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Cash data for the Central Government: Time Series Analysis

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Abstract

This paper examines the applicability of cash data as short-term indicators on the developments of the central government finances. Cash based revenue and expenditure items and reclassified to comply with the classification of annual SNA figures and the annual fiscal forecasts. The statistical properties of the data series are analysed using structural time series analysis. The models are used to forecast short-term developments of four revenue items and of five expenditure items. Also some tentative monthly estimates for the general government balance is presented.

The analysis demonstrates the volatile character of monthly cash series; in most cases trend components are insignificant. On the other hand seasonal variation is statistically significant for most of the analysed items. Estimated time series models produce quite plausible forecasts for the short-term developments of the central government income and expenditure items.

Keywords: cash based data, short-term forecasts

Tiivistelmä

Valtion kassalukujen käyttökelpoisuutta valtiontalouden indikaattorina selvitettiin rakenteellisen aikasarja-analyysin avulla. Kassaperusteiset aikasarjat luokiteltiin vastaamaan mahdollisimman hyvin SNA-käsitteitä ja vuotuisen julkisen talouden ennusteen luokitteluja. Lyhyen aikavälin ennusteet tuotettiin neljälle tuloerälle ja viidelle menoerälle. Lisäksi havainnollistettiin sitä, mitä kuukausipohjaista aineistoa on käytettävissä koko julkisen sektorin alijäämän arvioimiseksi.

Analyysi havainnollisti kassalukujen volatiilia luonnetta: trendiestimaatit eivät pääsääntöisesti olleet tilastollisesti merkitseviä. Toisaalta kausivaihtelu oli lähes joka erässä merkitsevää. Malleilla pystytään tuottamaan suhteellisen luotettavia lyhyen aikavälin ennusteita.

Asiasanat: kassaluvut, lyhyen aikavälin ennuste

Contents

Introduction

Monthly cash based data on central government revenues and expenditures are one of the most important information sources when assessing the development of public finances in Finland in the short term. The cash data for the central government expenditures and revenues are published regularly in a highly disaggregated form with a time delay of about a month. The data set is provisional, but not usually subject to revisions in a noticeable degree. The central government cash data suffer, however, from other shortcomings. One problem is that the contents of the cash based data series differ somewhat from the SNA (System of National Accounts) based data. Other problem with the cash data is the high temporary variation, which often blur the underlying developments of revenue and expenditure components. High stochastic variation diminishes substantially the applicability of monthly observations as indicators of fiscal developments.

This paper examines the applicability of cash data as short-term indicators on the developments of the central government finances. The derivation of reliable indicators of the central government fiscal variables requires that the information content of the cash based observations do not suffer from volatile movements in the time series. The monitoring process involves the comparison of the actual monthly observations and the annual fiscal forecasts for different components of expenditures and revenues as well as the analysis of the underlying trends of these components. Since the classification of the central government cash data differs from the SNA based concepts, the cash data have first to be reclassified and transformed so as to conform the SNA definitions.

First part of this paper examines the statistical properties of the cash data series. Especially, the purpose is to identify the systematic part of the variation of each revenue and expenditure component and to estimate short-term forecasting models for these items. The degree of disaggregation is chosen to conform the classification of annual SNA figures and the annual fiscal forecasts based on SNA data. The classification was affected also by the aim to obtain time series showing closely homogenous dynamics. On the other hand, the structure of the time series was deliberately kept as parsimonious as possible. Second part of the paper discusses possibilities to build short-term indicators also for the general government. Based on these experiments, some tentative monthly estimates for the general government balance are presented.

Structural Time Series Analysis for Cash Data

Analysing the information captured into time series itself is analogous to problem of estimating systematic components of time series. For time series, which obviously are non stationary by nature, the structural time series models provide a practical way to proceed. Such models consist of time varying unobservable components for trend, cycle, seasonal and irregular contributions to a series or group of series. Each component is assumed to be stochastic, with its time varying nature governed by an associated hyperparameter (Harvey, 1989). Hence, unlike typical ARIMA models where the starting point of analysis is to eliminate the trend, this approach estimates trend at the same time with stationary component thereby helping to define whether the trend is stochastic or deterministic by nature. In addition, because of the time varying nature of parametrisation, it is possible to get more precise picture of the developments of seasonal components.

