
TIT	-0.0572***	-0.0571***	-0.0299***
	(0.0014)	(0.0014)	(0.0017)
AIT	-0.1323***	-0.1443***	-0.1056***
	(0.0029)	(0.0032)	(0.0034)
Constant	0.1014***	0.0983***	0.0965***
	(0.0036)	(0.0036)	(0.0038)
Observation	39057	39057	39057
Banks	1172	1172	1172
R-Square	0.6377	0.6384	0.6516
Fixed Effects	Yes	Yes	Yes

*Note: *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$. The sample goes from 2004 to 2022. Regression results are obtained using the fixed-effect estimator with AR (1). Standard errors are reported in parentheses. Significant coefficients are in bold.*

ROA = Return on assets; ASSET= Total asset; RACR = Risk Adjusted Capital Ratio; NPA = Non-performing Asset; CTIR = Cost to income ratio; LTAR = Loan to asset ratio; DERT= Death rate; INF = inflation rate; RGDP = Real Gross Domestic Product; FFR= Federal fund rate; and LTBY = 10-Years Government Bond Yield; IT = Inflation targeting; TIT= Traditional inflation targeting and AIT= Average inflation targeting.

Table 6: Effect of IT on banks' profit with ROE as dependent variable

Variables	(A)	(B)	(C)
ASSET	0.3861***	0.3536***	0.1959***
	(0.0296)	(0.0207)	(0.0207)
RACR	0.0203***	0.0182***	0.0125***
	(0.0029)	(0.0029)	(0.0029)
NPA	-0.1496***	-0.1351***	-0.0337***
	(0.0073)	(0.0074)	(0.0081)
CTIR	-0.0833***	-0.0835***	-0.0839***
	(0.0004)	(0.0004)	(0.0004)
LTAR	0.0153***	0.0145***	0.0066***
	(0.0010)	(0.0010)	(0.0010)
DERT	0.4718***	0.4976***	0.5887***
	(0.0177)	(0.0178)	(0.0176)
INF		0.0668***	-0.0075
		(0.0065)	(0.0068)
RGDP		0.0386***	0.0370***
		(0.0076)	(0.0075)
FFR			0.0400***
			(0.0062)
LTBY			0.2706***
			(0.0115)
TIT	-0.7409***	-0.7419***	-0.3603***
	(0.0180)	(0.0179)	(0.0214)
AIT	-1.5137***	-1.7175***	-1.1888***
	(0.0363)	(0.0402)	(0.0430)
Constant	1.2508***	1.2104***	1.1037***
	(0.0407)	(0.0407)	(0.0038)
Observation	39057	39057	39057
Banks	1172	1172	1172
R-Square	0.5290	0.5307	0.5449
Fixed Effects	Yes	Yes	Yes

*Note: *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$. The sample goes from 2004 to 2022. Regression results are obtained using the fixed-effect estimator with AR (1). Standard errors are reported in parentheses. Significant coefficients are in bold.*

ROE = Return on equity; ASSET= Total asset; RACR = Risk Adjusted Capital Ratio; NPA = Non-performing Asset; CTIR = Cost to income ratio; LTAR = Loan to asset ratio; DERT= Death rate; INF = inflation rate; RGDP = Real Gross Domestic Product; FFR= Federal fund rate; and LTBY = 10-Years Government Bond Yield; IT = Inflation targeting; TIT= Traditional inflation targeting and AIT= Average inflation targeting.

Table 7: Comparing the effect of TIT and AIT on banks' stability and profit

Variables	(A) BS	(B) BS	(C) BS
AIT	-0.0687***	-0.0800***	-0.0834***
	(0.0043)	(0.0048)	(0.0048)
Observations	39057	39057	39057
Banks	1172	1172	1172
R-square	0.5477	0.5481	0.5542
Fixed Effects	Yes	Yes	Yes

Variables	(A) RAP	(B) RAP	(C) RAP
AIT	0.5285***	-0.5503***	-0.4828***
	(0.0134)	(0.0275)	(0.0272)
Observations	39057	39057	39057
Banks	1172	1172	1172
R-square	0.5494	0.5501	0.5596
Fixed Effects	Yes	Yes	Yes

Variables	(A) ER	(B) ER	(C) ER
AIT	-0.0012	-0.0012	-0.0015***
	(0.0004)	(0.0005)	(0.0006)
Observations	39057	39057	39057
Banks	1172	1172	1172
R-square	0.2826	0.2829	0.2906
Fixed Effects	Yes	Yes	Yes

Variables	(A) ROA	(B) ROA	(C) ROA
AIT	-0.0709***	-0.0819***	-0.0740***
	(0.0024)	(0.0028)	(0.0028)
Observations	39057	39057	39057
Banks	1172	1172	1172
R-square	0.6407	0.6413	0.6530
Fixed Effects	Yes	Yes	Yes

Variables	(A) ROE	(B) ROE	(C) ROE
AIT	-0.7182***	-0.9090***	-0.8068***
	(0.0304)	(0.0348)	(0.0345)
Observations	39057	39057	39057
Banks	1172	1172	1172
R-square	0.5332	0.5347	0.5467
Fixed Effects	Yes	Yes	Yes

*Note: *** p < 0.01, ** p < 0.05, and * p < 0.1. The sample goes from 2004 to 2022. Regression results are obtained using the fixed-effect estimator with AR (1). Standard errors are reported in parentheses. Significant coefficients are in bold.*

BS = Banks' stability; RAP= Risk adjusted profit; ER= Equity ratio; ROA=Return on asset; ROE= Return on equity.

The full table for each dependent variable is in tables 1, 2, 3, 4, 5 in Appendix C

Table 8: Effect of IT on banks' stability, including INF and IT interaction

	BS (Panel A)		**RAP (Panel B)**		**ER (Panel C)**	
Variables	**(1)**	**(2)**	**(1)**	**(2)**	**(1)**	**(2)**
ASSET	0.2934***	0.2838***	0.3484***	0.2346***	-0.0022***	-0.0023***
	(0.0044)	(0.0046)	(0.0162)	(0.0162)	(0.0005)	(0.0005)
RACR	0.0577***	0.0578***	0.0615***	0.0590***	0.0052***	0.0052***
	(0.0005)	(0.0005)	(0.0023)	(0.0022)	(0.0000)	(0.0000)
NPA	-0.0077***	-0.0041***	-0.0370***	-0.0399*	-0.0002*	-0.0000
	(0.0016)	(0.0012)	(0.0058)	(0.0063)	(0.0001)	(0.0001)
CTIR	0.0001	0.0001***	-0.0689***	-0.0690***	0.0000***	0.0000***
	(0.0000)	(0.0000)	(0.0004)	(0.0003)	(0.0000)	(0.0000)
LTAR	0.0099***	0.0096***	0.0194***	0.0142***	0.0006***	0.0006***
	(0.0002)	(0.0002)	(0.0008)	(0.0008)	(0.0000)	(0.0000)
DERT	0.0495***	0.0605***	0.2638***	0.3343***	-0.0009**	-0.0005
	(0.0034)	(0.0035)	(0.0141)	(0.0140)	(0.0003)	(0.0004)
INF	-0.0017*	-0.0030***	0.0329***	-0.0380*	-0.0004***	-0.0003***
	(0.0009)	(0.0010)	(0.0074)	(0.0078)	(0.0001)	(0.0001)
RGDP	0.0036***	0.0030***	0.0411***	0.0392***	0.0002**	0.0001*
	(0.0008)	(0.0008)	(0.0061)	(0.0061)	(0.0001)	(0.0001)
FFR		0.0210***		0.0526***		0.0017***
		(0.0011)		(0.0049)		(0.0001)
LTBY		-0.0164***		0.1446***		-0.0025***
		(0.0015)		(0.0091)		(0.0001)
TIT	-0.0383***	-0.0400***	-0.5392***	-0.3553***	-0.0011**	-0.0013***
	(0.0049)	(0.0049)	(0.0267)	(0.0277)	(0.0005)	(0.0005)
AIT	-0.0832***	-0.0959***	-0.8173***	-0.6511***	-0.0005	-0.0013
	(0.0080)	(0.0079)	(0.0536)	(0.0540)	(0.0008)	(0.0008)
INF*TIT	0.0130***	0.0139***	-0.0218*	0.0525	0.0008***	0.0007***
	(0.0016)	(0.0016)	(0.0126)	(0.0126)	(0.0002)	(0.0002)
INF*AIT	-0.0049***	-0.0017	-0.0806***	-0.0288**	-0.0002	-0.0001
	(0.0018)	(0.0018)	(0.0129)	(0.0129)	(0.0002)	(0.0002)
Constant	0.3573***	0.3581***	1.2158***	1.1800***	0.0130***	0.0135***
	(0.0027)	(0.0027)	(0.0339)	(0.0348)	(0.0003)	(0.0003)
Observation	39057	39057	39057	39057	39057	39057
Banks	1172	1172	1172	1172	1172	1172
R-Square	0.5489	0.5549	0.5481	0.5586	0.2835	0.2911
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

*Note: *** p < 0.01, ** p < 0.05, and * p < 0.1. The sample goes from 2004 to 2022. Regression results are obtained using the fixed-effect estimator with AR (1). Standard errors are reported in parentheses. Significant coefficients are in bold.*

BS = Banks' stability; RAP= Risk adjusted profit; ER= Equity ratio; ASSET= Total asset; RACR = Risk Adjusted Capital Ratio; NPA = Non-performing Asset; CTIR = Cost to income ratio; LTAR = Loan to asset ratio; DERT= Death rate; INF = inflation rate; RGDP = Real Gross Domestic Product; FFR= Federal fund rate; and LTBY = 10-Years Government Bond Yield; IT = Inflation targeting; TIT= Traditional inflation targeting and AIT= Average inflation targeting

Table 9: Effect of IT on banks' profit, including INF and IT interaction

	ROA (Panel A)		ROE (Panel B)	
Variables	**(1)**	**(2)**	**(1)**	**(2)**
ASSET	0.0389***	0.0259***	0.3658***	0.1997***
	(0.0016)	(0.0016)	(0.0208)	(0.0209)
RACR	0.0073***	0.0071***	0.0181***	0.0124***
	(0.0002)	(0.0002)	(0.0029)	(0.0029)
NPA	-0.0105***	-0.0015***	-0.1358***	-0.0353***
	(0.0006)	(0.0006)	(0.0074)	(0.0081)
CTIR	-0.0084***	-0.0085***	-0.0836***	-0.0840***
	(0.0000)	(0.0000)	(0.0004)	(0.0004)
LTAR	0.0020***	0.0014***	0.0140***	0.0063***
	(0.0001)	(0.0001)	(0.0010)	(0.0010)
DERT	0.0331***	0.0411***	0.4899***	0.5932***
	(0.0014)	(0.0014)	(0.0181)	(0.0180)
INF	0.0060***	-0.0024***	0.0819***	-0.0182*
	(0.0008)	(0.0008)	(0.0093)	(0.0097)
RGDP	0.0035***	0.0033***	0.0354***	0.0329***
	(0.0006)	(0.0006)	(0.0077)	(0.0076)
FFR		0.0066***		0.0401***
		(0.0005)		(0.0063)
LTBY		0.0157***		0.2703***
		(0.0009)		(0.0115)
TIT	-0.0583***	-0.0380***	-0.7718***	-0.4595***
	(0.0027)	(0.0028)	(0.0338)	(0.0350)
AIT	-0.1055***	-0.0872***	-1.4223***	-1.1166***
	(0.0055)	(0.0055)	(0.0675)	(0.0678)
INF*TIT	0.0007***	0.0045***	0.0167	0.0547***
	(0.0013)	(0.0013)	(0.0157)	(0.0156)
INF*AIT	-0.0113***	-0.0051***	-0.0863***	-0.0185
	(0.0013)	(0.0013)	(0.0162)	(0.0162)
Constant	0.0985***	0.0961***	1.2070***	1.0978***
	(0.0037)	(0.0038)	(0.0407)	(0.0412)
Observation	39057	39057	39057	39057
Banks	1172	1172	1172	1172
R-Square	0.6397	0.6520	0.5313	0.5451
Fixed Effects	Yes	Yes	Yes	Yes

*Note: *** p < 0.01, ** p < 0.05, and * p < 0.1. The sample goes from 2004 to 2022. Regression results are obtained using the fixed-effect estimator with AR (1). Standard errors are reported in parentheses. Significant coefficients are in bold.*

ROA = Return on asset; ROE= Return on equity; ASSET= Total asset; RACR = Risk Adjusted Capital Ratio; NPA = Non-performing Asset; CTIR = Cost to income ratio; LTAR = Loan to asset ratio; DERT= Death rate; INF = inflation rate; RGDP = Real Gross Domestic Product; FFR=

Federal fund rate; and LTBY = 10-Years Government Bond Yield; IT = Inflation targeting; TIT= Traditional inflation targeting and AIT= Average inflation targeting.

Table 10: Comparing the effect of TIT and AIT on banks' stability, including INF and IT interaction

Variables	(1) BS	(2) BS
AIT	-0.0401***	-0.0509***
	(0.0068)	(0.0068)
INF*AIT	-0.0218***	-0.0195***
	(0.0019)	(0.0019)
Observations	39057	39057
Banks	1172	1172
R-square	0.5502	0.5563
Fixed Effects	Yes	Yes
Variables	(1) RAP	(2) RAP
AIT	-0.1914***	-0.2300***
	(0.0536)	(0.0494)
INF*AIT	-0.1352***	-0.1129***
	(0.0140)	(0.0139)
Observations	39057	39057
Banks	1172	1172
R-square	0.5481	0.5607
Fixed Effects	Yes	Yes
Variables	(1) ER	(2) ER
AIT	0.0007	0.0002
	(0.0007)	(0.0007)
INF*AIT	-0.0010***	-0.0009***
	(0.0002)	(0.0002)
Observations	39057	39057
Banks	1172	1172
R-square	0.2836	0.2913
Fixed Effects	Yes	Yes

*Note: *** p < 0.01, ** p < 0.05, and * p < 0.1. The sample goes from 2004 to 2022. Regression results are obtained using the fixed-effect estimator with AR (1). Standard errors are reported in parentheses. Significant coefficients are in bold.*

BS = Banks' stability; RAP= Risk adjusted profit; ER= Equity ratio.

The full table is in table 6 in Appendix C.

Table 11: Comparing the effect of TIT and AIT on banks' profit, including INF and IT interaction

Variables	(1) ROA	(2) ROA
AIT	-0.0371***	-0.0415***
	(0.0051)	(0.0051)
INF*AIT	-0.0161***	-0.0136***
	(0.0014)	(0.0014)
Observations	39057	39057
Banks	1172	1172
R-square	0.6429	0.6541
Fixed Effects	Yes	Yes
Variables	**(1) ROE**	**(2) ROE**
AIT	-0.5268***	-0.5670***
	(0.0625)	(0.0619)
AIT	-0.1510***	-0.1180
	(0.0175)	(0.0174)
Observations	39057	39057
Banks	1172	1172
R-square	0.5358	0.5476
Fixed Effects	Yes	Yes

*Note: *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$. The sample goes from 2004 to 2022. Regression results are obtained using the fixed-effect estimator with AR (1). Standard errors are reported in parentheses. Significant coefficients are in bold.*

ROA=Return on asset; ROE= Return on equity.

The full table is in table 7 in Appendix C.

Table 12: Effect of IT on banks' stability and profit, including FFR and IT interaction

Variables	BS	RAP	ER	ROA	ROE
ASSET	0.2454***	0.2353***	-0.0052***	0.0286***	0.2503***
	(0.0048)	(0.0165)	(0.0005)	(0.0016)	(0.0115)
RACR	0.0566***	0.0589***	0.0052***	0.0070***	0.0115***
	(0.0004)	(0.0022)	(0.0000)	(0.0002)	(0.0029)
NPA	-0.0015	0.0431***	0.0001	-0.0011*	-0.0357***
	(0.0012)	(0.0063)	(0.0001)	(0.0006)	(0.0081)
CTIR	0.0001**	-0.0688***	0.0000***	-0.0085***	-0.0841***
	(0.0000)	(0.0003)	(0.0000)	(0.0000)	(0.0004)
LTAR	0.0091***	0.0145***	0.0005***	0.0015***	0.0078***
	(0.0002)	(0.0008)	(0.0000)	(0.0001)	(0.0010)
DERT	0.0985***	0.3240***	0.0026***	0.0384***	0.5509***
	(0.0038)	(0.0141)	(0.0004)	(0.0018)	(0.0181)
INF	-0.0031***	-0.0322***	-0.0003***	-0.0027***	-0.0063
	(0.0007)	(0.0055)	(0.0001)	(0.0006)	(0.0068)
RGDP	0.0040***	0.0429***	0.0002*	0.0039***	0.0433***
	(0.0008)	(0.0061)	(0.0001)	(0.0006)	(0.0075)
FFR	0.0247***	0.0565***	0.0017***	0.0086***	0.0678***
	(0.0013)	(0.0052)	(0.0001)	(0.0005)	(0.0067)
LTBY	-0.0069***	0.1486***	-0.0019***	0.0149***	0.2396***
	(0.0015)	(0.0095)	(0.0001)	(0.0010)	(0.0120)
TIT	-0.0139***	-0.2446***	0.0002	-0.0236***	-0.2803***
	(0.0036)	(0.0181)	(0.0004)	(0.0018)	(0.0231)
AIT	-0.0769***	-0.7162***	-0.0010*	-0.0988***	-1.1970***
	(0.0062)	(0.0384)	(0.0006)	(0.0039)	(0.0485)
FFR*TIT	0.0619***	-0.0102	0.0047***	-0.0093***	-0.1708***
	(0.0030)	(0.0106)	(0.0003)	(0.0011)	(0.0138)
FFR*AIT	-0.0472***	-0.0286**	-0.0019***	-0.0053***	-0.0091
	(0.0022)	(0.0115)	(0.0002)	(0.0012)	(0.0146)
Constant	0.3330***	1.1793***	0.0106***	0.0901***	1.0192***
	(0.0027)	(0.0351)	(0.0003)	(0.0038)	(0.0414)
Observation	39057	39057	39057	39057	39057
Banks	1172	1172	1172	1172	1172
R-Square	0.5674	0.5585	0.2979	0.6524	0.5468
Fixed Effects	Yes	Yes	Yes	Yes	Yes

*Note: *** p < 0.01, ** p < 0.05, and * p < 0.1. The sample goes from 2004 to 2022. Regression results are obtained using the fixed-effect estimator with AR (1). Standard errors are reported in parentheses. Significant coefficients are in bold.*

BS = Banks' stability; RAP= Risk adjusted profit; ER= Equity ratio; ROA=Return on asset; ROE= Return on equity; ASSET= Total asset; RACR = Risk Adjusted Capital Ratio; NPA = Non-performing Asset; CTIR = Cost to income ratio; LTAR = Loan to asset ratio; DERT= Death rate; INF = inflation rate; RGDP = Real Gross Domestic Product; FFR= Federal fund rate; and LTBY = 10-Years Government Bond Yield; IT = Inflation targeting; TIT= Traditional inflation targeting and AIT= Average inflation targeting.

