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Co-movement of national income and public spending: A cointegration analysis for Mexico (1993 -2017)

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ABSTRACT

This study established a long term cointegration equilibrum between national income and government consumption in Mexico for the period 1993 – 2017 using the Johansen procedure. Previously, time series were assesed individually to demonstrate stationarity using ADF, ADF-GLS and Phillip-Perron criteria. Afterwards, the Breitung-Candelon test showed that bi-variate Granger causality was found between these two times series for the first time in a study for Mexico. Finally, using the normalized integration equation parameters and an elasticity criteria widely used in the literature, neither Keynes hypothesis not Wagner hypothesis were validated for Mexico for the study period.

JEL Code E620, E650

1. Introduction

The purpose of this work is to understand co-movement and (statistical) causality between national income and public spending in Mexico under the prevalent rules of the economy. Causality is particularly important, among other reasons, because Mexican Government Officials have argued that the induced growth in public debt that peaked in fiscal year 2016 at 48.7% of GDP (vs. 29.6% of GDP in 2006)[1] was intended to stimulate economic growth through the expansion of public spending. However, it is not trivial to assess whether the public spending expansion worked in the intended way by the Mexican Government when the numbers are analyzed. During the public spending expansion period (2006 – 2016), government consumption grew 2.2% annually on average while the economy grew 2.4% in real terms (base 2008). However, during the period running from 1993 to 2005, government consumption grew 1.9% annually on average while the economy grew 2.9% yearly on average in real terms (base 2008). Therefore, we observe public spending growing at a faster pace than national income during the most recent ten years, which at a first glance may be at odds with the dominant theories under which the interaction between these two variables are typically assessed. Most of the academic work regarding the relationship between public spending and national income has been done under the conceptual framework of either Wagner (1889, 1912) or Keynes (1936). Therefore, it is worth undertaking the task to take a closer look at the interaction of these two-time series for Mexico under current economic conditions from an econometric standpoint.

Wagner (1889, 1912) indicated that economic growth induces (causes) public spending share of national income to increase. There were several reasons for this. First, as an economy grew, complexity of society grew. A more complex society implied an increased demand for protection, regulation and law enforcement. Second, the demand for education, culture and well-being related services grew as an economy expanded. In Wagner´s view, this type of goods was better provided by the

[1] Source: "Informe de Finanzas y Deuda Pública", SHCP, 2017Q4.

Government and therefore called for an increase in public spending. Third, as technology evolved, natural monopolies emerged, which were better managed by the State as a central coordinator. Airports, railroads and roads in general were clear examples of this concept at the time. Therefore, as pointed out by Bird (1971), "the expansion of public spending must be seen as a product of increased economic activity, and not the other way around". The conceptual framework under which these dynamics take place is known by economists as "Wagner´s Law".

Keynes (1936) indicated that public spending, among other public policy tools (eg, monetary policy), was meant to be used as a mean to influence (cause) economic activity. In his view, national income comprised four components: consumption, investment, government purchases and net exports. Therefore, during a recession, state intervention was required to compensate for a decrease in consumption, investment and / or net exports. A key assumption was that changes in aggregate demand had their most immediate impact on real output and employment, not prices, because they tended to be more rigid. Therefore, if public spending were to be increased, *ceteris paribus*, national income would grow by a multiple of the marginal increment of public spending. The conceptual framework under which these dynamics take place is known by economists as "Keynesian Economics" or "Keynes´ Law".

As stated by Dumitrescu, *et al.* (2016), "… several researchers consider both "Wagner´s Law" and "Keynes´Law" as a whole to discuss the relationship between public spending and national income". Therefore, both theories concur on the fact that there is indeed a positive correlation between national income and public spending with a magnitude of the caused effect more than proportional to the initial variable moved. However, they differ on the direction of causality. Keynes postulated that causality runs from public spending to national income, while Wagner postulated that causality runs from national income to public spending.

Interestingly enough, the Mexican case seems to present a positive correlation when looking at the 2006 – 2016 period, but the magnitude of the movement seems off

when comparing the mentioned periods by both Wagner´s and Keynes´ standards. Since a wide variety of variables are involved in the determination of both public spending and economic growth, it is important to isolate the effect of one variable over the other to understand, from a statistical standpoint, whether a long term equilibrium holds between these two time series. Specifically, the purpose of this study is to answer the following academic questions: First, i) do public spending and national income series present a long term cointegration relationship?; Second, ii) is causality occurring from national income to public spending, the other way around, in both directions or neither direction?; Finally, iii) does Keynes or Wagner hypothesis hold for the Mexican case?.

In this work, I use a specific aggregation of public spending series (government consumption) to answer the questions above and present evidence that, for the studied period, national income and public spending in Mexico present a long-term cointegration relationship using the Johansen approach. Also, I establish that causality in the sense of Granger runs in both directions. However, I neither validate "Wagner´s Law" nor "Keynesian Economics" since the magnitude of co-movement is not consistent with the academic standards long accepted in the literature for this purpose.

This document is organized as follows: in Section 2, I review the literature and discuss some of the major research milestones on the evolution of the study of correlation and causality between national income and public spending. I also discuss in detail the twelve studies that I have identified for the Mexican Case. Next, in Section 3, I discuss the data used for this study and its source, show descriptive statistics of both national income and government consumption series, as well as perform a preliminary visual analysis of their behavior. In Section 4, I analyze the stochastic trending of both national income and public spending testing for the presence of unit roots. In Section 5, I test for cointegration using the Johansen test, find a long term equilibrium and a short term equation to understand the co-movement of the studied time series. I also run a specific Granger-causality (Breitung-Candelon) test to

determine the existence and direction of causality. Last, in Section 6, I share my concluding remarks, as well as suggested extensions of this work.

2. Literature Review

Following Wagner (1889, 1912) and Keynes (1936), a large amount of literature has been produced to understand the relationship between national income and public spending. Peacock & Wiseman (1961) were among the first researchers to question some of Wagner´s key assumptions. In their view, Wagner´s argument presented "two serious defects". The first one was that Wagner adopted a holistic theory of the state which they did not believe to be equally applicable to different societies. The second one was that besides the secular trend of public expenditures, there were other aspects of public spending equally important, like the time pattern of public spending growth. Therefore, they emphasized that they were "not trying to formulate some "general law" which governs the growth of public expenditures in all circumstances". They acknowledged that to understand the relationship between public spending and national income, the specifics of each country and time period should be taken into account. Consequently, they formulated an Ordinary Least Squares (OLS) approach to test the validity of "Wagner´s Law" specifically for Great Britain during the period 1920 – 1938 using the functional form G = f (Y), where G stands for public spending and Y stands for national income. They concluded that Wagner´s Law was valid specifically for Great Britain for the studied period (1920 – 1938).

Other early empirical studies contributed to the literature by proposing alternative functional forms and variables that could assist testing the validity of "Wagner´s Law" for specific countries and time periods. Among these studies we find Peackock and Wiseman (1961); Gupta (1967); Goffman (1968); Pryor (1969); Musgrave (1969); Mann (1980); and many others. Table 1 shows the functional form proposed by each of the mentioned studies, as well as the corresponding specification.

Table 1: Functional forms and specifications to test for "Wagner´s Law" established by early studies.

Year	Author(s)	Functional Form	Specification
1961	Peackok & Wiseman	$G = f(Y)$	$ln\, G_t = a + b\, lnY_t + e_t$
1967	Gupta	$G/P = f(Y/P)$	$ln\,(G_t\,/P_t) = a + b\,\ln(Y_t/P_t) + e_t$
1968	Goffman	$G = f(Y/P)$	$lnG_t = a + b\,\ln(Y_t/P_t) + e_t$
1969	Pryor	$C = f(Y)$	$lnC_t = a + b\, lnY_t + e_t$
1969	Musgrave	$G/Y = f(Y/P)$	$\ln(G_t/Y_t) = a + b\, ln(Y_t/P_t) + e_t$
1980	Mann	$G/Y = f(Y)$	$\ln(G_t/Y_t) = a + b\, ln(Y_t) + e_t$

Source: Own elaboration, expanded from literature, multiple sources. Note: "Y" represents real national income, "G" real public spending; "P" population and "C" real consumption; "t" represents a time subscript and "e" a random error term.

In all these proposals by early studies, a log-linear functional form was used. Wagner law holds whenever the real income elasticity coefficients is greater than one for non-ratio versions and greater than zero for versions that include a ratio. Also, the direction of causality was assumed to run from national income to public spending. The vast majority of these works favored Wagner´s Law validity. However, as pointed out by Henrekson (1993), the problem was that they assumed that the time series they used for different periods and countries were all stationary and therefore subject to testing their hypothesis through a traditional OLS approach. Nonetheless, later studies in the literature tend to use the functional forms and specifications above to prove either Wagner or, its contrary, Keynes hypothesis. Nowadays, literature tends to validate either hypothesis (Keynes or Wagner) when correlation is positive, causality is proven and the effect in one variable occurs in greater magnitude than the marginal increment on the other, either on a dollar by dollar basis or in elasticity terms. This work does not take the approach of estimating various functional forms for hypothesis testing as some other works do. The approach of this document is to understand the underlying concept and use a robust statistical approach to test its validity.

