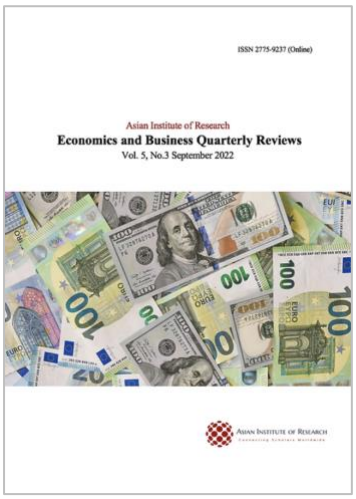

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Monetary Policy Responses to Crude Oil-Price Shocks: The Case of Selected Central Banks

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Abstract
Since the establishment of Central Banks, they have been responsible for their national economic stabilization. This paper explores how selected banks have responded to oil price shocks. Firstly, the paper provides a critical analysis of the effects of commodity price shocks using a version of the three equations – the New Keynesian model. Secondly, the paper chronologically investigates past responses to shocks from five central banks, emphasizing similar and extreme responses and their success. Lastly, the paper utilizes the historical analysis to formulate a recommended response for central banks today. The major outcome of this study is the culmination of a recommendation that proactively implementing contractionary monetary policy alongside expansionary fiscal policy, using conventional and unconventional policies is the most effective.

Keywords: Oil Price Shocks, Contractionary Monetary Policy, Expansionary Fiscal Policy, New Keynesian Model

1. Introduction

Central banks are responsible for stabilising the local economy through governance of the monetary system and policy. Throughout history, many events have destabilised the global economy causing fluctuating inflation, unemployment and GDP, and ultimately recessions; most recently the pandemic and conflict in Ukraine. One way in which these events destabilise is through commodity price shocks.

Oil price shock is one of the most pervasive commodity price shock due to its extensive use in every aspect of the supply chain and subsequent impact on the economy. This paper, therefore, highlights central bank responses to oil price shocks.

The paper starts by analysing the effects of commodity price shocks using a version of the three equation New Keynesian model. Then chronologically investigate past responses to shocks from five central banks, emphasising similar and extreme responses and their success. Finally, the study utilises the historical analysis to formulate a recommended response for central banks today.

2. Causes of Crude Price Oil Shocks of 1973, 1979 and 2008

At the culmination of the Yom Kippur War 1973, the Organisation of Arab Petroleum Exporting Countries, OAPEC, announced an oil embargo prohibiting many nations access to its oil supply due to Israeli allegiance through the conflict, dramatically increasing the price of oil. Thereafter, coined the "first oil shock," oil rose from $3.62 in January 1973 to $15.50, by February the following year, an increase of 328.28% (Trading Economics, 2022).

The Second Oil Shock of 1979 was as a consequence of the Iranian revolution, the global production of oil decreased by roughly 7% in 1979 (Gross, 2019). The price per barrel of crude oil rose from $62.50 to $140.19 in 15 months following this crisis (Macrotrends, 2022a).

The 2008 financial crisis did not only bring catastrophic effects to the financial market, but also commodity prices. Brent crude oil index reached a high of $132.7 in July 2008 before falling to $40.0 by December. (FRED, 2022c)

