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Federal legislative activism in Australia: a new approach to testing Wagner's law

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Abstract This paper considers the relationship between government growth and real GDP per capita by developing models of federal legislative output in Australia since 1901. Growth in legislation is found to be negatively related to growth in real income per capita in the short-run, implying that legislation responds to temporary economic shocks, but without a robust long-run relationship with the level of income. The growth in the number of pages of legislation enacted and legislative complexity also show a negative short-run relationship with growth in real national income per capita and a positive long-run relationship with the level of income.

Keywords Wagner's law · Australia · Legislation · Economic growth

JEL Classification D72 · D78

1 Introduction

Growth in government as a share of national income has been a stylised fact for most developed economies since the beginning of the 20th century. Buchanan's (1977: 5) taxonomy of theories of government growth divides them broadly into models of 'government by the people' and 'government against the people.' Within the former category are models suggested by Wagner's (1890) law of 'increasing state activity,' which maintains a positive relationship between the size of government and long-run economic development as proxied by real GDP per capita. Wagner's 'law' has no definitive formulation (Peacock and Scott 2000), but in empirical settings is often interpreted as an income elasticity of growth in government greater than one, thereby accounting for growth in the government share of national income over time.

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Previous efforts at testing Wagner's law have focused on the relationship between government spending or taxation and national income in both cross-sectional and time series settings (see e.g., Ram 1987; Easterly and Rebelo 1993; Oxley 1994), with mixed results. Durevall and Henrekson's (2010: 4) recent review of the literature finds that 35% of studies obtain unqualified support for Wagner's law, 35% fail to find support, while 30% find support conditioning on other variables or specific categories of government spending. Empirical tests of Wagner's law in the Australian context have been inconclusive (Dollery and Singh 2000; Chang et al. 2004). Lindert (1996) has characterised 'the notion that income growth will raise taxes and government spending, including social spending [as] the most durable black box in the whole rise-of-the-state literature.' Potential endogeneity between government spending, revenue and economic growth has been a significant complication for empirical work. There are often structural breaks in the time series for public sector accounts. Government spending and taxing may also be incomplete as a description of the size, scope and role of government.

This paper takes a new approach to the issue of government growth by developing three models of federal legislative outputs in Australia since the country's founding in 1901. Acts of federal parliament are among the most important outputs of the political process. New federal government policy initiatives and programs typically require enabling legislation, so the growth in federal legislation serves as a proxy for growth in government and may capture elements of both the size and scope of government. The models estimate the short-run and long-run relationship between legislative outputs and real GDP per capita. Since Wagner's law references the level of economic development rather than the size of the economy or population, per capita national income rather than real GDP is the appropriate measure.

Examining the relationship between national income and legislative output may assist in addressing the endogeneity problem typically encountered in the Wagner's law literature that arises from the lack of good instruments for government size. Particular legislation may help, hinder or be irrelevant to overall economic activity. A minimal amount of legislation and continuous legislative improvement is needed to define and enforce property rights and lower the transaction costs that might otherwise stand in the way of capturing the gains from trade. Excessive legislative activism, however, could be expected to raise transaction costs and rent-seeking activity, reducing national income. The difficulty in generalising about the implications of legislative outputs for economic activity is a useful property because growth in overall legislative output need not have systematic implications for real income per capita, while legislative output could be expected respond to contemporaneous or lagged income along the lines suggested by Wagner's law.

To address the endogeneity issue empirically, this paper exploits a long-run equilibrium relationship between Australian and UK real GDP per capita, reflecting their common institutional foundations, as well as Australia's integration into the world economy. Since it is unlikely that Australian legislative output would have systematic implications for UK real GDP per capita, the latter can be more reliably viewed as exogenously determined for Australian legislative output. Substituting UK for Australian real GDP per capita in the estimated models yields remarkably similar results.

This paper estimates three models that seek to explain growth in (1) the number of acts of parliament; (2) the total number of pages of legislation enacted; and (3) a measure of legislative complexity based on the annual average number of pages per act. The growth in the number of acts is found to be negatively related to growth in real GDP per capita in the short-run, but with little support for a long-run relationship with the level of real GDP per capita. This implies that the legislative process responds to temporary economic shocks, with negative shocks leading to increased legislative output. The growth in pages

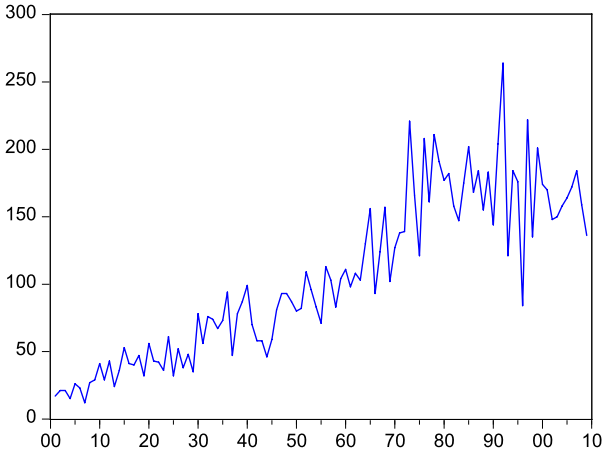

Fig. 1 Acts of federal parliament, 1901–2009. Source: Parliament of the Commonwealth of Australia (2005: 794) and as updated online (see Data Appendix)

of legislation enacted and legislative complexity also show a negative short-run relationship with growth in real national income per capita, but a positive long-run relationship with the level of income that is consistent with Wagner's law. However, the results for all three models are robust only for the post-World War II period. A concluding section considers some of the implications of these results.

2 The federal political process, legislative output and the size of government

A brief description of the federal political and legislative process is in order, as the institutions of Australian government have implications for the dynamics of growth in federal legislation (see McAllister et al. 1997 for an overview of the Australian political system). Australia has a parliamentary form of government and a federal parliament comprised of two houses. The House of Representatives has been elected on the basis of a constituency-based system since 1918. The Senate is elected via proportional representation within each state and territory. Acts of federal parliament require the support of both houses of parliament and are generally initiated by the governing party or coalition in the House of Representatives. Governments formed in the House of Representatives will often not enjoy a majority in the Senate. The division of power between the House of Representatives and Senate can result in new legislation being blocked or amended by non-government parties. Acts of parliament may represent new legislation or may amend or repeal older legislation. Some 'machinery' legislation, such as the budget appropriation bills, is required at regular intervals, but are small in number compared to the overall legislative output of parliament.

