**Government Size in Switzerland from 1960 to 2000: A Time Series Approach to
Testing Alternative Hypotheses**

by

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in partial fulfillment of the requirements for the degree of

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Abstract

This thesis is concerned with how the size of the government in Switzerland has evolved since 1960. The thesis revisits perhaps the most fundamental question in public finance, usually framed as “the growth of government” and tests in a methodical and systematic way many of the theories of government size that are found in the economic literature. It begins by assessing the strength of the relationship among a small subset of traditional economic variables and government size and then expands both the number of explanatory variables and the number of equations to test an increasing variety of theories that have become prominent in the recent public finance literature. The thesis also confronts the conceptual problem of translating cross section tests into their appropriate time series alternative. Chapter 1 provides a general introduction.

Chapter 2 uses single equation techniques to test for a persistent long run relationship between a number of different measures of government size and a small set of key economic variables. Cointegration methodology is used to test for a long-run, equilibrium relationship between government size, real income per-capita and the relative cost of government goods and services.

The purpose of Chapter 3 is to view government size as jointly determined by economic and political parameters in a more comprehensive model and to test for a unique long-run relationship between government size and an enhanced set of economic variables, where income and price are supplemented by complementary public choice variables such as income distribution, and measures of pressure groups, bureaucracy, and fiscal illusion.

Chapter 4 departs from the single equation framework to view government size as the outcome of the interaction between a demand and supply relationship. In Chapter 4 I use a multiple equation system to investigate whether such a system approach leads to a significant change in the estimated parameters when compared to those of the single government size equation.

Chapter 5 analyzes how government size interacts with the business cycle in particular and economic variability more generally. This reflects a trend in recent analysis that has turned from investigating the determinants of the long run government size to an exploration of the shorter run interrelationship between government size and economic fluctuations.

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Chapter 1: Introduction

This thesis is concerned with how the size of the government in Switzerland has evolved relative to GDP since 1960. Implicitly the thesis revisits perhaps the most fundamental question in public finance, usually framed as “the growth of government”, and asks whether the early pattern of continuous government growth has continued for Switzerland. More formally, the thesis tests in a methodical and systematic way many of the theories of government size that are found in the economic literature. It begins by assessing the strength of the relationship among a small subset of traditional economic variables and government size and then expands both the number of explanatory variables and the number of equations to test an increasing variety of theories that have become prominent in the recent public finance literature. In doing all of this within a time series perspective, the thesis also confronts the conceptual problem of translating cross section tests into their appropriate time series alternative.

The traditional demand-side model of government size forms the focus of Chapter 2 and becomes the benchmark model for the thesis. Here single equation techniques are used to test for a persistent long run relationship between a number of different measures of government size and a small set of key economic variables. I begin using cointegration methodology to test whether a long-run relationship can be found between government size and one particular variable - the level of real income per-capita. This relationship is commonly known as Wagner’s Law or “law of expanding state activity”. Standard demand theory also suggests that the price or cost of producing government goods and services relative to all other goods and services should be included in the simple demand

equation of government size. In the context of public finance, the relationship between real government size and the relative cost of providing government services has become important because it forms part of what is now commonly called Baumol's Cost Disease Hypothesis.

The empirical results of these tests are positive and do give preliminary insight into the ability of simple economic theory to explain the evolution of government size in Switzerland. Nevertheless, those tests also expose weaknesses that call for additional and/or alternative explanations of government size. This then leads, in Chapter 3, to the consideration of an additional set of potential determinants as proposed by the public choice literature.

The public choice literature gives us a basis for expanding the choice of explanatory variables, arguing that a theory of government size should reflect the political nature of government and the characteristics of the individuals making the political choices. This suggests that the relevant constraints on choice may include more than just the simple mean of per capita income and price as considered in chapter 2. The key in this chapter is to view government size as jointly determined by economic and political parameters in a more comprehensive model. The important question of Chapter 3 is then whether it is possible to find a unique long-run relationship between government size and an enhanced set of economic variables, where income and price are supplemented by complementary public choice variables such as income distribution, and measures of pressure groups, bureaucracy, and fiscal illusion. The main contribution of the chapter will be to apply cointegration and error correction methodology consistently to a more general equation of government size.

The empirical results of Chapter 3 indicate that the estimates of the elasticities of the traditional economic variables (Chapter 2) are not so robust to the addition of public choice. In particular, I find results that cast serious doubts on the validity of Wagner's Law for Switzerland. The variation found in the estimated price elasticities suggests a different problem. In this case it may be the case that a single equation of a demand and supply system may not be able to separate offsetting influences on price.

Chapter 4 departs from the single equation framework to view government size as the outcome of the interaction between a demand and supply relationship. The distinction between supply and demand side variables is crucial since different agents have generally different preferences for public goods and services and such preferences may act on either the supply or the demand side of the system. The single equation approach does not recognize this crucial distinction. Second, the single equation approach often leaves open the question of how should we interpret the estimated parameters. That is, if we interpret the estimated relationship as parameters of a demand curve, the results may be biased since the supply curve could have shifted in the meantime. We have the same problem if, conversely, we interpret the results as a supply relationship and the demand curve has shifted. Simultaneous estimation should alleviate this bias. A further shortcoming of the single equation approach is that it ignores the endogeneity that may arise between the dependent variable and the regression equation's independent or explanatory variables.

In Chapter 4 I analyze two particular issues in detail. One contemporary concern in relation to the growth of government is the possibility of a bi-directional relationship between government size and the size of the bureaucracy (the share of government employees in total employment). On the one hand, the production function suggests that

causality runs from government size to the size of the bureau. On the other, a number of writers have suggested the importance of a relationship running in the opposite direction by arguing that government employees are also voters with a much stronger interest in larger government size than the median voter. Hence given the large and growing size of government in the economy, government employees themselves may have become an important special interest group in explaining further increases in size. Complementing this approach, other public choice theories have emphasized the wish by bureaucrats to maximize the size of their own budget which could, in itself, explain a larger sized government. From the perspective of this chapter, then, the question arises as to whether the explanatory power of the bureau's size (bureaucratic power) should be interpreted mainly as a demand or supply influence on government size.

A second endogeneity concern arises from the possibility of a bi-directional relationship between government size and income. Two sets of theories with opposing causalities can be cited in this context. First many public finance theorists follow Wagner (1893) in arguing that government goods and services are highly income elastic so that increases in income will lead to more than proportional increases in government spending and therefore explain a greater share of government in GDP. On the other hand, economists more familiar with macroeconomics and growth theory see causality running in the opposite direction and investigate the effect that the size of government may have on the level and rate of growth of national income. This section of Chapter 4 then uses a multiple equation system to separate these diverging effects and investigates whether such a system approach leads to a significant change in the estimated parameters when compared to those of the single government size equation. Finally, the inclusion of a

third, additional, equation to the system may allow us to separate out the reciprocal interdependence.

In Chapter 5 I turn my attention to analyze how government size interacts with the business cycle in particular and economic variability more generally. This reflects a trend in recent analysis that has turned from investigating the determinants of the long run government size to an exploration of the shorter run interrelationship between government size and economic fluctuations. In this context, most studies have adopted a cross-sectional framework, typically using variations in five year averages across countries to test hypotheses. To explain the empirical differences that arise across countries, a number of new theories have been put forward. Particularly interesting are those theories that link government size to a restricted set of macro variables that reflect either domestic forms of variability or openness. Their basic empirical finding is that for developed economies, such as the OECD countries, government size is negatively related to the variability of GDP growth rates. Thus it would appear that on a cross-country basis, a large well-established government sector may serve as an economic stabilizer for the economy overall. On the other hand, a number of other authors have emphasized a different type and different direction of causality running from greater international uncertainty and variability to larger government size. In Chapter 5, then, I extend the VEC framework of Chapter 2 to a subset of business cycle variables and explicitly examine the feedback running from government size to these additional variables. The purpose of this chapter is to retest within a time series framework those theories that link government size to various business cycle indicators on a cross sectional analysis. In essence we wish to ask whether such hypotheses remain valid through time as well as

across time. I find that when, in a Vector Error Correction model, government size is modeled with a subset of economic variables including the employment rate to account for the business cycle, Wagner's Law is generally not validated by the data. This in contrast with what was found in the simple economic model of Chapter 2 but in line with the conclusions of Chapter 3.

Overall, my results suggest that the simple economic model of government size of Chapter 2 is quite robust and explains a significant amount of the variation in government size in Switzerland. However, even though the inclusion of public choice variables improves the explanatory power of the regression their inclusion weakens the case for Wagner's Law and the ability to confirm some of the public choice hypotheses. In part this may reflect as much a degrees of freedom problem as a questioning of the relevance of these hypotheses for Switzerland.

Chapter 2: Government Size and its Economic Determinants

2.1. The Growth of the Public Sector: Testing Wagner's Law for Switzerland

2.1.1. Introduction.

This chapter tests for a persistent relationship between government size and a small set of key economic variables for Switzerland. I begin by using the vector error correction methodology (VEC) to test whether there is a long-run relationship between the size of government and one particular variable - the level of economic activity. The idea of a causal relationship running from income to government size dates back at least to the 19th century and is attributed to the well-known German economist Adolph Wagner (1835-1917). In his *Grundlegung der Politischen Oekonomie* (1893), Wagner observed a close empirical relationship between the size of the public sector and the level of economic development and noted that there was an absolute as well as relative expansion of state activities relative to the rising level of national income. This has become what is commonly known as Wagner's Law or "law of expanding state activity".

Wagner himself put forward a number of different explanations for this empirical relationship. For example, he believed that the development of an increasingly industrial economic structure coupled with growing urbanization would require increasing expenditures in infrastructure, which could only be undertaken by the state. In addition, he argued that economic development would require more regulatory activity by the government, particularly in relation to property rights and contractual enforcement. These activities, he argued, would need to be provided by the state. Finally, it would be reasonable to think that with income rising, income elastic expenditures such as

charitable activities would become more prominent. Welfare expenditure by the state is likely a case in point.¹

To test for the presence of Wagner's Law in Switzerland is then to analyze the effect of income on real government size in a simple bivariate model where government size is a function only of real income per capita. In the following sections I add the relative cost of government services as a second explanatory variable, essentially treating government size as a demand variable within a simple economic framework. Later chapters will add socioeconomic characteristics and public choice variables to incorporate such factors as income distribution and elements of the electoral system to this basic setup. To analyze the generality of these relationships, I will use a number of different definitions of government size, defined more precisely below, in relation to income in Switzerland between 1960 and 2000.

2.1.2. Government Size

Before outlining the methodology used to test Wagner's Law, it is worth emphasizing that the measure of government that should be used to measure government size is not without ambiguity. On the expenditure side, on which I concentrate, current disbursements by the government can be divided into government consumption expenditures, subsidies, social benefits, other current transfers and property income paid

¹ See Payne and Ewing, 1996.

by government.² Because each of these categories of expenditure may respond differently to income and other variables, I present my findings for a number of categories as well as the total. I begin by reviewing how the different components of overall government expenditures have evolved over the last forty years in Switzerland. In particular I concentrate on three types of government expenditure and hence three ratios of government spending to GDP. My three measures of government expenditure are:

- a) Current Disbursements at all levels of government, that is at the federal, cantonal and communal level, (GCURRDISB)³
- b) General Government Consumption Expenditures at all levels, (GCONSEXP)
- c) Social Benefits paid by government, other transfers and subsidies at all levels, (SOCEXP).

My first measure of government size is then the ratio of current disbursements to GDP called GDISB. Between 1962 and 2000 current disbursements for all levels of government in Switzerland grew at an average rate of 8.32% a year, while the average yearly growth rate of GDP was only 5.7%. This implies the rise in GDISB shown in the first diagram in Figure 1.1. Over the time period between 1960 and 2000 GDISB grew from just under 21% of GDP to around 46%. My second measure of government size is the ratio of government consumption expenditures to GDP (GCONS) and the third

² Current disbursements are used because the more general total disbursement measure, which includes government investment, is not available at a consolidated level for Switzerland.

³ Note that GDISB is the broadest measure of government expenditures.

measure will be the ratio of social expenditures to GDP (GTRANSFER). These are shown in the second and third diagrams in Figure 1.1. What is common to all of these three definitions of government size is that all have risen since 1960 and only recently is there any suggestion that such increases may be stopping.

Figure 2.1: Evolution of various measures of Government Size

Source: OECD Statistical Compendium (1999) and www.sourceoecd.org, Switzerland 1960-2000.

It may be worth mentioning that this pattern of growth is not specific to the case of Switzerland but is consistent with many other OECD countries such as Austria and

Germany.⁴ In these countries as well there has been some reversal of the tendency to grow in most recent years.

Another interesting fact that should be recognized concerns the composition of general government expenditures and how it has evolved over the last 40 years. In particular, government consumption in this period grew at a yearly average rate of 6.6%, the growth rate of government gross investment was around 5.8%, while social benefit payments, other transfers and subsidies grew at an average of 9.6% per year. This means that there has been a significant shift in the composition of government spending away from consumption and investment expenditures towards income redistribution in the form of social security benefits and other transfers. This trend has also been found in other studies for other countries, and does not seem to have changed recently in the case of Switzerland.⁵ The diagrams in Figure 1.2 illustrate changes in the composition of current government disbursements.

⁴ On this subject see also Borchering, Ferris and Garzoni (forthcoming 2004).

⁵ See OECD, *The Role of the Public Sector* (1985), p. 16.

Figure 2.2: Composition of Current Disbursements

Source: OECD Statistical Compendium (1999) and www.sourceoecd.org, Switzerland 1960-2000.

2.1.3. Methodology and Empirical Testing

How can one test for Wagner's Law? The literature on this subject seems confusing at first sight since many different formulations of Wagner's Law have been used. Henrekson (1993) classifies at least five basic formulations that have been used in the literature. The model tested in this paper interprets Wagner's Law as the hypothesis that the share of government expenditure in GDP is an increasing function of real per capita income. That is,

$$G/Y = f(Y_{\text{real}}/N), \quad \text{with } f' > 0, \quad (2.1)$$

where G represents government spending in nominal terms, Y and Y_{real} are nominal and real income, respectively, N is total population and f' is the first derivative of government

size with respect to per capita income. In this model, when transformed into logarithms, evidence of Wagner's Law requires the estimated elasticity coefficient on the right hand side to be greater than zero.

The next step is to devise the correct econometric methodology for testing equation (2.1). This means that we have to recognize the time series properties of the dependent variable as well as the independent variable. As can be seen from Figures 2.1 above and 2.3 below, both the government size and the real income per capita (RGDPPC) series have been growing over time and appear to be non-stationary. In such a case, a simple least square regression of equation (2.1) may be spurious. If so, the least squares estimates of the coefficients would not have their usual asymptotic distributions. In order to check for non-stationarity, I performed an Augmented Dickey-Fuller Test (ADF) on the two series. The results are summarized in Table 2.1.

Figure 2.3:

Source: OECD Statistical Compendium (1999) and www.sourceoecd.org, Switzerland 1960-2000.

Table 2.1: ADF test on the levels and first differences

	Model Specification	
Series	Intercept, no Trend	Intercept and Trend
log(GDISB)	-1.1666(3)	-2.9561(2)
log(GCONS)	-1.6976(1)	-1.5858(1)
log(GTRANSFER)	-1.2260(3)	-2.7067(9)
log(RGDPPC)	-2.7466(5)	-1.9220(1)
First Differences	Intercept, no Trend	
dlog(GDISB)	-3.9576**(2)	
dlog(GCONS)	-4.7827**(0)	
dlog(GTRANSFER)	-4.4259**(2)	
dlog(RGDPPC)	-4.5307**(1)	

Notes: (**) and (*) denote rejection of the null hypotheses of a unit root at 5% and 10% confidence levels respectively; number of lags in ADF test in parentheses; the number of lags in the ADF test is determined by the Akaike Information Criteria (AIC).

By comparing the actual ADF $t(\beta)$ statistics to the 5% and 10% critical values, I cannot reject the null hypothesis of a unit root for each of the series in levels, while I can reject it when the series are first-differenced.⁶ Thus it appears that the four primary series are not stationary but become so upon first differencing. This confirms the visual impression created by Figures 2.1 and 2.3.

Even though the series are not stationary, estimation of equation (2.1) can be meaningful if the vectors in question are cointegrated. That is, even if the individual

⁶ In the case of income per-capita, the test on the level reveals the presence of a unit root at the 5% confidence level but not at the 10% level.

series are non-stationary it may be possible to find a linear combination of the two variables that yields error terms that are stationary i.e. $I(0)$. The cointegrating relationship can then be interpreted as evidence of a long-run equilibrium relationship.

To test for cointegration I will use the methodology developed by Johansen (1991, 1995) which involves testing the restrictions imposed by cointegration on the unrestricted Vector Autoregression (VAR) of the series. This two-step procedure involves estimating the unrestricted VAR and then testing whether we can reject the restrictions implied by the presence of cointegration in the Vector Error Correction model (VEC).⁷

Critical at this point is to determine the correct model to use in determining the presence of cointegration. I will restrict my analysis to two basic assumptions about the data series and for the form of the cointegrating equation (CE). The first model (M1) assumes no linear trend in the data and has an intercept in the CE. In this case, the vector error correction equation will have no constant term. The second model (M2) assumes the presence of a linear trend in the raw data but just an intercept in the CE and a constant term in VEC. The rationale for excluding a trend in the cointegration equation for both cases is that, since it is interpreted as a long-run equilibrium equation, a trend should not be included. Next I will run a Johansen cointegration test for the two models and different lag structures in the VEC. Since my sample size is not very large, I restrict the lags in the VEC to three. Hence the first case will have only one lag, the second two lags, and the third three lags in the VEC. Table 2.2 shows the number of cointegrating equations

⁷ For a technical discussion see also Eviews user guide pp. 504-522.

according to the Johansen cointegration test for model and lag structure for the three measures of government size

Table 2.2: Johansen Cointegration test between government size and income per-capita for different models and lags in the VEC

	Number of lags included in the VEC		
	LAGS=1	LAGS=2	LAGS=3
GDISB: M1) No linear trend in data, intercept in CE no intercept in VEC M2) Linear trend in data, intercept in CE and VEC	No. of CEs=1 No. of CEs=2	No. of CEs=2 No. of CEs=2	No. of CEs=1 No. of CEs=2 ¹⁾
GCONS: M1) No linear trend in data, intercept in CE no intercept in VEC M2) Linear trend in data, intercept in CE and VEC	No. of CEs=1 No. of CEs=2	No. of CEs=0 No. of CEs=0	No. of CEs=2 ¹⁾ No. of CEs=2 ¹⁾
GTRANSFER: M1) No linear trend in data, intercept in CE no intercept in VEC M2) Linear trend in data, intercept in CE and VEC	No. of CEs=1 No. of CEs=2	No. of CEs=2 No. of CEs=2	No. of CEs=1 No. of CEs=2

Notes: All variables in logs; test results according to the trace statistic; ¹⁾ Indicates discrepancy between trace statistic and maximum eigenvalue statistic.

From Table 2.2 it is immediately apparent that the results are dependent on the model and lag structure chosen for the test. For example, where I chose a single lag for the VEC, there is evidence of a unique cointegration equation only for model one for all three specifications of government size. For model two the trace statistic indicates that there are two cointegrating equations which, in turn, implies that the series are in fact $I(0)$. This

is in contradiction with the previous ADF test results.⁸ When I set the lags in the VEC at two, neither M1 or M2 indicates cointegration for any measure of government size. For the consumption measure of government size, the cointegration test indicates no cointegration, meaning that in this case no long-run equilibrium equation was found and that the relationship could be modeled as an unrestricted vector autoregression. For the other two measures of government size, on the other hand, we find that we have two cointegrating equations (full rank), which again contradicts the finding of the ADF test on the single series. Finally, setting the lag structure at three in the VEC yields a unique cointegration relationship for two of the three measures of government size, namely current disbursements and social expenditures, but only for M1. For the government consumption measure of government size, there is a discrepancy between the trace statistic and the maximum eigenvalue statistic. The former indicates full rank while the latter suggests no cointegration.

Given the results of this preliminary analysis, I will restrict the estimation of the cointegration equations to model one (M1) with one and three lags. The results are summarized in Table 2.3.

First we assess the explanatory power of the different VECs. In general, by increasing the number of lags included in the VEC, the R^2 increases significantly, from

⁸ This is not uncommon and may be due to several factors such as small sample size and misspecification of the model. It is worth mentioning that in the case at hand where I have two vectors, government size and real income per capita, the maximum number of cointegrating relationships is one.

0.27 to 0.49 for government disbursements, and from 0.22 to 0.39 for government social expenditures. However this also implies a decrease in degrees of freedom. For example, for the government current disbursements measure of government size, both the Schwartz Information Criterion (SIC), which poses a greater penalty on the number of variables, and the Akaike Information Criterion (AIC) tend to favour a VEC with just one lag. On the other hand for SOCEXP, the AIC favours a VEC(3), while the more economical SIC selects a VEC(1). For all three measures of government size, and across, all models the coefficients on real income per-capita in the cointegrating equation are positive and, in three of the five cases, significantly so. The income coefficients also vary significantly depending on the measure of government size. The VEC(1) specification yields, for instance, income coefficients of 0.7949 for government disbursements, 0.4431 for government consumption and 1.0576 for government transfers. The implied long-run income elasticity for government social expenditures is estimated at 2.0576 and is statistically greater than one. This confirms both Wagner's Law and the hypothesis that government transfers should be relatively more income elastic. In the VEC(3) specification, however, this result is reversed, and government transfers appear with a long-run implied income elasticity of 1.0494 which is not significantly different from unit elasticity. This suggests a qualification to the interpretation of Wagner's Law since one would expect transfer payments to be more responsive to income than goods and services.

Table 2.3: Cointegrating regressions and VEC for the three specifications of government size and different lag structures

Cointegrating Equation					
Government Size(GSIZE)	GDISB		GCONS	GTRANSFER	
	Lags=1	Lags=3	Lags=1	Lags=1	Lags=3
Intercept	-3.7365* (-5.90)	-1.8295 (-1.85)	-3.5733* (-11.64)	-5.1019* (-5.08)	-0.9957 (-0.64)
RGDPPC	0.7949* (4.92)	0.3245 (1.28)	0.4431* (5.37)	1.0576* (3.93)	0.0494 (0.12)
Error Correction					
ECT ¹⁾	-0.1022* (-3.21)	-0.017 (-0.47)	-0.1952* (-2.77)	-0.0923* (-3.94)	-0.0560* (-2.07)
D(GSIZE(-1))	0.0791 (0.41)	0.2442 (1.23)	0.1997 (1.43)	-0.0478 (-0.27)	0.0192 (0.10)
D(GSIZE(-2))	-	0.5968* (2.93)	-	-	0.2347 (1.25)
D(GSIZE(-3))	-	-0.4572* (-2.20)	-	-	-0.4953* (-2.45)
D(RGDPPC(-1))	-0.5373 (-1.82)	-0.3608 (-1.09)	-0.2567 (-1.19)	-0.8831* (-2.38)	-1.0007* (-2.45)
D(RGDPPC(-2))	-	0.9105* (3.14)	-	-	0.5078 (1.37)
D(RGDPPC(-3))	-	-0.2440 (-0.70)	-	-	-0.4209 (-0.90)
R ²	0.27	0.49	0.30	0.22	0.39
AIC	-9.34	-9.24	-9.50	-8.27	-8.29
SIC	-8.96	-8.50	-9.12	-7.89	-7.55
Long-run Implied Income Elasticity (CE)	1.7949 ^{a)}	1.3245	1.4431 ^{a)}	2.0576 ^{a)}	1.0494
F-Statistic	6.52	3.86	4.59	4.34	2.42

Notes: All variables in logs; the model specification is with no linear trend in the data, intercept in the CE and no constant in VEC; t-ratios in parentheses; ¹⁾ error correction term; (*) denotes values significantly different from zero at the 5% level; ^{a)} denotes values significantly different from one at 5% confidence.

In general, the VEC(1) estimations of the cointegrating equations yield income elasticities greater than unity for all three measures of government size and suggest that

in the long-run, Wagner's Law has indeed been a significant driving force in the growth of government. In fact, Wagner's Law requires that the coefficient on RGDPPC be greater than zero or that the implied income elasticity for government expenditures be greater than one. In three of the five estimated models this is the case.

The estimated error correction terms (ECTs) are quite consistent across models and measures of government size. Only for the VEC(3) for government disbursements is the ECT not statistically different from zero. For all other cases the VEC estimation supports the theory that the cointegrating relationship is an equilibrium relationship and that deviations in government size tend to return to the long-run equilibrium path. In the case of the VEC(1) for government current disbursements, the estimated ECT implies that a one percent deviation from the long-run equilibrium entails a correction of 0.1022 percent in the next period. The adjustment process can be seen in Figure 2.4. Government current disbursements and government transfers as a share of GDP, in fact, are below the long-run equilibrium level for the whole sample size while government size as measured by government consumption expenditure were below equilibrium for most of the 70s and 80s, with some spikes above in the late 70s and mid 90s.

