Effects of the U.S. Quantitative Easing on a Small Open Economy

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A brief overview

Quantitative Easing (QE) policies are used in developed economies to stimulate their economies when standard monetary policy has become ineffective (when the short-term interest rate is at its zero lower-bound).

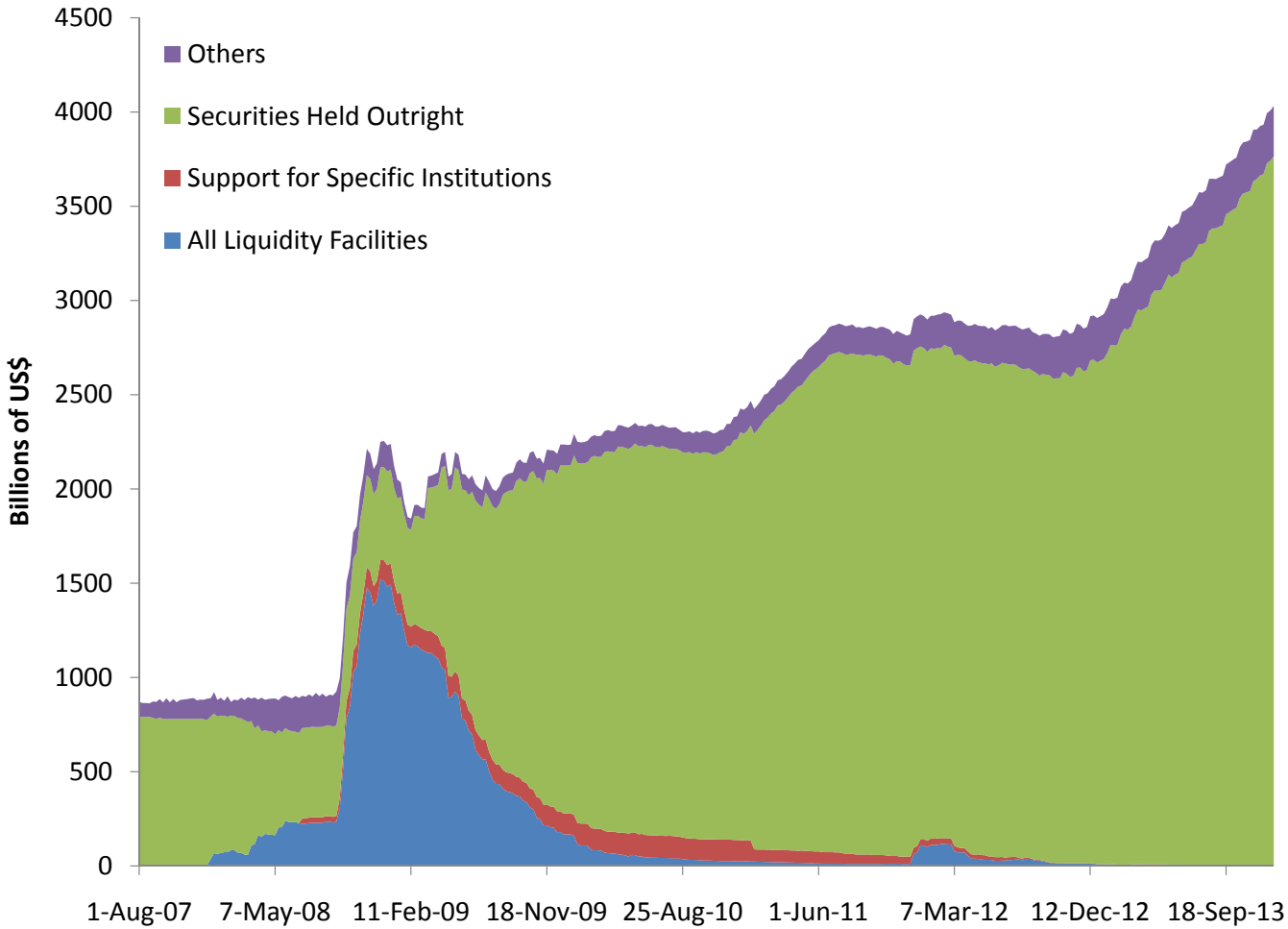
A central bank implements **QE** by purchasing assets of longer maturity, and thereby lowering longer-term interest rates, while simultaneously increasing the monetary base.

