The Bank Multiplier and A New Mechanism for the Transmission of the Monetary Policy

Nizam, Ahmed Mehedi

2 February 2019

The Bank Multiplier and A New Mechanism for the Transmission of the Monetary Policy

Ahmed Mehedi Nizam
ahmed.mehedi.nizam@gmail.com

February 2, 2019

Abstract

The concept of economic multiplier has been extensively used in the design and analysis of the fiscal policy. However, it has never been used to analyse the impact of nominal interest income received by the depositors through the banking channel on the total output. Here, we investigate the impact of nominal interest income on the macroeconomy using multiplier theory. We define and calculate the corresponding multiplier values algebraically and then we empirically calculate them using impulse response analysis. Along the way, we have shown a new mechanism for the transmission of the monetary policy decision which transcends through, as we call it here, the *nominal interest income channel.*

1 Introduction

Multiplier in economics measures the change in any endogenous variable in response to the change in any exogenous variable. The concept of economic multiplier is almost as old as economics itself. The *Tableau économique* (Economic Table) of François Quesnay is often attrubuted to be the beginning point of multiplier theory[1]. However, the modern theory of economic multiplier tended to evolve during the height of great depression when Keynes and Henderson [3] argued in favour of enhanced government spending in order to boost up employment. But, the Keynesian thoughs of combatting great depression through government impetus faced opposition from the office of the chancellor of exchequer saying "whatever might be the political or social advantages, very little additional employment can, in fact, and as a general rule, be created by State borrowing and State expenditure"[4]. This view of the office of the exchequer during 1930s is famously known as the Treasury View[5] which suggests any increase in government spending necessarily crowds out an equal amount of private spending or investment and thus has no net impact on economic activity. In his 1929 budget speech, Winston Churchill explained, "The orthodox Treasury view is that when the Government borrow[s] in the money market it becomes a new competitor with industry and engrosses to itself resources which would otherwise have been employed by private enterprise and in the process raises the rent of money to all who have need of it"[6]. However, the Keynesian macroeconomists rejected the treasury view and put forward the concept of fiscal multipliers in response. Richard Kahn in his famous paper "The Relation of Home Investment to Unemployment"[2] analyzed the impact of enhanced government spending on unemployment in the presence of spare capacity, monetory accomodation and sticky prices. Kahn's idea was further advanced and extended by Jens Warming[7] who introduced the concept of consumption functions in the analysis of economic multiplier. The first formal presentation of the multiplier by Keynes was in a series of four articles published in The Times in March 1933, entitled "The Means to Prosperity", followed by an article in the New Statesman in April entitled "The Multiplier"[4]. Keynes further argued in favour of the multiplier effect in his famous book "The General Theory of Employment, Interest, and Money"[8]. The idea of economic multiplier since its modern inception back in 1930s received mixed response from the economic community as rightly mentioned by *The Economist*: "Economists are in fact deeply divided about how well, or indeed whether, such (fiscal) stimulus works". After its inception in 1930s the research on economic multiplier evolves around its empirical estimation and its effectiveness to downplay recession. For example, the performance of *American Recovery and Reinvestment Act of 2009* was analyzed using the theories fiscal multipliers. Developed in order to combat the great recession, the recovery act was indeed a stimulus package enacted by the 11th US congress to create new jobs and to sustain the existing ones. Numerous other researches have been conducted aiming to estimate a *credible size* of the fiscal multipliers which include but not limited to [10], [11], [12], [13] etcetera. So far, multiplier theory has been predominantly used in the design and analysis of the fiscal policy. To the best of our knowledge, it has never been used to quantify the pronounced contribution of the interest income received by the depositors through the banking channel on the overall macroeconomy. Here, we use multiplier theory to analyze the contribution of interest income on aggregate output. The rest of the paper is organized as follows: Section 2 attempts to quantify the overall impact of nominal interest income on total output by introducing the concept of multipliers. Section 3 defines two different kinds of multiplier namely, cumulative and instantaneous multiplier. Section 4 provides the methodology used to calculate the multiplier values described in Section 3. Section 5 presents the result of empirical estimation of the multiplier values.

Section:6 describes a new mechanism for the transmission of moonetary policy in which monetary policy decision transcends through interest income recieved by the depositors from the banking channel. Finally, Section 7 makes some concluding remarks.

