VATT-KESKUSTELUALOITTEITA
VATT DISCUSSION PAPERS

339

GOVERNMENT SIZE AND OUTPUT VOLATILITY: NEW INTERNATIONAL EVIDENCE

Erkki Koskela
Matti Virén

Valtion taloudellinen tutkimuskeskus
Government Institute for Economic Research
Helsinki 2004

Erkki Koskela, Department of Economics, P.O. Box 17 (Arkadiankatu 7), FIN-00014 University of Helsinki, Finland. e-mail: erkki.koskela@helsinki.fi

Matti Virén, Department of Economics, 20014 University of Turku, Finland. e-mail: matvir@utu.fi

Koskela thanks the Research Unit on Economic Structures and Growth (RUESG) for financial support and the Bank of Finland for hospitality. Both authors thank the participants of the IIPF Congress in Prague, August 2003, for useful comments.

ISBN 951-561-504-6

ISSN 0788-5016

Valtion taloudellinen tutkimuskeskus

Government Institute for Economic Research

Arkadiankatu 7, 00100 Helsinki, Finland

Email: etunimi.sukunimi@vatt.fi

Oy Nord Print Ab

Helsinki, July 2004

ERKKI KOSKELA AND MATTI VIRÉN: GOVERNMENT SIZE AND OUTPUT VOLATILITY: NEW INTERNATIONAL EVIDENCE. Helsinki, VATT, Valtion taloudellinen tutkimuskeskus, Government Institute for Economic Research, 2004, (C, ISSN 0788-5016, No 339). ISBN 951-561-504-6.

Abstract: This paper re-examines the relationship between government size and output volatility from two perspectives. First, we use a wider international data set of 91 countries over the period 1980–1999 and thus not only the OECD data that have thus far been utilized. Second, we also allow for time series aspect by using panel data estimations. We have two new findings. First, the results from OECD countries about the negative relationship between output volatility and government size cannot be generalized to a wider international data set. Second, the relationship between government size and output volatility seems to be non-linear. More precisely, the negative effect of government size on output volatility is significantly negative only for countries with high and small public sectors.

Key words: Automatic stabilizers, government size, output volatility

JEL classification: E32, E62, H30

ERKKI KOSKELA AND MATTI VIRÉN: GOVERNMENT SIZE AND OUTPUT VOLATILITY: NEW INTERNATIONAL EVIDENCE. Helsinki, VATT, Valtion taloudellinen tutkimuskeskus, Government Institute for Economic Research, 2004, (C, ISSN 0788-5016, No 339). ISBN-951-561-504-6.

Tiivistelmä: Tutkimuksena kohteena on julkisen sektorin koon ja kokonaistuotannon vaihteluiden (volatiilisuuden) välinen riippuvuus. Tätä riippuvuutta tarkastellaan kahdesta näkökulmasta: Ensinnäkin tutkimuksessa käytetään aiempaa laajempaa kansainvälistä tilastoaineistoa 91 maasta ajanjaksolta 1980–1999, eikä siis pelkästään OECD-maita koskevia tilastotietoja niin kuin aiemmin. Toiseksi tutkimuksessa hyödynnetään myös aikasarjoja käyttämällä paneeliestimointia. Tutkimuksen tuloksista seuraavat kaksi on syytä mainita: Ensinnäkin OECD-maiden aineistoilla saatu tulos, jonka mukaan julkisen sektorin koon ja kokonaistuotannon vaihteluiden välillä on negatiivinen yhteys, ei yleisty laajemmalla kansainvälisellä aineistolla. Toiseksi tämä riippuvuus näyttää osoittautuvan epälineaariseksi. Negatiivinen riippuvuus julkisen sektorin koon ja kokonaistuotannon vaihteluiden välillä on merkitsevästi negatiivinen vain maissa, joiden julkinen sektori on hyvin pieni tai hyvin suuri.

Asiasanat: Automaattiset vakauttajat, julkisen sektorin koko, kokonaistuotannon vaihtelu

Contents

1. Introduction

In terms of fiscal policy the following issues have been subject to debate and research. First, fiscal policy as an automatic stabilizer, i.e. to what extent the given structure of fiscal policy helps to stabilize business cycles and second, the effectiveness of discretionary fiscal policy, i.e. the question of how discretionary changes in fiscal policy instruments affect economic behaviour. These potentially separate issues of fiscal policy raise a fundamental question: Do we need discretionary fiscal policy or is it enough to have automatic stabilizers? There are some theoretical controversies associated with the effectiveness of discretionary fiscal policy. According to a Keynesian view discretionary changes in fiscal policy are effective in terms of aggregate demand effects, while according to the Ricardian equivalence theorem e.g. expansionary fiscal policy is ineffective in terms of aggregate demand, which would imply that in this case there is no need for automatic stabilizers. Recently, it has been argued in the New Keynesian economics *framework under* imperfect product markets that fluctuations in welfare are magnified by the presence of taxes which lies at odds with the old Keynesian view (see Kleven and Kreiner (2003)).

Perotti (1999) has used data from a panel of 19 OECD countries over the period 1965-1994 to provide evidence which supports the notion that initial *financial* conditions *of the public sector* – like the initial level of debt - are an important determinant of fiscal shocks. More precisely, Perotti found evidence according to which expenditure shocks have Keynesian effects at low levels of debt and non-Keynesian effects in the opposite circumstances, while the evidence on a similar switch in the effects of tax shocks is less strong. This is clearly against the Ricardian equivalence theorem. But it is quite difficult to empirical separate between automatic stabilizers and discretionary fiscal policy (see e.g. Alesina and Perotti (1995) and Blanchard (1993) about empirical research on discretionary fiscal policy). Therefore, it is useful to argue in favour of trying to study the potential role of public sector size in terms of output volatility. The resulting estimates represent a sort of combination of automatic stabilizers and discretionary fiscal policy.

In the macroeconomic literature the relationship between government size and output volatility has been analysed both theoretically and empirically. In the old Keynesian economics the attention was focused on automatic fiscal stabilizers associated with income taxes, but these models are not based on optimising behaviour. Christiano (1984) has provided a survey and further research of automatic stabilizers in the partial equilibrium context of an optimising consumer choice model. He shows among others that the more the economic shocks are perceived as being idiosyncratic, the more the income tax will serve as an automatic stabilizer for insurance reasons (see also Barsky and Mankiw and Zeldes (1986) as well as Cohen and Follette (2000) for a further theoretical analysis along similar lines). There are some attempts to provide a theoretical analysis of automatic stabilizers in stochastic dynamic general equilibrium models. Gali (1994) has studied the effects of government size on output variability in the context of a *real business cycle* model in which government size is parametrized by the income tax rate and the share of government purchases in output. In his theoretical model income taxes are destabilizing, *while for most specifications government* purchases are stabilizing.