In November 2008, the Federal Reserve started buying mortgage-backed securities, treasury securities and other financial assets in different rounds (QE1, QE2, operation twist and QE3.)

A brief overview

FED's Quantitative Easing

Figure: FED's Balance Sheet



Source: Federal Reserve Economic Data (FRED)

A brief overview

Contribution and main result

Most of the work on QE is focused on developed countries. However, US **quantitative easing** policies also have spillover effects on developing countries.

After each US QE round, most emerging economies may have experienced large surges in capital inflows, which led to exchange rate appreciation, high credit growth, asset price booms, among other effects.

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Contribution: this paper assesses empirically the US QE effects on the Peruvian Economy. We focus on economic growth and inflation.

Main result: we find effects on financial variables but small effects on inflation and growth, based on a structural VAR (SVAR) model with block exogeneity (Zha, 1999) and sign and zero restrictions (Arias, Rubio-Ramirez, y Waggoner, 2014).

Outline

Related literature

- Baumeister and Benati (2012): SVAR with sign restrictions for QE effects in the U.S. and the U.K. and find that compressions in the long-term yield spread exert a powerful effect on both output growth and inflation.

- Schenkelgerg and Watzka (2013): SVAR with zero and sign restrictions for QE effects in Japan and find that a QE shock leads to a 7 percent drop in long-term interest rates and a 0.4 percent increase in industrial production.

Related literature

Main channels highlighted about QE effects for developing countries:

- **Liquidity channel**, increased global liquidity leads to investors searching for investment opportunities in emerging markets (increase of capital inflows to emerging economies). This induces higher credit growth.
- **Exchange-rate channel**, increase in capital inflows implies an exchange rate appreciation. Central banks that reduce the volatility in forex market accumulates international reserves.
- **Trade channel**, the increase in output growth in advanced economies, increases demand for exports from emerging markets.
- **Terms-of-trade channel**, investors bought gold with part of the excess of liquidity. Relevant for mineral exporter countries (e.g. Chile, Peru).

Empirical strategy

SVAR with block exogeneity

- The approach considers a two-block SVAR model featuring (1) the big economy and (2) a the small open economy. Where the last block is exogenous for the first one.

- Cushman and Zha (1997) argue that the imposition of block exogeneity in a SVAR is a natural extension for a small open economy model because it helps the identification of the monetary policy from the viewpoint of this small open economy.

- The use of block exogeneity also reduces the number of parameters needed to estimate for the small open economy block.

Empirical strategy

The setup

The big economy (US economy):

$$\mathbf{y}_t^{*\prime}\mathbf{A}_0^* = \sum_{i=1}^{p} \mathbf{y}_{t-i}^{*\prime}\mathbf{A}_i^* + \mathbf{w}_t^{\prime}\mathbf{D}^* + \varepsilon_t^{*\prime} \tag{1}$$

where y_t^* is $n^* \times 1$ vectors of endogenous variables for the big economy; ε_t^* is $n^* \times 1$ vectors of structural shocks for the big economy ($\varepsilon_t^* \sim N(0, I_{n^*})$); $\widetilde{\mathbf{A}}_i^*$ and $\mathbf{A}_i^*$ are $n^* \times n^*$ matrices of structural parameters for $i = 0, \ldots, p$; $\mathbf{w}_t$ is a $r \times 1$ vector of exogenous variables; $\mathbf{D}^*$ is $r \times n$ matrx of structural parameters; p is the lag length; and, T is the sample size.

Empirical strategy

The setup

The small open economy (Peruvian economy):

$$\mathbf{y}_t'\mathbf{A}_0 = \sum_{i=1}^{p} \mathbf{y}_{t-i}'\mathbf{A}_i + \sum_{i=0}^{p} \mathbf{y}_{t-i}^{*\prime}\widetilde{\mathbf{A}}_i^* + \mathbf{w}_t'\mathbf{D} + \varepsilon_t' \tag{2}$$

where y_t is $n \times 1$ vector of endogenous variables for the small economy; ε_t is $n \times 1$ vector of structural shocks for the domestic economy ($\varepsilon_t \sim N(0, I_n)$ and structural shocks are independent across blocks i.e. $E(\varepsilon_t \varepsilon_t^{*\prime}) = \mathbf{0}_{\mathbf{n}\times\mathbf{n}^*}$); $\mathbf{A}_i$ are $n \times n$ matrices of structural parameters for $i = 0, \ldots, p$; and, $\mathbf{D}$ is $r \times n$ matrix of structural parameters.

