

# Determinants of Fiscal Deficit. Peru: 1995 - 2018

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# Motivation

## Some insights of Schumpeter

“The fiscal history of a people is above all an essential part of its general history. An enormous influence on the fate of nations emanates from the economic bleeding which the needs of the state necessitates, and from the use to which its results are put (· · ·)”.

“The public finances are one of the best starting points for an investigation of society, especially though not exclusively of its political life. The full fruitfulness of this approach is seen particularly at those turning points, or better epochs, during which existing forms begin to die off and to change into something new, and which always involve a crisis of the old fiscal methods”.

**Joseph Schumpeter, The crisis of the Tax State, 1918**

# Motivation

Has Peruvian Public Finance always been outstanding?

- Peru has one of the strongest fiscal positions in Latin America and the Caribbean (LAC). **The decades of 70's and 80's versus 21st Century.**
- What are the **determinants of fiscal deficit** of a mining-exporting economy like Peru? What is **the weight of international factors** (the price of mineral products) and of **domestic factors** (the volume of mining exports, non-primary GDP and public expenditure)?
- Here, I built an index for both price and volume of mineral products **(using box number 101 of BCRP).**

# Theoretical and empirical literature

Fiscal Deficit in the world: What do we know?

Papers	Variables	Countries
Roubini and Sachs (1989)	$G$ and $r$	OECD
Easterly and Schmidt-Hebbel (1993)	$G$ and $r$	DE
Tujula and Wolswijk (2004)	$\frac{Debt}{GDP}$ and $DF_{t-s}$	OECD
Tujula and Wolswijk (2004)	$\Delta Y$ , $\pi$ and $r$	OECD
Tanzi (2007)	$G$	Argentina
Zeng (2014)	$\Delta Y$	World
Maltritz and Wuste (2015)	Fiscal Rule Index	EU
Cordes et al. (2015)	F.R.I and $G$ Rule	EU
Javid et al. (2011)	$y_t$ , $\pi$ and opening	ASEAN
Medina (2010, 2016)	Commodity index	LA
Lanteri (2015)	$ToT$	Argentina

# Theoretical and empirical literature

## Fiscal Deficit in Peru: What do we know?

- Unlike other secondary fields of macroeconomics, there is a lack of research in the public finances of Peru.

Papers	Variables	Period
Seminario et al. (1992)	$G$ and $ToT$	1970-1989
Arias et al. (1997)	$G$ , $T$ and $Y$	1970-1996
Medina (2010, 2016)	$G$ , $T$ and Commodity index	1975-2008
Martinelli and Vega (2019)	$\pi$ tax and Foreign Debt	1960 - 2017

# Model setup and hypothesis

## Key elements

- **Economy's structure.** A small and open economy, which has public debt in local and foreign currency. Besides, an important part of the tax collection comes from its mineral export sector. See Mendoza and Anastacio (2019, Forthcoming) .

$$DF = G + rB^g + r^*EB^{*g} - tY - tEP_x^*X_0 \quad (1)$$

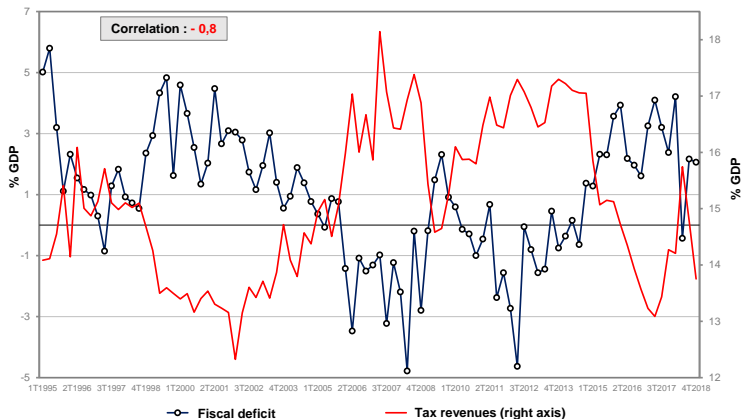
Where:  $DF$  is fiscal deficit,  $G$  is non-financial public expenditure,  $r$  and  $r^*$  are interest rate of domestic and external public debt in local and foreign currency respectively,  $B^g$  and  $B^{*g}$  are stock of local and external debt respectively,  $E$  is nominal exchange rate,  $t$  is tax rate,  $Y$  is nominal GDP,  $P_x^*$  and  $X_0$  are price and volume index of mining exports in foreign currency respectively.

