Measuring the Impact of Foreign Shocks in the Peruvian Economy[1]

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[1]The views expressed in this paper are our own and do not necessarily reflect those of the Central Reserve Bank of Peru.

Contents

Introduction

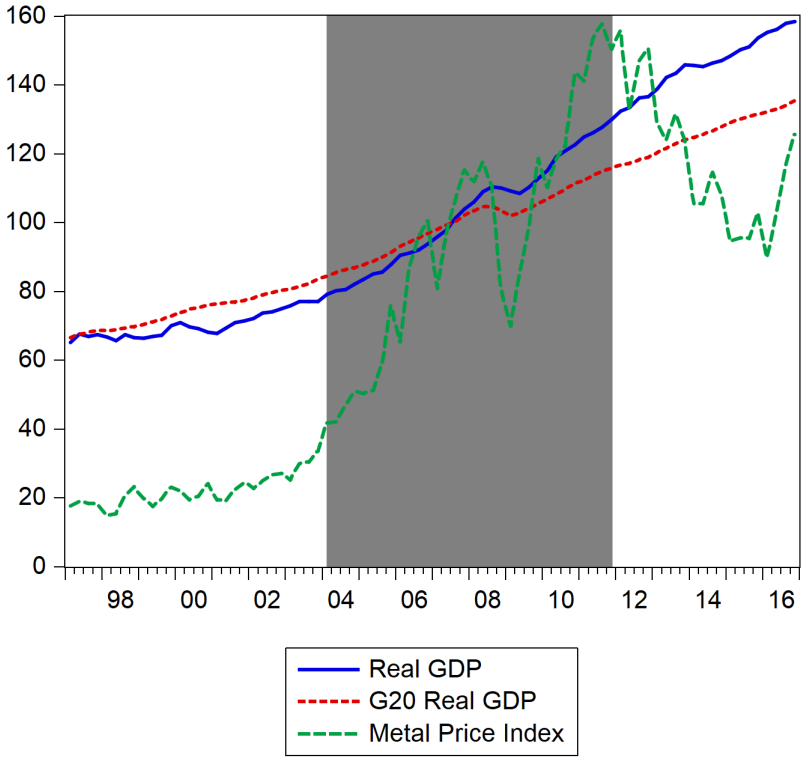
- In the international macroeconomics literature it has been commonly accepted that foreign shocks represent an important driver of business cycles in small open economies.
- However, recent papers have questioned the real contributions of the foreign shocks.
  - Schmitt-Grohé and Uribe (2017) argue the terms of trade explained aroung 10.5 percent of the fluctuations of the GDP in small open economies.

Introduction

- An interesting case of study is that of Peru in the 2000s.
  - Peru is mainly a commodity exporter, with minerals representing an average of 57% of the total exports between 2001 and 2017.
  - The international prices of the main minerals exported by Peru, copper and gold, grew a yearly average of 27% and 20% between 2004 and 2011, respectively.
  - The average GDP, consumption and investment real annual growth between 2004 and 2011 were of 7%, 6% and 14%, respectively.
  - In contrast, the averages corresponding to the 8-year period previous to the commodity price boom (1996-2003) were of 3%, 2% and 0%, respectively.

Introduction

Figure: GDP and Metal Price Index Evolution



Note: Variables expressed in 2007=100 scale.

Introduction

- In this paper we seek to find which are the true contributions of foreign variables to business cycles in Peru.
- We propose an empirical framework that considers a small open economy assumption.
- The foreign variables affect the domestic variables, but the domestic variables do not affect the foreign variables.
- As per the suggestion of Schmitt-Grohé and Uribe (2016), in the present document we consider using a metal price index instead of the terms of trade index.
- We explore different specifications to check the robustness of our results.

