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SPEND AND TAX OR TAX AND SPEND? PANEL DATA EVIDENCE FROM FINNISH MUNICIPALITIES DURING 1985 - 1999

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Abstract: This paper studies the dynamic interrelationship between total expenditures, own source revenues, grants received from state and loans in Finnish municipalities. Two separate panel data sets that cover the years 1985-1992 for matching grants period and 1993-1999 for formula based grant period are used for all municipalities. The analysis is done using the VAR method for panel data. I find, first, that there are important dynamic interrelationships between the variables in question. Second, I find that during the matching grants period, expenditures Granger-cause revenues uni-directionally, whereas during the formula based grants system the revenues and expenditures Granger-cause each other. The grants Granger-cause expenditures during both periods. In the end of the 1990s municipalities have been able to pay off their loans primarily by cutting expenditures and not by increasing own source revenues.

Key words: Local government expenditure, revenue, grants, Granger-causality

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Tiivistelmä: Tutkimuksessa tarkastellaan Manner-Suomen kuntien kokonaismenojen, omien tulojen, valtionosuuksien ja lainanoton välisiä syy- ja seuraussuhteita kahden erilaisen valtionosuusjärjestelmän aikana. Vuosina 1985-1992 käytössä oli kustannussidonnainen ja vuosina 1993-1999 laskennallinen valtionosuusjärjestelmä. Kummallekin periodille tehdään erikseen paneeliaineiston vektoriautoregressio-analyysiin perustuvat Granger-kausaalisuustestit, jonka jälkeen tuloksia verrataan keskenään. Tutkimuksen päätulosten mukaan kustannussidonnaisen järjestelmän aikana kuntien menot kasvoivat ensin, jonka jälkeen lisättiin verotuloja ja maksuja. Sen sijaan nykyisin käytössä olevan laskennallisen valtionosuusjärjestelmän aikana menot ja omat tulot määräytyvät yhtä aikaa. Kummankin periodin aikana valtionosuudet lisäävät kuntien menoja. Tutkimustulosten mukaan kunnat ovat 1990-luvun lopulla supistaneet lainojaan ennen kaikkea menoleikkausten, eivät niinkään kasvaneiden verotulojen ansiosta.

Asiasanat: Kuntien menot, rahoitus ja valtionosuudet. Granger-kausaalisuus.

Contents

1. Introduction

Several interesting questions have been raised by political scientists and economists about the inter-temporal links between government taxing and spending decisions. An understanding of the possible causal relations of government revenues and expenditures is of obvious importance: if it is possible to intervene to control one of the variables (spending or taxation) directly, would that provide control over the other variable? Four main hypotheses have been advanced in the literature:

"Tax and spend". The most well known advocate of this thought is Milton Friedman (1978), who argued that raising taxes will simply lead to more expenditures. According to Friedman, expenditures adjust up or down, to whatever level that can be supported by revenues. On the other hand Wagner (1976) and Buchanan and Wagner (1977) have argued that concentrating taxation on direct instead of indirect taxes would lead people to demand lower expenditures.

"Spend and tax". Barro (1979) said that increased taxes and borrowing result from increased government spending. Barro does not approve the idea of Buchanan and Wagner, that deficit spending itself would create the fiscal illusion that enables politicians to irresponsibly spend public funds. In addition, Peacock and Wiseman (1979) argued that increased expenditures result from crises, and that increased expenditure levels tend to persist even after the crisis is over.

"Spending and taxation are decided simultaneously". The ideas of fiscal synchronisation of revenues and expenditures have their theoretical background in Lindahl's model of benefit taxation and the median voter rule (Black 1948). For example Meltzer and Richard (1981) explained the size of government by using a model in which revenues and expenditures change concurrently. Nor do they accept the theory of fiscal illusion in their model.

"Revenues and expenditures change independently of each other". A fourth alternative is that the revenues and expenditures do not have any causal interdependence with each other. This could be the case if, for instance, the budget process was seriously affected by divergent interests and agendas. Hoover and Sheffrin (1992) point out that in the US, the period since 1970s has been marked with attempts to create causal interdependence between spending and taxing decisions.

These hypotheses have direct implications concerning the time series properties of expenditures and revenues. Under the first hypothesis past levels of revenues help predict current expenditure levels. Under the second hypothesis past expenditures help predict current revenues. The issue is then whether revenues Granger-cause expenditures or expenditures Granger-cause revenues. Granger causality test is a normal F-test to define if the lags of independent variable X

and lags of dependent variable have explanatory power in explaining the dependent variable Y. If the lags of X do not explain Y, one can conclude that X does not Granger cause Y.

During the last two decades, there have been several attempts to determine the direction of causation between spending and taxation. Almost all of the existing empirical studies on the subject have considered the United States' case. Most of the studies have been done using aggregate federal or aggregate state-local expenditure and revenue data. The results are mixed so that it seems difficult to draw any clear conclusions about them.

The empirical evidence seems to support the "tax and spend" hypothesis in papers published by Manage and Marlow (1986), Ram (1988a), and Hoover and Sheffrin (1992). Manage and Marlow (1986) using annual federal data (1929-82) from the US found evidence for bi-directional causality but also for unidirectional causality from revenues to expenditures. Ram (1988a) using annual (1929-83) and quarterly (1947-83) US data for both federal and state-local government sectors found causality running from revenue to expenditure in federal data, but predominantly from expenditure to revenue in data for the state-local government. Hoover and Sheffrin (1992) using quarterly federal US data (1950-89) found that before the 1960s the taxes appear to cause spending, but after the late 1960s taxes and spending are causally independent.

The "spend and tax" hypothesis was supported by Anderson, Wallace and Warner (1986) and von Furstenberg, Green and Jeong (1986). Anderson, Wallace and Warner (1986) found using annual federal data over the time period 1946-83, that expenditures cause revenues. Von Furstenberg, Green and Jeong (1986) found using quarterly US data for 1954-82, that total expenditure lead taxes.