2 Contribution of Nominal Interest Income on Total Output

In the existing body of knowledge, nominal interest expense is usually considered as a cost of production (Hicks, 1979) [19]. When the interest rate rises, so does the cost of production of the leveraged business concern which eventually shifts the aggregate supply curve upward resulting into a rise in general price level. A huge volume of literature has been dedicated to the investigation of the aforementioned effect of nominal interest expense on real economy. For example, Seelig (1974) [21] investigates the relationship between interest rate and price hike using sectoral data and shows that interest rate would have to double for there to be a noteworthy increase in price. Barth and Ramey (2001) [14] has shown that in many manufacturing concern, cost channel (nominal interest expense) is the primary mechanism for the transmission of monetary policy. They present aggregate and industry level evidences in favor of the existence of a cost channel of monetary policy transmission. Barth and Ramey (2001) [14] argued that this cost channel of monetary transmission has the ability to explain three empirical puzzles in monetary economics: The first puzzle being the degree of amplification observed by Bernenke and Gertler (1995) [15], the second one being the price puzzle first observed by Sims (1992) [27] and last one being the comparative behavior of differential effect of monetary shocks on key macro-economic variables introduced by Barth and Ramey (2001) [14]. Gaiotti and Secchi (2006) [18] observes the pricing behavior for some 2000 individual firms in Italy which are leveraged to some extent only to confirm the non-trivial existence of the cost channel of monetary transmission in micro level. Dedola and Lippi (2005) [17] also find evidences in favor of the cost channel whereby industries with higher nominal interest expense are more likely to increase their relative price in the wake of a monetary contraction using empirical data of individual industries in five OECD countries. Meanwhile, Rabanal (2003) [20] does not find any trace of the cost channel of monetary transmission in historical data of US and Euro area. However, Tillman (2006) [23] argues that the cost channel can be effectively used to explain inflation under New Keynesian Phillips Curve framework. All that are mentioned above tend to link nominal interest expense incurred by the borrower to price hike only overlooking the effect of nominal interest income earned by the banks and depositors and tax revenue received by the government from the banking channel (through tax on banks' profit and source tax on deposit) on the aggregate spending. As the nominal interest expense incurred by the borrowers are distributed as nominal interest income to the depositors & banks and as tax revenue to the government, changing the nominal interest expense will not only effect the real economy from the supply side but it also have an equivalent impact on the demand side through nominal interest income channel. Here, we try to quantify the effect of nominal interest income earned by the depositors & banks and tax revenue received by the government through banking channel on total output considering the fact that the nominal interest income earned by the parties and tax revenue received by the government are successively invested into the economy resulting into a series of consumption. Thus changing the nominal interest expense (resulting into a change in nominal interest income and tax revenue) is said to have a multiplied effect on the economy: A unit change in nominal interest expense results into a more than unit change in total output.

To begin the analysis, let us assume l be the nominal lending rate and L be the total amount of domestic credit. Then the nominal interest expense incurred by the borrowers is given by:

$$l \times L$$

As one party's expense is another party's income, the above expense will be distributed amongst different economic entities. If the Average Tax Rate of the economy as a whole is given by ATR then amount of disposable interest income of the entities receiving the nominal interest on deposit will be given by:

$$(1 - ATR) \times l \times L$$

A part of this disposable income will be spent in consumption while another part will bs saved. If the Average Propensity to Consume of the economy is given by APC then the amount spent in consumption will be given by:

$$APC \times (1 - ATR) \times l \times L$$

A part of the above spending is made to purchase locally produced goods and services while the rest will be spent to procure imported utilities. Thus, if the Average Propensity to Import of the economy is given by API then the amount spent in locally produced goods and services will be given by:

$$APC \times (1 - API) \times (1 - ATR) \times l \times L$$

Let, the quantity $APC \times (1 - API) \times (1 - ATR) \times l \times L$ be given by c. Then the above quantity turns out to be:

$$c \times l \times L$$

The above spending in locally produced goods and services will be received by the local manufacturers and service providers who in turn spend a portion of it and save the rest and the process continues. Thus the initial nominal interest expense incurred by the borrower will trigger a series of subsequent consumption in the economy. If the velocity of money is given by v, then we will have $(v - 1)$ number of subsequent consumption [24]. Here, we assume $(v-1)$ number of subsequent consumptions instead of v as money changes hand for the first time during the payment of nominal interest expense by the borrowers. Thus the total contribution TC of the initial nominal interest expense $l \times L$ will be given by the following sereis:

$$TC = c \times l \times L + c^2 \times l \times L + c^3 \times l \times L + ... + c^{v-1} \times l \times L$$
$$= (c + c^2 + c^3 + ... + c^{v-1}) \times l \times L$$

$$TC = \frac{c \times (1 - c^{v-1})}{1 - c} \times l \times L \qquad (1)$$

3 Different Kinds of Multipliers

If we change nominal interest expense by one unit it will bring about a more than one unit change in output due to multiplier effect. The multiplier namely $\frac{c \times (1 - c^{v-1})}{1-c}$ represents the change in nominal GDP brought about by an unit change in nominal interest expense. From now on, we call it as the nominal interest expense multiplier. Like the fiscal multipliers, we can define nominal interest expense multiplier both as an impact multiplier and cumulative multiplier depending upon the forcasting horizon under consideration. For impact multiplier (IM), the forcasting horizon can be only one period long and it can be defined as follows:

$$IM = \frac{\Delta GDP}{\Delta IE}$$

where IE represents total nominal interest expense of the leveraged business concern, the sign Δ represents the change in the quantity that follows it. However, the change in nominal interest expense, can have a pronounced effect on the nominal GDP extending from the period the change is applied to several subsequent time lags. And that is why we feel it necessary to define a cumulative version of the nominal interest expense multiplier:

$$CM = \frac{\sum_{i=0}^{n} \Delta GDP}{\sum_{i=0}^{n} \Delta IE}$$

where n represents the forcasting horizon under consideration.

4 Methodology

VAR mehtodology has been predominantly used in the empirical estimation of fiscal multipliers [see [25], [26] for example]. Using the footprint of the above literature, we also resort to VAR analysis in order to calculate nominal interest expense multiplier. Our VAR model consists of two endogenous variables namely nominal nominal GDP and nominal interest expense. As the variables need to be stationary to be fitted into VAR model, we first check for stationarity of our intended variables. We use ADF unit root test for stationarity check. Variables that are found to be non-stationary at level will be differenced until they become stationary.

To model impetus in nominal interest expense, we follow recursive formulation approach (Choleski Decomposition) proposed by Sims [27]. In this approach, ordering of the endogenous variables plays a crucial role as variables appearing later will respond contemporaneously to any change in the variables appearing earlier. As we are more likely to calculate the impact of any change in nominal interest expense to nominal GDP, we place nominal interest expense before nominal GDP in the representation of the endogenous variables.

Once the ordering of the variables is set, we select the appropriate lag length for our unrestricted VAR model. Lag lenght that minimizes the AIC information criterion is selected. In the next step, we determine the dynamic stability of our determined VAR model. The estimated VAR is stable (stationary) if all roots of AR characteristic polynomial have modulus less than one and lie within the unit circle. If the VAR is not stable, certain results (such as impulse response standard errors) are not valid. If the VAR model thus selected is found to be instable, then we increase the lag lenght and repeat the whole procedure unless we find a stable one.

After we have selected approprite lag length for our VAR model, we provide one standard deviation Choleski shock in nominal interest expense. We note down the response of nominal GDP to shock in nominal interest expense and also the response of nominal interest expense to its own shock. In the next step, we divide the response of nominal

GDP to shock in nominal interest expense by the response of nominal interest expense to its own shock in order to arrive at our desired multiplier values.