Methodology

- We consider a VAR model with an exogenous block of variables due to the small open economy assumption.
- We model the dynamics of the foreign variables F_t independently from the domestic variables Y_t.

$$F_t = A_1 F_{t-1} + A_2 F_{t-2} + \ldots + A_p F_{t-p} + u_t, \tag{1}$$

$$Y_t = B_1 Y_{t-1} + B_2 Y_{t-2} + \ldots + B_p Y_{t-p} + C_1 F_{t-1} + C_2 F_{t-2} + \ldots + C_p F_{t-p} + v_t. \tag{2}$$

- The two equations can be expressed in matrix notation as

$$\begin{bmatrix} F_t \\ Y_t \end{bmatrix} = \begin{bmatrix} A_1 & 0 \\ C_1 & B_1 \end{bmatrix} \begin{bmatrix} F_{t-1} \\ Y_{t-1} \end{bmatrix} + \ldots + \begin{bmatrix} A_p & 0 \\ C_p & B_p \end{bmatrix} \begin{bmatrix} F_{t-p} \\ Y_{t-p} \end{bmatrix} + \begin{bmatrix} u_t \\ v_t \end{bmatrix}. \tag{3}$$

Data

Table: Variables

Block	Variable	Variable Description
Domestic Block	r	Interbank Interest Rate
	rer	Real Exchange Rate
	c	Real Consumption
	i	Real Private Investment
	y	Real GDP
	π	Inflation Rate
Foreign Block	r^*	Moody's Seasoned Baa Corporate Bond Spread
	y^*	Real G20 GDP
	y^{ch}	Real China GDP
	p^*	Metal Price Index

Data

- The variables are divided in two different blocks: the domestic block and the foreign block.
- The data has a quarterly frequency and goes from 1994Q1 to 2016Q4.
- For the main results, the data is expressed in natural logarithms.
- Only the variables expressed in rates are not transformed (i.e. the interest rates and the inflation rates).

Metal Price Index

- This index is built taking into account the main 8 metals exported by the Peruvian economy: copper, gold, iron, lead, molybdenum, silver, tin and zinc.
  1. Multiply each price of the metal exports by the United States deflator, to convert the units from current dollars to constant dollars.
  2. Find the weights of the dollar exports of metal in the total amount of the 8-metal dollar export basket in each period.
  3. Take the 1994-2013 sample average of each weight to have an index with constant weights.[2]
  4. Find the 1-quarter growth rate for each of the metal price indices.
  5. Find the weighted metal price index 1-quarter growth rate using the individual weights and individual price indices.
  6. Set a metal price index with value of 100 in the first period considered in the sample.
  7. Recover the rest of the metal price index series using the growth rate.

[2] The years were chosen to match those used by Shousha (2016).

Baseline Specification

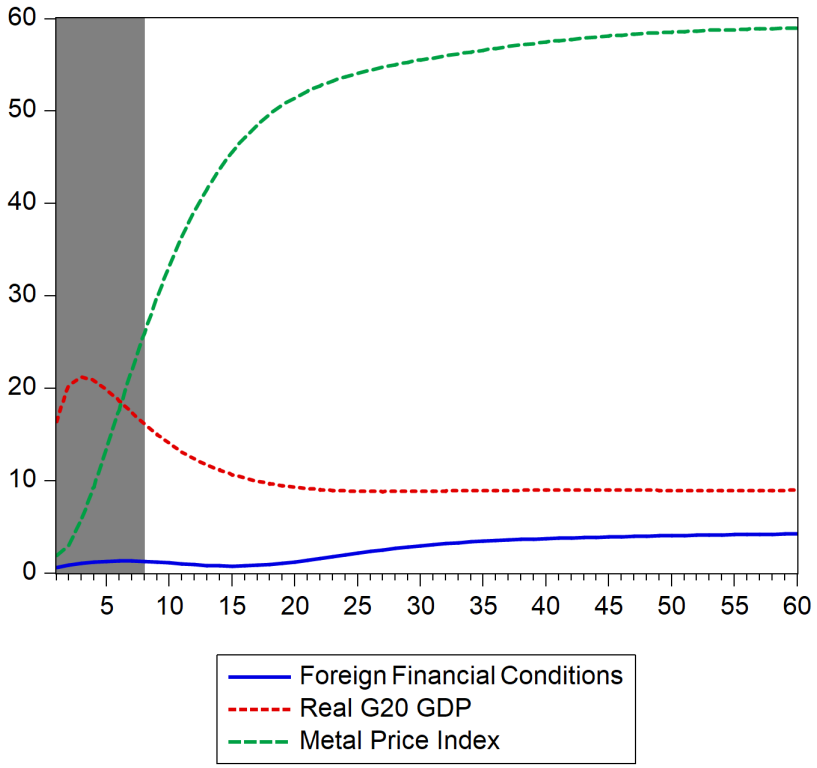
- The vector of variables for this baseline specification is

$$Y_t = \left[\underbrace{r_t^* \quad y_t^* \quad p_t^*}_{\text{Exogenous Block}} \quad \vdots \quad r_t \quad rer_t \quad c_t \quad i_t \quad y_t \quad \pi_t \right]'.$$

- The first three variables comprise the exogenous block of this specification.
- The ordering of the variables in the recursive scheme is the same as shown above.
- With this specification, considering natural logarithms for the variables and a linear trend, the Schwarz Information Criteria (BIC) indicates that the model to consider is the one which has only 1 lag.
- All the foreign shocks are considered to have a size of 1 standard deviation.