3. Evolution of Crude Oil Prices (1970-2014)

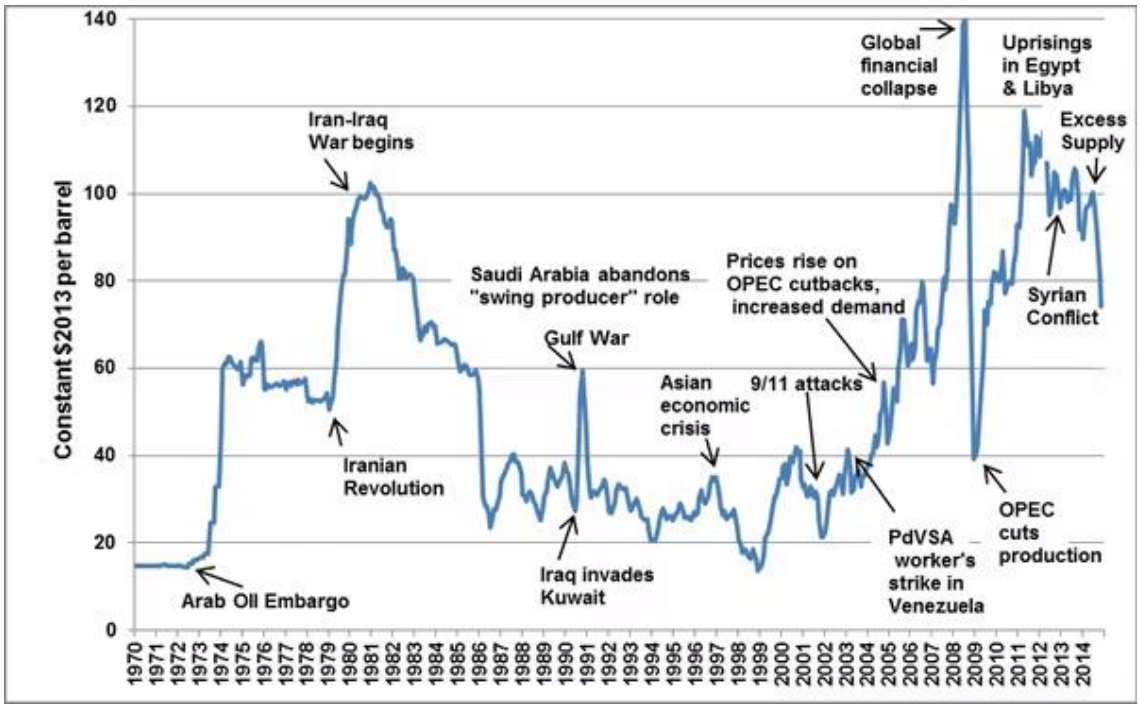

Figure 1: Crude oil prices react to many types of geopolitical events, from weather disasters to wars, revolutions, and economic growth or recessions. (U.S. Department of Energy)

4. Understanding Version Three Equation New Keynesian Model

Before discussing the notable time periods when the world experienced oil shocks, it is worth first discussing the key model used for this study – the version three equation New Keynesian Model. a new macroeconomic paradigm has emerged centered around the New Keynesian (henceforth NK) model, which is at the core of the more involved

and detailed dynamic stochastic general equilibrium (DSGE) models used for policy analysis at many central banks. Despite its apparent simplicity, the NK model is built on solid theoretical foundations and has therefore been used to draw normative conclusions on the appropriate response of monetary policy to economic shocks.

The general prescription arising from the canonical NK model (Goodfriend and King 2001) is that optimal monetary policy should aim at replicating the real allocation under flexible prices and wages, or natural output, which features constant average markups and no inflation. In the case of an oil price shock, policymakers should then simply stabilize prices, even if this leads to large drops in output and employment. Since the latter are considered efficient, monetary policy should focus on minimizing inflation volatility. There is an unexplained coincidence, that is, an absence of trade between stabilizing inflation and stabilizing the welfare-relevant output gap.

Modern monetary macroeconomics is based on what is increasingly known as the 3-equation New Keynesian model: IS curve, Phillips curve and a monetary policy rule equation. This model shows show how the equations can be derived from explicit optimizing behaviour on the part of the individual agents in the economy in the presence of some nominal imperfections. Further, this is in fact the approach already taken in many of the econometric models used for policy simulations within central banks or international institutions" (Woodford, 2003:237). It is against this backdrop that the three equation New Keynesian Model was adopted for this paper as its analytical tool.

5. Demand and Supply Causes of Crude Oil Prices

Before making attempts to assess the policy responses that the selected Central Banks took over the period under consideration in respect of crude oil price shocks, it is paramount that a brief overview of the demand and supply causes of crude oil prices are discussed. This is because since the 1970s oil crisis there has been a growing interest in understanding the dynamic effects of oil supply shocks on the real price of oil. Traditionally, these shocks were thought to reflect disruptions to the physical availability of crude oil caused mainly by exogenous geopolitical events. Yet several studies have appeared in recent years supporting the claim that oil supply shocks are of limited importance in explaining changes in the real price of oil during crisis periods, as most of the oil price changes in historical episodes can be largely explained by demand-specific shocks. However, historically, historical oil price shocks were primarily caused by significant disruptions in crude oil production that were brought about largely by exogenous geopolitical events, indicatively the 1956 Suez Crisis, the 1973 Arab Embargo, the 1979 Iranian Revolution, the 1980 Iran-Iraq War, and the 1990 Gulf War, immediate Post-September 2011 counter-attack by the US and its NATO allies on Iraq and the region, the 2008 financial crisis, and the Arab Spring pro-democracy protests in Middle-East and North Africa, especially the in Libya and Egypt in 2013/2014.

