On the Causal Relationship between Trade-openness and Government Size: Evidence from 23 OECD Countries*

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Abstract

In the literature on the effects of economic globalisation, the *compensation hypothesis* predicts a positive relationship between trade openness and the size of the public sector, as governments perform a risk mitigating role in the face of internationally generated risk and economic dislocations. Statistically, support for the compensation hypothesis should entail a positive causality running from trade-openness to government size. We use time series data – for 23 industrialised OECD countries over the 1948-1998 period – to test this hypothesis within the framework proposed by Sims and Granger. Our findings fail to provide overwhelming support for it.

Keywords: globalisation; trade-openness; government size; welfare state; causality; cointegration

JEL Classification: F15, H11, H5

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1. INTRODUCTION

In recent years economists and political scientists have increasingly focused their attention on the relationship between a country's government size in general, and its welfare state provision in particular, and its degree of international economic openness.

One of the dominant views that emerges from this literature – particularly amongst economists, see for instance Alesina and Perotti (1997) – is the so called *efficiency hypothesis* which suggests that economic globalisation inevitably strengthens the need to roll back government programmes, since: **(i)** public expenditure and the taxation necessary to finance it damage the international 'competitiveness' of national firms and industries, and **(ii)** the threat of international relocation of increasingly mobile capital, firms and jobs, undermines the revenue raising ability of governments.

This conventional wisdoms is however somewhat at odds with the concomitant occurrence of two major trends that have characterised the post World War II period, namely: **(1)** the process of international economic integration that has resulted in rapid and progressive increases in cross border flows of goods, services, capital and technology; and **(2)** the expansion of government sectors both in industrialised and in developing countries and, particularly in the former, the growing role of the state as provider of social insurance.

In his seminal contribution, Rodrik (1997a, 1998) uses cross-country data to investigate the nature of the relationship between 'trade-openness' and 'government size' – measured, respectively, by (Imports+Exports)/GDP averaged over the period 1980-1989 and Government Consumption/GDP averaged over the period 1990-1992 – and finds that there is a strong positive causation from the former to the latter. In contrast to the view that regards markets and governments as substitutes, Rodrik argues that this evidence suggests that there may be a degree of complementary between them. In particular, he suggests that the causal relationship between trade-openness and government size can be explained by what has become known as the '*compensation hypothesis*'. His basic argument is that the increased volatility brought about by growing exposure to, and dependence on, developments in the rest of the world creates incentives for government to provide social insurance against internationally generated risk and economic dislocations[1].

The aim of this paper is to go beyond the cross-country evidence and use time series data for a number of countries to further examine the link between trade-openness and

[1] Cameron (1978) was amongst the first to point to the positive relationship between openness and government size. He suggested that more open economies, due to higher rates of industrial concentration, were more likely to develop strong labour movements exerting stronger pressure on governments to provide social transfers.

government size in each country. Following Rodrik's argument, if the compensation hypothesis holds then, provided that **(i)** openness does increase exposure to external risk and **(ii)** governments do fulfil the risk mitigating role, we ought to find a positive causal relationship from trade-openness to government size. In other words when, for each country in the sample, we observe that both openness to international trade and share of government in the economy have systematically increased over time, the compensation hypothesis implies that we should also find that the former has caused the latter and not vice versa.

There are three main advantages in testing the direction of causality by using time series data for a number of individual countries. First, data are more homogenous and there is no need to control for country specific factors which account for inter-country heterogeneities – see Rodrik (1998) for an extensive list. As a result, the time-series causality tests proposed by Granger and Sims should give robust results. Second, time series data sets overcome the lack of time dimension of cross-country data, and the fact that any inference based on the latter is specific to the underlying period. This is particularly important in this context because, as Garrett (2001) argues, in so far as the relationship between trade-openness and government size is an effect of globalisation, it ought to be considered as a *process* rather than a steady state and a distinction ought to be allowed between the short-run and long-run relationships between these two variables. Using cross-country data sets, Garrett compares the results of regressions based on levels (averaged over the 1985-1995 period) with those based on changes (measured as the difference between 1970-1984 averages and 1985-1995 averages). His results confirm the importance of this distinction: whilst the regressions based on levels support Rodrik's finding that more open countries have larger governments, those based on changes indicate that government size grew less quickly in those countries in which trade-openness grew faster. This throws doubt on the robustness of Rodrik's finding. The third advantage of time series data is that it allows us to use the results derived from individual country data to obtain the response of government size to a change in degree of openness and compare this response across countries over a similar time period.

We use annual data over the period 1948-1998 for 23 OECD countries and find that data do not fully support a unique hypothesis; only for few countries in our sample do we find robust evidence for the existence of a causal relationship that is consistent with the 'risk compensation' hypothesis. These results question the universality of any single explanation of the link between the size of government and the extent of openness to trade in a country and beg a careful scrutiny of both the theoretical processes underlying such a link as well as the appropriateness of the measurements which approximate openness and government size.

Section 2 explains our data and methodology and reports the results of the causality tests. Section 3 concludes the paper. For convenience, all tables reporting the results are given at the end of the paper.

2. DATA, METHODOLOGY AND RESULTS

Data are from International Finance Statistic and Government Finance Statistic (IMF publications) and cover (with annual frequency over the period 1948-1998) the following 23 OECD countries, where the number in parentheses is our reference number for that country[2]: Australia (1), Austria (2), Belgium (3), Canada (4), Denmark (5), Finland (6), France (7), Germany (8), Greece (9), Iceland (10), Ireland (11), Italy (12), Japan (13), Luxembourg (14), Netherlands (15), New Zealand (16), Norway (17), Portugal (18), Spain (19), Sweden (20), Switzerland (21), United Kingdom (22), and United States (23).

We use the same measures of 'openness' and 'government size' as those in Rodrik (1998) and Garrett (2001), that is (Imports+Exports)/GDP and Government Consumption/GDP, henceforth denoted by X and Y respectively. To have a basic idea of how these countries compare, in Tables 1 and 2 we plot scatter diagrams using average data as that used in Rodrik's study – i.e. average Y over a number of years plotted against average X over the previous decade – for four decades: 1955-1964, 1965-1974, 1975-1984 and 1985-1994. Table 1 shows that an individual country's position over time is not immutable, as some countries have changed their position from one decade to the next. Figures in Table 2 repeat those in Table 1 but exclude Luxemburg (country No 14), which may be considered as an outlier, and add a polynomial and a linear fit which are shown by the solid and broken lines respectively[3]. These graphs clearly indicate that the nature of the relationship between openness and government size across the countries in the sample has altered over the four decades under consideration and support Garrett's concern regarding the importance of treating the effect of globalisation as a process by distinguishing between the short-run and long-run relationships.

[2] These are the industrialised countries for which data for longest common period exists.

[3] Different functional forms were tried but a 3rd order polynomial was chosen on the basis of statistical superiority. Table A in the Appendix shows how the fits are affected when Luxemburg is not excluded.

One way to accommodate Garrett's point and also test for the existence and direction of causality between openness and government size – *X* and *Y* – in each country is to use the routine bivariate vector autoregression (VAR) analysis – see, for example, Harvey (1990) and Enders (1995) for technical details. The results of the analysis are reported in Table 3, where the name and reference number of the countries are given in the first column. The second column shows the behaviour of openness and government size for each country over the 1948-1998 period and indicates that both *X* and *Y* have been growing in most countries. The rest of the columns in Table 3 give the results of VAR analysis.

