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QUANTITATIVE EASING AND CREDIT SUPPLY: 13 DEVELOPED ECONOMIES SIMULATED

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Purpose: This paper investigates how quantitative easing (QE) affects credit supply in advanced economies and whether the strength and direction of this impact vary across countries. It aims to identify the extent of heterogeneity in the credit channel of monetary transmission and determine under which structural and institutional conditions QE effectively stimulates credit creation.

Design/methodology/approach: The study uses quarterly BIS data for 13 advanced economies from 2008–2024. It applies the Local Projections method (Jordà, 2005) to estimate impulse response functions of credit to QE shocks, measured by changes in central bank balance sheets. The model includes country fixed effects and lagged endogenous variables to capture heterogeneity and dynamic adjustment. The analysis focuses on cross-country differences in the transmission of unconventional monetary policy.

Findings: Results reveal three clusters of credit responses to QE: (i) strong positive effects in Australia, the Euro area, New Zealand, the UK, and the US; (ii) weak but positive effects in Canada, Korea, Norway, and Poland; and (iii) weak and negative effects in Denmark, Japan, Sweden, and Switzerland. These outcomes indicate that QE supports credit growth only when supported by favorable financial and institutional environments. The findings confirm that QE's impact is heterogeneous and context-dependent rather than uniform across economies.

Research limitations/implications: A key limitation relates to lag selection in dynamic models, which may influence impulse response precision. Future studies should apply formal information criteria (AIC, BIC, HQC) and consider bank-level datasets or alternative transmission channels such as asset prices or exchange rates.

Practical implications: Liquidity injections alone are insufficient to ensure credit expansion. Policymakers should complement QE with measures that enhance bank profitability, reduce risk constraints, and stimulate loan demand. In flexible financial systems, QE can boost lending and investment, while in more rigid systems its effects remain limited.

Social implications: By clarifying how QE shapes credit creation, the study helps explain how monetary policy contributes to recovery, employment, and financial stability. Weak credit responses may restrict the broader social benefits of expansionary policies.

Originality/value: This is among the first comparative studies of QE's credit effects across 13 economies within a unified empirical framework. It documents substantial cross-country

heterogeneity and offers methodological guidance for future research on unconventional monetary policy.
Keywords: quantitative easing; credit supply; central bank; monetary policy.
Category: Research paper.

1. Introduction

Quantitative easing (QE) represents an unconventional monetary policy instrument employed by central banks to stimulate the economy through large-scale asset purchases and the injection of liquidity into the banking system. Following the global financial crisis of 2008, QE became a key component of monetary policy frameworks in the United States, the United Kingdom, the Euro area, and Japan. Empirical research shows that QE effectively increases commercial banks' reserves and lowers government bond yields, yet its transmission to bank lending remains complex and context-dependent, influenced by banks' portfolio structures, regulatory environments, and the transmission channels of monetary policy (Fatouh, 2016; Cecioni, Ferrero, Secchi, 2011).

In several cases, an increase in credit supply has been observed, particularly among banks heavily exposed to the assets purchased under QE. However, aggregate lending growth often remains moderate relative to the rise in reserves (Wang, 2023; Li, 2024). QE operates mainly through three channels - the "portfolio balance", "signaling", and "liquidity" channels (Yip, 2025). Asset purchases expand banks' reserves, reduce bond yields, and encourage a shift toward riskier or higher-yielding assets, which may in turn stimulate new lending (Li, 2024). The strength of these effects, however, depends on the structure of domestic financial systems and market conditions.

Studies for the United States, the United Kingdom, the Euro area, and Japan suggest that QE consistently increases banking system liquidity but that the response of lending is frequently limited or delayed (Papadamou, Siriopoulos, Kyriazis, 2020). In the U.S., the strongest credit growth was recorded among banks holding large volumes of mortgage-backed securities (MBS), with lending expanding by approximately 2-4% (Li, 2024). By contrast, Japan's approach emphasized long-term credit expansion, while the U.S. and U.K. focused primarily on rapid balance sheet expansion by central banks (Zeng, 2024; Rahman, Hutagaol, 2023).

The effectiveness of the credit channel is often constrained by structural factors such as low bank profitability, macroprudential regulations, or subdued loan demand (Papadamou et al., 2020). In some sectors, QE effects on credit proved short-lived, with banks more inclined to adjust their risk exposure than to increase loan volumes (Zhang, Liu, Liu, 2019). Cross-country differences in QE outcomes are therefore substantial, shaped by institutional structures, asset composition, and the regulatory context (Berger, Molyneux, Wilson, 2020; Li, 2024; Papadamou et al., 2020). In certain economies, QE has also been linked to rising financial risk-taking and asset price bubbles (Djatche, 2021; Li, 2024; Carbó-Valverde, Cuadros-Solas, Rodríguez-Fernández, 2021; Albertazzi et al., 2020).

Overall, evidence suggests that QE's impact on bank credit is heterogeneous and generally moderate, largely conditioned by the financial structure and risk appetite of the banking sector (Papadamou et al., 2020).

This growing body of literature highlights both the potential and the limitations of QE as a tool for stimulating credit creation. Yet, despite extensive empirical evidence from the U.S. and the U.K., the specific mechanisms through which excess liquidity translates—or fails to translate—into new lending remain debated, particularly within the euro area context. Recent studies have therefore sought to identify the structural conditions under which QE may paradoxically weaken rather than strengthen the credit channel.

Stempel et al. (2024) argue that under conditions of very high reserve liquidity, quantitative easing (QE) can have the opposite effect: excess banks experience an increase in balance sheet costs associated with holding deposits, which reduces their willingness to lend. This mechanism has not yet been empirically confirmed in the eurozone context. The study uses a SVAR model with sign and zero restrictions to identify excess liquidity shocks in the Eurosystem banking system. This shock is defined as an exogenous increase in excess reserves resulting from QE measures, in the absence of an immediate response in output and inflation.

The authors then use Local Projections to assess the impact of such shocks on the dynamics of MFI loans to non-financial corporations (NFCs) in individual countries. The results reveal significant heterogeneity:

1. In countries with high liquidity (Germany, France, the Netherlands), QE causes a decline in lending (e.g., to -2.5% in the Netherlands).
2. In countries with low liquidity (Italy, Spain, Portugal), the effects are zero or positive (e.g., +1% in Portugal).

The study by Serranito et al. (2023) makes a significant contribution to the literature on the effectiveness of QE in the euro area through the bank lending channel. The authors focus on the structural nature of credit, distinguishing between financing the real economy and non-productive loans (mortgage, consumer, and financial institutions). The study hypothesizes that excess bank reserves do not translate into an increase in productive credit but rather support the financing of speculative assets. The authors introduce a division of credit into:

1. Productive: loans to non-financial corporations (real economy).
2. Non-productive: loans to mortgages, consumer, and financial institutions.

