**PONTIFICIA UNIVERSIDAD
CATÓLICA DEL PERÚ**

FACULTAD DE CIENCIAS SOCIALES

Fiscal policy and the level of economic activity from 2000-2019

**TRABAJO DE INVESTIGACIÓN PARA OBTENER EL
GRADO ACADÉMICO DE BACHILLER EN CIENCIAS SOCIALES
CON MENCIÓN EN ECONOMÍA PRESENTADO POR:**

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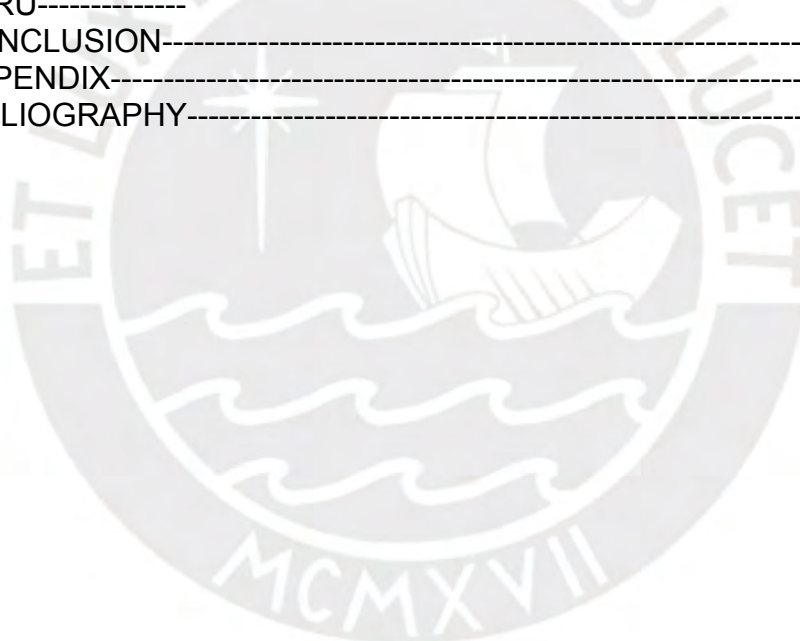
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RESUMEN

Desde que se estudia la efectividad de la política fiscal, las conclusiones son diversas, de acuerdo al marco temporal en análisis, el país, la situación y el modelo empírico. Por esa razón, nos enfocamos en analizar el Perú durante el proceso de consolidación fiscal y las nuevas reglas para la política fiscal del 2000 al 2019. En este sentido, nuestra investigación usa como modelo teórico uno con las características macroeconómicas para la economía Peruana. Asimismo, el modelo empírico un vector estructural autoregresivo (svar) incluye tres (3) variables fiscales y otras relacionadas al modelo teórico. También, incluimos la variable inversión pública relacionada a la regla de equilibrio fiscal en el Perú. Por esa razón, predecimos que la política fiscal tiene un efecto significativo en la actividad económica, resaltado por la inversión pública. Concluimos que el gasto de inversión tiene un efecto positivo y significativo en la actividad económica, mientras que los ingresos tributarios tienen un efecto menor y no significativo.

Palabras clave: inversión pública, ingresos tributarios, pbi, svar

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INTRODUCTION

There is no consensus in the theoretical literature on the effect of fiscal policy on the level of economic activity.

There is also no agreement on the empirical aspect. Since, different results are found according to the time frame, situation and empirical model used. If a postwar period is analyzed, the Keynesian effects hold. In other words, a contractionary fiscal policy reduces economic activity. Besides, the models used to measure the effect of fiscal policy on economic activity always consider that the instruments of this policy are public spending and tax revenues. However, in countries like Peru that are subject to a fiscal deficit target, the true policy instruments are only spending on public investment and tax revenues. Therefore, we wish to analyze the effect of these two.

Likewise, in the current conjuncture of the coronavirus pandemic, many countries implemented expansionary fiscal policy programs to favor the recovery of the economy, which is why it is imperative to study the effect on the economy.

Therefore, we will seek to evaluate the effect of fiscal policy on the level of Peruvian economic activity. Through a modified theoretical model, which provides the characteristics of our economy like exporter of commodities, with a central bank that sets the interest rate and maintains a regime of limited exchange rate flexibility among others. Likewise, the hypothesis of the theoretical model will be evaluated through the empirical model for 1995-2019. In this sense, 5 variables will be used: real GDP, real gross fixed investment, real tax income, and as external variables the export price index, and the 10-year interest rate of US bonds.

The core hypothesis that we present is that the power of fiscal policy, approximated by gross capital investment and taxes on the level of economic activity, has decreased in recent years, due to the weakening of our public finances. Besides, movements in public investment generate greater effects on economic activity than movements in taxes.