Forecast Error Variance Decomposition

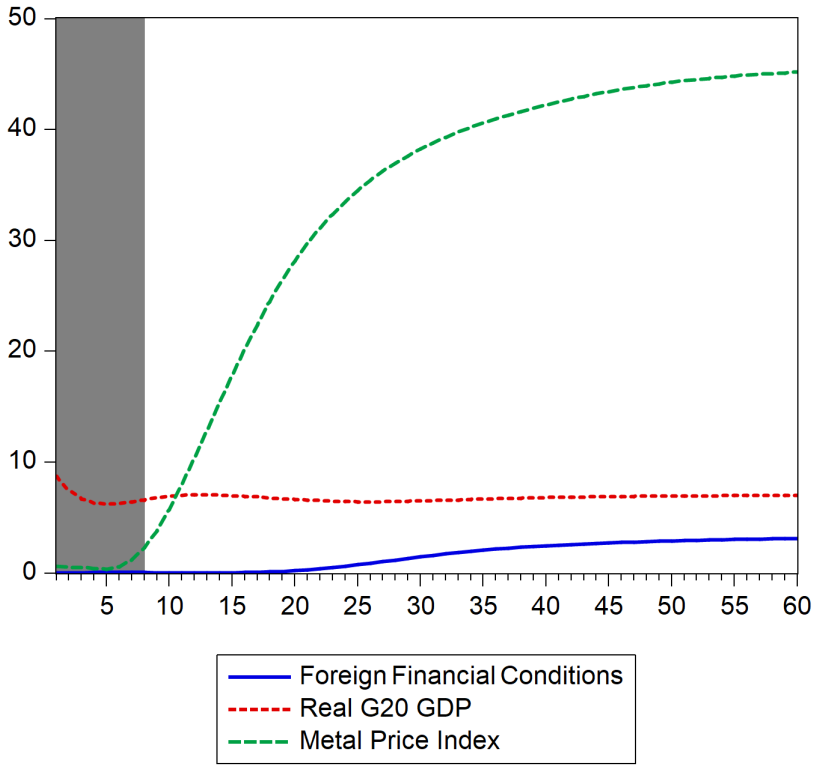
Figure: Forecast Error Variance Decomposition, Real GDP



Note: The shaded area denotes the first 8 periods or 2 years, the very short term of the model.

Forecast Error Variance Decomposition

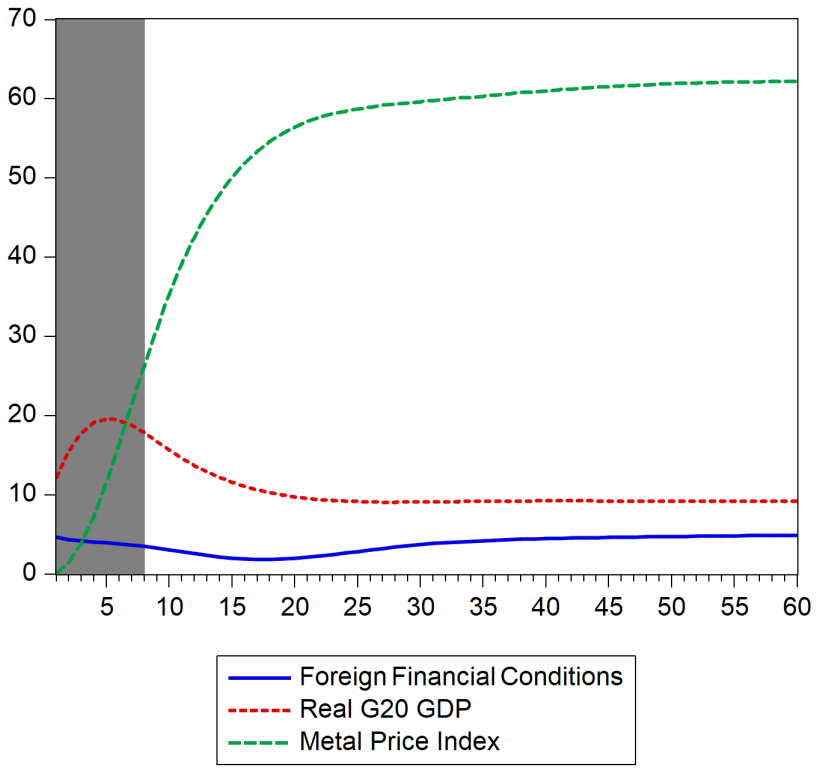
Figure: Forecast Error Variance Decomposition, Real Consumption