Local Projections and their smoothed versions were used, enabling the direct estimation of impulse response functions (IRFs) for credit and macroeconomic variables. The results presented by Serranito et al. show that:

1. Productive credit: QE triggers a negative response - banks restrict financing of the real economy.
2. Non-productive credit: a clearly positive response - increased financing of real estate, consumption, and the financial sector.
3. Real estate market: a strong and significant price increase, indicating the formation of price bubbles.
4. Industrial production and core inflation: no significant stimulus - QE does not significantly affect real economic activity or inflationary pressures.

The results are consistent across different methods of identifying QE shocks and across different indicators of excess liquidity, confirming their robustness.

Local Projections are effective in QE studies because they allow for direct estimation of the impulsive responses of variables to shocks, without requiring a full VAR specification. The method is robust to parameter instability and handles heterogeneous effects across countries or loan types well. Furthermore, they work with various shock identification methods and enable stable estimations, particularly in the smoothed version.

Local Projections, however, are not the only simulation method used to study QE. Silva et al.'s (2021) paper examines the effectiveness of conventional and unconventional monetary policy in an agent-based model that incorporates the interbank market and the central bank. The model includes households, consumer and capital firms, commercial banks, and the central bank, operating in the labor, consumption, capital, and credit markets. Conventional policy is simulated by the Taylor rule—a formula that determines the central bank interest rate based on deviations of inflation and output from their target levels. Unconventional policy is simulated by quantitative easing (QE) with threshold intervention at the unemployment rate.

Validation of the model against US data (1955-2015) demonstrated realistic GDP and interbank market dynamics and the ability to reproduce crises at unemployment rates greater than or equal to 15%. Experiments have shown that QE significantly reduces the number and intensity of crises compared to Taylor rules. Early intervention (unemployment threshold of 8%) eliminates crises and also stabilizes the labor market (lower standard deviation of the unemployment rate and lower kurtosis). The model does not account for nominal wage adjustments, so the impact of QE on inflation remains undetermined.

The conclusions indicate that agent-based macroeconomic models allow for the comparison of the effectiveness of various monetary policy instruments, and that QE is more effective in stabilizing the business cycle than the conventional Taylor rule.

Similarly, other methods can be applied to loans. Grimaldi & Kapoor (2023) analyzes the impact of the US Federal Reserve's quantitative easing (QE) policy on commercial bank lending, with particular emphasis on the heterogeneity of financial institutions. The authors demonstrate that QE's effects are not uniform but depend on the type of assets purchased (MBS vs. Treasury bonds) and on banks' internal characteristics, such as liquidity and capital resilience. This study fills a gap in the literature, which has previously focused primarily on the macroeconomic effects of QE and neglected its implications for loan volume.

The authors describe in detail the three main phases of the Fed's QE program. The first wave, QE1 (2008-2010), included the purchase of $1.25 trillion in MBS and $475 billion in Treasury and agency securities, increasing the Fed's share of the MBS market to approximately 25%. QE2 (2010-2011) purchased $600 billion in Treasury bonds and $178 billion in reinvestments. The final wave, QE3 (2012-2014), was an open-ended program, consisting of monthly purchases of $40 billion in MBS and $45 billion in Treasury bonds, totaling $1.613 trillion in assets.

The empirical analysis covers 7124 bank holding companies (BHCs) from 2006Q1 to 2014Q4, using quarterly FR-Y9C financial data. Banks' exposure to QE was measured as the share of MBS or Treasury bonds in assets before the program began. Banks in the top 25% of the distribution were designated as the treatment group, and the bottom 25% as the control group. Institutional heterogeneity was accounted for through measures of liquidity, defined as the share of cash and overnight deposits in assets, and capital resilience, expressed as the Tier 1 ratio to risk-weighted assets. The analysis utilized a difference-in-differences (DiD) model with interactions accounting for QE exposure, treatment group status, and bank characteristics, with the effects lagged by four quarters. Bank size, loan-to-deposit ratio, profitability, and bank and state-quarter fixed effects were also controlled.

The study results show that the impact of QE on bank lending depended on the type of assets purchased and the bank's condition. Banks well-endowed with liquidity and capital reduced lending after purchasing MBS but increased it after purchasing Treasury bonds. Weaker banks responded in the opposite way. The effects were uneven across banks and were strongest during QE3, and the results remained stable across bank groupings. The authors emphasize that bank heterogeneity is crucial for understanding how QE affects the real economy through the credit channel. From a monetary policy perspective, this means that quantitative easing programs should consider both the type of assets purchased and the diverse health of banks to effectively stimulate the economy. Nonlinear and differently oriented bank responses may explain the contradictory findings in the existing literature on the impact of QE on lending.

2. Methods

The primary objective of this study is to assess the impact of quantitative easing (QE) on the supply of credit across advanced economies and to identify cross-country heterogeneity in the strength and direction of this relationship. This objective is consistent with recent research that shows that monetary-policy shocks of the same size generate very different real and financial responses across countries, largely because of institutional and financial-market characteristics (Pica, 2023). By employing the Local Projections (LP) method based on BIS quarterly data for the period 2008-2024, the paper seeks to evaluate how central bank balance sheet expansions translate into credit growth under different institutional and financial conditions.

Based on previous findings (Cecioni, Ferrero, Secchi, 2011; Papadamou, Siriopoulos, Kyriazis, 2020; Li, 2024), and on more recent evidence of heterogeneous QE effects at the level of banks and mortgage markets (Grimaldi, Kapoor, 2023; Hertel et al., 2022), the study formulates the following hypotheses:

H1: Quantitative easing (QE) exerts a positive effect on credit supply in advanced economies.

H2: The magnitude of the credit response to QE is heterogeneous across countries, reflecting structural and institutional differences in banking systems (cf. Pica, 2023; Brissimis, Papafilis, 2022).

H3: In economies with persistent low interest rates and structural constraints (e.g., Japan, Sweden, Switzerland), the credit response to QE is weaker or insignificant.

These hypotheses allow the study to test not only the average effectiveness of QE in stimulating credit, but also the cross-country variation in its transmission mechanisms.