Section 1 presents the theoretical and empirical background of the relationship between fiscal policy and the level of economic activity. In section 2, the theoretical model is explained, from which we derive our hypothesis. In Section 3, the procedures that will be used to test the hypothesis are presented. In section 4, the main stylized facts of gross domestic product, taxes income, gross capital investment,export price index and 10 year US treasury bond interest rate. In section 5, the main results are discussed. Finally, we offer the conclusions and relevance for economic policy.

1. THEORETIC AND EMPIRICAL BACKGROUND
1.1. THEORETIC BACKGROUND

With Keynesian approach the economy performances rigid prices, as a consequence aggregate demand establishes output. In other words, consumption reacts to current income, and fiscal expansion has a multiplier effect on growth. In the same sense, with high unemployment rates (downward), the government should raise the expenditure or decrease the taxes to boost the demand. Besides, in upwards, the expenses have to be reduced and the taxes increases. Finally, this theory recommends countercyclical fiscal policy.

Other vision is the Ricardian equivalence, with a null fiscal multiplier among taxes and debt in a dynamic structure. The consumers know that a cut of tax in the present will be offset with higher of those in the future. In other words, their consumption is non variable as a reason that their permanent income follows the same behavior. Similarly, an increase in government expenditure nowadays, means future turn out of those. It means output without varying.

The neoclassical models of real business cycles show that a fiscal expansion with public waste generates an increase in gross domestic product, private investment and employment. But, a decrease of income and consumption of households. If the waste is financed with distortionary taxes, the product is invariable or decrease. Finally, with constant wastes, the taxes do not have a significance impact in the economic activity.

The neoKeynesian models try to regulate the negative effects of fiscal expansion faced by neoclassical models with income and consumption in households. So, they used nominal rigidities in prices and salaries with monopolistic competition. As a result, the increases of expenses also increase the payment of taxes, reducing the consumption and increasing the labor supply. Besides, the increase of expenditures, elevate the production supply, the labor demand and the real salary.

In New classical models the output variation are the result of supply shocks and not for demand shocks because they consider price clear markets. So, anticipated

policies that affect demand does not have effect on growth. Only, unanticipated policies that affects supply have relevance.

In our theoretical model, the relationship between fiscal policy and economic activity is adjusted to the characteristics of our economy.

1.2. EMPIRICAL BACKGROUND

The papers seek to measure the multiplier of gross capital investment and taxes on economic activity. For this reason, they analyze the effects in low-income countries, emerging economies and advanced countries. Along these lines, we have the following studies.

Although government spending has a more immediate impact on aggregate demand and tax cuts have a less direct impact on aggregate demand. In 10 emerging countries of Asia using quarterly data from 1977: Q3-2009: Q2 within a SVAR by each one, tax cuts have a greater countercyclical impact on output than government spending, considering that discretionary fiscal policy is the norm in Asia. Also, deficit financed tax cuts stimulate economic activity whereas deficit spending has a largely insignificant impact on output. (Jha, Mallick, Park and Quising: 2014).

Another paper analyzes the effects in Romania, an emerging economy, using an SVAR with quarterly data from 2000: 1 to 2012: 4. It analyzes the impact of the shocks using two forms with the recursive of Cholesky and with the Blanchard and Perotti method, where in the first the effects are greater than in the second. A weak response is observed in real output and that fiscal policy does not have such a significant effect in an emerging economy, therefore, the effect on real GDP is small between 0.1 and 0.13. (Boiciuc, I.: 2015).

Other author analyze the cases for Spain with an SVAR and quarterly data from 1987:1-2013:4. They found that government expenditures have positive effects on the product in the short term, but generate high inflation and public deficit and a lower product in the medium and long term. On the other hand, a tax increase damages the economy in the medium term and only temporarily improves the public budget balance. (De Cos (2015)).

In Italy, the impacts of public spending are not very persistent using SVAR and quarterly data from 1993:1 to 2013:1. Likewise, it deducts spending on public investment and current spending and observes that a shock to the former generates a multiplier effect of 1.7 on the product, but the latter has a small effect on economic activity of 0.6 and then a negative effect emerges. (Neri S. (2015)).

Besides, other document uses annual panel data from 1979-2011 for 21 advanced countries with the method of two stages least squares to show that spending multiplier is close to 1 during expansion, and up to 3 during contractions because here increases unemployment so government increases subsidies, transfers and welfare benefits and there is not a difference in the impact of spending during nominal zero lower bound. (Qazizada and Stockhammer: 2015).

Furthermore, a paper analyzes the effect of investment expense and consumption spending in public sector in Germany using a SVAR with quarterly data from 1988:1 – 2012:4. They found that consumption spending increases the product and private consumption, but in a weak way, also decreases private investment also in a small way. On the other hand, If we only take investment spending (capital formation and financial aid for investment), a significant effect on output is found. And taxes decrease the product. (Jörn T.(2016)).