There are major problems, however, when trying to define the causal relations between expenditures and revenues with aggregate federal data as von Furstenberg, Green and Jeong (1986) and Holtz-Eakin, Newey and Rosen (1989) point out. Because central government is involved in stabilisation activities, it is possible that this could in certain cases bias the results severely towards accepting the spend-and-tax hypothesis. One then ought to try to adjust the data so that the business cycle effects of the data would be diminished. The remaining problem in that case is how to measure the timing and severity of the business cycles.

The second problem concerning aggregate time series data is that in some studies it has been assumed that the time-series data used are stationary.[1] According to

[1] The writers in different papers have tried to take possible nonstationarity into account in various ways: for instance Ram (1988a) adds a time trend to the estimation equations to secure stationarity, whereas Anderson, Wallace and Warner (1986) first regress each variable against time and constant. The time series are differenced until time is insignificant. In other papers the possible problem of nonstationarity is handled by differencing the data once, or in some papers the stationarity issue is not mentioned at all.

the recent advances in time-series analysis this is questionable and could lead to spurious results. Therefore, yet another set of studies have examined whether revenues and expenditures are co-integrated. For instance Bohn (1991) using US budget data from 1790 to 1988 found evidence that "tax changes signal substantial spending changes", whereas the "spend and tax" hypothesis did not get support from his analysis. Hondroyiannis and Papapetrou (1996) using data for central government in Greece for 1957-93 found that expenditures lead revenues.

Although using aggregate state-local data avoids the problem of stabilisation activities, this type of data faces yet another problem, which Holtz-Eakin, Newey and Rosen (1989) mention, namely the adding up of local governments. Bearing in mind that each local unit may differ with respect to the functions they perform, their budgetary processes and the political environments in which they operate, the adding up is questionable.

In sum, the empirical evidence concerning the question of inter-temporal relations between government taxing and spending decisions seems problematic. This is because the consideration of stationarity of the time series has varied much in different papers, and because the stabilisation activity of central government has been taken into account in only few studies. In addition, the aggregation of local government data is not without problems.

The method developed by Holtz-Eakin, Newey and Rosen (1988) enables one to use Vector Autoregression (VAR) techniques on panel data from individual local governments to study the inter-temporal links between revenues and expenditures. Hence, neither stabilisation issues nor aggregation problems impede interpretation of the results. In addition, the stationarity of the time series is not an issue in panel data context.

There are to my knowledge three studies, where unaggregated state-local data have been used to test the Granger-causality between taxing and spending decisions using the VAR-method developed by Holtz-Eakin, Newey and Rosen (1988). Using annual US data for 171 municipal governments over the period 1972-80, Holtz-Eakin, Newey and Rosen (1989) found unidirectional causality from revenues to expenditures. Dahlberg and Johansson (1998) using annual data for 265 Swedish municipalities over the time period 1974–87 found that expenditures cause revenues. Moisio and Kangasharju (1997) concluded that evidence from annual (1985-92) data for 460 Finnish municipalities supports a bi-directional causality between revenues and spending.

The results in these studies are easier to compare, because the method is exactly the same. Still, the results do vary a lot. The reason for this lies probably partly in the differences of the fiscal structure and partly in differences in historical factors, political correlations of the fiscal process, and characteristics of the budget-

ary process itself.[2] Especially important are differences in tax bases, for instance in USA the main tax source for local governments is property taxation, whereas in Finland it is income taxation. The effect of change in tax incomes may then differ considerably in these two cases, because property tax income is over time more stable source of income than income taxation. In addition, some countries may have more binding rules for local government deficits than others. Further, some countries may have matching grant system in place whereas in others the role of matching grants may be small or non-existent. In different time periods these things may differ even within a country. All this leads one to assume that the comparison between Finland and Sweden would be most appropriate. Still, my general conclusion is that in this context due to country specific factors, a full comparability between any two countries is difficult.

In this paper the analysis of Moisio and Kangasharju (1997) is deepened by using four equation VAR (expenditures, revenues, grants and loans) for 436 municipalities[3] to test the Granger-causality between the variables. In addition, two separate time periods, 1985-92 and 1993-99, are being compared. Using two time periods makes it possible to compare the causal links of revenues, expenditures, grants and loans of Finnish municipalities in two different fiscal settings. In the first data period, the municipalities' grants consisted mostly of earmarked categorical matching grants, whereas in the second data period the grants are mostly formula based specific grants with no earmarking.

The main findings of my study are that during 1985-92 there was a unidirectional causal link from expenditures to revenues, but during the period 1993-99 there was a bi-directional causal relation between revenues and expenditures. For the first period the results are then more in line with Barro's view than that of Friedman's view. For the latter period the evidence supports the simultaneous decision process. As for the grants, it is found that in both periods grants cause expenditures and revenues and also revenues and expenditures cause grants. Loans seem to cause expenditures and revenues and revenues and expenditures cause loans during 1985-92. During 1993-99, loans cause expenditures but expenditures and revenues do not cause loans.

The paper is organised as follows. In section 2 the econometric model and estimation procedure is described. Section 3 comments on the data used and section 4 contains the empirical estimates. Section 5 presents the summary and conclusion as well as discussion and ideas for future research.

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[2] This has been noted also by Ram (1988b) in a study where 22 countries were compared.

[3] In Moisio and Kangasharju (1997) three equation VAR was used (expenditures, revenues, grants). This is problematic, however, as the Finnish municipalities are able to finance deficits by borrowing.