Before estimating the VAR system, we used standard statistical techniques to determine the trending nature of *X* and *Y* and found that in all countries both variables are $I(1)$ and first difference stationary[4]. This confirms that, in all the countries, both openness and government size have a stochastic trend which in most cases has led to a significant and persistent growth over the sample period. Given this result, we then used the Johansen's procedure to investigate whether these two variables are cointegrated in any of the countries and found that the hypothesis of existence of a cointegration between *Y* and *X* could not be rejected only in a small number of countries. The result of cointegration tests are shown in the first line in column three of Table 3, where for those countries for which cointegration cannot be rejected we also give the estimated coefficient, i.e. $\left(Y_t - \hat{\theta} X_t\right) \sim I(0)$ where $\hat{\theta}$ is the coefficient estimated by applying Johansen's decomposition.

We then proceeded to test for Granger causality as follows. In the absence of cointegration, we estimated the unrestricted VAR below

$$\begin{aligned} \Delta Y_t &= \sum_{i=1}^{q}\left(\alpha_i \Delta Y_{t-i} + \beta_i \Delta X_{t-i}\right) + U_t, \\ \Delta X_t &= \sum_{i=1}^{q}\left(\gamma_i \Delta Y_{t-i} + \phi_i \Delta X_{t-i}\right) + V_t, \end{aligned} \qquad \textbf{(1)}$$

where Δ is the first difference operator, *U* and *V* are random disturbances, $(\alpha_i, \beta_i, \gamma_i, \phi_i)$ are the parameters to be estimated and *q* is the appropriate lag-length chosen on the basis of various information criteria (not reported in the paper). The rejection (non-rejection) of the joint hypothesis $\beta_i = 0, \quad i = 1, ..., q$ leads to concluding that *X* causes (does not cause) *Y* and

[4] These and the subsequent test results are not reported in the paper but are available on request from the authors.

is shown in column three of Table 3 by "$X \Rightarrow Y$ through ΔX_{t-i} only" ("$X \not\Rightarrow Y$"). Also, the rejection (non-rejection) of the joint hypothesis $\gamma_i = 0, \quad i = 1,...,q$ leads to concluding that *Y* causes (does not cause) *X* and is shown in column three of Table 3 by "$Y \Rightarrow X$ through ΔY_{t-i} only" ("$Y \not\Rightarrow X$").

In those cases where *Y* and *X* did cointegrate, we estimated the Error Correction version of the VAR, namely

$$\begin{aligned} \Delta Y_t &= \sum_{i=1}^{q} \left(\alpha_i \Delta Y_{t-i} + \beta_i \Delta X_{t-i} \right) + \eta_y ECT_{t-1} + U_t, \\ \Delta X_t &= \sum_{i=1}^{q} \left(\gamma_i \Delta Y_{t-i} + \phi_i \Delta X_{t-i} \right) + \eta_x ECT_{t-1} + V_t, \end{aligned} \qquad \textbf{(2)}$$

where all notation are as in the equations in (1) and *ECT* denotes the residual from the cointegration equation whose effect on *Y* and *X* is captured by the coefficients η_y and η_x respectively. Clearly, in this situation a number of possibilities exist. In the case of testing for causation from *X* to *Y*: **(i)** *X* does not cause *Y* if η_y is insignificant and we cannot reject the joint hypothesis $\beta_i = 0, \quad i = 1,...,q$; and **(ii)** *X* causes *Y* if either η_y is significant, or we reject the joint hypothesis $\beta_i = 0, \quad i = 1,...,q$, or both. By the same token, when testing for causation from *Y* to *X*: **(iii)** *Y* does not cause *X* if η_x is insignificant and we cannot reject the joint hypothesis $\gamma_i = 0, \quad i = 1,...,q$; and **(iv)** *Y* causes *X* if either η_x is significant or we reject the joint hypothesis $\gamma_i = 0, \quad i = 1,...,q$, or both. The notation used in column three of Table 3 corresponding to the above cases is as follows:

(i) "$X \not\Rightarrow Y$";

(ii) either "$X \Rightarrow Y$ through both ΔX_{t-i} & ECT_{t-1}", or "$X \Rightarrow Y$ through ΔX_{t-i} only", or "$X \Rightarrow Y$ through ECT_{t-1} only";

(iii) "$Y \not\Rightarrow X$";

(iv) either "$Y \Rightarrow X$ through both ΔY_{t-i} & ECT_{t-1}", or "$Y \Rightarrow X$ through ΔY_{t-i} only", or "$Y \Rightarrow X$ through ECT_{t-1} only".

In addition to checking for Granger causality from *X* to *Y* and vice versa, we also carried out a version of Sims' causality test by investigating the extent of correlation between the residuals of the *ARIMA* models fitted to *X* and *Y* (regressions are not reported here).

Denoting these residuals by x and y and the correlation coefficient by ρ, we calculated the correlations between lagged, current and future x and y, denoted respectively by $\hat{\rho}_{(x_{-1},y)}$, $\hat{\rho}_{(x,y)}$ and $\hat{\rho}_{(x_{+1},y)}$ in column three of Table 3. These correlations provide a measure of causation from past X to current Y, instantaneous causation between X and Y, and causation from Y to future X (or from past Y to current X), respectively. On the null hypothesis $\rho = 0$, the estimator $\hat{\rho} \overset{a}{\sim} N(0,1/T)$, where T is the number of observations. Given the sample size used, $\rho = 0$ can be safely rejected at 5% critical level if $|\hat{\rho}| > 0.29$.

A few points are worth highlighting. First, the results of the causality tests are far from supporting a universal hypothesis: **(i)** only 3 out of 23 countries – Japan, Norway and the UK – satisfy the relationship between trade-openness and government size which is consistent with Rodrik's findings; **(ii)** in 6 countries – Denmark, Finland, Germany, Italy, Portugal and USA – the causality runs from government size to trade-openness; **(iii)** of the 5 countries which exhibit instantaneous causality between the two variables – Belgium, Greece, Italy, Portugal and Sweden – only Greece and Portugal show a positive relationship between trade-openness and government size; **(iv)** in 5 countries – Australia, Austria, Canada, Luxemburg and New Zealand – the causality runs in both directions; and finally **(v)** in 6 of the countries – France, Iceland, Ireland, Netherlands, Spain and Switzerland – we have been unable to find any indication of significant interaction between trade-openness and government size.

Second, regardless of the direction of causality, the distinction between the short-run and long-run nature of the relationship between the two variables, as emphasised by Garrett (2001), seems to be very relevant. Within the time series context, given that in all of the countries considered both trade-openness and government size are first difference stationary, the existence of a long-run relationship between these variables will manifest itself through cointegration between their levels. Only for five of the countries – Australia, Austria, Denmark, Luxembourg and N. Zealand – we could not reject the existence of a cointegration relationship and in all cases the coefficient estimates suggest the existence of a plausible positive long-run relationship between trade-openness and government. However, in none of these countries does the direction of causality conform to Rodrik's compensation hypothesis. As Rodrik himself points out, exposure to trade could be the result of government policy and it is possible that this is what our analysis is capturing.