Scott L. Montgomery, in his 15th March 2022 Commentary in the New Hampshire Bulletin provides highlights on the evolution of crude oil price shocks:

> *"The world is in the grip of an oil price shock. In just a few months, prices have risen from $65 a barrel to over $130, causing fuel costs to surge, inflationary pressure to rise, and consumer tempers to flare. Even before Russia's invasion of Ukraine, prices were climbing rapidly because of roaring demand and limited supply growth.*
> *Price shocks aren't new. Viewed historically, they are an integral part of oil market dynamics, not anomalies. They have occurred since the birth of the industry.*
> *Many factors can trigger oil price shocks. They include large shifts in either demand or supply anywhere in the world, since oil is a global commodity. Shocks can also result from war and revolution; periods of rapid economic growth in major importing nations; and domestic problems in supplier countries, such as political conflict or lack of investment in the oil industry. Overall, the worst spikes have combined two or more of these factors – and that's the situation today…*
> *Today [2022], multiple factors are raising oil prices. There are three key elements: Oil demand has grown more rapidly than expected in recent months as countries emerged from pandemic lockdowns; OPEC+, a loose partnership between OPEC and Russia, has not raised production at a commensurate level, and neither have U.S. shale oil companies; and Countries have drawn on stocks of oil and fuel to fill the supply gap, reducing this emergency cushion to low levels."*

It is worth noting that each time there are these crude oil price shocks, there are various policy responses that governments put in place as mitigating measures, especially for developed countries. These attempts are aimed at bringing price stability to the crude oil industry. These could include finding more oil, investing in energy research and development, fuel subsidies, and creating strategic oil reserves that governments could use to mitigate future price shocks. But for developing countries which are the hardest hit economically by crude oil price shocks, mainly depend on positive multiplier effects that trickle down from policy responses in the developed world. The figure1 below provides a historical overview of the oil crises from 1970 to 2014. The data for the current price shock due to the ongoing war between Russia and Ukraine has not been analysed yet. The policy responses that are the focus of this paper relate to monetary policy or what can also the called Central Bank Responses. Therefore, the paper shall limit itself to such responses.

The next section attempts to highlight the various monetary policy responses by selected Central Banks during the period of crude oil price shocks.

6. Assessing Central Banks' Responses to Post 1970 Crude Oil Price Shocks

6.1. The Federal Reserve

Due to rising inflation in 1973, the funds rate soared until falling from 11.22% in August to 8.81% by February 1974 (FRED, 2022a). The Federal Reserve, Fed, eased policy immediately following the first oil shock to overcome effects caused by the embargo.

6.2. Federal Funds Rate

Figure 2: The Federal Funds Effective Rate in America in the 1970's, (FRED, 2022a)

\The Federal Open Market Committee, FOMC, decided to accommodate rising oil prices and maintain real money balances. However, focus changed towards inflation as it became apparent it was out of control after wage and price controls were lifted in April 1974. The fund's rate consequently rose to 13.6% in July before falling back down to pre-crisis levels by early 1975 (FRED, 2022a). On reflection, they realised inflation was underestimated when the recession severity became apparent. They eased monetary policy and the fund rate remained low until 1977. In 1975, the US adopted an expansionary fiscal policy and the economy subsequently boomed. The next three years saw an average GNP growth rate of more than 4% and improved inflation as CPI steadily increased by 2% (FRED, 2022b). Despite their quick response, it took understanding the severity of the recession to encourage a stricter, inflation-focused policy and achieve greater stabilisation.

The Fed's response to the second oil shock was very similar to their response to the first. Inflation had reached 13% in 1980. They initially targeted a reduction in money supply growth as the fund rate rose to 18% in 1981, but later shifted their focus to inflation. Therefore, inflation reduced to 4% in 1982 (FRED, 2022a; FRED 2022b).
In order to balance their objectives, stabilising both inflation and real output growth, they could have adopted a less turbulent approach. It has since been suggested that keeping the growth rate of total spending unchanged might

have helped achieve this balance (FRBSF, 1990). The immediate effect of this would be undesirable with increased inflation and decreased output growth, but it may limit further costs to the economy. This was seen in the desperate attempts of rapid recovery after each crisis as they proved to be superficially successful but detrimental to the economy in the following years.