The next wave of studies started with the seminal work of Henrekson (1993), where he stated that previous works obtained spurious results since the times series used were not stationary. In this study, the author used public expenditure and national income series for Sweden for the period 1861 – 1990. He found that the mentioned time series were not cointegrated and therefore concluded that the evidence in favor of Wagner´s Law in previous studies was not valid. The main drawback of this work was that Henrekson tried to use it as conclusive evidence that "Wagner´s Law" was not valid in general. His argument was that previous evidence in favor of this law was methodologically flawed. However, his methodological contribution cleared the path for modern econometrics to analyze the relationship between national income and public spending using cointegration analysis.

Since then, many studies have been published for different countries and groups of countries using a wide variety of modern econometric methods, including but not limited to time series analysis, cointegration analysis, panel data analysis, among others. Conclusions of these studies have been mixed and sometimes even contradictory for the same countries with no discernible pattern. Including early studies, approximately two thirds of the publications in the literature supports "Wagner´s law" according to Dureval, et al (2011). On the other hand, Gunalp, *et al*. (2002) concluded that mixed results in the studies were explained by different methodological approaches and the different components underlying times series specific constructions. Other sources of disagreement regarding the validity and directionality of the dynamics between government expenditure and national income included, but were not limited to, the time periods studied as well as the stage of development of the country or set of countries examined. For instance, an inconsistency might seem to have arose when considering that a generalized consensus in the literature pointed toward the validity of "Wagner´s Law" in emerging countries while the empirical evidence seemed to establish its validity in developed economies. This is at least partially explained by the time periods studied since Wagner´s Law was intended for "…economies in early stages of

development"…, as stated by Sideris (2007). See Annex I for a comprehensive summary of selected studies and their findings.

In the Mexican Case, twelve publications were identified. I classified these studies according to their date of publication, the period studied, the methodological approach and the conclusion obtained.

Table 2: Summary of Wagner vs. Keynes Hypothesis for Mexico

Author(s)	Date	Time period	Method	Conclusion
Mann	1980	1925 - 1976	OLS	WH rejected
Nagarajan & Spears	1990	1925 - 1976	OLS	WH accepted
Murthy	1993	1950 - 1980	Cointegration	WH accepted
Ashworth	1994	1950 – 1988	Cointegration	WH rejected
Hayo	1994	1950 – 1980	Cointegration	WH rejected
Murthy	1994	1950 – 1988	Cointegration & ECM	WH accepted
Lin	1995	1950 – 1990	Cointegration & no causality	WH rejected, WH accepted
Galindo & Cordera	2005	1970 - 2004	VAR & structural change	WH rejected
Iñiguez & Montiel	2010	1950 – 1999	Cointegration, ECM & granger causality	WH accepted, KH rejected
Rodríguez, *et al.*	2013	1950 - 2009	VAR, structural change, granger	WH accepted
Rodríguez & López Herrera	2014	1980 - 2007	Data panel, unit roots & cointegration	WH accepted
Sánchez Juárez, *et al.*	2016	1925 – 2014	Cointegration & granger causality	WH accepted

Source: Own elaboration; expanded from the works of Iñiguez-Montiel (2010) and Sánchez Juárez, *et al.* (2016). Note: WH: Wagner Hypothesis. KH: Keynes Hypothesis.

Consistent with the international trend, both initial works regarding the Mexican case published before Henrekson (1993) were flawed by using OLS method on time series

that presented unit roots. This is the case of Mann (1980), who rejected WH, and Nagarjan & Spears (1990), who validated WH using an OLS approach.

Murthy followed Henrekson (1993) and used the new methodological approach by testing for unit roots and cointegration using Mexico national income and government expenditures time series. The null hypothesis that Wagner´s Law holds for Mexico was accepted, the exact opposite result obtained for Sweden by Henrekson (1993) in his seminal work. This study contributed to questioning the conclusion that Wagner´s Law was not valid in general simply because there was a problem with early estimation methods.

Works that followed for the same study period in Mexico as Murthy (1993) reached mixed conclusions. While Ashworth (1994) and Hayo (1994) rejected the Wagner hypothesis for the 1950 -1980 period, Lin (1995) introduced the use of a test of no causality to validate Wagner hypothesis during the period 1950 – 1990, although his initial result rejected Wagner´s Law. Murthy (1994) introduced an Error Correction Model to validate his initial 1993 study conclusion, this time extending the period of study eight more years (1950 – 1988).

The latest five studies that followed for Mexico starting in 2005 applied the methodological enhancements introduced previously and added some of their own. Iñiguez – Montiel (2010) introduced the use of a Granger – causality test to accept WH. Rodriguez *et al.* (2013) introduced the use of a VAR model and structural change determined by the year 1982 in which the Mexican Economy transitioned from a high state intervention period to a free market economy. He accepted the validity of Wagner´s Law. Rodriguez & López Herrera (2014) introduced a data panel analysis for Mexican states, following the seminal work of Nagarajan (2006) for Chinese provinces, and validated the Wagner hypothesis depending on the level of development of each state.

Finally, Sánchez Juárez *et al.* (2016) main contribution is to increase the sample size of long term studies in the Mexican economy constructing time series that run from

1925 to 2014 that were scattered in different official sources. They also used the modern analysis tools previously applied by authors that preceded them to avoid confusion on the validity of the law for the Mexican Case. They accepted Wagner´s Law hypothesis for the period 1925- 2014.

3. Evolution of national income and public spending in Mexico

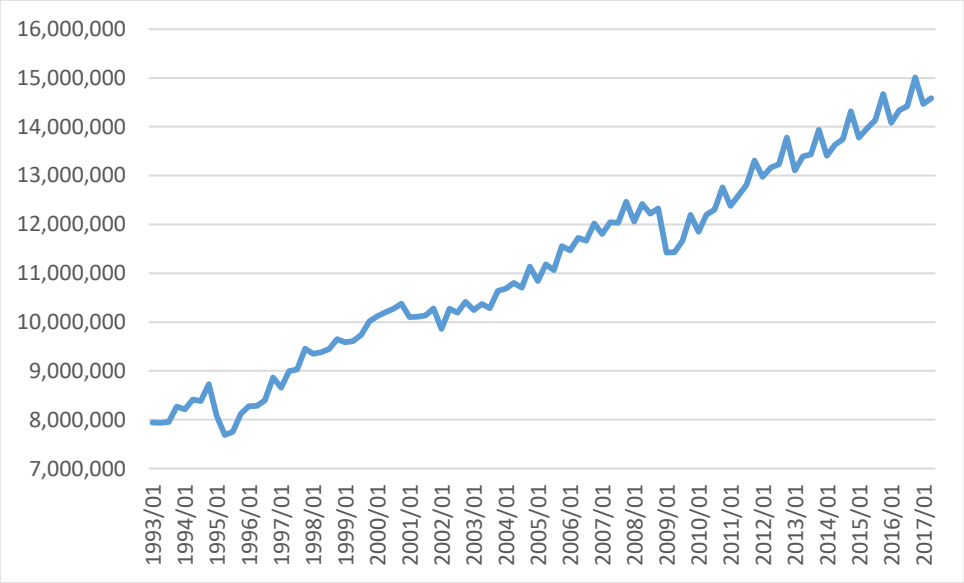
In this work, raw data for government consumption and national income series were sourced from INEGI, Mexico´s National Institute of Statistics and Geography. Data records begin on the first quarter of 1993 (1993Q1) and end on the second quarter of 2017 (2017Q2). Therefore, 98 time data points are used to analyze each variable. Both national income (Y) and public spending (G) were computed in real terms, using the implicit GDP deflator base 2008. Public spending excludes transfers and capital investments, and therefore stands for government consumption.

The chosen period for this study corresponds to the North America Free Trade Agreement (NAFTA) since the time when negotiations began and therefore expectations on economic incentives from a diversity of agents were first affected. Even though the Mexican Economy has been considered as an open economy since 1982, as Tornell *et al.* (2004) stated: "… its significance (NAFTA´s) resides in the fact that it codified the new rules of the game…", rules under which Mexico still play economically. Therefore, this paper contributes to understanding the dynamics between national income and public spending in Mexico under current economic conditions.