- **Hypothesis.** In the 1Q1995 - 4Q2018 period,  $DF$  was basically determined by **international conditions** and, to a lesser extent, by **domestic conditions** . The most important individual determinant has been the  $P_x^*$  and, secondly,  $X_0$  .

# 6 Stalized Facts

## Peruvian fiscal deficit and tax revenues

Figure 1: Peruvian fiscal deficit and tax revenues, 1T1995 – 4T2018



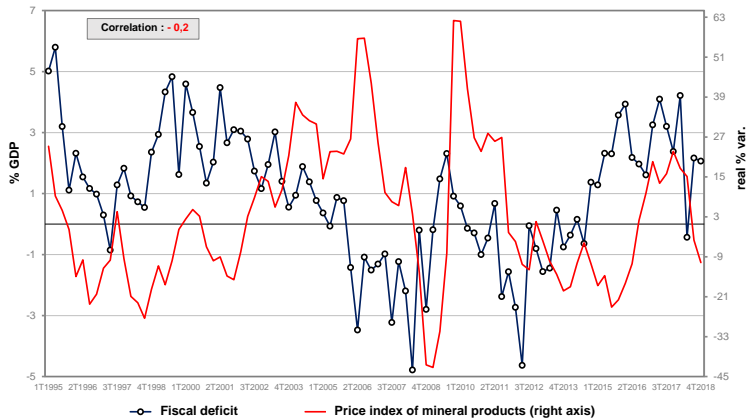
Source: Central Bank of Peru.



# 6 Stylized Facts

## Peruvian fiscal deficit and price index of mining exports

Figure 2: Fiscal deficit and price index of mineral products, 1T1995- 4T2018

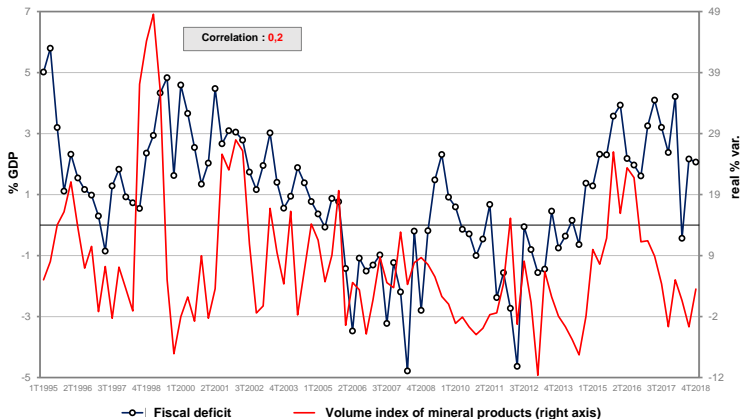


Source: Central Bank of Peru.

# 6 Stylized Facts

## Peruvian fiscal deficit and volume index of mining exports

Figure 3: Fiscal deficit and volume index of mining exports, 1T1995- 4T2018

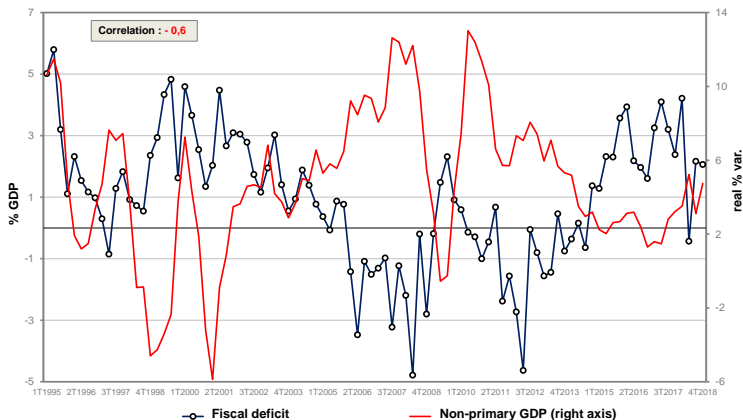


Source: Central Bank of Peru.