Figure 2.4: Actual vs. Estimated values of Government Size

The coefficients on the lagged changes in income and their significance also depend on the specific model. For example, for the current disbursement measure of government size the VEC(1) yields a coefficient for $D(RGDPPC(-1))$ of -0.5373 which is not statistically significant at the 5% level but is so at the 10% level. In the VEC(3), on the other hand, this coefficient loses significance and the estimated parameter on $D(RGDPPC(-2))$ becomes significant, with a positive value of 0.9105. In the VEC(1) for government consumption, the change in income at lag one is not statistically different from zero. For the transfer measure of government size, the VEC(1) yields a coefficient

of -0.8831 for the growth in income at lag one and this value is statistically different from zero. The VEC(3) also yields a statistically significant parameter $D(RGDPPC(-1))$ of -1.0007, while all other lags on the growth per-capita income enter insignificantly. Overall, all the short-run coefficients on income, particularly at lag one, are negative. This in my view, reflects the counter-cyclical behaviour of government size in response to short-run variations in output as variations in government size act as stabilizers in response to transitory changes in income.

The F-statistic, which is used to test for Granger causality, is based on the restricted model in which the coefficients on the cointegration's residuals as well as the lagged changes in the income variables are set to zero. This is equivalent to estimating the growth of government size as a simple autoregressive process of order one, or AR(1), in the case of the VEC(1) specification, or an AR(3) for the VEC(3). The F-statistics show that I must reject the null hypothesis of no "Granger causality" from real income to government size for four of the five VECs. Only for the VEC(3) of government transfers would I not reject the null hypothesis that all lagged income terms inclusive of the error correction term do not belong in the regression. This results are in line with the estimated long-run income elasticities of the cointegrating equations. This in my view emphasizes that in the long-run, real income per-capita does "Granger cause" government size.

2.1.4. Restatement and Conclusions

To summarize the results, these sections have tested Wagner's Law against Swiss government expenditure and income data from 1960 to 2000. Various econometric time series techniques, such as the use of an error correction model and testing for Granger

causality, produce evidence of a long-run positive relationship between government size and real income per capita. In terms of our more specific hypotheses, we found that the income elasticity estimates are strongly consistent with Wagner's Law and that the causality tests suggest that real income per capita "Granger causes" the share of government expenditure.

While confirmation of Wagner's Law tends to hold for our three alternative measures of government size, the causality tests seem to suggest more evidence of cointegration in levels and a stronger degree of causality running from real income to government size when the current disbursements measure of government size is used. However, before we accept these findings at face value, we should be aware of the potential weaknesses of simple univariate analysis. With only one explanatory variable, the estimated coefficient may include responses to variables other than income but that are correlated with it. Further analysis may be needed to assess the robustness of this relationship to the inclusion of other variables hypothesized to affect government size. We proceed to examine the inclusion of relative price next.

2.2. A simple economic model of government size

2.2.1. The relative cost of public goods and services

As we have seen in section 2.1, income explains a good deal of the long run evolution of government size. However, it is not the only explanatory variable implied by economic theory. One further variable that demand theory suggests would be important is the price or cost of producing government goods and services relative to all other goods and services. Discussion of the relationship between real government size and the relative

cost of providing government services has typically centered on what is now commonly called Baumol's Cost Disease Hypothesis. This refers to the numerous studies in public finance that point out the steady rise in the cost of government goods and services relative to privately produced goods over time and its positive correlation with growing government size.

W.J. Baumol (1967) explained the steady rise in relative cost by the difference in the factor intensities within the government sector on one side and the private sector on the other. In particular, Baumol argued that because the public sector is relatively labor intensive and capital relatively less important, technological change and thus the rate of productivity growth would be lower in the public sector than in the private sector. This implies that over time the real cost of producing public sector output should rise relative to all other goods. What is the implication for government size? If the demand curve for government goods and services is inelastic, then a rise in the relative price of government services will produce only a relatively small decrease in the quantity of government services demanded and result in higher aggregate expenditures on public sector output. Studies documenting the relative cost increase for the US include among others Bradford, Malt and Oates (1969), Borcharding and Deacon (1972), Beck (1976), Spann (1977), Peltzman (1980), Berry and Lowery (1984), Borcharding (1985), Ferris and West (1996b, 1999).

In the discussion above I talk interchangeably of cost and price. However, since government goods and services are not traded in a market, a market price as such is not observable. To test for the elasticity of the demand curve, then, it is necessary to have an observable counterpart. For this reason I use the ratio of the government expenditure

deflator to the GDP deflator (p_g/p) as a proxy for the relative price (RELPRICE). The evolution of this relative price in Switzerland is depicted in Figure 2.4. Consistent with Baumol's relative productivity hypothesis, there has been a steady increase in the relative price from 1960 into the early 1980's. From that point on, however, the tendency to rise has stopped, and there now seems to be even a slight downward trend.

Figure 2.4:

Source: OECD Statistical Compendium (1999) and www.sourceoecd.org, Switzerland 1960-2000.

Following the methodology used in relation to Wagner's Law, I can investigate the long run relationship between government size, real income per capita and the relative cost of providing government goods and services. Econometrically this means testing for evidence of cointegration among these time series.

To begin I check whether the relative price series is non-stationary and if so what is the order of integration. This can be done by applying an augmented Dickey-Fuller test

to the data series, which has been transformed into logarithmic form for interpretational convenience. The results are presented in Table 2.4.

Table 2.4: ADF test on the levels and first differences of RELPRICE

	Model Specification	
Series	Intercept, no Trend	Intercept and Trend
RELPRICE	-2.4327(0)	-0.7906(0)
First Differences	Intercept, no Trend	
D(RELPRICE)	-5.0984**(0)	

Notes: (**) denotes rejection of the null hypotheses of a unit root at the 5% confidence level; number of lags in ADF test in parentheses; the number of lags in the ADF test is determined by the Akaike Information Criteria (AIC).

Because the ADF statistic is below (in absolute terms) its critical value in levels and above it in first differences, the relative cost series appears to be I(1).

I next proceed to investigate whether there is a cointegrating relationship between government size and real income and relative price in levels. That is, in the vector error correction specification I am particularly interested in the normalized cointegrating equation for government size. Following authors such as Borcharding and Deacon (1972), Borcharding (1985) and others, a simple demand equation for government size can be used to establish an estimating equation. That is, from

$$\frac{G}{Y} = \left(\frac{Y}{N}\right)^{\alpha-1} \left(\frac{p_G}{p}\right)^{\beta+1} \quad (2.3)$$

I can proceed to specify the following VEC in differenced form (equation 2.4), where γ_1 is the error correction term related to the cointegrating equation in levels, derived by the normalized logarithmic transformation of equation 2.3.⁹

$$\begin{aligned} \Delta \log(GSIZE_t) = & \gamma_1 [\log(GSIZE_{t-1}) - c - (\alpha - 1) \log(RGDPPC_{t-1}) - (\beta + 1) \log(RELPRICE_{t-1})] \\ & + \sum_{i=1}^q \gamma_{2i} \Delta \log(GSIZE_{t-i}) + \sum_{i=1}^q \gamma_{3i} \Delta \log(RGDPPC_{t-i}) + \sum_{i=1}^q \gamma_{4i} \Delta \log(RELPRICE_{t-i}) + v_t \end{aligned} \quad (2.4)$$

Similar to the two-variable approach followed in section 1, the model described here deals with three variables which the results of the ADF tests have shown to be all I(1). This raises the possibility that we may discover more than one cointegrating relationship, in this case namely two. For example, there may be two separate relationships running from income to government size and from relative price to government size. Using the single equation Engle-Granger methodology in this case would imply that we assume the existence of only one cointegration relation among the three variables. This may be too restrictive an assumption and therefore I will use the same VEC methodology used in the previous section. This allows for the existence of simultaneous causal relationships between the three time series. Table 2.5 summarizes the results of the Johansen cointegration tests. Again, I restrict the analysis to the two basic model assumptions of no linear data trend and intercept in CE and no constant in the VEC (Model 1) and linear trend in the data and hence a constant term both in the CE and the VEC (Model 2).

⁹ In order to interpret the results correctly, we have to remember that $G = p_g * G_{real}$ and $Y = p * Y_{real}$, so that the price elasticity will be the estimated coefficient, $\hat{\beta}$, minus one.

Table 2.5: Johansen Cointegration Tests between government size, real income per-capita and relative price for the different models and lag structures

	Number of lags included in the VEC		
	LAGS=1	LAGS=2	LAGS=3
GDISB:			
1) Model 1	No. of CEs=1	No. of CEs=1	No. of CEs=1
2) Model 2	No. of CEs=0	No. of CEs=1 ¹⁾	No. of CEs=1
GCONS:			
1) Model 1	No. of CEs=1 ¹⁾	No. of CEs=0	No. of CEs=1
2) Model 2	No. of CEs=0	No. of CEs=0	No. of CEs=1
GTRANSFER:			
1) Model 1	No. of CEs=1	No. of CEs=1	No. of CEs=1
2) Model 2	No. of CEs=0	No. of CEs=1	No. of CEs=1

Notes: All variables in logs; test results according to the trace statistic; ¹⁾ Indicates discrepancy between trace statistic and maximum eigenvalue statistic.

Similar to my findings in Section 2.1.3, the results vary depending on the model and lag specification. Model 1 yields the result of a unique cointegrating relation in levels for all measures of government size and lag structures (the value of q in equation 2.4), except for the government consumption measure of government size at lags $q=2$. The results for Model 2 are more mixed. At lag 1 I cannot find any evidence of cointegration, but this becomes evident at lags 2 and 3, again except for government consumption. The estimated cointegrating equations and VECs for Model 1 are presented in Table 2.6.

As in the previous section 2.1.3, the explanatory power of the different VECs increases with the number of lags included. For government disbursements, for example the R^2 grows from 0.27 at $q=1$ to 0.62 at $q=3$. This, however, coincides with a loss in degrees of freedom that is more than proportional, since moving from a VEC(1) to a VEC(3) the number of parameters that has to be estimated grows by eighteen (six parameters per equation times three equations). In addition, adding lags in the VEC

directly reduces the sample size. Taking these facts into consideration, I may want to check both the Akaike Information Criterion (AIC) and Schwartz Information Criterion (SIC) in order to choose the best model for drawing statistical inferences on the estimated coefficients. For government disbursements the AIC selects a VEC(2), while it is perhaps not surprising that the SIC selects a VEC(1). The best model for government consumption expenditures is, according to both the AIC and the SIC, a VEC(1). For government transfers the AIC selects a VEC(3) and the SIC a VEC(1). Given the relative small sample size I tend to favour the SIC to pick the best VECs and these will be VECs(1) for all three measures of government size.

The error correction terms (ECTs) are negative and statistically different from zero for all measures of government size consistent with an equilibrium relationship. The speed of adjustment is much greater for government consumption than for the other government size measures. The estimated long-run income elasticities for government disbursements, consumption expenditures and social expenditures are all statistically greater than one, with values of 1.986 for GDISB, 1.337 for GCONS and 2.535 for GTRANSFER. The estimated coefficients on income per-capita are, in fact, quite similar to what was found in the previous section investigating Wagner's Law. The estimated income elasticity on GTRANSFER also confirms the hypothesis that government transfers be more income elastic. This confirms the finding of the previous section. Overall, the estimated income elasticities are strongly consistent with Wagner's Law, which requires that they be greater than one. The short-run coefficients on the growth of income per-capita at lag one, on the other hand, are negative for all measures of government size, and significantly so in particular for government disbursements and

social expenditures. The higher order lags on $D(RGDPPC)$ appear to lose in statistical significance. Only for $D(RGDPPC)$ at lag (-3) do I find a significant negative correlation, namely in the government disbursement and government transfer equations. Consistently I find an interesting dynamic pattern arising between the long and short-run. While the long-run relationship confirms Wagner's Law as a significant factor in the growth of government size, to the short-run deviations around equilibrium are both smaller and less significant. In this particular model, government size is found to behave counter cyclically in the short-run. This suggests the possibility of an additional short-run reason for variations in government size not present in the long-run.

Turning to the relative price, I find that for all specifications of government size the implied price long-run elasticities are negative. The respective elasticities for $GDISB$ and $GTRANSFER$ are -2.049 and -3.052, which are both smaller than zero and statistically significant. Government consumption expenditures, on the other hand, are found to be inelastic. In this case the data seem to support Baumol's hypothesis positing an inelastic demand for government size, while for the other two specifications, this assumption is not satisfied. In the short-run all of the coefficients on $D(RELPRICE)$ for government disbursements are positive and sometimes greater than unity. Statistically these values, however, translate into implied price elasticities that are not different from zero. In the $VEC(1)$ for government consumption, $D(RELPRICE(-1))$ appears with an estimated value of -0.084, which corresponds to an elasticity of -1.084 and is statistically different from zero. In the $VEC(3)$ this value becomes positive and hence the price elasticity becomes statistically insignificant. For government transfers, my findings mirror the results for government current disbursements. All coefficients on

Table 2.6: Cointegrating regressions and VEC for the three specifications of government size and different lag structures for Model 1

Cointegrating Equation								
Government Size (Gsize)	GDISB			GCONS		GTRANSFER		
	L=1	L=2	L=3	L=1	L=3	L=1	L=2	L=3
Intercept	-4.298** (-3.57)	-4.300** (-5.56)	-4.552** (-7.96)	-3.182** (-8.02)	-2.867** (-9.34)	-6.761** (-2.90)	-4.619* (-2.12)	-5.972** (-4.21)
RGDPPC	0.986** (3.09)	0.989** (4.82)	1.062** (6.97)	0.337** (3.19)	0.257** (3.16)	1.535** (2.48)	1.044* (1.80)	1.435** (3.81)
RELPRICE	-1.049 (-1.08)	-1.407** (-2.22)	-1.558** (-3.37)	0.585* (1.90)	0.842** (3.80)	-2.052 (-1.08)	-3.164 (-1.77)	-4.346** (-3.90)
Error Correction								
ECT ¹⁾	-0.068** (-3.02)	-0.062* (-1.96)	-0.130* (-2.67)	-0.304** (-3.64)	-0.303* (-2.56)	-0.073** (-3.99)	-0.037** (-2.21)	-0.094** (-4.33)
D(GSIZE(-1))	-0.066 (0.41)	-0.208 (-0.73)	-0.356 (-1.21)	0.190 (1.35)	-0.033 (-0.13)	-0.147 (-0.74)	-0.135 (-0.62)	-0.411 (-2.07)
D(GSIZE(-2))	-	0.009 (0.04)	0.073 (0.26)	-	0.254 (1.09)	-	-0.0006 (-0.002)	-0.164 (-0.86)
D(GSIZE(-3))	-	-	-0.569* (-2.65)	-	-0.037 (-0.19)	-	-	-0.672** (-3.64)
D(RGDPPC(-1))	-0.726* (-1.94)	-0.840* (-2.05)	-1.426** (-2.95)	-0.311 (-1.55)	-0.779* (-2.34)	-1.113** (-2.59)	-0.897* (-2.02)	-2.005** (-4.06)
D(RGDPPC(-2))	-	-0.065 (-0.17)	-0.049 (-0.11)	-	0.350 (1.21)	-	-0.178 (-0.38)	-0.414 (-1.04)
D(RGDPPC(-3))	-	-	-0.874* (-2.18)	-	-0.269 (-1.21)	-	-	-1.300** (-2.79)
D(RELPRICE(-1))	0.697 (1.41)	0.707 (1.38)	1.179* (2.18)	-0.084 (-0.23)	0.356 (0.87)	0.794 (1.26)	0.604 (0.92)	1.530* (2.45)
D(RELPRICE(-2))	-	1.247** (2.68)	1.237* (2.38)	-	0.344 (0.85)	-	1.561** (2.42)	1.720** (3.11)
D(RELPRICE(-3))	-	-	0.304 (0.61)	-	-0.631 (-1.41)	-	-	0.545 (0.93)
R ²	0.27	0.46	0.62	0.39	0.53	0.24	0.34	0.61
AIC	-15.58	-15.64	-15.36	-15.69	-15.11	-14.18	-14.25	-14.29
SIC	-14.90	-14.56	-13.87	-15.01	-13.63	-13.50	-13.17	-12.81
Long-run Implied Income Elasticity (CE)	1.986 ^{a)}	1.989 ^{a)}	2.062 ^{a)}	1.337 ^{a)}	1.257 ^{a)}	2.535 ^{a)}	2.044 ^{b)}	2.435 ^{a)}
Long-run Implied Price Elasticity (CE)	-2.049**	-2.407**	-2.558**	-0.415	-0.158	-3.052**	-4.164**	-5.346**

Notes: All variables in logs; the model specification is with no linear trend in the data, intercept in the CE and no constant in VEC; t-ratios in parentheses; ¹⁾ error correction term; (**) and (*) denote significance at the 5% and 10% level respectively; ^{a)} denotes values statistically different from one at 5%; ^{b)} denotes values statistically different from one at 10%.

D(RELPRICE) are positive and sometimes greater than one (D(RELPRICE(-1)) in VEC(1), D(RELPRICE(-2)) in VEC(2) and VEC(3)), but none of them imply price elasticities statistically different from zero. What is interesting to note is that the price elasticities tend to change from long to short-run for the different measures of government size. GDISB and GTRANSFER are price elastic in the long-run but not so in the short-run adjustment process. GCONS is inelastic in the long-run but becomes so in the short-run, at least in the VEC(1) specification. This leads me to conclude that Baumol's hypothesis would be rejected for GDISB and GTRANSFER in the long-run but may be reintroduced as a valid explanation of growing government size in the short-run. The opposite can obviously be said about government consumption (GCONS).

Table 2.7 summarizes the VEC estimation for Model 2, which assumes a linear trend and an intercept term both in the cointegration equation and the VEC. Before discussing the single coefficients, we should explicitly note that the introduction of new parameters further reduces the degrees of freedom. This is particularly true for the VEC(3) specification. With few degrees of freedom, the critical values of the t-distribution increase dramatically, so that t-statistics that would signify significance at conventional levels suddenly lose their statistical significance. This can be seen in the VECs(3) in Table 2.7. For the government consumption measure of government size, however, the VEC(3) is the only specification available.

For government disbursements both the AIC and SIC select the VEC(2) as the best model, and for social expenditures the SIC also selects the VEC(2). By comparing the estimation results for the both models (Model 1 and Model 2), I find that Model 1

Table 2.7: Cointegrating regressions and VEC for the three specifications of government size and different lag structures for Model 2

Cointegrating Equation					
Government Size (Gsize)	GDISB		GCONS	GTRANSFER	
	L=2	L=3	L=3	L=2	L=3
Intercept	-4.767	-5.084	-3.047	-4.83	-7.10
RGDPPC	0.987** (4.69)	1.074* (6.96)	0.290 (3.67)	0.812 (1.19)	1.429 (3.66)
RELPRICE	-1.466** (-2.26)	-1.585 (-3.38)	0.794 (3.68)	-3.538 (-1.69)	-4.461 (-3.86)
Error Correction					
ECT ¹⁾	-0.057 (-1.34)	-0.141 (-2.43)	-0.395 (-3.06)	-0.016 (-0.70)	-0.088 (-3.04)
D(Gsize(-1))	-0.211 (-0.71)	-0.345 (-1.14)	0.022 (0.08)	-0.161 (-0.70)	-0.415 (-2.03)
D(Gsize(-2))	0.005 (0.02)	0.087 (0.30)	0.346 (1.45)	-0.025 (-0.11)	-0.169 (-0.85)
D(Gsize(-3))	-	-0.558 (-2.52)	0.051 (0.27)	-	-0.676 (-3.56)
D(RGDPPC(-1))	-0.837* (-1.99)	-1.437 (-2.93)	-0.781 (2.41)	-0.887* (-1.97)	-1.991 (-3.94)
D(RGDPPC(-2))	-0.061 (-0.16)	-0.046 (-0.10)	0.397 (1.38)	-0.159 (-0.34)	-0.411 (-1.01)
D(RGDPPC(-3))	-	-0.878 (-2.15)	-0.223 (-1.02)	-	-1.291 (-2.71)
D(RELPRICE(-1))	0.722 (1.31)	1.164 (2.09)	0.192 (0.46)	0.716 (1.04)	1.536 (2.41)
D(RELPRICE(-2))	1.262** (2.54)	1.206 (2.22)	0.131 (0.31)	1.675** (2.47)	1.736 (3.03)
D(RELPRICE(-3))	-	0.278 (0.54)	-0.740 (-1.68)	-	0.564 (0.92)
Constant	0.029* (1.86)	0.063 (2.58)	0.013 (1.73)	0.040* (2.18)	0.108 (4.23)
R ²	0.46	0.62	0.57	0.34	0.61
AIC	-15.50	-15.18	-14.98	-14.12	-14.13
SIC	-14.34	-13.62	-13.41	-12.95	-12.56
Long-run Implied Income Elasticity (CE)	1.987 ^{a)}	2.074	1.290	1.812	2.429
Long-run Implied Price Elasticity (CE)	-2.466	-2.585	-0.206	-4.538	-5.461

Notes: All variables in logs; the model specification is with no linear trend in the data, intercept in the CE and no constant in VEC; t-ratios in parentheses; ¹⁾ error correction term; (**) and (*) denote significance at the 5% and 10% level respectively; ^{a)} denotes values statistically different from one at 5%.

seem to fit best. In general, both AIC and SIC are lower for Model 1 compared to a VEC of the same lag structure for Model 2. The estimated parameters do not differ significantly from the results of Model 1.

For all three types of government expenditures, I find long-run income elasticities that are greater than one. Statistical inference is however not so robust, since for the VEC(3) in particular, I do not have enough degrees of freedom. Therefore only the income elasticity for GDISB in the VEC(2) is significantly greater than one. The estimated price elasticities are also generally negative, but statistically so only for the government current disbursement specification in the VEC(2). Both findings reinforce the conclusions of the previous model that Wagner's Law is supported by the data and that Baumol's hypothesis, on the other hand, does not explain the growth of the government sector in the long-run.

2.3. Conclusions

This chapter has addressed and tested, using different econometric techniques such as VEC and Granger causality, different theories of the growth of government size from a simple demand side perspective. I find, for instance, that Wagner's Law is strongly supported by the data. All implied income elasticities are significantly greater than unity. This is in accordance with Wagner's Law. Also, Granger causality tests suggest that real income per capita does "Granger cause" government size. The estimated price elasticities, on the other hand, do not support the view of an inelastic demand for government expenditures, a condition that would be required for Baumol's hypothesis to have an effect on government size.

Without necessarily restricting ourselves to this demand side interpretation, the Johansen cointegration tests are significant in allowing us to conclude that there is an equilibrium relationship among these three important variables. The next chapter looks to see whether the political nature of government size is reflected in the data and hence whether the results of this chapter can be improved upon by including public choice variables.

Chapter 3: Introducing public choice variables to the basic economic model of government size.

3.1. Introduction.

In Chapter 2 our focus was on a strict economic explanation of government size—how much of the evolution of government size could be explained by only the small set of key economic demand side variables. Our finding was that the simple economic model performed relatively well in explaining the evolution of government size, particularly with respect to the government current disbursements and consumption measures. The findings of chapter 2 suggest that per capita income is a significant regressor in the cointegrating equation explaining both the current disbursements and consumption expenditures of the Swiss government. More specifically, the implied income elasticities in the government size equations in levels are greater than unity, thus consistent with Wagner's Law as an explanation of the growing share of government in the economy for Switzerland. Contrasting results are found with respect to the relative price. Government current disbursements and transfer payments are found to be price elastic while government consumption expenditures are relatively inelastic. This coupled with the tendency of the relative price of government goods to private goods to rise over time suggests that Baumol's Cost Disease effect is not particularly robust as an explanation of the growth of government size in Switzerland.