5 Data

We collect annual time series data of USA and UK regarding nominal lending rate, domestic credit as percentage of GDP and GDP in LCU from World Bank data warehouse which is publicly available through the URL: `data.worldbank.org/indicator`. We multiply nominal lending rate by total domestic credit to calculate annual interest expense. We begin our empirical analysis by performing ADF unit root test on interest expense and GDP. Results of the unit root test are presented in table: 1. All the time series except US interest expesne are found to be non stationary at level but stationary at first difference. So, we take first difference of each series before fitting them into VAR model. Then we select the appropriate number of lag for our VAR analysis. The maximum lag length tested is 5 (five). Lag length that minimizes Akaike Information Criterion (AIC) is selected. For both US and UK data, lag length is found to be 4(four). The results are presented at table: 2. Once we select the appropriate lag length, then we check for the dynamic stability of our selected VAR model by plotting the roots of the AR characteristic polynomial. As can be seen from figure: 1 and 2, all the unit roots for both the model lie within the unit circle which confers the dynamic stability of our selected VAR model. Then we construct our VAR model by taking interest expense and GDP as endogenous variables and provide one standard deviation Cholesky shock to the models. Response of GDP to shock in interest expense and also the response of interest expense to its own shock are noted. Point to point responses of GDP and interest expesne to shock in interest expense for US and UK data are presented in figure: 3, 4 and figure: 7, 8. Cumulative responses of GDP and interest expesne to shock in interest expense for US and UK data are plotted in figure: 5, 6 and figure: 9, 10.

Responses to GDP to change in interest expesne are then divided by responses of interest expense to its own shock to calculate the desired multiplier values. The results are presented at table: 3 and table: 4.

6 A New Mechanism for the Transmission of Monetary Policy

There are two central views regarding the transmission of monetary policy, namely, the money view and the credit view [28]. Apart from the traditional interest rate channel, at least 3 (three) more ideas namely, exchange rate mechanism, Tobin's Q channel and the wealth mechanism have been evolved under the name *Money View*. According to the traditional interest rate channel, monetary policy can use short term nominal interest rate in order to adjust long term real interest rate based upon two central assumptions: 1) The central bank can alter the short term nominal interest rate and 2) Investment expenditure is sensitive to changes in long term real interest rate. Changes in long term real interest rate will in turn bring about a change in investment and consumption expenditure. On the other hand, the exchange rate mechanism states that if domestic real interest rate rises then domestic deposits will eventually become more profitable than its foreign counterpart which leads to an increased demand of the domestic currency which culminates into the appreciation of the local currency. As the local currency appreciates, the local goods will enjoy a price hike abroad which reduces the net export. As export is a part of aggregate spending, aggregate demand reduces. Next, in Tobin's Q-channel [29], during the regime of an expansionary monetary policy, more money will flow into the stock market resulting into an increased market capitalization of the listed business concerns which results into a higher Tobin's Q ratio which provokes the companies to issue new stock (As it can issue new stock and sell it into the market with a positive margin). We notice an increase in investment as a result. Like the Tobin's Q-channel, the wealth mechanism [30] also works through the stock market channel and here, stocks are considered as a component of private wealth. As the stock appreciates so will be the private wealth which results into an enahanced private consumption and investment.

On the other hand, the credit view evolves over the idea that the central bank can use different monetary policy instruments to control the bank deposits. For example, the central bank may raise the reserve rate which reduces the bank's deposit base which in turn reduces the loanable funds. This mechanism regarding a controlled exposure of domestic credit is usually known as bank lending channel. But, this is not the only idea that has been captured under the heading *credit view*. Infact, like the *money view*, the *credit view* also encompasses a bunch of ideas and the bank lending channel is just one of them. Other ideas under the credit view includes balance sheet channel, cash flow channel, unanticipated price level channel, household liquidity effects etcetera [28].

None of the above ideas except the exchange rate mechanism under money view investigates the role of interest income in the transmission of monetary policy. In exchange rate mechanism, the domestic long term real interest rate is inversely tied to net export of the country. However, the role of the interest income in domestic spending has never been analyzed in greater detail. Here, we make a detailed analysis in section: 2 regarding the prounouced impact of interest income on domestic output. We describe how the initial interest expense incurred by the borrowers will be eventually distributed into the economy and how this initial spending in interest expense will trigger a series of subsequent consumption and investment into the economy. Hence, contrary to the traditional interest rate channel, here, we argue that a decline in short term nominal interest rate will reduce the total disposable income of the depositors. Reductioin in disposable income will result into a decline in aggregate spending.

7 Conclusion

In the existing body of knowledge, the role of the interest rate is often inversely associated with aggregate spending i.e., a rise in long term real interest rate results into a shrinking investment portfolio. However, considering the fact that one party's expense is another party's income, here, we argue that interest expense or interchangeably, interest income can also effect the economy from the demand side by enhancing aggregate demand. A higher interest expense of the borrowers will result into a higher interest income for lenders which increases the total disposable income of the lenders. Depending upon the Average Propensity to Consume (APC) of the economy, a part of this disposable income will be saved and other will be invested. Thus, the initial interest expense will trigger a series of subsequent consumption and the contribution of the initial interest expense will be multiplied by a *factor*. Here, we try to calculate the corresponding *factor* values by impulse response analysis of a VAR model constructed with GDP and interest expense as two endogenous variables. Our analysis suggests the existence of a new monetary policy transmission channel which is yet to be investigated with greater detail.