2. Econometric model

In order to empirically investigate the effects described above, I estimate dynamic panel data regressions using the method developed by Holtz-Eakin, Newey and Rosen (1988). The method estimates vector autoregression equations using panel data, which is different from usual causality testing framework, where time series data is used. For N cross-sectional units observed over T periods, the method essentially involves regression of the form:

(1) $$y_{it} = \alpha_0 + \sum_{l=1}^{m} \alpha_l y_{it-l} + \sum_{l=1}^{m} \delta_l x_{it-l} + f_i + u_{it},$$

$$i = 1, \ldots, N \text{ and } t = m+1, \ldots, T,$$

where α, δ are parameters, m is a lag length, f_i is a possible individual effect and u_t is an error term. The individual effect summarises the influence of unobserved variables, which have a persistent effect on the dependent variable.[4] The omission of this individual effect results in inconsistent estimates if it is correlated to other right hand side variables. A common way to delete the individual effect by using time means is not appropriate here, as this would result in inconsistent estimates (Holtz-Eakin, Newey and Rosen, 1988; Nickell, 1981). To eliminate the individual effect, Holtz-Eakin, Newey and Rosen (1988) suggest instead using an instrumental variable estimator to the first differenced equation[5]:

(2) $$y_{it} - y_{it-1} = \sum_{l=1}^{m} \alpha_l (y_{it-l} - y_{it-l-1}) + \sum_{l=1}^{m} \delta_l (x_{it-l} - x_{it-l-1}) + (u_{it} - u_{it-1}),$$

$$i = 1, \ldots, N \text{ and } t = (m+2), \ldots, T.$$

To ensure the identification of the parameters in equation (2) there must be sufficient number of instrumental variables. The number of instrumental variables needed can be defined using the orthogonality conditions:

(3) $$E[y_{is}u_{it}] = E[x_{is}u_{it}] = [\, f_i \;\; u_{it}] = 0 \quad (s < t).$$

The orthogonality conditions in (3) can be used to identify the parameters of (2) since the disturbance term v_{it} (= $u_{it} - u_{it-1}$) will be uncorrelated with y_{it-s} and x_{it-s} for $s \geq 2$. The equation for each time period t has 2m right hand side variables. To identify the parameters, there must be at least this many instrumental vari-

[4] For example, a municipality's expenditures each period might be affected by its geographical location or its "political make-up" (Holtz-Eakin, Newey and Rosen 1989).

[5] The problem with using the first difference in this context is that ($u_{it} - u_{it-1}$) and ($y_{it-1} - y_{it-2}$) are correlated because y_{it-1} depends on u_{it-1}. The solution to this problem is to use instrumental variable method, in which the number of the instruments used changes over time (Eakin, Newey and Rosen, 1988 and 1989).

ables. The 2(t-2) variables [y_{it-2}, …, y_{i1}, x_{it-2}, …, x_{i1}] are available as instrumental variables to estimate the equation for the time period t. Thus, to have at least as many instrumental variables as right hand side variables, it must be so that $2(t-2) \geq 2m$, or $t \geq m+2$. This means that given our assumed lag structure, it is impossible to estimate the equations for time periods before $t = m+2$. According Holtz-Eakin, Newey and Rosen (1989), an efficient estimator can be formed in three steps:

1. Estimate parameters for each period t using 2SLS estimation. The number of instruments grows with t. This step gives us consistent estimates of all parameters in the model. The residuals from each estimation are saved.

2. Using residuals from step 1. and the matrix of instrumental variables, the consistent estimate of the covariance matrix is calculated.

3. Using the estimated covariance matrix and all the observations available, the GLS estimator is formed to estimate the entire parameter vector.

Holtz-Eakin, Newey and Rosen (1988) give explicit formulas. Most importantly, they show that in this model linear constraints concerning i) parameter stability over time, ii) lag length and iii) causality can be tested in a conventional way, i.e. by noting that the difference in the constrained and unconstrained sum of squared residuals has a χ^2 distribution.

As for the question concerning parameter stability, in equation (2) it is assumed that parameters are stable not only across individuals, but over time as well. Similarly, each individual effect is assumed time invariant. A more general model would allow all of the parameters to depend on time period. Allowing time varying parameters makes identification more difficult, though. According to Holtz-Eakin, Newey and Rosen (1989), it is still possible to use the same estimation procedure. The procedure defining the assumption of parameter stability is: a) choose a relatively large value of m to be sure to avoid truncating the lag structure inappropriately, b) estimate the model with and without parameter stability; and finally, c) compare the sums of squared residuals.

Similarly, the question of the correct lag length m can be tested by starting with relatively large m and then shortening the lag and testing by using the change in squared residuals. The testing continues with successively smaller lag lengths until one is rejected by data, or $m = 0$.

The causality testing in the case of time stable parameters (equation 2) is simply a test of joint hypothesis $\delta_1 = \delta_2 = \ldots = \delta_m = 0$. In the model with time varying parameters the same procedure can be applied.

When testing the hypotheses of parameter stability over time, lag length and causality of the variables, a repeated test procedure is used, where the models are

estimated in unrestricted and restricted form[6] and the residual sum of squares from both estimations (noted by Q and Q_R) are compared by using the formula from F-test:

(4) $$L = Q_R - Q.$$

Q and Q_R are both χ^2 distributed when N grows. L is also χ^2 distributed and its degrees of freedom are equal to the degrees of freedom of Q_R minus the degrees of freedom of Q. The degrees of freedom for Q are equal to the number of instrumental variables minus estimated parameters.

In this paper causality is examined in terms of 'Granger causality'. The Granger causality test is a common way to measure causality between variables. In this test a normal F-test is used to define causality if the lags of independent variable X and lags of dependent variable have explanatory power in explaining the dependent variable Y. If the lags of X do not explain present Y, one can conclude that X does not Granger cause Y. Before doing tests of causality, one must first determine the correct lag length.

In the present paper the VAR-model in practice consists of four equations, where the left hand side variable is in turn total expenditures, total own source revenues, total grants received from state and the amount of loans. The estimation and nested testing procedures in practice are described in fourth section.

[6] As Holtz-Eakin et al. (1988) point out, it is imperative to use the same covariance matrix when estimating the restricted and unrestricted models.