The treatment of government size in this manner suggests that government output is provided in the same way as other goods. In fact, however, government output is allocated through political markets rather than economic. This suggests that the political

dimensions of choice matter and hence explain at least part of the variation in government size. This chapter then examines the explanatory power of a broader set of theories that regard government formation as a collective choice made by society. In essence, this means exploring the political institutions determining political choice and, in addition to mean income, the other moments of the distribution of characteristics of the population that determines government size. Fundamentally, this brings public choice as the economic foundation for the analysis of public institutions into our study of government size.¹⁰

3.2. Public Choice and Government Size

An emphasis on the political process, which is characteristic of the public choice approach, begins with the median voter theorem of Downs (1957) and Black (1958)... In such a model, voters are assumed to have single peaked preferences over levels of public expenditure and two parties compete for their votes by proposing different levels of expenditure. Under simple majority rule, the median voter becomes the decisive voter. Hence his preferred level of public expenditure will determine the actual demand for public expenditure. Under such circumstances, as shown by Borcharding and Deacon (1972) and Borcharding (1985), the demand for public expenditures will be determined by the relative price of public to private goods, income and tastes of the median voter (as

¹⁰ See D.C. Muller (1989) pp. 320-347 for a complete discussion on public choice and government size.

opposed to those of the voter with mean income as implied by the considerations of Chapter 2).¹¹

In this chapter then, I expand the median voter model and test the resulting predictions in relation to the same three definitions of government size as in chapter 2. My first, and most general, measure of government size is government current disbursements as a share of GDP (GDISB). This variable captures both the current services and transfer-payment activity of the government. The second measure of government size is restricted to government consumption expenditure as a share of GDP (GCONS). This was the measure best explained by the small set of traditional economic variables in Chapter 2. Finally, the third measure focuses explicitly on the redistributive role of government and is defined as expenditures on social benefits, other transfers and subsidies as a share of GDP (GTRANSFER).¹²

3.3. Economic Determinants of Government Size

In addition to the public choice variables that I will add, I will continue to use the set of demand side variables used in Chapter 2. The first demand variable, real income per capita (RGDPPC), reflects the first moment of the income distribution. Wagner's Law holds that the predicted coefficient on mean income should be positive. The second economic variable is relative price (RELPRICE), defined by the price deflator for government goods and services divided by the GDP deflator. The price effect is predicted

¹¹ See Hamlin A. in Gemmel (1993), pp. 74-75.

¹² All measures of government size are defined in nominal terms, i.e. $G_{\text{nominal}}/\text{GDP}_{\text{nominal}}$.

to be negative. Further, Baumol's Hypothesis suggests that the demand function for government services is price inelastic. In that case the coefficient on RELPRICE is expected to be less than one (in absolute terms) and, perhaps, insignificantly different from zero.

3.4. Government Size and Redistribution to Interest Groups

One well known political factor used to explain the growth of the public sector is the government's role in redistributing income and wealth among its citizens. Combining this function of government with self-interested majority voting, Meltzer and Richard (1978, 1981, 1983) explain the growth in government size through such variables as the expansion of suffrage. As more voters with ever lower incomes are included in the franchise, the median voter's preferred outcome shifts to ever higher tax-subsidy combinations, hence producing a bigger government.¹³ This idea can be best explained with the help of Figure 3.1. In that Figure the line $O\tau Y$ depicts the balanced budget condition for the government. It represents the maximum amount of transfers that can be financed at each tax rate given some level of mean income Y at time t . The maximum possible tax-transfer combination is τ^* . At any level of pre-tax income, increasing τ reduces post-tax $Y(t)$. After point τ^* , however, the disincentive effect of a higher tax rate on total tax revenue more than offsets the revenue-raising direct effect.

¹³ See Meltzer and Richard (1981, 1983).

Figure 3.1: Meltzer and Richard Hypothesis

Source: Cullis and Jones (1998), Mueller (1989)

The preferences of the median voter, in transfer-tax rate space, are given by the indifference curve I_m^0 . Such a voter is assumed to value the tax rate as a bad rather than a good, and this characteristic results in the upward sloping indifference curves depicted in Figure 3.1. A low income voter is assumed to value the tax rate as less of a bad than does a high income individual. That is, the indifference curve for a lower income individual is flatter than for a high income worker. In the limit, where the income level is so low that the individual would choose never to work, the indifference curve would become horizontal and he/she would be neutral vis-à-vis the tax rate. For the median voter represented by the indifference curve I_m^0 , the optimal tax-transfer combination chosen is M^*_0 . This is where his/her indifference curve is just tangent to the feasibility frontier. As more and more lower income individuals are included in the suffrage regime, the

indifference curve for the median voter becomes flatter and flatter, moving the voting equilibrium to M^*_1 . Hence, extending the voting franchise produces higher transfers and higher taxes.¹⁴

Switzerland was one of the last countries to introduce female suffrage. Only in 1971 were women finally allowed to vote at the federal level. This allows for a direct test of the Meltzer and Richard hypothesis. I will include a dummy variable, WOMEN, to test whether the expansion of the franchise has had the expected effect on government size as hypothesized by Meltzer and Richard.

Further explanations of the evolution of government size revolve around the effect of interest groups under majority rule. According to Tullock's classic article (1959), majority voting rule should inherently lead to a bigger government relative to the optimal outcome under unanimity since the majority does not have to bear the full cost of the government's activity.¹⁵ Recognizing that the government does not function costlessly as either a service provider or redistributor, other authors, like Kau and Rubin (1981 and 2002) have focused more on supply side effects, such as the cost of collecting taxes. To do so, they emphasize the importance of whether agents engage in income activities that are easily visible and hence taxed or not. Following this set of hypotheses, I include here the fraction of the population over 64 (OLDPOP) and the fraction of employment in farming (FARM) in order to test whether government size is driven by

¹⁴ See Cullis and Jones p. 361 and D.C. Muller, p. 330.

¹⁵ Additional contributions in such framework include Becker (1983, 1985) and North and Wallis (1982).

redistribution to strong interest groups. The share of the population that is older grows over time for most western, developed economies due to the dramatic increase in life expectancy. I would expect this section of the population to have higher demands for healthcare services, much of which is publicly supplied and financed. In addition, an older population is likely to demand increased transfer payments in the form of social security. For these reasons the coefficient on OLDPOP is expected to be positive.

Employment in farming has steadily decreased in the last four decades in Switzerland. However, farmers still retain relatively strong political leverage, particularly when, as a neutral country, Switzerland has put relatively more emphasis on self-sufficiency in agriculture than have other west European countries. This is further reflected in the fact that the agricultural sector in Switzerland is heavily subsidized. Employment in farming also provides an indirect test of the Meltzer-Richard mean to median income redistribution hypothesis. Since incomes in farming are traditionally lower than mean income, one would expect that increased employment in farming would lead to higher demand for redistribution by the state. For these reasons, I expect government size to be positively related to FARM. So that the expected sign of both estimated coefficient are positive.

To test for Kau-Rubin's supply side theory, I include the female labour force participation rate (FEMPART) as an explanatory variable. The hypothesis is that as more women leave home production to enter market activity, the cost of collecting taxes by the government decreases. Hence I expect that government size will be positively correlated with the female participation rate.

3.5. Government Size and Bureaucratic Power

One important and often overlooked special interest group that may explain the growing expansion of the public sector comes from extending the well-known bureaucracy argument developed in part by Niskanen (1971). As Muller states, "Government may grow not only because increasing expenditures are demanded by citizens, interest groups, or legislators, but also because they are demanded by the bureaucracy supplying government programs. The government bureaucracies are an independent force, which possibly may lead to increasing government size."¹⁶

In such a view, bureaucrats' incentives are to maximize the size of their budget, which inherently leads to a larger government than what is preferred by the median voter. In addition, government employees have a similar incentive to vote directly for larger government (see Corey and Garand, 2002). To test such a hypothesis, I need a proxy for bureaucratic power in the government size equation. Traditionally, this means including the number of employees in the public sector relative to the private. Following Ferris and West (1999) and Legrenzi and Milas (2002) I will use the share of employees in the government to population (BURO) to measure the effect that bureaucracy has on government size.¹⁷ The coefficient on BURO is expected to be positive.

¹⁶ D.C. Muller p. 338.

¹⁷ There is however an obvious problem of endogeneity. There is a clear two way relationship between BURO and the government size variables on the left hand side.

3.6. Government Size and Fiscal Illusion

A growing public sector may also be explained by the fact that voters may be deceived about the actual size (or actual cost) of the government. That is, taxes may be disguised in such a way that voters are induced to think that government size is smaller or less costly than it actually is. “Fiscal illusion” would then allow the government to grow beyond the optimal size preferred by the median voter. In order to test for fiscal illusion, I use the share of direct taxes in total tax revenues (DIRECT). The prediction is that as taxes are levied increasingly in the form of direct taxes, such as income taxes, voters are less likely to be mistaken about the real cost or size of the government. For this reason I expect government size to be negatively correlated with DIRECT, our measure of fiscal illusion.

3.7. Government Size and Country Size

A recent article by Alesina and Wacziarg (1998) investigated the relationship between country size and government size. It finds a significant negative correlation between different measures of government size and population as a proxy for country size in cross-country samples. Smaller countries would seem to have relatively large governments. In general, however, there are two opposing arguments. On the supply side, it can be argued that if public goods and services exhibit high fixed costs and have public good characteristics, such as non-rivalry and non-excludability, then the cost of providing these public services (such as parliament, roads etc.) should grow less than proportionally with population growth. That is, as long as there is no congestion in public good consumption, the production of government goods and services should exhibit economies

of scale. On the demand side, however, a bigger population allows for the cost of public provision to be divided over a larger number of taxpayers, thus decreasing the share of the cost that the median voter has to bear. Although a decrease in cost shared by the median voter also has an income effect, the more substitutable private and public goods are, the more dominant is the substitution effect. In this case, a bigger population may indeed imply a larger government size.¹⁸ Including population (POP) in the government size equation, allows a test for which one of these two counteracting effects dominates.

3.8. Government Size and Openness

Recent studies by Rodrik (1998) and Alesina and Wacziarg (1998) document a significant positive correlation between government size and openness in cross-country and panel data samples. Rodrik (1998) tests for the relationship between government size and openness for a wide range of countries. His benchmark regression of government size on openness, as measured by the ratio of imports plus exports to GDP, yields an elasticity coefficient of roughly 0.2 for government consumption and 0.5 for government investment. Both elasticities are positive and highly significant. The relation between government size and openness is also found to be robust to a wide range of control variables as well as being stable over time. Rodrik argues that this statistical relationship

¹⁸ See Alesina and Wacziarg (1998) pp. 308-309, and also Borchering (1985), pp366-367.

arises because the government insulates against variability in world markets.¹⁹ If we view the government as the safe, non-tradable, sector of the economy, incomes in this sector will be relatively stable. An increase in terms-of-trade riskiness in the tradable-goods sector may then result in the reallocation of resources toward the less risky sector of the economy. This hypothesis that the government size serves as social insurance against external risk is further reinforced by Rodrik's finding that the transfer measure of government size, rather than government consumption, is better correlated with exposure to external risk.²⁰

¹⁹ Rodrik's model sees the government as maximizing the expected utility of the representative household. The expected utility is found to be decreasing in the variance of the terms of trade. See Rodrik (1998) pp.1013-1014..

²⁰ It turns out that the estimated coefficient on external risk is greater in the regression equation using social security and welfare spending than in the government consumption specification. See Table 6 p. 1020 and pp.1019-1021.

Alesina and Wacziarg (1998) reproduce Rodrik's (1998) regressions.²¹ Their results tend to confirm Rodrik's finding of a positive and significant coefficient for openness in the government size equation. However, this result is sensitive to whether the variables are entered in logarithmic form or not and, when population is included in the regression equation to control for country size, the coefficient on openness tends to lose statistical significance.²² These studies and others suggest that the demand for government goods and services, either inclusive or exclusive of transfers, may depend on the exposure of the domestic economy to external markets. In this chapter I will test the hypothesized relationship between government size and openness across time for Switzerland. My measure of openness is the sum of imports and exports as a share of GDP (OPENNESS). The sign of its coefficient is hypothesized to be positive.

²¹ Besides the relationship between openness and government size, Alesina and Wacziarg (1998) are interested in analyzing openness and country size, as well as country size and government size. Historically, it appears that there is a positive relationship between trade volume and secessions. See Alesina and al. (1997). They also argue for a direct causality running from country size to trade volume. They find a robust and significant negative coefficient for population in the regression of openness on country size variables. See Alesina and Wacziarg (1998) pp.315-317.

²² In Alesina and Wacziarg (1998) we observe that the coefficient on population in the government size equation is negative and significant, while openness enters positively but is statistically not different from zero; see Table 7 column 6 on p. 318.

3.9. Government Size and Institutional Factors

Finally, I include the ratio of local government expenditure at the communal and cantonal level to total government expenditures (LOCAL) to control for the effects of jurisdictional institutions on government size. Two opposing arguments are widely cited in the literature and were recently tested on Italian data by Legrenzi and Milas (2002). The Tiebout hypothesis (1956) argues that taxpayers vote with their feet so that in a federal system, tax competition between local jurisdictions will lead to a lower tax-expenditure combination. According to this argument, a larger share of local in aggregate government expenditure should have a negative effect on government size. There is however a counterargument. Since local jurisdictions share the cost of services as the recipients of transfers from the central government, local governments often face a soft budget constraint (pay less than the full cost) and hence face less fiscal responsibility for increased expenditure. In this case a larger share of local government expenditure should lead to larger aggregate government size. The sign of the coefficient on LOCAL is therefore ambiguous and will depend on which of the aforementioned arguments dominates.²³

To test these hypotheses, I follow writers such as Henrekson (1988) and Ferris and West (1996a) in combining all these variables in a single reduced-form equation for the determinants of government size. In this form the equation is:

²³ See Legrenzi and Milas (2002). They find a positive and significant coefficient for LOCAL in their cointegrating regression for government size for Italy. This suggests that the soft budget constraint argument dominates over the Tiebout hypothesis.

$$GRATIO = g(RGDPPC^+, RELPRICE^-, OLDPOP^+, FARM^+, WOMEN^+, FEMPART^+, BURO^+, DIRECT^-, POP^?, OPENNESS^+, LOCAL^?) \quad (3.1)$$

where the plus and minus signs above the variables represent the predicted sign of the relationship between the dependent variable and its independent determinants.

3.10. Econometric testing and results

The econometric methodology used to test equation 3.1 is similar to that used to test the earlier simple economic model of government size in section 2.2. That is, since I am using time series data that may be non-stationary in levels, I want to investigate whether there exists a cointegrating relationship between government size and the designated set of independent variables. This means that I have to test all variables in the model for non-stationarity and then specify the correct cointegrating equation for testing.

We saw in section 2.1.3 that all three definitions of government size, GDISB, GCONS and GTRANSFER were all non-stationary in levels but became stationary when first-differenced. This allowed us to conclude that the three series are $I(1)$.²⁴ Also, real income per capita (RGDPPC) and the relative cost of government expenditure (RELPRICE) were considered as conventional economic determinants of government size. There I found that both real income per capita and the relative price were $I(1)$ variables. The inclusion of further public choice variables is of interest both in their own right and also by allowing a test of the robustness of the income elasticity estimates

²⁴ See Table 2.1 for the results of the Augmented Dickey-Fuller Test.

obtained in Chapter 2. In other words, I want to test whether the income and price elasticity estimates of Chapter 2 indeed captured the effect of income on government size, or whether these estimates were in some way biased because of omitted variables that affect government size.

We can now turn our attention to the new set of demand variables. Figures 3.1 to 3.8 depict the evolution of the additional public choice variables over the last forty years. In Switzerland, the share of the population over 64, OLDPOP, has steadily grown since the early 1960s, from just over 10% in 1960 to about 15% in 1997. Hence the series itself appears to be non-stationary.

Figure 3.1:

Source: OECD Statistical Compendium (1999) and www.sourceoecd.org, Switzerland 1960-2000.

Employment in agriculture as a share of total employment FARM, has, on the other hand, steadily decreased over the same period, from just over 7% in 1960 to just

over 2% in 1997. Again, visual inspection of the graph would suggest that this series is non-stationary in levels. Together these two variables should capture how changes in the strength of important interest groups have affected government size. This effect is hypothesized to be positive for both variables and stronger for the current disbursement measure and the transfer measure of government size rather than for government consumption..

Figure 3.2:

Source: OECD Statistical Compendium (1999) and www.sourceoecd.org, Switzerland 1960-2000.

As mentioned above, the female labour participation rate, FEMPART, is included in the government size equation to control for the relative ease by which the government taxes individuals. As more females enter the labour force, the cost of collecting taxes by the fiscal authority should decrease. Lower collection costs lead to higher tax revenues and therefore to increased expenditure by the government. In addition, however, the

absorption of ever larger proportions of the female population into the labour market may increase the demand for government services (e.g. child care). In Switzerland the female labour force participation rate increased from just over 50% in 1960 to almost 70% in 1997. From 1960 to the late 1970s it remained fairly constant, but increased dramatically from the early 1980s to the early 1990s. The early nineties show a leveling off at around 67% while at the end of the decade there is a definite breakthrough above 75%. Again, the visual inspection suggests that the series is not stationary in levels.

Figure 3.3:

Source: OECD Statistical Compendium (1999) and www.sourceoecd.org, Switzerland 1960-2000.

The effect that the size the government's bureaucracy may have on government size is measured by the share of government employees to total population. Here too, there has been a steady increase during the sample period, from around 8% in 1960 to around 13% in 1978. Thereafter, however, there has been little discernible upward trend in the ratio.

The fiscal illusion hypothesis is tested by including the changes in the share of total current receipts that are collected through direct income and wealth taxes (DIRECT) in the government size regression.

Figure 3.4:

Source: OECD Statistical Compendium (1999) and www.sourceoecd.org, Switzerland 1960-2000.

DIRECT grew dramatically between 1960 and 1976, from just over 26% to almost 34%. From 1976 onwards, however, this growth has been completely reversed, so that the share of direct taxes has basically reverted back to the level of the early 1960s. The graph in Figure 3.6 would also suggest that the series is not stationary.

In order to control for country size, I will include population in the government size equation. The population of Switzerland, POP, has grown from just under 5.5 million in 1960 to over 7 million in 2000. During the whole sample period, POP grew at an

average rate of 0.7% a year. Inspection of Figure 3.7 suggests that this series is also not stationary in levels.

Figure 3.5:

Source: OECD Statistical Compendium (1999) and www.sourceoecd.org, Switzerland 1960-2000.

Figure 3.6:

Source: OECD Statistical Compendium (1999) and www.sourceoecd.org, Switzerland 1960-2000.

Switzerland's exposure to foreign trade has evolved from just below 40% of GDP in 1960 to roughly 80% in 1997. The rate of growth of exports plus imports as a share of GDP has averaged 2.3% over the last forty years. A close look at Figure 3.8 also indicates that the rate of growth of OPENNESS has risen in the last decade. The series is increasing and possibly non-stationary.

Figure 3.7:

Source: OECD Statistical Compendium (1999) and www.sourceoecd.org, Switzerland 1960-2000.

The share of communal and cantonal expenditures as a share of current disbursements, which is my proxy for the institutional structure, does not exhibit any definite pattern of growth. The average share of government expenditure undertaken by local jurisdictions has remained around 60% for much of the sample period. Some growth is visible from 1960 to the early 1970s, when LOCAL reached 75%. Thereafter, however, LOCAL declined steadily to just over 50% by 2000. The series does not appear to be stationary, but further testing is necessary to confirm this interpretation of the diagram.

Figure 3.8:

Cantonal and communal expenditures as a share of total current disbursements

Source: OECD Surveys, Switzerland 1960-1999, OECD Statistical Compendium (1999) and www.sourceoecd.org, Switzerland 1960-2000.

The next step is to formally test for non-stationarity and see if the results confirm the impression given by preliminary visual inspection. Table 3.1 summarizes the results of the ADF and Phillips-Perron tests on the levels of the public choice variables when the series are entered in logarithmic form. The ADF test confirms that all variables are not stationary in levels, a result that the Phillips-Perron test generally confirms. For BURO the two results of unit root tests are somewhat contradictory. The ADF test would suggest that the series is stationary in levels, while the PP test indicates non-stationarity in levels and stationarity in first differences at the 11% confidence level. For DIRECT, the ADF test of first differences indicates rejection of a unit root only at 13% confidence level. The PP test, on the other hand, strongly suggests that DIRECT is indeed $I(1)$. For POP too there is a discrepancy between the results of the two tests. In this case the ADF test

strongly suggests that the series is $I(1)$ while the PP test rejects the null hypothesis of a unit root in POP at the 10% level of confidence. Overall, then, I conclude that the additional public choice variables are $I(1)$.

Table 3.1.: ADF and Phillips-Perron Tests on the levels and first differences of the public choice variables

Series	ADF [$t(\beta)$]	PP
OLDPOP	-0.867	-0.780
D(OLDPOP)	-4.75**	-4.770**
FARM	-1.775	-2.586
D(FARM)	-2.722*	-2.641*
FEMPART	0.8948	1.402
D(FEMPART)	-6.015**	-6.014**
BURO	-2.787*	-2.015
D(BURO)	-2.50 ^{a)}	-2.526 ^{c)}
DIRECT	-1.211	-1.079
D(DIRECT)	-2.435 ^{b)}	-8.729**
POP	-0.794	-2.865*
D(POP)	-3.83**	-2.976**
OPENNESS	-0.803	-0.838
D(OPENNESS)	-4.811**	-4.633**
LOCAL	-0.629	-0.629
D(LOCAL)	-7.384**	-7.384**

Notes: all series are in logarithms; (**) and (*) denote rejection of the null hypothesis of a unit root in the series at 5% and 10% confidence respectively; the model specification is with intercept but no time trend; the number of lags in the ADF test is set to minimize SIC; the truncation lag for the PP is set to automatic; a) indicates rejection of a unit root at 12% level of confidence; b) indicates rejection of a unit root at 13% level of confidence; c) indicates rejection of a unit root at 11% level of confidence.

Despite non-stationarity in the levels, it may be possible to find a linear combination of these variables that would yield residuals that are in fact stationary over time. Following Engle-Granger (1987) I can specify a regression equation in levels and test whether this produces residuals that are $I(0)$. This cointegrating relationship would then characterize the long-run equilibrium level of government size. The equation to be tested is an extended version of the equation tested in Chapter 2, and assumes that in addition to

government size and relative price as endogenous variables, public choice variables form part of the cointegrating equation. The estimating equation is then broadened to become

$$\begin{aligned} GRATIO = & c + (\beta_1 - 1)RGDPPC + (\beta_2 + 1)RELPRICE + \beta_3 OLDPOP + \beta_4 FARM \\ & + \beta_5 WOMEN + \beta_6 FEMPART + \beta_7 BURO + \beta_8 DIRECT + \beta_9 POP \\ & + \beta_{10} OPENNESS + \beta_{11} LOCAL + u. \end{aligned} \quad (3.2)$$

The econometric analysis is structured in two stages. In the first stage I look for evidence of cointegration among this set of variables and in the second stage I will make statistical inference on the size of the estimated coefficients. I follow a general to specific methodology, by including in the regression all the variables surveyed above, and then test whether this produces residuals that are stationary. If this is not the case, the least statistically significant variables are dropped and the equation is re-estimated. If the ADF test on the new residuals does not reject the presence of a unit root, this process is repeated until I eventually converge to the equations in Table 3.2.

Table 3.2: Cointegrating regressions for the three specifications of government size

	GDISB (1)	GCONS (2)	GTRANSFER (3)
RGDPPC	-1.379	-1.191	-1.537
RELPRICE	0.6917	1.432	0.4791
OLDPOP	1.9373	0.5015	2.7898
FARM	-	-0.4328	0.1197
WOMEN	-	-	-
FEMPART	-	-	-
BURO	-	-0.043	-
DIRECT	-	-	-
POP	2.404	0.6744	3.1894
OPENNESS	-	-	-
LOCAL	-	-	-
Implied Income Elasticity	-0.379	-0.191	-0.537
Implied Price Elasticity	-0.3083	0.432	-0.5209
R²	0.99	0.97	0.99
DW	1.38	1.11	1.56

Notes: all series are in logarithms.

The regressions in levels all exhibit very high coefficients of determination.

In order to make meaningful statistical inference from the estimated parameters I have to test first whether the residuals are stationary in levels. The results of the Augmented Dickey-Fuller Test and the Phillips-Perron tests are summarized in Table 3.3. For two of the three regressions, I reject the null hypothesis of a unit root in the residuals at a 5% confidence level. For government transfers, the null hypothesis of a unit root can be rejected only at the 10% level of confidence. This finding is consistent with the hypothesis of a long-run relationship between these sets of I(1) variables and allows us to

proceed to an evaluation of the individual hypotheses in relation to the different definitions of government size.

Table 3.3: ADF and Phillips-Perron Tests on the residuals of the regressions in levels

Series	ADF [$t(\beta)$]	PP	Critical Values ¹⁾
RESIDUAL(1)	-4.86**	-4.86**	5%: -4.76 10%: -4.39
RESIDUAL(2)	-5.80**	-5.73**	5%: -5.47 10%: -5.08
RESIDUAL(3)	-4.98*	-4.84*	5%: -5.12 10%: -4.74

Notes: the model specification is with intercept but no time trend; the number of lags in the ADF test is set to minimize SIC; (**) and (*) denote rejection of the null hypothesis of no-cointegration at 5% and 10% respectively; ¹⁾ Critical values are MacKinnon (1996) critical values adjusted by the number of integrated variables.