Figure 1 shows the evolution of real national income (Y). Units are shown in million pesos (real, base 2008). Average quarterly annual growth rate during the period of study is 2.6%. We observe 14 quarters of negative quarterly growth and 84 periods of positive growth. The highest growth period was the fourth quarter of 1996 with a 9.2% increment. The largest negative growth period was the second quarter of 1995 with a fall of 8.6%.

Figure 1: Real National Income (Y) Evolution

Real national income (GDP in real million pesos, base 2008)

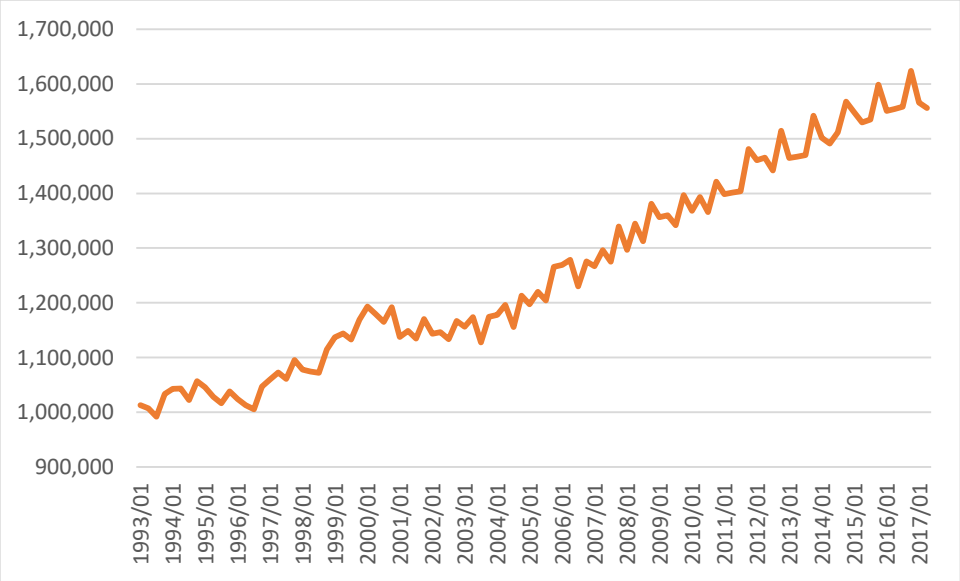


Source: Own elaboration with data from INEGI (2017).

Figure 2 shows the evolution of real government consumption (G). Units are shown in million pesos (real, base 2008). Average quarterly annual growth rate during the period of study is 3.4%. We observe 15 quarters of negative annual quarterly growth and 83 periods of positive growth. The highest growth period was the second quarter of 1999 with a 6.4% increment. The largest negative growth period was the first quarter of 2001 with a fall of 4.6%.

Figure 2: Real Public Spending (G) Evolution

Real public spending (Government consumption in million pesos, base 2008)

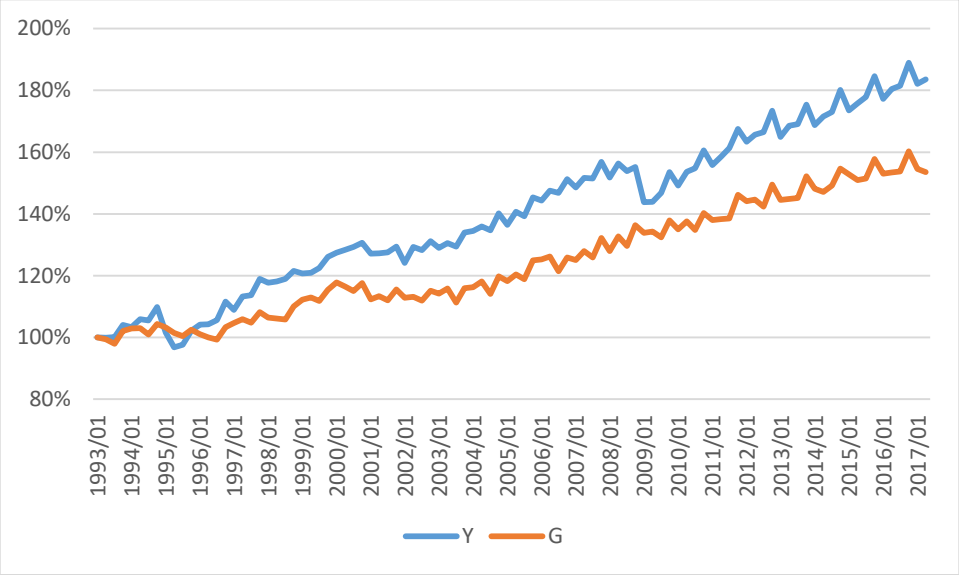


Time period

Source: Own elaboration with data from INEGI (2017)

Figure 3 shows the relative growth of both time series. To compare growth over time, I normalized the series using the first observation of each series as the base number (denominator). As a result, we can observe that national income grew 84% during the entire period of study, while government consumption grew 55%. Annual quarterly average growth rates are 2.6% and 1.9% of national income and government consumption, respectively. Annex II displays the complete database.

Figure 3: Relative growth of national income and public spending in Mexico (1993 – 2017)



Source: Own elaboration with data from INEGI (2017).

As observed in table 3, the growth rate of national income is higher than the growth pace of government consumption. In the absence of modern econometric techniques, a researcher would be tempted to test "Keynesian Economics" hypothesis along with its public spending multiplier effect theory and reject "Wagner´s Law". However, a robust econometric method should be used to assess whether this general observation holds.

4. Stochastic trending of variables

Cointegration analysis requires non-stationary times series´ order of integration to be one. Therefore, in this section, the presence of unit roots is tested for both national income (Y) and public spending (G) using three different methodologies: Augmented Dickey Fuller (ADF), ADF-GLS and Phillips-Perron.

Table 3. Results of the unit root test

	No constant		Constant	
Variable test	Y	G	Y	G
ADF	3.47	2.51	-0.77	0.18
	(0.99)†	(0.99)†	(0.82)*	(0.97)***
ADF-GLS	n.a.	n.a.	0.94	1.12
			(0.91)**	(0.93)**
Phillips-Perron	n.a.	n.a.	3.95	4.21
			(1.00)†	(1.00)†

Source: Own elaboration with data from INEGI (2017); † Denotes that the unit root test cannot be rejected at the 1% significance level. ***, ** and * indicate that null hypothesis is rejected at 1%, 5% and 10% significance levels; n.a. stands for not applicable.

Table 3 shows that the ADF test cannot rule out the null hypothesis of a unit root at 1% significance level for both Y and G time series. This inference applies to both specifications tested, a model with no constant and a model with constant.

When de-trending both Y and G using the procedure suggested by Elliot, Rothenberg and Stock (1996) for a greater power of the test, the null hypothesis of a unit root cannot be ruled out, as seen in the ADF-GLS results.

Finally, using the Phillips – Perron test, which addresses the issue that the data generating process may present a higher order of correlation than is admitted in the test equation by making a non-parametric correction to the t-statistic, the null cannot be ruled out at the 1% significance level.

As reported by Davidson and MacKinnon (2004), this test doesn´t perform as well as the ADF test in finite samples, which is the case here. Nevertheless, evidence of the existence of a unit root is strong for both specifications tested, with no constant and with constant.

As a result, it can be inferred that both Y and G are first order integrated series. Therefore, we can now proceed to test for a potential cointegration relationship between these two times series.

5. Cointegration Analysis

The results of the Johansen cointegration test and the Vector Error Correction are shown in Table 4. Consistent with the terminology referred in the rest of this document, national income is represented by "Y" and public spending by "G". Ljung-box, ARCH and Doornik- Hansen tests for autocorrelation, homoscedasticity and normality, respectively, are also shown.

Table 4. Results of the Johansen cointegration test and VECM

Number of cointegration equations	Trace statistic	p-value
None	40.646†	<0.0001
Up to one	5.3981	0.2515
Normalized cointegration equation		
$Y = -2.7\,x\,10^{6} + 10.154\,G$		
Vector Error Correction		
	ΔY	ΔG
ΔY_{t-1}	0.1645	0.0196
ΔY_{t-2}	-0.0266	-0.0038
ΔY_{t-3}	-0.5152^{***}	-0.0473^{***}
ΔG_{t-1}	-6.7306^{***}	-0.6148^{***}
ΔG_{t-2}	0.6964	-0.1971
ΔG_{t-3}	2.0942	-0.2421^{*}
Error Correction$_1$	0.1004^{***}	0.0134^{***}
R^2	0.67	0.69
Adjusted R^2	0.64	0.67
Durbin Watson	1.6994	1.3181
Assessment tests		
Autocorrelation test (Ljung-Box with 8 lags):		
1. GDP Equation: Q = 12.58 with p-value =	$P(\chi^2_{8d.f.} > 12.58) = 0.127$	
2. EXP Equation: Q = 13.18 with p- value =	$P(\chi^2_{8d.f.} > 13.18) = 0.106$	
Homoscedasticity test (ARCH with 8 lags):		
1. GDP Equation: LM = 1.84167 with p-value =	$P(\chi^2_{8d.f.} > 1.84167) = 0.985487$	
2. EXP Equation: LM = 6.47113 with p-value =	$P(\chi^2_{8d.f.} > 6.47113) = 0.594611$	
Normality test (Doornik-Hansen):		
DH = 9.39016 with p-value: 0.0521 (under the null it is distributed) = 0.127 $\chi^2_{4\,d.f.}$		

† Denotes that Ho cannot be rejected at the 1% significance level. ***, ** and * indicate that null hypothesis is rejected at 1%, 5% and 10% significance levels

Source: Own elaboration with data from INEGI (2017) using GRETL software.