3. Data

The source of the data used is Statistics Finland. The data contains information on 436 municipalities during the period 1985-99[7]. The variables used in the estimations are total expenditures, total revenues, total grants and long term loans of the municipalities. Revenues include all taxes and user fees. The grants variable consists of matching and lump sum grants and grants for investments. Lagged grants are included as right hand side variables for two reasons: firstly, theoretical considerations and earlier econometric work suggest that grants affect municipalities' expenditures differently than own source revenues. Secondly, grants variable has been included because I wanted to test the so called "flypaper effect". Flypaper effect means that an increase of one unit of exogenous general grant money stimulates municipal spending more than one money unit increase in municipal own source revenue. The reasons presented for the flypaper effect have comprised voters' asymmetric information and/or local bureaucrats' tendency to maximise budget.[8] Much of the previous evidence of the flypaper effect has come from cross section analyses of municipalities. Holtz-Eakin, Newey and Rosen (1989) argue that in dynamic framework the interpretation of the flypaper effect is that grants Granger-cause municipalities' expenditures.[9]

All variables are converted into real per capita figures using consumer price index so that the period 1985-92 amounts are converted to 1990 prices and period 1993-99 amounts are converted to 1995 prices. All variables are transformed to natural logarithms before estimations. Time dummies are added to control for possible trends and macroeconomic factors that are common to all municipalities.

The data has been divided into two periods for estimations. Namely, the time periods 1985-92 and 1993-99, are being compared. Using two time periods makes it possible to compare the causal links of revenues, expenditures, grants and loans of Finnish municipalities in two very different fiscal settings. In the first data period the municipalities' grants consisted almost totally of earmarked categorical matching grants, whereas in the second data period the grants due to major grant system reforms in 1993, 1996 and 1997 are now mostly formula based specific grants with no earmarking.[10]

There are also other considerable differences between the two periods. The first period consists of years mainly of economic boom that ended in 1990. From the

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[7] All municipalities existing in 1999 excluding municipalities located in the autonomous area of Åland islands.

[8] See for example Filimon, Romer and Rosenthal 1982, Wyckoff 1991 and Hines and Thaler 1995.

[9] Holtz-Eakin, Newey and Rosen (1989) argue also that the separation of matching and lump sum grants in dynamic causality testing framework is not essential, because "the existence of matching rates puts no restrictions on the way in which current expenditures respond to past innovations".

[10] The grant reform has been described in Koski 1996, Oulasvirta 1996 and Loikkanen, Moisio, Oulasvirta, 2000. In Loikkanen et. al. there is also a description of the grant cuts during the years 1993-98.

year 1990 to 1993 Finland faced a severe economic crisis during which GDP fell cumulatively more than 10 percent. The recession drove the public sector into serious deficit. From 1990 to the mid 1990s the public debt, which consisted mainly of central government debt, increased from about 15 % of GDP to 60 % of GDP.

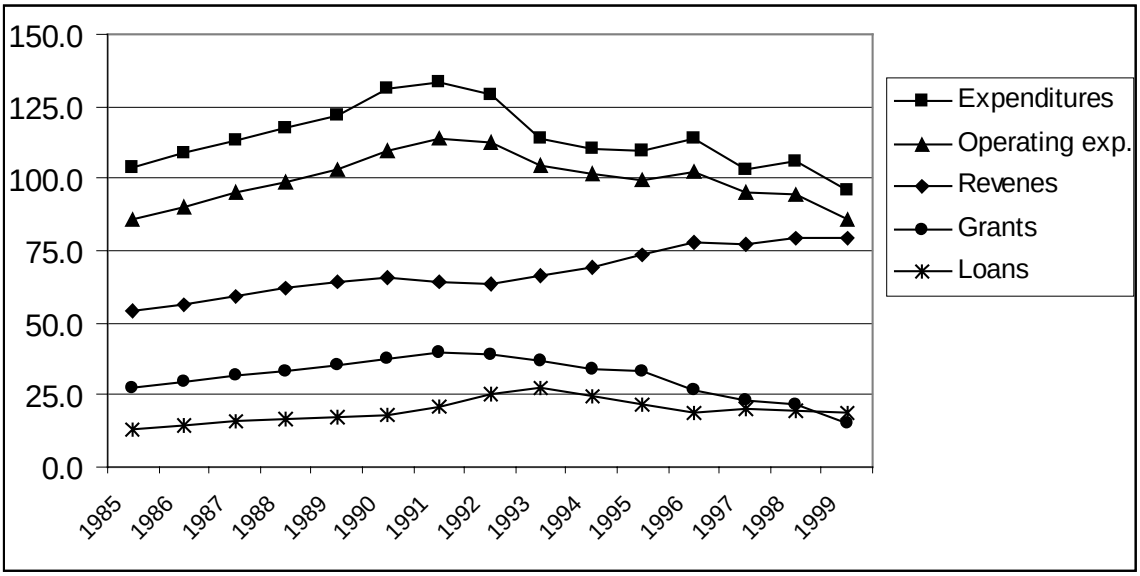
It is obvious that the recession also caused difficult times for the municipalities. As the unemployment rate rose from less than 4 percent in the end of 1980s to over 16 percent in 1994, the municipalities' tax incomes decreased and at the same time the welfare expenditures increased. Municipalities reacted to the decreasing tax base by raising tax rates, increasing fees for health and welfare services, borrowing, by holding back investments and restraining the health and welfare costs. Municipal salary expenditures were reduced by discharging the part time labour force and by laying off full time employees.

In 1994 the economy started recovering and the municipalities' tax incomes began to rise gradually. Municipalities were able to reduce their loans. However, the increasing revenues were balanced out by grant reductions during the years 1993-98. Between the years 1993-98, central government grants to municipalities were cut by over 33 % in real terms. The average level of local tax rate has not declined after the recession.

Differences between municipalities' rate of recovery after the recession have been large. The economic recovery first began in regions where large share of GDP comes from the export industry. After 1994, domestic migration from rural municipalities and smaller towns especially to Southern Finland increased. Those municipalities with negative net migration have been trying to cope with smaller tax base and less favourable age structure of population, at the same time when the municipalities with positive net migration struggle with increases of public service demand.