Third, a clear indication of a negative causation, e.g. a negative and significant instantaneous causality as in Belgium, Italy and Sweden, could suggest that the effect of the factors underlying the efficiency hypothesis dominates those underlying the compensation hypothesis.

Forth, the fact that only 5 out of 23 countries favour the existence of a long-run relationships strengthens Garrett's point that the link between openness and government size should be seen as a dynamic process and therefore may not be best captured by static regressions based on cross-country data which is averaged over a number of years. Garrett's approach, however, is to replace the levels with changes but still maintain a single data point for each country in the sample. Our results show that the dynamics of the relationship between trade-openness and government size varies considerably across countries. In order to provide some indication of the magnitude and pattern of the effect of these variables on each other within the VAR framework, in the last two columns of Table 3 we plot the accumulated responses of ΔY (or Y) and ΔX (or X) to a unit impulse to ΔX (or X) and ΔY (or Y)[5]. For each country, these graphs are based on the multipliers obtained from the estimated coefficients of the general VAR system – which we have used to construct the test statistics for Granger causality, reported in column three – and hence disregard the results of the causality tests. They should therefore be interpreted *as if* a two-way Granger causality between X on Y existed and are useful for a preliminary investigation, in different countries, of: **(i)** how rapidly the effects of the shocks settle; **(ii)** whether these effects are in the same or in the opposite direction; and **(iii)** how the magnitude of the effect of a unit shock to X on Y compares to that of Y on X. On the whole, it is clear that countries differ in this respect and disregarding these differences and simply representing each country in the panel by one data point could severely bias the results.

3. CONCLUSION

The analysis carried out in this paper fails to provide an overwhelming support for a positive causality from international trade openness to the size of the government sector. An extreme conclusion that can be drawn from these results is a refusal of the universal validity of the 'compensation hypothesis'. Alternatively, these finding could simply be taken to suggest that *trade* openness is not the main force driving the (risk-mitigating) growth in the size of

[5] We have chosen a unit shock in order to make the results comparable both between the two variables in a country and across different countries for the same variable. Note that the shock affects the level when the variables cointegrate.

governments. Despite Rodrik's (1998) suggestion that increasing openness in capital and financial markets, by constraining the revenue raising ability of governments, undermines the positive relationship between government size and openness, some have argued that capital mobility is associated with more public spending (Quinn, 1997). Thus, the bivariate VAR may not be strictly suitable in that the past values of trade openness and government expenditure may not provide the appropriate information set on the basis of which the compensation hypothesis could be verified and we would need to expand the system to include the additional relevant variables. Along similar lines, it could be the case that government consumption may not be the most relevant component of government budget which responds to openness. For instance, it could be argued that – particularly for mature industrial economies – a more suitable measure is welfare spending. However, time series data on capital mobility, FDI and components of government budget do not exist for a sufficiently long period for individual countries and further research ought to use the panel – pooled time series cross section – approach.

As Rodrik points out, a direct test of the compensation hypothesis is to examine whether openness raises exposure to risk – reflected, for instance, in an increase in consumption volatility and uneven income distribution – which is then dampened by a larger government size. Again, availability of time series data for individual countries is an obstacle and our parallel research on these issues relies on the panel approach. Our preliminary results in this direction in fact indicate that other variables have a significant role to play and that the compensation hypothesis may not be the main or the sole factor underlying the growth of government size[6].

[6] One direction that is worth investigation is the suggested link between government size and the extent, depth and composition of industrialisation as new sectors displace the more traditional ones in the economy – see Iversen and Cusack (2000) and Iversen (2001) for an exposition.

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Table 1. Relationship between trade-openness and government size over four decades in 23 OECD countries

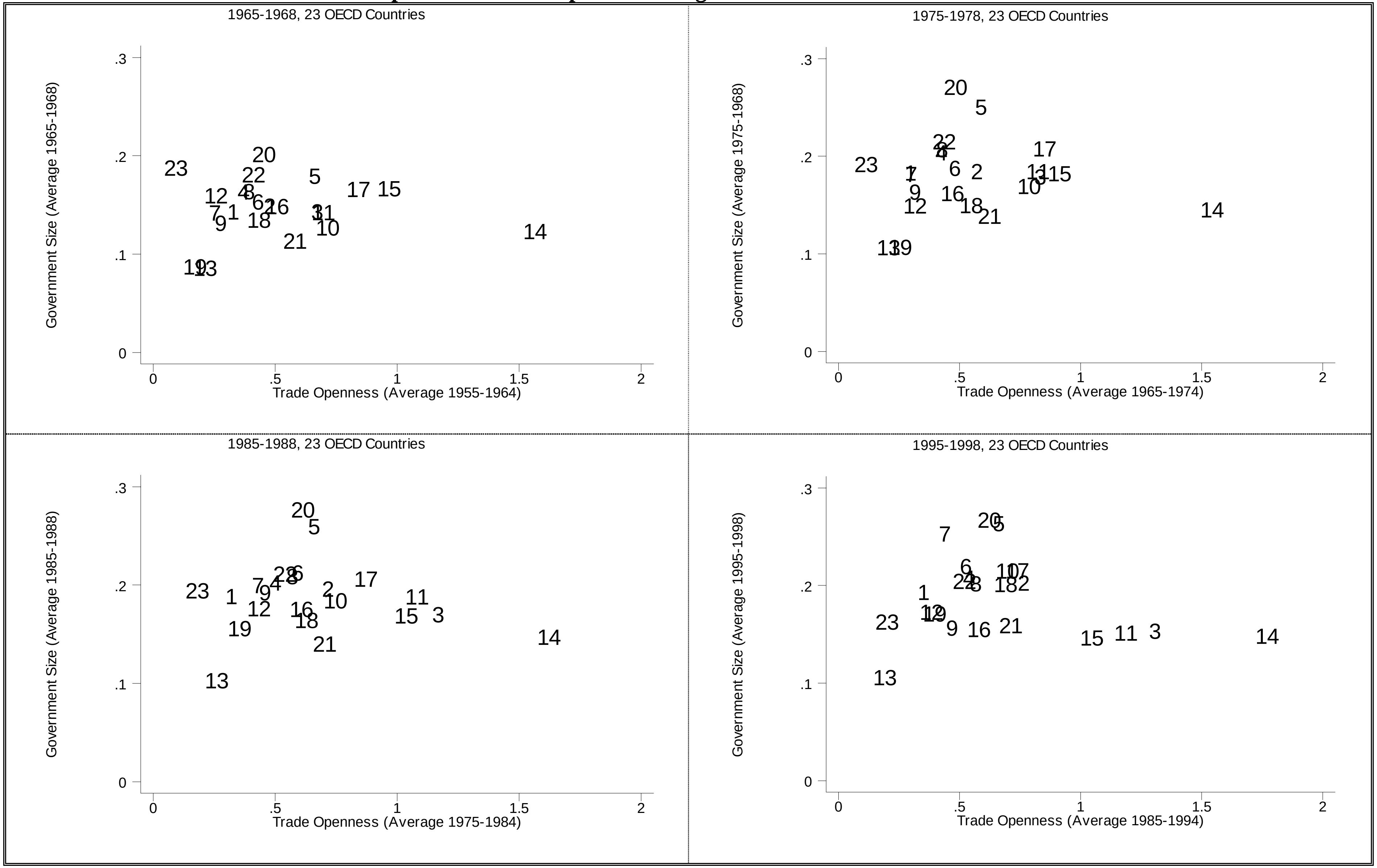
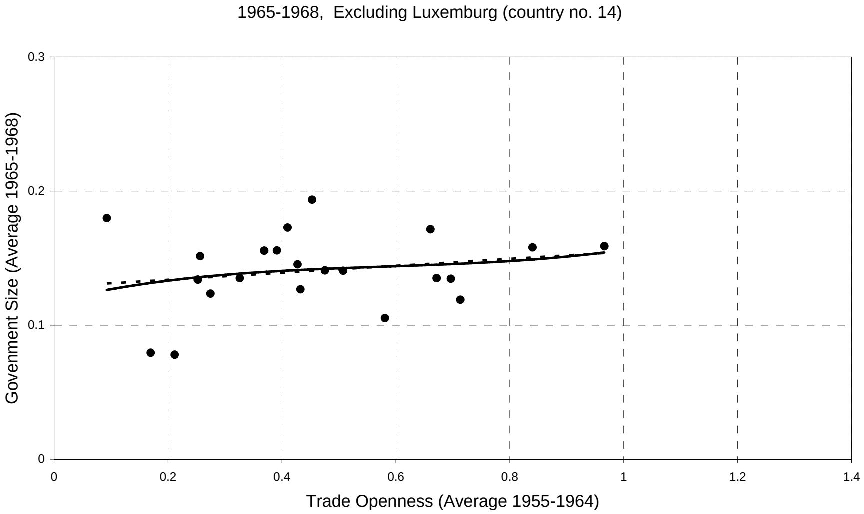
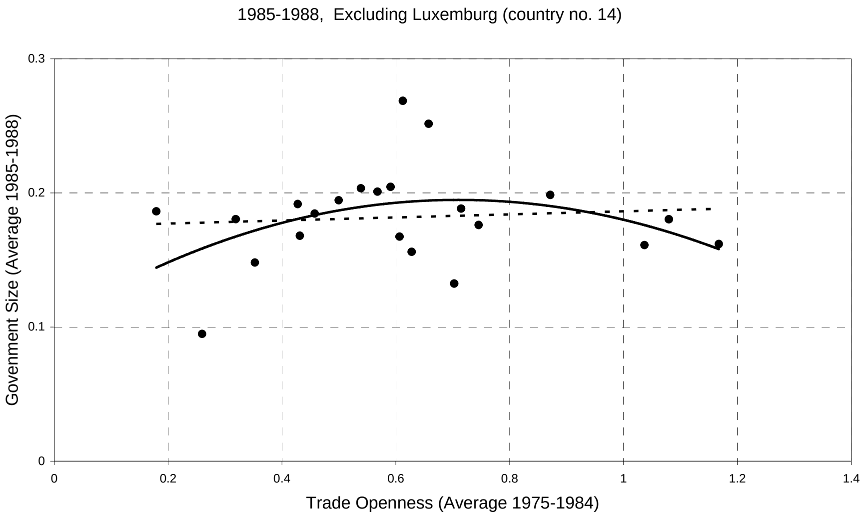