As shown by the trace statistic adjusted by sample size, it is possible to reject the null hypothesis of no cointegration when testing for none cointegrating vectors. However, we cannot rule out the null hypothesis when proving the presence of at least one cointegration vector. Therefore, we can infer the existence of a long term cointegration relationship between national income and public spending.

In the short term, 67% of national income (Y) variation is explained by the vector error correction model. In the case of government consumption (G), 69% of its variation is explained by this estimation. This means that should exogenous variables to the model have an impact on Y or G, this impact is relatively limited. Moreover, now we can study the specific effect that each of these variables have on the other. As shown by the assessment tests, there is no strong evidence of autocorrelation or of the absence of normality. Finally, strong evidence of the absence of heteroskedasticity has been found.

As shown above, there is a long-term equilibrium relationship between national income and government consumption. Any time an event alters one of them, the long term equilibrium will be attained by adjusting the other in the short term through a correction mechanism. However, the normalized cointegration equation can help us to better understand how these two variables co-move in the long run.

Given the linear specification,

$$Y = \alpha + \beta \ G$$

We can deduce the following

$$\frac{\partial Y}{\partial G} = \hat{\beta}$$

Multiplying both sides by the same ratio,

$$\frac{\bar{Y}}{\bar{G}} . \frac{\partial Y}{\partial G} = \frac{\bar{Y}}{\bar{G}} . \hat{\beta}$$

Where $\bar{Y}$ and $\bar{G}$ are average national income and public spending respectively. Rearranging, this implies that

$$\frac{\partial G \,/\, \bar{G}}{\partial Y \,/\, \bar{Y}} = \frac{1}{\hat{\beta}} \cdot \frac{\bar{Y}}{\bar{G}} = \ 0.87$$

As we can recall, this is a practical approximation to calculate elasticity. In this case, calculations show that a 1% change in national income (Y) corresponds to a variation of government consumption (G) of 0.87% on average in the long run. This calculation by no means implies causality. For this specific purpose I used the Breitung-Candelon Granger causality test.

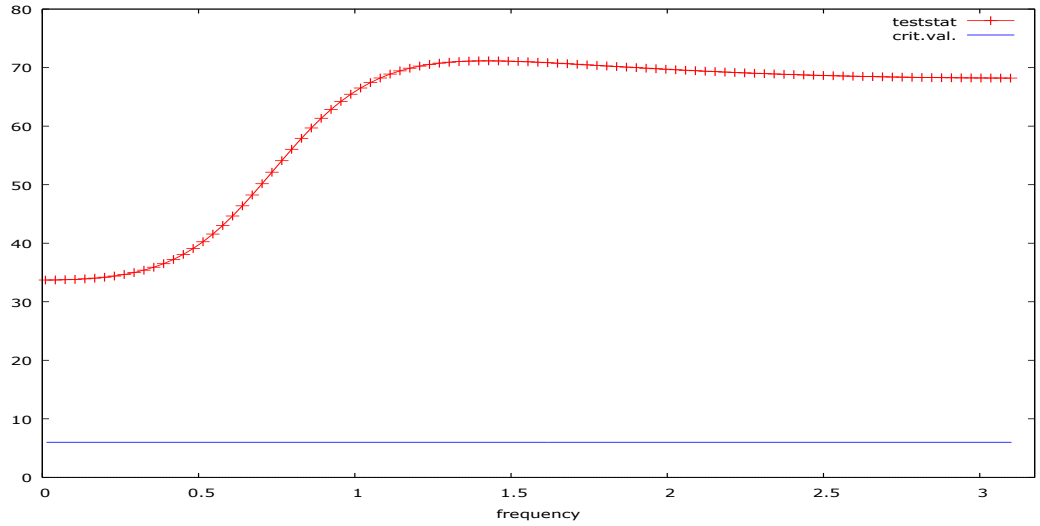
Breitung-Candelon (2006) adopted the framework of Geweke (1982) and Hosoya (1991) to design a test for causality in the frequency domain that can be applied to cointegration analysis. As Toda & Phillips (1993) considered, "In cointegrated systems the definition of causality at frequency zero is equivalent to the concept of "long-run causality"". Using this framework, I found evidence of Granger causality between national income (Y) and government consumption (G) as shown in Figure 4. In terms of causality, bi-variate Granger causality was found for Y and G in either direction. In particular, the non-causality (non-predictability) was ruled out in the following cases:

1. $G_t \overset{gc}{\rightarrow} Y_t$ for the whole study period

2. $Y_t \overset{gc}{\rightarrow} G_t$ for the whole study period

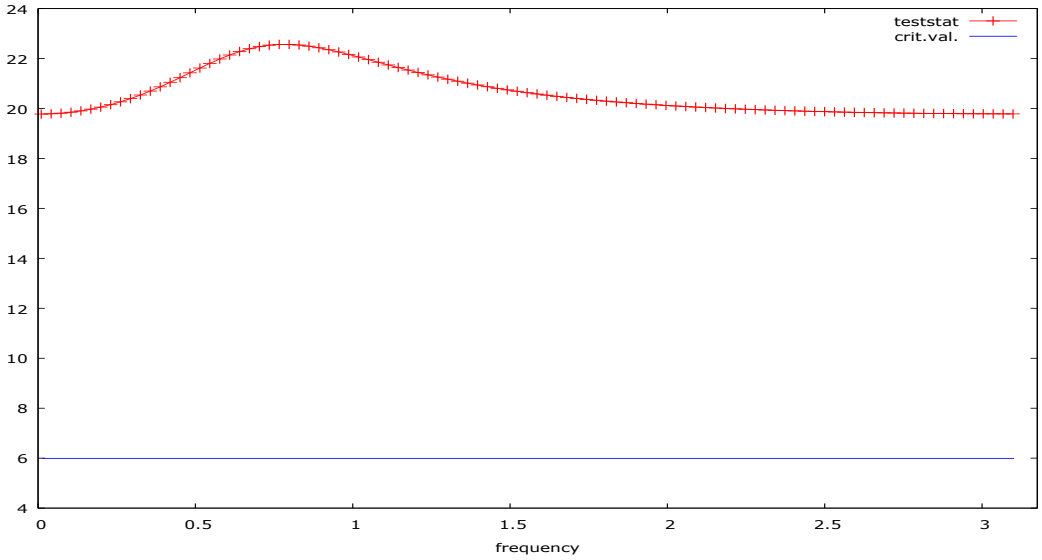
Figure 4: Breitung-Candelon test results

(a) $G_t \overset{gc}{\rightarrow} Y_t$



(b)

$(b)\ Y_t \overset{gc}{\rightarrow} G_t$



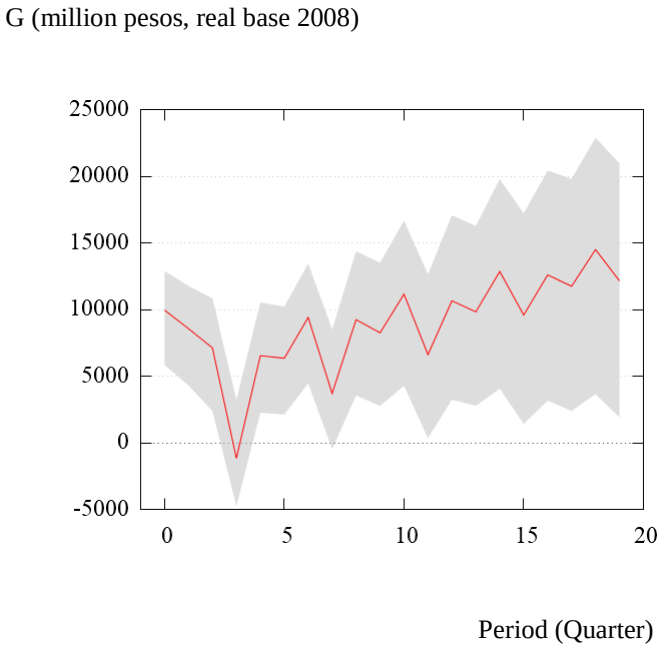
Source: Own elaboration with data from INEGI (2017) using GRETL software. Note: blue line represents 5% critical value, (a) red dashed line represents test statistic for $EXP_t \overset{gc}{\rightarrow} GDP_t$; (b) red dashed line represents test statistic for $GDP_t \overset{gc}{\rightarrow} EXP_t$.