This paper collects quarterly data from 2008-2024 for 13 countries or regions: Australia, Canada, Denmark, the Eurozone, Japan, South Korea, New Zealand, Norway, Poland, Sweden, Switzerland, the UK, and the USA. These are the major developed economies and those important from a monetary policy perspective. Four variables were created:

- *qe* – the share of central bank assets in GDP. This variable is measured as the ratio of the central bank's balance sheet measured in domestic currency (incl. conversion to current currency made using a fixed parity or market exchange rate).
- *credit* – the share of credit from all sectors to the non-financial private sector at market value in GDP.
- *qe_qoq* – the quarterly rate of change in the share of central bank assets in GDP; this value approximates the relative (percentage) change from quarter to quarter. Calculated as the difference of natural logarithms:

$$qe\_qoq_t = \ln(qe_t) - \ln(qe_{t-1})$$

- *credit_qoq* – quarterly rate of change in the share of private credit in GDP, calculated analogously:

$$credit\_qoq_t = \ln(credit_t) - \ln(credit_{t-1})$$

We chose this method of calculating quarterly changes because financial and macroeconomic data are often heteroscedastic. Logarithmic transformation reduces this problem by "flattening" the data and making them more comparable over time. Furthermore, changes expressed in logarithms are additive over time, meaning that successive increases can be added together, and the result corresponds to cumulative growth. Logarithmic differences are commonly used in macroeconomic and financial research, particularly in analyzing the dynamics of variables such as GDP, asset prices, and credit, and they are also standard in recent QE studies for the euro area and Poland (Pica, 2023; Hertel et al., 2022). As a result, the obtained results are consistent with conventions adopted in the literature.

For the purposes of the empirical analysis, we used internationally comparable statistical data from the Bank for International Settlements (BIS). The BIS maintains unified macroeconomic and financial databases, which enable comparisons and eliminate the problem of inconsistent definitions used by individual countries. The qe variable was taken from the Central Bank Total Assets (WS_CBTA) dataset, while the credit variable comes from the Credit to the Non-Financial Sector (WS_TC) dataset. Expressing this variable as a percentage of GDP allows us to assess the scale of private debt in the economy and compare it over time and across countries. This choice mirrors the data strategy in multi-country studies of monetary-policy heterogeneity, where cross-country comparability and uniform definitions are crucial (Pica, 2023).

Normality tests such as Shapiro–Wilk, Jarque–Bera, Kolmogorov–Smirnov and Anderson–Darling were performed to check whether the data are normally distributed. The Kruskal–Wallis test was used as a nonparametric statistical test to detect seasonality. To assess the validity of the classical regression model's assumptions, the Breusch–Pagan test was conducted, which detects heteroscedasticity, i.e. variation in the variance of the error term. Next, the Durbin–Watson test was performed to test for autocorrelation of the error terms, i.e. the dependence of error terms between subsequent observations. Additionally, the Ramsey RESET test was used to verify the model's specification and identify any omitted nonlinearities or significant variables

Given the following analysis, the Local Projections method (Jordà, 2005) is used in this paper. It is particularly suitable in this case because it does not require the assumption of normality in the distribution of residuals or explanatory variables and is resistant to heteroscedasticity. Crucially, recent econometric work has shown that, under fairly general conditions, LPs and VARs deliver the same impulse responses, so choosing LPs here is a matter of flexibility and robustness rather than a departure from the mainstream identification toolbox (Plagborg-Møller, Wolf, 2021). This method allows us to examine how a given variable responds to a shock in subsequent periods and to let the responses differ across countries, which is essential in a context where earlier studies have documented heterogeneous and sometimes even non-linear lending reactions to QE depending on bank liquidity and market structure (Grimaldi, Kapoor, 2023; Brissimis, Papafilis, 2022). Instead of building a single complex model describing the entire dynamics of the economy, as is the case with VAR models, Local Projections involve estimating separate regression equations for each time horizon.

3. Results

Shapiro-Wilk, Jarque-Bera, Kolmogorov-Smirnov and Anderson-Darling tests performed for the studied variables showed categorical rejection of the normal distribution hypothesis. The Kruskal-Wallis' tests the null hypothesis that the medians for all quarters of the year are equal, implying no seasonal differences. However, the results indicate no statistically significant seasonality in all countries studied. Tables with values are provided in the Appendix.

After including all data from all countries, the correlation matrix shows that the data is uncorrelated and statistically insignificant. The only statistically significant, weak positive correlation is between studied variables *qe* and *credit* and their quarterly changes. This property indicates the need to include country fixed effects and suggests that simple linear models may be inadequate.

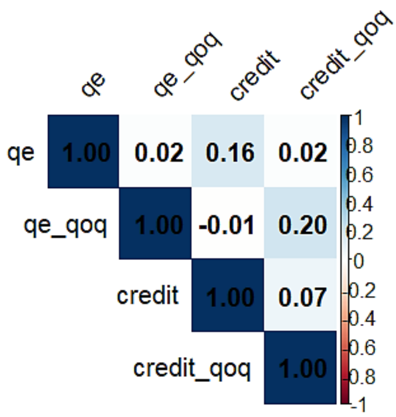

Figure 1. The correlation matrix.

Source: Own work.

The correlation between quarterly changes provides limited analytical value when assessing the impact of quantitative easing on credit - changes are typically irregular, and it takes time for one to influence the other.

Empirical analysis indicates significant variation in the relationship between quantitative easing (QE) and credit growth across countries. In some economies (Switzerland, Sweden, Canada, Norway, and Japan), we observe complementarity - a strong positive correlation, suggesting that the expansion of the central bank's balance sheet supported credit growth. In other countries, particularly Korea and the United Kingdom, a substitution effect is visible, where an increase in QE was associated with a reduction in credit growth. For Anglo-Saxon economies such as the United States, Australia, and New Zealand, this relationship is negative but relatively weaker. In Poland, on the other hand, no statistically significant correlation between the two processes was found. These results emphasize the heterogeneity of monetary policy transmission - the impact of QE on the credit sector is strongly determined by local institutional and structural conditions.

Therefore, we conducted a diagnostic analysis of regression models (in which *qe* explains *credit*) including country fixed effects - we allow a different intercept and slope for each country. The diagnostics also reveal significant violations of classical assumptions. The Breusch-Pagan test indicates the presence of heteroscedasticity - the variability of errors in the statistical model is not constant. The Durbin-Watson test indicates, suggesting strong positive autocorrelation of the residuals - the error from one period is related to the error from the next period, which violates the assumption of classical regression models. The RESET test did not detect any functional specification issues, which means that the linear Local Projections structure mentioned below is adequate. The regression models and test results are in the Appendix.

A set of Local Projections was estimated separately for each selected country. The shock variable in the model was the quarterly change in central bank assets (*qe_qoq*), while the response variable was the quarterly change in credit supply (*credit_qoq*). The model included two lags of endogenous variables - if we analyze the quarterly change in credit supply, we can assume that its current level depends not only on the current shock but also on how credit supply changed in the two preceding quarters. The lag of two quarters was chosen heuristically. This is intended to better capture the dynamics and prevent attribution of effects to the shock that result solely from inertia or trends in credit supply itself. Confidence intervals were estimated at the 95% level. Impulse responses were analyzed for a horizon of up to eight quarters after the shock, with the shock defined as an increase equal to one standard deviation in the *qe_qoq* variable. The results are presented in impulse response (IRF) plots and in tables in the Appendix, which include both point values and confidence bounds.