In order to correct for the possible correlation between the innovations of the set of I(1) variables, I will augment the cointegrating regression with contemporaneous, leads and lags changes of the variables as suggested by Saikkonen (1991).²⁵ This will allow for a meaningful statistical inference on the estimated parameters of the individual independent variables. Table 3.4 below shows the results of the estimation of the Saikkonen's augmented cointegration equations.

²⁵ Because of possible inconsistency in the standard errors of the Saikkonen's augmented cointegrating regression, the reported standard errors in Table 3.2 have been adjusted to account for serial autocorrelation. For the individual measures of government size, I found significant serial correlation in the residuals of the augmented regression only for government consumption expenditure. In that particular case, the Saikkonen's adjustment factor for the standard errors of the estimated parameters is calculated at 1.21.

Table 3.4: Augmented Cointegrating regressions for the three specifications of government size

	GDISB (1)	GCONS (2)	GTRANSFER (3)
RGDPPC	-1.641** (0.24)	-1.4815** (0.11)	-1.647** (0.54)
RELPRICE	1.672** (0.52)	3.5627** (0.21)	1.6982 (1.16)
OLDPOP	1.70** (0.15)	1.53** (0.23)	2.148** (0.51)
FARM	-	-0.1248 (0.09)	0.038 (0.35)
WOMEN	-	-	-
FEMPART	-	-	-
BURO	-	-1.0177** (0.14)	-
DIRECT	-	-	-
POP	3.023** (0.51)	2.5151** (0.23)	3.586* (1.49)
OPENNESS	-	-	-
LOCAL	-	-	-
Implied Income Elasticity	-0.641*	-0.4815**	-0.647
Implied Price Elasticity	0.672	2.5627**	0.6982
R²	0.99	0.99	0.99
DW	2.20	2.63	2.17

Notes: all series are in logarithms; standard errors in parentheses; (**) and (*) denote statistical significance at one (five) percent respectively.

In all three models the income coefficient estimates are both negative and highly significant. However, in terms of their elasticities, these coefficients translate into

elasticity values that are marginally less than zero for the government disbursement and government consumption equations and just slightly greater than zero for the transfer measure of government size. For government current disbursements and government consumption these income elasticities are significantly different from zero. Not so, however, for government transfers. Comparing these results to what was found for the simple economic model of government size of Chapter 2, there I found income elasticities that were significantly greater than one for all three types of government expenditures. In this extended model, then, the empirical results reject Wagner's Law as a possible explanation of the growing share of government in the economy. This rejects the conclusions of the previous chapter.²⁶

The results for the implied price elasticities of government demand are also quite different from what was found in the simple economic model. The price elasticity for government consumption is found to be positive and significantly so, while the coefficient for the transfer measure of government size is negative but statistically not different from zero. The result for government consumption casts some doubts on the existence of a price inelastic demand curve for government expenditure. On the other hand, it may be the case that a single equation, no matter how well specified, cannot separate out the opposing demand and supply effects on the cost/price of providing government services.

²⁶ It is useful to remember that because disbursements are the sum of consumption plus transfers the estimated parameters for this most comprehensive measure of government size (GDISB) is a weighted average of the other two measures.

When we consider the more general government expenditure definition, the consumption and transfer effects cancel out, so that the standard result of an inelastic demand function reappears. In this case, Baumol's Hypothesis would not be rejected for the more general measure of government size, unlike our earlier finding for government consumption. Once again, however, these inconsistent findings may be the net result of being unable to separate out demand and supply effects.

Turning to the public choice variables, the estimated coefficients on OLDPOP are positive and highly significant in all three models. Furthermore, the coefficients are greater than one in all cases, with the value in the government transfer equation being the largest at approximately 2.148.²⁷ These results confirm the hypothesis that the older segment of the population has a greater demand for such redistributive services as social security payments as well as for more consumptive government services such as health care.

The coefficient on the share of employment in farming (FARM) is negative for model (2) and positive for model (3). However, both are not significantly different from zero. One interpretation of this result is that some type of Kau-Rubin mechanism is at work here. Typically farmers are both self employed and work in rural areas. Both factors make it more costly for the government to observe earned income and so collect taxes. This negative effect of larger employment in farming on government size is possibly counterbalanced by a significant positive effect on the demand that a relatively larger

²⁷ Statistically, the coefficients for three government size measures are significantly greater than one at 5% confidence.

agricultural sector has for government transfers. The combined overall effect on government disbursements is insignificant so that FARM was left out from the more general, current disbursement, measure of government size.

The dummy variable WOMEN, which represents the date of the inclusion of women in the voting franchise, does not have any significant explanatory power on government size and hence has not been included in the estimation of all three specifications of government size. This suggests that the last broadening of the voters' franchise to individuals with lower income did not have the significant positive long-run effect on government size that is predicted by the Meltzer-Richard hypothesis.

The female participation rate also does not yield significant coefficients for all three models and hence was dropped as a possible long-run explanation of government size. It does not seem that increased female participation in the Swiss labour force has implied a bigger government size, either through a larger demand for publicly supplied goods and services demand or through easier taxation from the government.

Our proxy for the power of bureaucracy, BURO, also does not appear significantly in at least two of the three specifications of government size. Only for government consumption BURO enters significantly, however, with the wrong sign. A possible explanation for the lack of influence that bureaucracy has on government size in Switzerland may be traced to the traditionally strong role of direct democracy and to constitutional spending rules that should effectively reduce spending and/or deficits. For the case of Switzerland, recent studies by Feld and Kirchgaessner (2000, 2001b) have indeed shown that direct democracy and constitutional restraint mechanisms have a

negative effect on government expenditure. This evidence seems to be supported in this study.

The fiscal illusion hypothesis, captured by the variable DIRECT, does not seem to enter significantly in all three measures of government size. This result does not confirm the hypothesis that when more taxes are levied in the form of direct income and wealth taxes, a negative effect is produced on the size of government.

More consistent results across measures of size are obtained with respect to population (POP). Here population has an unambiguously positive effect on government size across all three formulations. In contrast to what Alesina and Wacziarg (1998) find for numerous OECD countries, there seem to be considerable diseconomies of scale in the production of government goods and services in the case of Switzerland. The data is then consistent with the hypothesis that there exists high substitutability between public and private goods so that an increase in population size effectively decreases the cost share of the median voter. According to this hypothesis, a strong substitution effect would explain the significant positive relationship between population and government size.

The estimation results with regard to OPENNESS are mostly inconsistent with Rodrik's hypothesis. Together with this set of explanatory variables I do not find OPENNESS to be a significant regressor in all three government size equations.

With respect to the influence that the institutional division of government activities has on overall government size, I find that my proxy for decentralization (LOCAL) and government size are not cointegrated. That is, when I add LOCAL to the set of variables considered here, I find that the residuals are non-stationary and hence I

can not conclude for cointegration. This framework, then, does not allow for a test of the validity of the two hypotheses considered in this case, namely competition among local jurisdictions versus soft budget constraint. Moreover we may keep in mind that the case of Switzerland is quite peculiar, since the presence of a strong direct democracy and constitutional expenditure mechanism has a strong influence on government size itself, which is not captured by LOCAL.

We may think of the regressions equations in levels as characterizing the long-run equilibrium among the set of independent variables and government size. This estimated long-run relationship yields residuals that are stationary in time. The use of these residuals, then allows us to specify an error correction model (ECM) that extends the analysis to a description of the dynamic adjustment process around the long-run, equilibrium path. The ECM involves estimating the changes in government size on an error correction term, its own lagged values and the contemporaneous and lagged changes in the set of independent variables.²⁸

The results of the ECM for the three definitions of government size are summarized in Table 3.5.

The first point worth mentioning is that by including the public choice variables, the ECM is able to explain around 90% of the variations in government size for all three specifications. As we recall, the VECs of Table 2.6 applied to the simple economic model

²⁸ Due to the relatively small sample size, the ECMs are specified using one lag both in the dependent variable and in the set of independent variables.

of government size could explain only between 20 and 60% of the variation in size.²⁹

Table 3.5: ECM regressions for the three government size specifications

Model	DGDISB	DGCONS	DGTRANSFER
ERROR CORRECTION	-0.697* (0.27)	-2.444** (0.75)	-1.180** (0.29)
DGRATIO(-1)	0.2079 (0.20)	0.090 (0.17)	0.31 (0.20)
DRGDPPC	-1.122** (0.14)	-0.809** (0.13)	-1.402** (0.28)
DRGDPPC(-1)	-0.050 (0.29)	-0.051 (0.24)	0.075 (0.37)
DRELPRICE	1.230** (0.24)	0.993** (0.21)	1.773** (0.52)
DRELPRICE(-1)	0.015 (0.37)	-0.005 (0.33)	-0.102 (0.56)
DOLDPOP	0.0269 (0.32)	0.1169 (0.25)	0.153 (0.58)
DOLDPOP(-1)	1.101 (1.04)	0.911** (0.28)	0.209 (0.57)
DFARM	-	-0.139* (0.06)	-0.0179 (0.14)
DFARM(-1)	-	-0.0289 (0.08)	0.092 (0.16)
DBURO	-	-0.300 (0.29)	-
DBURO(-1)	-	-0.113 (0.20)	-
DPOP	-0.140 (1.33)	-2.415 (1.31)	1.258 (2.93)
DPOP(-1)	1.101 (1.04)	2.753** (1.03)	0.336 (2.06)
CONSTANT	0.168* (0.007)	0.0039 (0.005)	0.024 (0.013)
R ²	0.84	0.87	0.75
DW	1.96	2.04	2.09
F-statistic	13.51	10.46	5.76

Notes: all variables in logarithms; standard errors in parentheses; (**) and (*) significantly different from zero at one (five) percent.

²⁹ Note, however, that the two methodologies are not directly comparable. The VEC approach of Chapter 2 implies a multiple joint estimation, while the method used in this chapter relies on a single equation approach.

By extending the model to include public choice variable there is a significant improvement in the coefficient of determination in the error correction model.

Next, I turn my attention to the error correction terms. In all three models the estimated parameters on the lagged residuals of cointegrating regressions enter with a negative sign and are statistically significant across specifications. This result points to the stability property of the relationship and increases one's confidence that the level regressions do represent an equilibrium relationship. The coefficients on the lagged dependent variables are all positive, but none are statistically significant. This suggests that the persistence in the transitory nature to shocks to government size shown in Chapter 2 can to some extent be explained by a more comprehensive theory of government size.

The coefficients on contemporaneous changes of real GDP per capita are negative and significant for all three models, and this translates into short-run implied income elasticities, β_1 , equal to zero. The changes in income at lag one do not seem to enter significantly. There is then no evidence of Wagner's Law in the short-run. Rather, these findings again suggest a short-run counter-cyclical role for government size. This reinforces the short-run role originally appearing in the estimation results of Chapter 2.

The relative price variable is significant in all three models of government size, and this implies a price elasticity, β_2 , of around 0.23, for government current disbursements, -0.058 for government consumption expenditures and 0.77 for government transfers. Nevertheless, none are statistically different from zero. Only in the second model is the price elasticity is of the right sign but again statistically insignificant. To the extent that the single equation captures a demand relationship, the ECM seems to

confirm Baumol's unbalanced growth hypothesis as a driving force in the growth of government size, at least in the short term.

OLDPOP, which was highly significant in the regression in levels, loses all statistical significance in the error correction regression, particularly at lag zero. DOLDPOP seems to retain some statistical significance at lag one, for at least the second measure of government size. This, in my view, signifies that the share of older population is a more important determinant of long-run evolution of government size and does not affect short-run variations as much. This is consistent with the predictable and slow moving evolution of such demographic variable.

The estimation results for the parameter on DFARM yield coefficients that are negatively correlated with the consumption and the transfer measures of government size. In model (2) I find the coefficient on DFARM to be -0.139 and this is statistically significant at 5%. This result is more consistent with the Kau-Rubin hypothesis that while farming is an important recipient of government subsidies, an increasing farming population also increases the cost to the government of collecting taxes. On net then, this negative effect on government size appears to prevail only marginally so that in the aggregate the two effects cancel.

Similar to my finding in the analysis of the cointegrating equation, DBURO does not seem to be statistically significant in the error correction equation. DBURO is negatively correlated with DGCONS but with no statistical significance.

Similarly to DOLDPOP, the population variable, DPOP, loses statistical significance in the regression in first differences. The same explanation applies, where

population captures longer run, secular effects, but cannot capture reasons producing short term variations in government size.

3.11. Conclusions

The purpose of this chapter was to extend the simple economic model of government size to include a broader set of theories aimed at explaining government size. I extended the econometric methodology of Chapter 2 by adding an additional set of public choice variables that take into consideration the political process as well as characteristics of the population that determine the evolution of government size.

In the first instance, the inclusion of public choice variables significantly increases the prediction power of the ECM regression in the short-run. The R^2 statistic of the ECMs with public choice variables is on average around 0.80. The empirical results indicate that the estimates of the elasticities of the traditional economic variables may not be robust to the addition of public choice considerations. In particular, the estimated income elasticities are consistently less than one and, in some cases even negative. This casts serious doubts on the validity of Wagner's Law for Switzerland. The variation found in the estimated price elasticities suggests a different problem. In this instance it may be the case that a single reduced form equation of a demand and supply system may not be able to separate offsetting influences on price.

The econometric analysis suggests that there are different cointegrating relationships, depending which definition of government size is chosen. A number of opposing results were found for our explanatory variables and these are not always solved by choosing a more comprehensive measure of government size. This suggests the

presence of diverging effects within the components of government spending that sometimes offset each other in the aggregate and so do not allow for a meaningful interpretation of the most comprehensive measure of government size. The parts may be more interpretable than the whole.

More general concerns revolve around the possible endogeneity between the dependent variable and some of the independent variables. One case in point is the potential two-way relationship between government size and employment in the government. In the present framework of a single equation, the causality of this relationship was presumed to run in only one direction. Causality may run in the opposite direction, however, with government employment determined by government size. This question cannot be answered in a single equation setting. In addition it may be useful to separate the variables according to whether they affect the demand or the supply of government goods and services. This has already appeared as a possibility with relative price and obviously cannot be addressed in the present single equation setup.

It is to address these identification and simultaneity issues that I again extend the methodology to a wider multiple equation framework. This is the purpose of chapter 4.

Chapter 4: The Demand and Supply for Government Expenditures: A Multiple Equation Approach to Explaining Government Size

4.1. Introduction

The purpose of this chapter is to estimate empirically a supply and demand model for government goods and services. In such a way I hope to remedy many of the problems that were associated with the single equation estimation technique used in previous chapters.

Perhaps the most significant shortcoming of the single equation approach is that it ignores endogeneities that may arise between the dependent variable in the regression equation and the equation's independent or explanatory variables. In this chapter I will analyze in detail two particular issues. One contemporary concern has been with the possibility of a bi-directional relationship between government size and the share of employment in government (the size of the bureaucracy). Here the production function provides the first connection between the two. From that perspective, should the demand for government services grow in relative terms, relatively more employees will be required to provide the higher demanded flow of government services. Causality then runs from government size to bureau size. A number of other writers, however, suggest the importance of a relationship running the opposite direction. For example, Buchanan and Tullock (1977), Musgrave (1981), Ferris and West (1999) and others, argue that government employees are also voters and voters with a much stronger interest in larger government size than the median voter. Hence given the large and growing size of

government in the economy, government employees themselves may have become an important interest group in explaining further increases in size. Other public choice theories emphasize that bureaucrats wish to maximize the budget of the bureau and this, in itself, could similarly explain a larger sized government. As in Niskanen (1971), the bureaucrat will extend the bureau's output beyond the efficient level, where the marginal benefit is equal to the marginal cost.³⁰ Conceptually at least, these latter two theories are similar in seeing causality run from bureau size to government size. From the perspective of this chapter, then, questions arise with respect to whether the measure of bureaucratic power should be interpreted mainly as a demand or supply influence.

A second endogeneity concern arises from the possibility of a bi-directional relationship between government size and income. Two sets of theories with opposing causalities can be cited in this context. First, as we have seen, many public finance theorists follow Wagner (1893) in arguing that government goods and services are highly income elastic, so that increases in income will lead to more than proportional increases in government spending and therefore explain a greater share of government in GDP. On the other hand, economists more familiar with macroeconomics and growth theory see causality running in the opposite direction and investigate the effect that the size of government may have on the level and rate of growth of national income. Authors such as Barro (1990), Karras (1999) and more recently Foelster and Henrekson (2001) have investigated the effects of government activity on economic development either on cross

³⁰ See Mueller(1991) pp.252-254.

country or time series data. Their research produces results that differ depending on the kind of government expenditure considered.

The purpose of this chapter is then to use a multiple equation system to separate these types of diverging effects and investigate whether such an approach leads to a significant change in the estimated parameters when compared to those of the single government size equation. The specification of a system of equations addresses a further problem of the single equation approach, namely how the estimated equation should be interpreted. That is, there is strong possibility that the estimated coefficients of the single equation may be biased either because the relationship is interpreted as a demand function and the supply has shifted, or because the estimated equation is considered to be a supply relationship where the demand function has changed in the interim. The specification of a system of simultaneous equations then corrects for the possible bias in the estimated parameters. Finally, the system of equations developed here extends the analysis and findings of the earlier chapters, by using the public choice hypotheses of chapter 3 to specify separate demand and supply relationships.

The structure of this chapter is as follows. First I specify a demand and supply model for the three definitions of government expenditures assuming that the share of government employees in the labour force, BURO, is exogenous. Next I introduce an additional equation for government employees, a demand relationship derived from the cost minimization problem facing the government. I then re-estimate the three-equation system simultaneously. In the second half of the chapter I will address the problem of simultaneity between government size and income using the error correction method

specified in chapter 2 in combination with a standard growth equation inclusive of government size.

4.2. A Demand and Supply Model of Government Size

I start by specifying the demand side of the model. Following the discussion in chapter 3 I begin by including the conventional economic variables that would enter the demand equation, namely relative price (RELPRICE) and income (RGDPPC). In this respect, the single equation approach used in the last chapter produced inconsistent results, particularly with respect to the estimated price elasticity. The concern is with the size of the price coefficient as a test of Baumol's cost disease hypothesis (discussed at length in Chapter 2). For Baumol's effect to account for growing government size, it is necessary that the demand curve be price inelastic. Hence Baumol's hypothesized relationship is that the price elasticity of demand is less than one in absolute value.

In the empirical work of Chapter 3 I found that while the demand relationship appeared to be price inelastic for the more general measure of government size (GDISB), the two more specific measures, GCONS and GTRANSFER produced completely opposing results. At that stage I speculated that the single equation specification was the probable cause in that the single estimate was unable to separate out opposing supply and demand effects. With respect to income per capita, RGDPPC, the results of Chapter 3 reject Wagner's Law. The income elasticity was found to be less than one. These estimates were in direct contrast with what was found in relation to the simple economic model of Chapter 2. One question of interest will be whether the estimates of the size of the income effect are robust to estimation within a system equation framework.

To the conventional determinants of demand, I add those public choice variables that have been considered an important influence on the demand for government goods and services, beginning with interest groups. Here it is widely argued that the older fraction of the population has a relatively high demand for the public goods provided by the government. An often cited example is the greater health care demanded by an increasingly aging population. I use OLDPOP, the ratio of population older than 64 to control for the strength of this particular interest group on demand. Another potentially strong voice demanding larger government is the number of government employees. My proxy for bureaucratic power, BURO, used in this chapter is the ratio of public employment to private employment.³¹ A third group that is hypothesized to affect the demand side is women in the labour force. To rationalize their inclusion, two types of hypotheses are commonly used. First, Kau and Rubin (1981) argue that earnings visibility is enhanced when women leave the home and enter the labour market. This reduces tax collection costs for the government and so increases government size. Accordingly, the female participation rate, FEMPART, should be correlated positively with government size. A second hypothesis is that working women have relatively high demands for government services. The often used example is the demand for

³¹ The reason for the change from Ch. 3 is the fact that later in the chapter, I will need to specify an additional equation for BURO. In that equation, derived from cost minimization, BURO should be viewed as labour use in the government sector relative to the private sector and, in turn, is a function of wages in the government sector relative to compensation in the private sector..

government provided day-care. The causation between FEMPART and government size implied by Kau/Rubin is then reinforced by direct effect on the demand for social services that this group may have.

In addition, I wish to test directly the Meltzer and Richard (1981, 1983) hypothesis that the expansion of the suffrage has been an important cause of the growth of government size. This hypothesis argues that the expansion of suffrage has brought successive groups into the franchise whose incomes are below that of the median voter. Hence newly enfranchised voters typically prefer higher transfer-tax combinations and hence will push the median voter equilibrium towards a bigger government sector. A recent study by Lott and Kenny (1999) has found that women are more likely to vote liberal and that the expansion of suffrage across the states of the United States has gone hand in hand with increased government expenditures and revenues. In my case, I introduce a dummy variable, WOMEN, to test for the effect of the introduction of women's suffrage at the federal level in Switzerland in 1971.

On the demand side, growth in government size may also be driven by the informational complexity of the fiscal system. Voters are often assumed to suffer from "fiscal illusion" so that as taxes become more complicated and less direct in their incidence, voters are fooled into thinking that the government is less costly than it actually is. I will use the share of direct taxes to total tax revenues (DIRECT) as a proxy for greater transparency in the fiscal system. DIRECT should be negatively correlated with government size.

Finally I control for the exposure of the domestic economy to foreign shocks. Cameron (1978), Rodrik (1998), and Alesina and Wacziarg (1998) have all found

significant and positive relationships between government size and trade volume (OPENNESS). Their hypothesis is that the government exists in part to buffer the domestic economy from volatility arising in the world markets so that a bigger government will better protect the domestic economy from foreign shocks. Hence the more open is the domestic economy, the more protection that will be demanded so that the relationship between OPENNESS and government size is predicted to be positive.

Summarizing all of these considerations in functional form, the demand side of the model is characterized by the equation:

$$GRATIO^d = g^d (RGDPPC^+, RELPRICE^-, OLDPOP^+, BURO^+, FEMPART^+, WOMEN^+, DIRECT^-, OPENNESS^+) \quad (4.1)$$

where the predicted sign of the partial derivative is indicated above each explanatory variable.

I now turn to the supply side. Starting from standard cost minimization considerations, larger government sizes can typically be produced only at higher cost so that on the supply side government size should be correlated positively with the relative cost of producing government goods and services (RELPRICE).³² In addition, Baumol's hypothesis of unbalanced growth argues that because the government sector is more labour intensive than the private sector, productivity growth through time should be much

³² As in Ferris and West (1996a), this corresponds to a movement along the supply curve. See p. 543.

slower than in the more capital intensive private sector. To proxy the lag in productivity within the government sector relative to the private sector, I use a dummy time trend (TIME). The hypothesis to be tested is that through time the productivity lag grows, and the cost of government goods and services rises relative to private goods, implying a continually upward shifting supply curve. Note that while this will cause the quantity of government services to contract, an inelastic demand curve for government services will mean that government expenditures will expand relative to private, so that government size will become larger.³³

Turning our attention to other public choice variables, Kau and Rubin (1981) discuss a number of variables that indicate changes in the cost of raising tax revenues and hence of supplying government.³⁴ I consider two: the ratio employment in farming to total population (FARM) and the urbanization rate (URBAN). Because farmers are typically self-employed and can often transact outside of markets, farm output is more difficult to tax. Tax collection costs for the government are then predicted to be directly proportional to the relative number of persons employed in the agricultural sector. The coefficient on FARM in the supply equation is therefore expected to be negative. In the same way, people living in urban areas are more likely to be involved in market activity,

³³ A necessary condition for growing government size is that the demand curve must be inelastic. Only then an upward shift in the supply function will cause an increase in aggregate expenditures.

³⁴ Unfortunately other measures such as the degree of self employment are unavailable for the whole sample period for Switzerland.

which is easier to monitor and tax by the government. Hence the coefficient on URBAN is expected to be positive.

A common finding in the empirical literature on government size, particularly in cross-sectional data, is that government size is negatively correlated with population size (POP).³⁵ The basis for this prediction is the public good character of some types of government activities. Given the relatively high fixed cost of setting up government services and the absence of congestion, non-rivalry and non-excludability in consumption lead to the prediction that the cost of government goods will grow less than in proportion to population. This would increase the quantity of government services demanded but, assuming an inelastic demand curve, lower expenditure on government services. This suggests that the coefficient on POP in the government size equation will to be negative.

One further explanatory variable that I wish to introduce in the supply side accounts for the special effect that the institutional structure has on government size. The federal character of Switzerland and its political institutions imply a number of different levels of government activity. Following Tiebout (1956), the existence of multiple different and autonomous local jurisdictions may reflect itself in increased tax competition, and this would lead to a smaller aggregate government size.³⁶ However, as pointed out by Legrenzi and Milas (2002), the presence of transfers in a federation from the central government to the communal and cantonal levels could result in less fiscal responsibility at the local level and hence produce a larger government. The share of

³⁵ On this subject see Alesina-Wacziarg (1998).