6.3. US Consumer Prices

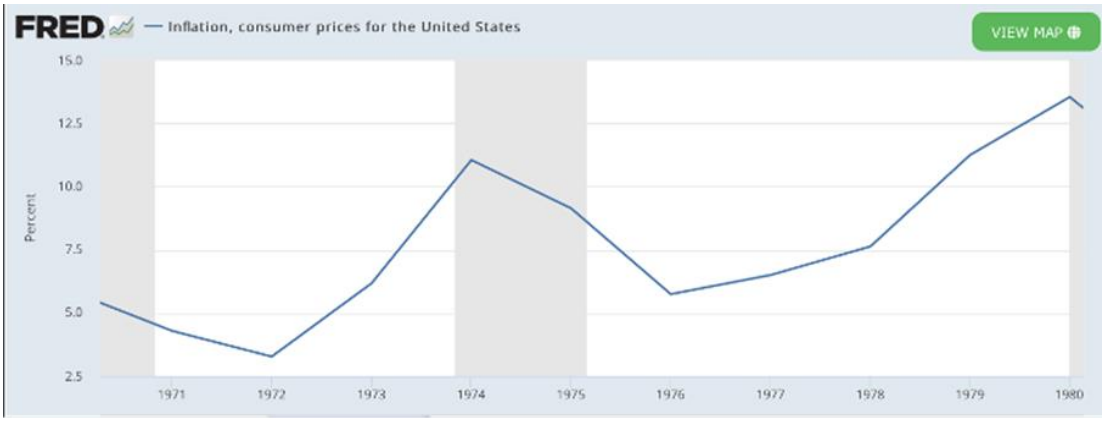

Figure 3: The Inflation, measured by Consumer Prices, in America in the 1970's, (FRED, 2022b)

The European Central Bank

To discuss the European response, as it was before the European Central Bank, ECB, was established, this paper considers an aggregated response from 9 member states of the European Economic Community, EEC. With the global capitalist economy experiencing difficulties, the first shock precipitated a steep recession accompanied by higher inflation. GNP growth made a U-turn, falling from 5.4% in 1973 to 2.6% in 1974 and unemployment rose from 2.4% to 3.4%. (OECD, 1974)

The reaction in Europe was generally inadequate. It wasn't until 1976 that France introduced strict policies known as Barre plans, despite inflation rising to 17% in 1974 (OECD, 1975). The first Barre plan prioritised controlling this inflation using drastic measures such as a 3-month price freeze, increased taxes and wage/salary controls. France only returned to pre-crisis levels by the end of 1978. (OECD, 1979)

Not all European banks responded with such hesitation, however. In 1974, the German Bundesbank aimed to reverse the price trend by limiting monetary expansion while, taking a similar approach to the US, adopting expansionary fiscal policy. They successfully moderated the rising inflation, whereas their European counterparts were far less successful (see figure 5). They stated in their 1974 annual report that countries that allowed inflation to rise only delayed the economic setback and unemployment growth. (Bundesbank, 1975)

6.4. European Consumer Prices

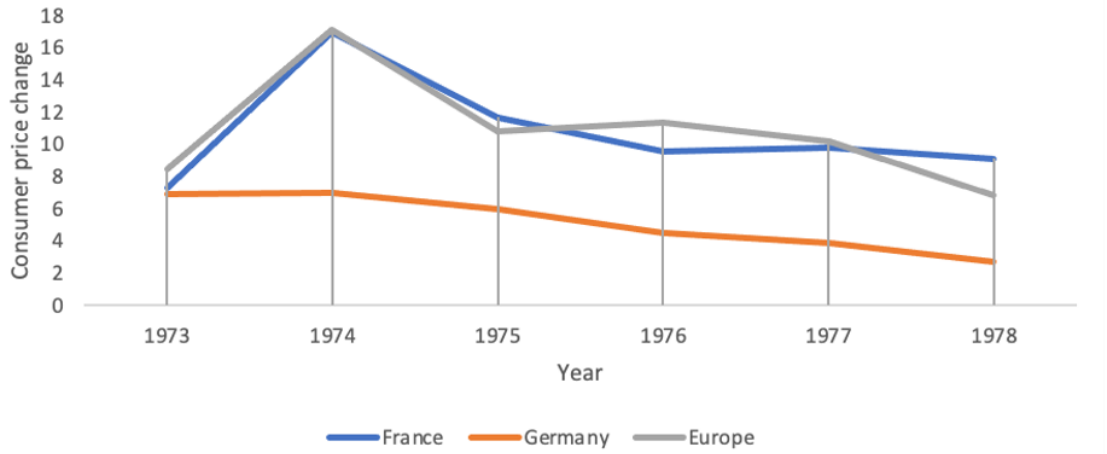

Figure 4: The Consumer prices as a percentage change from the previous year in the Euro area, data sourced from (OECD, 1973; 1974; 1975; 1979)