Table 13: Comparing the effect of TIT and AIT on banks' stability and profit, including FFR and IT interaction

Variables	**BS**	**RAP**	**ER**	**ROA**	**ROE**
AIT	-0.0637***	-0.4635***	0.0009*	-0.0747***	-0.9106***
	(0.0048)	(0.0106)	(0.0005)	(0.0031)	(0.0387)
FFR* AIT	-0.1096***	-0.0194***	-0.0066***	0.0039***	0.1601
	(0.0033)	(0.0147)	(0.0003)	(0.0015)	(0.0187)
Observations	39057	39057	39057	39057	39057
Banks	1172	1172	1172	1172	1172
R-square	0.5679	0.5598	0.2979	0.6536	0.5483
Fixed Effects	Yes	Yes	Yes	Yes	Yes

*Note: *** p < 0.01, ** p < 0.05, and * p < 0.1. The sample goes from 2004 to 2022. Regression results are obtained using the fixed-effect estimator with AR (1). Standard errors are reported in parentheses. Significant coefficients are in bold.*

BS = Banks' stability; RAP= Risk adjusted profit; ER= Equity ratio; ROA=Return on asset; ROE= Return on equity.

The full table is in table 8 in Appendix C.

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APPENDICES CHAPTER ONE

Appendix A: Correlation Matrix and VIF Test for Multicollinearity

Variables	BS	RAP	ER	ROA	ROE	ASSET	RACR	NPA	CTIR	LTAR
BS	1									
RAP	0.9661*	1								
ER	0.1252*	-0.0008	1							
ROA	0.1459*	0.1403*	0.1300*	1						
ROE	0.1034*	0.1319*	-0.1365*	0.9126*	1					
ASSET	0.0340*	0.0548*	-0.0579*	0.2079*	0.2151*	1				
RACR	0.0888*	-0.0001	0.5711*	0.0307*	-0.1095*	-0.1155*	1			
NPA	-0.0302*	0.0031	-0.0650*	-0.0885*	-0.0866*	0.7684*	-0.0976*	1		
CTIR	-0.1399*	-0.1168*	-0.1579*	-0.8614*	-0.7658*	-0.2486*	-0.0653*	0.0811*	1	
LTAR	-0.0499*	-0.0315*	0.0162*	-0.0214*	-0.0554*	-0.2609*	-0.3333*	-0.1501*	0.0277*	1
INF	0.0105*	0.0249*	-0.0526*	0.1970*	0.2239*	0.1122*	-0.0129*	-0.0967*	-0.2285*	-0.0510*
RGDP	0.0314*	0.0307*	0.0133*	0.1808*	0.1742*	0.0265*	0.0494*	-0.0598*	-0.2020*	-0.0480*
FFR	0.0014	0.0157*	-0.0857*	0.1373*	0.1818*	-0.0566*	-0.1859*	-0.2760*	0.0032	0.1068*
LTBY	-0.0092*	0.0134*	-0.1728*	-0.0389*	0.0477*	-0.1442*	-0.2057*	-0.2132*	0.1944*	0.0532*

*Note: * $p < 0.1$.*

BS = Banks' stability; RAP= Risk adjusted profit; ER= Equity ratio; ROA=Return on asset; ROE= Return on equity; ASSET= Total asset; RACR = Risk Adjusted Capital Ratio; NPA = Non-performing Asset; CTIR = Cost to income ratio; LTAR = Loan to asset ratio; INF = inflation rate; RGDP = Real Gross Domestic Product; FFR= Federal fund rate; and LTBY = 10-Years Government Bond Yield.

Appendix A: Correlation Matrix and VIF Test for Multicollinearity – Continue

Variables	INF	RGDP	FFR	LTBY	VIF
BS					
RAP					
ER					
ROA					
ROE					
ASSET					**4.08**
RACR					**1.27**
NPA					**3.80**
CTIR					**1.49**
LTAR					**1.32**
INF	1				**1.19**
RGDP	0.2474*	1			**1.10**
FFR	0.2059*	0.0234*	1		**2.76**
LTBY	0.0730*	-0.0261*	0.7466*	1	**2.57**

*Note: * $p < 0.1$.*

BS = Banks' stability; RAP= Risk adjusted profit; ER= Equity ratio; ROA=Return on asset; ROE= Return on equity; ASSET= Total asset; RACR = Risk Adjusted Capital Ratio; NPA = Non-performing Asset; CTIR = Cost to income ratio; LTAR = Loan to asset ratio; INF = inflation rate; RGDP = Real Gross Domestic Product; FFR= Federal fund rate; and LTBY = 10-Years Government Bond Yield.

Appendix B: Stationarity test for panel dataset

Test	**Levinim**	**ips**
Value	<0.001	<0.001

Appendix C: Comparing the effect of TIT to AIT

Table 1: Effect of IT on banks' stability, BS as dependent variable

Variables	(A)	(B)	(C)
ASSET	0.2925***	0.2900***	0.2815***
	(0.0044)	(0.0044)	(0.0045)
RACR	0.0577***	0.0577***	0.0578***
	(0.0005)	(0.0005)	(0.0005)
NPA	-0.0076***	-0.0075***	-0.0039***
	(0.0012)	(0.0012)	(0.0012)
CTIR	0.0001*	0.0001*	0.0001**
	(0.0000)	(0.0000)	(0.0000)
LTAR	0.0099***	0.0099***	0.0096***
	(0.0002)	(0.0002)	(0.0002)
DERT	0.0466***	0.0494***	0.0593***
	(0.0033)	(0.0033)	(0.0034)
INF		0.0014	0.0012*
		(0.0007)	(0.0007)
RGDP		0.0038***	0.0033***
		(0.0008)	(0.0008)
FFR			0.0210***
			(0.0011)
LTBY			-0.0172***
			(0.0015)
No IT	0.0229***	0.0232***	0.0237***
	(0.0035)	(0.0036)	(0.0036)
AIT	-0.0687***	-0.0800***	-0.0834***
	(0.0043)	(0.0048)	(0.0048)
Constant	0.3599***	0.3572***	0.3584***
	(0.0027)	(0.0027)	(0.0027)
Observation	39057	39057	39057
Banks	1172	1172	1172
R-Square	0.5477	0.5481	0.5542
Fixed Effects	Yes	Yes	Yes

*Note: *** p < 0.01, ** p < 0.05, and * p < 0.1. The sample goes from 2004 to 2022. Regression results are obtained using the fixed-effect estimator with AR (1). Standard errors are reported in parentheses. Significant coefficients are in bold.*

BS = Banks' stability; ASSET= Total asset; RACR = Risk Adjusted Capital Ratio; NPA = Non-performing Asset; CTIR = Cost to income ratio; LTAR = Loan to asset ratio; DERT= Death rate; INF = inflation rate; RGDP = Real Gross Domestic Product; FFR= Federal fund rate; and LTBY = 10-Years Government Bond Yield; IT = Inflation targeting; TIT= Traditional inflation targeting and AIT= Average inflation targeting

Table 2: Effect of IT on banks' stability with RAP as dependent variable

Variables	**(A)**	**(B)**	**(C)**
ASSET	0.3309***	0.3183***	0.2285***
	(0.0159)	(0.0160)	(0.0159)
RACR	0.0605***	0.0588***	0.0581***
	(0.0023)	(0.0023)	(0.0022)
NPA	-0.0380***	-0.0326***	0.0404***
	(0.0057)	(0.0057)	(0.0063)
CTIR	-0.0694***	-0.0694***	-0.0692***
	(0.0004)	(0.0004)	(0.0003)
LTAR	0.0192***	0.0187***	0.0141***
	(0.0008)	(0.0008)	(0.0008)
DERT	0.2405***	0.2530***	0.3178***
	(0.0140)	(0.0138)	(0.0137)
INF		0.0178***	-0.0277***
		(0.0052)	(0.0054)
RGDP		0.0422***	0.0422***
		(0.0061)	(0.0060)
FFR			0.0560***
			(0.0048)
LTBY			0.1221***
			(0.0092)
No IT	0.585***	0.5261***	0.3138***
	(0.0134)	(0.0134)	(0.0164)
AIT	0.5285***	-0.5503***	-0.4828***
	(0.0134)	(0.0275)	(0.0272)
Constant	1.1703***	1.1525***	1.1500***
	(0.0338)	(0.0338)	(0.0348)
Observation	39057	39057	39057
Banks	1172	1172	1172
R-Square	0.5494	0.5501	0.5596
Fixed Effects	Yes	Yes	Yes

*Note: *** p < 0.01, ** p < 0.05, and * p < 0.1. The sample goes from 2004 to 2022. Regression results are obtained using the fixed-effect estimator with AR (1). Standard errors are reported in parentheses. Significant coefficients are in bold.*

RAP = Risk-Adjusted Profit; ASSET= Total asset; RACR = Risk Adjusted Capital Ratio; NPA = Non-performing Asset; CTIR = Cost to income ratio; LTAR = Loan to asset ratio; DERT= Death rate; INF = inflation rate; RGDP = Real Gross Domestic Product; FFR= Federal fund rate; and LTBY = 10-Years Government Bond Yield; IT = Inflation targeting; TIT= Traditional inflation targeting and AIT= Average inflation targeting.

Table 3: Effect of IT on banks' stability with ER as dependent variable

Variables	**(A)**	**(B)**	**(C)**
ASSET	-0.0024***	-0.0023***	-0.0024***
	(0.0005)	(0.0005)	(0.0005)
RACR	0.0052***	0.0052***	0.0052***
	(0.0000)	(0.0000)	(0.0000)
NPA	-0.0002*	-0.0002*	-0.0000
	(0.0001)	(0.0001)	(0.0001)
CTIR	0.0000***	0.0000***	0.0000***
	(0.0000)	(0.0000)	(0.0000)
LTAR	0.0006***	0.0006***	0.0006***
	(0.0000)	(0.0000)	(0.0000)
DERT	-0.0009***	-0.0009***	-0.0005
	(0.0003)	(0.0003)	(0.0003)
INF		-0.0002***	-0.0001
		(0.0001)	(0.0001)
RGDP		0.0002***	0.0001**
		(0.0001)	(0.0001)
FFR			0.0017***
			(0.0001)
LTBY			-0.0025***
			(0.0001)
No IT	-0.0001	-0.0003	-0.0000
	(0.0004)	(0.0004)	(0.0004)
AIT	-0.0012	-0.0012	-0.0015***
	(0.0004)	(0.0005)	(0.0006)
Constant	0.0131***	0.0133***	0.0137***
	(0.0003)	(0.0003)	(0.0003)
Observation	39057	39057	39057
Banks	1172	1172	1172
R-Square	0.2826	0.2829	0.2906
Fixed Effects	Yes	Yes	Yes

*Note: *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$. The sample goes from 2004 to 2022. Regression results are obtained using the fixed-effect estimator with AR (1). Standard errors are reported in parentheses. Significant coefficients are in bold.*

ER = Equity ratio; ASSET= Total asset; RACR = Risk Adjusted Capital Ratio; NPA = Non-performing Asset; CTIR = Cost to income ratio; LTAR = Loan to asset ratio; DERT= Death rate; INF = inflation rate; RGDP = Real Gross Domestic Product; FFR= Federal fund rate; and LTBY = 10-Years Government Bond Yield; IT = Inflation targeting; TIT= Traditional inflation targeting and AIT= Average inflation targeting.

Table 4: Effect of IT on banks' profit with ROA as dependent variable

Variables	**(A)**	**(B)**	**(C)**
ASSET	0.0371***	0.0353***	0.0251***
	(0.0016)	(0.0016)	(0.0016)
RACR	0.0072***	0.0070***	0.0070***
	(0.0002)	(0.0002)	(0.0002)
NPA	-0.0108***	-0.0101***	-0.0014**
	(0.0006)	(0.0006)	(0.0006)
CTIR	-0.0084***	-0.0085***	-0.0085***
	(0.0000)	(0.0000)	(0.0000)
LTAR	0.0020***	0.0020***	0.0014***
	(0.0001)	(0.0001)	(0.0001)
DERT	0.0309***	0.0324***	0.0397***
	(0.0014)	(0.0014)	(0.0014)
INF		0.0032***	-0.0021***
		(0.0005)	(0.0006)
RGDP		0.0036***	0.0036***
		(0.0006)	(0.0006)
FFR			0.0071***
			(0.0005)
LTBY			0.0130***
			(0.0009)
No IT	0.0603***	0.0600***	0.0361***
	(0.0013)	(0.0013)	(0.0017)
AIT	-0.0709***	-0.0819***	-0.0740***
	(0.0024)	(0.0028)	(0.0028)
Constant	0.0927***	0.0900***	0.0921***
	(0.0036)	(0.0036)	(0.0038)
Observation	39057	39057	39057
Banks	1172	1172	1172
R-Square	0.6407	0.6413	0.6530
Fixed Effects	Yes	Yes	Yes

*Note: *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$. The sample goes from 2004 to 2022. Regression results are obtained using the fixed-effect estimator with AR (1). Standard errors are reported in parentheses. Significant coefficients are in bold.*

ROA = Return on assets; ASSET= Total asset; RACR = Risk Adjusted Capital Ratio; NPA = Non-performing Asset; CTIR = Cost to income ratio; LTAR = Loan to asset ratio; DERT= Death rate; INF = inflation rate; RGDP = Real Gross Domestic Product; FFR= Federal fund rate; and LTBY = 10-Years Government Bond Yield; IT = Inflation targeting; TIT= Traditional inflation targeting and AIT= Average inflation targeting.

Table 5: Effect of IT on banks' profit with ROE as dependent variable

Variables	(A)	(B)	(C)
ASSET	0.3561***	0.3252***	0.1949***
	(0.0204)	(0.0205)	(0.0205)
RACR	0.0160***	0.0141***	0.0112***
	(0.0029)	(0.0029)	(0.0029)
NPA	-0.1432***	-0.1297***	-0.0357***
	(0.0073)	(0.0074)	(0.0081)
CTIR	-0.0841***	-0.0843***	-0.0844***
	(0.0004)	(0.0004)	(0.0004)
LTAR	0.0135***	0.0128***	0.0061***
	(0.0010)	(0.0010)	(0.0010)
DERT	0.4478***	0.4716***	0.5695***
	(0.0176)	(0.0177)	(0.0176)
INF		0.0635***	-0.0031
		(0.0064)	(0.0068)
RGDP		0.0347***	0.0349***
		(0.0076)	(0.0075)
FFR			0.0440***
			(0.0062)
LTBY			0.2387***
			(0.0117)
No IT	0.7845***	0.7824***	0.4389***
	(0.0173)	(0.0173)	(0.0210)
AIT	-0.7182***	-0.9090***	-0.8068***
	(0.0304)	(0.0348)	(0.0345)
Constant	1.1533***	1.1172***	1.0562***
	(0.0406)	(0.0406)	(0.0412)
Observation	39057	39057	39057
Banks	1172	1172	1172
R-Square	0.5332	0.5347	0.5467
Fixed Effects	Yes	Yes	Yes

*Note: *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$. The sample goes from 2004 to 2022. Regression results are obtained using the fixed-effect estimator with AR (1). Standard errors are reported in parentheses. Significant coefficients are in bold.*

ROE = Return on equity; ASSET= Total asset; RACR = Risk Adjusted Capital Ratio; NPA = Non-performing Asset; CTIR = Cost to income ratio; LTAR = Loan to asset ratio; DERT= Death rate; INF = inflation rate; RGDP = Real Gross Domestic Product; FFR= Federal fund rate; and LTBY = 10-Years Government Bond Yield; IT = Inflation targeting; TIT= Traditional inflation targeting and AIT= Average inflation targeting.

Table 6: Effect of IT on banks' stability, including INF and IT interaction

	BS (Panel A)		RAP (Panel B)		ER (Panel C)	
Variables	**(1)**	**(2)**	**(1)**	**(2)**	**(1)**	**(2)**
ASSET	0.2893***	0.2799***	0.3206***	0.2227***	-0.0024***	-0.0025***
	(0.0044)	(0.0046)	(0.0161)	(0.0161)	(0.0005)	(0.0005)
RACR	0.0576***	0.0577***	0.0578***	0.0570***	0.0052***	0.0052***
	(0.0005)	(0.0004)	(0.0023)	(0.0022)	(0.0000)	(0.0000)
NPA	-0.0078***	-0.0042***	-0.0347***	-0.0386***	-0.0002**	-0.0000
	(0.0012)	(0.0012)	(0.0057)	(0.0063)	(0.0001)	(0.0001)
CTIR	0.0000	0.0001	-0.0696***	-0.0695***	0.0000***	0.0000***
	(0.0000)	(0.0000)	(0.0004)	(0.0003)	(0.0000)	(0.0000)
LTAR	0.0098***	0.0095***	0.0180***	0.0135***	0.0005***	0.0005***
	(0.0002)	(0.0002)	(0.0008)	(0.0008)	(0.0000)	(0.0000)
DERT	0.0498***	0.0604***	0.2501***	0.3214***	-0.0009**	-0.0005
	(0.0033)	(0.0035)	(0.0139)	(0.0139)	(0.0003)	(0.0004)
INF	0.0154***	0.0151***	0.0884***	-0.0501***	0.0005***	0.0005***
	(0.0012)	(0.0013)	(0.0097)	(0.0098)	(0.0001)	(0.0001)
RGDP	0.0030***	0.0024***	0.0348***	0.0341***	0.0002**	0.0001
	(0.0008)	(0.0008)	(0.0061)	(0.0061)	(0.0001)	(0.0001)
FFR		0.0209***		0.0582***		0.0017***
		(0.0011)		(0.0047)		(0.0001)
LTBY		-0.0169***		0.1197***		-0.0025***
		(0.0015)		(0.0092)		(0.0001)
No IT	0.0639***	0.0654***	0.6652***	0.4979***	0.0016***	0.0019***
	(0.0048)	(0.0048)	(0.0255)	(0.0269)	(0.0005)	(0.0005)
AIT	-0.0401***	-0.0509***	-0.1914***	-0.2300***	0.0007	0.0002
	(0.0068)	(0.0068)	(0.0536)	(0.0494)	(0.0007)	(0.0007)
INF*No IT	-0.0186***	-0.0194***	-0.0805***	-0.1057	-0.0009***	-0.0008***
	(0.0016)	(0.0016)	(0.0124)	(0.0124)	(0.0002)	(0.0002)
INF*AIT	-0.0218***	-0.0195	-0.1352***	-0.1129**	-0.0010***	-0.0009
	(0.0019)	(0.0019)	(0.0140)	(0.0139)	(0.0002)	(0.0002)
Constant	0.3480***	0.3489***	1.1364***	1.1305***	0.0128***	0.0133***
	(0.0027)	(0.0027)	(0.0339)	(0.0348)	(0.0003)	(0.0003)
Observation	39057	39057	39057	39057	39057	39057
Banks	1172	1172	1172	1172	1172	1172
R-Square	0.5502	0.5563	0.5481	0.5607	0.2836	0.2913
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

*Note: *** p < 0.01, ** p < 0.05, and * p < 0.1. The sample goes from 2004 to 2022. Regression results are obtained using the fixed-effect estimator with AR (1). Standard errors are reported in parentheses. Significant coefficients are in bold.*

BS = Banks' stability; RAP= Risk adjusted profit; ER= Equity ratio; ASSET= Total asset; RACR = Risk Adjusted Capital Ratio; NPA = Non-performing Asset; CTIR = Cost to income ratio; LTAR = Loan to asset ratio; DERT= Death rate; INF = inflation rate; RGDP = Real Gross Domestic Product; FFR= Federal fund rate; and LTBY = 10-Years Government Bond Yield; IT = Inflation targeting; TIT= Traditional inflation targeting and AIT= Average inflation targeting.