³⁶ See Feld and Kirchgaessner (2001a).

local government expenditure (communal and cantonal) relative to total government expenditures is my proxy to control for the jurisdictional factors affecting government size. The sign of the coefficient of this variable (LOCAL) will indicate which of hypothesis is more relevant in Switzerland's case.

Combining all these considerations, the supply side can be summarized in the following equation:

$$GRATIO^s = g^s (RELPRICE^+, TIME^+, FARM^-, URBAN^+, POP^-, LOCAL^?) \quad (4.2)$$

where again the predicted signs of the partial derivatives are included above each of the explanatory variables. Together equations (4.1) and (4.2) form the demand and supply system to be estimated below.

4.3. Estimation and results

Following Borcharding and Deacon (1972), Henrekson and Lybeck (1988), Ferris and West (1986a) and Borcharding Ferris and Garzoni (2004) we can represent the demand and supply model by the following regression system:

$$GRATIO^d = \alpha_1 + (\alpha_2 + 1)RELPRICE + (\alpha_3 - 1)RGDPPC + \alpha_4 OLDPOP + \alpha_5 BURO + \alpha_6 FEMPART + \alpha_7 WOMEN + \alpha_8 DIRECT + \alpha_9 OPENNESS \quad (4.3)$$

$$GRATIO^s = \beta_1 + (\beta_2 + 1)RELPRICE + \beta_3 TIME + \beta_4 FARM + \beta_5 URBAN + \beta_7 POP + \beta_8 LOCAL \quad (4.4)$$

On the demand side I expect the implied own price elasticity α_2 to be negative and less than one in absolute value. The income elasticity is predicted to be positive and, for Wagner's Law to be confirmed, α_3 would need to be significantly greater than one. The coefficients on OLDPOP, BURO, FEMPART, WOMEN and OPENNESS are all predicted to be positive with no a priori restrictions on their size. Finally, the fiscal illusion coefficient α_8 is expected to be negative. On the supply side, the coefficients on RELPRICE, TIME and URBAN are all predicted to be positive. FARM and POP are expected to be negatively correlated with government size, while there is no definitive prediction on the sign of LOCAL. A negative sign would be needed to confirm the dominance of the Tiebout effect

The system is estimated using three stage least squares (3SLS), which allows for joint estimation of the structural equations in the model. This results in a smaller asymptotic variance and hence in improved efficiency compared to a single equation method such as two stage least squares.³⁷ The results of the system estimation are summarized in Table 4.1.

³⁷ For further discussions on system estimation see among others Kennedy pp. 163-182 and Johnston-DiNardo pp. 305-318. It is also worth mentioning that in this case the necessary order condition for identifiability is satisfied. That is, both in the demand and supply equations, the number of predetermined variables excluded is at least as great as the number of endogenous variables minus one. (See Johnston-DiNardo p. 312) This results in both equations being overidentified.

I begin with the demand side and the coefficient on real income per-capita.

With regard to the implied income elasticities (listed at the bottom of the table), the system estimation reinforces the results of the single equation analysis of the previous chapter. Here all three income coefficients are significantly negative but greater than minus one. This translates in income elasticities that are all positive but not statistically different from zero. These results contradict the notion of a highly income elastic demand for government goods and services meaning that Wagner's Law is rejected by the data. This reinforces the result of Chapter 3 that suggests that the three variable model is too simplified.

The price coefficients found on the demand side are now consistent with an inelastic demand for public goods across all three specifications of government size. The own price elasticities range from -0.96 for government disbursements to 0.76 and -1.80 for government consumption and government transfers respectively. With none of these estimates being significantly different from zero, it is consistent with the requirement of Baumol's hypothesis that the demand curve be inelastic. In terms of their relative size, these estimates imply that government transfers are more sensitive to cost than government good and services.

Table 4.1: Three-Stage Least Squares Estimates of the Demand and Supply Equations for Government Size

	GDISB		GCONS		GTRANSFER	
	Demand	Supply	Demand	Supply	Demand	Supply
Constant	6.51** (1.30)	-5.12 (11.51)	3.25** (1.23)	-9.60 (7.98)	5.76** (1.72)	9.43 (14.64)
RGDPPC	-0.92** (0.22)	-	-0.77** (0.21)	-	-0.68** (0.31)	-
RELPRICE	0.04 (1.08)	1.48** (0.39)	1.76* (0.97)	0.74** (0.31)	-0.80 (1.45)	1.79** (0.50)
OLDPOP	0.48 (0.86)	-	0.61 (0.49)	-	0.31 (0.72)	-
FARM	-	-0.55* (0.28)	-	-0.39* (0.21)	-	-0.72** (0.36)
WOMEN	-0.04 (0.07)	-	-0.10 (0.06)	-	-0.02 (0.09)	-
FEMPART	1.35** (0.17)	-	0.86** (0.17)	-	1.56** (0.24)	-
URBAN	-	1.45* (0.75)	-	-0.36 (0.51)	-	2.91** (0.98)
BURO	0.63** (0.24)	-	-0.22 (0.23)	-	1.23** (0.34)	-
DIRECT	0.83** (0.22)	-	0.65** (0.23)	-	0.74** (0.31)	-
POP	-	-0.43 (1.59)	-	0.86 (1.09)	-	-2.88 (2.03)
OPENNESS	0.33 (0.32)	-	0.37 (0.30)	-	0.19 (0.45)	-
LOCAL	-	-0.74 (0.50)	-	-0.90** (0.31)	-	-0.014 (0.64)
TIME	-	-0.012* (0.007)	-	-0.009* (0.004)	-	-0.003 (0.008)
Implied income elasticity	0.08	-	0.23	-	0.32	-
Implied price elasticity	-0.96	-	0.76	-	-1.80	-
AdjR²	0.97	0.96	0.93	0.92	0.98	0.97
DW	1.65	1.16	1.83	1.90	1.30	0.84

Notes: All variables in logarithms; standard errors in parentheses; ** (*) denotes significance at 5% (10%) respectively.

The system estimation yields mixed results for the public choice variables in the demand equation. In particular, an increasing share in the older population now seems to be less of a factor in increasing government size than it was in the single equation framework. The coefficients on OLDPOP are all positive, which is consistent with the theory. However, across all three specifications of government size, they are insignificantly different from zero. The expansion of suffrage, captured by the dummy variable WOMEN, enters the demand side with wrong sign in all three cases. Statistically, however, the suffrage expansion coefficient is insignificant, perhaps because the dummy variable may not be able to capture the intertemporal dimension of the effect of increasing women participation in the voting process.³⁸

Female labour force participation, FEMPART, enters the demand side with a positive sign in all three specifications of government size. In addition the coefficients are all highly significant. This contradicts the finding in the single equation model where FEMPART was found to be negatively correlated with government consumption but positively with government transfers. One interpretation is that the system estimation better isolates the positive effect that increased female labour force participation has had on the demand for government goods and services.

The bureaucracy variable, BURO, appears with a different sign depending on which measure of government size is considered. BURO is positively correlated with

³⁸ The latest work in this subject by Lott and Kenny (1999) suggests that the impact of suffrage expansion may accumulate over time through increased voter participation rather than arise discretely.

government disbursements and government transfers. Both coefficients are also highly significant. With respect to government consumption on the other hand, the estimated coefficient is negative although not statistically different from zero. Overall, however, these results are closer to the predicted positive sign suggested by the underlining theory than those using the single equation specification. There I found BURO to be positive and statistically significant only for government transfers.

On the other hand, my results contradict directly the predictions associated with DIRECT and OPENNESS. The fiscal illusion hypothesis suggested that government size should be negatively correlated to the share of direct taxes levied by the government. This is not supported by the data. In all three specifications of government size, I find DIRECT to be positive and significant. In one sense this result is encouraging since in the previous chapter I found contrasting outcomes. At that stage, the share of direct taxes to total revenue was negatively correlated with government consumption but positively correlated with government transfers. The demand and supply framework seems to resolve the ambiguity in favour of rejecting the fiscal illusion hypothesis. Exposure to world markets, as captured by OPENNESS, was hypothesized to be positively correlated to government size. The result of the system estimation does yield positive coefficients for all three specifications. However none of the estimated parameters are significantly different from zero. Also following Rodrik (1998), this positive correlation should be stronger for the transfer measure of government size. This is not supported by my data, as the estimated coefficient ranges from 0.33 for government disbursements to 0.37 for government consumption and drops to 0.19 for government transfers.

I now turn to the supply side. For both the more general specification of government disbursements and the pure transfer measure, I find government size to be in accordance with standard supply theory and positively correlated to the relative price. That is, an increase in the cost of providing government goods and services is required to generate an increase in government size. However, the implied elasticities of supply are not statistically significantly different from zero. For the government consumption measure of government size, the implied elasticity of supply appears with the wrong sign, but once again has no statistical significance.

In contrast, the effect that the productivity lag (TIME) has on government size is quite robust. Given an inelastic demand, Baumol's hypothesis predicts a positive relationship between TIME and government size. For all three specifications of government size, I find negative coefficients and for both government disbursements and government consumption, the estimated parameters are also statistically significant. This implies either that TIME is not a good proxy for relative productivity growth or that Baumol's effect was not present in this time period.

More conventional results are found for the Kau/Rubin variables FARM and URBAN. Here, the system estimation yields estimated coefficients that are broadly consistent with the tax avoidance hypotheses. Across all three specifications I find that the share of farm employment in the total population is negatively correlated with government size. The estimated parameters range from -0.55 for government disbursements to -0.39 and -0.72 for government consumption and government transfers respectively and all are statistically significant. Worth mentioning is how this has changed relative to the single equation method used in Chapter 3. There I found that

FARM did not belong in the cointegrating equations for GDISB and GCONS. Only in the government transfer equation was FARM cointegrated with government size, however, the estimated coefficient was positive and not statistically significant. Similarly, increases in urbanization are hypothesized to reduce tax collection costs and increase size. Here, all measures of government size are consistently positively correlated with urbanization, particularly government disbursements and government transfers. Only in the case of government consumption does the system estimation yield an insignificant positive parameter.

It is with respect to population size that the results of the demand and supply system are definitely different from the single equation approach. In particular I find that POP loses statistical significance across all three specifications. For government disbursements and government transfers, the coefficient on population enters with the predicted negative sign, while for government consumption the estimated parameter is positive. All three coefficients, however, are statistically not different from zero. Compared with these findings, chapter 3 found that population size had a significant positive correlation with government size, strongly suggesting some degree of diseconomies of scale in government size. The present results of system estimation, however, imply that the two effects of population size on government size roughly cancel each other. That is, the negative effect due to the public nature of government goods and services is exactly matched by the positive effect that a larger population has on the cost facing the median voter and hence on government size.

Finally, the effect of jurisdictional structure on overall government size are less conclusive. Overall, the results of the system estimation reinforce the findings of the

previous chapter. There, the share of expenditures at the local level to total government expenditures was negatively correlated with overall size of government in the economy, consistent with the idea that greater competition across governmental jurisdictions is associated with a smaller sized government. Hence I find that the coefficients for LOCAL in the system estimation are much less robust. Only for government consumption is there a significantly negative coefficient on the relative size of local government. In the other two cases the results are not statistically different from zero. It then appears that the Tiebout hypothesis prevails with respect to government consumption. When I extend the definition of government size to a more general, transfer inclusive measure of government size, the case for Tiebout becomes less convincing. It is as if the soft budget constraint argument gains in importance as more transfer functions are added to government, to the extent of completely counterbalancing the aforementioned effect.

4.4. Endogeneity between Employment in the Government Sector and Government Size

The supply and demand system of the previous section treated the share of government employment in total employment (BURO) as purely exogenous. There are, however, obvious reasons why this may not be the case. For example, if we consider the production function underlying the production of government goods and services, employment will be tied to output as a factor of production. More particularly, cost minimization implies a labour demand function that depends upon the wage in the government sector (W_G), the quantity of goods and services produced (G), and the implicit price (P_G). The signs of the partial derivatives of the labour demand function

should be negative with respect to the wage and positive with respect to the quantity of goods produced and the price.

Formally, labour demand in the government sector can be characterized by the following equation:

$$N^{dG} = N^{dG}(\bar{W}_G, \bar{G}, \bar{P}_G). \quad (4.4)$$

In relative terms, the share of government employees to total employment should depend on the relative wage between government and private sector, on the relative size of the government sector in the economy and on the relative price between government output and private output. These considerations would lead to a general equation for relative labour demand of the following form:

$$\frac{N^{dG}}{N^Y} = BURO = N\left(\frac{W_G}{W_Y}, GRATIO, RELPRICE\right). \quad (4.5)$$

Linearizing (4.5), we get the following regression equation:

$$BURO = \delta_1 + \delta_2 RWAGEG + \delta_3 RWAGEP + \delta_4 GRATIO + \delta_5 RELPRICE + \delta_6 TIME \quad (4.6)$$

The additional variables in equation (4.6) are real wages in the government sector (RWAGEG) and real private sector compensations per employee (RWAGEP). The share of labour in the government sector is predicted to depend negatively on the relative

earnings in the two sectors. In terms of equation (4.6), this translates in an expected negative coefficient on RWAGEG and a positive coefficient on RPWAGE. BURO is also expected to depend positively on the size of government and the relative price. The labour demand equation allows for separate testing of Baumol's hypothesis. By adding a time trend to proxy the lag in technological improvements in the government sector, I can investigate whether in fact the government sector becomes relatively more labour intensive. In that case δ_6 is predicted to be positive.

In order to test whether BURO is in fact an endogenous variable in the structural system characterized by the regression equations (4.3) and (4.4), a standard Hausman Test for endogeneity was performed. This requires estimating equation (4.6) separately and using its predicted value (called BUROF) as an additional regressor in equations (4.3) and (4.4), the structural demand and supply system. If BUROF is found to be statistically significant in either equation, then I may conclude in favour of the endogeneity of BURO.³⁹ Table 4.2 summarizes the results of the Hausman Test for all three specifications of government size.

Table 4.2: Hausman Test for BURO in the structural equations

	GDISB		GCONS		GTRANSFER	
	Demand	Supply	Demand	Supply	Demand	Supply
BUROF	0.90 (1.15)	0.85** (3.27)	1.68* (1.86)	0.17 (0.43)	1.60 (1.11)	1.20** (4.73)

Notes: Dependent variable, BUROF, is the predicted value of the Least Squares Estimate of equation (4.6); all variables in logarithms; t-statistics in parentheses; ** (*) denotes significance at 5% (10%) respectively.

³⁹ See Johnston-DiNardo pp. 338-342.

In all three specifications BUROF enters significantly in either the supply or the demand equation for each measure of government size. For total government disbursements and social transfer expenditures, government bureaucracy appears to be endogenous to the supply side rather than to the demand for government services. In each case the supply coefficients for BUROF are positive and highly significant. For the government consumption measure of government size, the Hausman test is relatively weak, in this case suggesting that endogeneity runs through the demand rather than through the supply side. Here, however, the test statistic is significant only when I extend the confidence interval to ten percent.

Overall, the tests results point to a significant degree of endogeneity between relative output and input measures in the government sector and thus imply that the correct structural system should be the three equation system composed of the regression equations (4.3), (4.4) and (4.6) (rather than the two equation system estimated in the previous section).

The results of this simultaneous system estimation are summarized in Table 4.3. In the government employment equation, I have a high coefficient of determination and highly significant coefficients across all three definitions of government size. As predicted by the labour demand function, the share of government employees is negatively correlated with the relative factor costs. Across all three specifications, the data show a strong negative relationship between BURO and the real wage in the government sector. The coefficients for RGWAGE range from -1.56 for government disbursements (Column (1)), to -1.55 and -1.36 for government consumption (Column (2)) and transfers (Column (3)) respectively. All three estimated parameters are highly

different from zero from a statistical standpoint. Conversely, an increase in real compensations of the competing private sector will, everything being equal, increase the labour demand in the government sector relative to the private sector. I find the coefficients on RPWAGE to be all positive and statistically different from zero in all three models. Consistent with theory, the share of labour use in the public sector also depends positively with the size of that sector in the economy. As the government becomes larger in relative terms, the production relationship would suggest that relative labour use also increases. This hypothesis is confirmed, in all three specifications, by the positive estimated coefficients on GRATIO. As might be expected, this relation appears to be stronger for the consumption measure of government size than for government transfers.

Table 4.3: Three-Stage Least Squares Estimates of the Three-Equation System for Government Size

Demand	(1)	(2)	(3)	Supply	(1)	(2)	(3)
Constant	5.45 (1.10)	2.38** (0.86)	5.34** (1.40)	Constant	7.14 (9.59)	0.11 (6.68)	24.75* (13.50)
RGDPPC	-0.70** (0.18)	-0.54** (0.14)	-0.49** (0.24)	RELPRICE	1.38** (0.35)	0.72** (0.27)	1.55** (0.49)
RELPRICE	-0.36 (0.77)	0.77 (0.59)	-1.42 (1.01)	FARM	-0.51** (0.24)	-0.37** (0.18)	-0.73** (0.32)
OLDPOP	0.45 (0.42)	0.62* (0.33)	0.58 (0.54)	URBAN	2.15** (0.64)	0.33 (0.44)	3.45** (0.92)
WOMEN	-0.02 (-0.42)	-0.04 (0.03)	-0.001 (0.06)	POP	-2.12 (1.32)	-0.55 (0.91)	-4.87** (1.88)
FEMPART	1.19** (0.15)	0.67** (0.11)	1.35** (0.20)	LOCAL	-0.08 (0.40)	-0.41 (0.25)	0.69 (0.57)
BURO	0.79** (0.21)	0.12 (0.16)	1.33** (0.28)	TIME	-0.003 (0.005)	-0.003 (0.004)	0.008 (0.007)
DIRECT	0.60** (0.20)	0.33** (0.16)	0.56** (0.26)				
OPENNESS	0.15 (0.25)	0.08 (0.19)	-0.02 (0.32)				
Income El.	0.30	0.46**	0.51**				
Price El.	-1.36	-0.23	-2.42**				
Adj. R ²	0.97	0.95	0.97		0.96	0.94	0.95
DW	1.34	1.22	1.22		0.78	1.26	0.94
BURO		(1)	(2)	(3)			
Constant		5.18** (2.34)	2.94 (3.51)			5.08** (2.37)	
RGWAGE		-1.56** (0.25)	-1.55** (0.40)			-1.36** (0.24)	
RPWAGE		0.99** (0.12)	1.32** (0.22)			0.83** (0.12)	
GRATIO		0.72** (0.07)	1.10** (0.21)			0.60** (0.06)	
RELPRICE		1.59** (0.30)	0.74 (0.45)			1.61** (0.30)	
TIME		0.001 (0.002)	0.001 (0.003)			-0.001 (0.002)	
Adj. R ²		0.99	0.97			0.98	
DW		1.80	0.97			1.95	

Notes: Number (1), (2) and (3) refer to the three measures of government size (GDISB, GCONS and GTRANSFER); all variables are in logs; standard errors in parentheses; (**) and (*) denote significance at 5% and (10%) respectively.

The coefficients on RELPRICE also conform to the theory. As the price of government's goods and services grows relative to all other goods, value maximization implies that the public sector will be more willing to hire labour compared to the rest of the economy. This is confirmed in the BURO equation by the positive estimated parameters on RELPRICE. Particularly with respect with government disbursements and government transfers, I find the RELPRICE to be a significant explanation of the growth of labour use in the two sectors. As for government consumption, the relative price enters positively but is not statistically different from zero.

Finally the time trend, used to proxy the lag in technological progress between government and private sector, does not seem to play a significant role in the growth of relative employment. The estimated coefficients on TIME are positive, but very small and not statistically significant. In combination with my earlier findings, my impression is that the time dummy does not capture very well the relative evolution of technology between the two sectors. Better indicators may be needed to capture the Baumol effect on government employment.

I now turn to comparing the effect of endogeneizing government employment on the remaining two equations for government size with what was found in section 4.3. Starting from the demand side, the estimated coefficients for real income per capita are quite consistent with my previous findings. In terms of implied income elasticities, I find that the estimated values for government consumption and government transfers are now both positive and statistically different from zero. However, the estimated sizes still reject Wagner's Law of the income elasticity greater than one. The three-equation estimation has also the effect of making the price elasticities of demand increasingly negative.

Across all three models, the implied price elasticities are now all negative in magnitude. Still, while I cannot reject the hypothesis of an inelastic demand for government disbursements and government consumption, government transfers do exhibit an elasticity of -2.42 that is significantly different from zero at the 5% level.

The public choice variables in the demand equation seem to be robust to the endogeneizing of government employment, producing only marginal changes in magnitude from earlier estimates. The share of the population that is over 65 in the government consumption equation enters now with a value of 0.62 that is statistically significant at the 10% level. The dummy variable for women suffrage is as before slightly negative but statistically insignificant in all three specifications. The effect of increased female labour force participation on government size remains both positive and highly significant, as in the two-equation demand and supply model. Endogeneizing BURO has meant that the share of government employees (BURO) now enters the demand equation with slightly higher, positive value for all three definitions of government size. Still an increase in BURO appears to be significant only when government disbursements and government transfers are considered. DIRECT, my proxy for fiscal illusion, still enters with a positive sign and the coefficients remain significantly positive for all specifications of government size. Hence the fiscal illusion hypothesis is no more consistent with the data under the three-equation system than it was under the two-equation system. Finally, also as found earlier, increases in openness do not appear to have any significant effect on government size.

On the supply side, the coefficients on RELPRICE are very similar to the simple demand and supply model. Across all three specifications, all are now positive and

statistically significant. With respect to the Kau-Rubin variables, FARM and URBAN, the three equation system seems to allow more precise estimation of the parameters. For FARM, my results show a consistent negative correlation with government size as predicted by the theory. In all three specifications, the estimated coefficients are negative and significant at the 5% level. Urbanization enters as positive and significant for government disbursements and government transfers, whereas the estimated parameter in the government consumption supply equation is positive but not statistically different from zero. The three-equation estimation does introduce some change with respect to estimated coefficient on population. In particular, in the government transfer supply equation, I find that the coefficient on POP now becomes strongly negative and statistically significant, suggesting the existence of some degree of economies of scale in this dimension of government expenditures.⁴⁰ Finally, the three-equation system estimation does not improve on our test of Baumol's unbalanced growth hypothesis. The coefficients on TIME remain statistically insignificant in all three specifications of government size. As speculated earlier, this may be due to inappropriateness of a time dummy to capture the differences in productivity among the public and private sector.

Two basic conclusions can be drawn from this section. First, the presence of endogeneity (via the Hausman test) is reflected in the increase of the magnitude of the effect of BURO on the demand for government goods and services. However, it does not seem that this increase is statistically significant and only in one case does the three

⁴⁰ This reinforces the finding for GRATIO in the BURO equation. Both suggest economies of scale in transfers.

equation estimation change the estimated sign. Hence, from this point of view, accounting for endogeneity does not seem as necessary as previously hypothesized. The exercise has value, however, in confirming that the demand side effect is not merely the reflection of a production relationship tying employment to government size. After accounting for this production function relationship, there remains a strong and significant demand side role for BURO. Second, it is reassuring that accounting for this form of endogeneity improves somewhat the precision of the equations in terms of the other endogenous variables while leaving the size of the coefficient estimates of the other independent explanatory variables largely unchanged. In this sense, the two-equation demand and supply model of section 4.3 works quite well and it is more robust than might have been originally expected.

4.5. Endogeneity between Growth of Real Income per-capita and Growth of Government Size.

In this section I turn from relationships among the levels of the variables to focus on the relationship between the growth in real income per capita and the growth in government size. In chapter 3 I used an Error Correction Model (ECM) to analyze the dynamic adjustment of government size around its long-run equilibrium by regressing the growth of government size against the growth rates of a number of economic variables as well as public choice variables. The purpose of this section is to investigate the robustness of the ECM of chapter 3 by accounting of the possible bi-directional relationship between government size and income.

The recent growth literature has emphasized different ways that government size may influence economic growth. Studies by Barro (1981, 1990b, 1991a, 1991b), Barro and Sala-I-Martin (1995), Ram (1986), Karras (1999), Foelster and Henrekson (2001) have all found widely different results when estimating the effect of government size on economic growth, depending on what type of government expenditure is used in the growth equation. Foelster and Henrekson (2001), for example, use total taxes as a fraction of GDP and government expenditures as a fraction of GDP and find a “robust negative relationship between government expenditure and growth in rich countries”.⁴¹ Karras (1999), on the other hand, finds that “a higher tax rate permanently reduces the level of output but has no permanent effects on the output growth rate”.⁴² Barro and Sala-I-Martin (1995) include in their basic growth regression two measures of government size, namely $[GCONS]/Y$ and $[Government\ spending\ on\ education]/Y$ and find a significant negative coefficient for the government consumption measure of government size while public spending on education has a significant positive effect on economic growth.⁴³ These results are interpreted by their authors as implying that government consumption expenditures do not directly affect productivity but distort private decisions and hence reduce economic growth. Public expenditures on education, on the other hand, increase the quantity and quality of human capital and this is expected to have a direct positive effect on economic growth.