# 6 Stalized Facts

## Peruvian fiscal deficit and non-primary GDP

Figure 4: Fiscal deficit and non-primary GDP, 1T1995 – 4T2018

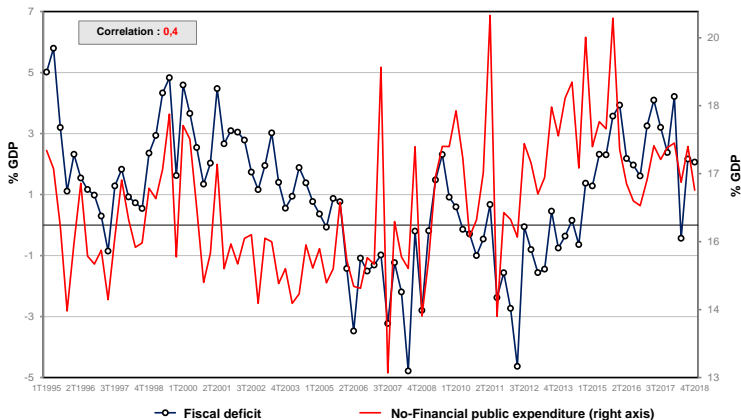


Source: Central Bank of Peru.

# 6 Stylized Facts

## Peruvian fiscal deficit and non-financial public expenditure

Figure 5: Fiscal deficit and non-financial public expenditure, 1T1995 – 4T2018

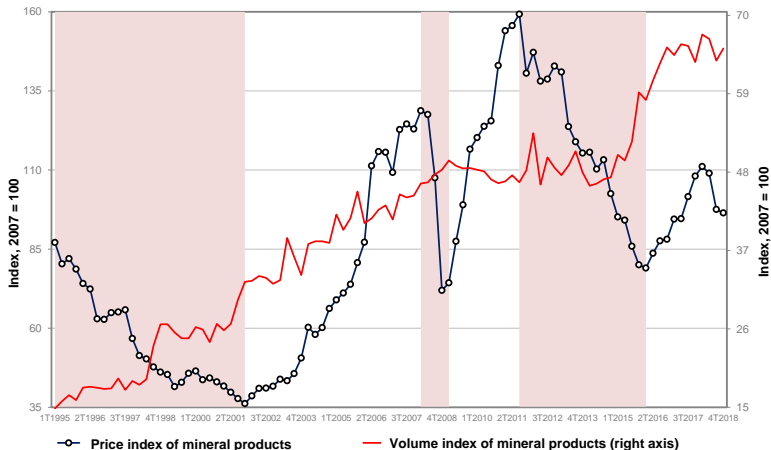


Source: Central Bank of Peru.

# 6 Stalized Facts

## Price and volume index of mining exports

Figure 6: Price and volume index of mineral products, 1T1995 – 4T2018



—○— Price index of mineral products

— Volume index of mineral products (right axis)

- **Coverage.** Here, I use data of Central Government (CG). **We don't have data of General Government (GG) and Non-Financial Public Sector (NFPS)**
- **Variables.** Quarterly.

Table 1: Main statistics of variables, 1T1995 – 4T2018

Statistics	ipm	ivm	gnoprim	gasto	déficit
Mean	3.5	7.1	4.8	6.2	1.0
Standard deviation	21.8	10.8	4.0	12.5	2.1
Minimum	-42.3	-11.1	-5.9	-19.2	-4.8
Maximum	62.0	48.1	13.0	64.8	5.8

**Note:** Only fiscal deficit is expressed as percentage of GDP.

**Source:** Central Bank of Peru.

- There are many academic articles that work the variables as a percentage of GDP in VARs. **See Christiano et al. (2005).**

Table 2: Tests of unit root of variables, 1T1995 – 4T2018

Tests	ipm	ivm	gnoprim	gasto	déficit
PP	-3.42**	-4.81***	-3.46**	-9.62***	-3.96***
ERS	1.95***	1.35	8.99*	21.95*	6.44*
ADF	-4.08***	-3.19**	-2.01	-3.76***	-3.27**

