Bulletin of Indonesian Economic Studies

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/cbie20

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Publisher: Taylor & Francis & ANU Indonesia Project
Journal: *Bulletin of Indonesian Economic Studies*
DOI: 10.1080/00074918.2020.1811837

Wagner's Law and the Dynamics of Government Spending in Indonesia

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August 18, 2020

Abstract

The nature of the empirical relationship between public expenditure and economic growth can be analysed from different viewpoints. This study focuses on the empirical testing of the validity or otherwise of Wagner's Law for the Indonesian economy. The high growth in the sample period 1980- 2014 make Indonesia a likely candidate for it. Causality and cointegrating techniques are used. A key finding in our vector-autoregression analysis is unidirectional causality running from GDP and Prices to Government Expenditure supporting Wagner's Law. In the case of Prices and Government Expenditure there is also evidence of a long-run cointegrating relationship, which appears stable and supports unidirectional causality. The vast majority of the deviations from the equilibrium relationship between Government Expenditure and Prices are found to be transitory shocks to Government Expenditure and significantly countercyclical with economic activity, suggesting that government expenditure does play a role in economic stabilisation.

1 Introduction

This paper examines the nature of relationship between the level of government spending and output for Indonesia. It tests Wagner (1911) theory that countries may prefer to have a higher level of government-spending-to-GDP ratio as their incomes grow, which based on arguments examining the role of public goods, externalities, and other micro-aspects of an economy. This testing contributes to the rich body of literature reviewed in Section 2. As pointed by Durevall and Henrekson (2011), prior to 1990 it was taken for granted that the Wagner's Law was an expected long-run property of economies. Later literature, however, found mixed evidence, particularly for low-income economies in the context of general economic deregulation of welfare states and privatization of public services. These empirical assessments have generally follow the suggestion by Oxley (1994) that vector-autoregressive (VAR) techniques should be preferred to single equation techniques, to capture complex dynamics including the effects of business cycle and prices. The combination of mixed results and dynamic complexities has brought renewed interest in Wagner's Law. This paper contributes to the body of international evidence on Wagner's Law by testing its validity for Indonesia in a period of rapid economic expansion.

Government expenditure may vary for different reasons, and part of the research challenge is to disentangle those. First, government spending is subject to automatic stabilizing effects. When income is the downturn of the business cycle, tax receipts decrease and that tends to lower the level of government spending. A second effect, associated with Keynes, is that there are discretionary changes in public expenditure used by governments to stabilise business cyclical fluctuations, in a counter-cyclical fashion. From this Keynesian short-run perspective, an active fiscal policy has a causal impact, through multiplier and accelerator effects, on the level of economic activity (Sedrakyan and Varela-Candamio (2009), Samudram and Vaithilingam (2009), Iniguez-Montiel (2010)). As is well known, a counter-cyclical discretionary fiscal policy may lead to a permanent change in the government-spending-to-GDP ratio in the long run only monetary policy can be theoretically truly neutral. Third, government-spending may increase relative to GDP in the long-run in accordance with Wagner's Law.

Part of the challenge of this study is identifying evidence that sustained observed increases in the government-spending-to-GDP ratio can be attributed to Wagner's Law and not to discretionary fiscal policy aimed at stabilising the business cycle. In the case of Indonesia, there are reasons to believe that discretionary fiscal policy may have played an important role, however it is less clear whether its effects on government spending are permanent or transitory. To do that assessment, we examine how public spending reacts to inflationary pressure factoring in the business cycle. The Indonesian federal authorities do not have any pre-commitment to use of fiscal policy for economic stability, and throughout the period there has been emphasis on controlling public debt by achieving zero fiscal budgets which are pro-cyclical. Despite these debt concerns, this paper finds evidence that fiscal policy has been used in a counter-cyclical fashion to smooth the business cycle, with transitory but not permanent effects. This finding, together with the findings of causality going from income and prices to government spending and no cointegration between government spending and output, leads us to support the presence of the Wagner's Law in Indonesia.

Methodologically, this studies employs various techniques under the umbrella of VAR econometric modelling. The base, unrestricted VAR that we first estimate is used as a descriptor of the data generating process. The vector-error correction model (VECM) representation and the structural VAR with permanent-transitory innovations that we propose are economic interpretations of the data generating process. Our analysis relies on Toda and Yamamoto (1995) result, that proves that VECM always have an unrestricted VAR representation, and justify using VAR variables in levels. The latter is particularly useful to extract causality information without the need of imposing strong assumptions on the structure of the VAR. All possible long-run cointegrating relationships are contemplated and, aforementioned, also permanent-transitory aspects of government spending are tested. The data comprises quarterly observations over the 1980-2014, a period of rapid economic growth. The variables used in this model are kept to the minimum that is needed for obtaining robust results. We include: Nominal Government Spending (G); Nominal GDP (Y); and the Price level from the GDP Deflator (P). All variables are used in natural logarithms and have been seasonally adjusted with ARIMA-based methods [1] by the data provider, the Statistics Office of Indonesia (Badan Pusat Statistiks).