3.1. Australia, Euro Zone, New Zealand, United Kingdom, United States

In countries such as Australia, the Eurozone, New Zealand, the United Kingdom, and the United States, the credit response to a positive shock to the central bank's balance sheet is significantly positive (approximately +3.04%, +6.54%, +6.29%, +7.29%, and +4.33%, respectively), indicating the effectiveness of the credit channel of monetary policy.

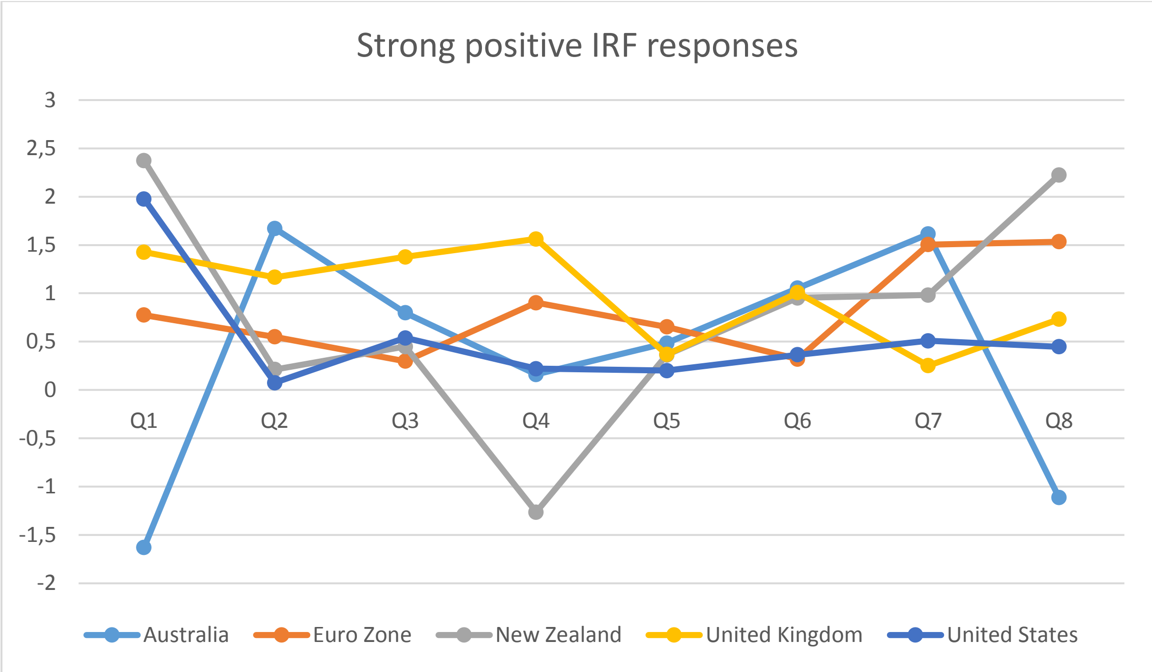

Figure 2. The line chart with IRF from 5 countries with strong positive responses.

Source: Own work.

Cumulative IRF values exceeding at least 3 percentage points may suggest that an increase in central bank assets leads to a significant expansion in the supply of credit to the private sector. This means that in these economies, quantitative easing effectively lowers financing costs, increases liquidity in the banking system, and stimulates lending. The monetary policy transmission mechanism operates in a classic manner: increased liquidity translates into easier access to credit for businesses and households, which supports economic growth. A common feature of this group of countries is highly developed financial markets, a dominant role of the private sector in financing investment, and flexible financial systems that enable the efficient transmission of monetary impulses from the central bank's balance sheet to the real economy.

3.2. Canada, Korea, Norway, Poland

In the group comprising Canada, Korea, Norway, and Poland, the credit response to central bank balance sheet expansion is positive (approximately +1.79%, +0.70%, +1.71% and +0.70%, respectively), but relatively weak and unstable.

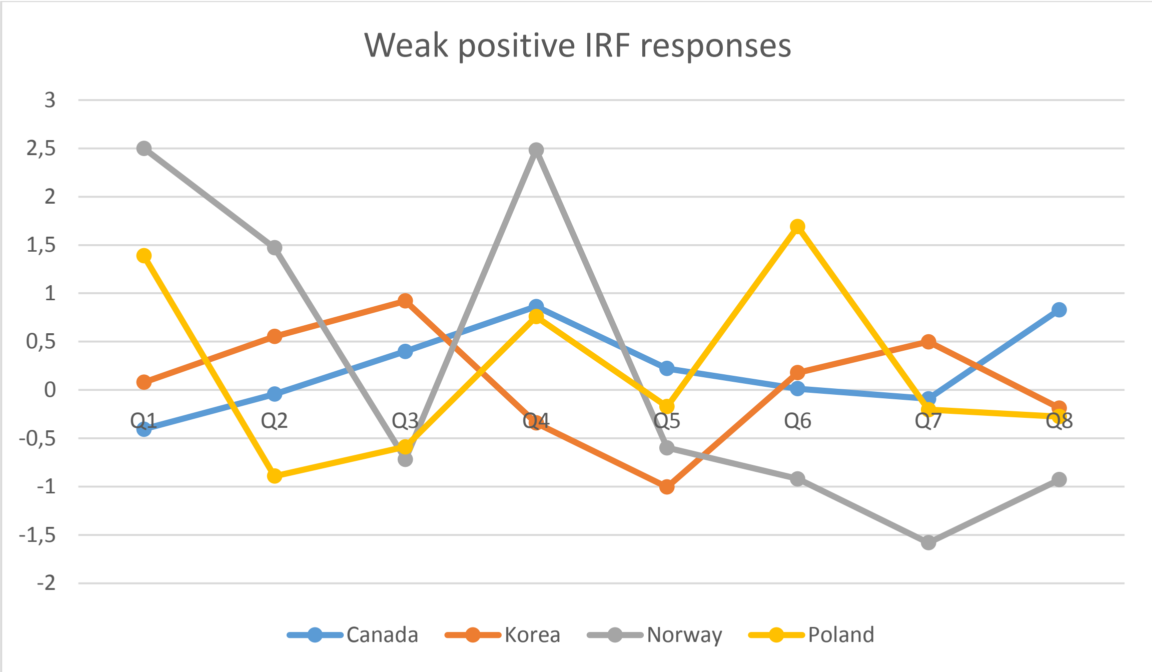

Figure 3. The line chart with IRF from 4 countries with weak positive responses.

Source: Own work.

