

The Redistributive Effects of Monetary Policy

Harjoat S. Bhamra

Imperial College

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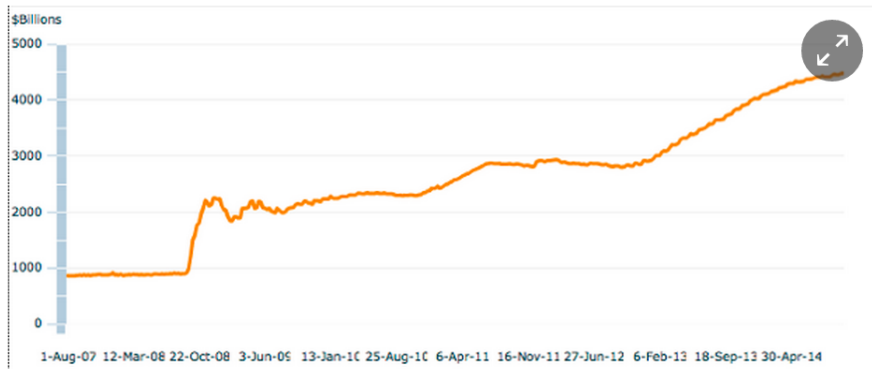
Paper's aim

- When a Central Bank injects money into the economy, who benefits the most and who benefits the least?
- Is it possible for anyone to lose out?
- If we think of the economy as a network, money will percolate through it, but how?

Why do we care?

- Central Banks have been hyperactive in recent times:
 - Lowering **reserve requirements** to make it easier for banks to lend.
 - Altering the **money supply** by changing short-term interest rates.
 - **Open market operations**: Fed buys and sells government securities in the open market. If the Fed wants to increase the money supply, it buys government bonds. This supplies the securities dealers who sell the bonds with cash, increasing the overall money supply.
 - **Quantitative easing (QE)**: Central Bank creates new money electronically. Used new money to buy financial assets, like government bonds from private sector businesses (insurance co's, pension funds, banks). Yields go down. Aim to induce private sector firms to invest in other, riskier assets like corporate bonds and equities. Makes holders of such instruments better off.
- Has this hyperactivity been worthwhile? If so, for whom?

The Fed's balance sheet has grown sharply

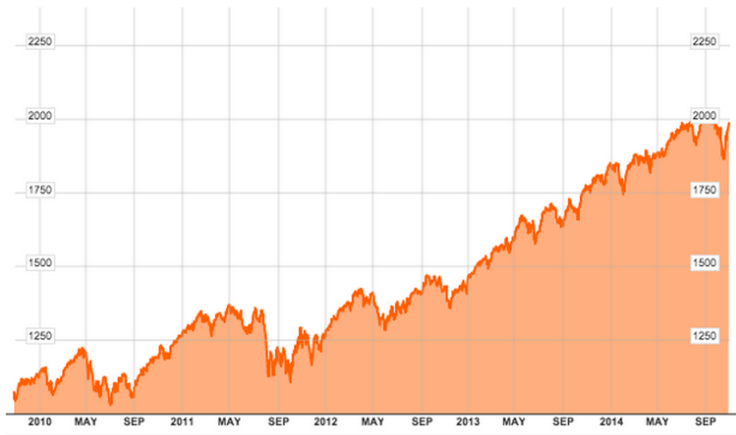


📷 Federal Reserve's total assets Photograph: Federal Reserve



Since the onset of the financial crisis, the Fed's balance sheet has swelled enormously. Its vast bond-buying programme took the balance sheet from about \$870bn in August 2007 to almost \$4.5tn today.

US equities have risen



📷 S&P 500 index Photograph: Bloomberg

[Quantitative easing](#), coupled with low interest rates, freed up capital in the US and encouraged a steady rise in risk appetite amid the Fed's ultra-supportive monetary policy. US share prices rose in this environment - the S&P 500 is now about 80% higher than it was in late 2009.

Recovery has been patchy

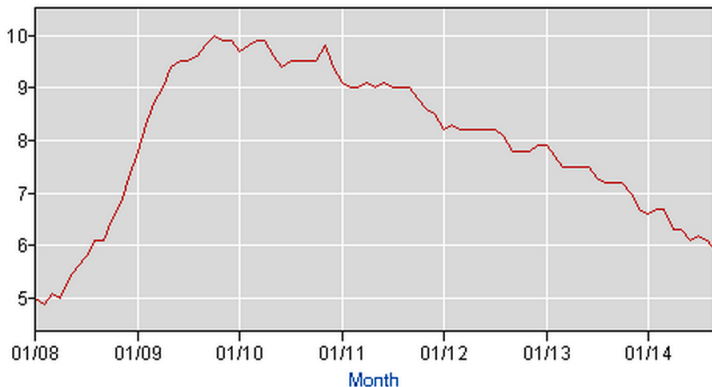


Percentage change in US GDP, annual rates Photograph: US Bureau of Economic Analysis



The [US economy](#) has proved relatively solid but growth rates have been patchy. The economy actually shrank as recently as the first quarter of this year but that was largely put down to a particularly harsh winter and GDP bounced back in the second quarter. The first estimate of third-quarter growth will be published on Thursday.