References

[1] Hegeland, H. 1954. The Multiplier Theory. C. W. K. Gleerup.

[2] Kahn, R.F. (June 1931). "The Relation of Home Investment to Unemployment". The Economic Journal. Wyley-Blackwell. 41 (162). doi:10.2307/2223697. JSTOR 2223697

[3] Keynes, J.M. and Henderson, H. (1929), Can Lloyd George Do It?, London: Hogarth Press.

[4] Snowdon, B., Vane, H.R. (2005). Modern macroeconomics: its origins, development and current state. Edward Elgar. p. 61. ISBN 978-1-84542-208-0.

[5] F.W. Leith-Ross to Sir Richard Hopkins and P.J. Grigg, 3 April 1929, quoted in G.C. Peden (2004), Keynes and His Critics, p. 80

[6] `https://en.wikipedia.org/wiki/Treasury_view#cite_note-2`

[7] Warming, J. (1932), International Difficulties Arising Out of the Financing of Public Works During a Depression, Economic Journal, June.

[8] Keynes, J.M. (1936), 'The General Theory of Employment, Interest, and Money' Palgrave Macmillan

[9] "Much ado about multipliers". The Economist. Sep 24, 2009. Retrieved 18 October 2011.

[10] Eckstein, Otto (1983). The DRI Model of the US Economy. New York: McGraw-Hill. ISBN 0-07-018972-2. See also Bodkin, Ronald G.; Eckstein, Otto (1985). "The DRI Model of the U. S. Economy". Southern Economic Journal. 51 (4): 1253Ũ1255. doi:10.2307/1058399. JSTOR 1058399.

[11] Ilzetzki, Ethan; Mendoza, Enrique G.; Végh, Carlos A. (2013). "How Big (Small?) are Fiscal Multipliers?". Journal of Monetary Economics. 60 (2): 239 to 254. doi:10.1016/j.jmoneco.2012.10.011.

[12] Acconcia, A.; Corsetti, G.; Simonelli, S. (2011). "Mafia and Public Spending: Evidence on the Fiscal Multiplier from a Quasi Experiment". CEPR Discussion Paper 8305. SSRN 1810270. See also http://voxeu.org/index.php?q=node/6314.

[13] IMF Global Prospects and Policies report 2012, page 43

[14] Barth, M. and V. Ramey (2001), ŞThe Cost Channel of Monetary TransmissionŤ, NBER Macroeconomics Annual 2001, Cambridge, MIT Press, pp. 199-240.

[15] Bernanke, B., Gertler, M. (1995). Inside the black box: The credit channel of monetary policy transmission. Journal of Economic Perspectives 9(4):27-48.

[16] Blinder, A. (1985, May). Credit rationing and effective supply failure. NBER working paper series.

[17] Dedola, L., Lippi, F., 2005. The monetary transmission mechanism: evidence from the industries of five OECD countries. European Economic Review 49, 1543-1569.

[18] Gaiotti, E., Secchi, A. (2006). Is there a cost channel of monetary policy transmission? An investigation into the pricing behaviour of 2,000 firms. Journal of Money, Credit, and Banking, v. 38, 8, pp. 2013-2038 .

[19] Hicks, J. (1979). Is Interest the Price of a Factor of Production? J. M. Rizzo (ed.), Time, Uncertainty and Disequilibrium .

[20] Rabanal, P., 2003. The cost channel of monetary policy: Further evidence for the united states and the euro area. Working Paper 03-7149, IMF.

[21] Seelig, A. S. (1974, September). Rising Interest Rate and Cost Push Inflation. Vol. 29, No. 4, pp. 1049-1061 .

[22] Sims, C. (1992). Interpreting the macroeconomic time series facts: The effects of monetary policy. European Economic Review 36(5):975-1000.

[23] Tillmann, P., 2006. Does the cost channel of monetary transmission explain inflation dynamics? Mimeo, University of Bonn.