Cumulative IRF values ranging from 0 to 3 indicate that the increase in central bank assets translates into a moderate credit expansion, but this effect is time-limited or occurs with a lag. This may indicate that in these economies, part of the monetary impulse is absorbed by other transmission channels, such as the exchange rate or asset prices, reducing the direct impact on credit supply. Additionally, a weaker response may result from limited demand for financing, a cautious banking sector stance, or existing capital restrictions that limit the scope for increased lending. In these countries, quantitative easing also plays a smaller role within monetary policy, making its impact on the credit sector more marginal compared to economies where this instrument is a key element of monetary transmission.

3.3. Denmark, Japan, Sweden, Switzerland

In the group comprising Denmark, Japan, Sweden, and Switzerland, the credit response to central bank balance sheet expansion is negative or close to zero (approximately -2.85%, -2.67%, -0.50% and -0.33%, respectively), indicating the ineffectiveness of the credit channel in transmitting monetary policy impulses.

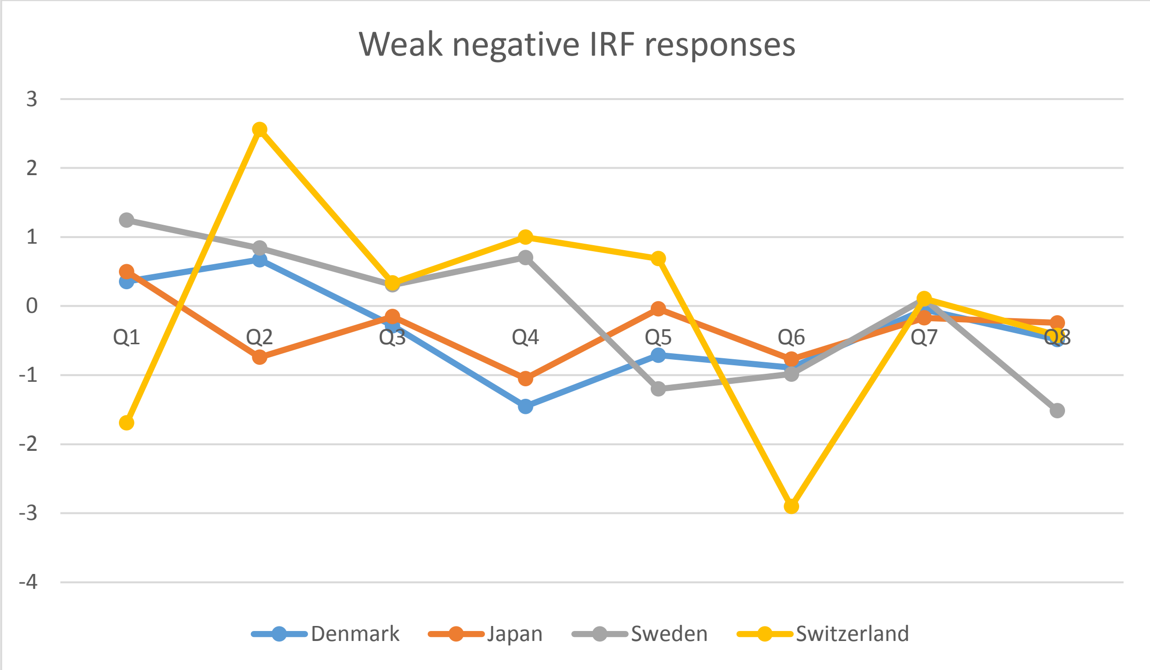

Figure 4. The line chart with IRF from 4 countries with weak negative responses.

Source: Own work.

In these economies, an increase in central bank assets does not lead to an increase in credit supply, and in some cases may even restrict it. Such results suggest the existence of structural barriers to the functioning of the financial sector, such as excess bank liquidity, persistent deflationary expectations, or a low propensity to take credit risk, particularly visible in the case of Japan. Furthermore, the limited credit response may result from a shift in monetary policy transmission toward alternative channels, particularly the exchange rate, which in small, open economies often plays a more important role than the credit channel. In some cases, restrictive financial regulations and a conservative stance of the banking sector may also play a significant role, limiting the ability or willingness of financial institutions to expand credit even in conditions of increased monetary liquidity.

4. Discussion

The results confirm that the effects of quantitative easing (QE) on credit supply are heterogeneous across developed economies, reflecting differences in financial structures, transmission channels, and the institutional environment. In countries such as Australia, the euro area, New Zealand, the United Kingdom, and the United States, QE effectively supported credit expansion, suggesting that abundant liquidity and flexible financial intermediation enabled a robust credit channel. These findings are consistent with Pica (2023), who documents that economies with deep capital markets and diversified banking sectors experience stronger balance sheet and credit responses to monetary expansion. Similarly, Grimaldi and Kapoor (2023) find that in jurisdictions with well-developed financial markets, QE stimulates bank lending primarily through the balance sheet and risk-taking channels, amplifying credit supply to the private sector.

By contrast, in Canada, Korea, Norway, and Poland, the response of credit to QE shocks was positive but modest and often short-lived. This result is in line with Brissimis and Papafilis (2022), who argue that in smaller, bank-dominated systems, QE effects may be partially offset by low loan demand and heightened macroprudential discipline. Hertel et al. (2022) similarly report that in Poland, the domestic QE program increased liquidity and lowered yields but did not translate proportionally into credit expansion, underscoring the role of structural constraints and risk aversion within the banking sector. In these economies, liquidity injections may have been partially absorbed through exchange rate adjustments or sovereign debt purchases rather than through credit creation.

In Denmark, Japan, Sweden, and Switzerland, the impact of QE on credit was neutral or even negative, which corroborates findings by Shah et al. (2025), who show that persistent low interest rates and deflationary expectations weaken banks' risk appetite, causing QE to operate more through asset-price and portfolio channels than through the credit channel. These results highlight that in environments characterized by long-lasting monetary accommodation and compressed margins, additional liquidity may contribute to asset inflation rather than real-sector lending.

From a methodological standpoint, the study demonstrates the usefulness of the Local Projections (LP) framework in analyzing heterogeneous, country-specific responses to monetary shocks. The results of Löf and Nyberg (2024) reinforce this approach, showing that LP methods are more flexible and less susceptible to misspecification than traditional VAR models, especially when responses vary across horizons or institutional contexts. This flexibility is crucial in multi-country analyses, as also emphasized by Plagborg-Møller and Wolf (2021), who show that under standard identification conditions, LPs and VARs estimate the same population impulse responses. Consequently, the LP approach used in this study should be viewed as a robust and transparent method for cross-country comparisons of QE effectiveness.

Moreover, the discussion highlights the need to integrate methodological rigor with economic interpretation. Future research may benefit from combining LP estimation with variable selection techniques such as LASSO or information-criterion-based lag optimization (AIC, BIC, HQC), as suggested by Löf and Nyberg (2024), to enhance model precision. Such improvements would make it possible to disentangle the distinct contributions of institutional and macro-financial factors to the heterogeneous outcomes of QE policies.