Table 7: Effect of IT on banks' profit, including INF and IT interaction

	ROA (Panel A)		**ROE (Panel B)**	
Variables	**(1)**	**(2)**	**(1)**	**(2)**
ASSET	0.0359***	0.0247***	0.3249***	0.1841***
	(0.0016)	(0.0016)	(0.0207)	(0.0208)
RACR	0.0069***	0.0069***	0.0128***	0.0099***
	(0.0002)	(0.0002)	(0.0029)	(0.0029)
NPA	-0.0103***	-0.0016***	-0.1324***	-0.0372***
	(0.0006)	(0.0006)	(0.0074)	(0.0081)
CTIR	-0.0085***	-0.0085***	-0.0846***	-0.0847***
	(0.0000)	(0.0000)	(0.0004)	(0.0004)
LTAR	0.0019***	0.0014***	0.0119***	0.0054***
	(0.0001)	(0.0001)	(0.0010)	(0.0010)
DERT	0.0317***	0.0398***	0.4711***	0.5772***
	(0.0014)	(0.0014)	(0.0178)	(0.0178)
INF	0.0109***	0.0065***	0.1483***	0.0870***
	(0.0010)	(0.0010)	(0.0121)	(0.0122)
RGDP	0.0028***	0.0027***	0.0262***	0.0257***
	(0.0006)	(0.0006)	(0.0076)	(0.0076)
FFR		0.0073***		0.0475***
		(0.0005)		(0.0063)
LTBY		0.0127***		0.2358***
		(0.0009)		(0.0117)
No IT	0.0735***	0.0554***	0.9611***	0.6650***
	(0.0026)	(0.0027)	(0.0321)	(0.0340)
AIT	-0.0371***	-0.0415***	-0.5268***	-0.5670***
	(0.0051)	(0.0051)	(0.0625)	(0.0619)
INF* No IT	-0.0079***	-0.0111***	-0.1026***	-0.1296***
	(0.0013)	(0.0013)	(0.0155)	(0.0154)
INF*AIT	-0.0161***	-0.0136***	-0.1510***	-0.1180
	(0.0014)	(0.0014)	(0.0175)	(0.0174)
Constant	0.0888***	0.0900***	1.0982***	1.0342***
	(0.0037)	(0.0038)	(0.0406)	(0.0411)
Observation	39057	39057	39057	39057
Banks	1172	1172	1172	1172
R-Square	0.6429	0.6541	0.5358	0.5476
Fixed Effects	Yes	Yes	Yes	Yes

*Note: *** p < 0.01, ** p < 0.05, and * p < 0.1. The sample goes from 2004 to 2022. Regression results are obtained using the fixed-effect estimator with AR (1). Standard errors are reported in parentheses. Significant coefficients are in bold.*

ROA = Return on asset; ROE= Return on equity; ASSET= Total asset; RACR = Risk Adjusted Capital Ratio; NPA = Non-performing Asset; CTIR = Cost to income ratio; LTAR = Loan to asset ratio; DERT= Death rate; INF = inflation rate; RGDP = Real Gross Domestic Product; FFR=

Federal fund rate; and LTBY = 10-Years Government Bond Yield; IT = Inflation targeting; TIT= Traditional inflation targeting and AIT= Average inflation targeting.

Table 8: Effect of IT on banks' stability and profit, including FFR and IT interaction

Variables	BS	RAP	ER	ROA	ROE
ASSET	0.2435***	0.2285***	-0.0052***	0.0281***	0.2426***
	(0.0048)	(0.0164)	(0.0005)	(0.0016)	(0.0211)
RACR	0.0566***	0.0581***	0.0052***	0.0069***	0.0105***
	(0.0004)	(0.0022)	(0.0000)	(0.0002)	(0.0029)
NPA	-0.0016	0.0413***	0.0001	-0.0013**	-0.0383***
	(0.0012)	(0.0063)	(0.0001)	(0.0006)	(0.0081)
CTIR	0.0001**	-0.0692***	0.0000***	-0.0085***	-0.0845***
	(0.0000)	(0.0003)	(0.0000)	(0.0000)	(0.0004)
LTAR	0.0090***	0.0140***	0.0005***	0.0015***	0.0073***
	(0.0002)	(0.0008)	(0.0000)	(0.0001)	(0.0010)
DERT	0.0992***	0.3160***	0.0026***	0.0377***	0.5431***
	(0.0038)	(0.0140)	(0.0004)	(0.0014)	(0.0180)
INF	-0.0026***	-0.0285***	-0.0003***	-0.0023***	-0.0011
	(0.0007)	(0.0055)	(0.0001)	(0.0006)	(0.0068)
RGDP	0.0038***	0.0415***	0.0002*	0.0038***	0.0415***
	(0.0008)	(0.0061)	(0.0001)	(0.0006)	(0.0075)
FFR	0.0877***	0.0607***	0.0064***	0.0009***	-0.0836***
	(0.0028)	(0.0101)	(0.0003)	(0.0010)	(0.0131)
LTBY	-0.0075***	0.1261***	-0.0019***	0.0123***	0.2101***
	(0.0015)	(0.0097)	(0.0001)	(0.0010)	(0.0122)
No IT	0.0266***	0.3099***	0.0004	0.0311***	0.3735***
	(0.0036)	(0.0179)	(0.0004)	(0.0018)	(0.0229)
AIT	-0.0637***	-0.4635***	-0.0009*	-0.0747***	-0.9106***
	(0.0048)	(0.0306)	(0.0005)	(0.0031)	(0.0387)
FFR* No IT	-0.0635***	-0.0045	0.0047***	0.0077***	0.1502***
	(0.0030)	(0.0106)	(0.0003)	(0.0010)	(0.0138)
FFR*AIT	-0.1096***	-0.0194**	-0.0066***	0.0039***	0.1601
	(0.0033)	(0.0147)	(0.0003)	(0.0015)	(0.0187)
Constant	0.3293***	1.1539***	0.0105***	0.0873***	0.9892***
	(0.0027)	(0.0351)	(0.0003)	(0.0038)	(0.0413)
Observation	39057	39057	39057	39057	39057
Banks	1172	1172	1172	1172	1172
R-Square	0.5679	0.5598	0.2979	0.6536	0.5483
Fixed Effects	Yes	Yes	Yes	Yes	Yes

*Note: *** p < 0.01, ** p < 0.05, and * p < 0.1. The sample goes from 2004 to 2022. Regression results are obtained using the fixed-effect estimator with AR (1). Standard errors are reported in parentheses. Significant coefficients are in bold.*

BS = Banks' stability; RAP= Risk adjusted profit; ER= Equity ratio; ROA=Return on asset; ROE= Return on equity; ASSET= Total asset; RACR = Risk Adjusted Capital Ratio; NPA = Non-performing Asset; CTIR = Cost to income ratio; LTAR = Loan to asset ratio; DERT= Death rate; INF = inflation rate; RGDP = Real Gross Domestic Product; FFR= Federal fund rate; and LTBY = 10-Years Government Bond Yield; IT = Inflation targeting; TIT= Traditional inflation targeting and AIT= Average inflation targeting.

CHAPTER TWO: ANALYZING THE COMBINED IMPACT OF MONETARY POLICY INSTRUMENTS ON THE PROFITABILITY OF BANKS

1. Introduction

The analysis of how monetary policy tools affects banks' profitability in the United States has been the subject of substantial research, especially after the 2007 – 2009 financial crisis. The accommodative monetary policy tools that followed the financial crisis sparked a heated debate about the potential consequences of these policy tools on the United States banking system (Bank for International Settlements, 2012; Dale, 2012; Plosser, 2012; Rajan, 2013). However, almost all these debates focus on a single monetary policy tool, holding other monetary policy tools constant. This study fills the gap by analyzing the combined effect of monetary policy tools on banks' profitability in the United States.

Given that the Fed’s monetary policies do not affect the economy directly, it is the banks that play the vital role in the transmission mechanism of monetary policy's effect on the economy (Bernanke and Gertler, 1995; Kashyap and Stein, 1994). Hence, it is important to examine how monetary policies affect banks’ profitability. Banks are expected to reduce rates and expand lending to increase investment with an expansionary monetary policy. If there is a contractionary monetary policy, banks are supposed to raise rates and cut lending to decrease investment. The reality, on the other hand, is far from clear. Banks, in fact, respond autonomously to policy rate changes by changing their retail spreads, balance sheets, and risk profiles (Jimenez et. al., 2014; Borio and Zhu, 2012; Hannan and Berger, 1991). Furthermore, following monetary policy changes, banks' lending decisions directly depend on their monetary policy exposure (Gomez et. al., 2016).

While monetary policy tools are not the only factors influencing bank profits, they have a significant impact. Monetary policy tools can assist banks in gaining access to central bank liquidity and lowering their debt costs, thereby strengthening bank capital, and reducing non-performing assets (loans) and loan loss provisions (Bernanke and Gertler, 1995; Praet, 2016; Bernanke, 2007; Diamond and Rajan, 2006; Freixas and Jorge, 2008) due to increased bank funding. Conversely, there may be drawbacks to monetary policy tools to the soundness of the financial sector and the economy (Taylor, 2008; Allen and Rogoff, 2011; Stiglitz, 2016). These drawbacks include the possibility of a drop in net interest income (Borio et al., 2017). The reduction of interest rates by the Fed can have the same effect as a yield curve flattening, as a bank's interest revenue falls along with rates. Hence, in as much as monetary policy change can increase banks' profit, these same policies which reduce interest rates could jeopardize bank profits.

In the period of the financial crisis, the Fed used various monetary policy tools, including dropping short-term interest rates and letting long-term interest rates fall to a historical low level, to stimulate the financial sector and the economy's growth. Hence, some argued that monetary policy was the sole answer to the economic and financial difficulties during the 2007-2009 financial crisis (El-Erian, 2016). According to Kliesen (2010), when the Fed kept short-term interest rates low, the banking industry raised its net interest margin, which led to an increase in the banking sector's retained profit and, consequently, the capital. Between the fourth quarter of 2008, when the Federal Open Market Committee (FOMC) reduced the federal funds target rate to almost zero, and the first quarter of 2010, the average banking industry's net interest margin climbed by 21% — moving from 3.15% to 3.83% and reaching its highest level in almost seven years (Kliesen, 2010; Federal Financial Institutions Examination Council (US) and Federal Reserve Bank of St. Louis, 2021).

It is clear that many academic studies have documented the relationship between monetary policy tools and bank profitability (e.g., Samuelson, 1945; Flannery, 1981; Hancock, 1985; Smith et al., 2017; Murphy et al., 2017; Chen and Johnson., 2020). However, almost all of these studies (e.g., Kumar et al., 2020; Brei et al. (2019); Altavilla et al., 2018; Zimmermann, 2017) concentrate on how a monetary policy tool by the Fed affects bank profit, holding other monetary policy tools constant. But the Fed generally does not use monetary policy tools in isolation. Therefore, holding other monetary policy tools constant and using a particular monetary policy tool to examine the effect monetary policy tools have on banks' profitability limits our ability to understand the full impact of monetary policy tools on bank profit.

Figure 1 shows that monetary policy tools are not used in isolation. Therefore, using just one monetary policy tool and holding other tools constant to analyze the impact of monetary policy on bank profit might lead to inconsistent or biased conclusions. This study, therefore, contributes to the banking literature by examining the influence of monetary policy tools on bank profitability in the United States in more depth by analyzing the joint impact of monetary policy tools on bank profit. The policy tools examined include open market operations, discount rate, reserve requirements and long-term interest rate.

Reserve requirements are a mechanism for influencing the liquidity and credit generation of banks. Murphy et al. (2017) discovered that lowering reserve requirements has a favorable impact on banks' lending capacity, resulting in greater profitability. However, Harper and Turner (2020) pointed out that reduced reserve requirements may expose banks to greater liquidity risks, thereby negating profit advantages.

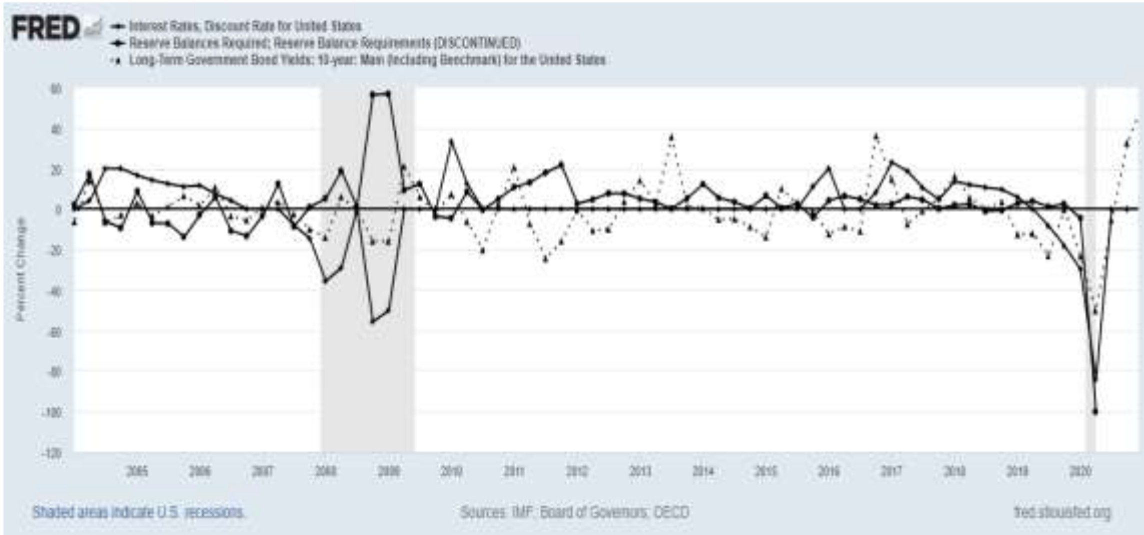

Figure 1: Monetary policy tools from 2004 to 2020

The buying and selling of government securities to affect the money supply is known as open market operations. Kim et al. (2019) evaluated the influence of open market purchases on bank profitability and discovered that expansionary activities were positively associated with greater bank profits as a result of expanded lending opportunities. Johnson and Foster (2021), on the other hand, contended that the impact of open market operations on bank profit might be modified by variables such as market expectations and inflation dynamics.

Several studies have been conducted to investigate the link between changes in the discount rate and their impact on bank profitability. Smith et al. (2017) discovered that lowering the discount rate has a favorable impact on banks' net interest margins, resulting in increased bank profits. Chen and Johnson (2020), on the other hand, warned that a protracted period of low discount rates might compress net interest margins, thereby harming bank profitability.

While previous studies have analyzed the individual impact of these monetary policy tools on bank profitability, this study takes a novel approach by examining their combined effect on bank profit. To accomplish this, the federal funds rate is used as a proxy to represent the collective influence of open market operation, discount rate and reserve requirements. By understanding how changes in the federal funds rate affect bank profitability, an insight into the combined impact of monetary policy tools can be gain on the banking sector in the United States.

The results of this study suggest that the federal fund rate has a positive relationship with bank profitability when the combined monetary policy tools are ignored. However, by including the combination of monetary policy tools, the federal fund rate has a negative relationship with bank profitability. Long-term bond yield has a positive impact on bank profitability. Finally, combined monetary policy tools have a positive effect on bank profitability. This means that each monetary policy tool's impact on bank profit depends on the other tools, and ignoring the combined impact of monetary policy tools in any analysis of bank profitability can result in bias and inconsistent conclusions.

This paper is divided into five sections. The second section reviews the literature. The research design, variable definitions, and data are discussed in Section 3. The results and additional analysis are discussed in Section 4 and Section 5 concludes the study.

2. Literature Review

Monetary policy tool effectiveness depends on critical transmission mechanisms that the Fed does not directly control. Monetary policy tool effectiveness depends on economic agents' reactions and motivations following the change in the policy tool. Banks are expected to lower interest rates and increase lending to increase investment in response to an expansionary monetary policy. In a contractionary monetary policy, banks are expected to raise interest rates and reduce lending to reduce investment. On the other hand, the reality of how monetary policy generally affects banks is fuzzy (Zentefis, 2017; Brunnermeier and Koby, 2016).

Most macroeconomic studies carefully model households' and businesses' reactions to monetary policy changes. Other studies explicitly include the banking sector and model bank responses to monetary policy. However, the combined effect of monetary policy tools on bank profit should not be taken for granted. This is because the manner through which monetary policy affects bank profit does not depend on one particular monetary policy tool. Zimmermann, (2017) argues that the channels through which monetary policy tools affect bank profit can be divided into three broad categories. The first class focuses on the direct effects on banks' existing stock of assets and liabilities, the second on the indirect effects through the real economy, and the third on the bank's endogenous reactions to monetary policy tool changes.

Samuelson (1945) contends that a simple maturity mismatch can affect bank margins and profit on the direct link between monetary policy and banks' profit. Since different maturities of assets and liabilities create a repricing risk for banks, a rise in interest rates, according to Samuelson (1945), harms the banking system if the average period of its incoming payments exceeds that of its outgoing payments. As a result, an expansionary monetary policy, like a decreased Fed fund rate, should improve bank profit. In contrast, a contractionary monetary policy, like an increased fed fund rate, should harm bank profit.

Other direct mechanisms through which monetary policy affects banks' profit, as discussed by Zimmermann (2017), include first, changes in policy rates cause a revaluation of securities on the bank's balance sheet. Secondly, the incentive for borrowers to use option effects, such as early repayment clauses, is highly dependent on the level of current interest rates. Interest rate changes may also impact the yield curve and bank earnings via the term premium (English, 2002).

Concerning the indirect effect of monetary policy tools on bank profit, monetary policy tightening generally leads to a short-run economic contraction. In contrast, expansionary monetary policy accompanies a real-economy expansion (Christiano et al.,1999; Romer and Romer, 2004). These real effects have an impact on the banking industry. For example, higher interest rates in the economy can reduce loan demand and loan growth. Additionally, higher interest rates can be linked to a higher likelihood of borrower default across a range of loan types, including mortgages, consumer loans, and business loans (Smith et al., 2018). As a result, banks often raise their loan loss provisions in response to the heightened risk of borrower defaults during periods of higher interest rates (Patel and Chen, 2019).

Concerning banks' endogenous reactions to monetary policy tool changes, banks may adjust their choice variables, such as retail interest rates and excess reserves, to maximize profit. Brown et al. (2018) analyzed how banks respond endogenously to changes in monetary policy, taking into account a variety of factors such as macroeconomic circumstances and regulatory limitations. The study discovered that banks intentionally change their retail interest rates and surplus reserves in order to maximize profits while meeting regulatory obligations. Furthermore, in markets with limited competition among banks, banks may be tempted to raise their retail rates to extract a higher margin from customers. In this case, the bank may trade off higher margin gains for deposit outflows (Drechsler et al., 2016 and Williams, 2016). Furthermore, if changes in interest rates make some assets more appealing relative to others, a bank may choose to adjust its asset composition in response to interest rate changes. Besides, given the reserve ratio, a bank may increase its excess reserve relative to the reserve ratio by considering the opportunity cost of lending and keeping funds in its vaults.