[24] Ahmed Mehedi Nizam, 2019. On the Algebraic Calculation of the Fiscal Multiplier, MPRA Paper, University Library of Munich, Germany.

[25] Fatás, Antonio and Ilian Mihov (2001), ŞThe Effects of Fiscal Policy on Consumption and Employment: Theory and EvidenceŤ, Centre for Economic Policy Research, CEPR Discussion Papers, No. 2760, April.

[26] Blanchard, Olivier and Roberto Perotti (2002), ŞAn Empirical Characterization of the Dynamic Effects of Changes in Government Spending and Taxes on OutputŤ, MIT Press, The Quarterly Journal of EconomicsŤ, Vol. 117(4): 1329-1368.

[27] Sims, Christopher A. (1980), ŞMacroeconomics and RealityŤ, Econometrica, Vol. 48(1): 1-48.

[28] Brinkmeyer, H and Börner, C.J.. (2015). Drivers of bank lending: New evidence from the crisis. 10.1007/978-3-658-07175-2.

[29] Tobin James, "A General Equilibrium Approach to Monetary Theory" Journal of money, Credit and Banking, February 1969.

[30] Modigliani Franco, "Monetary Policy and Consumption" In Consumer Spending and Monetary Policy: The Linkages. Boston: Federal Reserve Bank of Boston, 1971, pp. 9Ű84.

8 Tables

Country	Series	Date Range	ADF Type	Level/ Differenced	p-value	Remark @ 5%
USA	GDP	1969-2016	Trend and Intercept	L	0.8121	NS
				FD	0.0038	S
	IE	1969-2016	Trend and Intercept	L	0.0003	S
				FD	0	S
UK	GDP	1969-2014	Trend and Intercept	L	0.5075	NS
				FD	0.0033	S
	IE	1969-2014	Trend and Intercept	L	0.6268	NS
				FD	0.0001	S

Table 1: ADF Unit Root Test

Country	Time range	Max Lag	p [min LR]	p [min FPE]	p [min AIC]	p [min SC]	p [min HQ]
USA	1969-2016	5	2	4	4	2	2
UK	1969-2014	5	1	4	4	1	1

Table 2: Lag length selection for the VAR model

Period	D(US_IE)	D(US_GDP)	Impact Multiplier	Cumulative response of D(US_IE)	Cumulative response of D(US_GDP)	Cumulative multiplier
1	2.21E+11	3.54E+10	0.16	2.21E+11	3.54E+10	0.16
2	8.01E+10	7.37E+10	0.92	3.01E+11	1.09E+11	0.36
3	-8.14E+10	-6.03E+10	0.74	2.20E+11	4.88E+10	0.22
4	-9.64E+10	-8.45E+10	0.88	1.23E+11	-3.57E+10	-0.29
5	-4.66E+10	-5.67E+10	1.22	7.67E+10	-9.24E+10	-1.20
6	-2.70E+10	-1.32E+10	0.49	4.97E+10	-1.06E+11	-2.12
7	4.29E+10	-1.16E+09	-0.03	9.26E+10	-1.07E+11	-1.15
8	7.62E+10	2.46E+10	0.32	1.69E+11	-8.22E+10	-0.49
9	3.69E+10	1.06E+10	0.29	2.06E+11	-7.16E+10	-0.35
10	-2.40E+10	-2.15E+10	0.90	1.82E+11	-9.31E+10	-0.51

Table 3: Impulse Response Table for US Data

Period	D(UK_IE)	D(UK_GDP)	Impact Multiplier	Cumulative response of D(UK_IE)	Cumulative response of D(UK_GDP)	Cumulative multiplier
1	2.17E+10	1.50E+10	0.69	2.17E+10	1.50E+10	0.69
2	1.88E+09	5.62E+08	0.30	2.36E+10	1.56E+10	0.66
3	-3.23E+09	-6.41E+09	1.98	2.04E+10	9.15E+09	0.45
4	-5.20E+08	-3.17E+09	6.10	1.98E+10	5.98E+09	0.30
5	-4.69E+09	-7.99E+09	1.70	1.51E+10	-2.01E+09	-0.13
6	-1.58E+09	-3.54E+09	2.24	1.36E+10	-5.55E+09	-0.41
7	7.99E+08	-3.95E+08	-0.49	1.44E+10	-5.94E+09	-0.41
8	2.22E+09	52061933	0.02	1.66E+10	-5.89E+09	-0.36
9	2.27E+09	90735565	0.04	1.88E+10	-5.80E+09	-0.31
10	1.62E+08	-1.41E+09	-8.70	1.90E+10	-7.21E+09	-0.38