⁴¹ See Foelster and Henrekson (2001) p.1516.

⁴² See Karras (1999), p. 187.

⁴³ See Barro and Sala-I-Martin (1995), pp.433-434.

In this section I will integrate growth theory within my earlier analysis of the growth of government size. That is, growth theory investigates the effects of government size on output growth, whereas the major part of this thesis has viewed the growth of government size as driven by the growth of real output per capita. How these opposing causal relationships interact is the basis of my next two-equation system.

I start with the equation generating government size as defined in section 3.10. In that chapter, equation (3.2) was interpreted as a cointegration equation that explained the long-run evolution of government size. The existence of such a long-run equilibrium relationship allowed us to specify an error correction equation (ECM) that could capture the dynamic adjustment around this equilibrium path. Such an ECM was found to be in the following form;

$$\begin{aligned}
 DGRATIO_t = & \beta_1 ECT_{t-1} + \sum_{i=1}^2 \beta_{2i} DGRATIO_{t-i} + \sum_{i=0}^1 (\beta_{3i} - 1) DRGDPPC_{t-i} + \sum_{i=0}^1 (\beta_{4i} + 1) DRELPRICE_{t-i} \\
 & + \sum_{i=0}^1 \beta_{5i} DOLDPOP_{t-i} + \sum_{i=0}^1 \beta_{6i} DFARM_{t-i} + \sum_{i=0}^1 \beta_{7i} DFEMPART_{t-i} + \sum_{i=0}^1 \beta_{8i} DBURO_{t-i} \\
 & + \sum_{i=0}^1 \beta_{9i} DDIRECT_{t-i} + \sum_{i=0}^1 \beta_{10i} DPOP_{t-i} + \sum_{i=0}^1 \beta_{11i} DOPENNESS_{t-i} + \sum_{i=0}^1 \beta_{12i} DLOCAL_{t-i} + \varepsilon_t
 \end{aligned} \tag{4.7}$$

where the D in front of the name of the variables denotes the first difference. Because the variables are in logarithms, the first difference defines the growth rate. ECT is the error correction term that measures the adjustment to the lagged residuals of the cointegrating regression in levels. The first equation then views changes in government size caused by changes in per-capita income.

The second relationship views aggregate output as a production relationship. That is, aggregate output is a function of the labour, physical capital and human capital used in the production process. In addition, government size may enter the production function as

a productive input. These productive government inputs are assumed to be subject to a degree of congestion, such that an increase in Y at any given level of G will increase congestion and hence lower the availability of the productive government services to each individual producer.

More formally we can write the production function as:

$$Y_t = A_t L_t^{\theta_1} K_t^{\theta_2} H_t^{\theta_3} (G/Y)_t^{\theta_4} \quad \text{where } 0 \leq \theta_1, \theta_2, \theta_3, \theta_4 < 1. \quad (4.8)$$

In terms of income per capita, equation (4.8) becomes:

$$y_t = A_t L_t^{\theta_1-1} K_t^{\theta_2} H_t^{\theta_3} (G/Y)_t^{\theta_4} \quad (4.9)$$

Given the particular Cobb-Douglas form of the production, simple growth accounting yields the following equation for the growth rate of per capita income:

$$\frac{dy_t}{dt} \frac{1}{y_t} = \frac{dA_t}{dt} \frac{1}{A_t} + (\theta_1 - 1) \frac{dL_t}{dt} \frac{1}{L_t} + \theta_2 \frac{dK_t}{dt} \frac{1}{K_t} + \theta_3 \frac{dH_t}{dt} \frac{1}{H_t} + \theta_4 \frac{d(G/Y)_t}{dt} \frac{1}{(G/Y)_t}. \quad (4.10)$$

The growth equation that has to be estimated is then,

$$DRGDPPC = c + (\theta_1 - 1)DLFORCE + \theta_2(I/Y) + \theta_3DTERENR + \theta_4DGRATIO. \quad (4.11)$$

where, DRGDPPC, DLFORCE, DTERENR and DGRATIO are, respectively, the first differences of the logarithms of real per capita GDP, labour force, enrollment in tertiary education as a percent of gross enrollment (my measure of the accumulation of human capital), and government size. The growth rate of the capital stock is proxied by gross capital formation as a fraction of GDP.

My working hypothesis is that the growth rates of government size and income are jointly determined. Hence equations (4.7) and (4.11) are to be estimated together. Only in this way can one overcome the simultaneity in the relationship between government size and aggregate output.

As in section 4.4, I begin by performing a simple Hausman Test for endogeneity between the growth rate of government size and the growth rate of income per capita. This is done for all three specifications of government size and involves regressing income per capita as in (4.11), and then using the predicted value (DRGDPPCF) in the regression equation for government size and testing for its statistical significance. The results are summarized in Table 4.4.

Table 4.4: Hausman Test for DRGDPPC in the equation for government size

	D(GDISB) Reduced Form	D(GCONS) Reduced Form	D(GTRANSFER) Reduced Form
DRGDPPCF	-0.718 (-1.80)	-0.606** (-2.34)	-1.75** (-3.10)

Notes: Independent variable, DRGDPPCF, is the predicted value of the Least Squares Estimate of equation (4.11) for the three definitions of government size; all variables in logarithms except gross capital formation as a fraction of GDP (I/Y); t-statistics in parentheses; ** (*) denotes significance at 5% (10%) respectively.

In two of the three specifications of government size, namely government consumption and government transfers, the predicted values of the growth rates of per-capita GDP enter the government size equation significantly. In the case of the broader measure of government size, the coefficient is marginally insignificant. This finding is consistent with the presence of some degree of endogeneity between the growth rates of government size and per-capita income. Interestingly, the estimated coefficients on DRGDPPCF are negative across all three definitions of government size, suggesting the

presence of a negative externality that introduces a potential bias in the single equation estimation toward supporting Wagner's Law. In other words, because a growing government sector seems to have a negative effect on growth, accounting for the bi-directional relationship between income and government size would reduce the income elasticity in the government size equation, when the system is estimated simultaneously.⁴⁴

Next, I investigate whether the bi-directional causality shows up in the growth equation by again using the predicted value of government size from the government size equation as an additional regressor in equation (4.11). When we consider the coefficient on government size in the growth equation, we should find that the single equation estimation is biased towards a greater negative coefficient on government size. This is because the single equation estimation will attribute the change in the growth rate of income per-capita to the final change in the growth rate of government size rather than separating the first-order negative effect that growth of government size has on growth from the feedback that lower growth has on reducing the growth of the government sector. The results of the Hausman Test appear in Table 4.5.

⁴⁴ When the government size equation is estimated alone, one does not take into account the fact that increases in growth of government size reduce the growth rate of income in the growth equation. A reduction in the growth rate of income, however, reduces government size through the demand relationship for government size, and this in turn would imply a larger growth of income per-capita.

Table 4.5: Hausman Test for the three measures of government size in the growth equation

	DRGDPPC Growth Equation
DGDISBF	-0.38 (-1.13)
DGCONSF	-0.31 (-0.67)
DGTRANSFERF	-0.25 (-1.26)

Notes: Independent variables DGDISBF, DGCONSF and DGTRANSFERF are the predicted values of the Least Squares Estimate of equation (4.7) for the three definitions of government size; all variables in logarithms except gross capital formation as a fraction of GDP (I/Y); t-statistics in parentheses; ** (*) denotes significance at 5% (10%) respectively.

As one can see, the evidence of causality running to per-capita income from government size is not as strong as in the opposite direction. None of the three specifications of government size enter the growth equation significantly. This result would suggest that the potential endogeneity between growth rates of government size and per-capita income runs prevalently from the growth equation to the government size equation rather than vice versa.

I now turn my attention to the joint estimation of equations (4.7) and (4.11) and investigate whether this produces the hypothesized changes in the estimated coefficients, particularly in relation to the income elasticity in the government size equation and the government size coefficient in the growth equation. The results of the simultaneous estimation are summarized in Table 4.6.

Recalling the results of the ECM estimated as a single equation (see Table 3.4), the estimated coefficients on the growth of income per capita in the government size equation ranged from -1.119 for government disbursements to -0.8174 and -1.0337 for government consumption and government transfers. In all three specifications this

resulted in implied income elasticities equal to zero. The system estimation yields estimated parameters on DRGDPPC ranging from -0.983, -1.21 and -1.03 for the three measures of government size respectively. These are marginally greater in absolute terms in accordance with our hypothesis. However, statistically, this still translates into income elasticities that are not significantly different from zero.

Table 4.6: Simultaneous estimation of the growth rates of government size and income per-capita

Government Size Equation	GDISB	GCONS	GTRANSFER
ECT	-0.431** (0.22)	-1.233* (0.71)	-0.657** (0.23)
DGRATIO(-1)	-0.185 (0.17)	0.716** (0.34)	-0.002 (0.19)
DGRATIO(-2)	0.160* (0.08)	0.004 (0.09)	0.088 (0.12)
DRGDPPC	-0.983** (0.15)	-1.21** (0.16)	-1.03** (0.39)
DRGDPPC(-1)	-0.395 (0.29)	0.593 (0.46)	-0.19 (0.45)
DRELPRICE	0.699** (0.33)	1.97** (0.35)	0.65 (0.86)
DRELPRICE(-1)	0.310 (0.40)	-1.152 (0.98)	-0.259 (0.72)
DOLDPOP	0.521 (0.35)	0.933* (0.047)	0.848 (0.73)
DOLDPOP(-1)	0.940** (0.28)	0.053 (0.57)	0.93* (0.53)
DFARM	-0.0019 (0.10)	-0.383** (0.09)	0.247 (0.20)
DFARM(-1)	-0.0718 (0.14)	0.334 (0.26)	0.032 (0.32)
DFEMPART	0.0858 (0.15)	-0.612** (0.18)	0.373 (0.32)
DFEMPART(-1)	-0.0617 (0.20)	0.364 (0.29)	-0.143 (0.45)
DBURO	-0.071 (0.39)	-0.9178** (0.35)	0.591 (0.82)
DBURO(-1)	-0.128 (0.29)	0.501 (0.37)	-0.417 (0.58)
DDIRECT	0.144 (0.11)	-0.21* (0.11)	0.228 (0.24)

DDIRECT(-1)	0.1442 (0.08)	-0.004 (0.13)	0.191 (0.19)
DPOP	-0.900 (1.27)	1.928 (2.70)	0.659 (3.03)
DPOP(-1)	3.626** (1.18)	-0.734 (2.33)	3.193 (2.29)
DOPENNESS	0.190** (0.06)	0.165** (0.08)	0.131 (0.14)
DOPENNESS(-1)	-0.079 (0.09)	-0.311* (0.17)	-0.133 (0.19)
DLOCAL	-0.339** (0.05)	-0.004 (0.08)	-0.573** (0.11)
DLOCAL(-1)	-0.152* (0.07)	-0.031 (0.08)	-0.271 (0.16)
R ²	0.94	0.93	0.85
Implied Income Elasticity	0.017	-0.21	-0.03
Implied Price Elasticity	-0.301	0.97**	-0.35
S. E. of regression	0.015	0.012	0.033
Growth Equation	DRGDPPC	DRGDPPC	DRGDPPC
Constant	-0.044** (0.016)	-0.075** (0.01)	-0.042** (0.019)
DLFORCE	0.001 (0.11)	0.00014 (0.11)	0.034 (0.13)
I/Y	0.0026** (0.0007)	0.004** (0.0007)	0.0025** (0.0008)
DTERENR	-0.012 (0.14)	-0.23 (0.14)	-0.007 (0.17)
DGRATIO	-0.495** (0.07)	-0.6348** (0.10)	-0.3169** (0.06)
R ²	0.67	0.68	0.56
S.E. of regression	0.015	0.015	0.018

Notes: all variables in logarithms; standard errors in parentheses; ** (*) denotes significance at 5% and 10% respectively.

These results seem to confirm that specifying a system in order to account for the bi-directional relationship between income and government size does not change the estimated income elasticities of the government size equation in any significant way.

I will turn now to the output growth equation. Table 4.7 summarizes the results of the least squares estimation of the growth equation in isolation. At a first glance one can see that the system specification has yielded only marginal changes. The R² statistics are basically identical, so that specifying a system does not yield a better fit to the data.

Table 4.7: Single equation estimation of the growth rate of income per-capita

Growth Equation	DRGDPPC	DRGDPPC	DRGDPPC
Constant	-0.046** (0.017)	-0.076** (0.01)	-0.046** (0.02)
DLFORCE	-0.057 (0.10)	-0.033 (0.10)	-0.0168 (0.12)
I/Y	0.0027** (0.0008)	0.004** (0.0007)	0.0026** (0.0009)
DTERENR	-0.049 (0.13)	-0.255* (0.13)	-0.022 (0.16)
DGRATIO	-0.485** (0.08)	-0.62** (0.10)	-0.305** (0.07)
R ²	0.68	0.69	0.56
S.E. of regression	0.015	0.0149	0.017

Notes: all variables in logarithms; standard errors in parentheses; ** (*) denotes significance at 5% and 10% respectively.

In terms of the other individual variables, both in the system and in the single equation estimation, I/Y enters positively and with statistical significance. Coefficient sizes are also robust to the estimation method. The same can be said with respect to government size. Government size is consistently negative in its effect on economic growth. However, the working hypothesis for the system estimation was that the single equation estimation would result in coefficients on government size that would be biased toward confirming the negative effect that a growing government size has on economic growth. The prediction was that the coefficients on DGRATIO should fall in absolute terms when estimated as a system. This is not confirmed by the system estimation. The estimated parameters on GRATIO changed only marginally, and in some cases – notably government consumption and government transfers- the estimated coefficients were found to be greater in the system specification than in the single equation formulation.

The additional explanatory variables DTERENR and DLFORCE yield mixed results. Tertiary school enrollment was hypothesized to have a positive impact on

economic growth. This is not found in the data. My interpretation of this is that the growth in school enrollment may not be the right proxy to capture the growth of human capital used in the production process. A better variable may be years of schooling of the labour force, but this variable is not currently available in time series.

The growth of the labour force yields different results whether the growth equation is estimated in a system or in isolation. In the system estimation the coefficients on DLFORCE are consistently positive while in the single equation they become negative. However, regardless of the approach used, none of the estimated parameters on DLFORCE are statistically significant.

Overall, despite finding some evidence of endogeneity in the determination of the rates of growth of real output and government size, the quantitative significance of this interrelationship does not appear to be large. Hence for at least the case of Switzerland in this time period, studies that do not account for such interdependence do not appear to be biased by ignoring its presence.

Chapter 5: Incorporating theories of government size within the business cycle

5.1. Introduction

A considerable amount of recent work on government size has turned from investigating the determinants of the long-run government size to begin an exploration of the short run interrelationship between government size and economic fluctuations. In examining this cyclical relationship, most studies have adopted a cross-sectional framework, typically using variations in five-year averages across countries to test hypotheses. To explain the empirical differences that arise across countries, a number of new theories have been put forward. What seem particularly interesting are those that link government size to a restricted set of macro variables that reflect either domestic forms of variability (measured often as the standard deviation of the growth rate of GDP) or openness (measured as the ratio of foreign trade to GDP). The basic empirical finding is that across developed economies, such as the OECD countries, there is a well established negative relationship running between government size and the variance (or standard deviation) of GDP growth rates. It would appear that a large well-established government sector, one that is relatively stable, providing a stable domestic employment environment that is insulated from those shocks that affect the private sector, may be an implicit economic stabilizer for the economy overall. In one sense, this says nothing new. Standard intermediate macroeconomic theory suggests that a proportional income tax system will work as an automatic stabilizer in the sense that a proportional tax reduces the size of the Keynesian multiplier. Autonomous shocks to aggregate demand then have a smaller effect on equilibrium income. Recent studies by Gali (1994) and Fatas and

Mihov (2001) show that in a cross sectional sample of countries, this hypothesis is supported by the data. What is different about these newer approaches is that greater stability is linked directly to government size, where larger size itself reduces economic variability. In addition to its effect on domestic variability, a number of other authors have emphasized a different type and different direction of causality running from greater international uncertainty and variability to larger government size. In particular, Rodrik (1998) has investigated the relationship between the degree of openness and government size, where a larger sized government is hypothesized to better insulate the domestic economy from external shocks and the greater uncertainty that arises in more open economies. Hence Rodrik's cross sectional study looks for and finds a positive relationship between openness and government size.

The purpose of this chapter is to retest within a time series framework those theories that linked government size to various business cycle indicators in cross sectional analysis. In essence we wish to ask whether such hypotheses remain valid through time as well as across time.

The starting point will be the VEC framework used in Chapter 2. There the main concern was the validity of a parsimonious economic model explaining government size. Hence even though the VAR approach allowed for feedbacks between the endogenous variables (GRATIO, RGDPPC, RELPRICE), my analysis focused on the normalized cointegrating equation explaining government size and did not include an explicit examination of the feedback running from government size to other variables. The results there found that long-run government size was positively correlated with real income per-

capita and that long-run income elasticities were broadly consistent with Wagner's Law. In the short-run, however, government size was found to behave counter-cyclically.

This chapter reinvestigates the short run adjustment process in the following way. In Sections 5.2, 5.3, 5.4 and 5.5 I make greater use of the VAR (VEC) multiple equation framework and extend my analysis to possible bidirectional causalities among a key set of restricted variables. These consist specifically of government size, real income per-capita, openness and employment. In Section 5.6 I summarize the results and make some concluding remarks.

5.2. Methodology and Model

As mentioned earlier, the studies by Gali (1994) and Fatas and Mihov (2001) document a robust negative correlation between the variability of GDP growth and government size in cross country data. Economies with larger governments, as measured either by government tax revenues/GDP or government purchases/GDP, experience significantly milder fluctuations in GDP growth rates than countries with relatively small governments.⁴⁵ Based on this evidence, Gali (1994) concludes that government size works as an "automatic stabilizer" to dampen the scale of the business cycle. In addition to these studies of GDP, Abrams (1999) finds that across OECD countries, there is a significant positive correlation between unemployment rates and government size. He argues that many government programs have perverse incentive effects on the labour-

⁴⁵ See Gali (1994) pp. 125-132, Fata and Mihov (2001) pp. 8-10.

leisure choice that tend to raise reported unemployment rates.⁴⁶ Abstracting from the specific empirical relationships found, these studies both view causality as running from government size to economic variability, in the sense that economic variability could be modeled as a function of government size.

Juxtaposed to this approach, Rodrik (1998) and Alesina and Wacziarg (1998) find a positive correlation between a country's exposure to international trade and government size. They argue that greater exposure to international trade increases economic volatility and, if we assume the government sector is relatively stable and immune from economic shocks, this suggests that risk averse citizens may choose a bigger government in order to minimize economic fluctuations. This argument then emphasizes that causality may run from economic variability to government size. Combining this perspective with the approach taken above, these studies together suggest that economic variability and government size may be jointly determined. That is, while one may agree with Gali and Fatas and Mihov that greater government size can reduce variability in the economy, it may also follow that increased openness may increase exposure to risk and so result in a country choosing a larger government size.

To investigate the incidence and degree of causality between variability and size, I adopt total employment as a fraction of population (EMPRATE) as my proxy for economic variability. The reason not to use the unemployment rate, as measured by persons unemployed as a share of the labour force, becomes apparent when we consider the peculiarity of the evolution of the unemployment rate for Switzerland in the last four

⁴⁶ See Abrams(1999) pp.398-401.

decades, as depicted by Figure 5.1. The time series of unemployment for Switzerland from 1960-2003 underwent three distinct periods. From 1960 to 1974 unemployment was very low with an average rate of 0.01%. From 1975 to 1990 the average increased to 0.50%.

Figure 5.1:

Source: OECD Statistical Compendium (1999) and www.sourceoecd.org, Switzerland 1960-2000.

The unusual low unemployment rates during 60s, 70s and 80s are generally explained by the fact that Switzerland was able to absorb decreases in employment through the lay-offs of foreign labourers who typically did not have permanent work permits and hence were not measured as unemployed. A significant increase occurred in the period from 1991 to 2003 with an average unemployment rate of 3.35% particularly due to increased female labour participation and foreign workers now receiving permanent status. The apparent structural breaks in the series, due mainly to the treatment of foreign workers in the labour force, make unemployment problematic as a proxy for variability in the economy,

churning in the labour market, and ultimately the probability of becoming unemployed. In view of these issues, I find that variations in EMPRATE (total employment / population) are a more accurate measure of churning in the labour market and hence a better reflection of domestic variability. In essence, greater variations in the GDP growth will imply greater churning and hence lower employment levels. This is the mirror image of standard macroeconomic arguments that would suggest that a more variable business environment will experience greater frictional unemployment as firms both layoff and hire employees more frequently. Moreover, more highly volatile economic conditions will be correlated with higher structural unemployment. Economic shocks affect different sectors of the economy and require labour to have to move from one sector to another to seek employment. This increases the time each particular worker is in the unemployment pool and hence reduces the employment rate at a particular point in time.

To model the relationship between government size and the employment rate more formally, I postulate the following types of causality. If, as according to Gali (1994) and Fatas and Mihov (2001), the government size works as an automatic stabilizer, then in the long-run I should find a positive correlation with the employment rate. That is, the potential stabilization property of government size implies that a larger sized government (G_{SIZE}) will be associated with lower economic variability, less churning in the labour market and hence a higher employment rate (EMPRATE). That is:

$$EMPRATE = E^{(+)}(G_{SIZE}) \quad (5.1)$$

where the sign above the independent variable denotes the sign of its partial derivative.

If, on the other hand, the volume of international trade flows is an additional source of trading uncertainty and economic variability, then greater OPENNESS should be associated with lower employment rates (as emphasized by Rodrik (1998)) and I should find a negative correlation between GSIZE and EMPRATE. That is:

$$GSIZE = G^{(-)}(EMPRATE). \quad (5.2)$$

As it can be seen by the scatter plot in Figure 5.1, the data do show a positive relationship between employment and government size (where G is measured as current disbursements) across the sample period. Moreover, simple visual inspection suggests that government size is a positive function of employment rather than the other way around. One interesting question is whether this inference is confirmed by VEC estimation.

Figure 5.2:

Source: OECD Statistical Compendium (1999) and www.sourceoecd.org, Switzerland 1960-2000.

The discussion above also suggests a direct relationship between government size and openness. In the analysis below I use OPENNESS mostly for control reasons.

However, it may be the case that economic variability is greater when the domestic economy is increasingly exposed to foreign trade, and this additional variance may not be captured by lower domestic employment rates. Hence as long as increases in OPENNESS increase economic variability through channels that are not captured by EMPRATE, I should find government size positively correlated with exposure to volume of international trade. This can be formalized by the following equation.

$$G\text{SIZE} = G^{(+)}(\text{OPENNESS}) \quad (5.3)$$

Figure 5.3:

Source: OECD Statistical Compendium (1999) and www.sourceoecd.org, Switzerland 1960-2000.

The counter part to this hypothesized relationship is that a bigger size of government should allow the domestic economy to become more highly exposed to international trade for any given some level of economic variability. That is, given the degree of economic variability, a bigger government sector will allow for a larger foreign sector. This is represented by equation 5.4:

$$OPENNESS = O(GSIZE^{(+)}) \quad (5.4)$$

Figure 5.3 suggests a rather strong positive relationship between openness and government size as measured by GDISB. Standard public finance literature (as in Chapter 2) suggests that government size will be a function of real income per capita (RGDPPC). Wagner's Law implies that as the economy expands and becomes more developed,

government expenditures expand more than proportionately so that government size is income elastic. With respect to the relationship between government size and per capita income, I expect the estimated coefficient to be greater than zero. Hence our last relationship involving government size is:

$$G\text{SIZE} = G(RGDPPC)^{(+)} \quad (5.5)$$

The actual empirical relationship is represented below in Figure 5.4.

Figure 5.4:

Source: OECD Statistical Compendium (1999) and www.sourceoecd.org, Switzerland 1960-2000.

Finally we can test the relationship between EMPRATE and OPENNESS directly. If it is true that international markets are an additional source of variability, then employment should be negatively correlated with openness. That is:

$$\text{EMPRATE} = E(\text{OPENNESS})^{(-)} \quad (5.6)$$

As depicted by Figure 5.4 this does not seem the case. Historically greater openness is correlated with higher employment rates.

Figure 5.5:

Source: OECD Statistical Compendium (1999) and www.sourceoecd.org, Switzerland 1960-2000.