Unemployment has fallen sharply



📷 US unemployment rate (%) Photograph: US Bureau of Labor Statistics

The jobless rate in the US has fallen sharply since QE was launched, against a backdrop of economic recovery and heightened confidence. The unemployment rate reached a peak of 10% in October 2009, falling to 5.9% in September 2014 - the lowest level since August 2008. Earlier this year, the Fed abandoned its 6.5% unemployment target as a guide for raising interest rates.

US bond yields have fallen



📷 US government 10-year bond yields Photograph: Bloomberg



As in the UK, US bond-buying has helped to bring down the government's borrowing costs. As a guaranteed purchaser of assets and by supporting the US economy in this way, the Fed gave confidence to other investors.

Inflation has been falling



📷 US annual rate of inflation (consumer prices index) Photograph: US Bureau of Labor Statistics



US annual inflation has been on a downward path since the summer, and economists are expecting further falls. The consumer price index was flat at 1.7% in August but is likely to fall further as lower oil prices feed through. Weaker inflation could lead to mounting calls for another round of QE...

Revisiting the questions

- Who benefits the most
 - higher equity prices
 - lower bond yields
 - lower inflation
- Does anyone lose out?

Revisiting the questions II

- Economy exists to serve the needs of human beings
- How much do households benefit if the cost of capital for firms is lower because of QE?
- Do some households benefit very little? Do benefits depend on characteristics such as income, wealth, age, geographical location?
- Worth thinking about the redistributive effects of monetary policy

Toy Model

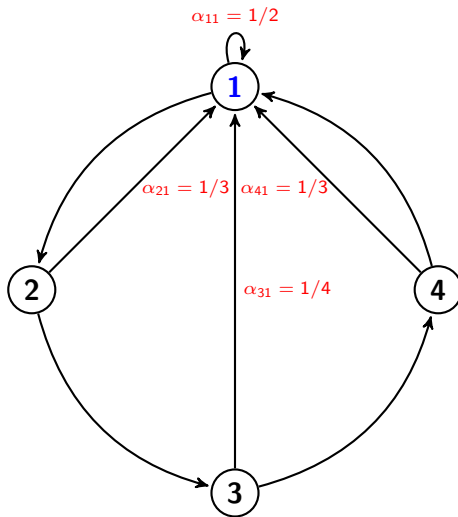
- Exchange economy
- Money and 4 types of Good
- $N = 4$ Agents
 - Agent n endowed with Good n and Money.
 - Agent n prefers to consume Good n and then Goods endowed to **nearest** Agents
- Central Bank, which can inject or extract money by purchasing Good 1
- Agent 1

$$\max_{m_1, x_{11}, x_{21}, x_{31}, x_{41}} \left(\frac{m_1}{\sum_{k=1}^4 m_k} \right)^{\beta} \prod_{i=1}^4 x_{i1}^{\alpha_{i1}}$$

- budget constraint

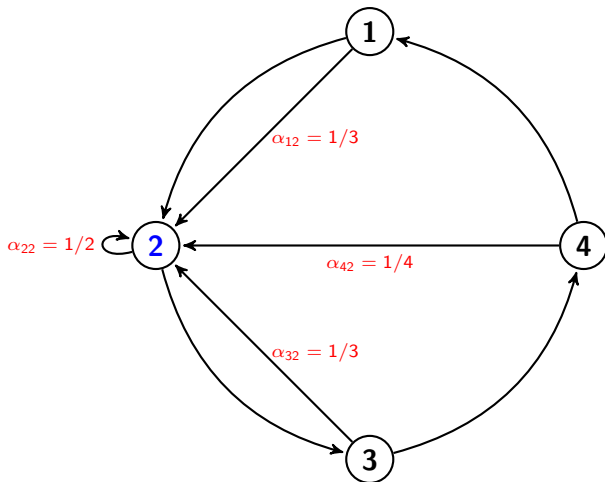
$$m_1 + p_1 x_{11} + p_2 x_{21} + p_3 x_{31} + p_4 x_{41} \leq \underbrace{M}_{\text{money endowment}} + \underbrace{p_1}_{\text{endowment of Good 1 for Agent 1}} \quad (1)$$

- Where does concept of distance come in?



$$\begin{pmatrix} \alpha_{11} \\ \alpha_{21} \\ \alpha_{31} \\ \alpha_{41} \end{pmatrix} = \begin{pmatrix} 1/2 \\ 1/3 \\ 1/4 \\ 1/3 \end{pmatrix}$$