The balance of this paper is organised as follows. Section 2 explores Wagner's Law and related literature. Section 3 studies the dynamic properties of the data, including unit root testing, vector-autoregressive settings, and causality. Section 4 looks into the vector error-correction model representation and performs a permanent-transitory forecast error decomposition and cyclical analysis. Section 5 concludes.

2 The Wagner's Law and Related Literature

The endogenous long-run relationship between government spending and consumption – with causality running from economic growth and activity to spending in the long run– has been dubbed Wagner's Law. Wagner (1911) argued that there

[1]For a description of the seasonal adjustment methodology, see Statistics Office of Indonesia (Badan Pusat Statistiks) (2010)

are three primary reasons for increased government expenditure. First, economic growth, modernization and industrialization initiate a substitution of public for private activity. This pushes governments to produce more regulations for private sector activities that lead to increases in government expenditure. Second, the demand for basic infrastructure, especially for health and education, lead to a further increase in government spending as real income rises –Wagner asserts that these facilities will be more efficient if conducted by government rather than private sector. Third, Wagner argues that governments should improve economic efficiency in monopolistic and imperfectly competitive market structures through large-scale investment. Overall, it was Wagner's view that economic development would be accompanied by relative growth of the public sector in the economy. We would add that in modern economies it is particularly important to consider that as a country develops, there is increased reliance on development technology which drives long-term growth and has important spillover effects. For research and development work, governments need to invest in developing an adequate institutional framework covering, inter alia, property rights, competition policy, regulations and patents. Therefore, it could be put forward as a hypothesis that emerging economies in which government participation increases relative to income have higher income growth over the long run. This is assuming that government spending channels in such a way that enhances private and develop of technologies with high spillover potentials. Unproductive government expenditure that crowds out private investment such as financing wars or inefficient bureaucracy - would not lead to long-term growth.

The Wagner hypothesis has attracted a great deal of interest in the public economics literature and has been tested for different economies both over time and across countries. Despite the fact that Wagner did not provide mathematical equations for his hypothesis, some economists have proposed econometric models for testing it. The first wave of research focused on industrialization in Western countries. The most important original empirical formulations in this literature are the following Peacock and Wiseman (1967), Gupta (1967), Goffman (1968), Pryor (1968), Musgrave and Musgrave (1989), Goffman and Mahar (1971), and Mann (1980). These versions include a variety of measures of government expenditure and national income but all essentially test the causal relationship between economic activity (using either real or nominal proxies such as GDP) and government expenditure. These studies typically used simple linear regression models with some measure of government expenditure as the dependent variable and then a proxy for economic activity as an explanatory variable - interpreting a significant (positive) coefficient on the explanatory variable as suggesting support for Wagner's Law.

A new branch of current literature has focused on studying Wagner's Law for both developed and developing countries using more modern econometric techniques for the analysis of time series and cross-sectional data sets. Indeed Oxley (1994) in his study of Wagner's Law in the British economy using time series data spanning 1870 to 1913 notes the potential flaw in the single equation studies noted above; in that Wagner's Law would require some testing in a framework that allowed for the possibility of bi-directional causality. He argues that unambiguous support for the thesis would require uni-directional causality flowing from economic activity to government expenditure. It is also important to note that Wagner's Law should be considered a long run phenomena - to some extent abstracting from the cyclical fluctuations in economic activity and government expenditure which might result from the operation of automatic stabilizers over the business cycle in the economy. A variety of papers have followed Oxley's suggestion and implemented a variety of tests looking at the stationarity properties of the data, as well as co-integration analysis, to test whether there is a long-run relationship between income and government spending and the testing of the causality hypotheses, for instance see: Sedrakyan and Varela-Candamio (2009), Hanif and Ahmed (2018), Cavicchioli and Pistoresi (2016), Bayrakdar and Yapar (2015), Kumar and Fargher (2012), Babatunde (2011), Samudram and Vaithilingam (2009), Iniguez-Montiel (2010), Lamartina and Zaghini (2008), Akitoby et al. (2006), Legrenzi (2004), Chang (2002), Ying-Foon and Kwan (2002), Kolluri and Wahab (2000), and Oxley (1994), to mention some. The results in this literature are mixed, with studies finding a co-integrating relationship in some countries but not in others and with a variety of results regarding the causal links between the variables. Durevall and Henrekson (2011) reviewed existing studies at the time and concluded that 65 percent of them found evidence supporting the Wagner's Law, whereas 35 percent did not. According to this new wave of research, the validity or otherwise of Wagner's Law is generally assessed with causality testing in a VAR setting or cointegration analysis, however important technical precautions need to take in order to guarantee robust sensitivity to satisfactorily confirm results.