Table 2. Relationship between trade-openness and government size over four decades in 22 OECD countries

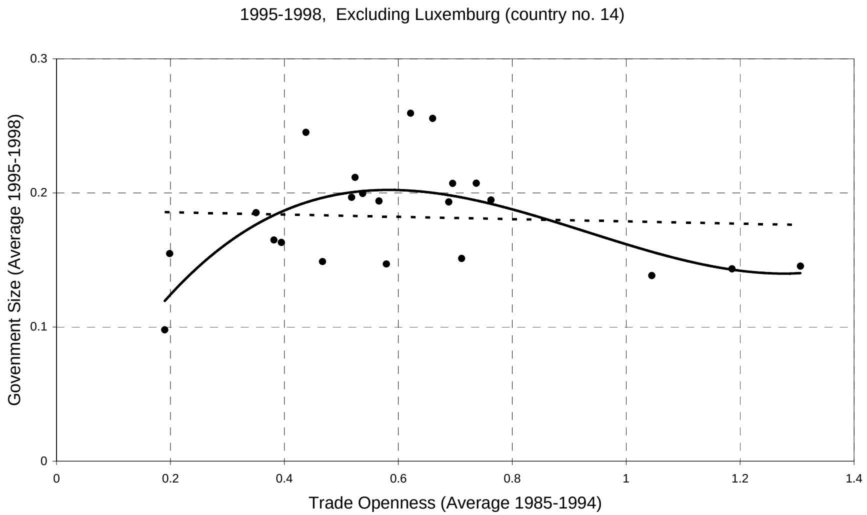


solid line: $Y_t = \hat{a} + \hat{b}\,X_t + \hat{c}\,X_t^2 + \hat{d}\,X_t^3$ broken line: $Y_t = \hat{a} + \hat{b}\,X_t$

solid line: $Y_t = \hat{a} + \hat{b}\,X_t + \hat{c}\,X_t^2 + \hat{d}\,X_t^3$ broken line: $Y_t = \hat{a} + \hat{b}\,X_t$

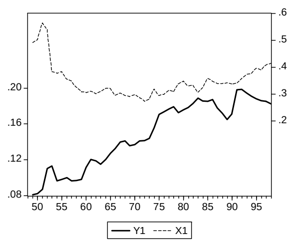
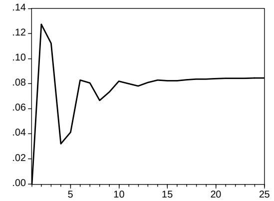
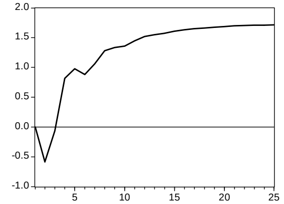
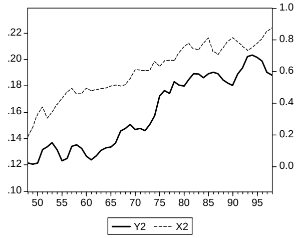
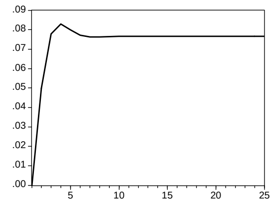
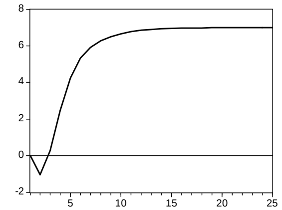
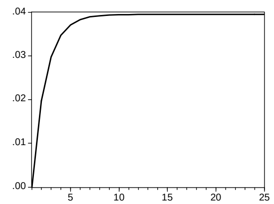
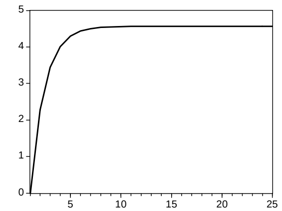


solid line: $Y_t = \hat{a} + \hat{b}\,X_t + \hat{c}\,X_t^2 + \hat{d}\,X_t^3$ broken line: $Y_t = \hat{a} + \hat{b}\,X_t$