Given how monetary policy tools affect banks' profit, the evidence on the relationship between monetary policy and bank profit is mixed. Borio et al. (2017) found a positive link between short-term interest rates and bank profitability in 109 large multinational banks from 14 developed nations between 1995 and 2012. Examining the relationship between bank profits, the rate of return on capital, changes in interest rates, and other components of monetary and regulatory policy, Hancock (1985) found a positive association between short-term interest rates and bank profitability. Berument and Froyen (2015) investigated Finnish retail banks for ten years, starting in 2004, when there was a significant change in policy rates and market interest rates. Their findings indicated a positive association between rate changes and bank profitability. Demirguc-Kunt and Huizinga (1999) analyzed banks from 80 nations between 1988 and 1995 and discovered a positive link between interest rates and bank profitability.

In contrast, other studies have shown a negative or no relationship between monetary policy and bank profit. In a studyon ten OECD countries between 1979 and 2001, English (2002) contends that monetary policy had no significant effect on bank interest margins. Also, lower interest rates encourage banks to shift away from interest-based income toward fee and trading-based income (Reserve Bank of New Zealand, 2019b), which are essential components of bank profit. According to monetary policy theory, interest rates have an inverse relationship with asset valuations (Ubl, 2014). Kumar et al. (2020) confirmed this theory by finding that low-interest rates increased a bank's asset valuation, which promotes bank profitability in the United States and other advanced nations. Brei et al. (2019) analyzed 113 large banks in 14 different countries from 1994 to 2015 and found that each percentage decrease in the interest rate set by the central banks led to a 0.93 percent increase in fees and commission income. In a study analyzing the profitability of banks in Sweden and Denmark, Madaschi and Nuevo (2017) discovered that banks' profitability grew under negative interest rates. Aharony et al. (1986) used capital market data to evaluate the impact of changes in interest rates on commercial bank risk and profitability. They found a negative relationship between bank returns and interest rates. Finally, Strásk and Hwang (2019) investigated 50 European banks from 2014 to 2018 and discovered a negative connection between monetary policy and bank profitability.

The above literature shows no consensus on the effects of monetary policy tools on various measures of banking profit. One reason may be that these studies typically focus on a particular monetary policy tool holding other policy tools constant or forgetting other policy tools. However, because the Fed does not use monetary policy tools in isolation, these studies may be looking at monetary policy partially. In particular, their analysis may involve omitted variable bias, and their conclusions may be biased and inconsistent. This paper solves this issue by using four monetary policy tools. This helps to give a more consistent and unbiased conclusion of the effect of monetary policy tools on banks' profit in the United States.

3. Data and Research Design

3.1. Description and source of Data

This study uses quarterly panel data of more than one thousand commercial banks in the United States. The sample covers 19 years from 2004 to 2022, a period spanning different economic cycles, the great financial crisis, and the COVID-19 crisis. Data were collected from two sources: bank-level data was collected from Compustat, and data on macroeconomic factors and monetary policy variables were collected from the St. Louis Federal Reserve economic database (FRED).

3.2. Dependent Variables

This study will use two variables to measure bank profits - return on equity and return on assets as dependent variables. Most studies use return on equity (ROE) and return on assets (ROA) as measures of bank profitability. When comparing the ROA and ROE, Athanasoglou et al. (2008) note that ROA is the main bank profitability ratio since it considers the risks associated with leverage. However, when using ROA, the existence of off-balance-sheet assets can potentially result in investors, financial institutions, researchers, and other financing entities believing that a bank is in a better financial position than they are. As a result, Goddard et al. (2004) suggest using ROE. Hence, both ROA and ROE are used as proxies for bank profit.

3.3. Independent Variables (Controls)

Several control variables are used to improve the study's internal validity by limiting the impact of confounding and other extraneous variables. First are a set of time-varying bank-specific indicators important for bank behavior to account for bank characteristics. Bank size measured by the total assets of the bank can have a significant impact on a bank's profitability. Larger banks may generate a higher level of liquidity than their smaller counterparts (Le, 2019) due to the advantages of economies of scale (Berger et al., 2016). However, larger banks may also face greater regulatory scrutiny, which can increase compliance costs and reduce profitability. On the other hand, small banks may have a more localized customer base, which can allow them to develop stronger customer relationships and better understand local market conditions. However, smaller banks may also have higher per-customer costs due to a lack of economies of scale.

According to the Basel Accords, all banks must maintain a minimum percentage of risk-adjusted capital (RACR) to absorb losses (Kumar, 2018). RACR is a measure of a bank's capital adequacy that considers the risk level of its assets. That is, it is used to assess a bank's capacity to absorb losses from credit, market, and operational risks. A higher RACR indicates that the bank has a larger capital buffer relative to its risk-weighted assets, which can help mitigate losses in the event of adverse events. On the other hand, a lower RACR may indicate that the bank is more vulnerable to unexpected losses. Hence, RACR is a crucial factor that impacts bank profit. According to Parmer (2014), non-performing assets (NPA) are a huge challenge for every bank in the financial sector. They are loans or advances given by banks to borrowers that have stopped generating income for the bank due to non-payment of interest or principal. Higher NPA means a bank may have to set aside more money as provisions to cover the expected losses. This reduces the bank's profits as it reduces the amount of money available for lending and other activities. Also, higher NPAs indicate a higher level of credit risk associated with the bank's lending practices and can lead to a loss of investor confidence.

The cost-to-income ratio (CTIR) is used in this study as a measure of managerial efficiency. CTIR measures how much money it takes managers of the bank to make a dollar of profit. A higher CTIR indicates that a bank’s managers are spending more money on operating expenses relative to its income, indicating managerial inefficiency (Kar, 2012; Abd and Hassan, 2010). Loan-to-asset ratio (LTAR) is a financial metric that measures the percentage of a bank's assets that are tied up in loans. In general, a higher LTAR can increase a bank's profitability by generating more interest income, but they also carry a greater risk of loan defaults and losses.

The macroeconomic indicators used in this study are the rate of inflation (INF) and the growth rate in real gross domestic product (RGDP). Inflation can impact a bank's profitability in various ways. A moderate level of inflation can lead to increased loan demand and higher interest income for banks, which can result in higher profits. However, high inflation can lead to increased costs for banks, such as higher wages, rent, and other expenses, which can decrease profitability. Additionally, bank profit can be influenced by changes in the economy, including changes in real GDP. When the economy is growing and real GDP is increasing, banks may experience increased demand for loans and other financial services, which can lead to higher profits. Conversely, during periods of economic contraction or recession, banks may experience a decrease in loan demand, leading to lower profits.

3.4. Independent Variables (Monetary Policy Tools)

The Fed utilizes three monetary policy tools. These tools are open market operations, the discount rate, and reserve requirements (Board of Governors of the Federal Reserve System, n.d.). The Board of Governors of the Fed is responsible for the discount rate and reserve requirements, and the Federal Open Market Committee is responsible for open market operations. Using these three tools, the Fed influences the demand for, and supply of, funds that depository institutions hold at the Fed and in this way alters the federal fund rate (FFR) (Board of Governors of the Federal Reserve System, n.d.). This FFR is the interest rate at which depository institutions lend balances at the Federal Reserve to other depository institutions overnight. Hence, since these monetary policy tools (open market operations, the discount rate, and reserve requirements) are used to adjust the FFR, the changes in the FFR can be used to measure the combined effectiveness of the open market operations, the discount rate, and reserve requirements on bank profitability. This study therefore uses the FFR, as a proxy for short-term monetary policy tools, to measure the combined influence of open market operation, discount rate and reserve requirements on bank profit.

As noted above, the Fed uses short-term monetary policy tools to influence economic growth and inflation. However, in periods where interest rates approach the zero lower bound, the effects of short-term monetary policy tools on the economy may take time to materialize, especially for longer-term investments such as housing and business investment. Therefore, the Fed uses changes in long-term interest rates to affect spending and investment decisions by households and businesses, which can in turn influence economic activity and inflation over a long-term (Federal Reserve Bank of St. Louis, "Monetary Policy Basics"). Long-term interest rates, such as the 10-year government bond yield, can provide an indication of how markets perceive the impact of monetary policy on the economy over the long term. The yield on a government bond with a long maturity, such as the 10-year bond, provides a gauge of market expectations about future inflation and economic activity. Therefore the 10-year government bond yield (LTBY) is used as a proxy of long-term monetary policy tools in this study.

Additionally, other variables were processed in different ways. First, all observations with missing data on total assets were deleted from the data set. Secondly, because the dataset contains extreme values, it was winsorized at the 95th percentile and 5th percentile levels to mitigate the effect of extreme values on the results of the study. Also, since the total assets and non-performing assets are highly skewed, the natural logarithm of these variables was used to improve the interpretation of the model. Finally, the FFR and the 10-year government bond yield are multiplied to generate the variable of interest which is an interaction term called INT. As a result, INT will serve as a measure of the combined effect of monetary policy tools on bank profit.

Descriptive statistics for the variables used in the study are presented in Table 1. Generally, we notice that apart from FFR, the standard deviations are smaller than their respective means which indicates the data used in this study is more tightly clustered around the mean. That is the data used in this study is relatively stable and consistent, with fewer extreme values or outliers. Thereby lending to consistent results from this study. Appendix A presents the correlation matrix of the variables and the variance inflation factors of the explanatory variables used in this study. Values from Appendix A suggest that multicollinearity is not an issue in this study because the VIF for each of the explanatory variables is less than 5 (Gujarati, 2004). Since non-stationarity is a property common in panel data, I performed a unit root analysis by applying two different tests: the IPS test (Im et al., 2003) and LEVINLIN test (Levin et al., 2002) for stationarity. The table in Appendix B shows that the tests employed to analyze stationarity strongly reject the null hypothesis that the data used have a unit root.

3.5. Model specification

3.5.1 Dynamic model

The literature on bank profit indicates the dynamic nature of bank profitability (Athanasoglou et al., 2008; Bikker and Vervliet, 2018; Delis and Kouretas, 2011). Bank profitability tends to persist over time. Therefore, this level of persistence is captured by including a lagged dependent variable in the model. Also, with the dynamic nature of bank profitability, pooled ordinary least squares (OLS) estimators and the within estimators are not adequate (Nickell, 1981). Specifically, a pooled OLS estimate of the lagged dependent variables is biased upwards while the within estimate is biased downwards. Hence, I use the two-step system generalized method of moment (GMM) estimation to examine the model below. This method of estimation uses lagged values of the independent variables in levels and in difference as instruments as well as lagged values of other, potentially endogenous regressors. In this way, potential endogeneity, unobserved heterogeneity, and persistence of the dependent variable are controlled for.

The model for this paper will be:

$$prof_{i,t} = \beta_1 prof_{i,t-1} + \beta_2 ASSET_{i,t} + \beta_3 \mathrm{RACR}_{i,t} + \beta_4 NPA_{i,t} + \beta_5 \mathrm{CTIR}_{i,t} + \beta_6 \mathrm{LTAR}_{i,t} + \beta_7 INF_{i,t} + \beta_8 RGDP_t + \beta_9 FFR_t + \beta_{10} LTBY_t + \beta_{10} INT_t + \delta_t + \varepsilon_{i,t} \quad (1)$$

where; $prof_{i,t}$ is the profitability of bank i in quarter t, $prof_{i,t-1}$ is the profitability of bank i in the previous quarter t-1, $\mathrm{ASSET}_{i,t}$ is a measure of the size of bank i in quarter t, $RACR_{i,t}$ is the risk adjusted capital ratio of bank i in quarter t, $NPA_{i,t}$ is the non-performing asset of bank i in quarter t, $CTIR_{i,t}$ is the cost-to-income ratio of bank i in quarter t, $\mathrm{LTAR}_{i,t}$ is the loan to asset ratio of bank i in quarter t, INF_t is the inflation rate in the country at quarter t, $RGDP_t$ is the real gross domestic product of the country in quarter t, FFR_t is the federal fund rate in quarter t, $LTBY_t$ is the long-term bond yields in the country in quarter t, INT_t is the FFR and LTBY interaction term, δ_t is a quarter fixed effect and $\varepsilon_{i,t}$ is the stochastic error term.

For robustness, a fixed-effect estimator with AR (1) which is consistent with our baseline GMM estimation is employed. The fixed-effect model is preferred because it's plausible that certain fixed-effects unique to each bank could have an impact on their profitability, which is referred to as unobserved heterogeneity. Furthermore, I winsorized the data at the 90th percentile and 10th percentile, and the 99th percentile and 1st percentiles, and performed the fixed effect analysis on the new winsorized data.

4. Results and Discussions

4.1. Regression Results

Tables 2 and 3 present the results for the regression analysis for return to asset (ROA) and return to equity (ROE) respectively. The coefficient estimates with the robust standard errors in parentheses are reported. Column A contains only federal fund rate (FFR) as the only monetary policy tool with control variables. Column B has only long-term bond yields (LTBY) as the only monetary policy tool with control variables. Column C contains only INT as the interaction of FFR and LTBY with control variables. Column D contains both FFR and LTBY as separate monetary policy variables with control variables. Lastly Column E contains both FFR and LTBY with their interaction term and control variables. The Sargan test results presented in tables 2 and 3 indicate that there is no evidence of overidentifying restrictions in the model. Moreover, the lack of second-order autocorrelation implies that the estimates are reliable and consistent.

The results associated with FFR and LTBY are highly consistent for both measures of bank profitability. The coefficient of FFR is positive in all the columns where there is no INT but negative in the column where there is INT. This indicates that in the absence of an interaction term that measures the combined impact of monetary policy, an increase in federal fund rates leads to increased bank profitability. In the literature, there is no clarity concerning the relationship between interest rates and bank profitability. However, without INT, this study tends to side with the studies like Borio et al. (2017) and Hancock (1985) that argue that interest rates have a positive relationship with bank profitability. However, when INT is added, the result in this study changes from positive to negative. Therefore, from this result, it is argued that omitting the combined impact of monetary policies in any bank profitability analysis can lead to biased and inconsistent conclusions.

The long-term bond yield provides a gauge of market expectations about future inflation and economic activity. The coefficient on LTBY is positive and statistically significant in the columns of ROA but insignificant in one column of ROE. This shows that an increase in LTBY leads to increased bank profitability. That is, an increase in long-term bond yields typically boosts bank revenue—as long as the number of loans issues remains steady or grows. This result appears to be inconsistent with Pasiouras and Kosmidou (2007), who suggested a negative association between bond rates and bank profit.

The coefficient for INT, the interaction of FFR and LTBY, is positive and statistically significant for both ROA and ROE. That is, the effect of each of the monetary policy tools on bank profit depends on each other. For example, a percentage increase in federal fund rate is associated with an additional 0.0053 percentage point in bank profit (ROA) for each additional percentage point increase in long-term bond yield. Therefore, it is quite a limitation to analyze the effect of monetary policy tools on bank profit holding other tools constant.

The impact of bank profitability in the previous year on current-year profitability is negative across all columns of ROA, except in Column E. However, when ROE is used to measure profit, the effect of profitability in the previous year becomes positive across all columns, and this is consistent with conventional knowledge. It is worth noting that the coefficients for bank profitability in the previous year are statistically insignificant in all cases. In the literature, the relationship between bank size, measured by total assets, and bank profitability is ambiguous. In this study, a negative relationship is found between bank size and bank profitability, indicating that banks in the United States face greater regulatory scrutiny, leading to increased compliance costs and decreased profitability. The results suggest that better capitalized banks are more profitable when profitability is measured by ROA, although this effect is insignificant when ROE is used. This could be explained by the fact that better capitalized banks are seen as safer and are able to secure low-cost deposits while charging premium lending rates, as well as their ability to withstand negative economic shocks. Surprisingly, there is evidence of a positive impact of non-performing assets on bank profitability, although this is statistically insignificant at traditional levels of significance. Additionally, there is some evidence to suggest that a higher cost to income ratio is associated with decreased bank profitability, which is in line with previous studies such as Athanasoglou et al. (2008).

The relationship between loan to asset ratio and bank profitability is uncertain. This study found a positive impact of loan to asset ratio on bank profitability when ROA is used indicating that banks in the United States are pursuing prudent credit policies resulting in low default rates and increased profitability. However, when ROE is used the effect of loan to asset ratio on bank profitability is negative and statistically insignificant. This study also found that high inflation rates in the United States have a negative impact on bank profitability, as they lead to increased costs for banks, thereby reducing profitability. Furthermore, the relationship between real GDP and bank profitability is uncertain. The study found a positive influence of real GDP on bank profitability when ROA is used, but a negative effect when ROE is used.

4.2. Robustness Tests

4.2.1. Regression Results with Using Bank Fixed-Effect Model AR (1)

To check the robustness of the results, a bank-fixed effects estimator is used. This estimator captures individual bank-specific effects and unobserved heterogeneity. The results of the fixed effects method of estimation are largely consistent with the two-step system GMM estimator. Tables 4 and 5 show the results obtained through the fixed effects estimator with AR (1). Column A contains only the federal funds rate (FFR) as the only monetary policy tool with control variables. Column B has only long-term bond yields (LTBY) as the only monetary policy tool with control variables. Column C contains only INT as the interaction of FFR and LTBY with control variables. Column D contains both FFR and LTBY as separate monetary policy variables with control variables. Lastly, Column E contains both FFR and LTBY with their interaction term and control variables.

In general, the findings are in line with the outcomes obtained from the two-step system GMM estimator. Notably, when there is no INT, the FFR coefficient is positive in all of the columns, but it is negative when INT is included in the analysis. This supports the argument that ignoring the combined impact of monetary policies in any analysis of bank profitability can result in bias and inconsistent conclusions. The LTBY coefficient is positive and statistically significant in the ROA and ROE columns. Additionally, the INT coefficient, which is the interaction of FFR and LTBY, is positive and statistically significant for both ROA and ROE. This buttresses the point that the impact of each monetary policy tool on bank profit is dependent on the other tools. As a result, it is imprudent to examine the effect of monetary policy tools on bank profit while holding other tools constant.

4.2.2. Regression Results with Using Bank Fixed-Effect Model AR (1) for 99th percentile and 1st percentile and 90th percentile and 10th percentile winsorized data.

Tables 6 and 7 and tables 8 and 9 present the results of the bank-fixed effects estimator performed on the winsorized data at the 99th percentile and 1st percentile, and the 90th percentile and 10th percentile, respectively. Tables 6 and 8 display the regression analysis results for return on assets (ROA), while table 7 and 9 present the results for return on equity (ROE). Each appendix consists of 5 columns. Column A includes only the federal fund rate (FFR) as the monetary policy tool with control variables. Column B includes only the long-term bond yields (LTBY) as the monetary policy tool with control variables. Column C includes only the interaction term INT of FFR and LTBY with control variables. Column D includes both FFR and LTBY as separate monetary policy variables with control variables. Lastly, Column E includes both FFR and LTBY with their interaction term and control variables.