Empirical strategy

The setup

Compact form:

$$\begin{bmatrix} \mathbf{y}_t' & \mathbf{y}_t^{*\prime} \end{bmatrix} \begin{bmatrix} \mathbf{A}_0 & -\widetilde{\mathbf{A}}_0^* \\ \mathbf{0} & \mathbf{A}_0^* \end{bmatrix} = \sum_{i=1}^{p} \begin{bmatrix} \mathbf{y}_{t-i}' & \mathbf{y}_{t-i}^{*\prime} \end{bmatrix} \begin{bmatrix} \mathbf{A}_i & \widetilde{\mathbf{A}}_i^* \\ \mathbf{0} & \mathbf{A}_i^* \end{bmatrix} + \mathbf{w}_t' \begin{bmatrix} \mathbf{D} \\ \mathbf{D}^* \end{bmatrix} + \begin{bmatrix} \varepsilon_t' & \varepsilon_t^{*\prime} \end{bmatrix} \begin{bmatrix} I_n & \mathbf{0} \\ \mathbf{0} & I_{n^*} \end{bmatrix}$$

Empirical strategy

Data

Monthly data: October 1995-December 2013.

Variables from the US economy:

- Economic policy uncertainty index (EPU_{US}).
- Term spread indicator (*Spread*).
- M1 Money Stock ($M1_{US}$).
- Federal Funds Rate (FFR).
- Consumer Price Index (CPI_{US}).
- Industrial Production Index (IP_{US}).

Empirical strategy

Data

Variables from the Peruvian economy:

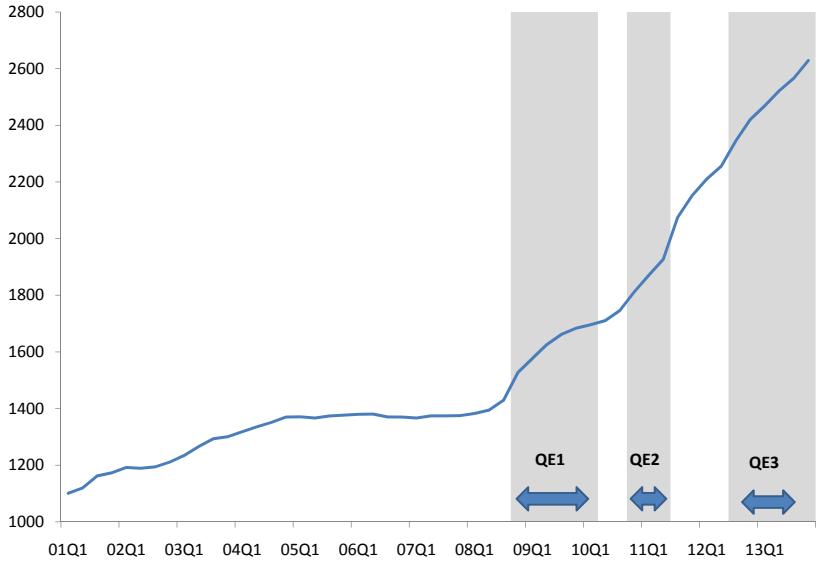
- Terms of trade (TOT).
- Real Exchange Rate (RER).
- Interbank Interest Rate in Soles (INT).
- Aggregated Credit of the Banking System in US Dollars (Cred_{FC}).
- Aggregated Credit of the Banking System in Soles (Cred_{DC}).
- Consumer Price Index (CPI).
- Real Gross Domestic Product (GDP).