Note: The shaded area denotes the first 8 periods or 2 years, the very short term of the model.

Forecast Error Variance Decomposition

Figure: Forecast Error Variance Decomposition, Real Private Investment



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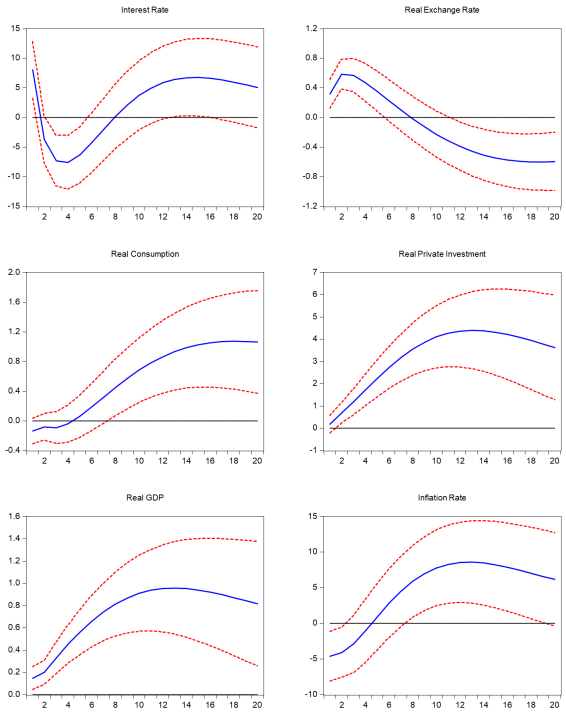
Impulse Response Functions

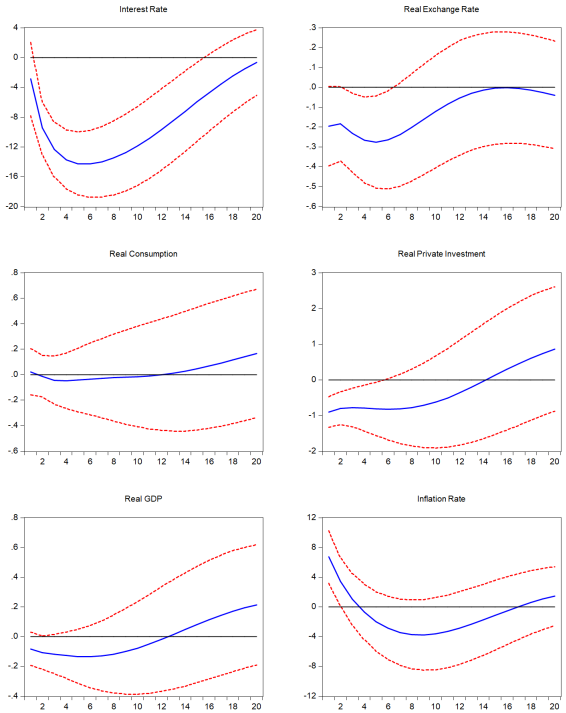
Figure: Impulse Response Functions, Metal Price Index Shock



Note: Solid line represents the mean of the IRF, while dashed lines represent the 68% confidence intervals. The vertical axes are expressed in percentage points.