Figure 1 summarises the development of the variables used in this study. As mentioned, municipal expenditures increased steadily in real terms until the beginning of 1990s, thereafter expenditures have been mostly on a downward slope. It is worth noting that real municipal total expenditures were in 1999 lower, and operating expenditures at the same level than they were in 1985. Municipal revenues decreased temporarily during the recession period, and after the mid 1990s revenues increased due to higher tax rates and improving employment as well as increased yield from company tax. Grants were cut during 1993-98 and in real terms they have somewhat diminished even after that. Municipalities used borrowing to cope with the beginning of the recession, but the level of loans has now returned to pre-recession level. In the present situation municipalities finance a much larger share of their expenditures from their own revenue sources than in the mid 1980s.

Figure 1. Aggregated Municipal Expenditures, Revenues, Grants and Loans (in billions of FIM, 1990 prices)



4. Results

The focus of the study is on dynamic interrelationships among four variables: expenditures, revenues, grants and loans. Each variable will have its own equation in the system. First, I estimate the model with expenditures on the left hand side and on the right hand side of the equation are its own lags and lags of other three variables and year dummies. The same is done to each variable. The results of the estimations are used to investigate parameter stability over time, lag length and finally the causation.

The estimations and tests are carried out in the following steps: first, the unrestricted model with no assumption of parameter stability over time is estimated and the overall model validity is tested. After that, the model is re-estimated using the assumption of time invariant parameters. This assumption is tested against the hypothesis of time variant parameters. In the third step using the model selected, the correct lag length is tested starting from the longest lag allowed by the data. Finally, the causation is tested by dropping each right hand variable at a time.

As the data has been divided into two separate periods, the respective results of the estimation are also reported in their own subsections, 4.1 and 4.2. First, the results of the estimations performed using data for years 1985 – 1992 are presented. I call this data period "the matching grant period" because approximately 99 percent of the grants to municipalities were specific matching grants during that time. The results for the latter data period, 1993 – 1999, are presented in the section called "the formula based grant period". In the end of the section, the results are discussed and a comparison of the results for the two periods is done.

4.1 The data period of the matching grant system (1985 - 1992)

The results[11] of the expenditures equation for the years 1985-92 are presented in Table 1. Looking at the results, the most general model has Q value 14.4 with 24 degrees of freedom.[12] The χ^2 value is 33.2, so the most general model is accepted as the starting point[13]. I next restrict the model by assuming time invariant

[11] All estimations are carried out using White's (1980) covariance matrix estimator to get consistent estimates of the standard error.

[12] The degrees of freedom are calculated by subtracting the total number of estimated parameters from the total number of instrumental variables (see Holtz-Eakin et al 1988 and Holtz-Eakin et al 1989 for more detailed description). For the year 1992 there are 6 years available for instrumental variables, which means $6 \times 4 = 24$ plus constant, altogether 25 instrumental variables. For the year 1991 the years 1985-1989 are usable, so we get $(5 \times 4)+1= 21$ instrumental variables and so on. The total number of instruments is then 24+21+17+13= 76. Because there are 13 parameters for each estimated year (4m + 1), the degrees of freedom for Q are 76 - 52 = 24.

[13] Holtz-Eakin et al (1989) stress that inferences about causality will be incorrect if the lag length or parameter constancy is wrongly chosen. To avoid these type II errors, they suggest that 0.10 level of signifi-

parameters: Q_R value is now 60.6 with 60 degrees of freedom. The L value is then 46.2 with 36 degrees of freedom[14]. At the 0.10 level of significance the critical value is 47.2 and therefore the hypothesis of time invariant parameters is accepted.

Next, the results relating to lag length are investigated, conditional on assumption that parameters are time invariant. The first question is whether the data will allow the lag length to shorten from three to two. When m = 2 is imposed, the value of Q is 66.8. Comparing this to the value of Q in line ii) of Table 1, it can be found that L = 6.2 and has 4 degrees of freedom[15]. The critical value of the $\chi 2$ distribution at the 0.10 level is 7.8. Therefore the restriction that two lags in each variable is enough is accepted. The testing then continues to test if lag length m = 1 would be accepted. When the expenditure equation is estimated with one lag, the Q value is 71.4 and comparing to the m = 2 situation the L value is 4.6, which means that m = 1 is also accepted. Now there is still the possibility that the lag length could actually be m = 0. Testing this hypothesis (see line v) in Table 1) against the m = 1 model gives Q value of 117.9; the L value is then 46.5 which is larger than the $\chi 2$ critical value so the data rejects this hypothesis by a wide margin.

Conditional on m = 1 and time invariant parameters, the testing of causality can now begin. To test whether revenues cause expenditures, the expenditure equation is simply estimated without revenues, and the increase in $\chi 2$ test statistic is evaluated. The Q value when revenues are excluded is 71.7; the L value is then 0.5 with one degree of freedom, which means that the hypothesis of non-causality is accepted. Hence, revenues do not cause expenditures.

Next, the causality from grants to expenditures is tested. The Q value is 79.3, L value is 7.9 and the hypothesis of non-causality is now rejected. Dropping the loans from the expenditure equation gives Q value 92.4 and L value of 21.0, so the hypothesis of non-causation is rejected by a wide margin.

To summarise the expenditure equation results, I found that during the period of matching grant system, the municipal expenditures can be described by a dynamic process which has only one year lags. The estimated parameters taken as a group are time invariant. Most importantly, one can reject the hypothesis that revenues caused expenditures. Grants cause expenditures so that changes in previous year grants cause the present expenditures to change. The stimulating effect of matching grants to expenditures already verified in previous studies (Oulasvirta 1996, Moisio 1998) is the most likely explanation for the causality. This also means that the flypaper effect is verified in the sense that past grant in-

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cance be used in testing the parameter stability and lag length, and 0.05 level of significance when testing the causality.

[14] There are 36 degrees of freedom because the 12 parameters for each of 1989 through 1991 are constrained equal to their 1992 values.