Because the focus of the following analysis is on short-term analysis the relevant systematic components are trend and seasonal variation. Observed time series y_t can be defined to consist following components

(1) $$y_t = m_t + z_t + e_t ,$$

where μ denotes trend , z seasonal component and *e* irregular component.

In the case of deterministic trend structural model can be expressed as

(2) $$y_t = a + bt + \sum_{j=1}^{s} g_j z_{jt} + e_t ,$$

where *a* and *b* are trend parameters and s denotes the number of seasonal periods. The general expression for a stochastic, time varying trend is

(3) $$m_t = m_{t-1} + b_{t-1} + h_t ; b_t = b_{t-1} + z_t ,$$

where $h_t \approx NID(0, s_h^2)$, $z_t \approx NID(0, s_z^2)$. The expected rate of change of a trend is modelled as a random walk (slope parameter) which means that the trend is allowed to change over time. In short term analysis this rate of change can be treated as constant. The expected unstability of the rate of growth is expressed by the variance term s_z^2. In this definition trend is subject to shocks directed to level or slope.

Forecasting is based on the inertia which is measured with the variance parameters, hyperparameters. They express the speed unobserved components are changing. Central government data is, however, subject to both temporary shocks caused by timing factors and permanent changes for example in tax parameters. These kinds of effects can be taken into account by adding intervention variables, which can be connected to the level or slope of the trend.

The estimation procedures are conducted assuming trigonometric seasonals and stochastic trend components; level and slope. The basic models are further modified adding intervention variables capturing the effects of out of range observations. Forecasts are produced for the current and the next year. It should be noted that the reliability of forecasts diminishes strongly towards the end of the forecast horizon.

Data and Estimation Results

Central Government Revenues

On the revenue side structural time series analysis is conducted for four major components: 1) direct taxes, 2) value-added taxes, 3) other direct taxes and 4) property income. Direct taxes, value added taxes and the property income sum up closely or exactly to the SNA based figures (see Appendix 1). Major discrepancy between the cash and the SNA based figures shows up in the component of other indirect taxes. Cash figures are smaller than SNA figures because the SNA concept includes also the share of the Social Insurance Institution of the VAT revenues and the refund of VAT to the municipalities[1]. The monthly time series for other indirect taxes were adjusted by correcting the level with the discrepancy and assuming otherwise the same monthly variation than the one prevailing in the original series. For forecasting period the residual component can be approximated ex ante from budget documents.

The sum of these four income components covered 91 per cent of the total receipts of the central government in 1997. The residual consists of miscellaneous components, which can be projected in the short term as a constant share of GDP.

Revenue components show rather heterogeneous time varying pattern (chart 1). The temporary variation is most pronounced in time series for direct taxes. Value-added taxes contain also some exceptional observations. It seems that all these items have a slightly increasing trend and there seems to exist seasonal variation at least for property income and other indirect income.

Estimations revealed a large number of auxiliary values for residuals of the basic models, which contained a stochastic trend and trigonometric seasonal components. The exceptional observations may reflect, for example, temporary changes in the timing of taxes or shifts in tax parameters. Hence they were connected to either irregular or trend components. To avoid the bias these exceptional observations can cause to trend or seasonal estimators, the effects of auxiliary values were modelled using intervention variables[2].

Time series model for direct taxes contained auxiliary residuals for two months in 1992 and for one month in years 1993, 1995, 1996 and 1998. Mostly, these derive from changes in the timing of tax refunds but also an exceptional increase in corporate taxes was behind one out of range value (spring 1998). For the value added taxes the auxiliary residuals dated to March in 1995 and February and March in 1997. The first one is caused by the refunding of value added taxes to construction firms and service sector, whereas for the latter time points it is difficult to define any specific reason.