Governments formed in the House of Representatives are elected for a notional term of three years, but enjoy considerable discretion over the timing of the next general election. The variable timing of federal elections disrupts the sitting schedule of federal parliament, so election years are often characterised by reduced legislative activity relative to non-election years. Figure 1 shows the number of acts passed by federal parliament for each calendar year since 1901.

The chart shows steady growth in legislative activity from 1901 until the early 1970s, before stabilising in a very broad range. The number of pages of legislation has also increased over time, especially since the early 1970s (Fig. 2).

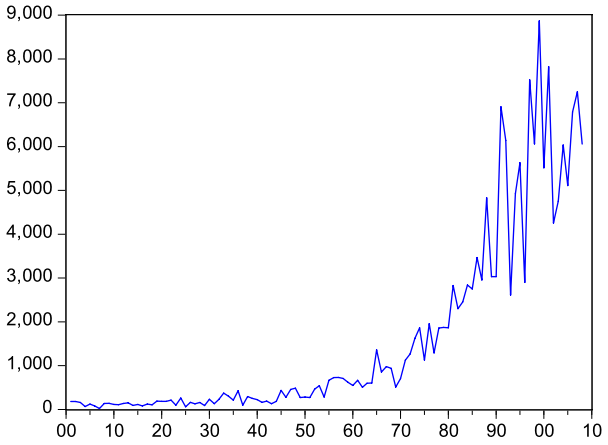

Fig. 2 Pages of federal legislation, 1901–2008. Source: Berg (2008)

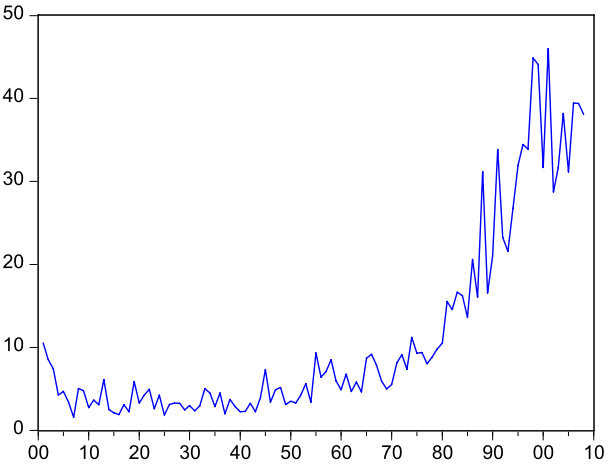

Fig. 3 Legislative complexity: Average number of pages per act, 1901–2008. Source: derived from series in Figs. 1 and 2

Dividing the number of pages of legislation enacted by the number of individual acts yields a proxy for legislative complexity, shown in Fig. 3.

Plotting the growth in legislative output against the tax share of GDP for all levels of government (Fig. 4) suggests that the former is a good proxy for growth in the size of government, having followed a similar trend. The tax share of GDP has shown more pronounced growth in war time when governments have made greater use of executive rather than legislative authority.

It might be argued that the growth in federal legislative output reflects increased centralisation of power in the hands of the federal government at the expense of other levels of government. Figure 5 plots the total number of pages of federal legislation against the total number of pages of legislation for all the mainland states (New South Wales, Victoria, Queensland, Western Australia and South Australia) over the period for which comparable data could be obtained.

Federal and state legislative output exhibit similar trends over the period for which comparable data are available, suggesting that growth in federal legislation has not substituted for state legislation.

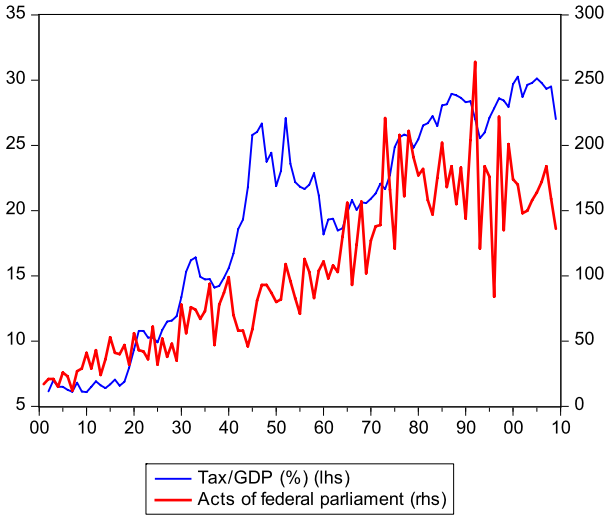

Fig. 4 General government tax revenue as a share of GDP (%) & acts of federal parliament, 1901–2009. Source: Barnard (1985) and Foster (1996)

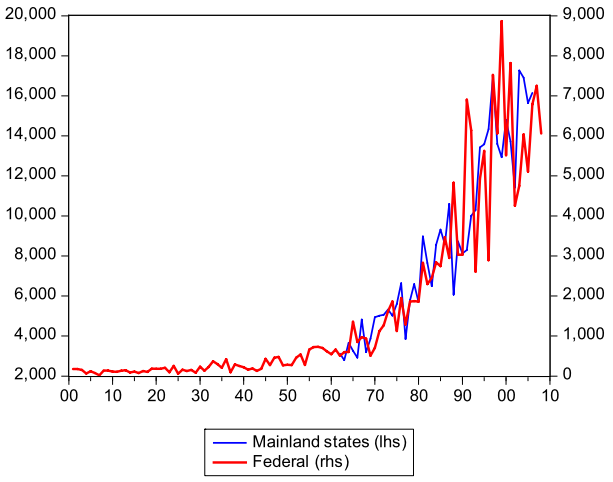

Fig. 5 Total number of pages of federal & state legislation, 1901–2008. Source: Berg (2008)

It might also be argued that legislative instruments are less important than the delegated legislation or regulations made under those instruments. Figure 6 shows the number of pages of federal statutory rules against the number of pages of federal legislation.