Mistakes made in the first oil shock resulted in higher average unemployment in Europe, from 2.8% in 1973 to 5.7% in 1979, and persistently high inflation (ECB, 2000). Following the success of the Fed's focus on limiting inflation in the first shock, European banks emphasised curbing inflation expectations and re-establishing price stability. This proved detrimental for employment and growth in the years following, but the focus on increased nominal interest rates in 1980 contributed to the declining inflation through the succeeding decade. CPI declined, after the initial 4.5% increase, down to 4% in 1988 – the lowest since 1970 (Macrotrends, 2022b). Sluggishly, the inflationary pressure from the oil price shock was successfully curbed by the policy response chosen. This mirrors the Fed's response which suggests inflation focusing policy is fairly ineffective in the short-term but can be effective in the long-term. The already high unemployment and declining real wages between 1979 and 1981 however, could also explain the improved performance (ECB, 2000).

6.5. The Bank of England

The Bank of England, BoE, faced a fall in GDP and excessive inflation as a result of the first oil shock. The growth rate of GDP fell to -2.7% in 1974 and CPI rocketed to 25% by 1975 (FRED, 2022d, 2022e). In response, the BoE's base rate fluctuated greatly from 5% before the price crisis to 13% after. However, their emphasis was on money supply growth (here referring to M3), which began to decline in 1974, to account for rising inflation (Bank of England, 1972-1981). Nationalised at the time, the BoE was strongly influenced by politics. A monetarist approach was adopted and there was an incentive to manipulate expectations to stimulate the economy. The attempt at stabilisation failed as the UK fell into recession, and the time-inconsistency of their policy responses resulted in the excessive inflation and higher unemployment. Fiscal spending increased dramatically in 1974, but failed to evade recession and simply increased government debt (National Archives, 2005). GDP only showed signs of recovery, albeit slowly, in 1976, demonstrating the ineffectiveness of policy during this crisis.

Leading up to the second crisis, the base rate fluctuated even more, at 5% just before the crisis and rising to 17% after. Contradictory to the last crisis, money supply growth increased, exceeding the bank's targets. (Bank of England, 1972-1981). However, the economy suffered again. CPI rose to nearly 22% and took 3 years to decline back to pre-1970s levels. GDP growth fell to -2% and made a slow recovery, and unemployment began its rise to historically high levels (FRED 2022d; 2022e; 2022f). Lyonnet and Werner explain the failure of the monetarist approach to policy in the UK as a result of the instability of spending velocity and high unemployment during this time (Lyonnet, 2012). On top of this, Nelson and Nikolov conclude a miscalculation of the real output gap during the 1970's contributed to poor policy decisions (Nelson, 2003). These monetary failures, combined with a lack of fiscal expansion due to the government debt generated from the first crisis, could explain the poor economic performance in the years post-crisis.

6.6. Bank of England 1969-1985

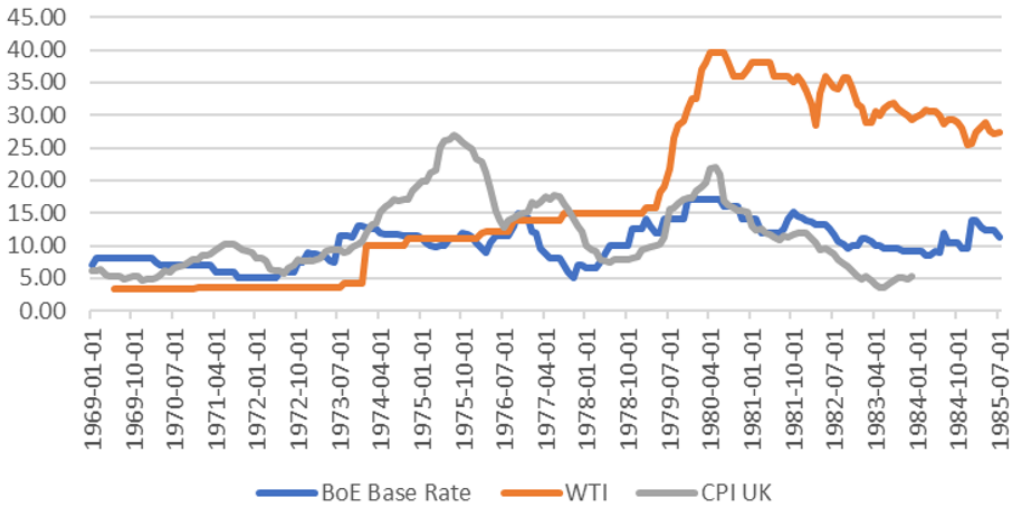

Figure 4: The Bank of England base rate, West Texas Index and Consumer Price Index from 1969 to 1985