[15] There are 4 degrees of freedom because 1 lag is reduced for each of the four variable compared to situation in line ii)

creases seem to cause future expenditure increases. Finally, I find also that past loans cause present expenditures.

Table 1. The expenditures equation 1985 – 1992 (T = 8, N = 436)

	Q	L	Df_Q	Df_L	χ^2	Accept?
i) Time varying parameters, m = 3	14.4		24		33.2	YES
ii) Time invariant parameters, m = 3	60.6	46.2	60	36	47.2	YES
iii) m = 2, given ii)	66.8	6.2	64	4	7.8	YES
iv) m = 1, given ii)	71.4	4.6	68	4	7.8	YES
v) m = 0, given ii)	117.9	46.5	72	4	7.8	NO
vi) drop revenues, given iv)	71.7	0.5	69	1	3.8	YES
vii) drop grants, given iv)	79.3	7.9	69	1	3.8	NO
viii) drop loans, given iv)	92.4	21.0	69	1	3.8	NO

Next, the results of the revenues equation are presented. As the test procedure was already described above in detail, I will therefore just briefly summarise the results which are reported in Table 2:

a) m = 3 seems to be at least sufficient to describe the dynamic process of the municipalities' revenues (line i)

b) given m = 3, the hypothesis of time invariant parameters is rejected (line ii),

c) one can reject the hypothesis that m = 2 (line iii),

d) expenditures, grants and loans cause revenues (lines iv-vi)

The most important result is that expenditures cause revenues. As I just found above that the revenues did not cause expenditures, I therefore find evidence that during 1985 – 1992 the data supports Barro's "spend and tax" hypothesis. This result is easy to accept, because municipalities' services were expanding rapidly during the data period used. Revenues may then just have followed the pace of increasing expenditures. The result that grants cause revenues, can be explained at least partly by the income effects of the matching grants: changes in amount of grants have changed the need for own source revenues. Finally, loans are found to cause revenues which can be explained so that the possibility to borrow has given the municipalities more room for manoeuvre in the own source revenue side.

All in all, the dynamic process as a whole seems to be very different in the expenditure and revenue equations, as there are clear differences in the parameter stability and lag length in the expenditures and revenues equations.

Table 2. The revenues equation 1985 – 1992, (T = 8, N = 436)

	Q	L	DfQ	DfL	$\chi 2$	Accept?
i) Time varying parameters, m = 3	22.7		24		33.2	YES
ii) Time invariant parameters, m = 3	143.0	120.3	60	36	47.2	NO
iii) m = 2, given i)	94.0	71.3	40	16	23.5	NO
iv) drop expenditures, given i)	73.8	51.1	36	12	21.0	NO
v) drop grants, given i)	76.6	53.9	36	12	21.0	NO
vi) drop loans, given i)	101.6	78.9	36	12	21.0	NO

Table 3 contains the results for the grant equation. As was mentioned above, most of the grants during 1985-92 were matching grants. Therefore it is perhaps a little trivial to present the results for the grants. The results are presented for checking reasons, however. In short, the results are following:

a) m = 3 seems to be at least sufficient to describe the dynamic process of the municipalities' grants (line i),

b) given m = 3, the hypothesis of time invariant parameters is rejected (line ii),

c) one can reject the hypothesis that m = 2 (line iii),

d) expenditures, revenues and loans cause grants (lines iv-vi)

The result that expenditures cause grants is obvious in the matching grant system and needs no further discussion. The second result that revenues cause grants can be explained by the so called classification of the municipalities, which was an integral part of the grant system at that time. Until 1996 the municipalities were divided into 10 different groups to define the grants[16] for each municipality. Revenues were taken into account when defining each municipality's group in the system, and that may be the reason why the causality from revenues to grants is verified. Lastly, the result that loans cause grants may have the same explanation, because the financial situation on the whole was evaluated for the classification.

Table 3. The grants equation 1985- 1992 (T = 8, N = 436)

	Q	L	DfQ	DfL	$\chi 2$	Accept?
i) Time varying parameters, m = 3	23.9		24		33.2	YES
ii) Time invariant parameters, m = 3	116.1	92.2	60	36	47.2	NO
iii) m = 2, given i)	65.2	41.3	40	16	23.5	NO
iv) drop expenditures, given i)	68.0	44.1	36	12	21.0	NO
v) drop revenues, given i)	70.0	46.1	36	12	21.0	NO
vi) drop loans, given i)	64.3	40.4	36	12	21.0	NO

[16] The matching rates of the grants, to be precise

Finally, in table 4 the loan equation results are presented. The main results are:

a) m = 3 seems to be at least sufficient to describe the dynamic process of the municipalities' loans (line i),

b) given m = 3, the hypothesis of time invariant parameters is rejected (line ii),

c) one can reject the hypothesis that m = 2 (line iii),

d) expenditures, revenues and grants cause loans (lines iv-vi)

The results suggest that all the three variables cause loans. The expenditures may cause loans simply because expenditures are financed at least partly by borrowing. The revenues and grants may cause loans for the same reason.

Table 4. The loans equation 1985 – 1992 (T = 8, N = 436)

	Q	L	DfQ	DfL	$\chi 2$	Accept?
i) Time varying parameters, m = 3	26.1		24		33.2	YES
ii) Time invariant parameters, m = 3	192.2	166.1	60	36	47.2	NO
iii) m = 2, given i)	112.7	86.6	40	16	23.5	NO
iv) drop grants, given i)	123.7	97.6	36	12	21.0	NO
v) drop revenues, given i)	129.2	103.1	36	12	21.0	NO
vi) drop expenditures, given i)	121.2	95.1	36	12	21.0	NO

4.2 The formula based grants data period (1993 – 1999)

Next, the same procedure of tests for the parameter stability, lag length and Granger-causation are performed on expenditures, revenues, grants and loans in the latter period (1993-99).