Table 4: Impulse Response Table for UK Data

9 Figures

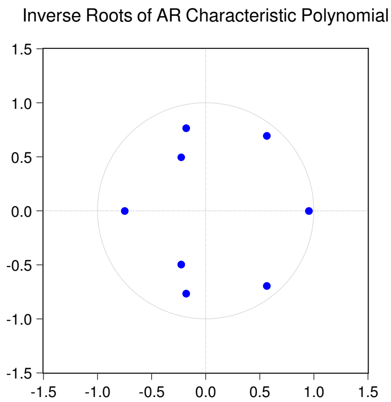

Figure 1: Roots of the AR characteristic polynomial for US data

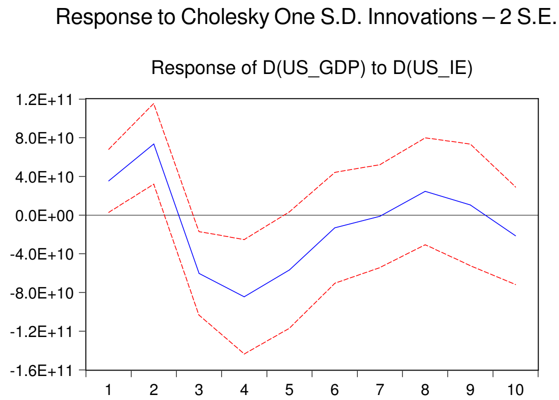

Figure 3: Responses of US GDP to shock in US Interest Expense

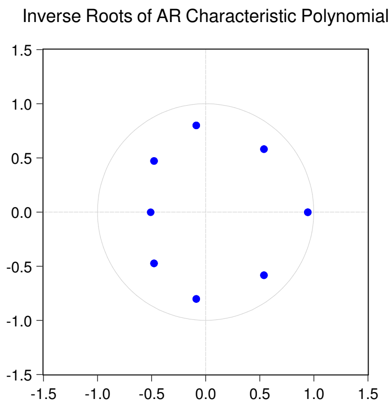

Figure 2: Roots of the AR characteristic polynomial for UK data

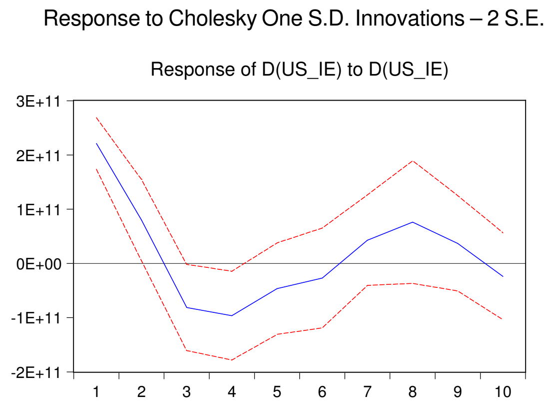

Figure 4: Responses of US Interest Expense to its Own Shock

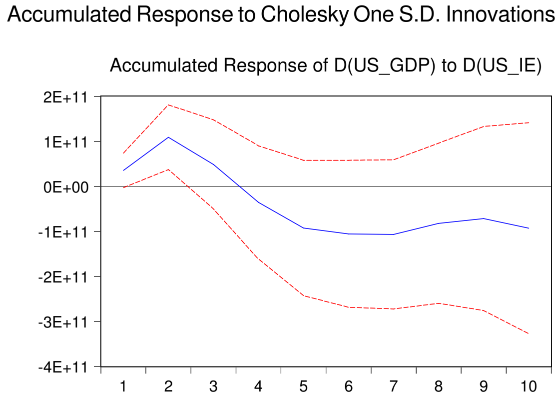

Figure 5: Cumulative Responses of US GDP to shock in US Interest Expense