**Note:** With intercept. \*, \*\* y \*\*\* indicate significance to 10, 5 y 1 percent, respectively. PP: Phillips-Perron; ERS: Elliot, Rothenberg and Stock ;ADF: Augmented Dickey – Fuller

# Methodology

On the ordering of our variables

- **Theory.** For SOE's, rich in minerals (especially copper) such as Peru, the price of mineral products is the variable that determines mining exports. **See FMI (2014, 2015, 2016).**

Table 3: Granger causality test, 1T1995 – 4T2018

Hipótesis nula	Chi-sq	df	Prob.
ipm $\rightarrow$ gnoprim	6.87	2	0.03
ivm $\rightarrow$ gnoprim	6.22	2	0.04
gnoprim $\rightarrow$ gasto	8.23	2	0.02
gnoprim $\rightarrow$ deficit	4.64	2	0.09
gasto $\rightarrow$ deficit	15.21	2	0.00
all $\rightarrow$ deficit	37.38	8	0.00

**Note:** Other combinations of variables fail to Granger cause (Do not reject the null hypotheses).



# Methodology

## Optimal choice of lag order

- **Martin et al. (2012)** found, after having made 2000 replications: I) that the BIC (SIC) penalizes additional variables harder than the AIC and, II) that the AIC tends to choose an order of lag greater than 3.

Table 4: Optimal choice of lag order, 1T1995 – 4T2018

Lag order	AIC	BIC	HQ
0	33.0	33.3	33.1
1	29.8	30.8*	30.2*
2	29.7	31.4	30.4
3	29.7	32.1	30.7
4	29.2	32.3	30.5
5	29.2	33.0	30.7
6	29.0	33.5	30.8
7	28.9	34.1	31.0
8	28.5*	34.5	30.9

**Note:** \* indicates selected lag order (minimum value) by criterion. AIC: Akaike Information Criterion, SIC: Schwarz Information Criterion y HIC: Hannan-Quinn Information Criterion.

- **Specification of the model.** Following **Zivot (2000)**, we have a VAR (2) with an exogenous variable (dummy of fiscal deficit rule):

$$y_t = \mu + \Phi_1 y_{t-1} + \Phi_2 y_{t-2} + \delta x_t + v_t \quad (2)$$

- **Our VAR is stationary:**

$$\det(I - \Phi - \Phi_2) \neq 1 \quad (3)$$

- Then, we have a SVAR:

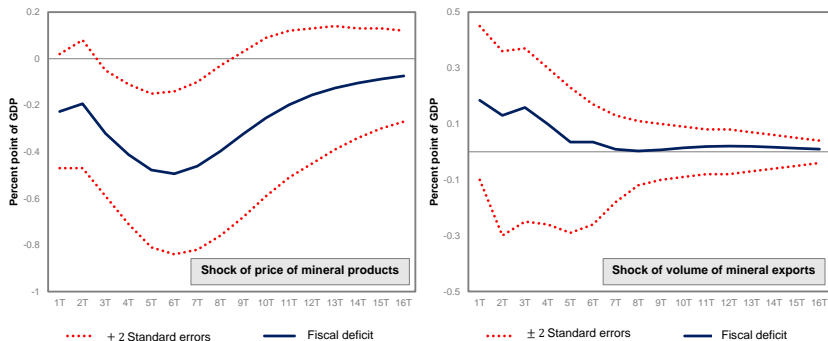
$$A y_t = a_0 + A_1 y_{t-1} + A_2 y_{t-2} + \eta x_t + B u_t \quad (4)$$

- Short-term identification (matrix A and B).

# Results

## Impulse Response Function (IRF)

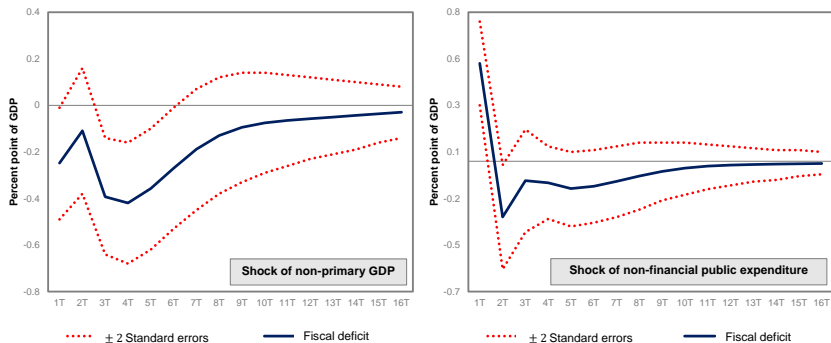
Figure 7: IRF of fiscal deficit to one standard deviation (s.d)