Moreover, another document uses quarterly data form 1998: Q1-2015: Q2 to demonstrate with different empirical models that in Paraguay the fiscal multipliers for capital expenditure are bigger than current expenditure, as soon as, the multipliers of taxes are close to zero with the conventional identification like the ratio of the peak of the output response to an initial government spending/tax shock or the ratio of the average output response to an initial fiscal policy shock, but the multipliers can be bigger with the narrative approach of this document, like the cumulative response in GDP relative to the cumulative government spending/taxes. (David: (2017)).

Furthermore, a paper analyzes the effects of public spending in the economic activity in Croatia, Slovenia and Serbia. They use a SVAR from 2003:q1-2014:q1. Also, they highlighted the difference in these economies, Croatia uses the exchange

rate as the main anchor of monetary policy, Slovenia is member of the European Union and Serbia uses inflation target. They conclude that by controlling for the level of public debt and the degree of trade openness, the multipliers are reduced. If it supposes a closed economy the multipliers have a range from 1.05-1.96. Furthermore, if a closed economy with public debt is assumed the multipliers goes between 0.6-0.86. Finally, if the economy opens the multipliers are between 0.3-0.5. (Deskar-Škrbić, M., & Šimović, H. (2017)).

Besides, a paper analyzes the case for Morocco using an SVAR with annual data from 1980-2016. Concludes that public spending shocks have a small effect on GDP, of .05, which can be explained by the significant increase in prices. (Karim, F. T. M. (2018)).

Finally, a paper uses data from 42 countries and demonstrates that output effects of government spending shocks in low-income countries with annual data from 1996-2017 using the local projection method with forecast errors are marginally smaller than emerging markets and lower than advanced economies. Also, the effects in low-income countries are bigger in recessions, with fixed exchange rate and with higher quality of institutions. (Honda, Miyamoto and Taniguchi: 2020).

Therefore, using a structural model of autoregressive vectors, we will evaluate the empirical relationship for the data from Peru.

2. THEORETIC MODEL AND HYPOTHESIS
2.1. THEORETIC MODEL

We considered Dancourt and Mendoza (2016). It is suited for a small and open economy. We disaggregate the public spending in gross capital income (GCI onwards) and OTHERSPENDINGS. Besides, we consider that competitiveness effect is higher than competitiveness balance sheet effect. For that reason, we generate the DA curve.

$$(IS)Y = k[\alpha_0 + \alpha_1 P^* - \alpha_4 i - (1 - \alpha_4)i^* + GCI + OTHERSPENDINGS - T$$
$$+ (\alpha_{11} - \alpha_6)(E - P)]$$

$$(BP)\beta_6(E^M - E) = \beta_0 + \beta_1 E - \beta_2 P - \beta_3 Y + \beta_4 P^* + \beta_5(ni - i^*)$$

$$(OA)P = \alpha_{14} E + \alpha_{15}(Y - Y^P)$$

$$(LM)M = P + Y - \lambda i$$

$$(DA)Y = \omega_1[\alpha_0 + GCI + OTHERSPENDINGS - T] + \omega_2[\beta_6 E^M - \beta_0] + \omega_3 P^* - \omega_4 i$$
$$- \omega_5 i^* + \omega_6 P$$

Where:

Y: gross domestic product

P^*: International prices of commodities

i: domestic interest rate

i^*: International interest rate

GCI: gross capital income

OTHERSPENDINGS: spendings different from gross capital income

T: tax income

E: real exchange rate

P: local prices

E^M: Target exchange rate

Y^P: Potential product

M: amount of money

The IS (investment saving) curve, or the equilibrium curve of the goods market, shows the combinations of interest rates and production levels.

The LM (liquidity money) curve represents all equilibrium points in the money market.

2.1.1. PREDICTIONS OF THE MODEL

An expansive fiscal policy through an increase in investment spending, generates an increase in the level of output, therefore the IS moves to the right. With this, the IS LM equilibrium moves, as the demand for money increases. As a consequence, the local interest rate goes up. On the private investment side, this is reduced because the relationship is negative, which partially reduces the DA.

In OA DA, the only one to shift to the right is the DA, thereby increasing prices and product. The increase in the interest rate increases the flow of capital to the Peruvian economy. Foreign investors seek to provide themselves with soles to buy local assets. Excess demand for local currency causes it to appreciate and reduces the exchange rate. Thus, net exports are reduced and the DA is reduced. As the BCRP goes against the current, it buys dollars and gets rid of soles, with the aim of reducing the supply of dollars and raising the exchange rate. In this sense, when the exchange rate rises, net exports recover. So, the product rises, the interest rate falls (because there is an excess supply of soles) and the BCRP has gathered more international reserves.

2.2. HYPOTHESIS

The power of the fiscal policy (with gross capital income and tax income) in Peru, in the period of fiscal consolidation, period 1995-2008, is higher than the period of fiscal fragility, period 2009-2019. And the effect is higher with gross capital income than with tax income.