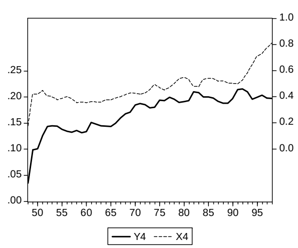
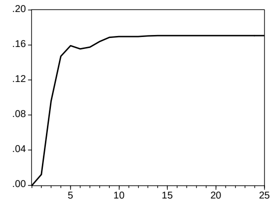
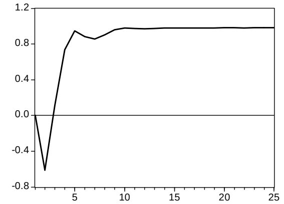
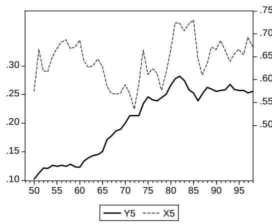
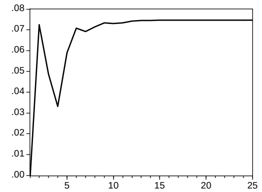
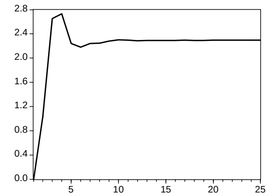
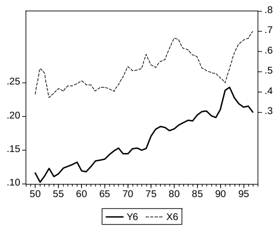
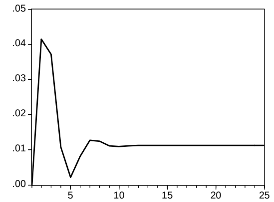
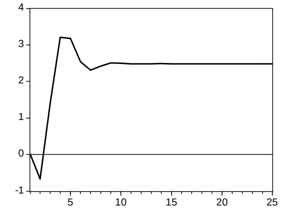
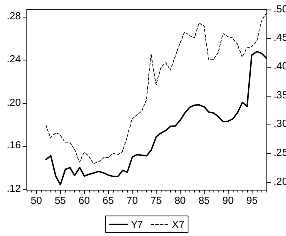
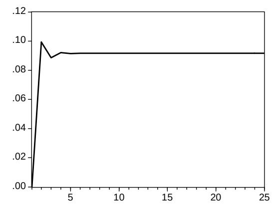
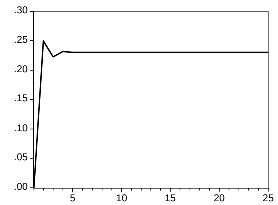
solid line: $Y_t = \hat{a} + \hat{b}\,X_t + \hat{c}\,X_t^2 + \hat{d}\,X_t^3$ broken line: $Y_t = \hat{a} + \hat{b}\,X_t$

Table 3. Causality Analysis of the Relationship between Trade-Openness and Government Size in 23 OECD Countries

Australia (1)	sample: 1949-1998 	**Cointegration:** $(Y_t - 0.64X_t) \sim I(0)$ **Causality:** $X \Rightarrow Y$ through ΔX_{t-i} only $Y \Rightarrow X$ through ECT_{t-1} only $\hat{\rho}_{(x_{-1},y)} = .333$; $\hat{\rho}_{(x,y)} = -.003$; $\hat{\rho}_{(x_{+1},y)} = -.131$	Response of Y to a shock to X 	Response of X to a shock to Y 
Austria (2)	sample: 1948-1998 	**Cointegration:** $(Y_t - 0.190X_t) \sim I(0)$ **Causality:** $X \Rightarrow Y$ through ECT_{t-1} only $Y \Rightarrow X$ through both ΔY_{t-i} & ECT_{t-1} $\hat{\rho}_{(x_{-1},y)} = .200$; $\hat{\rho}_{(x,y)} = -.236$; $\hat{\rho}_{(x_{+1},y)} = -.113$	Response of Y to a shock to X 	Response of X to a shock to Y 
Belgium (3)	sample: 1953-1997 	**Cointegration:** None **Causality:** $X \not\Rightarrow Y$ $Y \not\Rightarrow X$ $\hat{\rho}_{(x_{-1},y)} = .080$; $\hat{\rho}_{(x,y)} = -.491$; $\hat{\rho}_{(x_{+1},y)} = .214$	Response of ΔY to a shock to ΔX 	Response of ΔX to a shock to ΔY 

(i) The number in parentheses after the country name in column 1 is the reference number of the country, used in Figures in Table 1. **(ii)** For each country (j), the figure in column 2 depicts openness – *Xj* =(Imports+Expots)/GDP – and government size – *Yj* =Government Consumption/GDP – using independent scales measured on the right and the left axes, respectively. **(iii)** In the third column, $X \Rightarrow Y$ ($Y \Rightarrow X$) denotes the existence of Granger causation from *X* to *Y* (*Y* to *X*) and $\not\Rightarrow$ indicates the lack of such causation. *ECT* is the error correction term. $\hat{\rho}_{(x_{-1},y)}$, $\hat{\rho}_{(x,y)}$ and $\hat{\rho}_{(x_{+1},y)}$ are the estimated correlation coefficients between the residuals of *ARIMA* models fitted to *X* and *Y*, denoted by *x* and *y*, and correspond to Sims' concept of causality. If statistically significant, these respectively indicate causation from past *X* to current *Y*, instantaneous causation between *X* and *Y*, or causation from past *Y* to current *X*. The 5% critical value of ρ is ±0.29. **(iv)** The figures in the last two columns are the accumulated response of *Y* and *X* to a one unit shock to *X* and *Y* using the underlying general VAR specification. They give an indication of the way a change in one of the variables affects the other variable regardless of the causality tests.

Table 3 continued

Canada (4)	sample: 1948-1998 	**Cointegration:** None **Causality:** $X \Rightarrow Y$ through ΔX_{t-i} only $Y \Rightarrow X$ through ΔY_{t-i} only $\hat{\rho}_{(x_{-1},y)} = -.118$; $\hat{\rho}_{(x,y)} = -.226$; $\hat{\rho}_{(x_{+1},y)} = -.113$	Response of ΔY to a shock to ΔX 	Response of ΔX to a shock to ΔY 
Denmark* (5)	sample: 1950-1998 	**Cointegration:** $(Y_t - 0.435X_t) \sim I(0)$ **Causality:** $X \not\Rightarrow Y$ $Y \Rightarrow X$ through ECT_{t-1} only $\hat{\rho}_{(x_{-1},y)} = -.103$; $\hat{\rho}_{(x,y)} = -.089$; $\hat{\rho}_{(x_{+1},y)} = -.145$	Response of Y to a shock to X 	Response of X to a shock to Y 
Finland (6)	sample: 1950-1997 	**Cointegration:** None **Causality:** $X \not\Rightarrow Y$ $Y \Rightarrow X$ through ΔY_{t-i} only $\hat{\rho}_{(x_{-1},y)} = -.154$; $\hat{\rho}_{(x,y)} = -.207$; $\hat{\rho}_{(x_{+1},y)} = .014$	Response of ΔY to a shock to ΔX 	Response of ΔX to a shock to ΔY 
France (7)	sample: 1950-1998 	**Cointegration:** None **Causality:** $X \not\Rightarrow Y$ $Y \not\Rightarrow X$ $\hat{\rho}_{(x_{-1},y)} = .249$; $\hat{\rho}_{(x,y)} = -.084$; $\hat{\rho}_{(x_{+1},y)} = -.109$	Response of ΔY to a shock to ΔX 	Response of ΔX to a shock to ΔY 

* The results for Denmark are obtained by including a dummy for period 1950-1970 to account for the difference in pre and post 1970 behaviour.