Akitoby et al. (2006) studied 51 countries over the period 1970-2002, and is the main precedent for Indonesia Assessment of Wagner's Law in Indonesia. The analysis uses data for real GDP and real government spending breaks into two parts. First, the elasticity coefficient δ in $G = AY^{\delta}$ is computed, with aid of autoregressive econometric techniques. The authors suggest that $\delta > 0$ should be interpreted as an expansive version of Wagner's Law whereas $\delta > 1$ is a narrow interpretation of it. For Indonesia, this elasticity coefficient was estimated at $\delta = 0.85$. The second part of the analysis examines long-run cointegrating relationships between real output and government spending (either total or components of it). Table 2 in Akitoby et al. (2006) confirms that no long-run relationship is statistically significant for Indonesia, giving overall support for the Wagner hypothesis. A first limitation of this study is that it does not decompose government spending into automatic stabilizing, discretionary fiscal policy with possibly permanent effects on its level, and other (Wagner's Law) causes. So, when government spending grows relative to output, it is not possible to tell why it does so. A second general limitation is that the sample period ends in 2002, and substantial growth in output and government spending was observed afterwards. This study expands the research on Indonesia addressing these limitations.

3 Dynamic Data Properties, VAR Setting, and Causality

The three variables described earlier form the basis of our analysis, and we offer summary statistics for them in the Appendix. Before implementing any model, we analyse the stationarity properties of time series.

Table A2 reports a range of standard unit root tests on the three variables, with two real measures being added. To test non-stationarity null hypotheses, we use the Augmented Dickey-Fuller (ADF) test, and the Dickey-Fuller Generalised Least Squares (DF-GLS). The DF-GLS has more statistical power than the ADF for small samples under the presence of an unknown trend (Elliott and Stock (1996)). To eliminate potentially misleading conclusions, we also test the null- hypothesis of stationarity with Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test. The results suggest that nominal Government Expenditure, nominal GDP, real GDP and the GDP deflator are all I(1), as might have been expected. It is however interesting that the Real Government Expenditure variable (Nominal GDP deflated using the GDP Deflator) rejects the unit root null in both the ADF and the DF- GLS tests, but conversely does reject the stationarity hypothesis in the KPSS test. The implication of this, if we accept the rejection of the unit root null, would be that Nominal Expenditure and Price are cointegrated with a cointegrating vector (1,-1), a potential result that we should further examine.

In the light of the results in Table A2 we begin by considering simple bi-variate VAR models of the three variables. We contemplate the possibility, suggested by the above results, that Government Expenditure and Price are cointegrated. To do this we proceed to testing the lag order in base levels VAR. Since one of the issues raised in the introduction was the possibility of causal relationships existing between the variables we also use the levels VAR to test for Granger non-causality. Whilst the cointegration tests will also yield information about causal relationships Toda and Yamamoto (1995) demonstrate that it is valid to test for non-causality in a simple 'augmented' levels VAR. The augmentation involves including m extra lags in the VAR where m is the highest order of integration of the variables in the

VAR. In our context this means simply: establishing the lag length in the levels VAR, adding 1 further lag (since the variables are at most I(1)), and then using standard Wald tests to test zero restrictions on the first *m* 1 lags in the VAR.

Table 1 reports a variety of tests on the levels VAR. Since we have a reasonably long sample of data we began by estimating a VAR of order 10 and sequentially reduce it to 1. The first 3 columns of Table 1 report standard parsimonious information criteria: the Akaike Information Criterion (AIC), the Schwarz Criterion (SC) and the Hannan-Quinn (HQC). As can be seen these conflict, with HQ and SC selecting a lag structure of 2 but the AIC indicating 4 lags. Row 3 of the table shows an F-test for the implied restriction of the levels VAR. As we can see the restriction from 10 lags to 4 lags is not rejected at the 5 per-cent level suggesting that 4 lags would be the better choice. This is confirmed by tests for autocorrelation in the VAR at the chosen lags which suggest that there are significant problems in the individual equations when the number of lags is set to 2. Subsequently a levels VAR with 4 lags was selected.