Empirical strategy

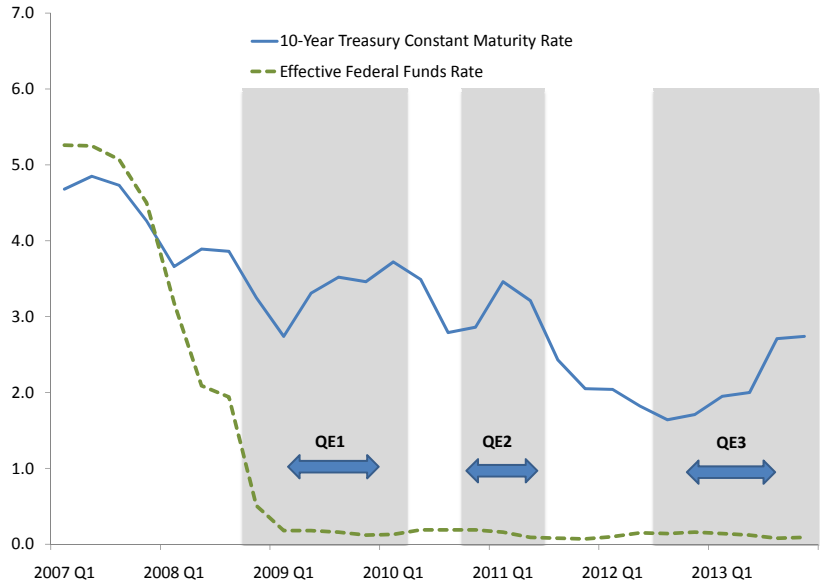
Identifying QE shocks

QE shock: **lowering longer-term interest rates**, while simultaneously **increasing the monetary base** and **keeping the federal fund rate low**.

(a) US M1 money stock



(b) Long- and short-term interest rates



Source: FRED.

Empirical strategy

Identifying QE shocks

Table: Identifying Restrictions for a QE shock in the U.S.

Variable	QE shock
US term spread indicator (*Spread*)	$-$
US M1 money stock ($M1_{US}$)	$+$
Federal Funds Rate (FFR)	0
Other US variables	?
Domestic (Peru) block	?

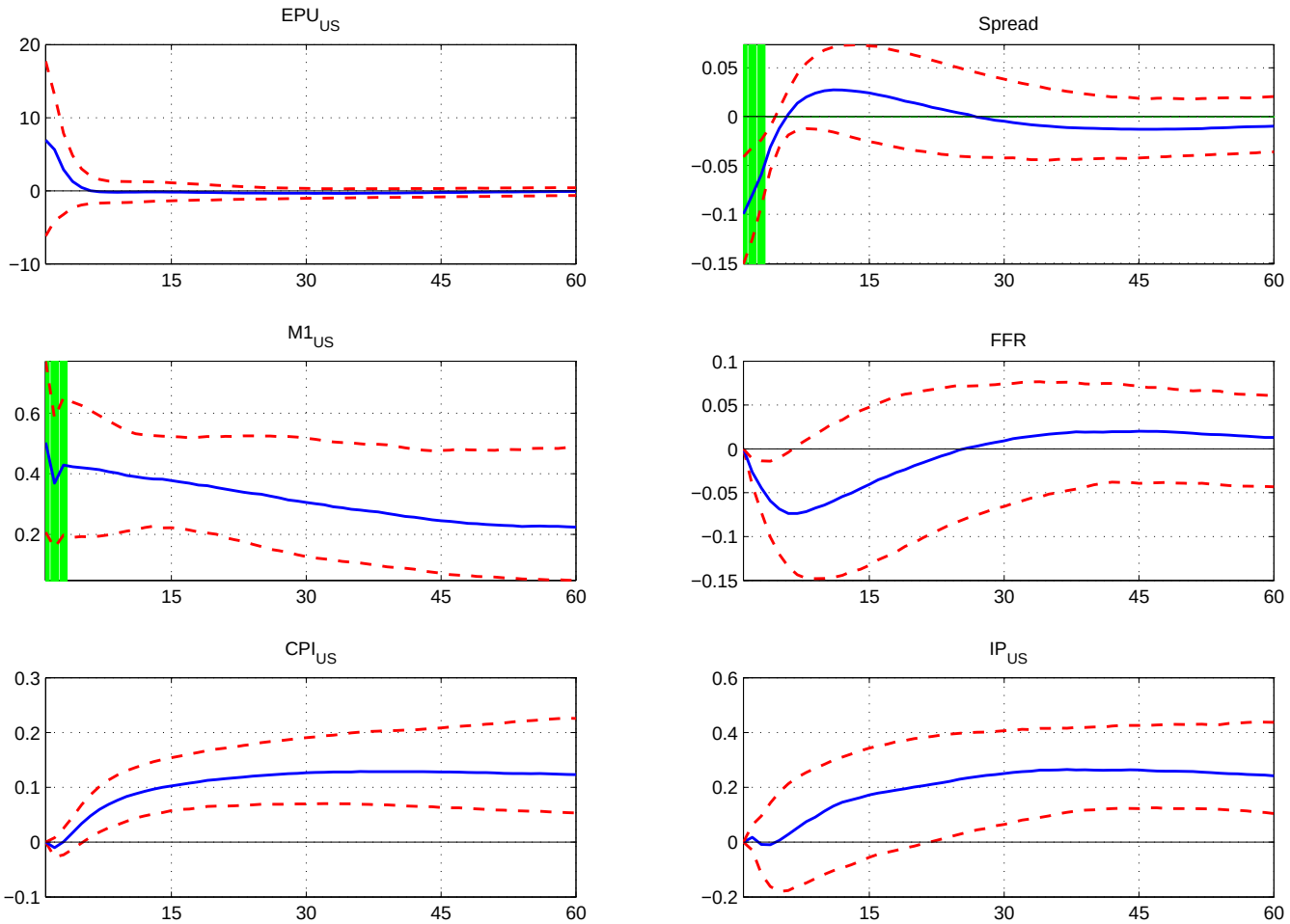
Note: ? = left unconstrained.