# Results

## Impulse Response Function (IRF)

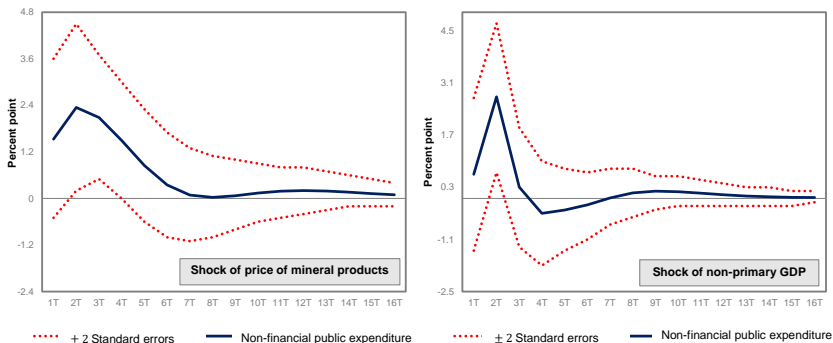
Figure 8: IRF of fiscal deficit to one s.d



# Results

## Impulse Response Function (IRF)

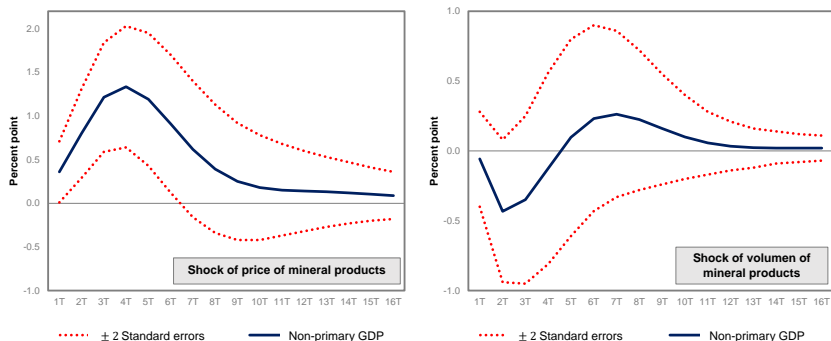
Figure 9: IRF of non-financial public expenditure to one s.d



# Results

## Impulse Response Function (IRF)

Figure 10: IRF of non-primary GDP to one s.d



# Results

## Windfall gains?

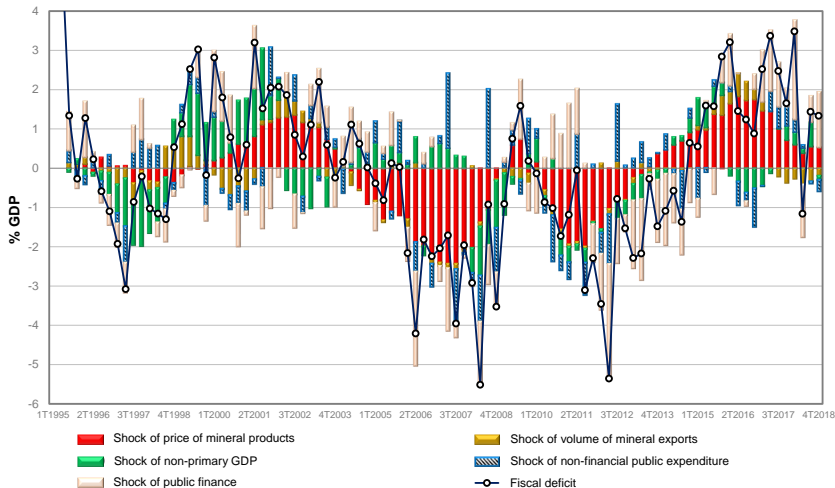
Table 5: Historical decomposition of fiscal surplus, mean 1T1995 – 4T2018