Impulse Response Functions

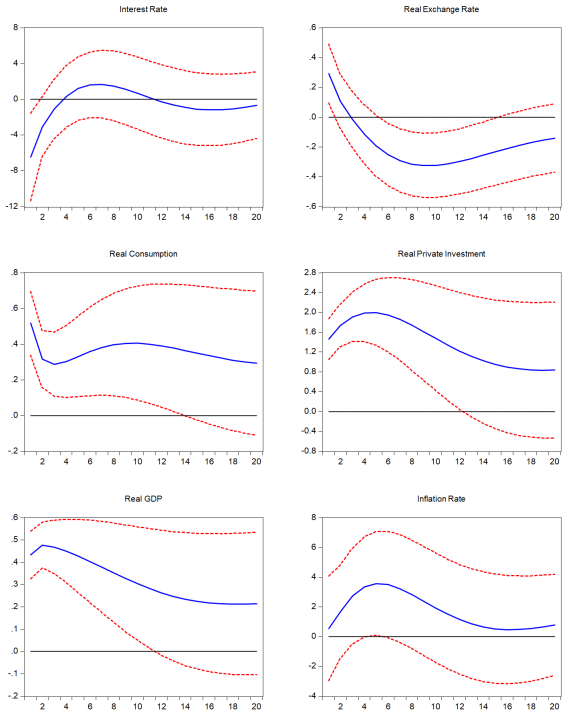
Figure: Impulse Response Functions, Foreign Interest Rate Shock



Note: Solid line represents the mean of the IRF, while dashed lines represent the 68% confidence intervals. The vertical axes are expressed in percentage points.

Impulse Response Functions

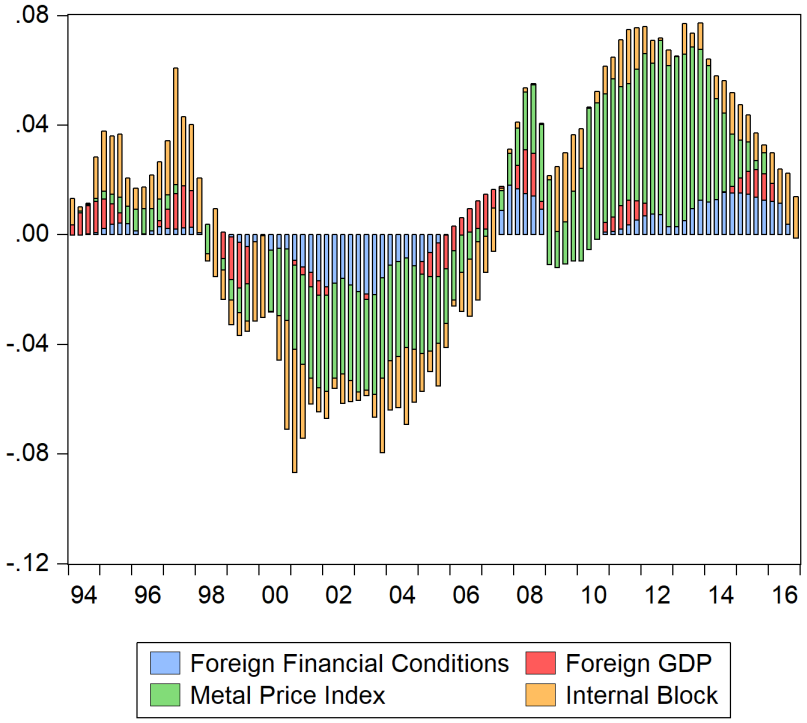
Figure: Impulse Response Functions, Foreign GDP Shock



Note: Solid line represents the mean of the IRF, while dashed lines represent the 68% confidence intervals. The vertical axes are expressed in percentage points.