3. RESEARCH METHODS AND PROCEDURES
3.1. CORROBORATION OF THE HYPOTHESIS

To estimate the effects of fiscal policy on economic activity. An empirical (econometric) model derived from the theoretical one will be built.

3.2. DATA

Quarterly data on Gross Domestic Product (GDP), Tax Income, Gross capital investment, all belonging to the Central Government, will be used. In addition, export price index and 10-year US Treasury bond interest rate for the period from 1995 to 2019. The sources of the data are the series of the Central Reserve Bank of Peru (BCRP in Spanish acronym), and FRED. Besides, all variables are in logs except the 10-year US Treasury bond interest rate and seasonally adjusted using the Census X12 filter.

The econometric model uses a data generating process for an economic series, $\{y_t\}_1^T$, with a trend break on an unknown date, T_b^c:

$$y_t = f(t)\theta + g(t, T_b^c)\gamma + \upsilon_t$$
$$B(L)\upsilon_t = e_t$$

Where:

$$e_t \sim i.i.d.(0, \sigma_e^2), f(t) = (1, t, t^2, \dots, t^p)$$
$$g(t, T_b^c) = 1(t > T_b^c)\{1, t - T_b^c, (t - T_b^c)^2, \dots, (t - T_b^c)^p\}, \theta = \left(\theta_0, \theta_1, \dots, \theta_p\right)',$$
$\gamma = \left(\gamma_0, \gamma_1, \dots, \gamma_p\right)'$, $B(L) = 1 - b_1 L - \dots - b_{k+1} L^{k+1}$ y $1(.)$ is a function.

So, $\{y_t\}_1^T$ has an autoregressive process (stationary or unit root) with a deterministic trend of order p with a break in the date T_b^c. Besides, the model allows the errors to have a serial correlation of order k.

3.3. EMPIRICAL MODEL

Structural Model of Autoregressive Vectors

The Structural Model of Autoregressive Vectors will be used to identify the effect of each of the fiscal shocks on economic activity in Peru.

First, we check that the variables are not stationary in levels using the augmented Dickey Fuller test, but they are stationary in first differences.

Chart:1 Stationary test

Variables	Period	Test ADF					
		Levels	Differences	Levels	Differences	Levels	Differences
		P value					
		AKAIKE		SCHWARZ		HANNAN QUINN	
TB	ALL QUARTERS	0.2461	0.0000	0.0583	0.0000	0.0583	0.0000
	1995:1-2008:4	0.6553	0.0423	0.4842	0.0003	0.4842	0.0003
	2009:1-2019:4	0.9168	0.0052	0.1386	0.0084	0.1385	0.0083
EPI	ALL QUARTERS	0.6013	0.0000	0.6013	0.0000	0.6013	0.0000
	1995:1-2008:4	0.7109	0.0027	0.0000	0.9973	0.0000	0.9973
	2009:1-2019:4	0.0876	0.0001	0.115	0.0238	0.1151	0.0237
GCI	ALL QUARTERS	0.4279	0.0000	0.4279	0.0000	0.4279	0.0000
	1995:1-2008:4	0.945	0.0000	0.1778	0.0000	0.1778	0.0000
	2009:1-2019:4	0.0679	0.0000	0.0168	0.0000	0.0167	0.0000
TI	ALL QUARTERS	0.7701	0.0000	0.7767	0.0000	0.7767	0.0000
	1995:1-2008:4	0.0000	0.0000	0.9284	0.0000	0.9284	0.0000
	2009:1-2019:4	0.0001	0.0000	0.3691	0.0001	0.369	0.0000
GDP	ALL QUARTERS	0.7159	0.0000	0.6938	0.0000	0.7159	0.0000
	1995:1-2008:4	0.9943	0.0000	0.9787	0.0000	0.9786	0.0000
	2009:1-2019:4	0.3312	0.0000	0.6352	0.0000	0.6351	0.0000

Source: Own elaboration.

We start with autoregressive vectors of order p.

$$VAR(p): Z_t = \phi(L)Z_{t-p} + \mu_t$$

$$(SVAR)\ AZ_t = \phi(L)Z_{t-p} + C\mu_t$$

$$Z_t = A^{-1}\phi(L)Z_{t-p} + A^{-1}C\mu_t$$

$$Z_t = W(L)Z_{t-p} + \varepsilon_t$$

Where Z_t = [TB_t, EPI_t, GCI_t, TI_t, GDP_t], is the vector of dependent variables, with 10 year treasury bond interest rate, export price index, gross capital investment, tax income and GDP. The vector $\mu_t = [\mu_t^{TB}, \mu_t^{EPI}, \mu_t^{GCI}, \mu_t^{TI}, \mu_t^{GDP}]$ contains the structural errors. And the vector $\varepsilon_t = [TB_t, EPI_t, GCI_t, TI_t, GDP_t]$ contains the errors in the reduced form. Those are a linear combination of the first errors ($\varepsilon_t = A^{-1}C\mu_t$). The A matrix contains the simultaneous relationships of the dependent variables. $\phi\{(L)\} = \phi\_0 - \phi\_1 L - ... - \phi\_\{p - 1\} L^\{p - 1\}\}$ is a lag polynomial of order p - 1. The matrix C contains the relations between the structural errors. So, ($A\varepsilon_t = C\mu_t$).