Overall, the findings emphasize that QE's effectiveness in stimulating credit depends not only on the magnitude of asset purchases but also on the structural and behavioral features of the banking system. Liquidity injections alone are insufficient to ensure credit expansion;

complementary measures addressing bank profitability, capital requirements, and loan demand are essential to reactivate the credit channel of monetary policy. The empirical evidence confirms H1, demonstrating that QE generally exerts a positive influence on credit supply across advanced economies. At the same time, the significant cross-country variation in responses supports H2, indicating that QE transmission is conditioned by institutional and structural characteristics. Finally, the weak or negative responses observed in Japan, Sweden, Switzerland, and Denmark are consistent with H3, suggesting that persistent low interest rates and structural constraints may substantially weaken the credit channel of monetary policy.

The results confirm that the effects of quantitative easing on credit supply are heterogeneous across developed economies, reflecting differences in financial structures, transmission channels, and the institutional environment. In countries such as Australia, the euro area, New Zealand, the United Kingdom, and the United States, QE effectively supported credit

5. Summary

This study assessed the impact of quantitative easing (QE) on credit supply across advanced economies and tested the hypothesis that this relationship is heterogeneous and shaped by country-specific structural conditions. Using BIS quarterly data for 13 developed countries (2008-2024) and the Local Projections (LP) framework (Jordà, 2005), the analysis identified how changes in central bank balance sheets affect credit dynamics. The results confirmed that QE generally supports credit expansion, but the magnitude and direction of the response vary considerably across economies. Three clusters of effects were identified: strong positive (Australia, euro area, New Zealand, United Kingdom, United States), weak positive (Canada, Korea, Norway, Poland), and weak or negative (Denmark, Japan, Sweden, Switzerland).

These findings are consistent with a broad body of evidence emphasizing the conditional effectiveness of QE. Studies such as Pica (2023) and Grimaldi and Kapoor (2023) show that QE is most effective in economies with deep and diversified financial markets, while Brissimis and Papafilis (2022) and Hertel et al. (2022) demonstrate that in smaller or more regulated systems, liquidity expansions often fail to produce proportional credit growth. Likewise, Shah et al. (2025) highlight that in low-rate environments, the credit channel weakens in favor of asset-price and portfolio effects. The observed heterogeneity therefore supports the view that QE's transmission is not uniform and that its success depends on institutional and market-specific features (Berger, Molyneux, Wilson, 2020).

From a methodological perspective, this study contributes to the growing empirical literature that applies the LP approach to assess monetary-policy transmission (Plagborg-Møller, Wolf, 2021; Löf, Nyberg, 2024). By explicitly modeling heterogeneous impulse responses across countries, the LP framework offers a flexible and transparent alternative to traditional VAR models. Future research should apply formal information criteria (AIC, BIC, HQC) and regularization techniques to refine lag selection and improve the robustness of inference.

Overall, the evidence confirms that while QE can foster credit growth under favorable structural and institutional conditions, its macroeconomic effectiveness remains context-dependent. Effective credit transmission requires complementary macroprudential, fiscal, and regulatory policies that strengthen the profitability and lending capacity of banks.

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Appendix

The appendix contains all the values of the selected tests and the exact simulation results.

Table 1.
Normality tests' approximate values for variables

qe	**Shapiro-Wilk**	**Jarque-Bera**	**Kolmogorov-Smirnov**	**Anderson-Darling**
Test value	$W = 0.685$	$JB = 1575.089$	$D = 0.269$	$A = 99.762$
p-value	$1.3 * 10^{-37}$	0.000	$7.2 * 10^{-56}$	$3.7 * 10^{-24}$
credit	**Shapiro-Wilk**	**Jarque-Bera**	**Kolmogorov-Smirnov**	**Anderson-Darling**
Test value	$W = 0.941$	$JB = 34.345$	$D = 0.123$	$A = 16.432$
p-value	$3.3 * 10^{-18}$	$3.5 * 10^{-8}$	$5.1 * 10^{-12}$	$3.7 * 10^{-24}$
qe_qoq	**Shapiro-Wilk**	**Jarque-Bera**	**Kolmogorov-Smirnov**	**Anderson-Darling**
Test value	$W = 0.749$	$JB = 20342.92$	$D = 0.161$	$A = 47.111$
p-value	$2.5 * 10^{-34}$	0.000	$5.5 * 10^{-20}$	$3.7 * 10^{-24}$
credit_qoq	**Shapiro-Wilk**	**Jarque-Bera**	**Kolmogorov-Smirnov**	**Anderson-Darling**
Test value	$W = 0.524$	$JB = 864280.2$	$D = 0.169$	$A = 61.624$
p-value	$3.1 * 10^{-43}$	0.000	$4.4 * 10^{-22}$	$3.7 * 10^{-24}$

Table 2.
Correlation coefficients' approximate values between qe and credit

Country	Correlation coefficient	p-value
Australia	−0.27218	0.02474
Canada	0.70279	$2.381 * 10^{-11}$
Denmark	0.52892	$3.538 * 10^{-6}$
Euro Zone	0.47949	$3.519 * 10^{-5}$
Japan	0.61122	$3.095 * 10^{-8}$
Korea	−0.62554	$1.175 * 10^{-8}$
New Zealand	−0.37354	0.00170
Norway	0.64367	$3.209 * 10^{-9}$
Poland	−0.15244	0.21461
Sweden	0.83294	$1.276 * 10^{-18}$
Switzerland	0.92339	$3.793 * 10^{-29}$
United Kingdom	−0.54382	$1.645 * 10^{-6}$
United States	−0.35099	0.00334

Table 3.
Kruskal-Wallis' test for seasonality approximate results

Country	*qe* p-value	*credit* p-value
Australia	0.89998	0.99684
Canada	0.89240	0.92142
Denmark	0.99503	0.98667
Euro Zone	0.96085	0.94342
Japan	0.99058	0.95452
Korea	0.50243	0.95981
New Zealand	0.86987	0.97911
Norway	0.95812	0.99269
Poland	0.97074	0.99886

Sweden	0.99132	0.99961
Switzerland	0.99853	0.99780
United Kingdom	0.97423	0.99252
United States	0.99891	0.97856

Table 4.
Regression model without country effects

Model				
$credit = 0.275 * qe + 179.380$				
Breusch-Pagan	**Durbin-Watson**	**Ramsey RESET**	**F statistic**	**Model fit**
$BP = 0.144$	$DW = 0.040$	$F = 17.442$	$F = 24.790$	$R^2 = 0.0273$
$p = 0.070$	$p = 9.8 * 10^{-188}$	$p = 3.7 * 10^{-8}$	$p = 7.7 * 10^{-7}$	$R^2_{adj} = 0.0262$