Table 3 continued

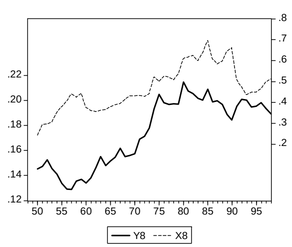
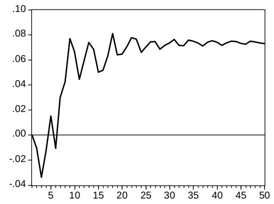
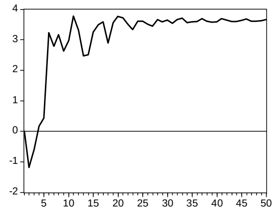
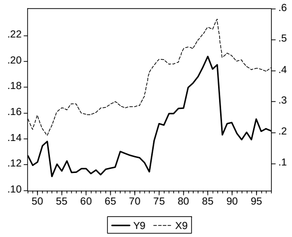
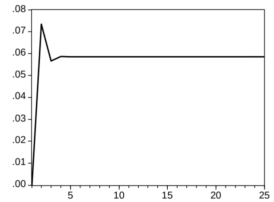
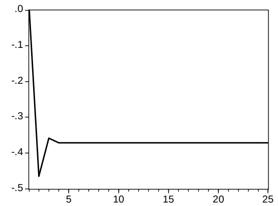
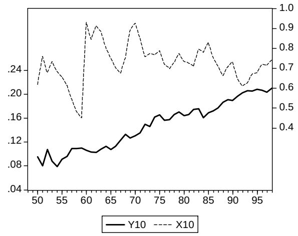
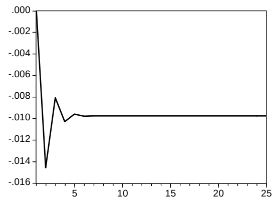
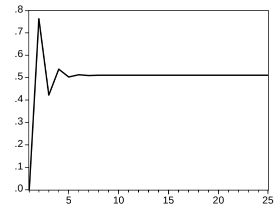
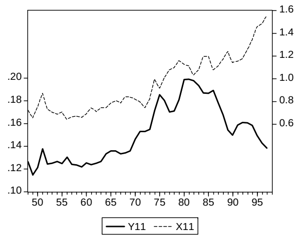
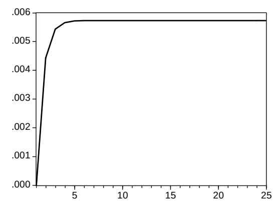
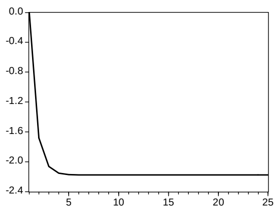
Germany (8)	sample: 1950-1998 	**Cointegration:** None **Causality:** $X \not\Rightarrow Y$ $Y \Rightarrow X$ through ΔY_{t-i} only $\hat{\rho}_{(x_{-1},y)} = -.185$; $\hat{\rho}_{(x,y)} = .043$; $\hat{\rho}_{(x_{+1},y)} = -.116$	Response of ΔY to a shock to ΔX 	Response of ΔX to a shock to ΔY 
Greece (9)	sample: 1948-1998 	**Cointegration:** None **Causality:** $X \not\Rightarrow Y$ $Y \not\Rightarrow X$ $\hat{\rho}_{(x_{-1},y)} = .073$; $\hat{\rho}_{(x,y)} = .415$; $\hat{\rho}_{(x_{+1},y)} = -.166$	Response of ΔY to a shock to ΔX 	Response of ΔX to a shock to ΔY 
Iceland (10)	sample: 1950-1998 	**Cointegration:** None **Causality:** $X \not\Rightarrow Y$ $Y \not\Rightarrow X$ $\rho_{(x_{-1},y)} = -.251$; $\hat{\rho}_{(x,y)} = -.195$; $\hat{\rho}_{(x_{+1},y)} = -.016$	Response of ΔY to a shock to ΔX 	Response of ΔX to a shock to ΔY 
Ireland (11)	sample: 1948-1997 	**Cointegration:** None **Causality:** $X \not\Rightarrow Y$ $Y \not\Rightarrow X$ $\hat{\rho}_{(x_{-1},y)} = .265$; $\hat{\rho}_{(x,y)} = -.105$; $\hat{\rho}_{(x_{+1},y)} = -.134$	Response of ΔY to a shock to ΔX 	Response of ΔX to a shock to ΔY 

Table 3 continued

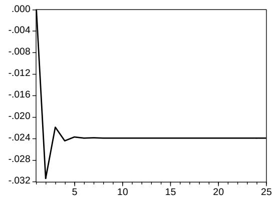
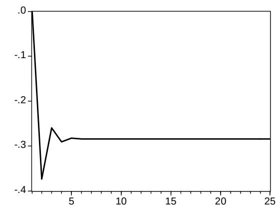
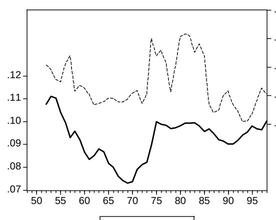
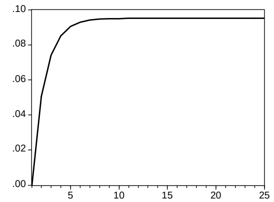
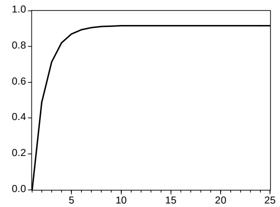
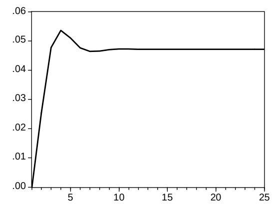
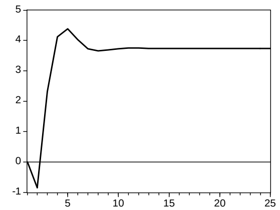
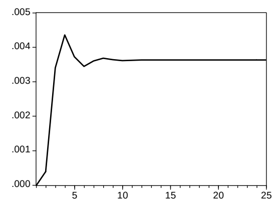
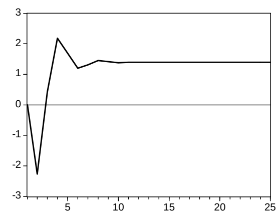
Italy (12)	sample: 1951-1997  	**Cointegration:** None **Causality:** $X \nRightarrow Y$ $Y \nRightarrow X$ $\hat{\rho}_{(x_{-1},y)} = -.014;\ \hat{\rho}_{(x,y)} = -.333;\ \hat{\rho}_{(x_{+1},y)} = -.302$	Response of ΔY to a shock to ΔX 	Response of ΔX to a shock to ΔY 
Japan (13)	sample: 1952-1998  	**Cointegration:** None **Causality:** $X \Rightarrow Y$ through ΔX_{t-i} only $Y \nRightarrow X$ $\hat{\rho}_{(x_{-1},y)} = .410;\ \hat{\rho}_{(x,y)} = -.062;\ \hat{\rho}_{(x_{+1},y)} = .137$	Response of ΔY to a shock to ΔX 	Response of ΔX to a shock to ΔY 
Luxembourg (14)	sample: 1950-1997  	**Cointegration:** $(Y_t - 0.15X_t) \sim I(0)$ **Causality:** $X \Rightarrow Y$ through ECT_{t-1} only $Y \Rightarrow X$ through both ΔY_{t-i} & ECT_{t-1} $\hat{\rho}_{(x_{-1},y)} = .186;\ \hat{\rho}_{(x,y)} = -.268;\ \hat{\rho}_{(x_{+1},y)} = -.051$	Response of Y to a shock to X 	Response of X to a shock to Y 
Netherlands (15)	sample: 1950-1998  	**Cointegration:** None **Causality:** $X \nRightarrow Y$ $Y \nRightarrow X$ $\hat{\rho}_{(x_{-1},y)} = -.107;\ \hat{\rho}_{(x,y)} = .169;\ \hat{\rho}_{(x_{+1},y)} = -.217$	Response of ΔY to a shock to ΔX 	Response of ΔX to a shock to ΔY 