If the data available were on a cross-section of countries, the hypothesis of bidirectional causality, such as among government size and unemployment and government size and openness, would best be resolved by simultaneous estimation methods such as through 2SLS or 3SLS. In a time series framework, however, I have to take account of the time series properties of the variables, and therefore cointegration analysis using a VEC model is one possible avenue to proceed. On the other hand, if we find that there exists only one cointegrating equation among the variables in levels, we will not be able to separate out the different theories, and hence the estimated cointegrating equation will represent only the net effect of the different feedbacks. In the short-run, the

VEC methodology should allow us to investigate the short-run dynamics given that particular estimated long-run relationship, and to test the different theories outlined above.

From previous chapters I determined that government size in all three specifications (GDISB, GCONS and GTRANSFER) is not stationary in levels, and hence is $I(1)$. RGDPG and OPENNESS are also found to be $I(1)$. In order to specify a VEC, we have therefore to check whether employment (EMPRATE) is nonstationary.

Figure 5.6:

Source: OECD Statistical Compendium (1999) and www.sourceoecd.org, Switzerland 1960-2000.

The evolution of EMPRATE for Switzerland as depicted by Figure 5.6 suggests that the series is not stationary in levels. From 1967 to about 1976 there appears to be a steady downtrend in employment rate from just over 50% to 47%. From 1977 to 1992 this trend has reversed, and the employment rate rose continuously from 47% to over 56%. During the early nineties there has been a renewed decline that now appears to

have levelled off at around 54%. The Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests confirm that the EMPRATE series is in fact non-stationary. The ADF for EMPRATE in levels is -1.543 while the first difference of the series in logs yields an ADF test statistic of -3.28. Therefore UNEMP is found to be I(1) at the 5% confidence level.⁴⁷

These findings then allow for the specification of the VEC. In the case of a unique cointegrating relationship, the normalized cointegrating equation for government size should have the following hypothesized signs:

$$G\text{SIZE} = G(RGDPPC^{(+)}, EMPRATE^?, OPENNESS^+). \quad (5.7)$$

The relationship in the cointegrating equation among EMPRATE and OPENNESS should also reflect equation 5.6.

Table 5.1 summarizes the results of the cointegration test for this set of variables. As a starting point, and partly due to the relatively small number of observations available, I choose to include only one lag in the VEC. Consistent with chapter 2 I also look at two different assumptions on time series properties of the series and the VEC specifications. Model 1 (M1) assumes no deterministic trend in the data and hence only an intercept in the cointegrating equation (CE) and no intercept in the VEC. Model 2 (M2) assumes a linear trend with an intercept both in the CE and VEC.

⁴⁷ EMPRATE here is in logarithmic form, as well as all the other variables.

Table 5.1: Johansen Cointegration test between government size, income per-capita, unemployment and openness for different models and lags in the VEC

GDISB, RGDPPC, EMPRATE, OPENNESS	
M1) No linear trend in data, intercept in CE no intercept in VEC	No. of CEs=1
M2) Linear trend in data, intercept in CE and VEC	No. of CEs=1 ¹⁾
GCONS, RGDPPC, EMPRATE, OPENNESS	
M1) No linear trend in data, intercept in CE no intercept in VEC	No. of CEs=1
M2) Linear trend in data, intercept in CE and VEC	No. of CEs=0
GTRANSFER, RGDPPC, EMPRATE, OPENNESS	
M1) No linear trend in data, intercept in CE no intercept in VEC	No. of CEs=1 ¹⁾
M2) Linear trend in data, intercept in CE and VEC	No. of CEs=1

Notes: All variables in logs; test results according to the trace statistic; ¹⁾ Indicates discrepancy between trace statistic and maximum eigenvalue statistic.

For both the government disbursement and the transfer measure of government size, I find a unique cointegrating relationship in both cases (M1 and M2). For the government consumption measure, on the other hand, there is evidence only of a long-run relationship in one case, namely when I consider model 1 (M1). Given the number of regressions that have to be estimated I will proceed by discussing the results for each measure of government size.

5.3. The Results for Government Current Disbursements

Table 5.2 summarizes the estimation results of the vector error correction system with one lag included and with the assumption of no deterministic trend in the data. The cointegrating equation is normalized with the government disbursements measure of government size as the dependent variable. Generally it would be interesting to look at different normalizations of the cointegrating equation. However, this is unnecessary

since the coefficients on both real income per-capita and the employment rate are statistically not different from zero. This makes a normalization of the system in terms of RGDPPEC and EMPRATE meaningless.

Table 5.2: Cointegrating regression and VEC for the GDISB specification of government size, Model 1 at LAG=1

Cointegrating Equation with GDISB as LHS variable				
Intercept	-0.3247 (1.05)			
RGDPPC	-0.0721 (0.26)			
EMPRATE	-0.0395 (0.27)			
OPENNESS	0.7923** (0.19)			
Error Correction				
	D(GDISB)	D(RGDPPC)	D(EMPRATE)	D(OPENNESS)
ECT ¹⁾	-0.1784** (0.06)	-0.1075** (0.04)	0.007 (0.021)	-0.1076 (0.07)
D(GDISB(-1))	0.3136 (0.19)	-0.2106 (0.13)	-0.1198* (0.06)	0.0989 (0.21)
D(RGDPPC(-1))	-0.2832 (0.32)	-0.0118 (0.23)	0.0198 (0.10)	-0.3008 (0.35)
D(EMPRATE(-1))	-0.1434 (0.46)	-0.4576 (0.33)	0.3901** (0.15)	-0.8828* (0.51)
D(OPENNESS(-1))	-0.2769* (0.14)	0.2716** (0.10)	0.1413** (0.04)	0.4193** (0.15)
R ²	0.28	0.31	0.52	0.15
AIC	-4.15	-4.81	-6.37	-3.94
SIC	-3.94	-4.59	-6.15	-3.73

Notes: All variables are in logs; standard errors in parentheses; ¹⁾ error correction term; (**) and (*) denote significance at the 5% and 10% level respectively.

Finally, I present the GDISB estimation output only for model 1, since model 2 did not present evidence of any stable long-run relationship, regardless of the type on normalization used.

In the government size equation expressed in levels, the only significant estimated coefficient is that associated with OPENNESS. This may make the estimation of the VEC with OPENNESS as the normalized coefficient a viable option, however the estimated cointegrating equation cannot be interpreted as long-run equilibrium relationship because the estimated ECT for OPENNESS is positive and not statistically different from zero. Only for the GDISB equation do I have a negative and significant error correction term.

In terms of the individual hypotheses, the estimated long-run relationship between GDISB and RGDPPC is not consistent with that implied by Wagner's Law, as the income coefficient is -0.0721, negative but statistically not different from zero. The estimated coefficient on OPENNESS in the GDISB equation is also consistent with the hypothesis that greater openness implies greater variability in the economy and hence a greater demand for government size, via the demand for insurance. In the same sense it is also consistent with the hypothesis that a larger government size allows "ceteris paribus" the existence of a larger foreign sector. The estimated coefficient on OPENNESS is 0.7923 and is statistically greater than zero.

In addition, GSIZE is found to be negatively correlated with the employment rate. This latter result would support the stabilization characteristic of government size as originally found by Gali and Fatas and Mihov, as greater domestic variability implies a greater government size. However, the estimated coefficient on EMPRATE (-0.0395) is not statistically different from zero.

Given this long-run equilibrium relationship for government size, I now turn my attention to the vector error correction results. Note that the error correction term in the lower panel of Table 5.2 captures the deviation of government size from the estimated long-run equilibrium level. In terms of the growth rates of GDISB, the error correction term is negative and statistically significant, implying that the estimated long-run equation in levels can indeed be interpreted an equilibrium relationship. A one percent deviation of government size above its “optimal” level would imply a correction (decrease) in the growth rate of GDISB of 0.1784%. In the first column of the lower panel of Table 5.2, none of the growth rates of real income per-capita and employment rate enters in the VEC in a significant way. The signs of the coefficients, however, lend some weak support to the counter-cyclical behaviour of government size. Positive (negative) growth rates of output and employment would imply a smaller (greater) growth rates of government size. The growth rate of OPENNESS is negatively correlated with the growth rate of government size, in direct contrast to what was found in the equation in levels. In the short-run it appears that a one percent increase in OPENNESS reduces government size by 0.27%.

When we look at the VEC in terms of the growth rate of real GDP per-capita, we find that levels of government size above long-run equilibrium are generally correlated with lower growth rates in real income. This result seems to confirm what the growth literature consistently finds in cross-country studies, namely a negative relationship between government expenditures (or government size) and income growth. Here, the difference is that the relationship is expressed in terms of the deviation of government size from its equilibrium level. My interpretation is that levels of government size

consistently above their long-run trend tend to have a negative impact on future growth rates of income.⁴⁸ Again, the growth rate of OPENNESS is the only one that appears to be statistically significant. Here positive growth rates in the share of international trade are positively correlated with higher growth rates of GDP per-capita.

Turning our attention to the growth rate of the employment rate, my measure of instability in the labour market, I find that deviations of government size from its equilibrium do not have a significant impact on employment rates. On the other hand, I find that, by accounting for this long-run relationship, growth rates in government size are generally correlated with decreases in the growth rates in employment rates. This result is not consistent with our hypothesis of government size having stabilizing properties. It seems that a growing government size increases the probability of unemployment rather than reducing it. Also it seems that present growth rates in employment are positively correlated with past growth rates. The coefficient on $D(EMPRATE(1))$ is 0.3901 and is statistically significant at 5%. My interpretation is that shocks to growth rates in employment have a permanent effect rather than being merely a transitory one. The estimated coefficient on $D(OPENNESS(-1))$ is also not consistent with our working hypothesis. I find a significant positive relationship (0.1413) between growth rates in OPENNESS and growth rates in EMPRATE. This result does not confirm

⁴⁸ See in this regard Barro (1981,1990b,1991a,1991b), Barro and Sala-I-Martin (1995), Karras (1999), Foelster and Henrekson (2001).

the hypothesis that greater exposure to international markets involves greater variability in the labour market and therefore increased risk by workers of being laid off.

When the error correction equation is expressed in terms of growth rate of OPENNESS I find that previous growth rates of OPENNESS are statistically significant. The coefficient of $D(\text{OPENNESS}(-1))$ is estimated at 0.2995 and is statistically different from zero only at 10% and would, similarly to the employment rate, underline the permanent nature of shocks to the growth rate of OPENNESS. In addition it also appears that growth rates in $\text{EMPRATE}(-1)$ and OPENNESS are negatively correlated. In this case positive growth rates in employment in the previous period reduce the growth of OPENNESS in the present.

5.4. The Results for Government Consumption Expenditure

Table 5.3 shows the estimated VEC for the government consumption measure of government size. Similarly to GDISB, the only meaningful normalization was to use GCONS as the dependent variable. All other normalizations did not exhibit the equilibrium characteristic of a negative error correction term. Consistent with the previous section, I also do not find cointegration when I consider model 2. None of the variables expressed in levels enters in the cointegrating equation in a statistically significant way. The coefficient for RGDPPC is estimated at -0.1191 and is not statistically different from zero. This result does not confirm Wagner's Law, as government consumption expenditure would be unit elastic. In contrast to the GDISB measure of government size, I also find that the link in levels between OPENNESS and GSIZE is insignificant in this case. The coefficient on OPENNESS is 0.1851, which is

positive but statistically not different from zero. Analogous to my findings for GDISB, EMPRATE is also not statistically significant. However, the sign on EMPRATE is, in the case GCONS, positive. Turning to the VEC for government consumption expenditures, I find that the error correction term (ECT) is negative and significantly so.

Table 5.3: Cointegrating regression and VEC for the GCONS specification of government size, Model 1 at LAG=1

Cointegrating Equation with GCONS as LHS variable				
Intercept	-1.2137 (1.34)			
RGDPPC	-0.1191 (0.32)			
EMPRATE	0.1760 (0.36)			
OPENNESS	0.1851 (0.24)			
Error Correction				
	D(GCONS)	D(RGDPPC)	D(EMPRATE)	D(OPENNESS)
ECT ¹⁾	-0.0895** (0.03)	-0.0426 (0.03)	0.0325** (0.01)	-0.1398** (0.05)
D(GCONS(-1))	0.2309 (0.15)	-0.0161 (0.14)	-0.0056 (0.06)	-0.1286 (0.20)
D(RGDPPC(-1))	-0.2214 (0.26)	0.1703 (0.24)	0.1629 (0.11)	-0.6303* (0.35)
D(EMPRATE(-1))	0.6589* (0.36)	-0.0939 (0.33)	0.4052** (0.15)	-0.5302 (0.48)
D(OPENNESS(-1))	-0.2744** (0.11)	0.2486** (0.10)	0.1376** (0.04)	0.3893** (0.15)
R ²	0.35	0.25	0.51	0.21
AIC	-4.59	-4.72	-6.33	-4.02
SIC	-4.38	-4.51	-6.12	-3.80

Notes: All variables are in logs; standard errors in parentheses; ¹⁾ error correction term; (**) and (*) denote significance at the 5% and 10% level respectively.

A one percent deviation of government size above its long-run equilibrium would imply a correction in the growth rate of GSIZE of -0.895% next period. Turning the attention to the individual hypothesis, I find that in contrast the GDISB specification, growth in the employment rate has a positive and significant impact on the growth of government size. Also, in order to confirm Rodrik's hypothesis that greater OPENNESS involves greater variability and hence greater demand for greater government size, the intermediate links must be established between OPENNESS and EMPRATE and between EMPRATE and GSIZE. In the case of government consumption, the link between EMPRATE and GSIZE does not work in the direction hypothesized by Rodrik. This seems to confirm the result in the equation in levels of the insignificant link between OPENNESS and GCONS and the further finding in the VEC that growth rates in OPENNESS and GSIZE are negatively correlated. The coefficient on $D(OPENNESS(-1))$ is -0.2744 and is statistically significant at 5%.

In terms of the VEC expressed in terms of EMPRATE, I find that deviations of government size above its long-run equilibrium are generally correlated with higher growth rates in the employment rate and hence reduce the probability for workers being laid off. This result would confirm the "automatic stabilizer" hypothesis of government size. I also find that past and present growth rates in the employment rate are positively correlated, as it was the case for the system with GDISB as the measure of government size. This would suggest that shocks to growth rates of employment are rather permanent. In contrast to Rodrik's hypothesized causality between OPENNESS and labour market variability, I find that past growth rates of OPENNESS have a positive effect on present

growth rates of the employment rate, and in this sense growth in OPENNESS significantly reduces the probability of being unemployed.

When the VEC is expressed with the growth rate of real GDP per-capita as the the dependent variable, the only variable that seems to significantly affect the growth of RGDPPC is the growth of OPENNESS. In this case growth in OPENNESS is positively correlated with the growth of real income per-capita. The coefficient on $D(\text{OPENNESS}(-1))$ is estimated at 0.2486 and is statistically significant at the 5% level.

It is interesting to note the results when $D(\text{OPENNESS})$ is the dependent variable. I find that too big a government generally reduces the growth in the economy's exposure to international markets. Consistently I find that shocks to growth rates of OPENNESS are of permanent nature rather than just transitory. The coefficient on $D(\text{OPENNESS}(-1))$ is estimated at 0.3893 and is statistically significant at 5%.

5.5. The Results for Government Transfers

Starting the analysis from model 1 (Table 5.4), the VEC estimation shows that the only the normalization of the cointegrating equation in terms of government size (GTRANSFER) can be interpreted as a long-run relationship. In the long-run government size equation, the coefficient on EMPRATE is estimated at -0.1521 and is statistically not different from zero. This is in line with what was found for the other two measures of government size. RGDPPC enters the government size equation with a coefficient of -0.1710 that is also statistically not different from zero. Again this is in line with what was found in the previous cases, namely that the data seem not to support Wagner's Law. Like with GDISB and in contrast to GCONS, OPENNESS enters in the GTRANSFER

equation positively and with strong significance. This result tends to confirm

Rodrik's hypothesis that in the long-run greater OPENNESS implies a larger government size.

Table 5.4: Cointegrating regression and VEC for the GTRANSFER specification of government size, Model 1 at LAG=1

Cointegrating Equation with GTRANSFER as LHS variable				
Intercept	-0.3965 (1.18)			
RGDPPC	-0.1710 (0.29)			
EMPRATE	-0.1521 (0.30)			
OPENNESS	1.2788** (0.20)			
Error Correction				
	D(GTRANSFER)	D(RGDPPC)	D(EMPRATE)	D(OPENNESS)
ECT ¹⁾	-0.2971** (0.07)	-0.0885** (0.03)	0.0096 (0.01)	-0.0825 (0.06)
D(GTRANSFER(-1))	0.1499 (0.16)	-0.1068 (0.08)	-0.0874** (0.03)	0.1086 (0.13)
D(RGDPPC(-1))	-0.5610 (0.41)	0.0738 (0.20)	0.0357 (0.09)	-0.2145 (0.32)
D(EMPRATE(-1))	-1.0920 (0.68)	-0.4955 (0.34)	0.3900** (0.15)	-0.9098* (0.53)
D(OPENNESS(-1))	-0.2950 (0.20)	0.2647 (0.10)	0.1460** (0.04)	0.4190** (0.16)
R ²	0.23	0.31	0.53	0.12
AIC	-3.42	-4.80	-6.37	-3.91
SIC	-3.20	-4.59	-6.16	-3.68

Notes: All variables are in logs; standard errors in parentheses; ¹⁾ error correction term; (**) and (*) denote significance at the 5% and 10% level respectively.

In the VEC expressed in terms of $D(\text{GTRANSFER})$, the only significant coefficient is the error correction term at -0.2971 . This confirms the equilibrium nature of the relationship in levels. All other slope coefficients in first differences do not enter significantly. Again, however, the negative signs on $\text{DRGDPPC}(-1)$ and $\text{DEMPRATE}(-1)$ would suggest some degree of counter-cyclical behaviour as far as government transfers are concerned.

When the equation in first differences is expressed with changes in real income per-capita [$D(\text{RGDPPC})$], I find stark similarities with the results for the more general measure of government size, namely government current disbursements. Consistently I find that too big a government, i.e. levels of government size above their equilibrium levels, is negatively correlated with growth rates of income per-capita. The data show that an excessive level combined with the passive nature of government expenditures may be a burden on economic growth. Similar to the estimation for GDISB I also find that higher growth in OPENNESS results in higher growth in output per-capita. The parameter on $D(\text{OPENNESS}(-1))$ is estimated at 0.2647 and is statistically significant at 5%. The other slope coefficients are all statistically not different from zero.

In the normalization of the VEC with $D(\text{EMP_RATIO})$ as the dependent variable, I find that deviations of the level of GTRANSFER for its equilibrium path have no significant impact on the employment rate. However, as in the case with GDISB , positive growth rates in government size tend to destroy jobs rather than creating them. The coefficient on $G(\text{GTRANSFER}(-1))$ is -0.0874 and is statistically significant at 5%. Growth in OPENNESS appears to create employment opportunities. Growth in OPENNESS is found to be positively correlated with the growth in the employment rate.

Finally, the significant positive correlation of the growth in the employment rate with its own past values indicates that shocks to employment may be rather of permanent nature.

In the D(OPENNESS) vector error correction equation, the only significant relationship is between growth rates in OPENNESS and their past values. Similarly to employment the autocorrelation is positive and significantly so, indicating some persistence in the shocks affecting growth in OPENNESS.

For model 2 (see Table 5.5) I find a stable long-run relationship only when the set of variables is expressed with real income per-capita as the dependent variable. In this case higher levels of GTRANSFER generally involve lower levels of RGDPPC. The coefficient on GTRANSFER in the income equation in levels is estimated at -0.2680 and is significant at 5% (SE=0.48). This value is consistent with an income elasticity of approximately -0.44 ($1/-2.268$) if the equation were to be expressed in terms of government size. This income elasticity is not consistent with Wagner's Law. Higher levels of OPENNESS are positively correlated with higher levels of income per capita in a significant way. This is consistent with the previous findings. The employment rate, on the other hand, does not affect the level of real GDP per-capita in a significant way.

Turning to the VEC, the only normalization in which the error correction term, i.e. deviations of RGDPPC from its long-run equilibrium, is significant is when D(RGDPPC) is the dependent variable. A one percent deviation of GDP per-capita above the long-run trend implies a reduction of its growth rate of 0.06%. Also growth rates in OPENNESS are positively correlated with present growth rates in GDP per capita.

Growth in the employment rate is, on the other hand, negatively correlated with the growth rate in income per-capita. In terms of all other normalizations of the VEC, the results are almost identical to model 1.

Table 5.5: Cointegrating regression and VEC for the GTRANSFER specification of government size, Model 2 at LAG=1

Cointegrating Equation with RGDPPC as LHS variable				
Intercept	1.2274			
GTRANSFER	-2.2680** (0.48)			
EMPRATE	-0.4092 (0.63)			
OPENNESS	3.3588** (0.67)			
Error Correction				
	D(RGDPPC)	D(GTRANSFER)	D(EMPRATE)	D(OPENNESS)
ECT ¹⁾	-0.0651** (0.02)	-0.0836 (0.05)	0.01149 (0.01)	0.0516 (0.03)
D(GTRANSFER(-1))	-0.0556 (0.09)	0.0984 (0.20)	-0.1079** (0.04)	-0.1164 (0.13)
D(RGDPPC(-1))	0.0490 (0.19)	-0.4488 (0.42)	0.0326 (0.09)	-0.2133 (0.28)
D(EMPRATE(-1))	-0.6072* (0.34)	-0.9052 (0.72)	0.4177** (0.16)	-0.5785 (0.49)
D(OPENNESS(-1))	0.2492** (0.10)	-0.3902* (0.22)	0.1420** (0.04)	0.3202** (0.14)
Constant	0.0105 (0.006)	0.0429** (0.01)	-0.0001 (0.002)	0.0244** (0.008)
R ²	0.35	0.20	0.54	0.32
AIC	-4.81	-3.33	-6.34	-4.11
SIC	-4.56	-3.07	-6.08	-3.86

Notes: All variables are in logs; standard errors in parentheses; ¹⁾ error correction term; (**) and (*) denote significance at the 5% and 10% level respectively.

5.6. Conclusions

The main purpose of this chapter was to explore and test different theories that link government size to the business cycle within a time series framework.

I find that when, in a Vector Error Correction model, government size is modeled with a subset of economic variables including the employment rate to account for the business cycle, Wagner's Law is generally not validated by the data. This in contrast with what was found in the simple economic model of Chapter 2 but in line with the conclusions of Chapter 3, where I included several public choice variables in the theory of government size. For the government disbursement and the transfer measures of government size, I do not find strong evidence that government size works as a stabilizer in the economy in the short-run. For at least two of the three measures of government size, the signs of the coefficients on the growth rate of the employment rate (DEMPRATE) and the growth rate of real income per-capita (DRGDPPC) are negatively correlated with the growth rate of government size and hence would suggest that government size works in a countercyclical fashion. This qualitative result, however, generally lacks of statistical significance.

I also find that government size is in the long-run positively correlated with openness, as found by Rodrik using cross-country data. In the short-run I consistently find that levels of government size above their long-run trend and growth rates of GDP per-capita are mostly negatively correlated, as found in several growth theory studies. Higher growth rates in the foreign sector also seem to imply higher growth rates of real output per-capita. Different results are only obtained for the government consumption measure of government size. One of the issues with the methodology used here is that in

some cases the cointegrating relationship in terms of government size cannot be interpreted as a long-run equilibrium relation. Also, the cointegration framework does not allow for the separation of the feedbacks among the variables and hence only captures the net effect.

Chapter 6: Conclusions

This thesis deals with one of the central questions in public finance and public choice; namely, what are the determinants of government size and ultimately what the appropriate size of government is. More specifically, the goal is to extend current research traditionally done in cross-sectional models by using a time series approach applied to data from Switzerland from 1960 to 2000. The methodology of this research is to test a number of different theories of government size in an incremental way. That is, in Chapter 2, I start by testing a parsimonious economic model that works as the base case for subsequent chapters. In Chapters 3 and 4, I then extend the analysis by including different theories of government size that are commonly found in the public choice literature. This approach not only implies the inclusion a larger number of explanatory variables but inherently allows one to test whether the actual size of government is the result of a demand and supply relationship. Finally, in Chapter 5, I concentrate on the relationship between government size and the business cycle.

I start, in Chapter 2, by looking at government size from a simple demand side perspective that allows investigation of two fundamental theories of government size, Wagner's Law and Baumol's Hypothesis of Unbalanced Growth. When income per capita and the relative price (cost) of government output to private output are the only variables in the government size equation, I find first that Wagner's Law is consistently supported by the data. Granger causality tests confirm this view as real income per-capita does "Granger cause" government size. Secondly, because the relative cost of government output has generally risen over the sample period, the demand function must

be price inelastic to explain Baumol's hypothesis of the growth in government size.