The results presented in tables 6, tables 7, tables 8, and tables 9 are in agreement with those obtained from the two-step system GMM in table 2, table 3, and the fixed effect model in table 4, and table 5. Particularly, in all the columns where there is no interaction term, INT, the FFR coefficient is positive, but it becomes negative when an INT is introduced. This finding supports the argument that ignoring the combined impact of monetary policy tools in any analysis on their effect on bank profitability can lead to biased and inconsistent conclusions. The coefficient for LTBY, on the other hand, is positive and statistically significant in the ROA and ROE columns. Furthermore, the coefficient for INT, which is the interaction between FFR and LTBY, is also positive and statistically significant in both the ROA and ROE columns. These findings continue to reinforce the idea that the impact of each monetary policy tool on bank profit depends on the other tools. Therefore, it is imprudent to examine the effect of individual monetary policy tools on bank profit while holding other tools constant.

5. Conclusion

The study investigates the combined impact of monetary policy tools on the profitability of banks in the United States. A quarterly dataset containing more than one thousand commercial banks in the United States from 2004 to 2022 was utilized.

The findings of this study suggest that without adding the interaction term of the federal fund rate and long-term bond yield to the analysis, the coefficient of the federal fund rate is positive. However, when the interaction term is included, the federal fund rate has a negative relationship with bank profitability. This supports the argument that ignoring the combined impact of monetary policies in any analysis of bank profitability can result in bias and inconsistent conclusions. The coefficient of the long-term bond yield has a positive impact on bank profitability, and the coefficient of INT, which is the interaction term of the federal fund rate and long-term bond yield, has a positive impact on bank profitability. This means that the impact of each monetary policy tool on bank profit is dependent on the other tools. Therefore, examining the effect of monetary policy tools on bank profit while holding other tools constant is inefficient.

The findings from this study should inform the Fed and other monetary policy authorities about how to analyze the effect of monetary policy tools on bank profit in the future. Banks are a vital sector of the economy, and their profitability is crucial for economic growth and development. Hence, proper analysis of the relationship between monetary policy tools and bank profitability will help monetary policy authorities to better examine and appraise their policies to help sustain the banking sector.

Table 1: Descriptive Statistics for quarterly data

Variable	Notation	Measure	Mean	Std. Dev.	Min	Max
Dependent Variables						
Return on Asset	ROA (%)	$\frac{Net\ Income}{Total\ Assets} \times 100$	0.1900	0.1476	-0.1721	0.4397
Return on Equity	ROE (%)	$\frac{Net\ Income}{Stockholders\ Equity} \times 100$	1.9494	1.5743	-1.8206	4.8514
Independent Variables						
Control Variables						
Total Asset	ASSET	Natural log of total assets of a bank	7.8538	1.6723	5.3552	12.2382
Risk Adjusted Capital Ratio	RACR (%)	$\frac{Tier\ 1\ Capital + Tier\ 2\ Capital}{Risk - Weighted\ Assets}$	14.7595	3.1315	10.7285	23.1415
Non-performing Asset	NPA	Natural log of non-performing assets of a bank	2.9943	1.6540	0.0000	6.6036
Cost to Income Ratio	CTNR (%)	$\frac{Total\ Operating\ Expenses}{Total\ Operating\ Income} \times 100$	80.4233	15.0812	57.1362	116.4944
Loan to Asset Ratio	LTAR (%)	$\frac{Gross\ Loans}{Total\ Assets} \times 100$	67.6305	11.6957	33.3482	84.5701
Inflation Rate	INF (%)	Quarterly percentage change in personal consumption expenditures excluding food and energy (chain-type price index)	1.9767	0.9169	0.8000	4.7000
Real Gross Domestic Product	RGDP (%)	Quarterly percentage change in real gross domestic product.	0.5221	0.5051	-0.5269	1.5428
Monetary Policy Tools						
Federal Fund Rate	FFR (%)	Quarterly federal funds rate, percentage	1.2625	1.6147	0.0800	5.2467
Long-Term Bond Yields	LTBY (%)	Quarterly 10-year long-term government bond yields, percentage	2.8769	1.0263	1.3233	4.7300

Table 2: Regression results of Two-Step System GMM Model – ROA

Variables	(A)	(B)	(C)	(D)	(E)
Lagged ROA	-0.0110 (0.0118)	-0.0110 (0.0118)	-0.0110 (0.0118)	-0.0118 (0.0121)	0.0547 (0.0627)
ASSET	-0.0139 (0.0219)	-0.0139 (0.0219)	-0.0139 (0.0219)	-0.0135 (0.0218)	-0.0195 (0.0205)
RACR	0.0211* (0.0113)	0.0211* (0.0113)	0.0211* (0.0113)	0.0205* (0.0114)	0.0141*** (0.0060)
NPA	0.0222 (0.0203)	0.0222 (0.0203)	0.0222 (0.0203)	0.0225 (0.0203)	0.0196 (0.0190)
CTIR	-0.0114*** (0.0009)	-0.0114*** (0.0009)	-0.0114*** (0.0009)	-0.0115*** (0.0009)	-0.0106*** (0.0007)
LTAR	0.0023 (0.0054)	0.0023 (0.0054)	0.0023 (0.0054)	0.0027 (0.0054)	0.0059 (0.0039)
INF	-0.0151* (0.0081)	-0.0194*** (0.0064)	-0.0151* (0.0081)	-0.0187*** (0.0063)	-0.0163*** (0.0057)
RGDP	0.0031 (0.0025)	0.0082** (0.0040)	0.0029 (0.0025)	0.0081* (0.0042)	0.0179*** (0.0070)
FFR	0.0222*** (0.0041)			0.0076 (0.0060)	-0.0204* (0.0123)
LTBY		0.0272** (0.0118)		0.0252* (0.0133)	0.0191*** (0.0060)
INT			0.0050*** (0.0008)		0.0053*** (0.0021)
Constant	0.6881 (0.6501)	0.6600 (0.6620)	0.6892 (0.6499)	0.6456 (0.6680)	0.5188* (0.2945)
Observation	33568	33568	33568	33568	33568
Banks	1013	1013	1013	1013	1013
AR (2)[a] (p-value)	0.311	0.311	0.311	0.287	0.697
Sargan test[b] (p value)	0.335	0.335	0.335	0.285	0.082

*Note: *** p < 0.01, ** p < 0.05, and * p < 0.1. The sample goes from 2004 to 2022. Regression results are obtained using the two-step system GMM method of estimation. Standard errors are reported in parentheses. Significant coefficients are in bold.*

[a] Reports p-values for the null hypothesis that there is absence of second-order autocorrelation.

[b] Reports p-values for the null hypothesis that there is no evidence of overidentifying restrictions

ROA = Return on assets; ASSET= Total asset; RACR = Risk Adjusted Capital Ratio; NPA = Non-performing Asset; CTIR = Cost to income ratio; LTAR = Loan to asset ratio; INF = inflation rate; RGDP = Real Gross Domestic Product; FFR= Federal fund rate; and LTBY = 10-Years Government Bond Yield.

Table 3: Regression results of Two-Step System GMM Model – ROE

Variables	(A)	(B)	(C)	(D)	(E)
Lagged ROE	0.0204	0.0204	0.0222	0.0142	0.0204
	(0.0197)	(0.0198)	(0.0209)	(0.0193)	(0.0197)
ASSET	-0.4630	-0.4892	-0.4552	-0.7317	-0.4630
	(0.6196)	(0.6318)	(0.6349)	(0.5693)	(0.6196)
RACR	0.3325	0.3225	0.3439	0.3053	0.3325
	(0.2156)	(0.2157)	(0.2389)	(0.2143)	(0.2156)
NPA	0.3909	0.4225	0.3829	0.6162	0.3909
	(0.5029)	(0.5126)	(0.5163)	(0.4624)	(0.5029)
CTIR	-0.1322***	-0.1341***	-0.1318***	-0.1391***	-0.1322***
	(0.0179)	(0.0185)	(0.0195)	(0.0171)	(0.0179)
LTAR	-0.0652	-0.0631	-0.0660	-0.0945	-0.0652
	(0.1003)	(0.1013)	(0.1009)	(0.0984)	(0.1003)
INF	-0.2863**	-0.3454***	-0.2877**	-0.3682***	-0.3179***
	(0.1297)	(0.1040)	(0.1308)	(0.0998)	(0.0515)
RGDP	-0.1084**	-0.0356	-0.1138**	-0.0667	-0.0868
	(0.0495)	(0.0815)	(0.0495)	(0.0815)	(0.2501)
FFR	0.3434***			0.1812	-0.0956
	(0.0754)			(0.1171)	(0.3266)
LTBY		0.3902*		0.2880	0.3643*
		(0.2194)		(0.2410)	(0.2155)
INT			0.0768***		0.0469
			(0.0168)		(0.0511)
Constant	14.8829	14.7656	14.7116	19.2078	14.4676
	(13.5222)	(13.9385)	(13.9716)	(13.1331)	(13.5584)
Observation	33568	33568	33568	33568	33568
Banks	1013	1013	1013	1013	1013
AR (2) (p-value)	0.446	0.425	0.461	0.417	0.446
Sargan test (p value)	0.924	0.180	0.101	0.171	0.175

*Note: *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$. The sample goes from 2004 to 2022. Regression results are obtained using the two-step system GMM method of estimation. Standard errors are reported in parentheses. Significant coefficients are in bold.*

[a] *Reports p-values for the null hypothesis that there is absence of second-order autocorrelation.*

[b] *Reports p-values for the null hypothesis that there is no evidence of overidentifying restrictions*

ROE = Return on equity; ASSET= Total asset; RACR = Risk Adjusted Capital Ratio; NPA = Non-performing Asset; CTIR = Cost to income ratio; LTAR = Loan to asset ratio; INF = inflation rate; RGDP = Real Gross Domestic Product; FFR= Federal fund rate; and LTBY = 10-Years Government Bond Yield.

Table 4: Regression results using bank fixed-effect model AR (1) – ROA

Variables	(A)	(B)	(C)	(D)	(E)
ASSET	0.0463***	0.0533***	0.0482***	0.0513***	0.0526***
	(0.0011)	(0.0011)	(0.0011)	(0.0011)	(0.0011)
RACR	0.0099***	0.0090***	0.0097***	0.0094***	0.0092***
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
NPA	-0.0069***	-0.0100***	-0.0059***	-0.0069***	-0.0067***
	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)
CTIR	-0.0079***	-0.0082***	-0.0079***	-0.0081***	-0.0081***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
LTAR	0.0027***	0.0024***	0.0026***	0.0023***	0.0023***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
INF	-0.0068***	-0.0078***	-0.0074***	-0.0083***	-0.0085***
	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)
RGDP	0.0012*	0.0014**	0.0010	0.0015**	0.0012*
	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)
FFR	0.0161***			0.0068***	-0.0106***
	(0.0041)			(0.0005)	(0.0017)
LTBY		0.0291***		0.0229***	0.0196***
		(0.0006)		(0.0008)	(0.0008)
INT			0.0039***		0.0043***
			(0.0001)		(0.0004)
Constant	0.1464***	0.0985***	0.1392***	0.1123***	0.1098***
	(0.0038)	(0.0037)	(0.0038)	(0.0039)	(0.0039)
Observation	35895	35895	35895	35895	35895
Banks	1125	1125	1125	1125	1125
R-Square	0.6378	0.6365	0.6410	0.6345	0.6292
Fixed Effects	Yes	Yes	Yes	Yes	Yes

*Note: *** p < 0.01, ** p < 0.05, and * p < 0.1. The sample goes from 2004 to 2022. Regression results are obtained using the two-step system GMM method of estimation. Standard errors are reported in parentheses. Significant coefficients are in bold.*

ROA = Return on assets; ASSET= Total asset; RACR = Risk Adjusted Capital Ratio; NPA = Non-performing Asset; CTIR = Cost to income ratio; LTAR = Loan to asset ratio; INF = inflation rate; RGDP = Real Gross Domestic Product; FFR= Federal fund rate; and LTBY = 10-Years Government Bond Yield.

Table 5: Regression results using bank fixed-effect model AR (1) – ROE

Variables	**(A)**	**(B)**	**(C)**	**(D)**	**(E)**
ASSET	0.5567***	0.6246***	0.5732***	0.6146***	0.6336***
	(0.0138)	(0.0137)	(0.0137)	(0.0137)	(0.0137)
RACR	0.0536***	0.0434***	0.0523***	0.0456***	0.0430***
	(0.0030)	(0.0030)	(0.0030)	(0.0030)	(0.0030)
NPA	-0.1154***	-0.1362***	-0.0974***	-0.1181***	-0.1142***
	(0.0095)	(0.0089)	(0.0095)	(0.0094)	(0.0093)
CTIR	-0.0769***	-0.0805***	-0.0774***	-0.0803***	-0.0803***
	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)
LTAR	0.0240***	0.0183***	0.0233***	0.0179***	0.0192***
	(0.0010)	(0.0010)	(0.0010)	(0.0010)	(0.0030)
INF	-0.0330***	-0.0512***	-0.0404***	-0.0538***	-0.0554***
	(0.0061)	(0.0061)	(0.0061)	(0.0061)	(0.0061)
RGDP	0.0062	0.0108	0.0045	0.0109	0.0073
	(0.0080)	(0.0079)	(0.0080)	(0.0079)	(0.0079)
FFR	0.1766***			0.0394***	-0.2494***
	(0.0054)			(0.0067)	(0.0218)
LTBY		0.3720***		0.3366***	0.2812***
		(0.0080)		(0.0101)	(0.0108)
INT			0.0453***		0.0713***
			(0.0012)		(0.0051)
Constant	1.5440***	1.0907***	1.4868***	1.1485***	1.1243***
	(0.0420)	(0.0415)	(0.0420)	(0.0420)	(0.0420)
Observation	35895	35895	35895	35895	35895
Banks	1125	1125	1125	1125	1125
R-Square	0.5082	0.5090	0.5052	0.5074	0.5036
Fixed Effects	Yes	Yes	Yes	Yes	Yes

*Note: *** p < 0.01, ** p < 0.05, and * p < 0.1. The sample goes from 2004 to 2022. Regression results are obtained using the two-step system GMM method of estimation. Standard errors are reported in parentheses. Significant coefficients are in bold.*

ROE = Return on equity; ASSET= Total asset; RACR = Risk Adjusted Capital Ratio; NPA = Non-performing Asset; CTIR = Cost to income ratio; LTAR = Loan to asset ratio; INF = inflation rate; RGDP = Real Gross Domestic Product; FFR= Federal fund rate; and LTBY = 10-Years Government Bond Yield.

Table 6: Regression results using bank fixed-effect model AR (1) for winsorize data at 99th and 1st percentile – ROA

Variables	(A)	(B)	(C)	(D)	(E)
ASSET	0.0425***	0.0552***	0.0456***	0.0520***	0.0544***
	(0.0018)	(0.0019)	(0.0018)	(0.0019)	(0.0019)
RACR	0.0108***	0.0098***	0.0106***	0.0101***	0.0099***
	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)
NPA	-0.0040***	-0.0092***	-0.0029**	-0.0051***	-0.0049***
	(0.0012)	(0.0012)	(0.0012)	(0.0012)	(0.0012)
CTIR	-0.0097***	-0.0099***	-0.0097***	-0.0098***	-0.0098***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
LTAR	0.0024***	0.0020***	0.0024***	0.0019***	0.0020***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
INF	-0.0015***	-0.0136***	-0.0124***	-0.0139***	-0.0145***
	(0.0008)	(0.0004)	(0.0008)	(0.0008)	(0.0008)
RGDP	0.0015***	0.0022***	0.0020***	0.0022***	0.0026***
	(0.0005)	(0.0004)	(0.0005)	(0.0005)	(0.0005)
FFR	0.0204***			0.0080***	-0.0158***
	(0.0007)			(0.0009)	(0.0028)
LTBY		0.0356***		0.0281***	0.0243***
		(0.0010)		(0.0013)	(0.0014)
INT			0.0049***		0.0057***
			(0.0002)		(0.0006)
Constant	0.3184***	0.2160***	0.3015***	0.2406***	0.2328***
	(0.0086)	(0.0087)	(0.0086)	(0.0089)	(0.0089)
Observation	35926	35926	35926	35926	35926
Banks	1131	1131	1131	1131	1131
R-Square	0.7282	0.7119	0.7217	0.7118	0.7068
Fixed Effects	Yes	Yes	Yes	Yes	Yes

*Note: *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$. The sample goes from 2004 to 2022. Regression results are obtained using the two-step system GMM method of estimation. Standard errors are reported in parentheses. Significant coefficients are in bold.*

ROA = Return on assets; ASSET= Total asset; RACR = Risk Adjusted Capital Ratio; NPA = Non-performing Asset; CTIR = Cost to income ratio; LTAR = Loan to asset ratio; INF = inflation rate; RGDP = Real Gross Domestic Product; FFR= Federal fund rate; and LTBY = 10-Years Government Bond Yield.

Table 7: Regression results using bank fixed-effect model AR (1) for winsorize data at 99th and 1st percentile – ROE

Variables	(A)	(B)	(C)	(D)	(E)
ASSET	0.4916***	0.6427***	0.5284***	0.6191***	0.6557***
	(0.0313)	(0.0315)	(0.0313)	(0.0318)	(0.0320)
RACR	0.1149***	0.0994***	0.1120***	0.1026***	0.0989***
	(0.0058)	(0.0058)	(0.0058)	(0.0058)	(0.0058)
NPA	-0.0915***	-0.1503***	-0.0691***	-0.1119***	-0.1077***
	(0.0217)	(0.0201)	(0.0216)	(0.0216)	(0.0216)
CTIR	-0.1175***	-0.1201***	-0.1178***	-0.1198***	-0.1198***
	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)
LTAR	0.0278***	0.0199***	0.0267***	0.0193***	0.0207***
	(0.0021)	(0.0021)	(0.0021)	(0.0021)	(0.0021)
INF	-0.0902***	-0.1271***	-0.1050***	-0.1297***	-0.1379***
	(0.0139)	(0.0140)	(0.0139)	(0.0139)	(0.0140)
RGDP	-0.0026	0.0093	0.0041	0.0085	0.0160**
	(0.0076)	(0.0076)	(0.0076)	(0.0076)	(0.0076)
FFR	0.2826***			0.0758***	-0.3494***
	(0.0124)			(0.0159)	(0.0490)
LTBY		0.5367***		0.4678***	0.3981***
		(0.0177)		(0.0228)	(0.0240)
INT			0.0699***		0.1028***
			(0.0027)		(0.0112)
Constant	3.9595***	2.7894***	3.7748***	2.9426***	2.8454***
	(0.1266)	(0.1278)	(0.1267)	(0.1294)	(0.1296)
Observation	35926	35926	35926	35926	35926
Banks	1131	1131	1131	1131	1131
R-Square	0.5959	0.5904	0.5928	0.5892	0.5855
Fixed Effects	Yes	Yes	Yes	Yes	Yes

*Note: *** p < 0.01, ** p < 0.05, and * p < 0.1. The sample goes from 2004 to 2022. Regression results are obtained using the two-step system GMM method of estimation. Standard errors are reported in parentheses. Significant coefficients are in bold.*

ROE = Return on equity; ASSET= Total asset; RACR = Risk Adjusted Capital Ratio; NPA = Non-performing Asset; CTIR = Cost to income ratio; LTAR = Loan to asset ratio; INF = inflation rate; RGDP = Real Gross Domestic Product; FFR= Federal fund rate; and LTBY = 10-Years Government Bond Yield.