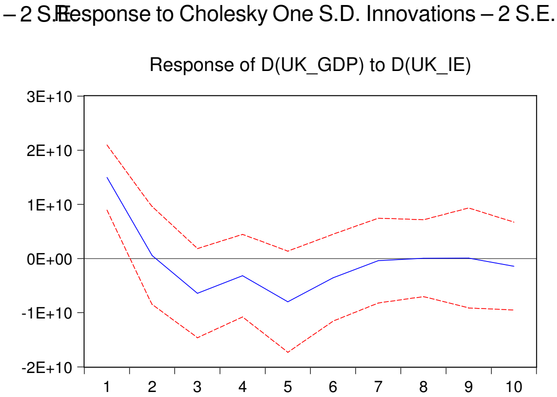

Figure 7: Responses of UK GDP to shock in UK Interest Expense

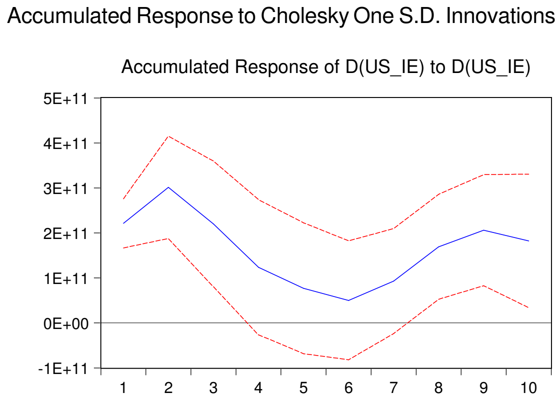

Figure 6: Cumulative Responses of US Interest Expense to its Own Shock

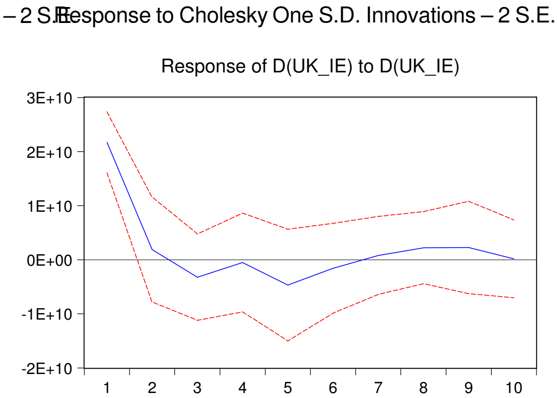

Figure 8: Responses of UK Interest Expense to its Own Shock

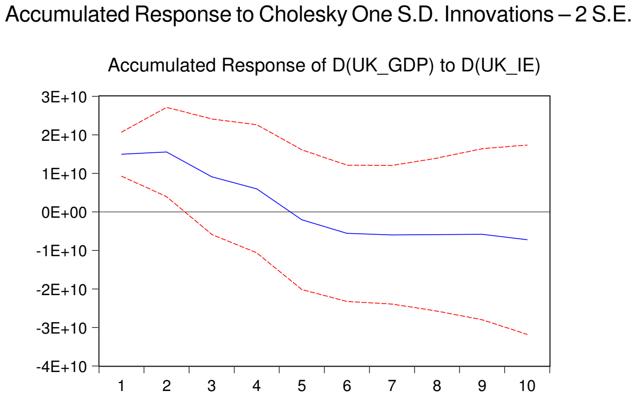

Figure 9: Cumulative Responses of UK GDP to shock in UK Interest Expense

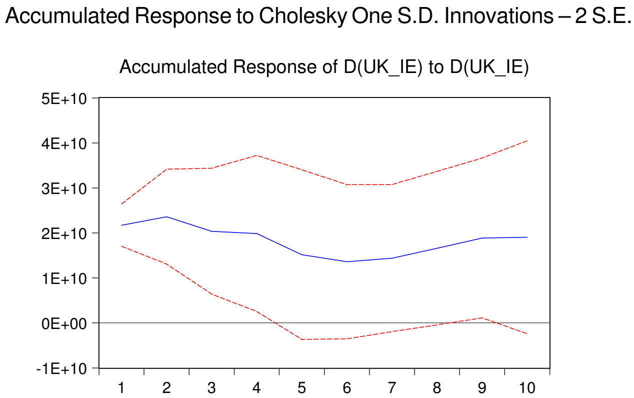

Figure 10: Cumulative Responses of UK Interest Expense to its Own Shock