Therefore, the two cointegrated variables are tied by bivariate Granger-causal links. This evidence holds for the whole period of study in both directions. This means that whenever public spending moves initially, it Granger causes national income to move in the same direction. Also, an initial movement in national income Granger causes government consumption to move in the same direction. In conclusion, an initial movement in either variable Granger causes a movement in the other. This fact by itself offers strong support for both Wagner and Keynes hypothesis, except for the fact that additional conditions must be met.

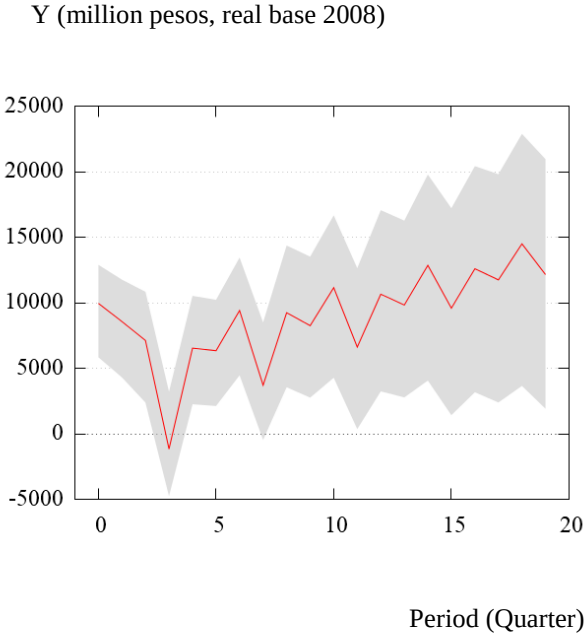
To analyze how an initial movement on one variable affects the other over time, I show the impulse-response functions in Figure 5. The line in red is the trajectory followed by the variable pictured (G or Y) after an initial shock in the other variable. The gray area depicts a 95% confidence interval.

Figure 5: Impulse-response functions

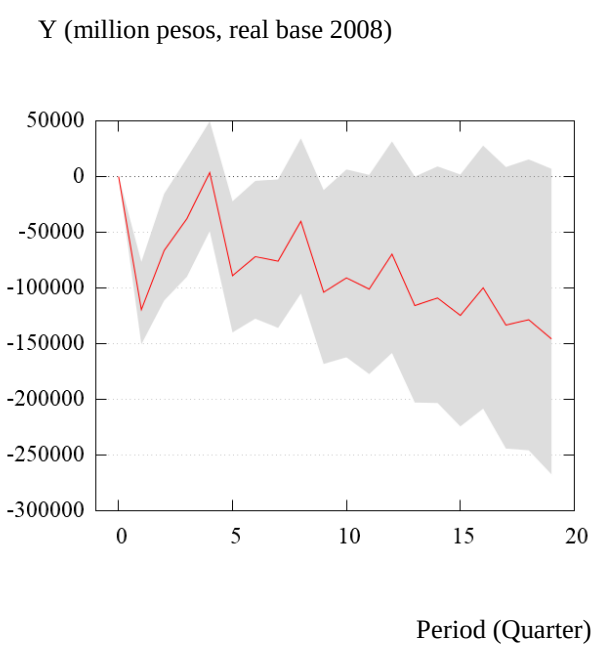
(5.1) Effect over time on G of a Y shock of one standard deviation



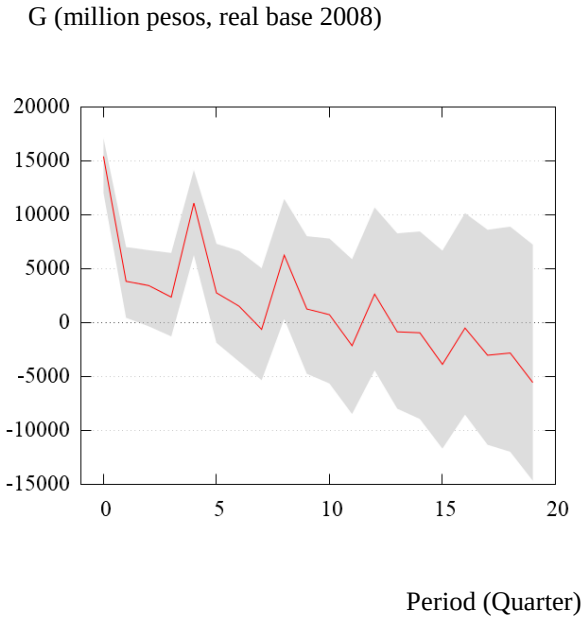
(5.2) Effect over time on Y of a Y shock of one standard deviation



(5.3) Effect over time on Y of a G shock of one standard deviation



(5.4) Effect over time on G of a G shock of one standard deviation



Evidence from the impulse response-functions shows that a movement in Y corresponds to movements in both Y and G that are statistically different from zero in the short run. In particular, as observed in figure 5.1, an initial movement of $2 billion pesos in Y (one standard deviation) corresponds to a variation of around $10 thousand million pesos in G stabilized after two years. Also, as seen in figure 5.2, this same initial shock corresponds to a variation of around $200 thousand million pesos in Y stabilized after the same period of time (between 8 and 10 quarters). On the other hand, figures 5.3 and 5.4 show that an initial movement on G is not statistically different from zero except for the fifth quarter, which implies that any initial effect tends to dissipate over time. Therefore, even taking into account that impulse-response functions do not imply causality in any way, they do offer support to Wagner hypothesis and do not offer support to Keynes hypothesis.

In conclusion, the Johansen test showed that the hypothesis of a long term cointegration relationship between national income and government consumption hold for Mexico during the 1993 – 2017 period. Also, the Breitlung-Candelon supported bi-variate Granger causality between these variables. On the other hand, the impulse response functions showed that a movement in Y tend to have a positive

effect on G that stabilizes over time, but not the other way around since the effect of an initial movement in G tend to dissipate after an initial short term co-movement in the same direction. Finally, the elasticity approach used in the literature to assess whether Keynes or Wagner hypothesis hold did not allow us to validate either since the magnitude of the effect could not be interpreted as marginally more than proportional.

6. Concluding remarks

This paper used the Johansen test to confirm that a long term cointegration relationship between national income and government consumption was present in Mexico during the period running from the first quarter of 1993 to the second quarter of 2017. Moreover, the two cointegrated variables were tied by bivariate Granger-causal links. This meant that not only an initial movement in government consumption caused a movement in national income in the same direction, but also, an initial movement in national income caused public spending to move in the same direction. Also, impulse response functions showed that a move in Y tend to have a positive effect on G over time stabilizing after two years, but not the other way around. Finally, considering that the long term equilibrium relationship between national income and government consumption is less than proportional using the elasticity approach widely leveraged in the literature, this work does not support either Keynes or Wagner hypothesis for the period of study in the Mexican case.

In the first section, I introduced the motivation of this paper by establishing that co-movement and causality between national income and public spending remained relevant to public policy making in the Mexican Case since recent developments showed an increased public debt justified by an increment in government spending to cause economic growth. In Section 2, I reviewed the literature motivated by the Keynes vs. Wagner discussion, scholars who first conceptualized the relationship between national income and public spending. I discussed how both Wagner and Keynes defended the universal applicability of their frameworks and were questioned by early scholars, who argued that co-movement and causality work different for each

country in a specific time period. I also showed the functional forms and specifications that those early scholars proposed to validate Wagner or Keynes and how those proposals prevailed despite a significant change in methodological approach used in the post-Henrekson (1993) literature. At the end, I showed that to validate either, it was a matter of causality and magnitude of co-movement, regardless of the specific functional form used to study this phenomenon. In this section I also showed the results of twelve academic works done for Mexico during different time periods, as well as the methods used and their validity. In Section 3, I described the time series used on this work and why it was worth to study this period, namely, because it was a period where the open economy (which started earlier in 1982) maintained the rules of the economy fundamentally unchanged (*ceteris paribus*). In section 4, I analyzed the stochastic trending of variables using ADF, ADF-GLS and Phillip Perron tests. I concluded that the original series were stationary and therefore subject to cointegration analysis. In section 5, I demonstrated that a long term cointegration relationship between public spending and national income hold for the period of study. Moreover, bi-variate Granger causality was found for Y and G using the Breitung-Candelon test. Finally, both Keynes and Wagner hypothesis were not validated for Mexico during the period of study since the magnitude of the effect caused by an initial movement in the other variable proved not to be marginally more than proportional. This was validated by using an elasticity criteria conceptually consistent with the extensive literature on this subject.