Finally, we impose the restrictions in the SVAR for both periods with the Cholesky approach.

Graph 1: Matrix of variables

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ \theta_{21} & 1 & 0 & 0 & 0 \\ \theta_{31} & \theta_{32} & 1 & 0 & 0 \\ \theta_{41} & \theta_{42} & \theta_{43} & 1 & 0 \\ \theta_{51} & \theta_{52} & \theta_{53} & \theta_{54} & 1 \end{bmatrix} \begin{bmatrix} \varepsilon_{TB} \\ \varepsilon_{EPI} \\ \varepsilon_{GCI} \\ \varepsilon_{TI} \\ \varepsilon_{GDP} \end{bmatrix} = \begin{bmatrix} \lambda_{11} & 0 & 0 & 0 & 0 \\ 0 & \lambda_{22} & 0 & 0 & 0 \\ 0 & 0 & \lambda_{33} & 0 & 0 \\ 0 & 0 & 0 & \lambda_{44} & 0 \\ 0 & 0 & 0 & 0 & \lambda_{55} \end{bmatrix} \begin{bmatrix} \mu_{TB} \\ \mu_{EPI} \\ \mu_{GCI} \\ \mu_{TI} \\ \mu_{GDP} \end{bmatrix}$$

Source: Own elaboration.

Check the lag order selection and stability of those in the appendix section.
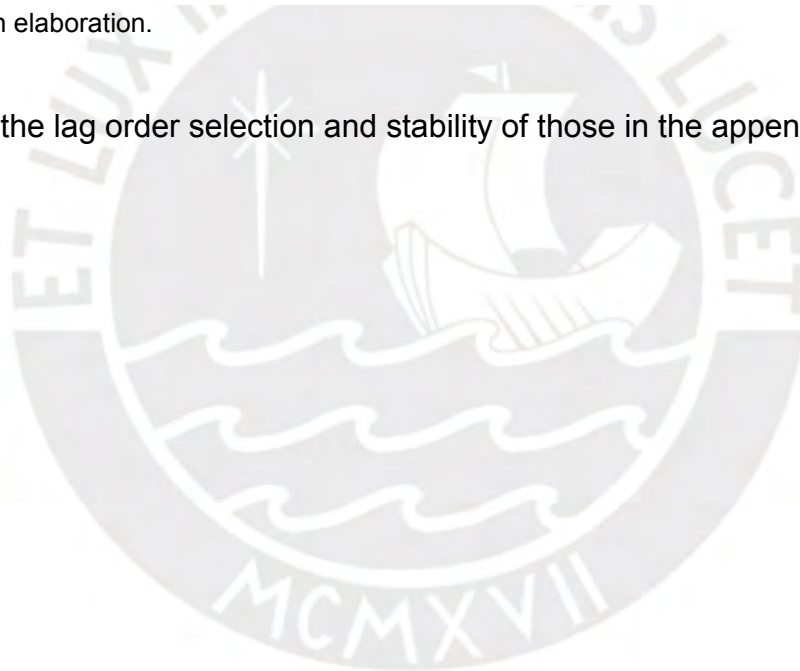
4. FISCAL POLICY AND ECONOMIC ACTIVITY: THE STYLIZED FACTS IN PERU

We would see the behavior of the principal fiscal variables and the evolution of the economic activity through the years 1995 - 2019.

For this section we use the software Eviews. Also, all variables are expressed in logarithms except the 10-year US Treasury bond interest rate. As well, are seasonally adjusted using the method CENSUS x12. And we get the cyclical and tendency components with Hodrick and Prescott filter.