Table 8: Regression results using bank fixed-effect model AR (1) for winsorize data at 90th and 10th percentile – ROA

Variables	(A)	(B)	(C)	(D)	(E)
ASSET	0.0456***	0.0501***	0.0471***	0.0489***	0.0500***
	(0.009)	(0.0009)	(0.0009)	(0.0009)	(0.0009)
RACR	0.0093***	0.0086***	0.0092***	0.0089***	0.0088***
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
NPA	-0.0068***	-0.0086***	-0.0056***	-0.0063***	-0.0059***
	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)
CTIR	-0.0071***	-0.0074***	-0.0072***	-0.0074***	-0.0074***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
LTAR	0.0027***	0.0025***	0.0027***	0.0024***	0.0025***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
INF	-0.0032***	-0.0040***	-0.0040***	-0.0046***	-0.0050***
	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)
RGDP	0.0004	0.0006	0.0002	0.0006	0.0003
	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)
FFR	0.0131***			0.0054***	-0.0093***
	(0.0003)			(0.0004)	(0.0014)
LTBY		0.0241***		0.0194***	0.0161***
		(0.0005)		(0.0006)	(0.0007)
INT			0.0034***		0.0038***
			(0.0001)		(0.0003)
Constant	0.1040***	0.0737***	0.0992***	0.0815***	0.0801***
	(0.0027)	(0.0026)	(0.0027)	(0.0027)	(0.0027)
Observation	38951	38951	38951	38951	38951
Banks	1161	1161	1161	1161	1161
R-Square	0.5942	0.5915	0.5890	0.5901	0.5851
Fixed Effects	Yes	Yes	Yes	Yes	Yes

*Note: *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$. The sample goes from 2004 to 2022. Regression results are obtained using the two-step system GMM method of estimation. Standard errors are reported in parentheses. Significant coefficients are in bold.*

ROA = Return on assets; ASSET= Total asset; RACR = Risk Adjusted Capital Ratio; NPA = Non-performing Asset; CTIR = Cost to income ratio; LTAR = Loan to asset ratio; INF = inflation rate; RGDP = Real Gross Domestic Product; FFR= Federal fund rate; and LTBY = 10-Years Government Bond Yield.

Table 9: Regression results using bank fixed-effect model AR (1) for winsorize data at 90th and 10th percentile – ROE

Variables	(A)	(B)	(C)	(D)	(E)
ASSET	0.5681***	0.6069***	0.5806***	0.6020***	0.6180***
	(0.0111)	(0.0110)	(0.0110)	(0.0109)	(0.0110)
RACR	0.0401***	0.0327***	0.0396***	0.0344***	0.0325***
	(0.0026)	(0.0025)	(0.0025)	(0.0025)	(0.0025)
NPA	-0.1123***	-0.1187***	-0.0945***	-0.1079***	-0.1018***
	(0.0070)	(0.0065)	(0.0069)	(0.0068)	(0.0068)
CTIR	-0.0680***	-0.0715***	-0.0686***	-0.0713***	-0.0714***
	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)
LTAR	0.0230***	0.0188***	0.0224***	0.0185***	0.0196***
	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)
INF	-0.0027	-0.0187***	-0.0121***	-0.0212***	-0.0252***
	(0.0052)	(0.0052)	(0.0052)	(0.0052)	(0.0052)
RGDP	-0.0017	0.0036	-0.0042	0.0028	-0.0007
	(0.0066)	(0.0065)	(0.0066)	(0.0065)	(0.0065)
FFR	0.1381***			0.0262***	-0.2068***
	(0.0044)			(0.0053)	(0.0177)
LTBY		0.3033***		0.2809***	0.2288***
		(0.0064)		(0.0080)	(0.0088)
INT			0.0376***		0.0603***
			(0.0010)		(0.0044)
Constant	1.1101***	0.8221***	1.0686***	0.8467***	0.8325***
	(0.0285)	(0.0283)	(0.0285)	(0.0285)	(0.0286)
Observation	38951	38951	38951	38951	38951
Banks	1161	1161	1161	1161	1161
R-Square	0.4247	0.4363	0.4242	0.4350	0.4317
Fixed Effects	Yes	Yes	Yes	Yes	Yes

*Note: *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$. The sample goes from 2004 to 2022. Regression results are obtained using the two-step system GMM method of estimation. Standard errors are reported in parentheses. Significant coefficients are in bold.*

ROE = Return on equity; ASSET= Total asset; RACR = Risk Adjusted Capital Ratio; NPA = Non-performing Asset; CTIR = Cost to income ratio; LTAR = Loan to asset ratio; INF = inflation rate; RGDP = Real Gross Domestic Product; FFR= Federal fund rate; and LTBY = 10-Years Government Bond Yield.

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APPENDICES CHAPTER TWO

Appendix A: Correlation Matrix and VIF Test for Multicollinearity

Variables	ROA	ROE	ASSET	RACR	NPA	CTIR	LTAR	INF	RGDP	FFR	LTBY	VIF
ROA	1											
ROE	0.9132*	1										
ASSET	0.2208*	0.2304*	1									**4.59**
RACR	0.0509*	-0.0850*	-0.0981*	1								**1.26**
NPA	-0.0891*	-0.0789*	0.7830*	-0.0745*	1							**4.11**
CTIR	-0.8648*	-0.7683*	-0.2576*	-0.0858*	0.0866*	1						**1.57**
LTAR	-0.0361*	-0.0739*	-0.2849*	-0.3176*	-0.1927*	0.0354*	1					**1.31**
INF	0.2033*	0.2287*	0.1365*	-0.0155*	-0.0637*	-0.2346*	-0.0554*	1				**1.20**
RGDP	0.1872*	0.1781*	0.0407*	0.0540*	-0.0426*	-0.2086*	-0.0509*	0.2522*	1			**1.10**
FFR	0.1441*	0.1902*	-0.0008	-0.2177*	-0.2048*	-0.0075	0.1107*	0.2045*	0.0183*	1		**2.66**
LTBY	-0.0497*	0.0383*	-0.0995	-0.2372	-0.1356*	0.2022*	0.0602	0.0629*	-0.0408*	0.7291*	1	**2.46**

*Note: * $p < 0.1$. ROA = Return on Asset; ROE = Return on equity; ASSET= Total asset; RACR = Risk Adjusted Capital Ratio; NPA = Non-performing Asset; CTIR = Cost to income ratio; LTAR = Loan to asset ratio; INF = inflation rate; RGDP = Real Gross Domestic Product; FFR= Federal fund rate; and LTBY = 10-Years Government Bond Yield.*

Appendix B: Stationarity test for panel dataset

Test	**Levinim**	**ips**
Value	<0.001	<0.001

CHAPTER THREE: THE EFFECT OF AVERAGE INFLATION TARGETING ON MACROECONOMIC OUTCOMES IN THE UNITED STATES

1. Introduction

To stimulate economic growth and achieve a desired level of inflation, central banks in many countries rely on monetary policy, and one policy that has gained popularity in recent years is inflation targeting. In January 2012, the Federal Reserve adopted the policy to peg inflation to a 2% target (U.S. Bureau of Economic Analysis, 2020). In August 2020 the Federal Reserve amended its policy from inflation targeting to average inflation targeting (AIT) (U.S. Bureau of Economic Analysis, 2020). This paper analyzes the effect of AIT on macroeconomic outcomes using models developed for inflation rate, output growth rate, and interest rate.

The Reserve Bank of New Zealand was the first central bank to adopt inflation targeting in 1990, followed by the Bank of Canada in 1991 (Jahan, 2018). Since then, inflation targeting has gained popularity. Currently, more than twenty-six central banks have adopted inflation targeting (CentralBankNews.info, 2022). These include the Bank of England, the European Central Bank, and many central banks in Latin American countries (Hammond, 2011). One key feature of inflation targeting is an announced target or a target range, for some measure of inflation (Hammond, 2011; Petursson, 2005). This announced target makes the inflation targeting process transparent to the extent that forecasts of inflation and other macroeconomic variables are frequently published. Moreover, there is an explicit recognition that low and stable inflation is the main objective of an inflation target policy (Bernanke & Mishkin, 1997). Also, central banks that use an inflation targeting policy have some independence when selecting policy instruments to control the inflation rate. For example, they can set their instrument, usually a short-term nominal interest rate, without political interference (Debelle & Fischer, 1994).

Before January 2012, the Federal Reserve used an implicit inflation targeting policy. This policy did not have many of the characteristics of the traditional inflation targeting policy, which is an announcement of an inflation target and timely published forecasts. The unstated target for this implicit inflation target policy was 2% (U.S. Bureau of Economic Analysis, 2020). However, in January 2012, Chairman Bernanke stated that the Federal Reserve would now have an explicit inflation target that is in line with all the world's major central banks (U.S. Bureau of Economic Analysis, 2020). Using this explicit inflation targeting policy, the Federal Open Market Committee (FOMC) reacted to rising prices by raising the federal funds rate when inflation approached or exceeded the 2% target, even if only temporarily, as it did in 2018.

However, with the onset of COVID-19 pandemic, there was a destabilization of the economy of the United State resulting in an unstable inflation rate and lower economic growth rate. Yet the effort to use monetary policy to revive the economy was ineffective. The decline in real interest rate over the last 20 years pushed the federal fund rate to near the effective lower bound and placed downward pressure on the inflation rate. This situation has made conventional monetary policies less effective in bringing the economy back on track from the adverse effects of the COVID-19 pandemic.

Hence, in August 2022, Chairman Powell announced a revision to the Federal Reserve's IT monetary policy strategy, re-framing the 2 percent IT policy as a long-run AIT of 2 percent (U.S. Bureau of Economic Analysis, 2020; Powell, 2020). Thus, with the new framework, the FOMC will allow inflation above its target of 2 percent to offset periods of low inflation. To put it another way, the FOMC is aiming for a long-term AIT of 2 percent. According to the announcement by Chairman Powell (Powell, 2020), this revision from IT to AIT will help them to better achieve the dual mandate of maximum employment and stable prices, thereby reviving the economy from the adverse effect of the COVID-19 pandemic. Moreover, it is important to note that a critical component that is missing from the AIT is the horizon over which AIT will be measured.

After the adoption of AIT, inflation rates increased sharply from the 2 percent target. Figure 1 shows the historical inflation data as measured by the personal consumption expenditure, Chain-type Price Index, from January 2004 to June 2022. The figure shows that the inflation rate declined following the 2012 IT announcement. The inflation rate decreased from an average of 2.5 percent in the first quarter of 2012 to 0.2 percent in the fourth quarter of 2015. Also, prior to 2020, there were only two brief periods since the financial crisis of 2007-2009 when the inflation rate exceeded the 2 percent target. However, after the implementation of AIT in 2020, the inflation rate increased from 1.1 percent in the third quarter of 2020 to 1.2 percent in the fourth quarter of 2020 and continued to increase until it peaked at 6.6 percent in the second quarter of 2022. This inflation rate of 6.6 percent is the highest rate since the first quarter of 1980.

Before the implementation of AIT, the Federal Reserve rarely tolerated inflation rates above 2 percent and has raised interest rates whenever inflation approached the target of 2 percent. But with AIT, the Federal Reserve will accept higher inflation than it has if they believe inflation can return to 2 percent. Hence it is interesting to examine whether the increase in the inflation rate is a result of the implementation of the AIT policy. If so, to what extent has the introduction of AIT caused the inflation rate to increase?

Figure 1: The FOMC's preferred inflation measure, the core personal consumption expenditures index (in solid), and the 2 percent target inflation (in dash-dot).

It should be noted that since the implementation of the AIT global economic growth has been weak (World Bank, 2022) as a result of the COVID-19 pandemic. Also, the inflation rate increase is occurring at a time when there is a weak growth rate in the gross domestic product (GDP) in the United States. Figure 2 shows the behavior of the real GDP in the United States after the transition to AIT.

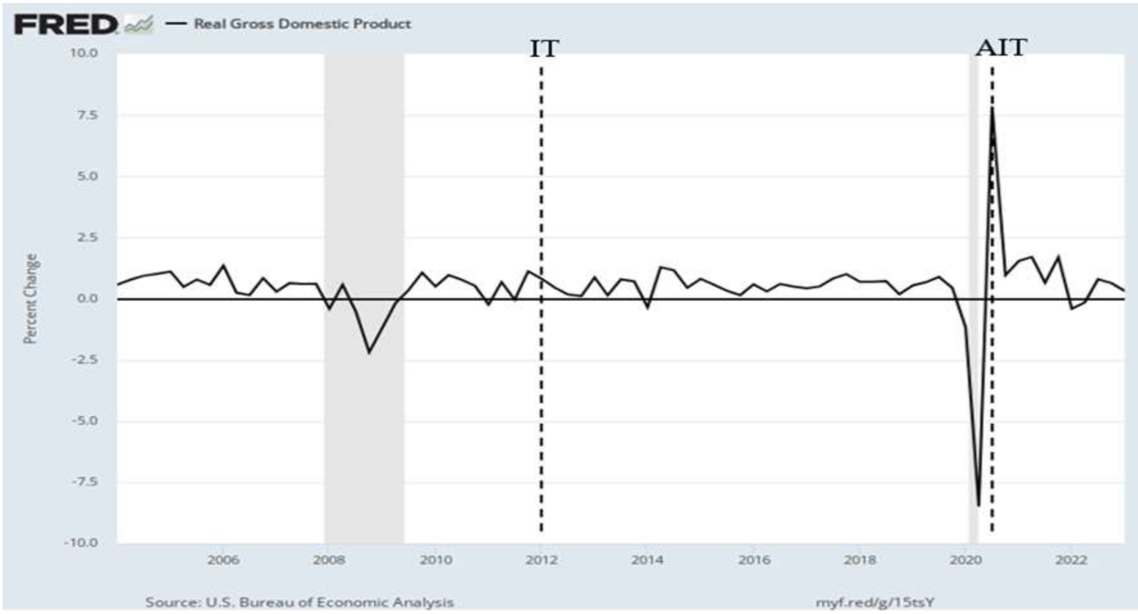

Figure 2: Real gross domestic product of the United States

From figure 2, the percent change in the real growth rate in the GDP decreased from 7.85 percent in the third quarter of 2020 to 0.96 percent in the fourth quarter of 2020. Then, the real GDP growth rate increased from 0.96 percent in the fourth quarter of 2020 to 1.71 percent in the second quarter of 2021, then a further decrease in the real GDP to 0.66 percent in the third quarter of 2021. Additionally, real GDP decreased to -0.41 percent in the first quarter of 2022, following an increase of 1.70 percent in the fourth quarter of 2021 (U.S. Bureau of Economic Analysis, 2022).

Moreover, between February and April 2020, the federal funds effective rate was reduced from 1.58 percent in February of that year to 0.05 percent in April (U.S. Bureau of Economic Analysis, 2022). The rate reduction was in response to the COVID-19 crisis, as was the Federal Reserve's quantitative easing during the period of the pandemic

(Milstein & Wessel, 2021). The federal fund effective rate was 0.10 percent in August 2020, the month AIT was implemented, and after many minor revisions, it was set to 0.08 percent in September 2021, and remained stable until March 2022, when it was adjusted to 0.2 percent (U.S. Bureau of Economic Analysis, 2022). The federal funds effective rate in the United States was 1.68 percent in July 2022 and continued to increase until it reached 4.10 percent in December 2022 (U.S. Bureau of Economic Analysis, 2022). Majerol (2022) claimed that the reason for the increase in the federal fund rate is to fight against inflation.

From the above, it appears that the adoption of AIT has resulted in changes in the macroeconomic outcomes in the United States. Hence, this study investigates whether there is a direct and/or indirect effect of AIT on macroeconomic outcomes -inflation, output growth rate, and interest rate - in the United States. Several studies have looked at how different economies are affected by IT (see Petursson, 2005; and Junankar and Wong, 2020). Other studies have also forecasted the effect of AIT on macroeconomic outcomes (Amano et al., 2020; Budianto et al., 2020 and Curdia, 2022). Jia (2022), in her commentary on AIT, also demonstrated how AIT is a better policy in a low-rate environment because of its ability to anchor inflation expectations and presented the possible implications of a flexible implementation of AIT. However, to the best of the author's knowledge, there is currently no study on the effect of the AIT policy, implemented in August 2020, on macroeconomic outcomes in the United States. Hence, this study contributes to the literature by examining the influence of AIT on the United States economy. The analysis is carried out by testing the following hypothesis.

Hypothesis 1: There is a relationship between AIT and inflation rate in the United States.

Hypothesis 2: There is a relationship between AIT and output growth rate in the United States.

Hypothesis 3: There is a relationship between AIT and interest rate in the United States.

After controlling for global and domestic factors that can affect macroeconomic factors, the results of this study show that the direct effect of the introduction of AIT is an increase in the percentage change in the inflation rate by more than 11 percentage point, an increase in the percentage change of the output growth rate by more than 33 percentage point when lagged variables are excluded, and an increase in the nominal interest rate by more than 0.5 percentage point. Also, the results shows that the total effect of the adoption of AIT is an increase in inflation rate by more than 19 percentage point and a nominal interest rate increase of more than 1 percentage point, but a decrease in the percentage change in output growth rate although it is insignificant at all the traditional levels of significance. This implies that the total effect of the adoption of average inflation targeting has led to an increase in inflation rate and interest rate but not a significant change in the output.

This paper is divided into five sections. The second section reviews the literature. The research design, variable definitions, and data are discussed in Section 3. The results and additional analysis are discussed in Section 4 and Section 5 concludes the study.

2. Literature review

Early empirical research on the macroeconomic effects of inflation targeting (see Bernanke, Laubach, Mishkin, and Posen, 1999; Corbo, Landerretche, and Schmidt-Hebbel, 2001; Neumann and von Hagen, 2002; and Truman, 2003) offered some evidence to support the idea that inflation targeting enhances macroeconomic performance.

The impact of inflation targeting on emerging market economies and OECD countries differs significantly regarding how it affects the average inflation rate. Considering subgroups of OECD nations, Ball and Sheridan (2004), Lin and Ye (2007), and Angeriz and Arestis (2008) demonstrated that the impacts of inflation targeting on average inflation and inflation variability are negligible. The same was confirmed by Mishkin and Schmidt-Hebbel (2007) for the OECD nations in their sample. Nevertheless, in their analyses of groups of emerging-market economies, Batini and Laxton (2007), Gonçalves and Salles (2008), and Lin and Ye (2009) discovered a considerable impact of inflation targeting on average inflation and frequently also on inflation variability. Combining both OECD and emerging-market economies, studies by Hyvonen (2004), Pétursson (2004a), Vega and Winkelried (2005), Mishkin and Schmidt-Hebbel (2007), and Pétursson (2009) found a significant effect of inflation targeting on average inflation and inflation volatility.