First, the results of the expenditures equation are presented in table 5. The main findings are:

a) lag length of three is at least sufficient to characterise the data (line i),

b) given m = 3, the hypothesis of time invariant parameters is rejected (line ii),

c) one can reject the hypothesis that m = 2 (line iii),

d) revenues, grants and loans cause expenditures (lines iv-vi)

The test statistic rejects the expenditure equation with three lags. This could mean that a longer lag structure would be needed to describe the expenditures properly. However, as the data does not allow for a longer period, and because the test rejects the model only by a small margin, the testing procedure is continued.

The revenues cause expenditures during the formula based grant period. This probably reflects the increased importance of municipalities' own source revenues in the municipal finance during the latter part of the 90s. The grants cause

expenditures, so the flypaper effect is at work. Also loans still cause expenditures.

Table 5. The expenditures equation 1993 – 1999 (T = 7, N = 436)

	Q	L	DfQ	DfL	$\chi 2$	Accept?
i) Time varying parameters, m = 3	19.7		12		18.5	NO
ii) Time invariant parameters, m = 3	117.5	97.8	36	24	33.2	NO
iii) m = 2, given i)	98.2	78.5	24	12	18.5	NO
iv) drop revenues, given i)	116.4	96.7	21	9	16.9	NO
v) drop grants, given i)	82.9	63.2	21	9	16.9	NO
vi) drop loans, given i)	69.8	50.1	21	9	16.9	NO

Table 6 presents the results for the revenues equation. The main findings are:

a) lag length of three is at least sufficient to characterise the data (see line i),

b) given m = 3, the hypothesis of time invariant parameters is rejected (line ii),

c) one must accept the hypothesis that m = 2 (line iii),

d) one can reject the hypothesis that m = 1 (line iv),

e) expenditures and grants cause revenues (lines v-vi)

f) loans do not cause revenues (line vii)

Expenditures are found to cause revenues. This means that there is a bi-directional causality between revenues and expenditures, which suggests that taxing and spending decisions are made simultaneously in the municipalities. This finding differs from the one made during matching grants period. The result that grants cause revenues mean that changes of grants received by municipalities in 1990s have caused the municipalities to change own source incomes. The evidence suggests also that loans do not have any causal effect on revenues.

Table 6. The revenues equation 1993 – 1999 (T = 7, N = 436)

	Q	L	DfQ	DfL	$\chi 2$	Accept?
i) Time varying parameters, m = 3	7.2		12		18.5	YES
ii) Time invariant parameters, m = 3	41.7	34.5	36	24	33.2	NO
iii) m = 2, given i)	23.7	16.5	24	12	18.5	YES
iv) m = 1, given iii)	107.2	83.5	36	12	18.5	NO
v) drop expenditures, given iii)	40.7	17	30	6	12.6	NO
vi) drop grants, given iii)	42.5	18.8	30	6	12.6	NO
vii) drop loans, given iii)	27.4	3.7	30	6	12.6	YES

Table 7 summarises the estimation results for the grants equation. The findings are the following:

a) lag length of three is at least sufficient to characterise the data (see line i),

b) given m = 3, the hypothesis of time invariant parameters is rejected (line ii),

c) one can reject the hypothesis that m = 2 (line iii),

d) expenditures and revenues cause grants (lines iv-v)

e) loans do not cause grants (line vi)

Expenditures and revenues cause grants in the present system probably because of the tax base equalising system[17] and because in the present grant formulas, the circumstantial factors that may cause higher spending are taken into account. These circumstantial factors are for instance low population density, remoteness, index for sickness of population and unemployment. Loans are not found to cause grants.

Table 7. The grants equation 1993 – 1999, (T = 7, N = 436)

	Q	L	DfQ	DfL	$\chi 2$	Accept?
i) Time varying parameters, m = 3	9.6		12		18.5	YES
ii) Time invariant parameters, m = 3	65.2	55.6	36	24	33.2	NO
iii) m = 2, given i)	36.2	26.6	24	12	18.5	NO
iv) drop expenditures, given i)	40.1	30.5	21	9	16.9	NO
v) drop revenues, given i)	32.5	22.9	21	9	16.9	NO
vi) drop loans, given i)	17.1	7.5	21	9	16.9	YES

Finally, the results of the loans equation are presented in table 8. The findings are:

a) lag length of three is at least sufficient to characterise the data (line i),

b) given m = 3, the hypothesis of time invariant parameters is rejected (line ii),

c) one must accept the hypothesis that m = 2 (line iii),

d) one can reject the hypothesis that m = 1 (line iv),

e) expenditures cause loans (line v)

f) revenues and grants do not cause loans (lines vi-vii)

The evidence suggests that during 1993-99 loans have been caused by expenditures alone. Bearing in mind that on average, municipalities have reduced their loans at the end of the 1990s, the bi-directional causality of loans and expenditures suggests that loan cuts have been at least partly financed by expenditure cuts.

[17] The tax base equalising system guarantees 90 % of the average tax base to all municipalities. In other words, when municipality's tax base is lower than 90 % of the average, then the municipality will receive a lump sum grant of the amount of the difference. The municipalities with over 90 % of the tax base finance the system. More detailed description of the present grant system can be found in Loikkanen, Moisio and Oulasvirta (2000).

Table 8. The loans equation 1993 – 1999, (T = 7, N = 436)

	Q	L	DfQ	DfL	$\chi 2$	Accept?
i) Time varying parameters, m = 3	7.0		12		18.5	YES
ii) Time invariant parameters, m = 3	20.9	13.9	36	24	33.2	YES
iii) m = 2, given ii)	26.8	6.8	40	4	7.8	YES
iv) m = 1, given iii)	37.3	10.5	44	4	7.8	NO
v) drop expenditures, given iii)	33.5	6.7	42	2	6.0	NO
vi) drop revenues, given iii)	28.1	1.3	42	2	6.0	YES
vii) drop grants, given iii)	28.1	1.3	42	2	6.0	YES

4.3 Comparison of the two periods

In this section the results of the two previous subsections are discussed. The differences of the estimation results in the "matching grants period" and "formula based grant system" are compared by discussing each equation in turn.