Baumeister and Benati (2012) and Peersman (2011) impose similar identification for the US economy and the Euro area, respectively.

Empirical strategy

Responses after a QE shock

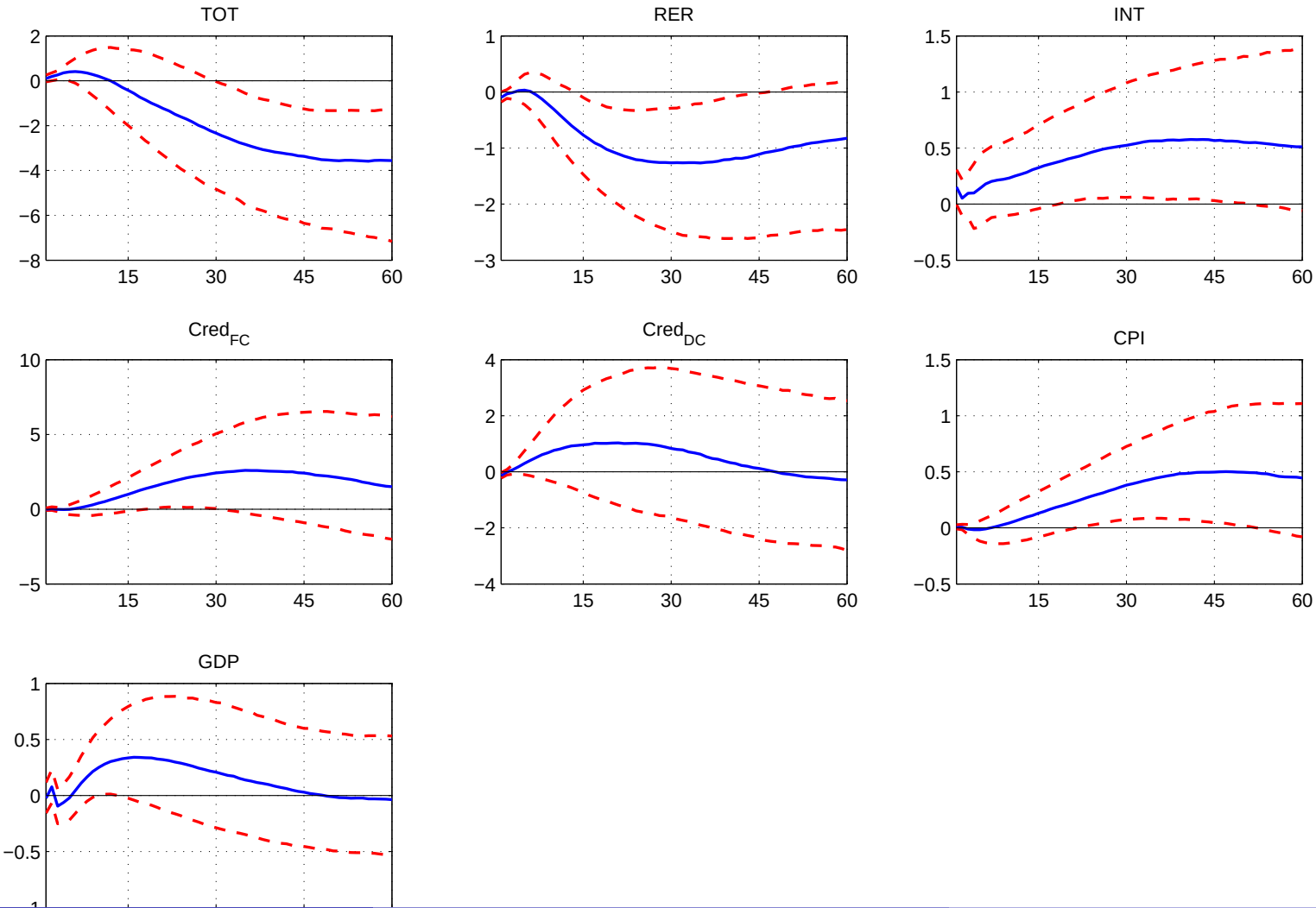
Figure: U.S. responses after a QE shock; median value and 68% bands