Finally, as possible extensions of this work, it would be interesting to test other functional forms that are classic on this literature to validate either Keynes or Wagner, both or none. Also, it would be interesting to use different aggregations of both national income and public spending to refine the implications of the public policy tools available to Government Officials and other interested parties.

Annex I: Summary of selected international literature after Henrekson (1993)

Studies that support the Wagner Hypothesis

Year of study	Author(s)	Country or Region	Period of study	Method	Main conclusion
1994	Oaxley, Les	UK	1870 - 1913	Cointegration and Granger causality	Wagner hypothesis holds
1996	Ahsan, Syed M & Sahni, Balbir	Canada	1952 - 1988	Cointegration and Granger causality	Wagner hypothesis holds
1997	Ansari, Gordon & Akumoah	Ghana, Kenya and South Africa	1957-1990	Cointegration, Granger and Holmes Hutton causality	Wagner hypothesis holds
1997	Chlestos, Michael & Kollias Christos	Greece	1958 - 1993	Cointegration and Granger causality	Wagner hypothesis holds
2001	Islam, Anisul M.	USA	1929 - 1996	Cointegration and Granger causality	Wagner hypothesis holds
2001	Tang Tuck Cheong	Malasya	1960 - 1998	Cointegration and Granger causality	Wagner hypothesis holds
2004	Suday Osaretin Iyare; Torye Lorde	9 Carribean countries	1950 - 2000	Cointegration, ECM and Granger causality tests	Wagner hypothesis holds for Guyana
2007	Sideris, Dimitrios	Greece	1833 - 1938	Cointegration and Granger causality	Wagner hypothesis holds
2008	Kumar Saten, et al.	New Zeland	1960 - 2007	Cointegration and Granger causality	Wagner hypothesis holds

Studies that support Keynes Hypothesis

Year of study	Author(s)	Country or Region	Period of study	Method	Main conclusion
2004	Suday Osaretin Iyare; Torye Lorde	9 Carribean countries	1950 - 2000	Cointegration technique, ECM and Granger	Keynes hypothesis holds for Grenada and Jamaica
2006	Ergun Dogan; Tuck Cheong Tang	5 South East Asian countries	1960 - 2002	Cointegration technique, ECM and Granger	Keynes hypothesis holds for Phillipines
2011	Babatunde, M. Adetunji	Nigeria	1970 - 2006	ARDL, Bounds test and UECM	Keynes hypothesis holds
2011	Govindaraju, VGR Chandran; et al.	Malasya	1970 - 2006	ARDL, Bounds test and UECM	Keynes hypothesis holds
2013	Ebaidalla Mahjoub Ebaidalla	Sudan	1970 - 2008	Cointegration technique, ECM and Granger	Keynes hypothesis holds

Studies that support the feedback hypothesis

Year of study	Author(s)	Country or Region	Period of study	Method	Main conclusion
2003	Suleimen Abu-Bader, Aamer S. Abu-Qarn	Egypt, Israel and Syria	1967 - 1998	Cointegration technique, ECM and Granger	Feedback hypothesis holds
2004	Nikolaos Dristsakis; Antonis Adamopoulos	Greece	1960 - 2001	Cointegration technique, ECM and Granger	Feedback hypothesis holds
2005	Ferda Halcioglu	Turkey	1960 - 2000	Cointegration technique, ECM and Granger	Feedback hypothesis holds
2008	Paresh Kumar Narayan; et al.	China Provinces		Panel unit root, panel cointegration and Granger causality	Feedback hypothesis holds
2009	Emmanuel Ziramba	South Africa	1960 - 2006	ARDL, Bounds test and UECM	Feedback hypothesis holds
2009	Mohammad Ghorbani; Ali Firooz Zarea	Iran	1960 - 2000	Engel-Granger cointegration test and Granger causality test	Feedback hypothesis holds
2009	Turan Yay; Huseyin Tastan	Turkey	1950 - 2004	Engel-Granger, Johansen and Pesaran cointegration tests, ECM, Granger causality tests	Feedback hypothesis holds
2012	Cosimo Magazzino	Italy	1960 - 2008	Cointegration technique, ECM and Granger	Feedback hypothesis holds
2013	Antonio Bojanic	Bolivia	1940 - 2010	Cointegration technique and ECM	Feedback hypothesis holds

Studies that support the neutrality hypothesis

Year of study	Author(s)	Country or Region	Period of study	Method	Main conclusion
1999	Safa Demirbas	Turkey	1950 - 1990	Cointegration and Granger causality tests	No causation in any way
2003	Muhlis Bagdigen; Hakan Cetintas	Turkey	1965 - 2000	Cointegration and Granger causality tests	No causation in any way
2006	Chiung-Ju Huang	China, Taiwan	1979 - 2002	UECM and Granger Causality	No causation in any way
2007	Dipendrah Sinha	Australia	1950 - 2003	ARDL framework and Toda Yamamoto Granger causality test	No causation in any way
2009	Omoke Philip Chimobi	Nigeria	1970 - 2005	Cointegration and Granger causality tests	No causation in any way
2010	Muhammad Azfal; Qaiser Abbas	Pakistan	1960 - 2007	Cointegration and Granger causality tests	No causation in any way

Annex II: INEGI Data for national income and public spending (2017)

Period No.	Period (quarter)	Real GDP 2008	Real public spending 2008	Period No.	Period (quarter)	Real GDP 2008	Real public spending 2008	Period No.	Period (quarter)	Real GDP 2008	Real public spending 2008
1	1993/01	7,945,204	1,013,112	34	2001/02	10,108,445	1,148,999	67	2009/03	11,666,878	1,341,709
2	1993/02	7,939,362	1,007,026	35	2001/03	10,136,952	1,134,955	68	2009/04	12,198,808	1,396,670
3	1993/03	7,954,943	992,291	36	2001/04	10,278,368	1,170,207	69	2010/01	11,850,338	1,367,848
4	1993/04	8,268,036	1,033,734	37	2002/01	9,861,366	1,143,424	70	2010/02	12,203,471	1,393,560
5	1994/01	8,210,538	1,042,888	38	2002/02	10,270,413	1,146,712	71	2010/03	12,300,733	1,365,659
6	1994/02	8,413,362	1,043,313	39	2002/03	10,192,405	1,133,619	72	2010/04	12,756,093	1,421,446
7	1994/03	8,381,196	1,022,657	40	2002/04	10,417,924	1,166,844	73	2011/01	12,377,643	1,398,403
8	1994/04	8,728,621	1,057,011	41	2003/01	10,247,794	1,156,493	74	2011/02	12,597,004	1,401,636
9	1995/01	8,072,388	1,045,758	42	2003/02	10,371,845	1,173,762	75	2011/03	12,813,766	1,403,604
10	1995/02	7,690,088	1,028,049	43	2003/03	10,282,861	1,127,813	76	2011/04	13,308,559	1,480,735
11	1995/03	7,754,839	1,016,875	44	2003/04	10,640,929	1,174,726	77	2012/01	12,976,746	1,460,485
12	1995/04	8,117,299	1,038,459	45	2004/01	10,687,035	1,177,838	78	2012/02	13,163,915	1,465,498
13	1996/01	8,274,612	1,023,977	46	2004/02	10,800,224	1,196,438	79	2012/03	13,227,471	1,441,791
14	1996/02	8,285,441	1,012,972	47	2004/03	10,702,790	1,156,052	80	2012/04	13,782,004	1,514,490
15	1996/03	8,392,099	1,005,386	48	2004/04	11,137,966	1,213,107	81	2013/01	13,105,884	1,464,717
16	1996/04	8,863,689	1,047,001	49	2005/01	10,842,832	1,197,641	82	2013/02	13,395,147	1,467,196
17	1997/01	8,653,780	1,060,089	50	2005/02	11,179,407	1,220,300	83	2013/03	13,434,815	1,470,060
18	1997/02	8,997,962	1,073,034	51	2005/03	11,067,641	1,204,515	84	2013/04	13,937,173	1,541,591
19	1997/03	9,030,688	1,061,221	52	2005/04	11,552,091	1,265,570	85	2014/01	13,405,383	1,501,252
20	1997/04	9,451,788	1,095,701	53	2006/01	11,466,953	1,269,293	86	2014/02	13,630,771	1,490,754
21	1998/01	9,352,705	1,077,926	54	2006/02	11,724,227	1,278,916	87	2014/03	13,745,513	1,511,288
22	1998/02	9,383,805	1,074,786	55	2006/03	11,666,303	1,230,208	88	2014/04	14,314,309	1,567,549
23	1998/03	9,451,320	1,072,127	56	2006/04	12,017,204	1,275,707	89	2015/01	13,783,087	1,548,225
24	1998/04	9,653,699	1,114,923	57	2007/01	11,803,995	1,267,144	90	2015/02	13,971,132	1,529,785
25	1999/01	9,587,901	1,137,015	58	2007/02	12,047,528	1,296,267	91	2015/03	14,132,917	1,534,870
26	1999/02	9,611,203	1,143,892	59	2007/03	12,034,348	1,274,972	92	2015/04	14,668,722	1,598,783
27	1999/03	9,734,474	1,133,163	60	2007/04	12,464,537	1,339,710	93	2016/01	14,080,629	1,550,424
28	1999/04	10,017,205	1,169,251	61	2008/01	12,057,513	1,296,857	94	2016/02	14,333,716	1,554,030
29	2000/01	10,123,135	1,193,258	62	2008/02	12,417,609	1,344,473	95	2016/03	14,421,873	1,557,910
30	2000/02	10,200,999	1,179,739	63	2008/03	12,225,011	1,312,781	96	2016/04	15,012,430	1,623,816
31	2000/03	10,273,678	1,165,441	64	2008/04	12,327,321	1,381,117	97	2017/01	14,469,247	1,565,904
32	2000/04	10,376,634	1,191,880	65	2009/01	11,425,377	1,356,610	98	2017/02	14,586,819	1,555,633
33	2001/01	10,100,254	1,137,908	66	2009/02	11,431,934	1,360,194				