The growth in the number of pages of statutory rules is broadly proportional to the growth in the number of pages of legislation shown in Fig. 2 under which those rules are made, suggesting that growth in the latter can also proxy for the former.

3 Data and order of integration tests

In addition to the three measures of legislative output shown above, the following explanatory variables are used in subsequent empirical work (see Appendix for data sources):

ELECTION is a dummy variable that takes a value of one in election years and zero otherwise to account for the disruptive effect of general elections on federal legislative activity.

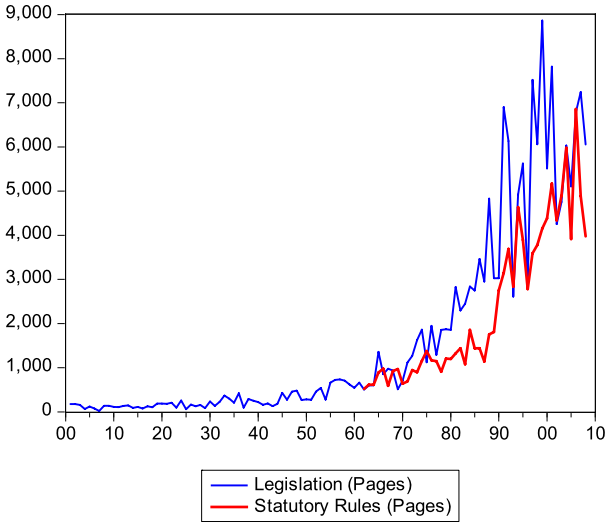

Fig. 6 Pages of federal legislation & pages of statutory rules (delegated legislation), 1901–2008. Source: Berg (2008)

hours is the log of the number of hours the House of Representatives sits in a calendar year. The number of sitting hours varies from year to year for a variety of reasons, including federal elections and so has an influence on the quantity of legislative output.
rgdp and $rgdp_{UK}$ are the log of Australian and UK real GDP per capita, respectively.
WWI and *WWII* are dummy variables that take a value of one in the years 1914–1918 and 1940–1945 respectively to capture the disruptive effect of the World Wars on legislative activity and the increased reliance on executive rather than parliamentary authority in these years.

It is necessary to test the order of integration of the dependent and explanatory variables to determine the most appropriate specification for the empirical models that follow. Table 1 shows Augmented Dickey-Fuller (ADF) tests for the order of integration for the log of new acts of parliament (*acts*), the log of the number of new pages of federal legislation enacted (*pages*) and the log of the number of pages enacted divided by the number of new acts (*complexity*), as well as federal parliamentary sitting hours (*hours*) and Australian and UK real GDP per capita, respectively (*rgdp* and $rgdp_{UK}$). Results are shown for both the full sample period and pre- and post-World War II samples. It is widely acknowledged that governments have assumed a much greater role throughout the developed world in the post-World War II period (Tanzi and Schuknecht 2000). The pre- and post-World War II samples may therefore exhibit different time series properties and may need to be modelled separately. The pre and post-World War II periods are also an obvious potential breakpoint point to test for the consistency and robustness of the estimated relationships.

The integration tests for the full sample period find that the data are I(1) in levels, although *acts, pages* and *complexity* are found to be stationary in levels with the inclusion of an exogenous trend, while *hours* is stationary in levels regardless of choice of exogenous regressors. The sub-sample tests are generally in-line with the full sample tests, although *complexity* is stationary in levels in the pre-World War II period without the inclusion of an exogenous trend. Given uncertainty about whether the data are trend or first-difference stationary, the bounds testing procedure for level relationships suggested by Pesaran et al. (2001) can be employed to test the significance of the lagged levels of the variables of interest in a conditional unrestricted error correction framework. This approach allows testing of

Table 1 Augmented Dickey-Fuller tests

Variable[(a)]	Lags[(b)]	Constant	Constant & trend
Full sample (1901–2008/09)			
acts	2/2	−2.025	−2.626
Δ*acts*	1/4	−12.977***	−8.328***
pages	2/1	−0.105	−5.384***
Δ*pages*	1/1	−12.182***	−12.198***
complexity	2/1	−0.172	−3.986**
Δ*complexity*	1/1	−11.136***	−11.383***
rgdp	2/2	0.4761	−1.844
Δ*rgdp*	1/1	−7.162***	−7.201***
$rgdp_{UK}$	1/1	0.7567	−2.549
$\Delta rgdp_{UK}$	0/0	−7.114***	−7.243***
hours	3/3	−3.977***	−4.219***
Δ*hours*	1/1	−15.724***	−15.665***
Pre-War sample (1901–1945)			
acts	1/0	−1.918	−5.763***
Δ*acts*	0/0	−12.999***	−12.963***
pages	1/0	−2.604	−6.781***
Δ*pages*	0/0	−12.380***	−12.320***
complexity	0/0	−5.292***	−5.191***
Δ*complexity*	1/1	−10.787***	−11.025***
rgdp	2/1	−1.404	−3.559**
Δ*rgdp*	1/1	−4.245***	−4.141**
$rgdp_{UK}$	2/2	−0.9267	−2.494
$\Delta rgdp_{UK}$	1/1	−4.536***	−4.470***
hours	0/0	−5.440***	−6.531***
Δ*hours*	1/1	−9.709***	−9.640***
Post-War sample (1946–2008/9)			
acts	2/2	−1.746	−1.872
Δ*acts*	1/1	−11.955***	−11.948***
pages	2/0	−0.637	−6.695***
Δ*pages*	1/1	−9.492***	−9.408***
complexity	1/0	−0.737	−5.566***
Δ*complexity*	0/0	−13.473***	−13.361***
rgdp	0/0	0.232	−2.683
Δ*rgdp*	1/1	−7.469***	−7.288***
$rgdp_{UK}$	2/1	0.154	−4.063**
$\Delta rgdp_{UK}$	1/1	−6.297***	−7.201***
hours	0/0	−7.809***	−7.744***
Δ*hours*	1/1	−11.828***	−11.720***

Notes: (a) t-tests for $\rho = 1$ in regressions of $y_t = \alpha + \rho y_{t-1} + \varepsilon_t$ and $y_t = \alpha + \beta_t + \rho y_{t-1} + \varepsilon_t$ for sample period 1900–2008 or 2009. Asterisks (***, **, *) denote statistical significance at the 1%, 5% and 10% levels, respectively. (b) Lag length for test with constant/constant and trend, chosen by SIC

long-run relationships in a manner that is robust to the order of integration of the variables and the presence of cointegrating relationships. Standard errors for the estimated long-run relationships between variables in levels can be obtained using Bårdsen's (1989) methodology. The non-standard critical values derived by Ericsson and MacKinnon (2002) can also be compared to the t-statistic on the lagged level of the dependent variable to test for cointegration under the assumption that real GDP per capita is weakly exogenous for the three measures of legislative output.