Empirically, the issue about the effectiveness of automatic stabilizers can be approached in various ways. A straightforward way to proceed is to run simulations with macroeconomic models. There are problems with this approach like: i) there is a potential specification uncertainty and ii) models exist only for a limited number of countries. Since the effectiveness of automatic stabilizers might be related to the relative size of government sector one may develop a simpler test procedure by regressing output volatility by the size of government the idea being that bigger governments – probably with higher degree of tax progression – have more effective automatic stabilizers and thereby smoothen business cycles to a higher extent.

In terms of empirics there is currently quite a lot of evidence about the negative relationship between government size and output volatility. Gali (1994) has studied this issue by using data from 22 OECD countries over the period 1960–1990. According to his simple cross-country regressions both taxes and government purchases seem to be working as automatic stabilizers, partly in contrast to his real business cycle model. The same finding have shown to hold by Cohen and Follette (2000) by using time-series data from the U.S. Macroeconomic models usually provide evidence of automatic stabilizers, but they largely assume the answers by ruling out the so-called Ricardian equivalence in their specification of the consumption function (see the discussion e.g. in Blanchard (2000), who also argues from a normative point of view that with respect to aggregate demand shocks, automatic stabilizers stabilize and that is good but that with respect to aggregate supply shocks automatic stabilizers also stabilize, but this is not good; they do not allow for the adjustment of output that would be desirable in this case).

A problem with the approach used e.g. by Gali (1994) is that the correlation between government size and output volatility may be subject to a reverse causality leading to a bias in simple OLS regressions. It has been suggested from a political economy point of view that more volatile countries are expected to have bigger governments for stabilizing output. Rodrik (1998) has argued and presented empirical evidence in favour of the view that the more open the economies are the bigger is the size of their government, ceteris paribus. His theoretical explanation emphasizes social insurance against external risks. See also Alesina and Wacziag (1998) for a slightly different theoretical explanation about the observed positive relationship between trade openness and government size. Persson and Tabellini (2001) have argued that in presidential regimes the size of government is smaller and less responsive to income shocks than in parliamentary regimes. They have provided empirical evidence in favour of this hypothesis.

Fatás and Mihov (2001) and Anres, Domenech and Fatas (2004) have taken these omitted variables bias possibilities of OLS regressions into account by using a data set for 20 OECD countries over the somewhat longer period 1960–1997 and using instruments for government size. According to their IV estimation results government size has a negative effect on output volatility, and in fact a larger than in the case of OLS regressions. There is also evidence according to which government size and automatic stabilizers are positively correlated across countries (see e.g. Noord (2000)).

There are two potential problems in the current empirical literature associated with the relationship between government size and output volatility. First, studies have used only either time-series data from U.S. or cross-country regressions from the OECD-countries data set. Second, in the cross-country analyses the focus has been on the cross-country regressions, where the time series aspect has been ignored. In many countries, however, the relative size of government has changed dramatically from the 1960s to the 1990s. Under these kinds of circumstances the average values may not be representative, in particular, if the relationship between output volatility, government size and automatic stabilizers is not linear.

In this paper we use a wider international data set from 91 countries over the period 1980-1999 including OECD countries as well to re-examine the relationship between government size and output volatility in order to see whether the results obtained earlier with smaller data sets are robust. Moreover, and importantly, we also use unbalanced panel data estimations to check whether the results will change when we allow not only for cross-country aspect but also the time series aspect of data.

We proceed as follows: In section 2 we present the specifications to be estimated, characterize the data set and provide definitions for the variables to be used in empirical estimations. Section 3 presents the cross-country and panel data estimation results, while section 4 concludes.

2. The data and estimation methods

As we mentioned earlier we carry out both cross-country and panel data estimations. The data we use are collected from the World Bank's World Development Indicators CD-ROM. The time series cover the period 1960–1999. The number of countries is 109, although the data for several of those is somewhat deficient. Therefore, in the case of cross-section estimations the maximum number of countries included into the regressions was restricted to 91 and the values of the dependent and explanatory variables in this case are sample averages for 1980–1999. Under the pooled times-series cross-section data the maximum number of data points is 2068, but this panel data set is not balanced. Next we characterize the alternative dependent and potential explanatory variables, which we use in empirical estimations.

The dependent variable, which we use in the cross-section data, is the standard deviation of output (GDP) growth rate for the sample period and it is denoted by *SD(y)*. In the pooled cross-section time-series data, there is no exact counterpart for this variable. Therefore, three alternative proxies are used in what follows. The first one is simply the squared output growth term. The second alternative is the squared difference between actual output growth (Δy) and 10 year lagged average of output growth Δy^* rates. The third alternative applies to the (squared) Hodrick-Prescott residual = $(y - y^{HP})/y^{HP}$. These three measures are denoted, respectively, as $(\Delta y)^2$, $(\Delta y\text{-}\Delta y^*)^2$ and ⌂y^2.[1]

The potential explanatory variables are the following: First, the basic variable is the government size, measured by three alternative ways: (i) the so-called gross tax rate, i.e. all taxes and transfers from the private sector to the public sector/GDP, denoted by TAX, (ii) public consumption/GDP, denoted by *public cons*. And (iii) total public sector expenditure/GDP, denoted by *public exp*. The potential problems with the basic regression between output volatility and government size are *both* an omitted variables bias and an endogeneity issue. In other words, the results of this simple regression could only represent an indirect link between output volatility and government size. We thus add several variables to our baseline regression to control for these possibilities.

In addition to government size variable, there are other potential candidates for explanatory variables to account for output volatility like the living standard measured by GDP per capita, denoted by GDP*pc*, because poorer economies might have more volatile business cycles (see e.g. Acemoglu and Zilibotti (1997)) and the average output growth, denoted by *growth*. Moreover, as has

[1] With the Hodrick-Prescott filter we have the well-known weighting parameter choice problem (see e.g. Baxter and King 1999). Here we used the value of 100 but we also experimented with smaller parameter values without any noticeable difference in results.

been argued along different lines from a political economy point of view (see e.g. Rodrik (1998), Alesina and Wacziag (1998) and Persson and Tabellini (2001)) the size of government might be endogenous to economic conditions. If governments like to stabilize business cycles, inherently more volatile economies might choose larger governments. To the extent that volatility depends on the openness, there is a positive relationship openness and volatility. In what follows the openness of economies are measured by the export/GDP share, denoted by *X*.