The BoE began to decrease interest rates slowly from 5.57% in December 2007 once the recession hit. However, in July 2008 crude oil prices began to fall significantly, but, much like the ECB, it wasn't until September that the BoE responded. They made a faster descent, opting for a more dramatic interest rate response due to the risk of undershooting the inflation target and succeeded in lowering CPI to 1% temporarily before it rose again (Bank of England, 2009). By March 2009, the base rate was at 0.5%, nearing the effective lower bound, and the bank resorted to quantitative easing. However, Lyonnet and Werner found it had no impact on the UKs economy (Lyonnet, 2012). Despite the stabilisation attempts and expansionary measures, GDP plummeted, and the persistent lack of credit supply caused the slowdown to persist for an extended period of time. GDP growth recovered by 2010 but it took until 2014 for GDP to reach pre-recession level.

The crisis also brought huge regulatory reforms, introducing an independent Financial Policy Committee, new regulation authority and financial market supervisors to monitor risks in the financial market which could impact the rest of the economy. Interbank lending was also cut by 2/3rds. It is likely these additional policies were essential to regain confidence and eventually stabilise the economy.

6.7. Bank of England 2002-2014

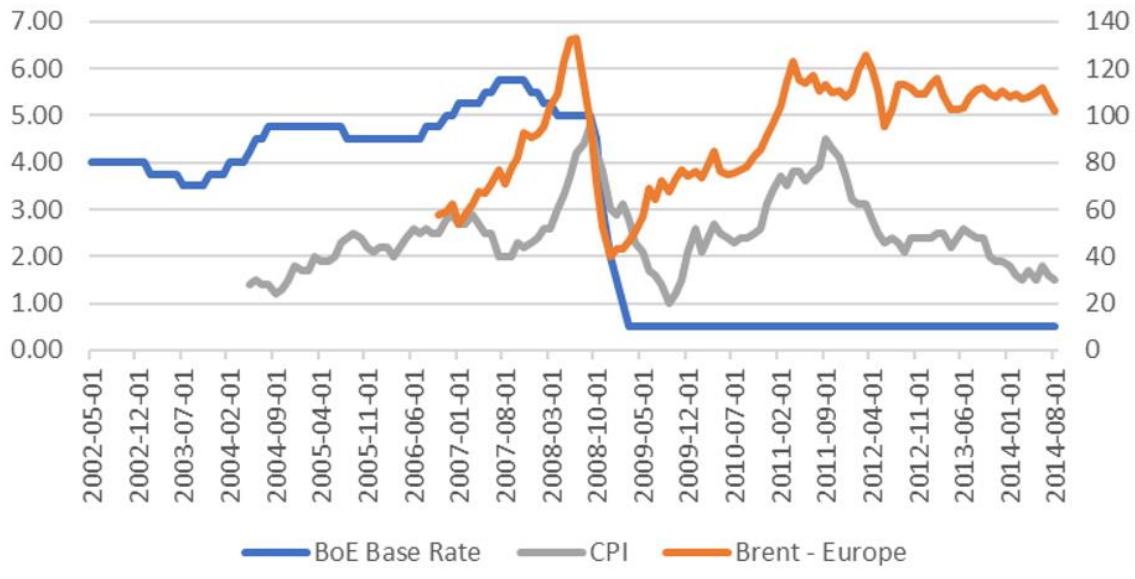

Figure 5: The Bank of England base rate, Consumer Price Index and Brent Crude Oil prices from 2002 to 2014

6.8. The People's Bank of China

After the 2008 crisis, inflation in China reached an all-time high of 6% and GDP growth fell from 14% to 10%. The People Bank of China's, PBoC, main response was cutting benchmark deposit and lending rates, reducing the deposit reserve ratio. They also reduced open market operations and introduced policies such as window guidance and rediscount policy to influence credit orientation and structure. Consequently, monetary liquidity increased, broad money growth increased by 1.1 percentage points from the previous year and excess reserves increased by 1.8%. The deposits of financial institutions grew 4.1% faster than the previous year. Not only did the policies impact financial markets successfully but also macroeconomic variables. Inflation dropped to -0.5%, while GDP only fell by around 0.2% and the unemployment rate rose 0.1%. This is significantly better than the other economies discussed (Monetary Policy Analysis Group of the People's Bank of China, 2009).