Empirical strategy

Responses after a QE shock

Figure: Peruvian responses after a QE shock; median value and 68% bands



Counterfactual analysis

The setup

Pesaran and Smith (2012) define a "policy effect" relative to the counterfactual of "no policy scenario".

- Suppose that the policy intervention is announced at the end of the period T for the periods $T+1, T+2, ..., T+H$.
- The intervention is such that the "policy on" realized values of the policy variable are different from the "policy off" counterfactual values (what would have happened in the absence of the intervention).

Counterfactual analysis

The setup

- $\Omega_T = \{x_t \text{ for } t = T, T-1, T-2, ...\}$ is the information set available at time t.
- Let m_t be the policy variable.
- The realized policy values are:
  $\Psi_{T+h}(m) = \{m_{T+1}, m_{T+2}, ..., m_{T+h}\}$.
- The counterfactual policy values are:
  $\Psi_{T+h}(m^0) = \{m^0_{T+1}, m^0_{T+2}, ..., m^0_{T+h}\}$.

Counterfactual analysis

Ex-ante policy evaluation

- Compare the effects of two alternative sets of policy values: $\Psi_{T+h}(m^0)$ and $\Psi_{T+h}(m^1)$.
- The ex-ante effect of the "policy on" $\Psi_{T+h}(m^1)$ relative to "policy off" $\Psi_{T+h}(m^0)$ is given by:

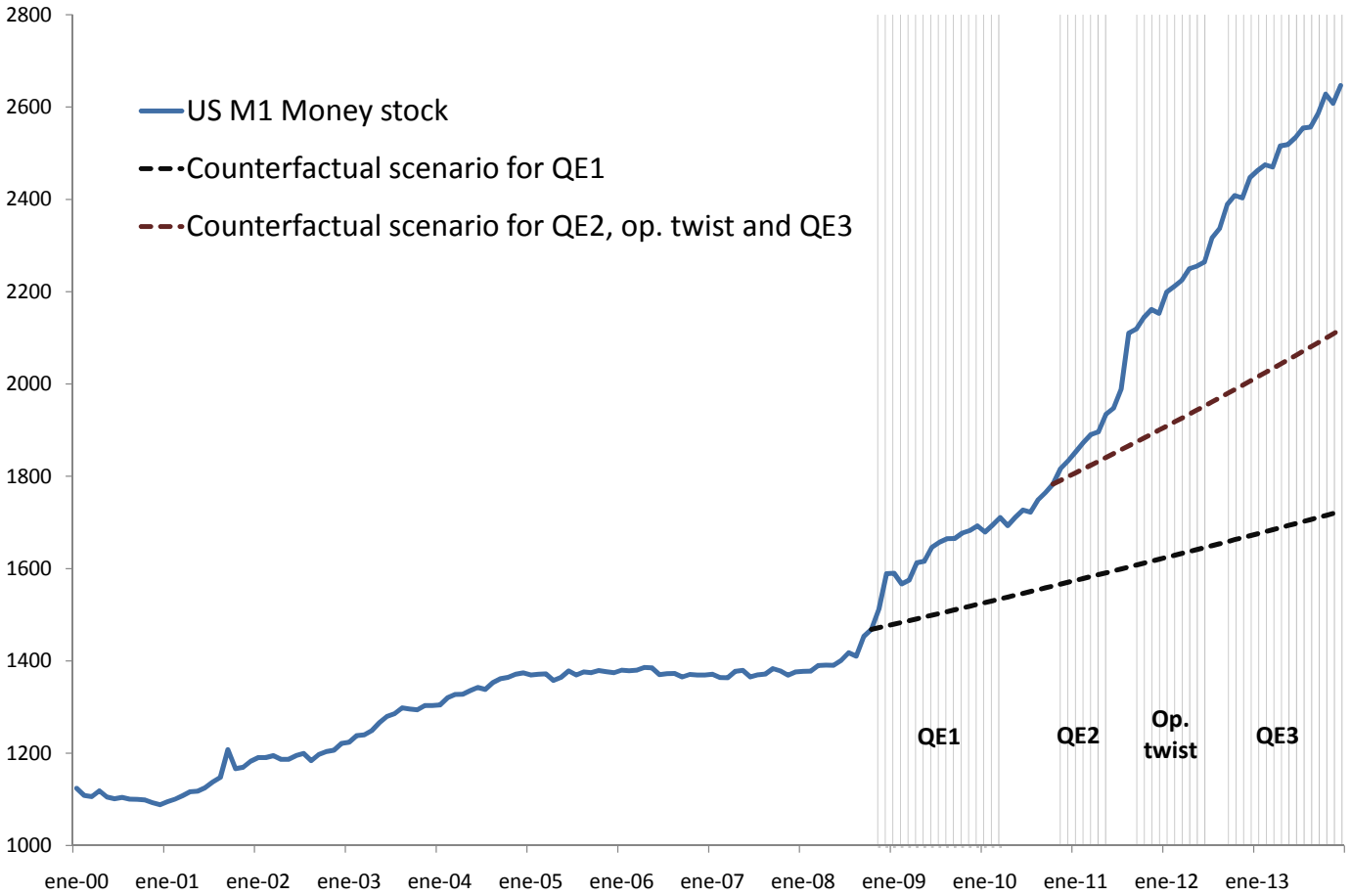
$$d_{t+h} = E(z_{t+h}|\Omega_T, \Psi_{T+h}(m^1)) - E(z_{t+h}|\Omega_T, \Psi_{T+h}(m^0)), \ h = 1, 2, ..., H, \tag{3}$$