Table 1: Tests on the levels VAR

	AIC	HC	HQ
Lag Order Selected	4	2	2
F test for restriction from 10 lags	$\chi^2(24)$=35.00 [0.0683]	$\chi^2(32)$=55.78 [0.0057]**	$\chi^2(32)$=55.78 [0.0057]**
Test for autocorrelation at selected lag in:			
a) Govt. Exp. Eqn.	F(5,114) = 1.89 [0.1022]	F(5,118) =3.28 [0.0082]**	F(5,118) =3.28 [0.0082]**
b) Price Deflator Eqn.	F(5,114) = 0.42 [0.8314]	F(5,118) =2.90 [0.0165]*	F(5,118) =2.90 [0.0165]*

Figures in [ ] are p=values, * indicates significance at the 10 per-cent

Since the maximum order of integration in the VAR was 1, we re-estimated it with 5 lags in order to carry out the non-causality tests as suggested by Toda and Yamamoto (1995). The results of Wald tests of zero block restrictions on Price in the (nominal) Government Expenditure equation ($\chi^2(4)$ = 19.02, p-value 0.00) and on the first 4 lags of the latter in the equation for the former ($\chi^2(4)$ = 3.77, p-value 0.43) establish unidirectional causality from Price to Government Expenditure. Table A3 shows the results of the Johansen trace test for cointegration between the two variables and as we can see it confirms the expectation that they do in fact cointegrate, with a cointegrating vector of (1,-1.47) suggesting that they move together in the long run and that Government Expenditure goes up more than proportionately with respect to Price. A Likelihood Ratio test of the restriction that α, the cointegrating vector was in fact (1,-1) produces a test statistic of 15.55, which with 1 degree of freedom rejects at better than 1 per-cent. However, the cointegration results presented in Table A3 below allowed only a constant in the cointegrating vector and an orthogonal constant in the VAR. If we re-test allowing a constant and trend in the cointegrating vector we still get strong evidence of a single cointegrating vector and the normalized α vector is (1, -1.056, -0.0116). Now, a test of the restriction that the α vector is (1, -1, α_3) yields a LR test of 0.48 with p-value 0.49, i.e. it does not reject the restriction. This fits with the finding in the unit root tests that Real Government Expenditure is stationary around a linear trend.

The LR tests on the loading vector (γ) suggest that whilst the null that γ_1 (the coefficient on Government Expenditure) can strongly reject the zero restriction (LR=10.7, p-value=0.00) the same restriction on γ_2 (the coefficient on Price) marginally fails to reject (LR=3.41, p-value=0.06) confirming the causality tests from the levels VAR.

Next, we consider the bi-variate VAR including nominal Government Expenditure and nominal GDP. We use the same procedure as above to establish lag length, this time finding that a lower order VAR with 3 lags produced acceptable diagnostics [2]. Estimating a VAR(4) and testing zero restrictions on the first 3 lags showed evidence of causality running from GDP to Government Expenditure ($\chi^2(3) = 8.2612$ [0.0409]*) but not the converse ($\chi^2(3) = 0.89374$ [0.8269]). Table A4 shows the Johansen trace test which this time suggests no evidence of cointegration between the two variables.

Finally, we considered the bivariate VAR including nominal GDP and Price where a VAR(4) was found acceptable. Estimating the VAR(5) and testing zero restrictions on the first 4 lags showed clear bi-directional causality with the zero restrictions on the lags of Price in the GDP equation rejecting at better than 1 per-cent ($\chi^2(4) = 18.564$ [0.0010]**), and the zero restrictions on GDP in the Price equation also rejecting at better than 1 per-cent ($\chi^2(4) = 16.492$ [0.0024]**). Additionally, the Johansen's test in Table A5 show no evidence of cointegration between the two variables.

We next proceed to confirming bivariate cointegration results, following Stock and Watson (1993) recommendation that cointegration should be tested with more than one method. We adopt the ARDL Bounds test proposed by Pesaran and Smith (2001), which has been used for testing Wagner's Law hypotheses (Mohammadi et al. (2008)). The results, show in Table A6, support the Johansen's test results. The null hypothesis of no cointegration is only rejected for the Government

[2] detailed results available on request

Spending and Price relationship.

In summary, the simple bi-variate models tell us the following. There seems to be unidirectional causality running from GDP to Government Expenditure and from Prices to Government Expenditure. In the case of Prices and Government Expenditure there is also evidence of a long run cointegrating relationship, which appears stable and supports the suggestion that the causality runs from Price to Government Expenditure. The estimated cointegrating vector also seems stable and suggests that Government Expenditure rises more than one-for-one with Price. There is no evidence of cointegration between the other 2 pairs of variables.