Finally, sectoral specialization – captured by differences in sectoral shares across countries and over time – might affect output volatility (see e.g. Krugman (1991)). We have used three different measures to try to capture this aspect: i) the GDP share of agriculture, denoted by *AGRI*, ii) the GDP share of investment denoted *INV* and iii) the GDP share of military expenditures, denoted by *MIL*. We also use two other additional controls: i) the average life expectancy, denoted by *LIFE* and ii) the total population size of the country, denoted by *POP*.

After having characterized the data and the variables to be used, we briefly describe the estimation procedures in different cases. First, the cross-section regressions are estimated both by using OLS and the Instrumental Variable method (IV). The latter is used take account for possible endogeneity of the government size in terms of output volatility, i.e. economies that display higher volatility might choose larger governments to stabilize their business cycles. We also provide some sensitive analysis by using various robust estimators to explore whether the estimation results are sensitive to outlier observations. Second, in the case of pooled cross-section time-series panel data, both the (unweighted) OLS and GLS estimators are used. In the case of GLS, the data are weighted, conventionally, by the inverses of residual variances. In the panel data estimations the specifications include country dummies to take into account the fixed effects. In the case of panel data we allow for potential non-linearity of the relationship between government size and volatility. Preliminary Hausmann-tests indicated that the fixed effects specification is superior to the random effects specification, so that in what follows we stick to this model (for comparisons and elaborations of these different type of panel data specifications, see e.g Baltagi (1995) and *Arellano (2003)*).[2]

---

[2] The test results about the fixed and random effect specifications of the panel data model are available from the authors upon request.

3. Cross-Country and Panel Data Estimation Results

In this section we present estimation results concerning the relationship between output volatility and government size and proceed as follows: First we report three sets of estimation results by focusing the cross-country regressions and second, we allow for time series aspect of the data in the panel estimation in order to check the robustness of results and potential non-linearity of the relationship between volatility and government size.

3.1 Cross-country estimates

Before we turn to estimation results, a short look at the data probably merits note. The cross-section data for output volatility SDGY and the alternative measures for public sector size: *TAX*, EXPEN and GCONS, are illustrated in Figure 1. As one case, there sees to be no clear pattern between output volatility and government size in this bivariate setting in this wider international data set. Whether this is true when we make the relationship conditional to other variables can be seen below when we look at the regression results.

Table 1 reports the OLS estimates about the relationship between output volatility, measured by the standard deviation of the output growth rate and government size measured in three alternative ways and it also include the GDP per capita and the growth rate of GDP as additional explanatory variables. We have estimated the model over different set of countries depending on the level of GDP.

The estimation results can be characterized as follows. First, there does not seem to be a statistically significant relationship between output volatility and government size for the whole set of countries. Moreover, the explanatory power of the specification is very low. Eliminating countries with a low level of GDP will change the findings by giving the significant negative relationship between output volatility and government size, measured by the gross tax rate. Second, the GDP per capita seems to relate negatively to output volatility suggesting that poorer countries are more volatile, ceteris paribus, while the GDP growth rate is always statistically insignificant. Finally, if government size is measured by using public consumption/GDP ratio or public expenditure/GDP ratio, the results are mixed; for the whole data there seems to be a positive relationship between output volatility and government size while for the high-income (OECD) countries the relationship is negative, but very weak and unprecise.

Figure 1. The relationship between output volatility and government size

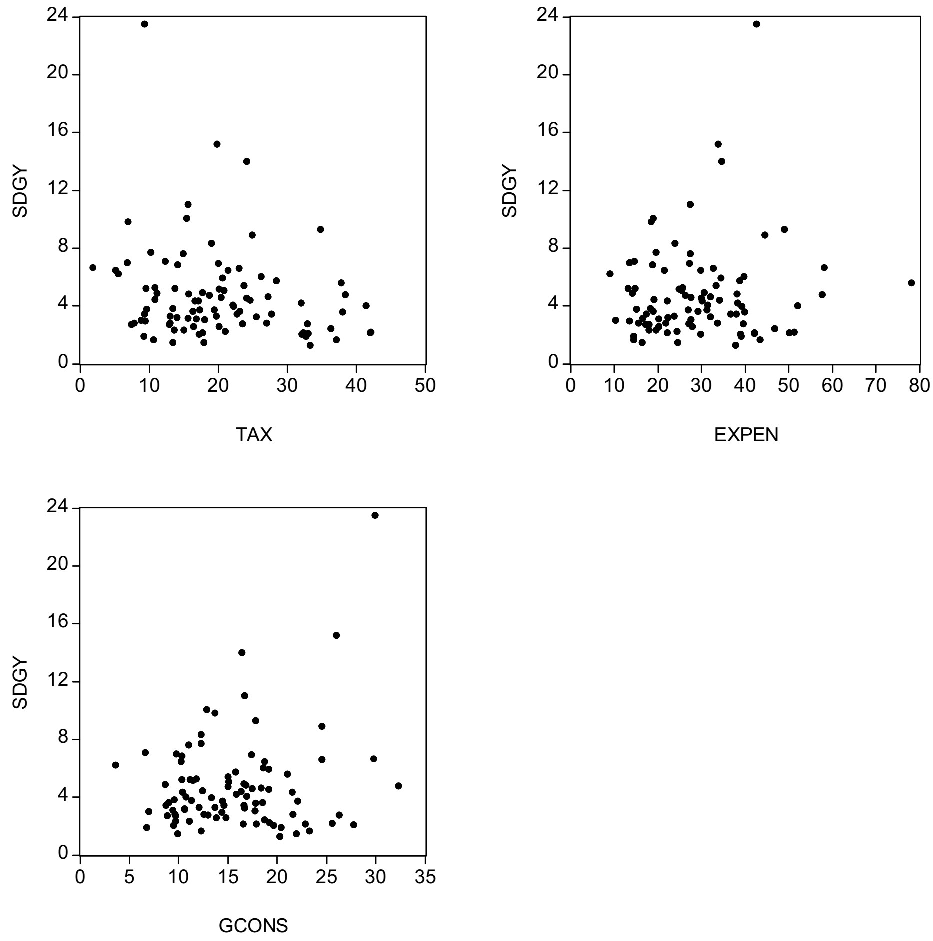


Table 2 provides estimates using the same data set, but incorporating some additional explanatory variables as potential controls like the share of export to GDP, and sectoral specialization measures: i) the GDP share of agriculture, ii) the GDP share of investment and iii) the GDP share of military expenditures. It also includes two other additional controls: i) the average life expectancy and ii) the total population size of the country. The estimation results – presented in Table 2 – can be characterized as follows:

First, allowing for additional controls will increase the explanatory power of output volatility equation. In particular, the GDP shares of military expenditures and investment as well as the total population of country seem to have statistically significant effect both in the whole and smaller data sets. The variables INV and MIL affect positively, while the variable POP negatively the output volatility. Second, while the share of exports to GDP is not statistically significant, it is negative. Finally, the government size variable – for three alternative ways to measure – is now always negative and its t-value becomes higher, when the whole dataset is restricted to OECD sample. But in most cases it is not statistically significant.