All variables have a growing trend except the 10 year treasury bond interest rate, that has decreasing trend. And we notice a break in the tendency during the the financial crisis of 2008-2009.
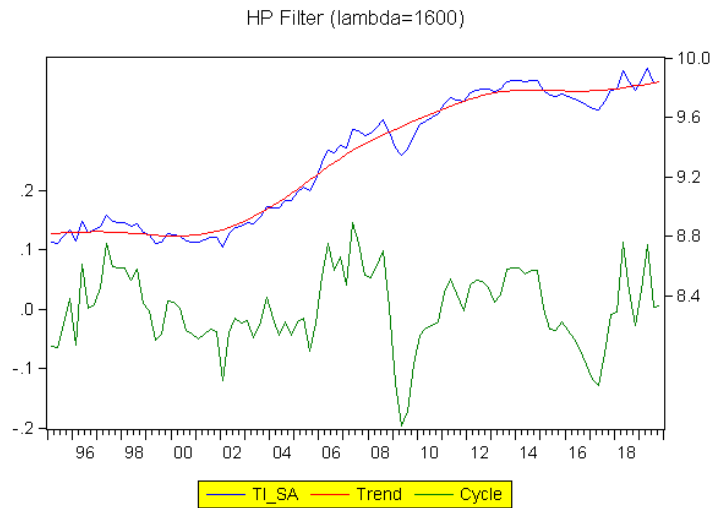
Graph2: GDP seasonally adjusted
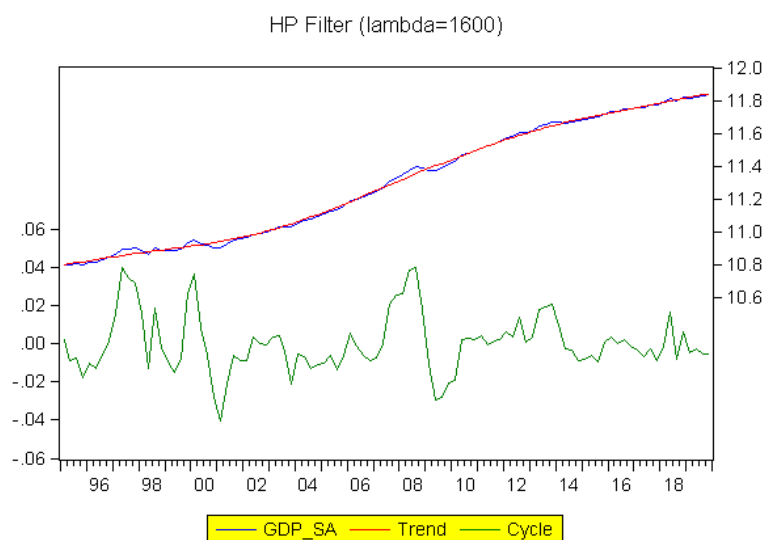
Source: Own elaboration.

First, the gross domestic product shows an increase since 1995, as a reason of the recovery of fiscal stability since this year.
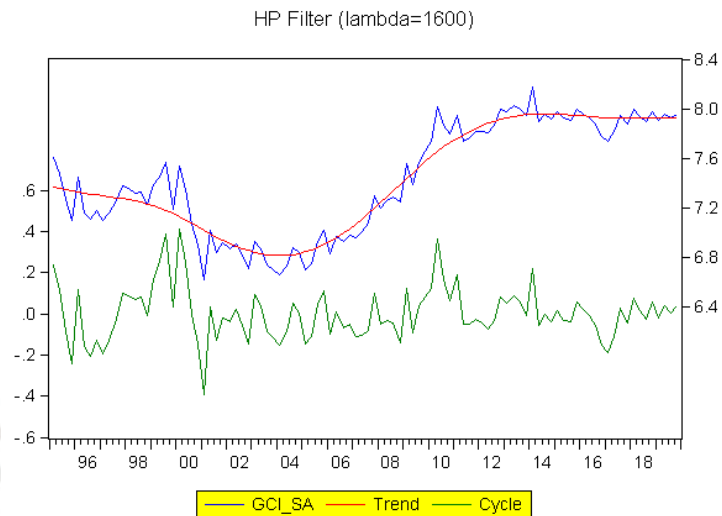
Graph 3: Tax income seasonally adjusted

Source: Own elaboration.

Second, the tax income has growing tendency due to the creation of new tax measures over time. But, Peru's tax pressure is low. Likewise, evasion and avoidance are the champions.
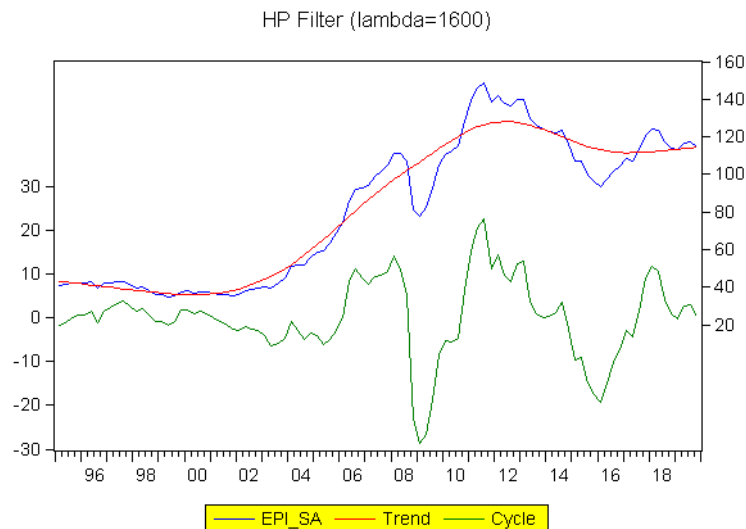
Graph 4: Gross capital income seasonally adjusted

HP Filter (lambda=1600)

Source: Own elaboration.