Table 2: Causality in the 3 variable VAR

Zero restriction on lags of:	Govt. Exp equation	Price equation	GDP equation
Govt. Exp.	-	3.4151 [0.6363]	3.1723 [0.6734]
Price	5.0549 [0.4092]	-	20.149 [0.0012]**
GDP	2.0323 [0.8447]	18.527 [0.0024]**	-
Price and GDP	21.062 [0.0207]*		

Figures in [ ] are p=values, * indicates significance at the 10 per-cent level ** at the 5 per-cent level

Overall assessment of the causality findings are also confirmed in the three-variable levels VAR. Table 2 shows the results. The first 3 lines suggest no causality from either the Price or GDP into Government Expenditure but do still suggest bi-directional causality between Prices and GDP. However if we test for the joint significance of the price variable and The GDP variable in the Government Expenditure equation the test statistic is significant at the 2 per-cent level (p-value 0.0207) suggesting that there is unidirectional causality from GDP and Prices to Government Expenditure, a result supportive of Wagner's Law. Additionally, Table 2 shows bi-directional causality between Prices and GDP.

An interesting question is how robust our causality results are. In particular, we want to assess if the main structural event in the sample, the Asian Financial Crisis of 1997, has substantially affected causal relationships. With reversal of capital account flows, sharp real exchange rate depreciation, financial turmoil and deep recession, the 1997 crisis has generally called for deep re-evaluation of macroeconomic policies among Asian policymakers. To assess if there have been any implications for our prevalence Wagner's Law conclusions, we split the sample period in two up to Q4 1997 and thereafter- and proceed to causality testing. Results are reported in Table A7. We find that none of the causality links previously detected have disappeared. The interesting addition is that, post-crises, the causal links going from GDP and Price into Government Spending have strengthen. This strongly reinforces the presence of Wagner's Law suggesting it is becoming more and more relevant for Indonesia.

4 VECM Representation, and Permanent-Transitory Decomposition

Since there is evidence of a long run cointegrating relationship between the Government Expenditure and the Price variables, this section explores it further to cast some light on it, and additionally examines the cyclical components of government expenditure and economic activity. Table 3 shows the estimated VECM and as can be seen the parameters ($\hat{\gamma}$) of the loading vector (1,-1.47) suggest that it is the level of government expenditure which does most of the correction with its co-efficient (-0.33) being clearly significant at 5% whilst the coefficient on the ECM term in the ΔP equation is relatively low in absolute size (0.05) and not significant at the 5% level.

The above cointegration results tell us that in this case there is one permanent shock or common trend (Stock and Watson (1988)) and one transitory shock. The framework developed by King et al. (1991), Gonzalo and Granger (1995) and Gonzalo and Ng (2001) allows us to use this estimated cointegrating vectors to decompose the innovations of the system into their permanent and transitory (P- T) components. The steps taken to achieve the P-T decomposition are clearly laid out in Gonzalo and Ng (2001) and centre around the construction of a matrix fddf $\hat{G} = (\hat{\gamma}'_{\perp}, \hat{\alpha}')'$ where $\hat{\gamma}'_{\perp}\hat{\gamma} = 0$. The permanent and transitory shocks can then be obtained as $\hat{G}\hat{e}_t$ where $\hat{e}_t$ is the set of residuals of the estimated VECM.
Intuitively what happens is that if, for example, one of the coefficients of the loading vector, $\hat{\gamma}_i$ say, is relatively small then the i_{th} variable does little adjustment in the face of transitory shocks -so this variable would get little weight in the transitory innovations and more weight in the permanent innovations. It is clear therefore that the decomposition is significantly influenced by the construction of these weights and thus the $\hat{\gamma}$ vector. Indeed, Gonzalo and Ng (2001) advise the setting of statistically insignificant parameters in the vector to zero and Chan and MacDonald (2015) show the sensitivity of results to the parameterization of the loading vector in an asymmetric setting. In this particular case, and as noted

Table 3: Estimated VECM

	Equation	
Dependent Variable	ΔG	ΔP
$\hat{\partial}x_{t-1}$	-0.33	0.05
	(-3.24)**	(1.80)*
ΔG_{t-1}	-0.38	-0.01
	(-3.40)**	(-0.26)
ΔG_{t-2}	-0.10	-0.00
	(-0.92)	(-0.07)
ΔG_{t-3}	-0.12	-0.01
	(-1.41)	(-0.39)
ΔP_{t-1}	0.64	0.30
	(1.99)**	(3.37)**
ΔP_{t-2}	0.14	0.31
	(0.43)	(3.46)**
ΔP_{t-3}	-0.59	-0.17
	(-1.81)*	(-1.94)*
R^2	0.37	0.21