Table 1. Estimates of a simple SD(y) equation

	Constant	Govsize	GDPpc	Growth	R2/SEE	Gov size	GDPpc/ n
1	5.373	-.042			.023	TAX	y>0
	(9.77)	(1.78)			2.580		91
2	5.649	-.073			.084	TAX	y>5000
	(6.33)	(2.76)			2.344		41
3	5.857	-.093			.244	TAX	$y>10^4$
	(4.77)	(2.51)			1.630		27
4	5.333	.024	-.017	-.041	.148	TAX	y>0
	(7.26)	(0.77)	(3.91)	(0.31)	2.442		91
5	8.340	-.080	-.017	.000	.361	TAX	$y>10^4$
	(3.32)	(2.18)	(2.13)	(0.00)	1.559		27
6	4.000	.134	-.020	-.053	.210	Public cons.	y>0
	(4.56)	(2.19)	(4.45)	(0.44)	2.352		91
7	7.305	-.050	-.020	.112	.219	Public cons.	$y>10^4$
	(2.46)	(0.67)	(2.16)	(0.58)	1.724		27
8	4.660	.042	-.018	-.030	.182	Public exp.	y>0
	(6.28)	(2.05)	.(4.95)	(0.23)	2.41		91
9	8.151	-.037	-.023	-.023	.246	Public exp.	$y>10^4$
	(2.25)	(0.81)	(2.13)	(0.49)	1.691		26

The dependent variable is the standard deviation of the output growth rate. Heteroskedasticity adjusted White's t ratios are inside parentheses. TAX denotes the gross tax rate, public cons. public consumption/GDP. Public/exp public expenditure/GDP, GDPpc Per Capita Gross Domestic in US dollars, and Growth the growth rate of Gross Domestic Product. The last column indicates how the sample is defined. Thus, y>0, n=91 means that all 91 observations are included. The y>104 threshold roughly corresponds to difference between the OECD and the rest of the world countries.

All the estimations presented thus far have been OLS estimates. But it has been argued that there is a potential endogeneity problem between output volatility and government size, because government size might for political economy reasons be affected by the degree of volatility of economies. In Table 3 we present IV estimation results for two data sets, for the whole one and the OECD sample using the specification of equation (7) of Table 2.

Table 2. Estimates of an extended SD(y) equation

	1	2	3	4	5	6	7	8	10
Const.	19.303	13.169	18.221	13.600	18.516	12.309	15.603	29.068	13.393
	(4.29)	(2.20)	(4.95)	(2.07)	(4.82)	(1.72)	(6.28)	(4.41)	(1.92)
Govsize	-.035	-.117	-.007	-.034	-.013	-.036	-.005	-.030	-.038
	(0.72)	(2.27)	(0.33)	(1.17)	(0.65)	(1.41)	(0.30)	(1.41)	(1.69)
GDPpc	-.003	-.008	-.004	-.004	-.005	-.005			
	(0.56)	(0.91)	(0.88)	(0.56)	(0.96)	(0.67)			
Growth	-.163	-.070	-.167	-.122	-.196	-.187			
	(1.05)	(0.34)	(1.01)	(0.57)	(1.08)	(0.92)			
X	-.006	-.010	-.006	-.003	-.005	-.001			
	(0.78)	(1.12)	(0.71)	(0.28)	(0.67)	(0.11)			
POP	-.428	-.502	-.396	-.412	-.422	-.425	-.407	-.572	-.363
	(2.35)	(4.05)	(2.49)	(2.69)	(2.48)	(2.89)	(3.40)	(4.72)	(1.09)
INV	.106	-.032	.107	.072	.113	.062	.080	.084	.037
	(2.32)	(0.38)	(2.22)	(0.80)	(2.20)	(0.67)	(2.27)	(1.43)	(1.09)
LIFE	-.137	.015	-.132	-.051	-.128	-.024	-.107	-.241	-.062
	(2.77)	(0.12)	(2.82)	(0.41)	(2.74)	(0.20)	(4.56)	(3.01)	(0.65)
MIL	.207	.187	.180	.118	.202	.194	.181	.100	.111
	(2.46)	(6.07)	(2.38)	(2.23)	(2.61)	(5.79)	(2.51)	(2.89)	(2.95)
AGRI	-.023	-.047	-.022	.003	-.022	.011			
	(1.72)	(1.17)	(1.69)	(0.07)	(1.62)	(0.29)			
R2/SEE	.437	.769	.435	.714	.441	.714	.391	.692	.678
	1.814	.761	1.819	.847	1.819	.847	1.845	1.324	.804
Gov size	Public cons.	Public cons.	TAX	TAX	Public exp.	Public exp.	TAX	TAX	TAX
GDPpc	$y>0$	$y>10^4$	$y>0$	$y>10^4$	$y>0$	$y>10^4$	$y>0$	$y>5000$	$y>10^4$
N	89	26	89	26	88	26	89	40	26

Notation is the same as in Table 1. Now, only X denotes exports/GDP, POP log(total population), INV gross capital formation/GDP, LIFE means life expectancy, MIL military expenditure/GDP and AGRI the employment share of agriculture. The models appear to be “strictly” linear: thus e.g. the RESET F test for equation 7 in Table 2 turns out to be 0.032 with marginal probability 0.968.

The results can be characterized as follows: First, like in the earlier estimations, eliminating countries with a low level of GDP will increase the explanatory power of the output volatility specification. Second, IV estimations both with the whole and narrower data sets provide slightly higher coefficients (and t-ratios) of the government size variable, measured by the gross tax rate, than OLS estimations. But still the effect of the government size variable remains rather marginal.