In the export price index, we see a break in 2008 as a reason of the crisis. After that the behavior of growing tendency continues.
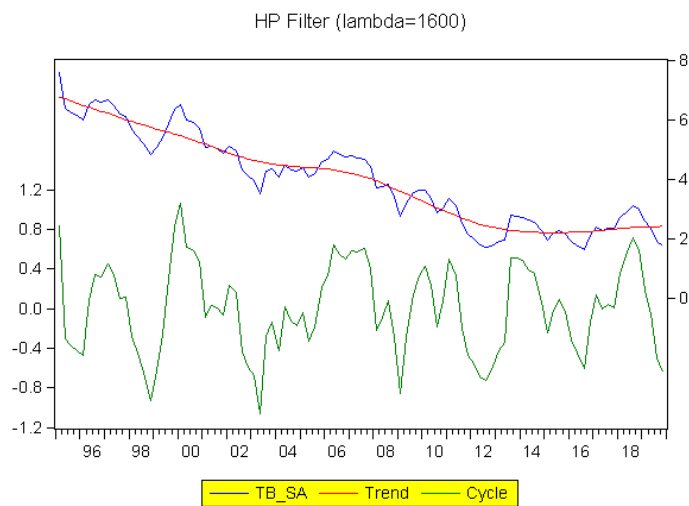
Graph 5: Export price index income seasonally adjusted

HP Filter (lambda=1600)

Source: Own elaboration.

The treasury bonds interest rate of US show a decreasing tendency.

Graph 6: Treasury bonds interest rate seasonally adjusted

Source: Own elaboration.

5. CONCLUSION

La elaboración del modelo empírico nos da como resultado que el gasto de inversión tiene un efecto positivo y significativo, mientras que los ingresos tributarios tienen un efecto negativo y no significativo. Lo anterior está acorde a la realidad económica porque la inversión exacerba los efectos en la actividad económica. Incluso usamos el pbi no primario para ver el efecto en este, con lo que resulta un efecto mucho más ampliado. Por otro lado, con los ingresos tributarios, es sabido que en el Perú existe tanto evasión y elusión con lo que una política fiscal solo con ingresos tributarios no es muy relevante como en países europeos o de Norteamérica donde tienen una cultura tributaria bien interiorizada. Todos estos resultados fueron obtenidos con diversas pruebas de robustez, específicamente mediante diversas restricciones de estos modelos de vectores autoregresivos.
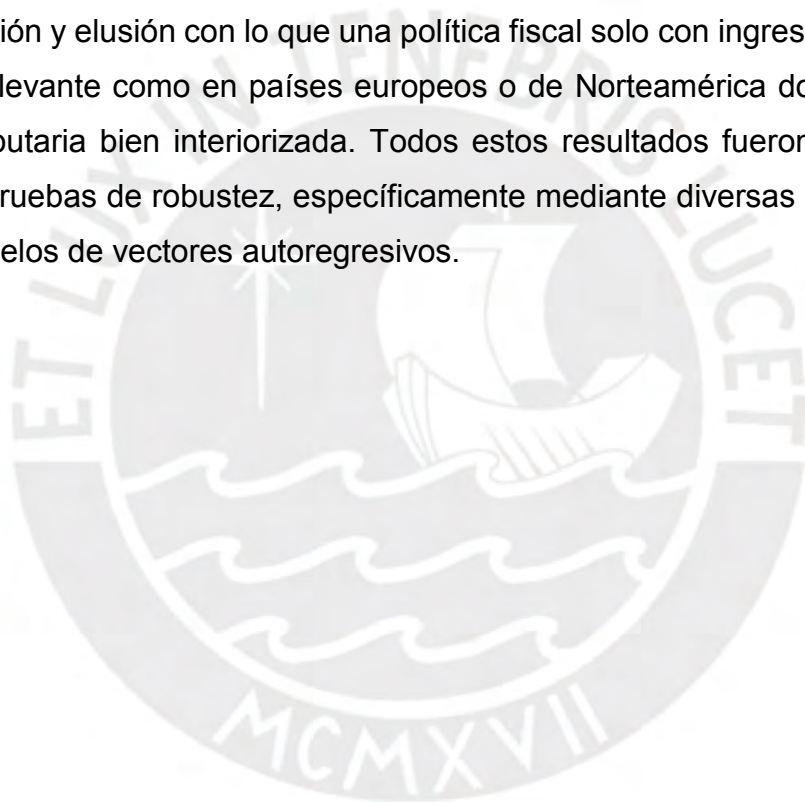
6. <u>APPENDIX</u>

In the first period, the lag order selection criteria choose only one lag for the VAR, according to the Akaike information criteria.