Table 5.
Regression models with country effects (different intercepts)

Country	Model			
Australia	$credit = 0.339 * qe + 180.358$			
Canada	$credit = 0.339 * qe + 200.024$			
Denmark	$credit = 0.339 * qe + 241.404$			
Euro Zone	$credit = 0.339 * qe + 156.279$			
Japan	$credit = 0.339 * qe + 141.390$			
Korea	$credit = 0.339 * qe + 169.909$			
New Zealand	$credit = 0.339 * qe + 171.252$			
Norway	$credit = 0.339 * qe + 227.200$			
Poland	$credit = 0.339 * qe + 66.928$			
Sweden	$credit = 0.339 * qe + 234.659$			
Switzerland	$credit = 0.339 * qe + 212.224$			
United Kingdom	$credit = 0.339 * qe + 156.262$			
United States	$credit = 0.339 * qe + 148.501$			
Breusch-Pagan	**Durbin-Watson**	**Ramsey RESET**	**F statistic**	**Model fit**
$BP = 114.090$	$DW = 0.134$	$F = 85.489$	$F = 758.7$	$R^2 = 0.9189$
$p = 2.9 * 10^{-18}$	$p = 1.9 * 10^{-175}$	$p = 1.3 * 10^{-34}$	$p = 2.2 * 10^{-16}$	$R^2_{adj} = 0.9177$

Table 6.
Regression models with country effects (different intercepts and slopes)

Country	Model			
Australia	$credit = -0.379 * qe + 189.052$			
Canada	$credit = 2.667 * qe + 181.744$			
Denmark	$credit = 1.953 * qe + 199.893$			
Euro Zone	$credit = 0.185 * qe + 161.790$			
Japan	$credit = 0.161 * qe + 154.935$			
Korea	$credit = -3.567 * qe + 277.063$			
New Zealand	$credit = -0.669 * qe + 186.001$			
Norway	$credit = 3.376 * qe + 175.370$			
Poland	$credit = -0.268 * qe + 81.104$			
Sweden	$credit = 2.277 * qe + 200.487$			
Switzerland	$credit = 0.652 * qe + 183.885$			
United Kingdom	$credit = -0.642 * qe + 181.604$			
United States	$credit = -0.348 * qe + 164.340$			
Breusch-Pagan	**Durbin-Watson**	**Ramsey RESET**	**F statistic**	**Model fit**
$BP = 136.524$	$DW = 0.270$	$F = 1.927$	$F = 678.6$	$R^2 = 0.9519$
$p = 2.5 * 10^{-17}$	$p = 2.5 * 10^{-156}$	$p = 0.146$	$p = 2.2 * 10^{-16}$	$R^2_{adj} = 0.9505$

Below, we present the results of the Local Projections simulations in the form of 13 tables, each representing the simulation values for the studied countries. Each country is provided with IRF values and confidence intervals (both multiplied by 100). Because the *credit_qoq* variable is defined as a difference in logarithms, the percentage values lose their multiplicative nature at the expense of their additive nature - to obtain the total change over the eight quarters, the IRF values must be summed. Confidence intervals for impulse response functions are computed based on the robust Newey-West standard errors, according to the following formula:

$$IRF_{bounds} = IRF \pm 1.96 * SE$$

Where SE is a standard error estimated using the Newey-West method. The coefficient 1.96 is the multiple that corresponds to a confidence level of 95%.

Table 7.
Local Projections approximate values for IRF and the confidence bounds for Australia

Australia results for Local Projections			
quarter	**IRF**	**lower confidence bound**	**upper confidence bound**
1	-1.6313333436837	-3.73080240037614	0.468135713008737
2	1.67199471099902	-0.843621715935673	4.18761113793371
3	0.798671277582065	-0.973284133832014	2.57062668899614
4	0.160685347704672	-2.02268428458448	2.34405497999383
5	0.484933830678326	-1.69361710889542	2.66348477025208
6	1.0540646528452	-1.14133553545997	3.24946484115037
7	1.61291842106082	-0.493409496202983	3.71924633832463
8	-1.11316120543722	-2.96041431513609	0.734091904261653
3.038773692		**the total change over 8 quarters**	

Table 8.
Local Projections approximate values for IRF and the confidence bounds for Canada

Canada results for Local Projections			
quarter	**IRF**	**lower confidence bound**	**upper confidence bound**
1	-0.406577289832882	-1.12235011369318	0.309195534027413
2	-0.0428283378552967	-0.647154443370598	0.561497767660005
3	0.398230490172663	-0.73823244572212	1.53469342606745
4	0.863053215543881	-0.22197855064604	1.9480849817338
5	0.221883749139986	-0.618765958318508	1.06253345659848
6	0.0133003591818196	-0.663326403086034	0.689927121449673
7	-0.091355534618081	-0.775695643839135	0.592984574602973
8	0.829918648524968	-0.166250088213239	1.82608738526318
1.7856253		**the total change over 8 quarters**	

Table 9.
Local Projections approximate values for IRF and the confidence bounds for Denmark

Denmark results for Local Projections			
quarter	**IRF**	**lower confidence bound**	**upper confidence bound**
1	0.355642107976317	-0.777895621154717	1.48917983710735
2	0.672584801021471	-1.5915497300509	2.93671933209384
3	-0.284802307163721	-1.76615501860816	1.19655040428072
4	-1.45429613536185	-2.48250138311308	-0.426090887610621
5	-0.710917004655285	-1.80774647531841	0.385912466007838
6	-0.891956432305372	-1.60904670580508	-0.174866158805661
7	-0.0529624578891486	-0.776861783330612	0.670936867552314

8	-0.484569191210895	-1.96881665078433	0.999678268362535
-2.85127662		**the total change over 8 quarters**	

Table 10.
Local Projections approximate values for IRF and the confidence bounds for Euro Zone

Euro Zone results for Local Projections			
quarter	**IRF**	**lower confidence bound**	**upper confidence bound**
1	0.77466269703526	-0.726900678395825	2.27622607246635
2	0.550416797702441	-0.4600327575335	1.56086635293838
3	0.296956744895377	-1.09004510686676	1.68395859665752
4	0.903328245723587	-0.150695611665367	1.95735210311254
5	0.652736345561567	-0.643803663733398	1.94927635485653
6	0.319598749368802	-1.73581994209754	2.37501744083514
7	1.50463859778216	0.619775159867462	2.38950203569685
8	1.53408646493419	0.154926839491216	2.91324609037717
6.536424643		**the total change over 8 quarters**	

Table 11.
Local Projections approximate values for IRF and the confidence bounds for Japan