Another oil price shock accrued in 2014, similar to that in 2008, where the average Brent crude futures price decreased 29.5% from the second quarter of 2014 creating a deflationary pressure. The Asia crude spot index also fell drastically in the second quarter. The inflation rate fell to 2% and GDP growth rate decreased to 7.5%. In response to the falling commodity prices, the benchmark deposit and lending rates were cut asymmetrically – the one-year lending rates reduced by 2.6% and deposit rate by 1.3%. Open market operations were conducted flexibly, using forward and reverse repos and short-term liquidity adjustment. Many new instruments were introduced, including reduction in ratio reserve target, refinancing and pledging supplementary lending. These served to aid financing agriculture, rural areas and struggling areas of the economy. The central bank also employed Standing Lending Facilities, SLF, medium-term lending facilities, window guidance and credit policy guidance to achieve policy objectives.

The policy increased the growth of broad money supply, such that it exceeded GDP by 3%, meeting the effective demand of the real economy. Diminishing lending and deposit rates spread across financial institutions and growth in deposits slowed. However, the policy did not appear as effective as the 2008 response. Despite unemployment falling by 0.05%, while inflation and GDP growth continued to decline to 1.5% and 7% respectively – a similar position to that seen before the monetary policy was implemented (Monetary Policy Analysis Group of the People's Bank of China, 2009).

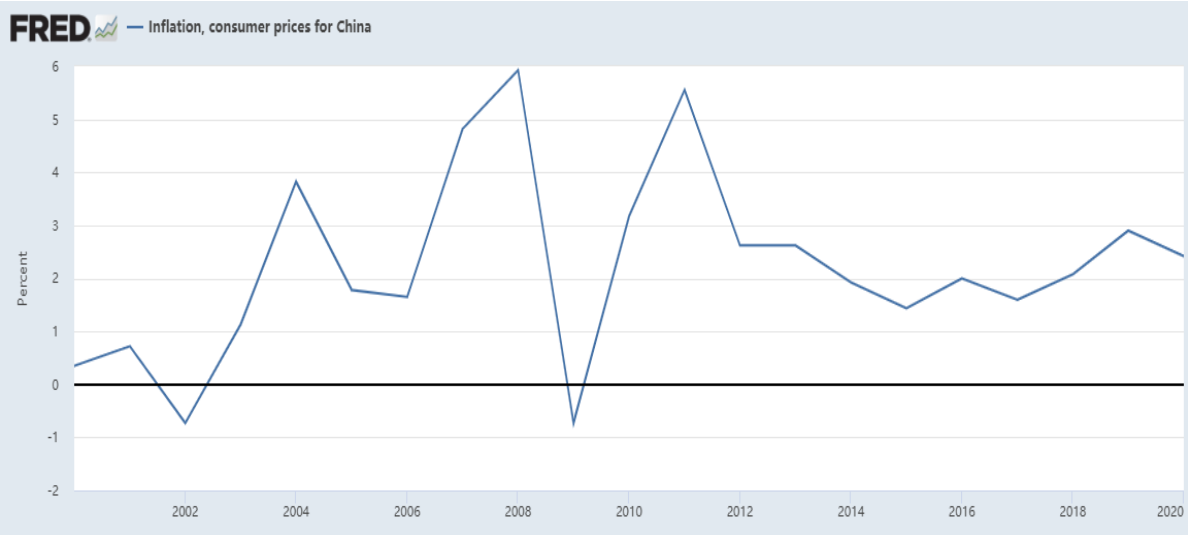

Figure 6: Inflation, consumer price for China (2000-2016)

6.9. The South African Reserve Bank

Central bank responses in developing economies have often depended on the reactions of developed economies when dealing with global commodity shocks. For instance, during the 1970s global oil shocks, the South African

Reserve Bank, SARB, did not undertake any monetary policy responses but leveraged on those in big economies like the US resulting in subsided price pressures coordinated with the global response. However, a monetary policy response may be required when shocks are more domesticated. For example, in import dependent developing economies where local currency depreciation can occur.

During the 2008 financial crisis, following the weakening of the South African Rand, the SARB responded by successively but gradually lowering the repo rate by 650 basis points between November 2008 and November 2010. It improved banking regulation and supervision, enhanced its institutional capacity to ensure financial stability, while avoiding the dangers of over-regulation; and it used moral suasion to get banks to tighten their lending criteria, while letting credit flow. These interventions successfully kept inflation in the single digits and incentivised increased focus on financial stability objectives. Therefore, it is beneficial for central banks to respond to commodity price shocks, especially those that are persuasive, such as energy shocks, and persistent (SARB, 2008; Padayachee, 2014).