4 Empirical specification and results

Three models are estimated by least squares using data for the period from 1900 to 2009 and for pre- and post-war sub-samples (1901–1945 and 1946–2009), adjusted for lags in variables and data availability. Equation (1) takes the first-difference in the log of the number of acts passed (*acts*) as the dependent variable. Equation (2) has the first-difference of the log of the number of pages enacted (*pages*) as the dependent variable. Equation (3) takes the first-difference of the log of the average number of pages per act (*complexity*) as the dependent variable.

Equation (1) takes the following form:

$$\Delta acts_t = \alpha_0 + \alpha_1 \Delta acts_{t-1} + \alpha_2 \Delta acts_{t-2} + \alpha_3 \Delta acts_{t-3} + \alpha_4 \Delta hours_t + \alpha_5 ELECTION_t + \alpha_6 WWI_t + \alpha_7 WWII_t + \alpha_8 \Delta rgdp_{t-1} + \alpha_9 rgdp_t + \alpha_{10} acts_t + \varepsilon_t \quad (1)$$

Table 2 shows the full and sub-sample results for (1).

The lags of the dependent variable show that growth in the number of acts follows a third-order autoregressive process, which is likely driven by the three-year terms of the federal parliaments in which Australian governments are formed. An increase in the hours federal parliament sits results in an increase in the quantity of legislation passed, although this effect is not statistically or quantitatively significant in the post-World War II period. Federal election years reduce growth in the number of acts passed, consistent with their disruptive effect on the parliamentary schedule and legislative process. World Wars I and II also reduced the quantity of acts passed, reflecting the disruptive effect of the war and the increased use of executive rather than legislative authority during the war years, although the coefficient estimates are subject to large standard errors.

The coefficient on lagged growth in real GDP per capita implies that a one percent increase in real income per capita in the previous year yields a 1.8% decrease in the growth rate of acts of federal parliament in the current year, with a slightly larger estimate of 1.9% for the post-World War II period. If the annual variation in growth in real GDP per capita is mainly driven by the business cycle rather than changes in permanent income, then this result implies that growth in the number of acts passed is driven by temporary economic shocks. The estimated response is consistent with negative economic shocks leading to increased legislative enactments to insulate political constituencies against economic adversity.

The F-test for the joint significance of the lagged variables in levels exceeds the upper bound of the 5% critical values suggested by Pesaran et al.'s (2001) bounds testing procedure for the full sample period ($F_{Upper} = 4.85$) and the 1% critical values for the post-World War II sample period ($F_{Upper} = 6.36$). However, the estimated long-run relationship shows considerable parameter instability and the large standard errors on the long-run coefficient ($\theta = \alpha_9/(-\alpha_{10})$) obtained using Bårdsen's (1989) methodology argues against a robust long-run relationship between acts passed and the level of real GDP per capita. The

Table 2 Equation (1): Growth in acts of federal parliament

Variable	Full sample	Pre-war	Post-war
Constant	37.792	555.547	78.657
	(42.110)	(428.684)	(55.167)
$\Delta acts_{t-1}$	-0.670^{***}	-0.695^{**}	-0.501^{***}
	(0.126)	(0.312)	(0.117)
$\Delta acts_{t-2}$	-0.400^{***}	-0.437	-0.340^{***}
	(0.119)	(0.306)	(0.114)
$\Delta acts_{t-3}$	-0.2137^{**}	-0.341^{***}	-0.075
	(0.082)	(0.124)	(0.123)
$\Delta hours_t$	0.144^{*}	0.212^{*}	0.003
	(0.083)	(0.119)	(0.156)
$ELECTION_t$	-0.163^{***}	-0.123	-0.202^{***}
	(0.051)	(0.078)	(0.068)
WWI_t	-0.025	0.012	
	(0.071)	(0.086)	
$WWII_t$	-0.191^{*}	-0.010	
	(0.108)	(0.134)	
$\Delta rgdp_{t-1}$	-1.748^{**}	-1.096	-1.882^{*}
	(0.740)	(1.138)	(1.022)
$rgdp_{t-1}$	0.022	-0.598	0.1146
	(0.074)	(0.547)	(0.113)
$acts_{t-1}$	-0.096	-0.080	-0.352^{**}
	(0.070)	(0.148)	(0.148)
$\theta = \alpha_9/(-\alpha_{10})$	0.232	-7.508	0.326
	(0.623)	(19.552)	(5.533)
F-test of $\alpha_9 + \alpha_{10} = 0$	4.860^{**}	2.277	10.810^{***}
Adj. R^2	0.551	0.519	0.589
S.E.	22.380	27.318	18.764
JB-test	{0.00}	{0.00}	{0.90}
LM test −1st order	{0.08}	{0.71}	{0.92}
BPG-test	{0.02}	{0.32}	{0.16}

Notes: Sample period is 1905–2009. Numbers in parentheses are Newey-West HAC robust standard errors, those in braces are p-values. Asterisks (***, **, *) denote statistical significance at the 1%, 5% and 10% levels, respectively. F-test critical values based on Pesaran et al. (2001). All variables are multiplied by 100 so coefficients are in percentages

cointegration test proposed by Ericsson and MacKinnon (2002) for the null of $\alpha_{10} = 0$ is not rejected, with a p-value of 0.69 for the full sample, 0.90 for the pre-war sample and 0.26 for the post-war sample using their non-standard critical values (this test differs from the significance levels reported in the table based on standard critical values). There is not a robust long-run relationship between acts passed and the level of real GDP per capita.