Determinants	p.p. of GDP	% of fiscal surplus
Price of mineral products	0.08	56.3
Foreign determinant	0.08	56.3
Volume of mineral exports	0.01	10.4
Non-primary GDP	-0.003	-1.9
Non-financial public expenditure	-0.003	-2.2
Public finance	0.05	37.3
Domestic determinants	0.05	43.7
Fiscal surplus	0.13	100

# Results

## Historical decomposition of fiscal deficit

Figure 11: Historical decomposition of fiscal deficit to shocks, 1T1995 – 4T2018





# Results

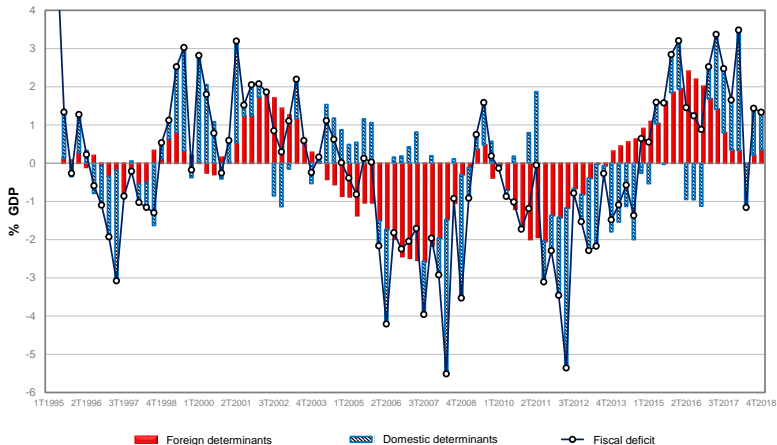
## 7 pictures of fiscal deficit

- **Picture 1: 3Q1999.** Aggregate shock, public finances shock and public expenditure shock.
- **Picture 2: 2Q2001.** Public finances shock, aggregate shock and price index of mining exports.
- **Picture 3: 1Q2006-1Q2009.** Price index of mining exports, public finances shock and aggregate shock.
- **Picture 4: 2Q2009-4Q2009.** Public expenditure shock and public finances shock.
- **Picture 5: 2Q2015-4Q2015.** Price and volume index of mining exports, aggregate shock and public finances shock.
- **Picture 6: 4Q2016.** Public expenditure shock, price and volume index of mining exports and aggregate shock.
- **Picture 7: 1Q2018-4Q2018.** Public finances shock, price and volume index of mining exports and aggregate shock.

# Results

## External and domestic determinants

Figure 12: Historical decomposition of fiscal deficit to foreign and domestic determinants, 1T1995 – 4T2018



- **Model 1.** To start, I propose the following model:

$$ipm \rightarrow ivm \rightarrow gnoprim \rightarrow deficit \quad (5)$$

- **Model 2.** Based on the Forecast Error Variance Decomposition (FEVD) of the previous model, I included a new variable:

$$ipm \rightarrow ivm \rightarrow gnoprim \rightarrow gasto \rightarrow deficit \quad (6)$$

- **Model 3.** To accomplish an analysis of robustness, I replaced the variable *gprim* for the variable *ivm*:

$$ipm \rightarrow gprim \rightarrow gnoprim \rightarrow gasto \rightarrow deficit \quad (7)$$

# Conclusions

- 1 During the period 1Q1995 - 4Q2018, 56,3 percent of the Peruvian fiscal deficit have been explained by external factors, specifically, by the price of mineral products (**To understand, we need to think in the structure of our economy. And the fiscal rule?**).
- 2 The domestic determinants explain a little less than 44 percent of the fiscal deficit, and within domestic factors, the volume of mining exports, non-financial public expenditure and non-primary GDP are the most important components.
- 3 The prices of minerals have not always had a preponderant effect on the fiscal deficit. (**The weight of the determinants of the fiscal deficit has changed over time**).
- 4 **For example:** While the domestic determinants explained almost 90 percent of the fiscal deficit in 1995, the external determinants explained 63 percent of the fiscal deficit between 2006 and 2009.

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**MUCHAS GRACIAS POR VENIR!**

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