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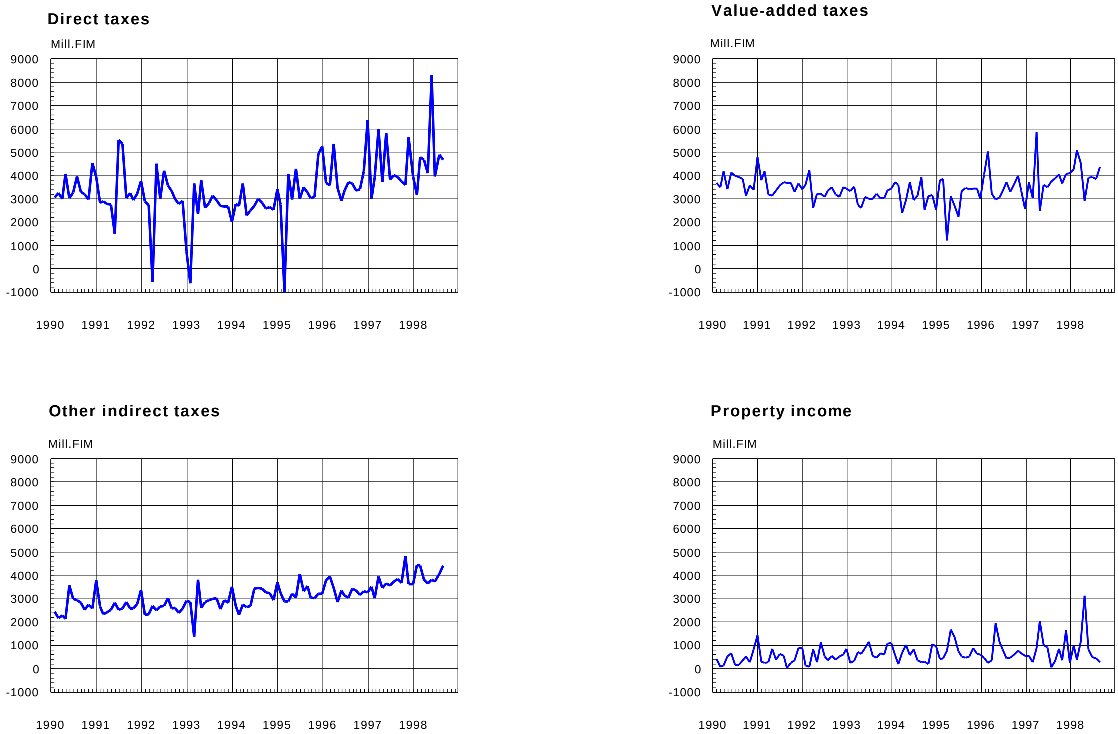
[1] The correspondence between SNA and cash concepts are summarised in Appendix 2.

[2] The estimation results and diagnostics is reported in Appendix 3.

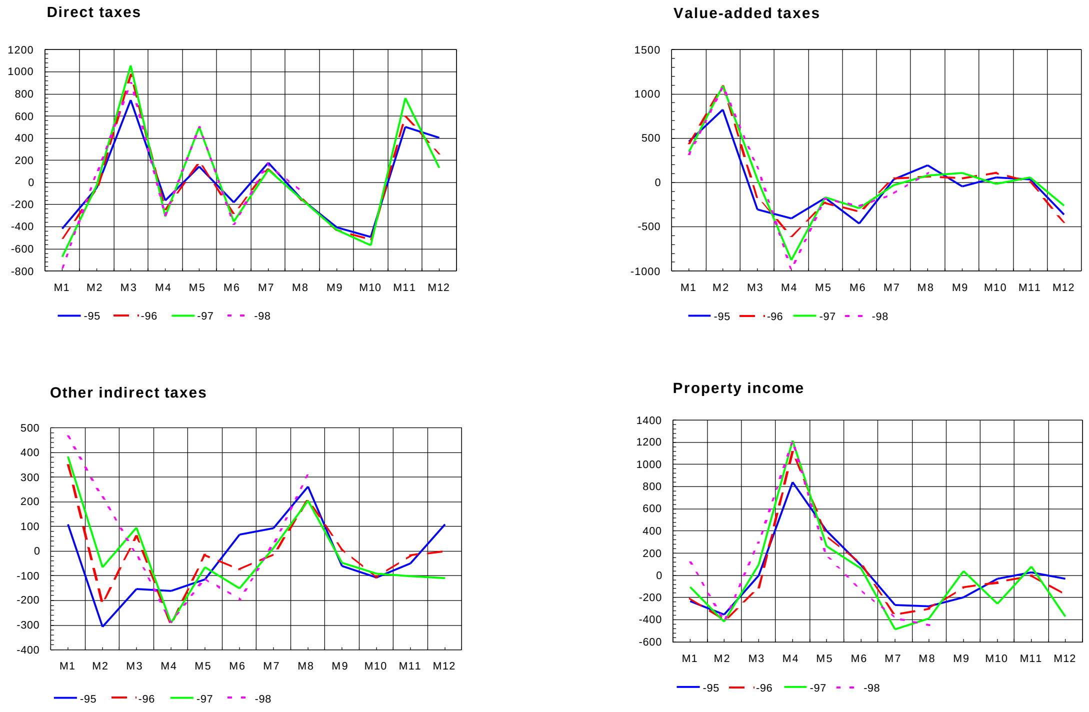
Chart 1. **Central Government Revenues**