Note: Data sourced from INEGI (Mexico´s National Institute of Statistics and Geography) website (https://www.inegi.org.mx/) in January 2018. Since information was obtained, two major changes occurred on INEGI´s website: i) Data in real terms changed from base 2008 to base 2013 and ii) the website itself was redesigned. Original website route for information was: a) National Income (Y), base 2008: "Cuentas nacionales> Producto interno bruto trimestral, base 2008> Valores a precios de 2008> Producto interno bruto, a precios de Mercado"; b) Government consumption (G), base 2008: "Cuentas nacionales> Oferta y utilización total de bienes y servicios, base 2008> Series originales> A precios constantes> Valores absolutos> Utilización de bienes y servicios> Consumo total> Consumo de gobierno".

Annex III: Script for Gretl

Unit Root Tests

ADF Test

```
loop foreach i lista
   adf -1 $i --nc --test-down=BIC
endloop
loop foreach i lista
   adf -1 $i --c --test-down=BIC
endloop
loop foreach i lista
   adf -1 $i --ct --test-down=BIC
endloop
```

ADF-GLS Test

```
loop foreach i lista
   adf -1 $i --c --test-down=BIC --gls --perron-qu
endloop
loop foreach i lista
   adf -1 $i --ct --test-down=BIC --gls --perron-qu
endloop
```

Phillips Perron test

```
loop foreach i lista
   PPtest($i,Tcon0,0,1)
endloop
```

Phillips Perron test with constant

```
loop foreach i lista
   PPtest($i,Tcon0,0,1)
endloop
```

Phillips Perron test with constant and trend

```
loop foreach i lista
   PPtest($i,Tcon1,0,1)
Endloop
```

Cointegration analysis

```
coint2 4 PIBReal GgobReal --rc
```

VEC Estimation

```
vecm 4 1 PIBReal GgobReal --rc --impulse-responses
```

Assessment tests

```
modtest 8 --autocorr
modtest 8 --arch
modtest --normality

modtest 4 --autocorr --univariate
modtest 4 --arch --univariate

modtest 8 --autocorr --univariate
modtest 8 --arch --univariate
```

Granger causality tests

```
var 8 PIBReal GgobReal --lagselect
var 5 PIBReal GgobReal --robust-hac –robust
```

Annex IV: Frequency Table for Breitung-Candelon´s procedure

Frequency	$EXP_t \overset{gc}{\rightarrow} GDP_t$	$GDP_t \overset{gc}{\rightarrow} EXP_t$	Frequency	$EXP_t \overset{gc}{\rightarrow} GDP_t$	$GDP_t \overset{gc}{\rightarrow} EXP_t$
0.010	19.776	33.710	1.586	20.582	70.920
0.073	19.812	33.763	1.649	20.487	70.753
0.136	19.905	33.911	1.712	20.487	70.569
0.199	20.056	34.189	1.775	20.328	70.376
0.262	20.267	34.656	1.838	20.261	70.183
0.325	20.539	35.392	1.901	20.202	69.992
0.388	20.867	36.501	1.964	20.148	69.720
0.451	21.236	38.089	2.027	20.101	69.633
0.514	21.620	40.252	2.090	20.058	69.468
0.577	21.982	43.034	2.153	20.020	69.313
0.640	22.280	46.390	2.216	19.986	69.169
0.703	22.480	50.164	2.279	19.955	69.037
0.766	22.565	54.102	2.342	19.928	68.915
0.829	22.542	57.914	2.405	19.904	68.803
0.892	22.432	61.344	2.468	19.882	68.702
0.955	22.263	64.230	2.531	19.864	68.612
1.018	22.063	66.516	2.594	19.847	68.531
1.082	21.850	68.228	2.657	19.833	68.460
1.145	21.641	69.443	2.720	19.820	68.398
1.208	21.442	70.256	2.783	19.810	68.345
1.271	21.442	70.760	2.846	19.801	68.301
1.334	21.259	71.035	2.909	19.794	68.266
1.397	20.942	71.145	2.972	19.789	68.240
1.460	20.808	71.139	3.035	19.786	68.222
1.523	20.688	71.055	3.067	19.785	68.216

Note: Critical value is 5.991 at 5% significance level. Therefore, causality in the sense of Granger is significant in both ways for the entire period of study with a 95% confidence.

Annex V. Bibliography

Abu-Bader, S., & Abu-Qarn, A. S. (2003). "Government expenditures, military spending and economic growth: Causality evidence from Egypt, Israel and Syria". Journal of Policy Modeling, 25(6–7), 567–583.

Ahsan, M., Kwan, A.C. C. & Sahni, B. S. (1996). "Cointegration and Wagner's hypothesis: Time series evidence for Canada". Applied Economics, 28, 1055–1058.

Ansari, M. I., Gordon, D.V., & Akuamoah, C. (1997). "Keynes versus Wagner: public expenditure and national income in three African countries". Applied Economics, 29, 543–550.

Ashworth, J. (1994). "Spurious in Mexico: a comment on Wagner's Law". Public Finance, 49, 282–286.

Bagdigen, M., & Cetintas, H. (2003). "Causality between public expenditure and economic growth: The Turkish case". Journal of Economic and Social Research, 6(1), 53–72.

Bohl, M. (1996). "Some International Evidence on Wagner's Law". Public Finance, 51, 185-200.

Bojanic, Antionio N. (2013). "Testing the Validity of Wagner´s Law in Bolivia: A Cointegration and Causality Analysis with Disaggregated Data". Revista de Análisis Económico, Vol. 28, No. 1, pp 25-45.

Breitung, J. & Candelon, B. (2006). "Testing for short- and long-run causality: A frequency domain approach". Journal of Econometrics 132, 363-378.

Burney, N.A. (2002). "Wagner's Hypothesis: Evidence from Kuwait Using Cointegration Tests", Applied Economics, 34, 49-57.

Chang, T. (2002). "An Econometric Test of Wagner's Law for Six Countries Based on Cointegration and Error-Correction Modelling Techniques". Applied Economics, 34, 1157-69. Chang

Chang, T., W. Liu and S. B. Caudill. (2004). "A Re-examination of Wagner's Law for Ten Countries Based on Cointegration and Error-Correction Modelling Techniques", Applied Financial Economics, 14, 577-89.

Chimobi, O. P. (2009). “Government expenditure and national income: A causality test for Nigeria”. European Journal of Economic and Political Studies, 2(2), 1–12.

Chletsos, M., & Kollias, C. (1997). “Testing Wagner’s law using disaggregated data in the case of Greece: 1958–93”. Applied Economics, 29, 371–377.

Davidson, Russell and James G. MacKinnon (2004), “Econometric Theory and Methods, p.623”. ISBN 978-0-19-512372-2

Demirbas, S. (1999). “Cointegration Analysis-Causality Testing and Wagner’s Law: The Case of Turkey, 1950–1990”. Discussion Papers in Economics, 99/3. Department of Economics, University of Leicester.

Diamond, Jack. (1977). "Wagner's 'Law' and the Developing Countries," The Developing Economies, pp. 37-59.

Dogan, E., & Tang, T. C. (2006). “Government expenditure and national income: Causality test for five South East Asian countries”. International Business & Economics Research Journal, 5(10), 49–58.