Equation (2) models growth in *pages* and is given an error correction specification of the following form:

$$\Delta pages_t = \alpha_0 + \alpha_1 \Delta pages_{t-1} + \alpha_2 ELECTION_t + \alpha_3 WWI_t + \alpha_4 WWII_t + \alpha_5 \Delta rgdp_{t-1} + \alpha_6 rgdp_{t-1} + \alpha_7 pages_{t-1} + \varepsilon_t \quad (2)$$

Table 3 shows the full and sub-sample results for (2).

Table 3 Equation (2): Growth in pages of federal legislation

Variable	Full sample	Pre-war	Post-war
Constant	−888.525***	−497.509	−1018.335***
	(223.639)	(636.681)	(208.99)
$\Delta pages_{t-1}$	−0.278***	−0.322**	−0.1630*
	(0.087)	(0.135)	(0.083)
$ELECTION_t$	−0.224***	−0.232	−0.219**
	(0.080)	(0.141)	(0.084)
WWI^t	−0.368***	−0.358***	
	(0.080)	(0.105)	
$WWII_t$	−0.222**	−0.049	
	(0.085)	(0.221)	
$\Delta rgdp_{t-1}$	−3.616**	−4.069*	−2.504
	(1.436)	(1.919)	(1.761)
$rgdp_{t-1}$	1.381***	0.908	1.596***
	(0.323)	(0.753)	(0.308)
$pages_{t-1}$	−0.540***	−0.518***	−0.642***
	(0.114)	(0.186)	(0.118)
$\theta = \alpha_6/(-\alpha_7)$	2.560***	1.754	2.489***
	(0.148)	(1.49)	(0.149)
F-test of $\alpha_6 + \alpha_7 = 0$	15.513***	0.273	22.401***
Adj. R^2	0.488	0.453	0.459
S.E.	38.909	52.328	29.545
JB-test	{0.00}	{0.00}	{0.53}
LM test −1st order	{0.01}	{0.03}	{0.74}
BPG-test	{0.11}	{0.56}	{0.77}

Notes: Sample period is 1903–2009. Numbers in parentheses are Newey-West HAC robust standard errors, those in braces are p-values. Asterisks (***, **, *) denote statistical significance at the 1%, 5% and 10% levels, respectively. F-test critical values based on Pesaran et al. (2001). All variables are multiplied by 100 so coefficients are in percentages

Lagged growth in real GDP per capita has a large effect on growth in the number of pages of legislation enacted, with an estimated elasticity of −3.6% for the full sample, −4.1% for the pre-war sample and −2.5% in the post-World War II period. This is consistent with the previous model in suggesting that legislative output responds to economic shocks. In particular, there is an increase in legislative output in response to economic downturns that likely reflects an attempt to insulate political constituencies against adverse shocks. The magnitude is similar across sub-samples, although it falls short of conventional levels of statistical significance in the post-World War II period estimates.

The F-test for the joint significance of the variables in levels exceeds the upper bound for the 1% critical values derived by Pesaran et al. (2001), although only for the post-World War II period. The long-run elasticity of growth in pages enacted with respect to the level of real GDP per capita is given by $\theta = \alpha_6/(-\alpha_7)$, for which the reported standard errors are obtained using Bårdsen's (1989) methodology. The full-sample long-run elasticity is 2.6, although this result is driven by the post-World War II sample. The pre-war sample does not yield statistically significant results, but the long-run elasticity is similar to that found for the full sample. The positive long-run relationship between the level of real GDP per capita and the growth in pages enacted is consistent with Wagner's law in suggesting that legislative output is positively related to economic development, as measured by the level of real GDP per capita, with an elasticity greater than one. The cointegration test proposed

Table 4 Equation (3): Growth in complexity of federal legislation

Variable	Full sample	Pre-war	Post-war
Constant	−514.400***	459.028	−597.721***
	(94.117)	(621.745)	(195.278)
$\Delta complexity_{t-1}$	−0.443***	−0.013	−0.468***
	(0.076)	(0.192)	(0.083)
$\Delta complexity_{t-2}$	−0.187**	−0.011	−0.198*
	(0.081)	(0.122)	(0.108)
WWI_t	−0.284***	−0.413***	
	(0.107)	(0.099)	
$WWII_t$	−0.042	0.045	
	(0.177)	(0.156)	
$\Delta rgdp_{t-1}$	−1.676	−0.360	−1.173
	(1.221)	(2.702)	(1.494)
$rgdp_{t-1}$	0.658***	−0.385	0.7334***
	(0.118)	(0.700)	(0.235)
$complexity_{t-1}$	−0.397***	−1.061***	−0.363***
	(0.080)	(0.302)	(0.118)
$\theta = \alpha_5/(-\alpha_6)$	1.658***	−0.339	2.023***
	(0.222)	(0.593)	(0.314)
F-test of $\alpha_5 + \alpha_6 = 0$	16.950***	2.348	7.788***
Adj. R^2	0.416	0.481	0.402
S.E.	30.988	36.390	25.233
JB-test	{0.39}	{0.99}	{0.36}
LM test −1st order	{0.22}	{0.96}	{0.07}
BPG-test	{0.15}	{0.41}	{0.26}

Notes: Sample period is 1905–2008. Numbers in parentheses are Newey-West HAC robust standard errors, those in braces are p-values. Asterisks (***, **, *) denote statistical significance at the 1%, 5% and 10% levels, respectively. F-test critical values based on Pesaran et al. (2001). All variables are multiplied by 100 so coefficients are in percentages

by Ericsson and MacKinnon (2002) for the null of $\alpha_7 = 0$ is rejected, with a p-value of 0.00 for the full sample, 0.13 for the pre-war sample and 0.00 for the post-war sample using their non-standard critical values (this test differs from the significance levels reported in the table). This points to a long-run relationship with the level of real GDP per capita, although again, only for the post-war period.

Equation (3) models growth in *complexity* and is given an error correction specification of the following form:

$$\Delta complexity_t = \alpha_0 + \alpha_1 \Delta complexity_{t-1} + \alpha_2 WWI_t + \alpha_3 WWII_t + \alpha_4 \Delta rgdp_{t-1} + \alpha_5 rgdp_{t-1} + \alpha_6 complexity_{t-1} + \varepsilon_t \quad (3)$$

The results are shown in Table 4, for which robust standard errors are reported.