Greater demand for goods endowed to nearby agents: $x_{i1} = \alpha_{i1} \frac{m_1/p_1}{\beta}$



$$\begin{pmatrix} \alpha_{11} \\ \alpha_{21} \\ \alpha_{31} \\ \alpha_{41} \end{pmatrix} = \begin{pmatrix} 1/2 \\ 1/3 \\ 1/4 \\ 1/3 \end{pmatrix} \rightarrow \begin{pmatrix} \alpha_{12} \\ \alpha_{22} \\ \alpha_{32} \\ \alpha_{42} \end{pmatrix} = \begin{pmatrix} 1/3 \\ 1/2 \\ 1/3 \\ 1/4 \end{pmatrix}$$

Greater demand for goods endowed to nearby agents: $x_{i1} = \alpha_{i1} \frac{m_1/p_1}{\beta}$

Symmetry

- Agent 2 differs from Agent 1 as follows
 - Agent 2 is endowed with a unit of Good 2
 - Parameters governing demand obtained by imagining Agent 1's α 's are on a wheel & spinning the wheel down by one number

$$\begin{pmatrix} \alpha_{11} \\ \alpha_{21} \\ \alpha_{31} \\ \alpha_{41} \end{pmatrix} = \begin{pmatrix} 1/2 \\ 1/3 \\ 1/4 \\ 1/3 \end{pmatrix}, \quad \begin{pmatrix} \alpha_{12} \\ \alpha_{22} \\ \alpha_{32} \\ \alpha_{42} \end{pmatrix} = \begin{pmatrix} 1/3 \\ 1/2 \\ 1/3 \\ 1/4 \end{pmatrix}$$

- Do same for Agents 3 and 4 to generate matrix of α 's

$$\mathbf{A} = \begin{pmatrix} \alpha_{11} & \alpha_{12} & \alpha_{13} & \alpha_{14} \\ \alpha_{21} & \alpha_{22} & \alpha_{23} & \alpha_{24} \\ \alpha_{31} & \alpha_{32} & \alpha_{33} & \alpha_{34} \\ \alpha_{41} & \alpha_{42} & \alpha_{43} & \alpha_{44} \end{pmatrix} = \begin{pmatrix} 1/2 & 1/3 & 1/4 & 1/3 \\ 1/3 & 1/2 & 1/3 & 1/4 \\ 1/4 & 1/3 & 1/2 & 1/3 \\ 1/3 & 1/4 & 1/3 & 1/2 \end{pmatrix}$$

- **Key ideas:**
 - Agent 1 is closest to Agent 2 and 4: $\alpha_{21} = \alpha_{41} = 1/3$ – more demand for Goods 2 & 4
 - Agent 1 is farthest from Agent 3: $\alpha_{31} = 1/4 < \alpha_{21} = \alpha_{41} = 1/3$ – less demand for Good 3

Central Bank

- Central bank purchases Q/p_1 units of Good 1 – injects Q units of Money into Economy

$$m_1 + m_2 + m_3 + m_4 = 4M + Q \quad (2)$$

- **Main Result:** If $Q > 0$ then Agent 1 is strictly better off and the farthest Agent from Agent 1 is strictly worse off
 - Interesting that an Agent can be worse off.

Is this the right way to think about redistributive effects of monetary policy?

- Central banks buy financial assets, not goods
- Can we use a model with heterogeneous goods as a reducing form way of modelling substitutability/complementarity across asset classes?

Does the simple circular network capture redistributive effects?

- Households who save mainly via bank deposits lost out from QE
- Households long the stock market benefited from QE
- Do the benefits from QE to firms/banks get passed on to households? If so, which ones?
 - What fraction of households have substantial savings in bank deposits of stocks? Probably a small fraction.
- Paper interprets Agent 1 as Wall Street and Agents distant from Agent 1 as Main Street
 - Misses the idea of money percolating through the network
 - Need dynamic model for this

Introducing Dynamics

- Model firms endowed with goods the central bank can purchase.
- Model households endowed with goods the central bank cannot purchase.
- Firms provide households with labor and households invest in firms
- Have a matrix capturing movement of capital through the network of firms and households (Entities) over one period, W_{ij} summarizes net capital flow from Entity i to Entity j

$$\mathbf{W} = [W_{ij}] \quad (3)$$

- Some firms receive injection of money from central bank – vector $\mathbf{x}$. Entity i gets x_i
- Want to know what happens to $\mathbf{x}$: who gets the money? How does it percolate?
- After k rounds of trade, $\mathbf{x}$ will be spread across Entities. The vector telling us who has what is $\mathbf{W}^k \mathbf{x}$
- **To analyze how the money has percolated just analyze $\mathbf{W}^k \mathbf{x}$**

Concluding Remarks

- Interesting research question
- Can we replace different asset classes with different goods?
- Is the circular network of agents the right one for the questions asked?
- What about dynamics?