Chart 2: First lag order criteria

VAR Lag Order Selection Criteria
Endogenous variables: DTIB DIPE DIBK DING DPBI
Exogenous variables: C
Date: 07/19/21   Time: 17:29
Sample: 1995Q1 2008Q4
Included observations: 51

Lag	LogL	LR	FPE	AIC	SC	HQ
0	96.37817	NA	1.91e-08	-3.583458	-3.394063*	-3.511084*
1	124.2975	49.26937*	1.71e-08*	-3.697940*	-2.561572	-3.263701
2	139.0416	23.12810	2.64e-08	-3.295751	-1.212409	-2.499644
3	151.2932	16.81582	4.69e-08	-2.795811	0.234504	-1.637838
4	183.0048	37.30782	4.19e-08	-3.059012	0.918276	-1.539173

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Source: Own elaboration.

Also, the VAR is stable.

Chart 3: Stability of first model

Roots of Characteristic Polynomial
Endogenous variables: DTIB DIPE DIBK DING DPBI
Exogenous variables: C
Lag specification: 1 1
Date: 07/19/21   Time: 17:31

Root	Modulus
0.808122	0.808122
-0.439643	0.439643
-0.328666	0.328666
0.162577 - 0.105865i	0.194007
0.162577 + 0.105865i	0.194007

No root lies outside the unit circle.
VAR satisfies the stability condition.

Source: Own elaboration.

In the second period, the lag order selection criteria choose nothing lags for the VAR, but we need one to use VAR approach. So we choose one lag.

Chart 4: Second lag order criteria

VAR Lag Order Selection Criteria
Endogenous variables: DTIB DIPE DIBK DING DPBI
Exogenous variables: C
Date: 07/19/21   Time: 20:36
Sample: 2009Q1 2019Q4
Included observations: 39

Lag	LogL	LR	FPE	AIC	SC	HQ
0	106.8341	NA*	3.71e-09*	-5.222264	-5.008987*	-5.145742*
1	126.8337	33.84536	4.86e-09	-4.965829	-3.686167	-4.506697
2	152.0614	36.22450	5.13e-09	-4.977510	-2.631462	-4.135768
3	181.9016	35.19612	4.78e-09	-5.225725	-1.813291	-4.001373
4	208.5127	24.56410	6.43e-09	-5.308346*	-0.829526	-3.701384

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Source: Own elaboration.

Also, the VAR is stable.

Chart 5: Stability of second model

Roots of Characteristic Polynomial
Endogenous variables: DTIB DIPE DIBK DING DPBI
Exogenous variables:
Lag specification: 1 1
Date: 07/19/21   Time: 20:46

Root	Modulus
0.506273 - 0.056715i	0.509440
0.506273 + 0.056715i	0.509440
-0.464641	0.464641
0.436573	0.436573
-0.027617	0.027617

No root lies outside the unit circle.
VAR satisfies the stability condition.

Source: Own elaboration.
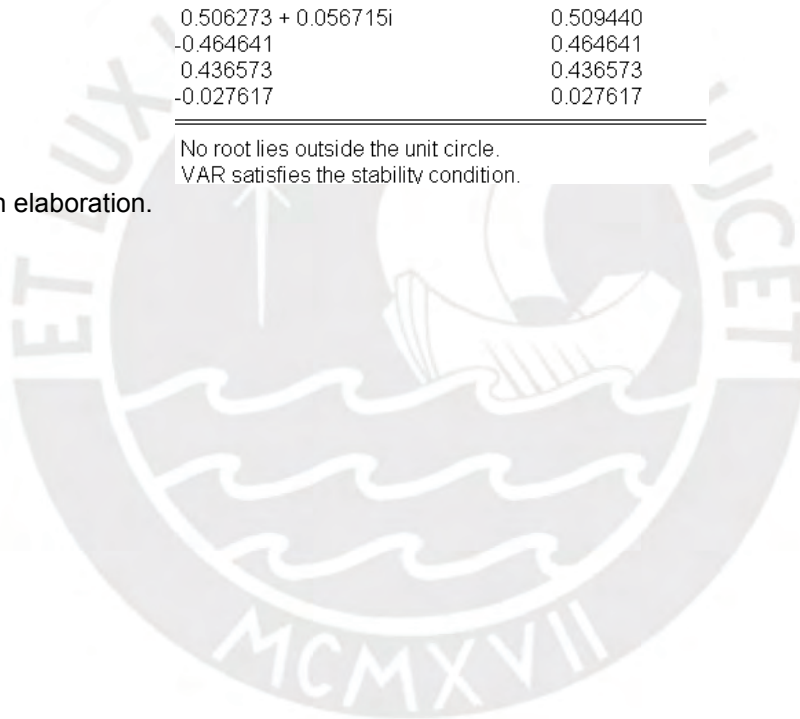
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