Table 3. IV estimates of equation (7) in Table 2

	7	7-1	7-2
Const.	15.603	15.907	13.604
	(6.28)	(6.17)	(2.02)
TAX	-.005	-.018	-.041
	(0.30)	(0.74)	(2.17)
POP	-.407	-.432	-.364
	(3.40)	(3.33)	(4.30)
INV	.080	.083	.034
	(2.27)	(2.27)	(1.08)
LIFE	-.107	-.102	-.062
	(4.56)	(4.32)	(0.67)
MIL	.181	.175	.107
	(2.51)	(2.45)	(2.97)
R2/SEE	.391	.392	.678
	1.845	1.849	0.805
Estimator	OLS	IV	IV
GDPpc	y>0	y>0	$y>10^4$
n	89	88	26

The list of instruments includes public consumption, public expenditure and output growth.

To conclude, according to our cross-country estimates the relationship between output volatility and government size is not uniform, but seems to depend on the data set. There is evidence – though not very strong – that this relationship is negative for the OECD countries, but not for the wider international data set of 91 countries, which we have also used. This might suggest that the relationship between volatility and government size may not be linear, but depend for instance on the relative size of government.[3]

Results may also be sensitive to some outlier observations. To examine this possibility we used various robust estimators, most notably the Least Median of Squares (LMS) regression. Basically, the results coincided with those with OLS and IV estimator. Thus, e.g. with equation (1) in Table 1, the coefficient of the Govsize variable, measured by the gross tax rate, TAX, turned out be -.031 with the "t-ratio" 1.67. Accordingly, with equation (4) in the same Table, the coefficient turned out to be -.002 (0.14). Finally, with equation 1 in Table 2, the LMS regression estimate turned out to be .005 (0.23). These findings clearly suggest that outlier observations are not the reason for the poor performance of the Govsize variable in the output volatility regression. Rather, the opposite seems to be true so that if outliers are "properly" taken into account, the predictive power of the TAX variable diminishes even further.

[3] For a theoretical analysis of the potential non-linear relationship between government size and economic performance, see e.g. Barro (1990), who extends one strand of endogenous-growth model to include tax-financed government services that affect production or utility.

This conclusion lies in confirmity with closer scrutiny of some individual extreme observations. So, if we take equation 1 in Table 1 and look at the coefficient of the Govsize variable (measured by the Gross tax rate) we obtain the following parameter estimates for different subset of the data (the percentage number for the Govsize variable indicates which part of the data are included), presented in Table 4.

Table 4. Sensitivity analysis with the basic equation

Data	Coefficient	t-ratio	n
<10 %	-.581	3.38	13
<20 %	-.014	0.13	50
<30 %	+.020	0.42	75
<40 %	-.033	1.17	88
>10 %	-.045	1.62	78
>20 %	-.108	2.50	41
>30 %	+.050	0.51	16
>40 %	-2.713	9.30	3

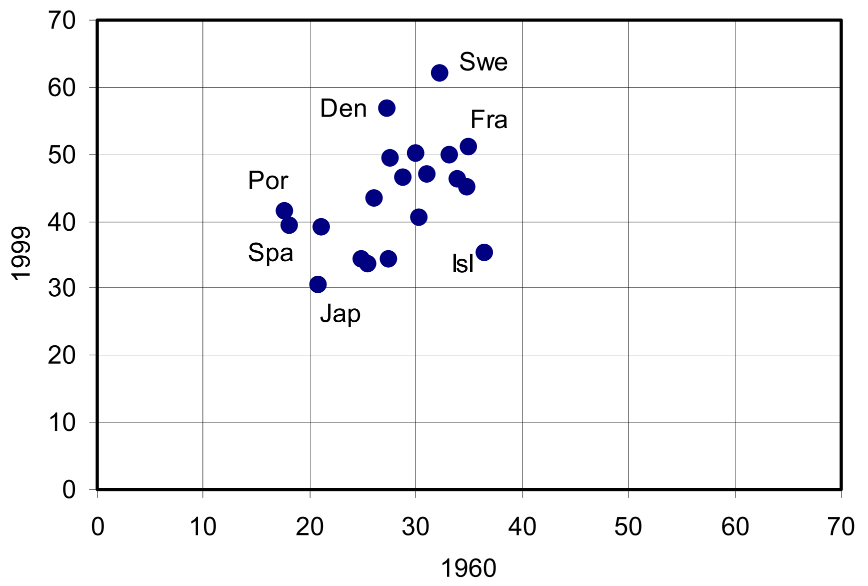
The data column refers to data classified on the basis of government size, measured by the gross tax rate, and while column n denotes the number of countries in various classifications.

Quite clearly, the parameter estimates with seemingly high t-values represent the both extremes of the data where the number of data points is very small. The strong negative relationship does not seem to represent the main part of the data. To get more affirmative results it might be useful not only look at the sample averages of the data – as we have done above – but also utilise the time series aspects of the data. To this kind of analysis we do indeed turn now.

3.2 Panel data estimates

In many countries the relative size of government has changed dramatically from the 1960s to the 1990s so that the average values may not be representative, in particular, if the relationship between output volatility, government size and automatic stabilizers is not linear. Figure 2 describes the development of the gross tax rate in some OECD countries from 1960s to 1999. One can see that with the exception of Iceland (*Isl*) the gross tax rates have increased quite dramatically.

Figure 2. Comparison of Gross Tax rates for 1960 and 1999



In Table 5 we present panel data estimates by using the fixed effect specifications. Preliminary Hausmann-tests indicated that the fixed effects specification is superior to the random effects specification, so that in what follows we stick to this model.[4]

The results can be briefly characterized as follows: For the whole set of countries including the time series aspect of the data the coefficient of the government size variable – measured by the gross tax rate – is negative but only marginally significant. The t-ratios are low particularly with the OLS estimates while weighing (GLS) produces somewhat higher values. Given the number of observations ($n > 2000$) one might have expected more precise results. Moreover, one has to keep in mind that the negative result in this panel data set-up might just reflect the negative correlation between the growth of government and the decrease of output volatility in general. We are not able to control very well the determinants of global decrease of output volatility, and therefore it is possible that the government size variable accounts for the effects of these other determinants.

Moreover, there is some evidence about the non-linear relationship between output volatility and government size. This can be seen from two last specifications in Table 5. The threshold value of 30 % of the relative size of government seems to be either statistically significant or close to it depending on how to measure output volatility in the case of panel data. As for the control values, they seem to be less robust both in terms of coefficient signs and statistical significance. Only the population size value is robust in terms of

[4] Test results are available from the authors upon request.

alternative output volatility proxies and estimation methods. Also the export/GDP share variable behaves in a relative consistent way along the line of the hypothesis presented e.g. by Rodrik (1998).