where z_t is one of the variables in the matrix x_t (for example, inflation in Peru), except the policy variable(s).

Counterfactual analysis

Counterfactual scenario

Figure: U.S. M1 Money Stock



Counterfactual analysis

Ex-ante results

Table: QE effects throughout the U.S. M1 in the U.S. (keeping low the FED interest rate)

	QE ex-ante effect		
	Median QE1	68% lower bound	68% upper bound
M1 Money stock (% change)	8.23	–	–
FED interest rate (p.p)	0.00	–	–
Term spread (p.p)	-0.19	-0.20	-0.17
Inflation rate (%)	0.95	0.92	0.97
Industrial production (%)	2.43	2.32	2.54

Counterfactual analysis

Ex-ante results

Table: QE effects throughout the U.S. M1 in Peru (keeping low the FED interest rate)

	QE ex-ante effect		
	Median QE1	68% lower bound	68% upper bound
Terms of trade (% change)	5.51	5.16	5.83
Exchange rate (% change)	-3.19	-3.39	-2.94
Interest rate (p.p)	-0.29	-0.35	-0.25
Credit in U.S. dollars (%)	6.41	6.13	6.65
Credit in Soles (%)	4.72	4.48	4.95
Inflation rate (%)	0.48	0.43	0.53
Activity growth (%)	0.21	0.11	0.35

Conclusion

- Our results suggest small effects of US QE on key macroeconomic variables.
- The increase in international liquidity seems to transmit effects over the macro-economy through channels such as interest rates, credit growth, and exchange rate.
- But, we find not significant effects on inflation and economic growth in Peru.
- In that regard, our prior is that the central bank anticipated most of those effects and adopted macroprudential policies that mitigate any negative effect that may spread over the whole Peruvian economy.

Agenda

- Include variables that capture other transmission channels: **Portfolio re-balancing channel** and **Signaling channel**, that operates through the effect on agents' expectations.
- Include macroprudential variables: reserve requirements and forex market interventions (control of exchange rate variability); which might tend to mitigate most of the transmission mechanism.
- QE1 (a program to purchase agency debt and MBS "to provide greater support to mortgage lending and housing markets") vs QE2 ($300 billion in long-term Treasuries "to help improve conditions in private credit markets")
- Estimate the effects in other countries (Chile, Colombia and Mexico)
- Look at QE Exit (Tapering)

END