The model for legislative complexity does not show a statistically significant short-run relationship with lagged growth in real GDP per capita, although the sign and magnitude of the coefficient is not inconsistent with that found for the other two measures of legislative output. The F-test for the joint significance of the lagged variables in levels exceeds the upper bound for the one per cent critical values derived by Pesaran et al. (2001), for the full sample and the post-World War II period, but not the pre-war period. The long-run relationship between legislative complexity and the level of real GDP per capita given by

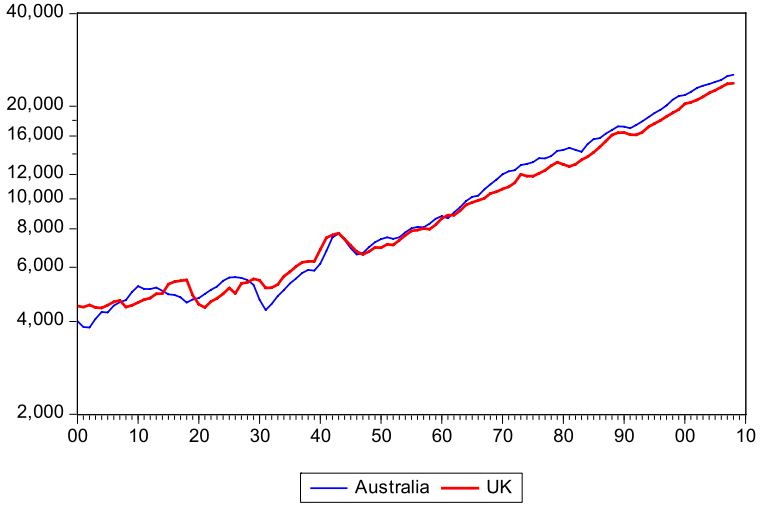

Fig. 7 Australia & UK real GDP per capita (1990 Geary-Khamis PPP dollars, log scale)

$\theta = \alpha_5/(-\alpha_6)$ has an estimated elasticity of 1.7% for the full sample period. Again, this result is driven by the post-World War II sample period, for which the elasticity is 2%. The pre-war sample period does not yield statistically significant results. The cointegration test proposed by Ericsson and MacKinnon (2002) for the null of $\alpha_6 = 0$ is rejected, with a p-value of 0.00 for the full sample, 0.03 for the pre-war sample and 0.08 for the post-war sample using their non-standard critical values (this test differs from the significance levels reported in Table 4). This points to a long-run relationship between complexity and the level of real GDP per capita, although the p-values for the sub-samples exceed the 5% significance level.

The three models of Australian legislative output can be re-estimated using UK real GDP per capita as an explanatory variable instead of Australian real GDP per capita, with the UK data serving as proxy for the level of economic development in Australia. Figure 7 shows that Australian and UK real GDP per capita begin and end the sample period at similar levels and appear to have a common trend.

More formally, results from a simple error correction model (4) with Australian real GDP per capita as the dependent variable suggest that the two series are cointegrated:

$$\Delta rgdp_t = \alpha_0 + \alpha_1 \Delta rgdp_{t-1} + \alpha_2 GD_t + \alpha_3 \Delta rgdp_{UKt-1} + \alpha_4 rgdp_{UKt-1} + \alpha_5 rgdp_{t-1} + \varepsilon_t \quad (4)$$

where GD_t is a dummy variable taking a value of one in 1929–31 during the Great Depression (when the Australian economic significantly underperformed the UK) and other variables are as previously defined. The results from (4) are shown in Table 5.

The long-run elasticity of Australian to UK real GDP per capita given by θ is close to unity at 1.06%. This can be interpreted as reflecting Australia's integration into the world economy and the common institutional arrangements in both countries that are an important driver of long-run economic development. The cointegration test proposed by Ericsson and MacKinnon (2002) for the null of $\alpha_5 = 0$ is rejected, with a p-value of 0.07 using their non-standard critical values. These results suggest that UK real GDP per capita can serve as a

Table 5 Equation (4): Growth in Australian real GDP per capita

Variable	
Constant	−5.044
	(4.966)
$\Delta rgdp_{t-1}$	0.415***
	(0.0900)
GD_{t-1}	−0.071***
	(0.016)
$\Delta rgdp_{UK_{t-1}}$	0.008
	(0.088)
$rgdp_{UK_{t-1}}$	0.125***
	(0.041)
$rgdp_{t-1}$	−0.117***
	(0.038)
$\theta = \alpha_4/(-\alpha_5)$	1.062***
	(0.041)
Adj. R^2	0.4316
S.E.	2.413

Notes: Sample period is 1902–2008. Numbers in parentheses are standard errors. Asterisks (***, **, *) denote statistical significance at the 1%, 5% and 10% levels, respectively. All variables are multiplied by 100 so coefficients are in percentages

proxy for the level of economic development in Australia. Since it is unlikely that Australian legislative outputs systematically influence the level of economic development in the UK in the long-run, UK real GDP per capita can be more reliably viewed as exogenous with respect to Australian legislative output than Australian real GDP per capita.

The coefficients in the re-estimated models have the same interpretation, although, lagged growth in UK real GDP per capita can now be viewed as the response of Australian legislative output to foreign economic shocks. As a small, open economy integrated into the world economy, foreign shocks potentially have a large influence over the domestic business cycle, so foreign GDP can proxy for short-run external shocks, as well as long-run economic development.

Table 6 shows the full and sub-sample results for (1), substituting UK for Australian real GDP per capita. The coefficient on lagged growth in UK real GDP per capita does not satisfy conventional levels of statistical significance, although the negative sign is consistent with the results obtained using the Australian data in suggesting that legislative output increases in response to adverse external shocks. The F-test for the joint significance of the lagged variables in levels exceeds the upper bound of the one percent critical values suggested by Pesaran et al.'s (2001) bounds testing procedure for the post-World War II sample period ($F_{Upper} = 6.36$). However, the estimated long-run relationship shows considerable parameter instability across sample periods and the large standard errors on the long-run coefficient ($\theta = \alpha_9/(-\alpha_{10})$) argues against a robust long-run relationship between acts passed and the level of real GDP per capita. The cointegration test proposed by Ericsson and MacKinnon (2002) for the null of $\alpha_{10} = 0$ is not rejected, with a p-value of 0.66 for the full sample, 0.60 for the pre-war sample and 0.15 for the post-war sample using their non-standard critical values. There is not a robust long-run relationship between acts passed and the level of UK real GDP per capita, consistent with results obtained using the Australian income data.