Dritsakis, N. & A. Adamopoulos. (2004). “A Causal Relationship between Government Spending and Economic Development: An Empirical Examination of the Greek Economy”. Applied Economics, 36, 457-64.

Durevall, Dick, & Magnus Henrekson. (2011). “The Futile Quest for a Grand Explanation of Long-Run Government Expenditure.” Journal of Public Economics, 95(7-8): 708722.

Dumitrescu Peculea, Adelina; Wang, Lingxao & Xu, Handuo. (2016). “The relationship between public expenditure and economic growth in Romania: Does it obey Wagner´s or Keynes´s Law?” Theoretical and Applied Economics, Volume XXIII, No. 3(608), Autumn pp. 41-52

Galindo, L., & Cordera, R. (2005). “Las relaciones de causalidad entre el gasto público y el producto en México: ¿Existe evidencia de cambio estructural?” Revista Mexicana de Economía y Finanzas, 4(4), 369–386.

Gandhi,V.P. (1971). “Wagner’s law of public expenditure: do recent cross-section studies confirm it?” Public Finance, 26, 44D 56.

Goffman, Irving J., & Dennis J. Mahar. (1971). “The Growth of Public Expenditures in Selected Developing Nations: Six Caribbean Countries 1940-65”. Public Finance, 26(1): 57-74.

Ghorbani, M., & Zarea, A. F. (2009). “Investigating Wagner’s law in Iran’s economy”. Journal of Economics and International Finance, 1(5), 115–121.

Govindaraju, C. V. G. R., Rao, R., & Anwar, S. (2010). “Economic growth and government spending in Malaysia: A re-examination of Wagner and Keynesian views”. Economic Change and Restructuring.

Günalp, Burak, & Timur H. Gür. (2002). “Government Expenditures and Economic Growth in Developing Countries: Evidence from a Panel Data Analysis”. METU Studies in Development, 29(2): 311-332.

Gupta, Shirshankar P. (1967). “Public Expenditures and Economic Growth: A Time Series Analysis”. Public Finance, 22(4): 423-461.

Halicioglu, F. (2005). “Testing Wagner’s Law for Turkey, 1960–2003”. Public Economics.

Hayo, B. (1994). “No further evidence of Wagner’s Law for Mexico”. Public Finance, 49, 287–294.

Henrekson, Magnus. (1993). “Wagner’s Law: A Spurious Relationship?” Public Finance, 48(2): 406-415.

Holmes, J. M. & Hutton, P.A.(1990a). “On the causal relationship between government expenditures and national income”. The Review of Economics and Statistics, 72, 87D 95.

Huang, C. J. (2006). “Government expenditures in China and Taiwan: Do they follow Wagner’s Law?” Journal of Economic Development, 31(2), 139–148.

Iñiguez-Montiel, A. (2010). “Government expenditure and national income in Mexico: Keynes versus Wagner”. Applied Economics Letters, 17(9), 887–893. http://dx.doi.org/10.1080/13504850802599433

Islam, A. M. (2001). “Wagner’s law revisited: Cointegration and exogeneity tests for the USA”. Applied Economics Letters, 8, 509–515.

Iyare, S. O., & Lorde, T. (2004). “Co-integration, causality and Wagner’s law: Tests for selected Caribbean countries”. Applied Economics Letters, 11, 815–825.

Keynes, J.M. (1936). “The general theory of interest, employment and money”. London: Macmillan.

Kumar, S. (2009). “Further evidence on public spending and economic growth in East Asian Countries”. MPRA Paper No. 19298.

Landau, Daniel. (1986). “Government and Economic Growth in the Less Developed Countries: An Empirical Study for 1960-1980.” Economic Development and Cultural Change, 35(1): 35-75.

Legrenzi, G. (2000). “The Long-Run Relationship between Public Sector Size and Economic Growth: Income Elasticity and Causality of the Italian General Government Expenditure (1861-1998)”, International Review of Economics and Business, 47, 415-37.

Lin, C. (1995). “More evidence on Wagner’s Law for Mexico”. Public Finance, 50, 267–277.

Loizides, J. & G. Vamvoukas. (2005). “Government Expenditure and Economic Growth: Evidence from Trivariate Causality Testing”, Journal of Applied Economics, 8, 125-52.

Magazzino, C. (2010). “Wagner’s law” in Italy: Empirical evidence from 1960 to 2008”. Global & Local Economic Review, 2(January–June), 91–116.

Mann, Arthur J. (1980). “Wagner’s Law: An Econometric Test for Mexico, 1925-1976.”. National Tax Journal, 33(2): 189-201.

Michas, Nicholas A. (1975). “Wagner’s Law of Public Expenditures: What Is Appropriate Measurement for a Valid Test?.” Public Finance, 30(1): 77-84.

Mohsin,M., Bhat, K.S. & Kamaiah B. (1992). “Causality between public expenditure and national income in India”. Asian Economic Review, 34, 375Ð 90.

Murthy, N.R.V., (1993), “Further Evidence of Wagner's Law for Mexico: An Application of Cointegration Analysis”. Public Finance, 48, 92-96.

Murthy, N. (1994). “Wagner’s Law, spurious in Mexico or misspecification: a reply”. Public Finance, 49, 295–303.

Musgrave, Richard A. (1969). “Fiscal Systems”. New Haven: Yale University Press.

Nagarajan, P., & Spears, A. (1990). An econometric test of Wagner´s law for Mexico: a reexamination. Public Finance, 45, 167–178.

Nagarajan, P. K., Nielsen, I., & Smyth, R. (2008). "Panel data cointegration, causality and Wagner's law: Empirical evidence from Chinese provinces". China Economic Review, 19(2), 297–307.

Oxley, L. (1994). "Cointegration, causality and Wagner's law: A test for Britain 1870-1913". Scottish Journal of Political Economy, Vol. 41, No. 3.

Peacock, Alan T., & Jack Wiseman. (1961). "The Growth of Public Expenditure in the United Kingdom". Princeton: Princeton University Press.

Pryor, F.L. (1968). "Public Expenditures in Communist and Capitalist Nations". Homewood, IL: Richard D. Irwin. Inc., Nobleton, OT: Irwin-Dorsey Limited.

Ram, Rotti. (1986). "Causality between Income and Government Expenditure: A Broad International Perspective." Public Finance, 41(3): 393-413.

Ram, Rotti. (1987). "Wagner's Hypothesis in Time Series and Cross Section Perspectives: Evidence from 'Real' Data for 115 Countries." Review of Economics and Statistics, 69(2): 194-204.

Rodríguez, D., & López-Herrera, F. (2014). "Desarrollo económico y gasto público de las entidades federativas en México. Análisis de cointegración en panel y la ley de Wagner". Gestión y Política Pública, 22(2), 299–330.

Rodríguez, D., Venegas-Martínez, F., & Lima, V. (2013). "La ley de Wagner versus la hipótesis keynesiana: el caso de México, 1950–2009". Investigación Económica, 72(283), 69–98. http://dx.doi.org/10.1016/S0185-1667 (13)72587-6

Rubinson, R. (1977). "Dependency, government revenue, and economic growth". 1955D 70. Studies in Comparative Economic Development, 12, 3D 28.

Sánchez-Juárez, Isaac., García Almada, Rosa M. & Barajas Bustillos, Héctor. (2016). "The Relationship between Total Production and Public Spending in Mexico: Keynes versus Wagner". International Journal of Financial Research, Vol. 7, No. 1

Sideris, D. (2007). "Wagner's Law in 19th Century Greece: A cointegration and causality analysis". Bank of Greece, Working Papers No. 64.

Sinha, D. (2007). “Does the Wagner’s law holds for Thailand? A time series study”. MPRA Paper No. 2560.

Singh,B. & Sahni,B. S. (1984). “Causality between public expenditure and national income”. The Review of Economics and Statistics, 66, 630 D44.

Tang, T. & Cheong. (2001). “Testing the relationship between government expenditure and national income in Malaysia”. Analysis, 8(1–2), 37–51.

Toda, H.Y. & Phillips, P.C.B. (1993). “Vector autoregressions and causality”. Econometrica 61, 1367–1394.

Tornell, Aaron; Westermann, Frank & Martinez Trigueros, Lorenza. (2004) “NAFTA and Mexico's Economic Performance”. CESifo Working Paper Series No. 1155.

Wagner, A. H. (1912). “Les fondaments de l´economie politique”. Paris: Girard & Briere.

Wagner, A. H. (1883). “Finanzwissenschaft”. Leipzig.

Yay, T., & Tastan, H. (2009). “Growth of public expenditures in Turkey during the 1950–2004 period: An econometric analysis”. Romanian Journal of Economic Forecasting, 4, 101–118.

Ziramba, E. (2009). “Wagner’s Law: An econometric test for South Africa 1960–2006”. South Africa Journal of Economics 76(4), 596–606.