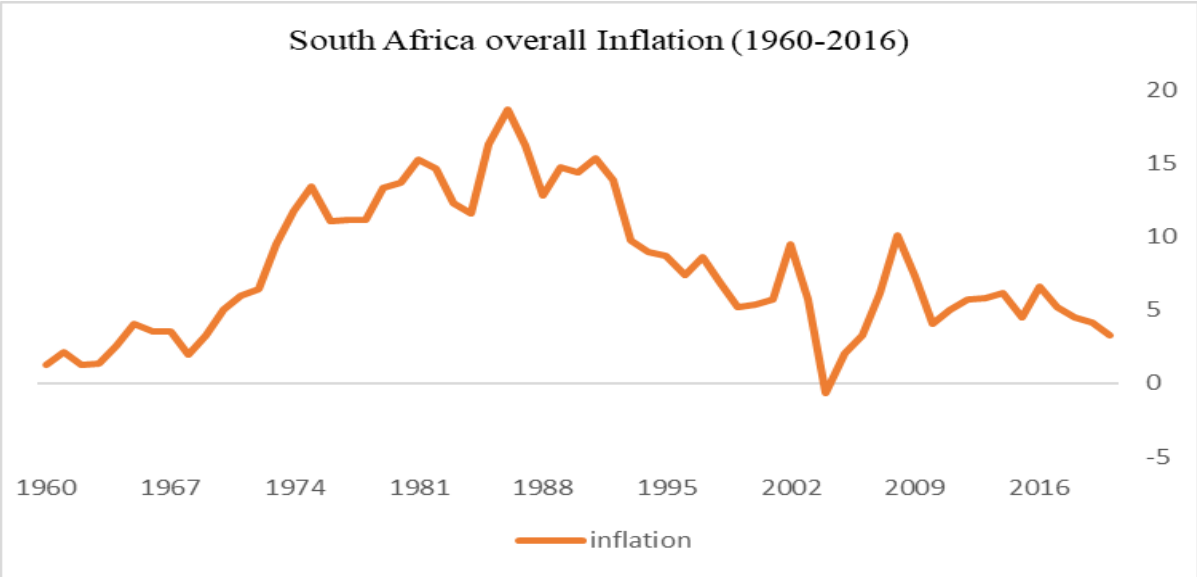

Figure 7: South African Inflation (FRED,2022)

7. Conclusion and Recommendation

To respond to oil shocks and counter the associated inflationary pressures and fluctuations in economic output, central banks should use a combination of different policies and tools. The case studies in this paper reveal that central banks could undertake contractionary/expansionary monetary policy when faced with a positive/negative oil price shock to stabilise the economy. Previously, during the 1970s crises a monetarist approach was more widespread. However, in recent decades interest rate changes have been preferred alongside inflation targeting due to instability in financial markets and general reduction in inflation seen in developed countries, making money supply control less predictable. The People's Bank of China, however, concentrated on adjusting monetary aggregates, mainly using required reserve ratios, and expansionary open market operations, with relative success. These can be complimented with unconventional policies such as: quantitative easing, seen more since the 2008 financial crisis; moral suspension as in South Africa, and targeting financing, such as PBoCs SLF scheme. Enhanced macroprudential financial system supervision is another key tool implemented globally after the 2008 financial crisis.

However, the case studies here reveal that not all monetary policy implemented in the past has worked and there is not a one-size-fits-all solution across countries and shocks. Depending on the gravity, cause of the shock and level of financial development in each country, monetary authorities may not have a specific rule book for each type of commodity price shock. It seems that success is conditional on central banks being proactive in their response rather than reactive. This is possible with comprehensive economic forecasts and market surveillance. The main challenge when facing commodity price shocks is that they cannot accurately determine long run

inflation, as they tend to exhibit only a transitory effect. Central banks can use inflation targeting operations, but only concentrate on the underlying inflation level otherwise they risk overshooting and destabilising the economy further. Additionally, it is argued that developing countries with less fiscal space and limited monetary policy impact could leverage the response of large central banks where the shocks are global. For instance, during the 1970s the Reserve Bank of South Africa did not react to the shocks but benefited from the reactions of big economies.

Conflict of Interest Statement

We, Austin Mwange and Ayanda Meyiwa, being the authors declare no conflicts of interest.

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