Table 6 Equation (1): Growth in acts of federal parliament

Variable	Full sample	Pre-war	Post-war
Constant	32.194	339.860	82.226
	(44.925)	(517.80)	(61.819)
$\Delta acts_{t-1}$	-0.647^{***}	-0.667^{**}	-0.468^{***}
	(0.117)	(0.293)	(0.124)
$\Delta acts_{t-2}$	-0.378^{***}	-0.375	-0.304^{***}
	(0.115)	(0.286)	(0.104)
$\Delta acts_{t-3}$	-0.2191^{**}	-0.329^{***}	-0.061
	(0.082)	(0.111)	(0.126)
$\Delta hours_t$	0.148^{*}	0.199	-0.005
	(0.084)	(0.124)	(0.165)
$ELECTION_t$	-0.156^{***}	-0.126	-0.201^{**}
	(0.052)	(0.079)	(0.077)
WWI_t	0.038	0.081	
	(0.079)	(0.101)	
$WWII_t$	-0.212^{*}	-0.082	
	(0.108)	(0.198)	
$\Delta \text{rgdp}_{UK_{t-1}}$	-0.931	-1.001	-0.274
	(0.800)	(0.813)	(1.356)
$rgdp_{UK_{t-1}}$	0.026	-0.359	0.131
	(0.074)	(0.674)	(0.111)
$acts_{t-1}$	-0.096	-0.050	-0.398^{**}
	(0.066)	(0.185)	(0.146)
$\theta = \alpha_9/(-\alpha_{10})$	0.273	-7.222	0.330
	(0.519)	(101.023)	(3.513)
F-test of $\alpha_9 + \alpha_{10} = 0$	3.435	0.599	9.489^{***}
Adj. R^2	0.532	0.502	0.569
S.E.	22.847	27.793	19.229
JB-test	{0.00}	{0.00}	{0.87}
LM test $-$1st order	{0.07}	{0.59}	{0.27}
BPG-test	{0.06}	{0.47}	{0.37}

Notes: Sample period is 1905–2009. Numbers in parentheses are Newey-West HAC robust standard errors, those in braces are p-values. Asterisks (***, **, *) denote statistical significance at the 1%, 5% and 10% levels, respectively. F-test critical values based on Pesaran et al. (2001). All variables are multiplied by 100 so coefficients are in percentages

Table 7 shows the full and sub-sample results for (2), substituting UK for Australian real GDP per capita.

Lagged growth in UK real GDP per capita has a large effect on growth in the number of pages of legislation enacted, with an estimated elasticity of -3% for the full sample, and -5% for the pre-war sample, although the results for the post-World War II period are statistically insignificant. This likely reflects the strong economic links between the Australian and UK economies in the pre-war period, which weakened in the post-war period. It is consistent with the results from the model estimated using Australian real GDP per capita in implying that legislative output responds positively to negative economic shocks, in this case, foreign economic shocks.

The F-test for the joint significance of the variables in levels exceeds the upper bound for the 1% critical values derived by Pesaran et al. (2001) for the full sample and for the post-World War II period. The long-run elasticity of growth in pages enacted with respect to

Table 7 Equation (2): Growth in pages of federal legislation

Variable	Full sample	Pre-war	Post-war
Constant	−1269.149***	−1564.691**	−1062.170***
	(209.621)	(585.447)	(267.397)
$\Delta pages_{t-1}$	−0.221**	−0.317**	−0.151
	(0.088)	(0.132)	(0.096)
$ELECTION_t$	−0.173**	−0.098	−0.220**
	(0.080)	(0.148)	(0.081)
WWI_t	−0.324***	−0.270***	
	(0.075)	(0.084)	
$WWII_t$	−0.443***	−0.506	
	(0.098)	(0.219)	
$\Delta rgdp_{UK_{t-1}}$	−2.995***	−5.025***	0.486
	(1.031)	(1.390)	(1.702)
$rgdp_{UK_{t-1}}$	1.906***	2.239***	1.641***
	(0.290)	(0.689)	(0.384)
$pages_{t-1}$	−0.688***	−0.670***	−0.640***
	(0.089)	(0.159)	(0.130)
$\theta = \alpha_6/(-\alpha_7)$	2.773***	3.341***	2.571***
	(0.132)	(1.185)	(0.168)
F-test of $\alpha_6 + \alpha_7 = 0$	38.857***	5.331	14.607***
Adj. R^2	0.5037	0.511	0.4476
S.E.	38.292	49.447	29.847
JB-test	{0.00}	{0.00}	{0.34}
LM test −1st order	{0.01}	{0.08}	{0.92}
BPG-test	{0.74}	{0.93}	{0.57}

Notes: Sample period is 1903–2009. Numbers in parentheses are Newey-West HAC robust standard errors, those in braces are p-values. Asterisks (***, **, *) denote statistical significance at the 1%, 5% and 10% levels, respectively. F-test critical values based on Pesaran et al. (2001). All variables are multiplied by 100 so coefficients are in percentages

the level of real GDP per capita is given by $\theta = \alpha_6/(-\alpha_7)$, for which the reported standard errors are obtained using Bårdsen's (1989) methodology. The full-sample long-run elasticity is 2.8, remarkably similar to that found using the Australian data. The positive long-run relationship between the level of UK real GDP per capita and the growth in pages enacted is consistent with Wagner's law in suggesting that legislative output is positively related to economic development, with an elasticity greater than one. The cointegration test proposed by Ericsson and MacKinnon (2002) for the null of $\alpha_7 = 0$ is rejected, with a p-value of 0.00 for the full sample, 0.01 for the pre-war sample and 0.00 for the post-war sample using their non-standard critical values. This points to a long-run relationship with the level of UK real GDP per capita as a proxy for the level of economic development in Australia.

Equation (3) is re-estimated substituting UK real GDP per capita for that of Australia, with results reported in Table 8.