Table 5. Estimates with panel data

$$(\Delta y)^2 = -1.025*TAX + 6.898*\Delta y + .025*GDPpc + .482*X - .663*Pop + \Sigma D_j$$

(2.16) (23.81) (0.52) (2.18) (6.13)

R2 = .393, DW = 1.612, n = 2068, estimator OLS

$$(\Delta y)^2 = -.330*TAX + 5.823*\Delta y - .035*GDPpc + .275*X - .200*POP + \Sigma D_j$$

(2.72) (47.88) (0.49) (4.07) (5.12)

R2 = .393, DW = 1.612, n = 2068, estimator GLS

$$(\Delta y\text{-}\Delta y^*)^2 = -.803*TAX - 1.548*\Delta y + .004*GDPpc + .433*X - .459*POP + \Sigma D_j$$

(2.29) (6.90) (0.10) (2.57) (5.37)

R2 = .223, DW = 1.752, n = 1938, estimator OLS

$$(\Delta y\text{-}\Delta y^*)^2 = -.419*TAX - 1.700*\Delta y - .009*GDPpc + .125*X - .175*Pop + \Sigma D_j$$

(4.09) (17.06) (1.48) (2.27) (5.55)

R2 = .216, DW = 1.744, n = 1938, estimator OLS

$$⌂y^2 = -.828*TAX + .973*\Delta y + .076*GDPpc - .157*X - .431*POP + \Sigma D_j$$

(1.16) (0.67) (1.71) (0.43) (3.38)

R2 = .169, DW = 1.057, n = 2068, estimator OLS

$$⌂y^2 = -.191*TAX + .155*\Delta y - .007*GDPpc + .021*X - .120*Pop + \Sigma D_j$$

(2.24) (1.97) (1.35) (0.45) (4.58)

R2 = .157, DW = 1.037, n = 2.068, estimator GLS

$$⌂y^2 = -.710*TAX + 1.054*\Delta y - .075*GDPpc - .219*X - .257*Pop + .545*⌂y^2_{-1} + \Sigma D_j$$

(1.09) (0.74) (1.89) (0.60) (2.32) (3.10)

R2 = .256, DW = 1.376, n = 2.068, estimator OLS

$$(\Delta y\text{-}\Delta y^*)^2 = -.405*TAX - .457*\{TAX|TAX\geq 30\} - 1.587*\Delta y + .001*GDPpc + .424*X - .468*POP + \Sigma D_j$$

(1.01) (1.95) (7.05) (0.30) (2.52) (5.47)

R2 = .224, DW = 1.758, n = 1938, estimator OLS

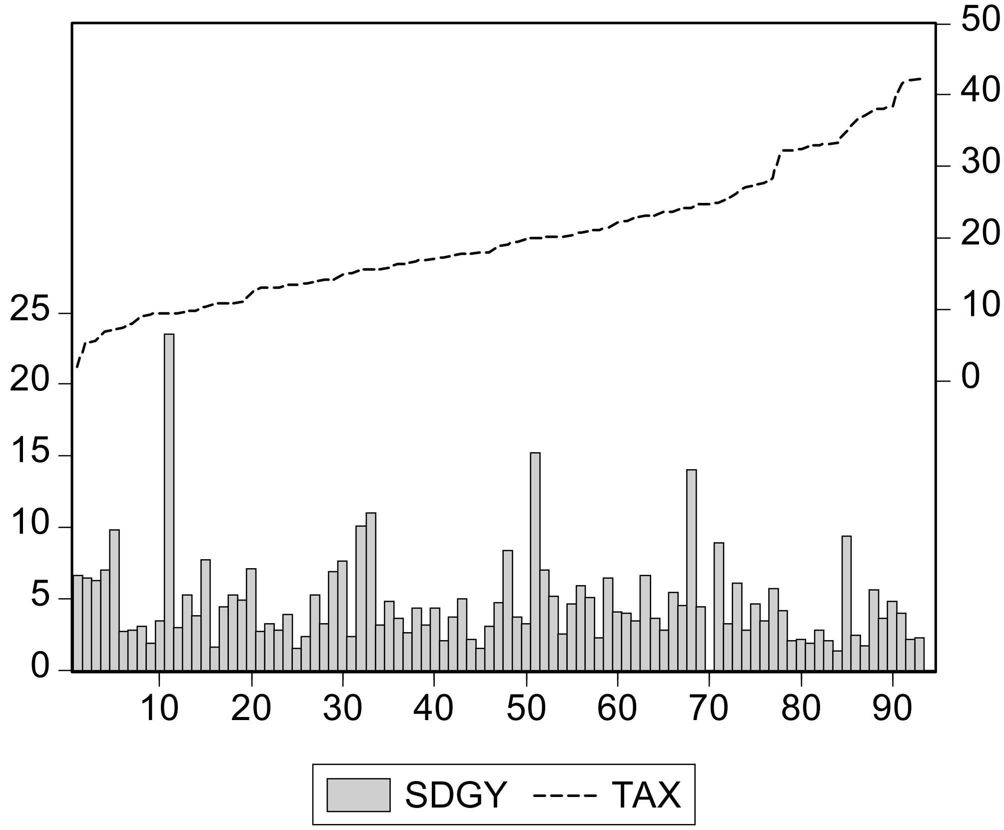
$$(\Delta y\text{-}\Delta y^*)^2 = -.199*TAX - .162*\{TAX|TAX\geq 30\} - 1.711*\Delta y + .001*GDPpc + .118*X - .188*POP + \Sigma D_j$$

(1.81) (2.75) (17.28) (1.34) (2.09) (6.01)

R2 = .224, DW = 1.758, n = 1938, estimator GLS

ΣD_j indicates country dummies, subscript -1 the lagged value.
The threshold value *TAX=30* per cent is obtained by a (relatively rough) search procedure.

Figure 3. Relationship between the Government size and output volatility



As we can see from Figure 3, that even though there is weak statistical evidence in favour of it, the negative relationship between government size – measured by the gross tax rate (TAX) – and output volatility – measured by the standard deviation of GDP growth (SDGY) – is not very strong, the say the least.

4. Conclusions

In this paper we have re-examined the relationship between government size and output volatility from two perspectives. First, we have used a wider international data set of 91 countries over the period 1980–1998 – including also OECD countries – than what has been done in the earlier literature to re-examine the relationship between government size and output volatility in order to see whether the results obtained earlier with smaller *OECD* data sets are robust. Second, we have also allowed for time series aspect by using panel data estimations to check whether the results will change when we allow not only for cross-country aspect but also the time series aspect of data.