The estimated error-correction term is $ECM = \hat{\partial}x_{t-1} = G_{t-1}$ $1.4725P_{t-1}$. Figures in ( ) are t-statistics, * in- dicates significance at the 10 per-cent level ** at the 5 per-cent level

above the restriction that $\hat{\gamma}_2$, the coefficient on the ECM in the ΔP equation could not reject the restriction that it was zero at the normal 5% significance level and hence we have constructed $\hat{\gamma}^{\perp}$ as [-0.33,0.0] [3] to calculate orthogonalized shocks were calculated as $\hat{\eta} = \hat{H}^{-1}\hat{G}\hat{e}_t$ where $\hat{H}$ was obtained by applying a Choleski decomposition to cov($\hat{G}\hat{e}_t$).

Table 4 shows the orthogonalised forecast error variance decomposition, showing what fraction of the *h*-step ahead forecast error variance can be attributed to the permanent and transitory shocks. As can be seen, and as anticipated, the results suggest that most of the variance in the growth of government expenditure is due to transitory shocks, 95% at the infinite horizon, whereas for the variance of the growth in prices the equivalent figure is under 1%. The practical implication of these results in the present case is that we are able to infer that the vast majority of the deviations from the equilibrium relationship between Government expenditure

[3] allowing it to take its value of 0.05 has little effect on the results below.

Table 4: Orthogonalized Variance Decomposition

Horizon h	$\Delta G_{t+h} - E_t\Delta G_{t+h}$ P	T	$\Delta P_{t+h} - E_t\Delta P_{t+h}$ P	T
1	0.019	0.981	1.00	0.000
2	0.042	0.958	0.9998	0.001
3	0.043	0.957	0.999	0.001
4	0.044	0.956	0.998	0.002
∞	0.051	0.949	0.997	0.003

The tables show the proportion of the variance in the h-step ahead forecast error that is attributable to the Permanent (P) and Transitory (T) shocks. Note that $\hat{\gamma}' = [-0.33, 0.0]$

and Prices (the ECM) are due to transitory shock to Government Expenditure.

This raises the interesting question of the extent to which the ECM (or the deviation of nominal government expenditure from its long run trend) is correlated with business cycle fluctuations –the a-priori expectation being that if government expenditure (both discretionary and through automatic stabilisers) works to stabilise fluctuations in GDP, the ECM would be negatively correlated with deviations of economic activity from trend. Thus for example when there is a positive deviation of output from trend we might expect Government Expenditure to fall to stabilise the level of activity. One corollary of the results above is that if we used the P-T decomposition suggested in Gonzalo and Granger (1995) what we find is that the trend component of the Price variable will dominate leaving very little cyclical fluctuation - whilst the Government Expenditure variable will show significant deviations from trend. The P-T decomposition suggested in Gonzalo and Granger (1995) decomposes the vector of series X_t into their Permanent and Transitory components as

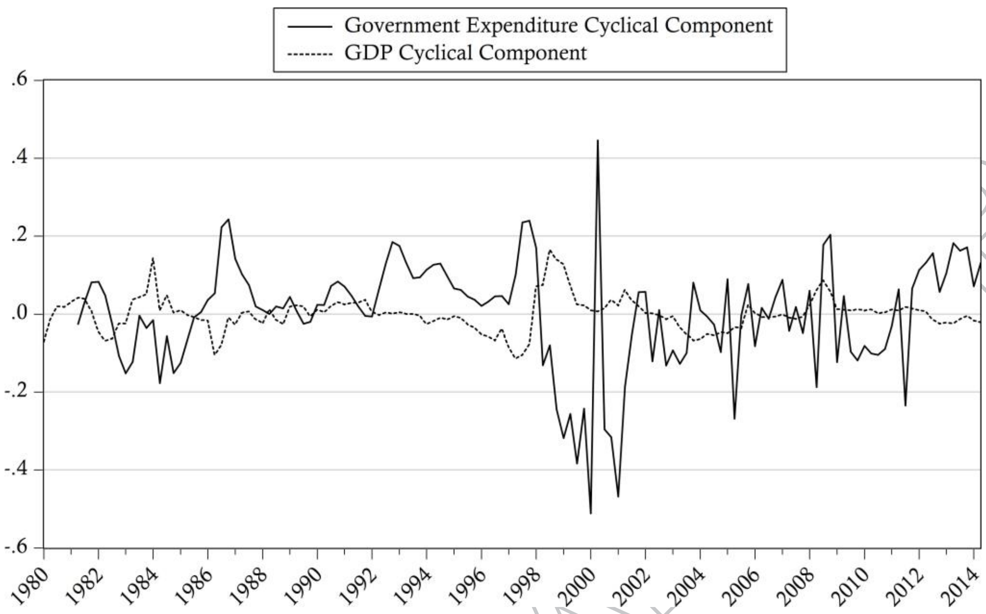
$$X_t = A_1\hat{\gamma}_{\perp}^{\prime} X_t + A_2\hat{\alpha}^{\prime} X_t \quad (1)$$