The results of expenditure equations for the two time periods differ considerably. The main two differences are:

a) The data for 1985-92 suggests a unidirectional causality from past expenditures to present revenues, whilst the data for 1993-99 suggests that there is a bi-directional causality.

b) The expenditure model fitted for the former period suggests that one year lags are enough and the data for the years 1993-99 indicates that at least three year lags are needed to describe the dynamic process.

The first observation means in practice that during the matching grant system the expenditures were clearly altered first and revenues then followed, whilst during the formula based grants system the two variables cause each other. The second observation means that in the first data period the decisions on expenditure changes were made faster than in the latter period.

Much of the results can be explained by observing first, that during the matching grant period the municipalities often planned the increases in their services simply by calculating how much the state would pay for the eventual expenditures. In other words, the matching rate stimulated municipalities to increase their spending. With rapidly expanding service supply, it must have been difficult for any municipality to correctly forecast their future spending. Municipalities therefore probably made too optimistic budgets concerning both revenues and expenditures[18]. Municipalities were then bound to raise their taxes afterwards. Second, during the previous grant system, municipalities were divided into 10 groups based on evaluations of their economic ability. The matching rates were higher

[18] One can then argue that the classical budget maximisation and asymmetric voter information were at work.

for those municipalities that were evaluated to be the poorest. Some municipalities may then have tried to strategically raise their expenditures in order to be moved to a group with higher matching rate.

Third, during the latter period the grant system was altered so that the connection between grants and municipal expenditures was abolished. After the grant reform in 1993 the municipalities began to receive grants based on special formula that took municipalities' needs and circumstances into account. At the same time municipalities' freedom to allocate their funding also increased. Fourth possible reason for the difference is that the grants were reduced considerably cut during the period 1993-98.

As a result of all that, the importance of municipalities' own source revenues in financing the expenditures has increased considerably. This is the most likely reason for the result that municipalities in the latter data were found to define their expenditures and revenues simultaneously.

The differences in dynamic processes suggest that nowadays the municipalities' expenditures are affected by changes in revenues and grants from much longer period than before. One of the reasons for this may be that the new Municipal Act requires municipalities to make a financial plan for at least three years ahead. Also the balancing of the budget is supposed to take place within three tears.

Finally, the similarities in the two expenditure equations are that both grants and loans cause expenditures. In other words, the flypaper effect in the sense that past grants predict the future expenditures is verified in both grant systems. The evidence that loans cause expenditures may be true for separate reasons. For instance, during the first data period both expenditures and loans were growing, whereas during the latter period both were diminishing.

As for the revenues equations, the differences are smaller because during both periods expenditures and grants caused revenues. This suggests that expenditures and grants simply are the most important determinants of municipal revenues irrespective of the grant system or even the fiscal setting in general. The difference between the periods is that during the latter period loans do not cause revenues whereas the former data suggests that they do. Also the dynamic process is one year shorter during the latter period.

Grants are caused by expenditures, revenues and loans in the first period but not by loans during the latter period. This may be explained by differences in the tax base equalisation schemes and other grant system differences in the two periods.

Loans are caused by all three right hand side variables in the first period but only by expenditures in the latter period. In the former period loans were used both to build the increasing municipal service structure and to cope with the first years of the recession. In the latter period the municipalities' strategy seems to have been to decrease the loans as much as possible from the peak of the beginning of 1990s. After the mid 1990s the repayment of loans together with decreased interest rates have reduced the municipal total expenditures.

The evidence that during the period 1993-99 loans have been caused only by expenditures raises some questions about how the cuts on municipalities' loans have been achieved in 1990s. It is somewhat surprising that revenues do not cause loans, because the general belief has been that increased revenues have made it possible for the municipalities to reduce their loans.

5. Summary and conclusions

In this paper I have investigated the dynamic inter-relationship between municipal expenditures, revenues, grants and loans in Finland. The main reason for starting this research was because the data that was available offered a unique possibility to compare the dynamic interrelationships in two very different grant systems. Therefore two separate time periods, 1985-92 (matching grant system) and 1993-99 (formula based grant system) were selected for this study.

The main findings of the investigation are that during the matching grant system expenditures cause revenues, whereas revenues do not cause expenditures. During the formula based grant system a bi-directional causality between expenditures and grants is discovered. Therefore, Barro's hypothesis of "spend and tax" is supported in the matching grants system, whereas in formula based system the evidence supports the fact that revenues and expenditures are decided concurrently.

Grants cause expenditures during both data periods, so the hypothesis of flypaper effect is supported during both estimation periods. Loans cause expenditures and revenues in the matching grant system, but in the formula based system loans cause only expenditures.

The policy implication from this study is that during the matching grant system (1985-92) the best way for central government to influence municipalities' expenditures would have been to alter the grants (by changing the matching rates) given to municipalities. The adjustment of expenditures would have been quick - only one year. The best way for the central state to affect municipalities' revenue side, if direct measures were unavailable, would have been to try to alter the municipalities' expenditures and/or grants. The adjustment period needed for the change would have been clearly longer than in the expenditures case.

As for the latter period (1993-99), the policy implications are the same in that the central state should alter the formula based grants in order to affect municipalities' expenditures. The other possibility would be to change municipalities' revenues. According to the results, restricting municipalities' right to borrow would also affect the expenditures. More importantly, this would presumably happen without any effect to revenues. The adjustment time is clearly longer than in the 1980s as grants, revenues and loans cause expenditures with at least three year lags.

In addition to the above, the results indicate that there are clear differences in the dynamic processes between periods and separate equations. The results show also, that the stability of the estimated parameters in the latter period especially is not self-evident and needs to be tested.

An interesting future topic of research would be to investigate the dynamic interrelationships between these four fiscal variables using separate groups of municipalities. Especially interesting would be to find out if there are differences between poor and rich municipalities in the causality. The work concerning these issues has already begun.

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