According to our findings the negative relationship between output volatility and government size cannot be generalized to a wider international data set. The result is not robust and it is so weak that it does now allow for any conclusions on the role automatic stabiliser, for instance. Moreover, and secondly, the relationship between government size and output volatility may be non-linear. More precisely, the negative relationship between output volatility and government size – if it existed – seems to apply only to high public sector- and low public sector-countries. This feature of the results deserves, however, further theoretical analysis.[5]

[5] Andres, Domenech and Fatas (2004) have explored alternative theories that my explain why government size can have a negative effect on the volatility of output fluctuations by starting from the notion that in a standard real business cycle model there is clear connection between government size and volatility as was originally shown in Gali (1994). They compare the predictions of a standard model to those of models that incorporate nominal rigidities, costs of adjustment for capital and rule-of-thumb consumers. These extended models produce negative relationships between government size and volatility.

References

Acemoglu, D. and Zilibotti, F. (1997): "Was Prometheus unbound by chance? Risk, diversification and growth", *Journal of Political Economy*, 105(4), 709-751.

Adres, J., Domenech, R. and Fatas, A. (2004): Government Size and Macroeconomic Volatility. Unpublished mimeo, March.

Alesina, A. and Perotti, R. (1995): "Fiscal expansions and adjustments in OECD countries", *Economic Policy*, 21, 207-248.

Alesina, A. and Wacziag, R. (1998): "Openness, country size and government", *Journal of Public Economics*, 69, 305-321.

Arellano, M. (2003): Panel Data Econometrics, Oxford University Press.

Baltagi, B.H. (1995): Econometric Analysis of Panel Data, John Wiley & Sons, New York.

Barro, R.J. (1990): "Government spending in a simple model of endogenous growth", *Journal of Political Economy*, 98, S103-S124.

Barsky, R., Mankiw, N.G. and Zeldes, S. (1986): "Ricardian consumers with Keynesian Properties", *American Economic Review*, 76, 676-691.

Baxter, M. and R. King (1999) Measuring Business Cycles: Approximate Band-Pass Filter for Economic Time Series: *The Review of Economics and Statistics* 81(4), 575-593.

Blanchard, O. (1993): "Suggestions for a new set of fiscal indicators", in Verbon, H. and van Winden, F. (eds.) The New Political Economy of Government Debt, Elsevier Science Publishers.

Blanchard, O. (2000): "Commentary", *FRBNY Economic Policy Review*/April, 69-74.

Christiano, L.J. (1984): "A re-examination of the theory of automatic stabilizers", Carnegie-Rochester Conference Series on Public Policy, 20, 147-206.

Cohen, D. and Follette, G. (2000): "The automatic fiscal stabilizers: quietly doing their thing", FRBNY *Economic Policy Review*/April, 35-68.

Fátas, A. and Mihov, I. (2001): "Government size and automatic stabilizers: international and intranational evidence", *Journal of International Economics*, 55, 3-28.

Gali, J. (1994): "Government size and macroeconomic stability", *European Economic Review*, 38, 117-132.

Kleven, H.J. and Kreiner, C. T. (2003): “The role of taxes as automatic stabilizers in New Keynesian economics”, *Journal of Public Economics*, 87, 1123-1136.

Krugman, P. (1991): Geography and Trade, MIT Press, Cambridge.

Van der Noord, P. (2000): “The size and role of automatic stabilizers in the 1990s and beyond”, Economics department working paper No. 230.

Perotti, R. (1999): “Fiscal policy in good times and bad”, *Quarterly Journal of Economics*, 1399-1436.

Persson, T. and Tabellini, G. (2001): “Political institutions and policy outcomes: what are the stylised facts?”, mimeo, February.

Rodrik, D. (1998): “Why do more open economics have bigger governments?”, *Journal of Political Economy*, 106(5), 997-1032.

VATT-KESKUSTELUALOITTEITA / DISCUSSION PAPERS ISSN 0788-5016 - SARJASSA ILMESTYNEITÄ

280. Laine Veli: Evaluating Tax and Benefit Reforms in 1996 – 2001. Helsinki 2002.

281. Pekkala Sari – Tervo Hannu: Unemployment and Migration: Does Moving Help? Helsinki 2002.

282. Honkatukia Juha – Joutsenvirta Esa – Kemppi Heikki – Perrels Adriaan: EU:n laajuisen päästökaupan toteuttamisvaihtoehdot ja vaikutukset Suomen kannalta. Helsinki 2002.

283. Kotakorpi Kaisa: Access Pricing and Competition in Telecommunications. Helsinki 2002.

284. Hämäläinen Kari – Böckerman Petri: Regional Labour Market Dynamics, Housing and Migration. Helsinki 2002.

285. Sinko Pekka: Labour Taxation, Tax Progression and Job Matching – Comparing Alternative Models of Wage Setting. Helsinki 2002.

286. Tuomala Juha: Työttömyyden alueellisen rakenteen kehitys 1990-luvulla. Helsinki 2002.

287. Berghäll Elina: Virosta ja Ahvenanmaan itsehallintoalueelta Suomeen kohdistuvat verokilpailupaineet. Helsinki 2002.

288. Korkeamäki Ossi – Kyyrä Tomi: The Gender Wage Gap and Sex Segregation in Finland. Helsinki 2002.

289. Kilponen Juha – Santavirta Torsten: Taloudellinen kasvu, innovaatiot ja kilpailu – katsaus kirjallisuuteen ja politiikkasuosituksiin. Helsinki 2002.

290. Siivonen Erkki – Huikuri Satu (Edited): Workshop on Studies for Northern Dimension Kalastajatorppa 30 – 31 May, 2002. Helsinki 2002.

291. Pohjola Johanna – Kerkelä Leena – Mäkipää Raisa: Who Gains from Credited Forest Carbon Sinks: Finland and Other Annex I Countries in Comparison. Helsinki 2002.