With the effect of inflation targeting on output growth, critics of inflation targeting, including Friedman and Kuttner (1996), Friedman (2002) and Cecchetti and Ehrmann (2002) are concerned that inflation targeting is primarily focused on inflation. And that efforts to control inflation will lead to real-economy instability and possibly lower growth as well. In their sample of OECD countries, Fang, Miller, and Lee (2009) found consistent results for countries that target inflation and experience lower output growth and higher output growth variability in the short run. However, this effect fades in the long run. Moreover, Ball and Sheridan (2005), in their sample of 20 OECD countries, found no significant effect of inflation targeting on average output growth or output volatility. According to Goncalves and Carvalho (2009), inflation-targeting OECD countries suffer more minor output losses in terms of sacrifice ratios during disinflationary periods than their non-targeting counterparts. When considering emerging-market economies, Batini and Laxton (2007) and Gonçalves and Salles (2008) discover that inflation targeting lowers the volatility of output growth.

Currently, most of the studies in the inflation-targeting literature look at the Zero lower bound (ZLB). These studies focus on conventional monetary policy, like quantitative easing (see Gertler and Karadi, 2011; Gertler and Karadi, 2013; Carlstrom, Fuerst, and Paustian, 2017; Sims and Wu, 2020; Sims, Wu, and Zhang, 2021), forward guidance (see Levin et al., 2010), or the negative interest rate policy (see Wu and Xia, 2020; Ulate, 2021). A few papers study a mix of policy tools at the ZLB (see Swanson, 2018; Wu and Zhang, 2019; Sims and Wu, 2020; Levin and Sinha, 2020; Swanson, 2021). In contrast to these publications, this study focuses on AIT, the Federal Reserve's newest monetary policy tool, and a revision of the inflation targeting policy and how it affects macroeconomic performance.

It is important to note that, during the recession and recovery from the 2008 Global Financial Crisis, the Federal Reserve kept the federal funds rate near zero for more than six years (Board of Governors of the Federal Reserve System, 2022). During this time, inflation mostly remained below the Federal Open Market Committee's (FOMC) target of 2% (U.S. Bureau of Economic Analysis, 2022). Researchers, such as Ajello et al. (2020), have looked at how a low natural interest rate combined with the ZLB on the nominal federal funds rate makes it more difficult for the Federal Reserve to resolve tradeoffs between the dual mandate of inflation stabilization and maximum employment. However, Mertens and Williams (2019) discuss that when the traditional monetary policy tool is unable to resolve the tradeoffs between the dual mandate of inflation stabilization and maximum employment, AIT emerged as a possible strategy to mitigate the effects of the ZLB in this environment.

According to Mertens and Williams (2019), AIT can mitigate the effects of the ZLB by raising inflation expectations when inflation is low. Svensson (2020) discussed the benefits of AIT in comparison to annual inflation targeting, price-level targeting, temporary price-level targeting, and nominal-GDP targeting. He found out that AIT has some advantages over the other strategies. The robustness of AIT to alternative assumptions about the slope of the Phillips curve and the uncertainty of economic slack has also been discussed by Hebden et al. (2020). They found that AIT can moderately offset the real effects of adverse economic shocks, even when much of the public is uninformed about the monetary strategy. Andrade et al. (2021) show that AIT can be used as a substitute for a higher inflation target in the eurozone, which is experiencing a low-interest rate. Papell and Prodan (2020) showed that AIT is consistent with an alternative policy rule forward guidance. They observed that the federal funds rate prescriptions from the consistent rules are closer to the liftoff from the effective lower bound in December 2015 and provide a closer fit to the actual federal funds rate than other policies to reduce or stabilize inflation.

Coibion et al. (2020) used survey data to examine how AIT affects expectations, whereas I examine how AIT affects macroeconomic outcomes such as inflation rate, output growth rate, and interest rates. Moreover, Amano et al. (2020) used a model to investigate the optimal degree of history dependence under AIT and discovered that it is relatively short. The focus of their paper is on a simple instrument rule. On the other hand, this paper aims to develop a model for analyzing how the implementation of AIT has impacted economic outcomes.

3. Data and Research Design

3.1. Description and Source of Data

This study uses quarterly time series data from the United States. The sample spans 19 years, from 2004 to 2022. This sample period is used because it includes various economic cycles, the Great Financial crisis, the Russian-Ukrainian war, and the COVID-19 crisis. Data were collected from two sources - the St. Louis Federal Reserve economic database (FRED) and the International Monetary Fund (IMF) database. The dependent variables are real personal consumption expenditure, real gross domestic product, and federal fund rate for the inflation rate, output growth rate, and interest rate models, respectively. Moreover, apart from the federal fund rate, which is measured as percentage, all the dependent variables are measured as a percentage change.

Further, additional variables, as defined below, were used in the model. First, the percentage of the output gap is derived by dividing the difference between the real GDP and potential real GDP by the potential real GDP and multiplying it by 100. Secondly, Using the Fisher equation the real interest rate is calculated by subtracting the inflation rate from the federal fund rate, which is a proxy for nominal interest rate. Next, the percentage change in the global price index of all commodities is used as a proxy for the global inflation rate. The expected inflation variable is from the inflation expectation surveys of consumers conducted by the University of Michigan. To obtain the remaining global data, countries of the G-20 are used because it brings together the world's major economies. Furthermore, the countries that form the G-20 account for more than 80 percent of world GDP, 75 percent of global trade, and 60 percent of the planet's population (G20, n.d). To measure global output, the quarterly real GDP of each country in the G-20 countries is divided by the quarterly exchange rate (domestic currency per United States dollar, quarter average) of that country. Then, the resulting GDP, in US dollars, is summed up for the various G-20 countries and the percentage change is calculated. Finally, the global interest rate is computed by adding and taking the averages of the central bank policy rate of the countries in the G-20. Then the percentage for the global interest rate is calculated.

Descriptive statistics for the variables used in the study are presented in Table 1. Generally, most of the variables have standard deviations that are larger relative to their respective means, especially global inflation, global GDP, real GDP, and output gap. This indicates high variability in the variables used in the study.

Overall, the descriptive statistics reveal a higher standard deviation compared to the means. Notably, the mean (standard deviation) for global inflation and global real GDP is 1.7837 percent (8.8869 percent) and 0.0654 percent (7.5962 percent), respectively. This indicates that global inflation and global real GDP have shown significant volatility during the study period. However, there are exceptions for personal consumption expenditure and federal fund rate, which have a mean (standard deviation) of 0.5408 percent (1.6384 percent) and 1.3108 percent (1.6204 percent), respectively. This suggests that inflation and interest rates have been relatively stable throughout the analysis period. The mean real GDP is 2.0658 percent, with a standard deviation of 5.8683 percent, indicating a higher variability in output growth rate.

With the descriptive statistics, I also compare the behavior of the macroeconomic outcomes, namely inflation rate, output growth rate, and interest rate, before and after the introduction of AIT. From table 2, the inflation rate, measured by the percentage change in real personal consumption expenditure has increased on average from 0.4617 percent to 1.3784 percent after the introduction of AIT. Furthermore, the percentage change in real GDP, which measures output growth rate, has increased on average from 1.3773 percent to 6.6100 percent after implementing AIT. Finally, the percentage nominal interest rate, measured by the federal fund rate, has decreased from 1.3997 percent to 0.7237 percent after the adoption of AIT.

Additionally, since non-stationarity is a property common in time series data, a unit root analysis is performed by applying two tests: the Augmented Dickey-Fuller test and the Phillips-perron test (Phillips and Perron, 1988) for stationarity. The table in Appendix A shows that the Augmented Dickey-Fuller and Phillips-perron tests reject the hypothesis that the variables, expected inflation, federal fund rate, and global interest rate, are stationary. However, at first difference, all series become stationary. The table in Appendix B shows that the Augmented Dickey-Fuller and Phillips-perron tests strongly reject the null hypothesis that the data used in the study, at first difference, have a unit root.

3.2. Model specification

3.2.1. Effect on inflation

The model used to test hypothesis 1 is the Congressional Budget Office's (CBO's) Philip curve model (Schafer, 2022). The original Phillips curve depicted the relationship between unemployment and wage inflation in the United Kingdom. However, it is now more commonly used to describe the relationship between unemployment, or another measure of labor utilization, and price inflation in goods and services. The theory behind this relationship is that as the unemployment rate falls, firms must offer higher wages to attract candidates from a shrinking labor pool to fill job openings. As a result, firms' production costs rise, and some of that cost is passed on to consumers through higher prices.

Central banks that use IT or AIT policy attempt to stabilize inflation around a set target and place some premium on stabilizing or increasing the real economy. Thus, the target value of the inflation rate of the central bank does not only include inflation but other variables like unemployment. When an economy is out of equilibrium due to an increase in aggregate demand, the quantity of goods and services demanded exceeds the number of goods and services produced at the current price level. Prices rise due to the temporary shortage of goods and services in the economy, as limited quantities are sold to consumers willing to pay more. Therefore, the inflation rate model used in this study will account for the effect of fluctuations in aggregate demand on inflation. That is, the CBO's Phillips curve model used in this study will include a variable for output gap (demand and supply) to account for the effect of the temporal shortage or surplus in goods and services.

Following Chen (2019), I include a variable that measures the changes in inflation due to changes in the relative price of imports. Shocks to short-run aggregate supply influence inflation through imported prices. A sudden increase in short-run aggregate supply due to positive global shocks, such as good weather and technology, can cause a temporary surplus of goods and services in the economy, pushing global prices down. Conversely, a sudden decrease in short-run aggregate supply caused by negative global shocks, such as a crude oil shortage, bad weather, war, and a pandemic, can result in a temporary shortage of goods and services, lifting global prices. Hence, a change in global prices can affect inflation in an economy like the United States, which heavily depends on imports. Hence a variable for global inflation is included in the CBO's Philips curve model to account for the effect of external price on the inflation rate in the United States.

Also, expected inflation can influence current inflation by affecting supply or demand. According to Schafer, (2022), inflation expectations can become a self-fulfilling prophecy, meaning that if expected inflation rises, actual inflation rises as well. If consumers anticipate higher inflation in the future, they may realize that their purchasing power will weaken more quickly, leading to an increase in demand for goods and services, hence, putting inflationary pressure on the economy. If businesses anticipate higher inflation in the future, they may believe it will be more profitable to produce or sell goods or services later, when the selling price of their output will be higher but some of their input prices, such as wages, will remain fixed. As a result, they may opt to reduce production today, putting the economy under inflationary pressure. With inflation targeting, there is an announced numerical target for inflation (Svensson, 2010). Hence, economic agents can make a prediction of inflation in the short run. Nevertheless, during this AIT period, making accurate short-run predictions of inflation becomes challenging due to the scarcity of information, especially when no specific horizon is given. Consequently, a variable for expected inflation is included in the inflation rate model to examine how expected inflation by economic agents has affected inflation rate since the implementation of AIT.

To assess the effect of the AIT on inflation, an indicator variable is added to the model which indicates quarters in which AIT was being implemented. The coefficient of this variable is the primary value of interest as it tells how inflation rate has changed after the introduction of AIT. The model also includes a lagged variable of current inflation to account for a possible bias due to the potential correlation between the indicator variable and past inflation. Following Petursson (2005), lagged variables of the output gap and global inflation are included in the model to account for any effect of the past output gap and past global inflation on current inflation. Therefore, the model used to examine the effect of AIT on inflation is:

$$\pi_t = \alpha_\pi + \beta_\pi AIT + \delta_\pi \pi_{t-1} + \gamma_\pi (y_t - y_{et}) + \gamma'_\pi (y_{t-1} - y_{et-1}) + \varphi_\pi \pi^I_t + \varphi'_\pi \pi^I_{t-1} + \tau_\pi \pi^e_{t+1} + \delta_t + \varepsilon_{\pi t} \quad (1)$$

where π_t is the current inflation rate, AIT is an indicator variable that takes on the value of 1 if AIT period and 0 otherwise, π_{t-1} is the lagged inflation rate, y_t is current real GDP, y_{et} is the potential real GDP, $y_t - y_{et}$ is the deviation from the equilibrium output in the current quarter (output gap in the current quarter), $y_{t-1} - y_{et-1}$ is the output gap in the previous quarter, π^I_t is the current quarter global inflation rate, π^I_{t-1} is the pervious quarter global inflation rate, $\pi^e_{t+1}$is the expected inflation rate in the next quarter, δ_t is the year fixed effect and $\varepsilon_{\pi t}$ is a white noise Gaussian error term in the inflation rate model.

3.2.2. Effect on output growth

Researchers that interpret IT as a strict monetary rule argue that inflation targeting can be harmful to growth (Friedman and Kuttner, 1996; Petursson, 2005), because of the trade-off between stabilizing the inflation rate and increasing the output growth rate. Any monetary policy that increases the output growth rate through the increase in aggregate demand will cause an increase in inflation rate. Thus, fixing the economy around a specifically targeted inflation rate can have a static, if not negative, effect on output growth. This seems to be confirmed when looking at the average growth of all 21 IT countries as of 2005 (Petursson, 2005). Petursson (2005) found that economic growth, measured by percentage changes in constant price GDP, has fallen slightly on average after inflation targeting in these countries. Hence, given that this AIT does not have a stated horizon like the traditional IT, it is important to examine the effect of the adoption of AIT on real output growth rate.

Monetarists argue that the government intervenes to manage the growth rate of money supply to harmonize it with the growth rate of output in the long run. They claim that the effect of money supply on the economy is different in the long-run and short-run (Froyen,1998). In the short run, the money supply is the dominant influence on the real variables (real GDP and employment) and price level. Nevertheless, in the long run, the influence of variation in the money supply is primarily on the price level and other nominal variables but not on real variables like real output and employment (Froyen,1998). Hence, a variable for real interest rate is added to the output growth rate model to account for the effect of money supply on output growth rate as argued by Milton Friedman in his monetarism theory.

Furthermore, part of the output growth in a country can be related to global structural factors such as international competition, the emergence of new suppliers of manufacturing and trade goods, COVID-19, and oil prices (Petursson, 2005). Therefore, a variable for global output growth rate is added to account for the strong effect of global growth on the output growth rate in the United States.

Finally, an indicator variable (AIT) is added to the output growth rate model to test hypothesis 2. The model also includes a lagged variable of current output to account for a possible bias due to the potential correlation between the indicator variable and past output performance because current output may depend on its lag. Following Petursson (2005), lagged variables of the real interest rate and global output are included in the model to account for any effect of the past interest rate and pervious global output on current output measure by the GDP. Hence, the model below will be used is analyze the effect of AIT on output growth rate:

$$y_t = \alpha_y + \beta_y AIT + \delta_y y_{t-1} + \gamma_y (i_t - \pi_t) + \gamma_y' (i_{t-1} - \pi_{t-1}) + \varphi_y y_t^I + \varphi_y' y_{t-1}^I + \delta_t + \varepsilon_{yt} \quad (2)$$

where y_t is the current output growth rate, AIT is an indicator variable that takes on the value of 1 if average inflation period and 0 otherwise, y_{t-1} is the previous quarter's output, i_t is the current nominal interest rate, π_t is the current inflation rate, $i_t - \pi_t$ is the current real interest rate, i_{t-1} is the pervious quarter's nominal interest rate, π_{t-1} is the previous quarter's inflation rate, $i_{t-1} - \pi_{t-1}$ is the previous quarter's real interest rate, y_t^I is the current global output growth rate, y_{t-1}^I is the pervious quarters global output growth rate, δ_t is the quarter fixed effect and ε_{yt} is a white noise Gaussian error term.

3.2.3. Effects on interest rate

For the public to have confidence in an IT monetary policy, the implementation of IT should decrease inflation expectations and the inflation risk premium on nominal interest rates (Petursson, 2005). As a result, nominal interest rates should decrease as well. Since economic agents have no knowledge of the horizon of the Federal Reserve's AIT, it is difficult for them to make better predictions. It is therefore important to analyze whether nominal interest rates have changed after the adoption of the AIT monetary policy framework. Following the Taylor Rule (Taylor, 1993), an interest rate model which includes the inflation rate, the global interest rate, and the output gap is developed to test hypothesis 3. I use this model to estimate the effect of AIT on nominal interest rate. The model is as follows:

$$i_t = \alpha_i + \beta_i AIT + \delta_i i_{t-1} + \gamma_i \pi_t + \gamma_i' \pi_{t-1} + \tau_i (y_t - y_{et}) + \tau_i' (y_{t-1} - y_{et-1}) + \varphi_i i_t^I + \varphi_i' i_{t-1}^I + \delta_t + \varepsilon_{it} \quad (3)$$

where i_t is the current nominal interest rate, AIT is an indicator variable that takes on the value of 1 if average inflation period and 0 otherwise, i_{t-1} is the previous quarter's nominal interest rate, π_t is the current quarter's inflation rate, π_{t-1} is the previous quarter's inflation rate, $y_t - y_{et}$ is the deviation from the equilibrium output in the current quarter (output gap in the current quarter), $y_{t-1} - y_{et-1}$ is the output gap in the previous quarter, i_t^I is the current quarter's global nominal interest rate, i_{t-1}^I is the previous quarter's global nominal interest rate, δ_t is the year fixed effect and ε_{it} is a white noise Gaussian error term.

3.3. Econometric Methodology: Three Stage Least Square (3SLS) Estimations

Estimating each model separately by pooled OLS or fixed effect models only provides reduced form estimates for the effects of AIT on the inflation rate, output growth rate, and interest rate. However, this estimation method provides no indication of the indirect and direct effects of AIT on the inflation rate, output growth rate, and interest rate. For instance, estimates of the parameter for the AIT in equation (2) embed the direct impact of AIT on real GDP and its indirect effects via inflation rate (real interest rate) as have been discussed above. Thus, the coefficient of AIT in equation (2) could be significant just because of its direct effect on real GDP. However, AIT's effect on real GDP can be indirect through other variables like the inflation rate (real interest rate). Hence, I use the 3 Stage Least Square (3SLS) estimation method to disentangle direct effects from indirect effects and eliminate the problem of endogeneity.

Zellner and Theil (1962) 3SLS estimates a system of structural equations with endogenous explanatory variables. All dependent variables are assumed to be endogenous and are treated as correlated with the disturbances in the system of equations. Additionally, unless otherwise stated, all other system variables are assumed to be exogenous to the system and unrelated to the disturbances. Also, exogenous variables are assumed to serve as instruments for endogenous variables.

In this study, the inflation rate affects the real output growth and interest rate. The real output growth rate affects the inflation rate and interest rate, and the interest rate affects the real output growth rate. Then inflation rate, real output growth rate, and interest rate are the endogenous variables in this system of equations modeled by the 3SLS, and they are assumed to correlate with the disturbances in the system of equations.