Table 3 continued

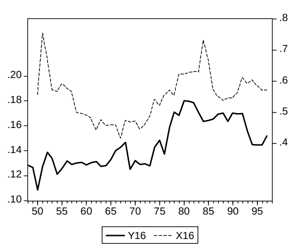
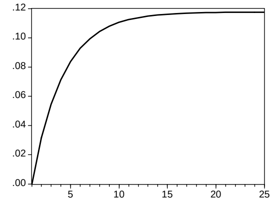
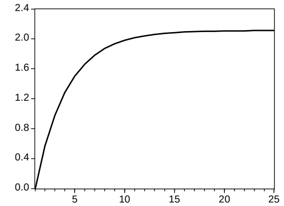
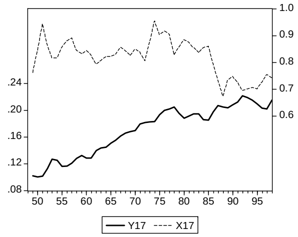
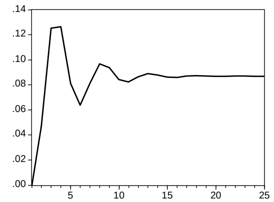
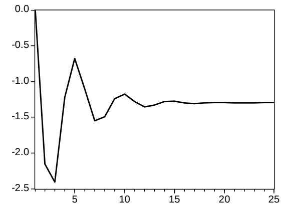
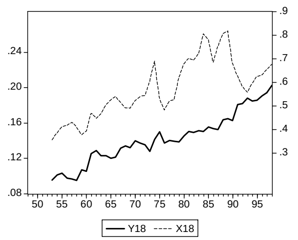
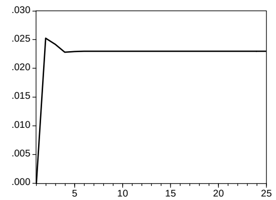
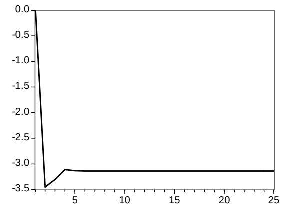
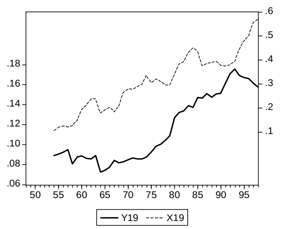
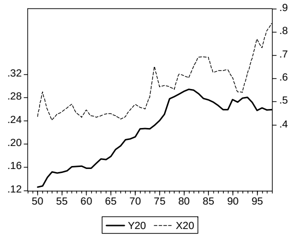
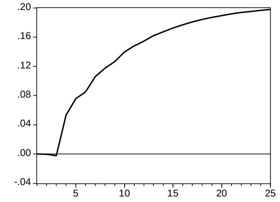
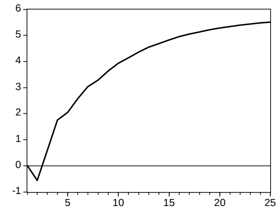
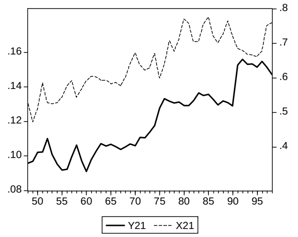
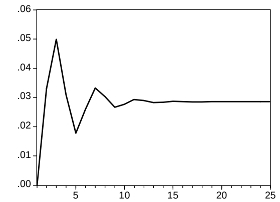
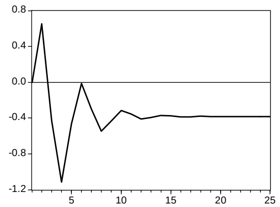
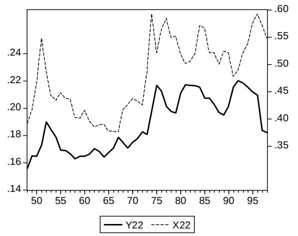
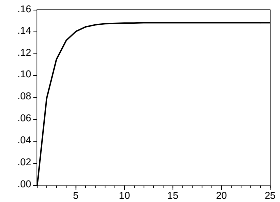
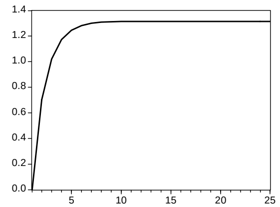
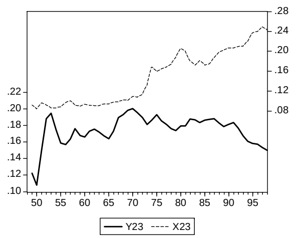
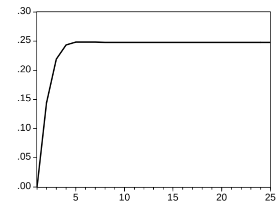
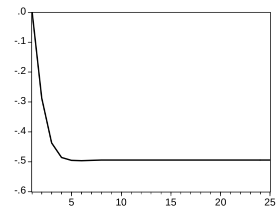
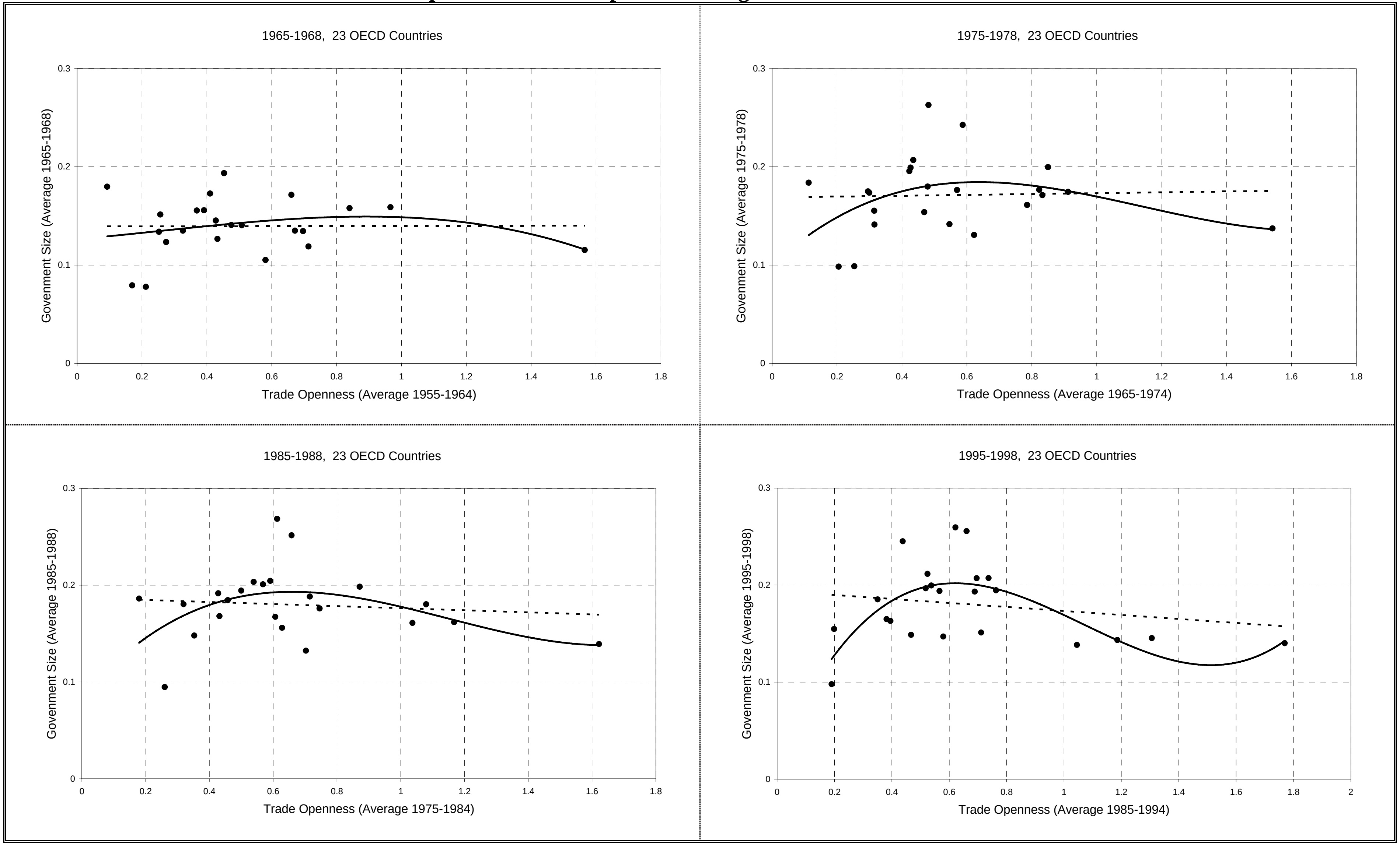
N. Zealand (16)	sample: 1950-1997 	**Cointegration:** $\left(Y_t - 0.27X_t\right) \sim I(0)$ **Causality:** $X \Rightarrow Y$ through ECT_{t-1} only $Y \Rightarrow X$ through ECT_{t-1} only $\hat{\rho}_{(x_{-1},y)} = -.036$; $\hat{\rho}_{(x,y)} = -.014$; $\hat{\rho}_{(x_{+1},y)} = -.057$	Response of Y to a shock to X 	Response of X to a shock to Y 
Norway (17)	sample: 1949-1998 	**Cointegration:** None **Causality:** $X \Rightarrow Y$ through ΔX_{t-i} only $Y \not\Rightarrow X$ $\rho_{(x_{-1},y)} = .224$; $\rho_{(x,y)} = -.274$; $\rho_{(x_{+1},y)} = -.064$	Response of ΔY to a shock to ΔX 	Response of ΔX to a shock to ΔY 
Portugal (18)	sample: 1953-1998 	**Cointegration:** None **Causality:** $X \not\Rightarrow Y$ $Y \Rightarrow X$ through ΔY_{t-i} only $\rho_{(x_{-1},y)} = .038$; $\rho_{(x,y)} = .872$; $\rho_{(x_{+1},y)} = -.131$	Response of ΔY to a shock to ΔX 	Response of ΔX to a shock to ΔY 
Spain (19)	sample: 1954-1998 	**Cointegration:** None **Causality:** $X \not\Rightarrow Y$ $Y \not\Rightarrow X$ $\hat{\rho}_{(x_{-1},y)} = -.058$; $\hat{\rho}_{(x,y)} = -.097$; $\hat{\rho}_{(x_{+1},y)} = -.085$	Response of ΔY to a shock to ΔX 	Response of ΔY to a shock to ΔX 