292. Montén Seppo – Tuomala Juha: Alueellinen työttömyys ja pitkäaikaistyöttömyys 1990-luvulla. Helsinki 2003.

293. Lyytikäinen Teemu: Pienituloisuuden dynamiikka Suomessa. Helsinki 2003.

294. Aulin-Ahmavaara Pirkko – Jalava Jukka: Pääomapanos ja sen tuottavuus Suomessa vuosina 1975-2001. Helsinki 2003.

295. Vaittinen Risto: Maatalouskaupan vapauttaminen – kansainväliset vaikutukset ja merkitys EU:lle. Helsinki 2003.

296. Haataja Anita: Suomalaiset mikrosimulointimallit päätöksenteon valmistelussa ja tutkimuksessa. Helsinki 2003.

297. Kangasharju Aki – Korpinen Liisa – Parkkinen Pekka: Suomessa asuvat ulkomaalaiset: Esiselvitys. Helsinki 2003.

298. Hietala Harri – Lyytikäinen Teemu: Työn, pääoman ja kulutuksen verorasituksen mittaaminen. Helsinki 2003.

299. Räisänen Heikki: Rekrytointiongelmat ja työvoimapotentiaali lääkärien, lastentarhanopettajien, farmaseuttien ja proviisorien ammateissa. Helsinki 2003.

300. Kröger Outi: Pääoma- ja yritystulojen verotus – uusi suunta? Helsinki 2003.

301. Kari Seppo – Liljeblom Eva – Ylä-Liedenpohja Jouko: Snedvridande beskattning av utländska investeringar: Reell och finansiell aktivitet inducerad av skattearbitrage. Helsinki 2003.

302. Pekkala Sari: Is Little Brother Nothing but Trouble?: Educational Attainment, Returns to Schooling and Sibling Structure. Helsinki 2003.

303. Vaittinen Risto: Liberalisation of Agricultural Trade – Global Implications and what it Means for the EU. Helsinki 2003.

304. Kangasharju Aki – Venetoklis Takis: Do Wage-subsidies Increase Employment in Firms? Helsinki 2003.

305. Räisänen Heikki: How to Cope with Labour Market Policy Tools in Economic Downturn: Finnish Evidence. Helsinki 2003.

306. Ruotoistenmäki Riikka – Siivonen Erkki: Tiehankkeiden rahoitusvajeen ratkaisu? Helsinki 2003.

307. Hjerppe Reino: Social Capital and Economic Growth Revisited. Helsinki 2003.

308. Honkatukia Juha – Kangasharju Aki – Vaittinen Risto: Suuren aluepolitiikan ja hajasijoittamisen vaikutuksia Keski-Suomessa. Helsinki 2003.

309. Luukkonen Antti: Palkkadiskriminaatio Suomen teollisuussektorin toimihenkilöillä vuonna 2000. Helsinki 2003.

310. Pekkala Sari: What Draws People to Urban Growth Centers: Jobs vs. Pay? Helsinki 2003.

311. Rantala Juha – Romppanen Antti: Ikääntyvät työmarkkinoilla. Helsinki 2003.

312. Hämäläinen Kari: Education and Unemployment: State Dependence in Unemployment Among Young People in the 1990s'. Helsinki 2003.

313. Berghäll Elina – Kiander Jaakko: The Finnish Model of STI Policy: Experiences and Guidelines. KNOGG Thematic Network WP4 Country Report – Finland. Helsinki 2003.

314. Kilponen Juha – Sinko Pekka: Does Centralised Wage Setting Lead into Higher Taxation? Helsinki 2003.

315. Järviö Maija-Liisa: Julkisesti tuettu hammashuolto vuosina 1994-2000. Helsinki 2003.

316. Ollikainen Virve: The Determinants of Unemployment Duration by Gender in Finland. Helsinki 2003.

317. Kari Seppo – Lyytikäinen Teemu: Efektiivinen veroaste eri sijoitusmuodoissa. Helsinki 2003.

318. Peltola Mikko – Soininen Jarno: Lasku- ja kasvualojen työmarkkinat 1990-luvulla. Helsinki 2003.

319. Sinko Pekka: Subsidizing vs. Experience Rating of Unemployment Insurance in Unionized Labor Markets. Helsinki 2003.

320. Korkeamäki Ossi – Kyyrä Tomi: Explaining Gender Wage Differentials: Findings from a Random Effects Model. Helsinki 2003.

321. Luukkonen Antti: Sukupuolten palkkaero yksityisissä palveluammateissa. Helsinki 2003.

322. Hjerppe Reino: Uncovering the Dimensions of the Common Good – Problems of Measurement of the Size of the Public Sector. Helsinki 2003.

323. Perrels Adriaan – Ahlqvist Kirsti – Heiskanen Eva – Lahti Pekka: Kestävän kulutuksen potentiaalia etsimässä – esitutkimus –. Helsinki 2004.

324. Tukiainen Janne: Access to Computer, Internet and Mobile Phone at Home in Finland, Ireland, Netherlands and Sweden. Helsinki 2004.

325. Räty Tarmo – Luoma Kalevi – Aronen Pasi: Palvelusetelit kuntien sosiaalipalveluissa. Helsinki 2004.

326. Parkkinen Pekka: Hoiva- ja hoitopalvelumenot tulevaisuudessa. Helsinki 2004.

327. Korkeamäki Ossi – Kyyrä Tomi – Luukkonen Antti: Miesten ja naisten palkkaerot yksityisellä sektorilla. Helsinki 2004.

328. Mäkelä Pekka: Kariutuneet kustannukset ja omaisuudensuoja päästökaupassa. Helsinki 2004.

329. Honkatukia Juha: Päästöoikeuksien jakotapojen kustannusvaikutukset. Helsinki 2004.

330. Moisio Antti: Julkisen rahan liikkeet Uudenmaan ja muun Suomen välillä. Helsinki 2004.

331. Laine Veli: Eläkejärjestelmän kannustinvaikutukset. Helsinki 2004.

332. Kari Seppo – Kröger Outi – Rauhanen Timo – Ulvinen Hanna: Beskattning av småföretag i Finland. Helsinki 2004.

333. Leppälehto Jenni: Naapurialueiden vaikutus veroprosentin määräytymisessä paikallistasolla. Helsinki 2004.

334. Pekkala Sari: Maahanmuuton taloudelliset vaikutukset. Helsinki 2004.

335. Perrels Adriaan: The Basic Service Quality Level of Transport Infrastructure in Peripheral Areas. Helsinki 2004.

336. Kiander Jaakko: Growth and Employment in Nordic Welfare States in the 1990s: a Tale of Crisis and Revival. Helsinki 2004.

337. Kari Seppo – Ylä-Liedenpohja Jouko: Effects of Equalization Tax on Multinational Investments and Transfer Pricing. Helsinki 2004.

338. Hietala Harri – Kari Seppo – Rauhanen Timo – Ulvinen Hanna: Laskelmia yritys- ja pääomaverouudistuksesta. Helsinki 2004.