The coefficient on lagged growth in UK real GDP per capita implies that legislative complexity increases in response to negative foreign shocks in the pre-war period, but not in the post-war period. This is consistent with the much closer economic ties between the United Kingdom and Australia during the pre-war period, when lagged growth in UK real GDP per capita would serve as a better measure of external shocks. The F-test for the joint significance of the lagged variables in levels exceeds the upper bound for the one per cent critical values derived by Pesaran et al. (2001), for the full sample and the post-World War II

Table 8 Equation (3): Growth in complexity of federal legislation

Variable	Full sample	Pre-war	Post-war
Constant	−666.900***	186.481	−701.205***
	(113.302)	(411.601)	(221.621)
$\Delta complexity_{t-1}$	−0.446***	−0.112	−0.416***
	(0.078)	(0.165)	(0.133)
$\Delta complexity_{t-2}$	−0.189**	−0.050	−0.165
	(0.0816)	(0.122)	(0.110)
WWI_t	−0.223**	−0.339***	
	(0.089)	(0.085)	
$WWII_t$	−0.126	0.009	
	(0.161)	(0.222)	
$\Delta rgdp_{UK_{t-1}}$	−1.676	−3.127*	0.007
	(1.221)	(1.616)	(1.465)
$rgdp_{UK_{t-1}}$	0.844***	−0.063	0.859***
	(0.144)	(0.470)	(0.267)
$complexity_{t-1}$	−0.466***	−1.063***	−0.411***
	(0.091)	(0.202)	(0.126)
$\theta = \alpha_5/(-\alpha_6)$	1.814***	−0.592	2.090***
	(0.148)	(0.438)	(0.290)
F-test of $\alpha_5 + \alpha_6 = 0$	27.916***	3.706	8.236***
Adj. R^2	0.4441	0.5414	0.4053
S.E.	30.219	34.219	25.159
JB-test	{0.46}	{0.90}	{0.52}
LM test -1^{st} order	{0.33}	{0.42}	{0.10}
BPG-test	{0.30}	{0.82}	{0.18}

Notes: Sample period is 1905–2008. Numbers in parentheses are Newey-West HAC robust standard errors, those in braces are p-values. Asterisks (***, **, *) denote statistical significance at the 1%, 5% and 10% levels, respectively. F-test critical values based on Pesaran et al. (2001). All variables are multiplied by 100 so coefficients are in percentages

period, but not the pre-war period. The long-run relationship between legislative complexity and the level of UK real GDP per capita given by $\theta = \alpha_5/(-\alpha_6)$ has an estimated elasticity of 1.8% for the full sample period and 2.1% for the post-war period, remarkably consistent with the results obtained with the Australian data. The pre-war sample period does not yield statistically significant results. The cointegration test proposed by Ericsson and MacKinnon (2002) for the null of $\alpha_6 = 0$ is rejected, with a p-value of 0.00 for the full sample, 0.00 for the pre-war sample and 0.05 for the post-war sample using their non-standard critical values. This points to a long-run relationship between legislative complexity and the level of UK real GDP per capita as a proxy for the level of economic development in Australia.

5 Conclusion

The results from the three models estimated in this paper imply that legislative output responds to short-run economic shocks, with the political process generally reacting to negative shocks with increased legislative activism. Given that growth in real GDP per capita is positive on average, it is difficult to account for the long-run growth in federal legislative output with reference to these short-run dynamics. The empirical results suggest that there is a positive long-run relationship between legislative output, as measured by the number of pages enacted and legislative complexity and the level of real GDP per capita. This

long-run relationship is consistent with Wagner's law of increasing state activity, which suggests that growth in government is driven by long-run trends in economic development that are captured by the level of real GDP per capita. This result was also shown to hold when substituting UK for Australian real GDP per capita, exploiting the long-run relationship between the level of economic development in the two countries. Given the implausibility of Australian legislative output determining the level of economic development in the United Kingdom, this suggests causality runs from economic development to legislative output.

While some contributions to the literature on Wagner's law have found that this long-run relationship is driven by interactions between income and the age dependency ratio (Shelton 2007), no role could be found for an Australian age dependency ratio variable in the empirical models developed in this paper. A reviewer suggested that Australian legislative output might also be influenced by the number of members of the Australian parliament, consistent with the model first developed by Weingast et al. (1981), particularly given the significant expansion of the House of Representatives in 1949. However, the size of the House of Representatives did not yield meaningful results in either of the three models estimated here.

The lack of statistical support for the long-run relationship in the pre-World War II sample places a question mark over the general applicability of these results and Wagner's law. This finding is consistent with the increased government activism observed throughout the developed world in the post-war period, but may also indicate that there is no necessary long-run historical relationship between these proxies for government growth and national income. This is consistent with the results obtained by Durevall and Henrekson (2010) for Britain and Sweden, where Wagner's law holds for specific periods in the two countries' histories, but not for others. The time frame and stage of economic development over which Wagner's law is meant to apply has not been settled by previous theoretical or empirical work. It could be that Wagner's law must attain a threshold condition for government size or scope that was not satisfied in Australia's case until after World War II. Further research could test this proposition in a cross-country setting using a similar approach to the one taken here.

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Data Appendix

Data sources are as follows:

acts is the log of the number of acts passed by the Australian federal parliament in a calendar year. Source: Parliament of the Commonwealth of Australia (2005) *House of Representatives Practice*, 5th edition, Appendix 17. Online version updated with data to 2009.

ELECTION is a dummy variable that takes a value of one in calendar years that include federal elections and zero otherwise. Sources: McAllister et al. (1997) and Barber et al. (2008).

hours is the log of the number of hours the House of Representatives sits in a calendar year. Source: Parliament of the Commonwealth of Australia (2005) *House of Representatives Practice*, 5th edition, Appendix 16. Online version updated with data to 2009.

pages is the log of the number of pages of federal legislation enacted annually. Source: Berg (2008).

rgdp and $rgdp_{UK}$ are the log of Australian and UK real GDP per capita respectively in 1990 Geary-Khamis PPP dollars. Source: Angus Maddison, Statistics on World Population, GDP and Per Capita GDP, 1-2008 AD, http://www.ggdc.net/maddison/. Accessed 29 June 2010.

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