Japan results for Local Projections			
quarter	**IRF**	**lower confidence bound**	**upper confidence bound**
1	0.498767116672489	-0.282202986284158	1.27973721962914
2	-0.742377568019966	-1.79539642619423	0.310641290154298
3	-0.151635052676141	-0.688135390617745	0.384865285265463
4	-1.04926761114311	-1.6461539567718	-0.452381265514414
5	-0.0410922316860797	-1.12807453363807	1.04589007026591
6	-0.769897850066623	-1.38690569941475	-0.152890000718492
7	-0.171323721783863	-0.706554098175656	0.363906654607931
8	-0.242073438266701	-0.828849942230684	0.344703065697283
-2.668900357		**the total change over 8 quarters**	

Table 12.
Local Projections approximate values for IRF and the confidence bounds for Korea

Korea results for Local Projections			
quarter	**IRF**	**lower confidence bound**	**upper confidence bound**
1	0.079788449185785	-0.785203588274669	0.944780486646238
2	0.553740895249992	-0.277198744025885	1.38468053452587
3	0.920703550415181	-0.231568814839975	2.07297591567034
4	-0.341106169826532	-1.56249251952696	0.880280179873891
5	-1.00410473146196	-1.9472917975164	-0.0609176654075249
6	0.177937252995616	-0.347627665139333	0.703502171130566
7	0.497804466451399	-0.252921845173212	1.24853077807601
8	-0.187132658763125	-1.51549717092917	1.14123185340292
0.697631054		**the total change over 8 quarters**	

Table 13.
Local Projections approximate values for IRF and the confidence bounds for New Zealand

New Zealand results for Local Projections			
quarter	**IRF**	**lower confidence bound**	**upper confidence bound**
1	2.37387436153867	-0.319929307948019	5.06767803102535
2	0.212148444894583	-1.5973258613795	2.02162275116866
3	0.448582360438585	-2.13927754240936	3.03644226328653
4	-1.2654748383961	-2.84299853317504	0.312048856382831
5	0.362882389166914	-1.91321512667399	2.63897990500782

6	0.952109202234919	-1.40607820154124	3.31029660601108
7	0.981857500602439	-1.66576121438298	3.62947621558785
8	2.22262429343323	0.211773130422047	4.23347545644442
6.288603714		**the total change over 8 quarters**	

Table 14.
Local Projections approximate values for IRF and the confidence bounds for Norway

Norway results for Local Projections			
quarter	**IRF**	**lower confidence bound**	**upper confidence bound**
1	2.5004948804087	-0.0555872651763042	5.0565770259937
2	1.47039484707476	-0.458900183462864	3.39968987761238
3	-0.718671244491555	-3.49270894872844	2.05536645974533
4	2.48387338658022	0.310206978193792	4.65753979496664
5	-0.598655208326965	-2.01459028823405	0.817279871580115
6	-0.920553042602299	-3.06929261157594	1.22818652637134
7	-1.58104844040807	-3.2979927620773	0.135895881261148
8	-0.928355111510678	-2.69170815633996	0.834997933318607
1.707480067		**the total change over 8 quarters**	

Table 15.
Local Projections approximate values for IRF and the confidence bounds for Poland

Poland results for Local Projections			
quarter	**IRF**	**lower confidence bound**	**upper confidence bound**
1	1.3878916009697	-0.113310085620752	2.88909328756015
2	-0.892846400778989	-2.49446189986113	0.708769098303153
3	-0.588315950562585	-1.74202257506234	0.565390673937167
4	0.758433321132173	-0.569336054190228	2.08620269645457
5	-0.172849763816462	-1.60682783178858	1.26112830415566
6	1.68918373289212	0.583798766779552	2.79456869900468
7	-0.204748168673073	-1.66209266015649	1.25259632281034
8	-0.275487345578896	-1.38232288858998	0.831348197432192
1.701261026		**the total change over 8 quarters**	

Table 16.
Local Projections approximate values for IRF and the confidence bounds for Sweden

Sweden results for Local Projections			
quarter	**IRF**	**lower confidence bound**	**upper confidence bound**
1	1.24372430729893	-1.23545542459871	3.72290403919656
2	0.841355411847128	-0.385724878541998	2.06843570223625
3	0.307218902837047	-1.2621433986332	1.87658120430729
4	0.703479977575907	-2.21728964390275	3.62424959905457
5	-1.20134681054419	-4.71526787446179	2.31257425337342
6	-0.984824284894103	-3.62622754374876	1.65657897396055
7	0.101661769728319	-1.38630599040763	1.58962952986426
8	-1.51305187354842	-3.05558517579199	0.0294814286951589
-0.5017826		**the total change over 8 quarters**	

Table 17.
Local Projections approximate values for IRF and the confidence bounds for Switzerland

Switzerland results for Local Projections			
quarter	**IRF**	**lower confidence bound**	**upper confidence bound**
1	-1.69247369351655	-3.47628013240276	0.0913327453696516
2	2.55817937657374	-0.619373420054373	5.73573217320185
3	0.334563673632464	-2.17178980796291	2.84091715522784
4	0.998941203534369	-1.13252356155113	3.13040596861987
5	0.688317293786464	-1.33879750994121	2.71543209751414
6	-2.90396101598065	-6.21108082427919	0.403158792317884
7	0.107190063710399	-1.60486033112113	1.81924045854193
8	-0.424667313150388	-2.04731990489451	1.19798527859373
-0.333910411		**the total change over 8 quarters**	

Table 18.
Local Projections approximate values for IRF and the confidence bounds for United Kingdom

United Kingdom results for Local Projections			
quarter	**IRF**	**lower confidence bound**	**upper confidence bound**
1	1.42673303080049	-1.07798874782889	3.93145480942987
2	1.16675940025266	0.00499854350809117	2.32852025699723
3	1.37587964388522	0.0967812749204793	2.65497801284997
4	1.56210395826852	-0.159249661743075	3.28345757828012
5	0.367456538636795	-0.69034005978745	1.42525313706104
6	1.00759057251291	0.0147765568155633	2.00040458821026
7	0.250755570988586	-0.956656187191204	1.45816732916838
8	0.732627949530919	-0.694744054682789	2.15999995374463
7.889906665		**the total change over 8 quarters**	

Table 19.
Local Projections approximate values for IRF and the confidence bounds for United States

United States results for Local Projections			
quarter	**IRF**	**lower confidence bound**	**upper confidence bound**
1	1.97653504323971	-1.4686734869364	5.42174357341581
2	0.0748331748413837	-0.859750823618158	1.00941717330093
3	0.53805705491926	-0.301387758208506	1.37750186804703
4	0.220407637608644	-0.846814645624183	1.28762992084147
5	0.199503595770099	-0.715475286782035	1.11448247832223
6	0.364308395300319	-0.451880937145324	1.18049772774596
7	0.508218628576256	-0.234614458996711	1.25105171614922
8	0.446782992839937	-0.612069107494489	1.50563509317436
4.328646523		**the total change over 8 quarters**	