Moreover, estimates of β capture any direct impact on the economic outcomes in the system of equations. That is, β_π is the direct impact of AIT on the inflation rate, β_y is the direct impact of AIT on the growth rate, and β_i is the direct impact of AIT on the interest rate. In turn, $\beta_\pi\gamma_y$ and $\beta_\pi\gamma_i$ capture the indirect effects of AIT on the inflation rate via real gross domestic product and federal fund rate, respectively. $\beta_y\gamma_\pi$ and $\beta_y\tau_i$ capture the indirect effects of AIT on output growth rate through inflation rate and federal fund rate, respectively, and $\beta_i\gamma_y$ is the indirect impacts of AIT on the federal fund rate via real gross domestic product. The total effect of AIT on each dependent variable is the combination of direct and indirect effects. Consequently, this study will estimate and report the direct and total effects of AIT on the various macroeconomic outcomes.

3.4. Robust Test

For robustness, the seemingly unrelated regression (SUR) model is used to estimate the effect of the AIT policy on inflation rate, output growth rate, and interest rate. In cases where the regression model consists of multiple equations, SUR (Zellner, 1962) is a widely used estimation method designed to disentangle the direct and indirect effects. Regression coefficients, covariances between error terms, and unknown parameters in SUR are all calculated using techniques based on Generalized Least Squares or Maximum Likelihood.

4. Results and Discussions

4.1. Direct Effect of Average Inflation Targeting on Economic Outcomes

The main results for inflation rate, output growth rate, and interest rate models using the 3SLS and SUR are reported in tables 3, 4, and 5 respectively. By controlling global and domestic factors that affect macroeconomic outcomes, the results show that the direct effect of the introduction of AIT is an increase in the percentage change of inflation rate, output growth rate and interest rate. That is, unlike the traditional IT, AIT has led to an increase in inflation rate and interest rate. However, consistent with traditional IT, AIT has promoted real output growth rate. The next section details the direct effect of the introduction of the AIT on the macroeconomic variables used in the study.

4.1.1. Inflation rate

The results presented in table 3 indicate that the adoption of AIT has directly increased inflation in the United States and the change is significant at the 1 percent level of significance. This shows that adopting AIT has played a significant role in increasing inflation in the United States. The adoption of AIT led to more than a 11 percentage point increase in the rate of inflation – i.e., 2 percent to more than 13 percent. This result is consistent with the robust check conducted with the SUR.

Furthermore, a 1 percentage point increase in the percentage change in output gap has led to a more than 2 percentage point decrease in inflation rate, and this estimate is significant at a 1 percent level of significance. An output gap suggests that an economy is running at an inefficient rate. The negative relationship between the output gap and inflation rate shows that as the actual output falls below potential output over time, prices will begin to fall to reflect weak demand.

Moreover, a 1 percentage point increase in the percentage in the global inflation rate has resulted in a 0.0104 percentage point decrease in inflation rate in the United States. This is in contrast with the expectation that a temporary shortage of goods and services caused by the COVID-19, which raised global prices, has caused the domestic prices to increase. However, this estimate is not significant at any of the traditional levels of significance. Finally, a 1 percentage point increase in expected inflation rate has led to about a 1 percentage point increase in the current inflation rate and it is significant at 10 percent level of significance. Consumers will increase the demand for goods and services when they expect inflation rate to increase. This will lead to demand-pull inflation in the current period. This finding is consistent with Schafer (2022), who postulates that inflation expectations can increase the actual inflation rate in the current period. It is worth noting that the robust check done with the SUR is consistent with the results presented in this section.

4.1.2. Output growth rate

According to the estimates in 4, AIT has resulted in a direct average increase of more than 5% in the percentage point in gross domestic product in the United States. However, this estimate is not significant at any of the traditional level of significance. However, by excluding the lags of global real GDP and real interest rate, the direct effect of AIT on the percentage change in output growth rate is more than 33 percentage point increase. These estimates are significant at a 1 percent level of significance. Furthermore, table 4 shows that a 1 percentage point increase in real interest rate results in a 0.4108 percentage point increase in the percentage change in gross domestic product and it is significant at a 1 percent. In a high-growth economy like the United States, a higher real interest rate is required to encourage the volume of saving required for the high levels of investment required to boost economic growth.

Furthermore, a 1 percentage point increase in the percentage global real GDP leads to a 0.1408 percentage point increase in the percentage change in real GDP in the United States. This estimate is significant at a 1 percent level. This implies that the output growth of the United States has a positive relationship with the output growth of the global economy. Hence, any factor that affect the world's economy will have the same effect on the economy of the United States. With a country like the United States which is a significant part in the global economy, the GDP in the United States will increase as the global GDP increase. Likewise, the decrease in global GDP, which was because of the COVID-19 has cause the GDP in the United States to decrease. It is important to note that the robustness check conducted using SUR is in line with the results presented in this section.

4.1.3. Interest rate

From table 5, the adoption of AIT has resulted in a direct average increase of in the nominal interest rate in the United States. From this study, the implementation of AIT has increased the nominal interest rate by 0.7697 percentage point. This estimate is significant at a 10 percent level. Also, a 1 percentage point increase in the inflation rate has caused a 0.0417 percentage point decrease in the interest rate. In theory, when inflation is increasing, lenders will increase interest rates to encourage people to spend less and save more. Therefore, this estimate is contrary to what was expected in this study. Additionally, a 1 percentage point increase in the output gap leads to a 0.0775 percentage point increase in interest rate. But this is not significant at all the traditional levels of significance. Finally, a 1 percentage point increase in the percentage change in global interest rate causes a 0.0623 percentage point decrease in interest rate in the United States. This is significant at a 5 percent level. The robustness check conducted using SUR is consistent with the results presented in this section.

4.2. Indirect and Total Effect of Average Inflation Targeting on Economic Outcomes

A potential shortcoming of the results above is that they only provide the direct effects of AIT, for example, the direct impact of AIT on inflation, holding the effects on output growth rate and interest rates constant. Thus, omitting the potential effect of AIT on the inflation rate operating through its impact on output growth rate and interest rates. Suppose the output growth rate affects the inflation rate, and the interest rate affects the output growth rate. In that case, there are indirect effects of AIT on the inflation rate via its effects on interest rates and output growth rate. The same would be true for output growth rate and interest rate if such feedback effects exist, thus biasing the true total effects of AIT on macroeconomic outcomes.

Table 6 compares the direct, indirect, and total effects with standard errors calculated using the delta method in STATA statistical software. For the inflation rate and interest rate, the total effects are bigger than the direct effect of AIT. Nevertheless, the total effect of AIT on output growth rate is smaller than the direct effect of AIT, although they are insignificant at all the traditional levels of significance. Using the 3SLS and SUR, the indirect effect of AIT on the inflation rate through the output growth rate and interest rate are more than 5 percentage point, consequently, the total effect of AIT on the inflation rate are 19.7491 and 20.4918 percentage points respectively.

Moreover, the indirect effect of AIT on the output growth rate through inflation rate and interest rate using 3SLS and SUR are respectively 13.0198 and 12.5896 percentage points decrease in the output growth rate. Therefore, the total effect of AIT on the output growth rate is more than a 6 percentage point decrease in the output growth rate. Lastly, the result of the 3SLS and SUR shows that the indirect effect of AIT on the nominal interest rate, through the output growth rate, are an increase of 0.3162 and 0.0781 percentage points, respectively. Hence, the total effect using the 3SLS and SUR is 1.0859 and 0.2677 percentage points, respectively. Though, the total effect result from the SUR is insignificant at all the traditional levels of significance.

5. Conclusion

Since New Zealand initially adopted IT approach in early 1990, there has been an increase in support to monetary policy based on an IT. In January 2012, the Federal Reserve adopted IT to pin its inflation rate to a target of 2 percent. However, the use of conventional monetary policy in a zero-lower bound environment to revive the economy from the shocks of the COVID 19 pandemic was futile. Therefore, in August 2020, the Federal Reserve revised the IT policy strategy to implement an AIT as part of its long-run monetary strategy framework. The adoption of the AIT policy strategy was to help the Federal Reserve better achieve its dual mandate of stable inflation rate and stable growth rate.

After controlling various global and domestic factors that may influence macroeconomic conditions, the primary findings of this study reveal that the introduction of AIT has direct effects on key economic indicators. Specifically, it leads to an increase in the inflation rate by over 11 percentage points, a boost in the output growth rate by more than 33 percentage points (when lagged variables are excluded), and an uptick in the nominal interest rate by more than 0.5 percentage points.

Furthermore, the results demonstrate that the overall effect of adopting AIT is a significant increase in the inflation rate, exceeding 19 percentage points, along with a rise of more than 1 percentage point in the nominal interest rate. However, it also shows a decrease in the percentage change of the output growth rate, which is not statistically significant at conventional levels. This implies that the total effect of the adoption of average inflation targeting has indeed led to higher inflation and interest rates, but it hasn't caused a significant change in output.

The findings from this study should provide useful information for the Federal Reserve, other monetary policy authorities and business agents about the impact of AIT on the United States economy. This study should assist them in examining and appraising their policies to help sustain the United States economy. Conflicts between the lower inflation rate and economic stability will continue to arise. It is up to the Federal Reserve and other monetary policy authorities to examine the durability of their policies and how best those policies can cause significant economic growth and stability.

Table ***1: Descriptive Statistics of the variables over the period 2004-2022***

Variable	Notation	Mean	Std. Dev	Min.	Max.
Dependent Variables					
Personal Consumption Expenditure (%)	π_t	0.5408	1.6384	-9.2156	9.3525
Gross Domestic Product (%)	y_t	2.0658	5.8683	-29.9000	35.3000
Federal Fund Rate (%)	i_t	1.3108	1.6204	0.0600	5.2567
Independent Variables					
Global Inflation (%)	π_t^I	1.7837	8.8869	-35.6397	18.2362
Output Gap (%)	$y_t - y_e$	-1.8620	2.0012	-10.4174	1.1306
Expected Inflation (%)	π_{t+1}^e	3.1772	0.7138	2.0333	5.3333
Real Interest Rate (%)	$i_t - \pi_t$	-0.7313	1.8645	-5.9300	1.1306
Global GDP (%)	y_t^I	0.0654	7.5962	-48.9671	22.0404
Global Interest Rate (%)	i_t^I	5.3411	1.3345	1.0469	8.3347
Average Inflation Targeting	AIT	No = 66 Yes=10			

NOTE: No= The number of quarters before AIT; Yes= The number of quarters after AIT.

Table 2: Summary of Macroeconomic Outcome variables (in Levels) Before and After AIT Introduction

Variable	**Notation**	**Before AIT**	**AIT Period**
Personal Consumption		0.4617	1.3784
Expenditure (%)	π_t	(1.7005)	(1.2635)
Gross Domestic Product		1.3773	6.6100
(%)	y_t	(4.5642)	(10.4930)
Federal Fund Rate (%)		1.3997	0.7237
	i_t	(1.6614)	(1.2273)

NOTE: The figures which are not in the bracket are the mean. The figures in the bracket are the standard deviation.

Table 3: Regression results of 3SLS and SUR Model on inflation rate from eqn. (1)

Variable	3SLS (i)	3SLS (ii)	3SLS (iii)	SUR
$\boldsymbol{Constant}$	0.5884 (0.9754)	0.6382 (0.8965)	0.8546 (0.8081)	0.8660 (0.8081)
$\boldsymbol{AIT}$	11.9193*** (2.1450)	12.6387*** (2.0111)	14.4254*** (1.9416)	14.5160*** (1.9425)
$\boldsymbol{\pi_{t-1}}$	0.0293 (0.0925)	0.0562 (0.0898)	-0.2639 (0.2039)	-0.2614 (0.2039)
$\boldsymbol{(y_t - y_{et})}$	-2.3852*** (0.2412)	-2.5118*** (0.2239)	-2.3322*** (0.2526)	-2.3381*** (0.2526)
$\boldsymbol{(y_{t-1} - y_{et-1})}$			-0.6749** (0.2952)	-0.6829** (0.2955)
$\boldsymbol{\pi_t^I}$		0.0072 (0.0204)	-0.0069 (0.0246)	-0.0104 (0.0247)
$\boldsymbol{\pi_{t-1}^I}$			0.0022 (0.0221)	-0.0033 (0.0223)
$\boldsymbol{\pi_{t+1}^e}$	0.5852 (0.3625)	0.6689* (0.3781)	0.9306* (0.5034)	0.9811* (0.5062)

*Note: 3SLS (i) is 3SLS estimates without lags and international influence. 3SLS (ii) is 3SLS estimates without lags, but with international influence. 3SLS (iii) is 3SLS estimates with lags and international influence. SUR is SUR estimates with lags and international influence. *, ** and *** respectively denote significance at 10%. 5% and 1% levels. The sample goes from 2004 to 2022. Standard errors are reported in parentheses.*

Table 4: Regression results of 3SLS and SUR Model on output growth rate from eqn. (2)

Variable	3SLS (i)	3SLS (ii)	3SLS (iii)	SUR
$Constant$	-0.0072 (2.3162)	-0.7290 (2.2112)	-0.0720 (1.5336)	-0.0715 (1.5336)
AIT	36.5790*** (3.8335)	33.4566*** (3.7264)	5.7744 (4.4549)	5.7696 (4.4556)
y_{t-1}	-0.7320*** (0.0447)	-0.6993*** (0.0428)	-0.2159*** (0.0728)	-0.2161*** (0.0728)
$(i_t - \pi_t)$	1.4282*** (0.1533)	1.5111*** (0.1469)	0.4108*** (0.1478)	0.4116*** (0.1478)
$(i_{t-1} - \pi_{t-1})$			-2.4452*** (0.2972)	-2.4441*** (0.2973)
y_t^I		0.1785*** (0.0531)	0.1408*** (0.0473)	0.1410*** (0.0473)
y_{t-1}^I			0.1363*** (0.0461)	0.1370*** (0.0462)

*Note: 3SLS (i) is 3SLS estimates without lags and international influence. 3SLS (ii) is 3SLS estimates without lags, but with international influence. 3SLS (iii) is 3SLS estimates with lags and international influence. SUR is SUR estimates with lags and international influence. *, ** and *** respectively denote significance at 10%. 5% and 1% levels. The sample goes from 2004 to 2022. Standard errors are reported in parentheses.*

Table 5: Regression results of 3SLS and SUR Model on interest rate from eqn. (3)

Variable	3SLS (i)	3SLS (ii)	3SLS (iii)	SUR
$\boldsymbol{Constant}$	0.3812*** (0.1372)	0.4210*** (0.1299)	0.4490*** (0.1265)	0.4248*** (0.1252)
$\boldsymbol{AIT}$	0.2869 (0.3320)	0.5590* (0.3310)	0.7697* (0.4108)	0.1897 (0.4056)
$\boldsymbol{i_{t-1}}$	0.3255*** (0.0928)	0.1844* (0.0994)	0.1700 (0.1132)	0.1304 (0.1124)
$\boldsymbol{\pi_t}$	-0.0328** (0.0163)	-0.0322** (0.0160)	-0.0417** (0.0186)	0.0001 (0.0183)
$\boldsymbol{\pi_{t-1}}$			-0.0901** (0.0347)	-0.0640* (0.0343)
$(\boldsymbol{y_t - y_{et}})$	0.0306 (0.0423)	0.0087 (0.0426)	0.0775 (0.0516)	0.1560*** (0.0509)
$(\boldsymbol{y_{t-1} - y_{et-1}})$			-0.1101** (0.0524)	-0.0598 (0.0517)
$\boldsymbol{i_t^I}$		-0.0726*** (0.0276)	-0.0623** (0.0277)	-0.0700** (0.0275)
$\boldsymbol{i_{t-1}^I}$			-0.0244 (0.0518)	-0.0136 (0.0516)

*Note: 3SLS (i) is 3SLS estimates without lags and international influence. 3SLS (ii) is 3SLS estimates without lags, but with international influence. 3SLS (iii) is 3SLS estimates with lags and international influence. SUR is SUR estimates with lags and international influence. *, ** and *** respectively denote significance at 10%. 5% and 1% levels. The sample goes from 2004 to 2022. Standard errors are reported in parentheses.*

Table 6: Direct, indirect, and total effects of AIT

	3SLS	SUR
	Inflation Rate	
Direct Effect	14.4254*** (1.9416)	14.5160*** (1.9425)
Indirect Effect	5.3237** (2.1840)	5.9758*** (2.2132)
Total Effect	19.7491*** (3.2093)	20.4918*** (3.2779)
	Output Growth Rate	
Direct Effect	5.7744 (4.4549)	5.7696 (4.4556)
Indirect Effect	-13.0198 (10.1317)	-12.5896 (9.8090)
Total Effect	-7.2454 (5.7652)	-6.8200 (5.4465)
	Interest Rate	
Direct Effect	0.7697* (0.4108)	0.1897 (0.4117)
Indirect Effect	0.3162 (0.2026)	0.0781 (0.1693)
Total Effect	1.0859* (0.5895)	0.2677 (0.5733)

*The table reports the estimated direct, indirect, and total effects of AIT adoption. 3SLS is 3SLS estimates with lags and international influence. SUR is SUR estimates with lags and international influence. *, ** and *** respectively denote significance at 10%. 5% and 1% levels. The sample goes from 2004 to 2022. Standard errors, reported in parenthesis, are calculated using the delta method.*

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APPENDICES CHAPTER THREE

Appendix A: Stationarity test (Level)

Variables	**Notation**	**ADF**	**PP**
Real Personal Consumption Expenditure	$\pi_t(\%)$	-10.7380***	-10.8440***
Real Gross Domestic Product	$y_t(\%)$	-10.9850***	-11.1770***
Output Gap	$(y_t - y_e)(\%)$	-3.1620**	-3.1080**
Federal Fund Rate	$i_t(\%)$	-0.7320	-1.6040
Global Inflation	$\pi_t^I(\%)$	-5.1770***	-5.0770***
Expected Inflation	$\pi_{t+1}^e(\%)$	-2.2450	-2.2900***
Real Interest Rate	$(i_t - \pi_t)(\%)$	-5.9000***	-6.1100***
Global GDP	$y_t^I(\%)$	-4.4610***	-4.3970***
Global Interest Rate	$i_t^I(\%)$	-2.1470	-2.3730

*NOTE: ADF = Augmented Dickey–Fuller test; PP = Phillips-Perron Test; P-values are the Mackinnon approximate. P-values. *** p < 0.01, ** p < 0.05, and * p < 0.1.*

Appendix B: Stationarity test (First Difference)

Variables	**Notation**	**ADF**	**PP**
Real Personal Consumption Expenditure	$\pi_t(\%)$	-16.8930***	-23.3920***
Real Gross Domestic Product	$y_t(\%)$	-16.8680***	-24.798***
Output Gap	$(y_t - y_e)(\%)$	-10.6370***	-10.8330***
Federal Fund Rate	$i_t(\%)$	-2.8440*	-2.8590*
Global Inflation	$\pi_t^I(\%)$	-9.5670***	-10.1000***
Expected Inflation	$\pi_{t+1}^e(\%)$	-7.5990***	-7.5540***
Real Interest Rate	$(i_t - \pi_t)(\%)$	-16.4330***	-19.9070***
Global GDP	$y_t^I(\%)$	-9.2400***	-9.1060***
Global Interest Rate	$i_t^I(\%)$	-6.9690***	-6.8970***

*NOTE: ADF = Augmented Dickey–Fuller test; PP = Phillips-Perron Test; P-values are the Mackinnon approximate. P-values. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.*