where $A_1 = \hat{\alpha}_{\perp}(\hat{\gamma}^{\prime}\hat{\alpha}_{\perp})^{-1}$ and $A_2 = \hat{\gamma}(\hat{\alpha}^{\prime}\hat{\gamma})^{-1}$.

The above discussion raises the question of the extent to which the cyclical movements in economic activity are correlated with the cyclical component of nominal expenditure as calculated above. To test this we compared the cyclical components of nominal expenditure obtained above with the cyclical component of nominal GDP which we obtained by de-trended the data using a standard Hodrick- Prescott filter, with the standard quarterly setting $\lambda = 1600$. These two cyclical components are plotted in Figure 1

What we now require is a measure of the extent to which these cyclical components are in-phase with each other, to assess if it is the case that when GDP is

Figure 1: Cyclical components for nominal Government Expenditure (from VECM) and nominal GDP (from Hodrick-Prescott filtering)



above trend government expenditure is below trend. Harding and Pagan (2006) have suggested a number of measures for testing whether the cyclical components of time series data are synchronized with each other using simple binary indicators which take the value 1 when a series in an expansionary phase and 0 when in a contractionary phase. If we denote these binary measures as S_{ge_t} and S_{gdp_t} respectively for government expenditure and GDP, then their concordance index is calculated as

$$\hat{I} = \frac{1}{T}\left\{\sum_{t=1}^{T} S_{ge_t} S_{gdp_t} + \sum_{t=1}^{T}(1 - S_{ge_t})(1 - S_{gdp_t})\right\}. \qquad (2)$$

This concordance statistic takes the value 1 when the two series are perfectly procyclical ($S_{get} = S_{gdpt}$) and zero when the two series are perfectly countercylical ($S_{get} = (1 - S_{gdpt})$) Harding and Pagan (2006) suggest using ρ_s, i.e. the correlation between S_{get} and S_{gdpt} , as a test of the null of non-synchronization between the two series. This correlation can be robustly estimated using GMM and the moment condition

$$E\left[\sigma_{S_{ge_t}}^{-1}\left(S_{ge_t} - \mu_{S_{ge_t}}\right)\sigma_{S_{gdp_t}}^{-1}\left(S_{gdp_t} - \mu_{S_{gdp_t}}\right) - \rho_S\right] = 0. \qquad (3)$$

Since both the cyclical components of nominal Government Expenditure and nominal

GDP as calculated above are mean zero it seems logical to construct the two binary indices using the simple rule that they become whenever the cyclical component is greater than 0, and 0 otherwise. Thus the measure is picking up periods when the series are above trend and periods when it is below trend. Applying this method and definitions, we find that the simple coherence index takes the value 0.355 and the correlation calculated from equation (3) is -0.2944 with a t statistic of -2.73 and a corresponding p-value of 0.007. This evidence formally proves a significant level of coherence between nominal GDP and nominal Government expenditure which is counter-cyclical in nature.

5 Conclusions

With careful implementation of time series econometric techniques on Indonesia's data, this study has contributed to the body of international evidence supporting the prevalence of Wagner's Law. This main result was obtained after developing a deep understanding of the dynamics between nominal government spending, nominal output and prices. The analysis commenced with the setup of an unrestricted VAR, which pointed at causality from output and prices into government spending, and no cointegration between government spending and output, both of which a priori support the Wagner's Law hypothesis. This results was shown to remain robust when the sample was split into two sub-samples, i.e. after and before the Asian Financial Crisis. It was however unclear whether this result could have been the outcome of discretionary fiscal policy that attenuate the business cycle possibly leaving permanent changes in the composition of output, including the level of government spending. Further analysis revealed that discretionary fiscal policy was present in the sample. This was supported by the finding of a cointegrating relationship between government spending and price fluctuations that share bidirectional causality with business cycle fluctuations over a four-quarter horizon. As suspected, this long-run stable relationship between government spending and output was found to be counter-cyclical with respect to the business cycle a finding which is not consistent with a pure automatic stabilising for fiscal policy. Further assessment of these discretionary fiscal policy interventions revealed that they overall lead to short transitory changes in government spending, and not permanent changes in it. Our results are consistent with Akitoby et al. (2006) and confirm the presence of the Wagner's Law, but with added testing that rules out permanent changes on government spending from fiscal policy. In future research, it may be interesting to conduct analysis of the presence of Wagner's Law in Indonesia with province level data, and government spending disaggregation. As the Wagner (1911) hypothesis applies sometimes to central government spending and sometimes to province government spending, this research could bring light on the decomposition of the observed overall increased share of government spending relative to output.