Table 3 continued

Sweden (20)	sample: 1950-1998 	**Cointegration:** None **Causality:** $X \not\Rightarrow Y$ $Y \not\Rightarrow X$ $\hat{\rho}_{(x_{-1},y)} = .045;\ \hat{\rho}_{(x,y)} = -.339;\ \hat{\rho}_{(x_{+1},y)} = -.108$	Response of ΔY to a shock to ΔX 	Response of ΔX to a shock to ΔY 
Switzerland (21)	sample: 1948-1998 	**Cointegration:** None **Causality:** $X \not\Rightarrow Y$ $Y \not\Rightarrow X$ $\hat{\rho}_{(x_{-1},y)} = .123;\ \hat{\rho}_{(x,y)} = -.196;\ \hat{\rho}_{(x_{+1},y)} = -.040$	Response of ΔY to a shock to ΔX 	Response of ΔX to a shock to ΔY 
U.K. (22)	sample: 1948-1998 	**Cointegration:** None **Causality:** $X \Rightarrow Y$ through ΔX_{t-i} only $Y \not\Rightarrow X$ $\hat{\rho}_{(x_{-1},y)} = .143;\ \hat{\rho}_{(x,y)} = -.078;\ \hat{\rho}_{(x_{+1},y)} = .159$	Response of ΔY to a shock to ΔX 	Response of ΔX to a shock to ΔY 
U.S.A. (23)	sample: 1949-1998 	**Cointegration:** None **Causality:** $X \not\Rightarrow Y$ $Y \Rightarrow X$ through ΔY_{t-i} only $\hat{\rho}_{(x_{-1},y)} = .152;\ \hat{\rho}_{(x,y)} = -.232;\ \hat{\rho}_{(x_{+1},y)} = -.121$	Response of ΔY to a shock to ΔX 	Response of ΔX to a shock to ΔY 

APPENDIX: Table A . Relationship between trade-openness and government size over four decades in 23 OECD countries*



* The solid and broken lines represent $\hat{Y}_t = \hat{a} + \hat{b}\,X_t + \hat{c}\,X_t^2 + \hat{d}\,X_t^3$ and $\hat{Y}_t = \hat{a} + \hat{b}\,X_t$ fits respectively.