Historical Decomposition

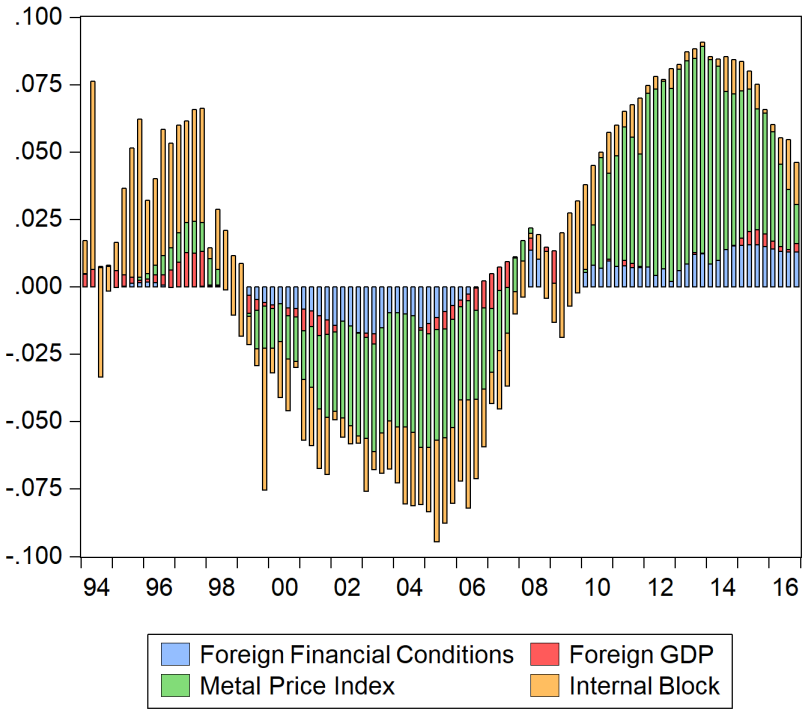
Figure: Historical Decomposition, Real GDP



Note: Variables expressed in natural logarithms.

Historical Decomposition

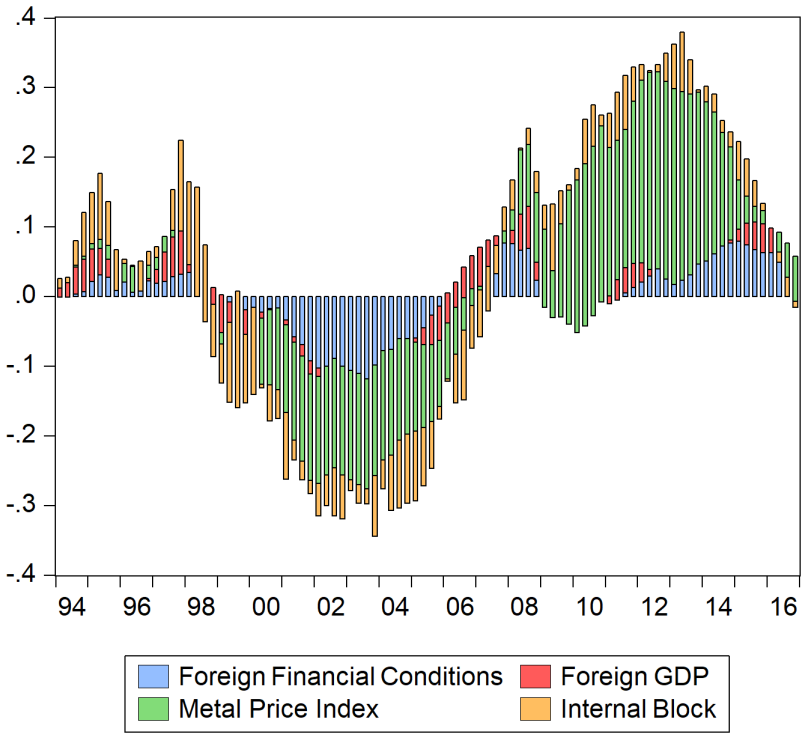
Figure: Historical Decomposition, Real Consumption



Note: Variables expressed in natural logarithms.

Historical Decomposition

Figure: Historical Decomposition, Real Private Investment



Note: Variables expressed in natural logarithms.

Robustness Analysis

- We performed additional robustness exercises:
  - Eliminating the exogenous block.
  - Changing the ordering of the variables.
  - Adding real credit.
  - Using China GDP instead of G20 GDP.
  - Using Terms of Trade index instead of metal price index.
  - Using real variables only.
  - Shortening the sample.

Preliminary Conclusions

- The metal price index is the main source of fluctuations for the main macroeconomic variables.
  - Metal price shocks explain approximately 60 percent of the FEVD of the GDP and the investment.
  - The historical decomposition analysis shows a large part of the economic growth in the 2000s in Peru can be attributed to the metal prices.
  - The impulse response function analysis shows metal price shocks generate a positive, persistent and statistically significant effect over GDP, consumption and investment.
- However, domestic shocks cannot be deemed unimportant.
  - The historical decomposition analysis shows the important role domestic shocks had in the 1990s and 2000s.
  - During the last financial crisis, domestic shocks acted as a positive buffer.
- The results are robust to different specifications.