The data, however, does not support this condition. In a single equation setting, the price elasticity estimate is not consistent with size needed to have the desired effect on government size.

However, aside from the particular estimated signs and magnitudes of the parameters, the Johansen cointegration test allows me to conclude that there is a stable equilibrium relationship among these three important variables. With some differences between the different measures of government size, cointegration among these variables can be found for all three variables.

In Chapter 3, I investigate whether the political nature of government size is reflected in the data and hence whether the results of the preliminary model can be improved upon by including public choice variables. Moreover, I want to see if the previously estimated coefficients on income and price change in a significant way when the simple economic model of government size is extended in this way. To do so I add a set of public choice variables designed to take into consideration the political institutional setting as well as characteristics of the population that determine the collective choice mechanism underlying the evolution of government size. My empirical results suggest that the estimates of the elasticities of the traditional economic variables are not robust to the addition of public choice considerations. A significant change is observed with respect to the estimated income elasticities, which now are consistently less than one and, in some cases even negative. This reverses the results of the previous chapter on the validity of Wagner's Law for Switzerland. On the other hand, the estimated relative price

elasticities remain positive and suggest that a single reduced form equation of a demand and supply system may not be able to separate offsetting influences on price.

What my findings on the public choice variables indicate overall is that different estimates for the effect of the independent variables can be found depending on which particular definition of government size is chosen. More specifically, I often find opposing signs for the effects of the public choice considerations on the provision of goods and services versus transfers and the net effect is not always apparent when the more comprehensive measure of government size is used. This suggests that the presence of diverging effects within the individual components of overall government spending sometimes offset in the aggregate so that the individual parts may be more consistently meaningful than the insignificance of the aggregate measure would seem to imply. For example, I find that GTRANSFER, the transfer component of government size is quite more responsive to special interest groups (OLDPOP) than the consumption component (GCONS). This result could not have been observed if one would have tested this relationship solely on the aggregate measure of government size, namely GDISB.

In Chapter 4, my goal was to address the identification and simultaneity issues that the single equation model of Chapters 2 and 3 are unable to resolve. Therefore I extended the single equation methodology of Chapters 2 and 3 to a multiple equation framework. The first half of the chapter handles two specific concerns: the first is to see if a demand supply setup can separate the explanatory variables according to whether they affect the demand or the supply for government goods and services; and, second, to test for the possibility of a two-way relationship between government size and the employment in the government. In Chapter 3, the share of government employment was

presumed to reflect a lobby group effect running from larger proportional employment to larger government size. On the other hand, causality will also run in the opposite direction, with the scale of government employment determined by government size.

In the first model used, a demand and supply model of government size with BURO exogenous, I find that all income elasticities are positive but not statistically different from zero. These results reinforce the findings of Chapter 3 and again contradict the initial Chapter 2 finding of a highly income elastic demand for government goods and services. Wagner's Law is again rejected by the data. The demand price coefficients found on the demand side of the model are now consistent with an inelastic demand for public goods across all three specifications of government size. None of these estimates is significantly different from zero. This is consistent with the cost disease hypothesis requiring that demand curves be inelastic. In relative terms, my results show that government transfers are more sensitive to the cost of provision than are traditional government goods and services. With respect to the public choice variables, the system estimation yields mixed results.

The second model extends the basic demand and supply model to whether BURO is endogenous and to investigate what difference it makes if BURO is treated as such. Here I find, first, that the Hausman test implies that I cannot reject the presence of endogeneity between government size and BURO in the data. Second, after accounting for this endogeneity by adding an additional equation, I find generally that the magnitude of the effect of BURO on the demand for government goods and services increases. On the other hand, the size of this increase does not appear to be statistically significant and

only in one of the three cases does the estimated coefficient change sign. From this point of view, accounting for the endogeneity of BURO does not seem as necessary as was initially hypothesized. What is reassuring about the exercise, however, is that accounting for the production function relationship between BURO and government size does not eliminate the finding of a strong and significant demand side role for BURO.

A final point of interest is that the three-equation system does not change the coefficient estimates of the other independent explanatory variables in any significant way. In this sense, the previous two-equation demand and supply model is more robust than might have been originally expected.

The last half of the chapter investigates the possible endogeneity between growth of income per-capita and growth of government size. Here I find that while the potential for a significant effect being present, the quantitative significance of this interrelationship does not appear to be large. Hence at least for the case of Switzerland in this particular time period, studies that do not account for income/government size interdependence do not appear to introduce much of a bias by failing to control for its presence.

The purpose of Chapter 5 is to test different theories that link government size to both the long run variability of the economy and the shorter run business cycle within a Vector Error Correction model. This extends to a time series setting, cross country analysis where government size has been modeled with a subset of economic variables including the employment rate to account for either the amount of variability within the economy or to proxy the business cycle. Consistent with the previous chapters 3 and 4, I find that Wagner's Law is not validated by the data. For two of the three measures of government size, I do find some qualitative evidence that government size works as a

stabilizer in the economy in the short-run, similarly to what I found in Chapter 2. In this chapter, for two of the three measures of government size, the data shows that growth rates of the employment rate and the real income per-capita are negatively correlated with the growth rate of government size, and hence would yield some corroboration that growth rates of government size do behave counter-cyclically in the short-run. While the signs of the estimated coefficients point in this direction, their magnitude is not statistically significant.

In terms of some of the more interesting particular results, I find that government size is positively correlated with openness in the long run, as has found by Rodrik using cross-country data. In the short-run I consistently find that levels of government size above their long-run trend and growth rates of GDP per-capita are mostly negatively correlated, as found in several growth theory studies. Higher growth rates in the foreign sector also seem to imply higher growth rates of real output per-capita. Only for the government consumption measure of government size, do I find different results.

If one can generalize from the specific case of Switzerland investigated here, my thesis suggests two important conclusions for our current understanding of how to model government size. First, the analysis suggests that simple models of government size are likely to be too simple. In particular, tests for Wagner's Law and/or Baumol's cost disease are likely to need to include control for other significant determinants of government size and for interacting demand/supply considerations. Second, the prediction for the effect of different economic and/or political variables on government size will often depend on the dependent variable modeled. That is, as I have shown, conflicting results often appear when different measures of size are chosen. Hence my

results make it difficult to support a unique all-encompassing theory of government size and speak to the complexity of the issues underlying the growth of the government sector. This is due not only to the fact that government size is an aggregate consisting of a large number of distinct goods and services but also to the fact that each component is determined by a number of other demographic, social, and political considerations. To advance our understanding of the aggregate, more progress must be made understanding the separate components of government's interaction with the private economy.

DATA APPENDIX:**Data Sources and Descriptions:**

GCURRDISB: Current Disbursements, Government Switzerland; OECD 68 YPG, 1960-2000, annual data, MN SFR.

SOCBEN: Social Benefits paid by Government, Switzerland; OECD 68 SSPG, 1960-2000, annual data, MN SFR.

OTRANSFERS: Other current Transfers paid by Government, Switzerland; OECD 68 TRPG, 1960-2000, annual data, MN SFR.

SUBSIDIES: Subsidies, Switzerland; OECD 68 TSUB, 1960-2000, annual data, MN SFR.

GCURREC: Current Receipts, Switzerland; OECD 68 YRG, 1960-2000, annual data, MN SFR.

TDIRECT: Total Direct Taxes, Switzerland; OECD 68 TY, 1960-2000, annual data, MN SFR.

GWAGES: Government Consumption, Wages, Switzerland; OECD 68 CGW, 1960-2000, annual data, MN SFR.

POP64+: Population 65 years and over, Switzerland; OECD 681208, 1960-2000, annual data, TH (Mid-year estimate).

POP: Total Population, Switzerland; OECD 68 1, 1960-2000, annual data, TH (Mid-year estimate).

AGRIC: Civilian Employment, Agriculture, Hunting, Forestry, and Fishing, Switzerland; OECD 681449, 1960-2000, annual data, TH (Estimate average/year)

FEMPLAB: Total Labour Force Females, Switzerland; OECD 681322, 1960-2000.

annual data, TH (Estimate average/year).

GCONSEXP: General Government Consumption Expenditure, Switzerland; OECD 68

CGAA, 1960-2000, annual data, MN SFR.

EXPORTS: Exports of Goods and Services, Switzerland; OECD 6806, 1960-2000,

annual data, MN SFR.

IMPORTS: Imports Goods and Services, Switzerland; OECD 6807, 1960-2000, annual

data, MN SFR.

GDP: Gross Domestic Product, Volume, Switzerland; OECD 68 GDPV, 1960-2000,

annual data, MN SFR (1990).

CANTCOMEXP: Government Expenditures at the Cantonal and Municipal Level,

Switzerland; OECD Country Surveys, Switzerland, 1960-2000, annual data, MN SFR.

P: Deflator for GDP at Market Prices, Switzerland; OECD 68 PGDP, 1960-2000, annual

data, 1990=100.

GOVEMP: Employment Government, Switzerland; OECD 68 EG, 1960-2000, annual

data, Number.

TOTEMP: Total Employment, Switzerland; OECD 68 ET, 1960-2000, annual data,

Number.

FEMPOP: Female Population from 15 to 64 Years, Switzerland; OECD 681211, 1960-

2000, annual data, TH (Mid-year estimates).

Pg: Deflator, Government final consumption expenditure, Switzerland; OECD

CHE_PCG, 1960-2000, annual values extrapolated from quarterly data, 1990 = 100. See

also Deflator Public Consumption, Switzerland; OECD Outlook 2003, 1960-2000, annual data, 1990=100.

I/Y: Gross Capital Formation as a share of GDP; World Bank World Development Indicators (WDI Online), 1965-1999, annual data.

COMPEMP: Compensation of Employees; OECD Economic Outlook No 74: Annual and Quarterly data, 1960-2000, annual data.

URBANPOP: Urban Population as a share of Total Population; World Bank World Development Indicators (WDI Online), 1960-1999, annual data.

RELPRICE= $\text{LN}(\text{Pg}/\text{P})$

LN: Logarithmic operator

D: Difference Operator [$\text{DX}=\text{X}-\text{X}(-1)$]

RGDPPC= $\text{LN}(\text{GDP}/\text{POP})$

OPENNESS= $\text{LN}[(\text{IMPORTS}+\text{EXPORTS})/\text{GDP}]$

FEMPART= $\text{LN}(\text{FEMPLAB}/\text{FEMPOP})$

TRANSFERS= $\text{SOCBEN}+\text{OTRANSFERS}+\text{SUBSIDIES}$

GDISB= $\text{LN}(\text{GCURRDISB}/\text{GDP})$

GCONS= $\text{LN}(\text{GCONSEXP}/\text{GDP})$

GTRANSFERS= $\text{LN}(\text{TRANSFERS}/\text{GDP})$

OLDPOP= $\text{LN}(\text{POP}_{64+}/\text{POP})$

FARM= $\text{LN}(\text{AGRIC} \cdot 1000/\text{TOTEMP})$

BURO= $\text{LN}(\text{GOVEMP}/\text{TOTEMP})$

DIRECT= $\text{LN}(\text{TDIRECT}/\text{GCURREC})$

LOCAL= $\text{LN}(\text{CANTCOMEXP}/\text{GCURRDISB})$

$$\mathbf{RWAGEG}=\mathbf{LN}[(\mathbf{GWAGES}*1000000/\mathbf{GOVEMP})/\mathbf{P}*100]$$

$$\mathbf{RWAGEP}=\mathbf{LN}[(\mathbf{COMPEMP}*1000000/(\mathbf{TOTEMP}-\mathbf{GOVEMP})/\mathbf{P}]$$

$$\mathbf{EMPRATE}=\mathbf{TOTEMP}/(\mathbf{POP}*1000)$$

References

- Abizadeh, S., and J. Gray, 1985. "Wagner's Law: A pooled time-series, cross-section comparison," *National Tax Journal*, 38, pp. 209-218.
- Abrams, B. A., 1999. "The effect of government size on the unemployment rate." *Public Choice*, 99, pp. 395-401.
- Alesina, A., and R. Wacziarg, , 1998. "Openness, Country Size and Government," *Journal of Public Economics*, 69, pp. 305-21.
- Aubin, C., J. Berdot, D. Goyeau , and J. Lafay, 1988. "The Growth of Public Expenditure in France," in J.A. Lybeck and M. Henrekson, eds., *Explaining the Growth of Government*, Amsterdam: Elsevier Science Publishers (North-Holland), pp. 201-30.
- Barro, R. J., 1981. "Output Effects of Government Purchases," *Journal of Political Economy*, 89, 6, pp. 1086-1121.
- Barro, R. J., 1990b. "Government Spending in a Simple Model of Endogenous Growth," *Journal of Political Economy*, 98, 5, pp. 103-125.
- Barro, R. J., 1991a. "Economic Growth in a Cross Section of Countries," *Quarterly Journal of Economics*, 106, 2, pp. 407-443.
- Barro, R. J., 1991b. "A Cross Country Study of Growth, Saving, and Government," *National Saving and Economic Performance*, Chicago, University of Chicago Press.
- Barro, R. J., and X. Sala-I-Martin (1995). "Economic Growth," New York, McGraw-Hill.
- Baumol, W.J., 1967. "The macroeconomics of unbalanced growth: The anatomy of urban crisis," *American Economic Review*, 57, pp. 415-426.
- Baumol, W.J., 1993. "Health Care, education and the cost disease: A looming Crisis for public choice," *Public Choice*, 77, pp. 17-28.
- Beck, M., 1979. "Public sector growth: a real perspective," *Public Finance*, 34, 4, pp. 313-356.
- Berry, W. O. and D. Lowery, 1984. "The Growing Cost of Government: A Test of Two Explanations," *Social Science Quarterly*, 65, pp. 735-49.

- Bird, R.M., 1971. "Wagner's 'Law' of expanding state activity," *Public Finance*, 26, pp. 1-26.
- Black, D., 1958. "The Theory of Committees and Elections," Cambridge: Cambridge University Press.
- Bohl, M.T., 1996. "Some international evidence on Wagner's Law," *Public Finance* 51, 2, pp. 185-200.
- Borcherding, T. E., and R. Deacon, 1972. "The demand for the services of non-federal governments," *American Economic Review* 62, pp. 891-901.
- Borcherding, T. E., 1976. "The Coastal Plan as a Statewide Zoning Ordinance," in Eugene Bardach, et al., *The California Coastal Plan: A Critique*, San Francisco, CA: Institute for Contemporary Studies.
- Borcherding, T. E., 1977. "The sources of growth of public expenditures in the U.S., 1902-1970". In *Budgets and Bureaucrats: The Sources of Government Growth*, T.E. Borcherding, ed., Durham, N.C., Duke University Press.
- Borcherding, T. E., 1985. "The causes of government expenditure growth: A survey of the U.S. evidence," *Journal of Public Economics*, 28, pp. 359-382.
- Borcherding, T.E., J.S. Ferris, and A. Garzoni, forthcoming 2004. "Changes in the Real Size of Government Since 1970," in Juergen Backhaus and Richard Wagner (eds.), *Kluwer Handbook in Public Finance*, New York: Kluwer Academic Press.
- Bradford, D.F., R. A. Malt, and W.E. Oates, 1969. "The Rising Cost of Local Government Services," *National Tax Journal*, 22, pp. 891-901.
- Buchanan, J.M., and G. Tullock, 1977. "The expanding Public Sector: Wagner Squared," *Public Choice*, 32, pp. 147-150.
- Cameron, D.R, 1978. "The Expansion of the Public Economy: A Comparative Analysis," *American Political Science Review*, 72, pp. 1243-61.
- Corey, E.C., and L.C. Garand, 2002. "Are Government Employees more likely to vote?," *Public Choice*, 111, 3-4, pp. 259-283.
- Cullis, J., and P. Jones, 1998. "Public Finance and Public Choice," Oxford: Oxford University Press.
- Downs, A., 1957. "An Economic Theory of Democracy," New York: Harper and Row.

- Downs, A., 1961. "In Defense of Majority Voting," *Journal of Political Economy*, 69, pp. 192-9.
- Engle, R., and C. Granger, 1987. "Co-integration and Error Correction: Representation, Estimation and Testing," *Econometrica*, 35, pp. 251-76.
- Eviews User's Guide, 1994-98, Irvine CA: Quantitative Micro Software.
- Fatas, A., and I. Mihov, 2000. "Government Size and Automatic Stabilizers: International and Intranational Evidence," *Journal of International Economics*, 55, pp. 3-28.
- Feld, L.P., and G. Kirchgaessner, 2000. "Direct Democracy, Political Culture, and the Outcome of Economic Policy: Some Swiss Experience," *European Journal of Political Economy*, 16, pp. 287-306.
- Feld, L.P., and G. Kirchgaessner, 2001a. "Income Tax Competition at the State and Local Level in Switzerland," *Regional Science and Urban Economics*, 31, pp. 181-213.
- Feld, L.P., and G. Kirchgaessner, 2001b. "The Political Economy of Direct Legislation: The Role of Direct Democracy in Local and Regional Decision-Making," *Economic Policy*, 33, pp. 331-67.
- Ferris, J. S., and E.G. West, 1996a. "Testing theories of real government size: U.S. experience, 1959-89," *Southern Economic Journal*, 62, pp. 537-553.
- Ferris, J. S., and E.G. West, 1996b. "The cost disease and government growth: qualifications to Baumol," *Public Choice*, 89, pp. 35-52.
- Ferris, J. S., and E.G. West, 1999. "Cost disease versus Leviathan explanations of rising government cost," *Public Choice*, 98, pp. 307-316.
- Folster, S., and M. Henrekson, 1999. "Growth and the public sector: a critique of the critics," *European Journal of Political Economy*, 15, pp. 337-358.
- Folster, S., and M. Henrekson, 2001. "Growth effects of government expenditure and taxation in Rich Countries," *European Economic Review*, 45, pp. 1501-20.
- Gali, J., 1994. "Government size and macroeconomic stability," *European Economic Review*, 38, pp. 117-132.
- Gandhi, V.P., 1971. "Wagner's Law of public expenditure: Do recent cross-section studies confirm it?," *Public Finance*, 26, pp. 44-56.

- Ganti, S., and B.R. Kolluri, 1979. "Wagner's Law of Public Expenditures: Some efficient results for the United States," *Public Finance*, 34, 2, pp. 225-33.
- Gemmell, N., 1993. "The Growth of the Public Sector: Theories and Evidence," Aldershot: Edward Elgar Publishing.
- Goffman, I.J. and D. J. Mahar, 1971. "The growth of public expenditure in selected developing nations: Six Caribbean Countries," *Public Finance*, 26, 1, pp. 57-74.
- Granger, C.W.J., and P. Newbold, 1974. "Spurious Regressions in Econometrics," *Journal of Econometrics*, 2, 1, pp. 11-120.
- Hamlin, A., 1993. "Public Expenditure and Political Process," in "The Growth of the Public Sector: Theories and Evidence," Aldershot: Edward Elgar Publishing.
- Henrekson, M., 1988. "Swedish Government Growth: A Disequilibrium Analysis," in J.A. Lybeck and M. Henrekson, eds., *Explaining the Growth of Government*, Amsterdam: Elsevier Science Publishers (North-Holland), pp. 93-132.
- Henrekson, M., and Lybeck J.A., 1988. "Explaining the Growth of Government in Sweden: A Disequilibrium Approach," *Public Choice*, 57, pp. 213-32.
- Henrekson M., 1990. "An Economic Analysis of Swedish Government Expenditure," Ph. D. Thesis, Gothenburg University.
- Henrekson M., 1993. "Wagner's Law – A spurious Relationship?," *Public Finance*, 48, 2, pp. 406-15.
- Holsey C.M. and T. E. Borcharding, 1997. "Why does Government's Share of National Income grow? An Assessment of the Recent Literature on the U.S. Experience," in *Perspectives on Public Choice: A Handbook*, Dennis C. Mueller (eds.), New York: Cambridge University Press.
- Karras, G., 1999. "Taxes and Growth: Testing the Neoclassical and Endogenous Growth Models," *Contemporary Economic Policy*, 17, pp. 177-188.
- Kau, J.B., and P. H. Rubin, 1981. "The size of government," *Public Choice*, 37, pp. 261-274.
- Kau, J.B., and P. H. Rubin, 2001. "The Growth of Government: Sources and Limits," *SSRN Working Paper*.
- Kristov, L., P. Lindert, and R. McClelland, 1992. "Pressure Groups and Redistribution," *Journal of Public Economics*, 48, 135-63.

- Legrenzi, G., and C. Milas, 2002. "The Role of omitted variables in identifying a long-run equilibrium relationship for the Italian government growth," *International Tax and Public Finance*, 9, 4, pp. 435-49.
- Lott, J. R., and L. W. Kenny, 1999. "Did Women's Suffrage Change the Size and Scope of Government?," *Journal of Political Economy*, 107, 6, pp. 1163-1198.
- Lutters, R., 1998. "The Role of Economic Analysis in regulatory Reform, Office of Management and Budget, Report to Congress on the Costs and Benefits of federal Regulation," Washington, D.C.: Government Printing Office.
- Lybeck, J.A., 1986. "The Growth of Government in Developed Countries," Aldershot: Gower Press.
- Lybeck, J.A., and M. Henrekson, 1988. "Explaining the Growth of Government," Amsterdam: Elsevier Science Publishers.
- MacKinnon, J.G., 1996. "Numerical Distribution Functions for Unit Root and Cointegration Tests," *Journal of Applied Econometrics*, 11, 6, pp. 601-618.
- Meltzer, A.H., and S.F. Richard, 1981. "A Rational Theory of the Size of Government," *Journal of Political Economy*, 89, pp. 914-927.
- Meltzer, A.H., and S.F. Richard, 1983. "Tests of a Rational Theory of the Size of Government," *Public Choice*, 41, pp. 403-418.
- Mueller, D. C., 1989. "Public Choice II," Cambridge: Cambridge University Press.
- Mueller, D. C., and Peter, Murrell, 1993. "Interest Groups and the Size of Government," 344-64, in *The Public Choice Approach to Politics*, edited by Mueller, D.C., Aldershot, U.K: Elgar Press.
- Mueller, D.C., and P.Murrell, 1985. "Interest Groups and the Political Economy of Government Size," in F. Forte and A. Peacock (eds.), *Public Expenditure and Government Growth*, Oxford: Basil Blackwell, pp. 13-36.
- Musgrave, R.A., 1981. "Leviathan Cometh- Or does He?," in Helen F. Ladd and T. Nicolaus Tideman (eds.), *Tax and Expenditure Limitations*, Washington, D.C.: Urban Institute, pp. 77-120.
- Niskanen, W.A. Jr., 1971. *Bureaucracy and Representative Government*, Chicago: Aldine-Atherton.
- Payne, J.E., and B.T. Ewing, 1996. "International evidence on Wagner's hypothesis: A cointegration analysis," *Public Finance*, 51, 2, pp. 258-274.

- Peacock, A.T., and J. Wiseman, 1979. "Approaches to the analysis of government expenditure growth," *Public Finance Quarterly*, 7, pp. 3-23.
- Peacock, A.T., and A. Scott, 2000. "The curious attraction of Wagner's Law," *Public Choice*, 102, pp. 1-17.
- Peltzman, S., 1980. "The growth of government," *Journal of Law and Economics* 23, 2, pp. 209-287.
- Perkins, G. M., 1977. "The Demand for Local Public Goods: Elasticities of Demand for Own Price, Cross Price and Income," *National Tax Journal*, pp. 411-422.
- Ram, R., 1986. "Causality between income and government expenditure: A broad international perspective," *Public Finance*, 41, pp. 393-413.
- Rodrik, D., 1998. "Why Do More Open Economies Have Bigger Governments," *Journal of Political Economy*, 106, 5, pp. 997-1032.
- Saikkonen, P., 1991. "Asymptotically Efficient Estimation of Cointegration Regressions," *Econometric Theory*, 7, 1, pp. 1-21.
- Spann, R., 1977. "The macroeconomics of unbalanced growth and the expanding public sector," *Journal of Public Economics*, 8, pp. 397-404.
- Tiebout, C. M., 1956. "A Pure Theory of Local Expenditures," *Journal of Political Economy*, 64, pp. 416-24.
- Tullock, G., 1959. "Some Problems of Majority Voting," *Journal of Political Economy*, 67, pp. 571-79.
- Tullock, G., 1977. "Demand-Revealing Process, Coalitions and Public Goods," *Public Choice*, 29, pp.103-105.
- Wagner, A., 1893. "Grundlegung der politischen Oekonomie," Leipzig: 3rd edition.
- Wagner, R.E., and W.E. Weber, 1977. "Wagner's Law, Fiscal Institutions and the Growth of Government," *National Tax Journal*, 30, pp. 59-68.