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Appendix

Table A1: Descriptive Statistics

	Variable		
	G: Govt. Expenditure	Y : GDP	P : GDP Deflator
Mean	10.339	12.201	-1.499
Median	10.052	12.095	-1.809
Max	13.068	14.771	0.201
Min	7.670	9.483	-3.218
Std Dev	1.624	1.606	1.516
Observations	138	138	138

Table A2: Unit Root Tests

	Variable				
	Nominal Govt. Exp	Nominal GDP	GDP Deflator	Real Govt. Exp.	Real GDP
ADF (levels)	-2.87 [0.18]	-1.63 [0.77]	-2.49 [0.33]	-5.62 [0.00]	-1.65 [0.77]
ADF (1^{st} diff.)	-19.74** [0.00]	-6.62** [0.00]	-5.97** [0.00]	-9.53** [0.00]	-10.49** [0.00]
DF-GLS (level)	-2.79 (-2.99)	-1.80 (-2.99)	-2.20 (-2.99)	-5.43** (-2.99)	-1.15 (-2.99)
DF-GLS (1^{st} diff.)	-16.39** (-1.94)	-2.12** (-1.94)	0.32** (-1.94)	0.24** (-1.94)	0.43** (-1.94)
KPSS (level)	0.40** (0.15)	0.22** (0.15)	0.32** (0.15)	0.24** (0.15)	0.43** (0.15)
KPSS (1^{st} diff.)	0.05 (0.46)	0.10 (0.46)	0.11 (0.46)	0.027 (0.46)	0.17 (0.46)

Figures in [ ] are p-values for the test statistic, figures in ( ) are 5 per-cent critical values. * indicates significant at the 10 per-cent level, ** at the 5 per-cent level

Table A3: Bi-variate cointegration test: Govt. Exp. and Price deflator

	Trace Test
Null: At most zero cointegrating vectors	15.71 9** [0.0463]
Null: At most 1 cointegrating vector	0.003 [0.952]

Figures in [ ] are p=values, * indicates significance at the 10 per-cent level ** at the 5 per-cent level

Table A4: Bi-variate cointegration test: Govt. Exp and GDP

	Trace Test
Null: At most zero cointegrating vectors	11.452 [0.1852]
Null: At most 1 cointegrating vector	0.001 [0.650]

Figures in [ ] are p=values, * indicates significance at the 10 per-cent level ** at the 5 per-cent level

Table A5: Bi-variate cointegration test: GDP and Price Deflator

	Trace Test
Null: At most zero cointegrating vectors	5.045 [0.804]
Null: At most 1 cointegrating vector	0.007 [0.339]

Figures in [ ] are p=values, * indicates significance at the 10 per-cent level ** at the 5 per-cent level

Table A6: Pairwise ARDL Bounds Testing

Variable				
Dependent	Independent	F-Stat	I(0) Bound	I(1) Bound
Govt. Expenditure	Price	9.27	4.94	5.73
Price	Govt. Expenditure	2.28	4.94	5.73
Govt. Expenditure	GDP	5.06	4.94	5.73
GDP	Govt. Expenditure	0.21	4.94	5.73
GDP	Price	0.94	4.94	5.73
Price	GDP	1.17	4.94	5.73

Table A7: Causality sensitivity analysis: Subsamples

Subsample		VAR Equation		
	Zero restrictions on:	Gov. Expenditure	Price	GDP
1980:1	Gov. Expenditure	-	1.0937 [0.3802]	2.0751 [0.0741]
1997:4	Price	0.60953 [0.7214]	-	5.6324 [0.0002]***
	GDP	0.85475 [0.5349]	2.0751 [0.0741]**	-
	Zero restrictions on:	Gov. Expenditure	Price	GDP
1998:1	Gov. Expenditure	-	0.86729 [0.5259]	1.0334 [0.4158]
2014:2	Price	2.2514 [0.0544]*	-	5.5027 [0.0002]***
	GDP	2.7811 [0.0213]**	2.0751 [0.0741]**	8.8953 [0.0000]***