Basic model for other indirect taxes contained several large residuals: February and March 1993, June 1995, February 1996 and March 1997 as well as October 1997. Most of these are connected to rises in product taxes; especially the energy taxes have often been raised in the early months of the years. The latest observation refers to the picking up of the output growth and a related fast accumulation in product taxes. The property income contained two interventions: for November 1997 and April 1998 due to the bank support repayments. The corresponding intervention variables were statistically significant and connected to the irregular part of residual except for the latest one. In the model for other indirect taxes this intervention was linked the to level of residual causing a kink to the trend estimate.

All the considered revenue items were subject to statistically significant seasonal variation. Moreover, the seasonal components have remained mostly invariant with respect to time (chart 2). Seasonal variation derives from budgeting practices as well as from variation in e.g. retail sales and wage payments. For example, for the direct taxes the positive seasonal components in March and in May can be explained with additional tax payments of households and firms. Likewise positive components for July are due to holiday wages and the peak for November is caused by the changed distribution of taxes between central and local government. Value added taxes contained a peak in February and nearly of the equal size negative component in April reflecting with a two months lag the seasonal variation of the value of the retail sales. Seasonal variation in other direct taxes reflects mostly the variation in excise taxes. Large positive component for January is due to the increased returns of alcoholic taxes reflecting the boomed sales at Christmas times. The same effect is behind the peak in August. Property income varies also in a systematic way within year reflecting mostly the timing of dividend payments.

Chart 2. **Seasonal Components for the Central Government Revenues**



Estimations show that the trend components are mostly statistically insignificant. Partly this is a result of the relatively short estimation period; for longer estimation period trend estimates might have been significant. However, the short data series set emphasises the most resent developments and thereby improve the short-term forecasting ability of the models. Accordingly, the intervention variables for the near past influence heavily on the trend estimates and the forecasts. For instance, if the substantial increase in corporate tax in 1998 (intervention variable for May 1998) is interpreted as a temporary observation, the trend increase in revenues from direct taxes would be less steep than otherwise had been the case (chart 3). Despite of statistically somewhat unreliable coefficient estimates, forecasts for revenue items maintain certain indication value in the near term. The forecasts can be seen as a possible outcome if private consumption and output continue to grow at a phase prevailing at the end of the estimation period.

Short-term projections can be used to assess whether revenues are approaching forecasted annual figures. This kind of comparison is relevant only for a time period of some months because trend estimates are based on underlying assumption of unchanged policy and stable economic growth. For the current situation where the growth rate is forecasted to slow down, time series models produce higher accumulation of tax income than seems to be plausible for 1999 (chart 4). For 1998 time series forecasts are much more in line with the annual fiscal forecasts. However, interesting interpretation can be given to two projections for direct taxes in chart 4. The upper line represents trend developments under assumption of a continuing increase in corporate earnings whereas lower line is produced by assuming that the high level of corporate taxes in the early months 1998 was temporary by nature. The chart shows concretely the magnitude of uncertainty incorporated in the tax revenue forecasts.

Chart 3. Estimated Trends and Forecasts for Central Government Revenues

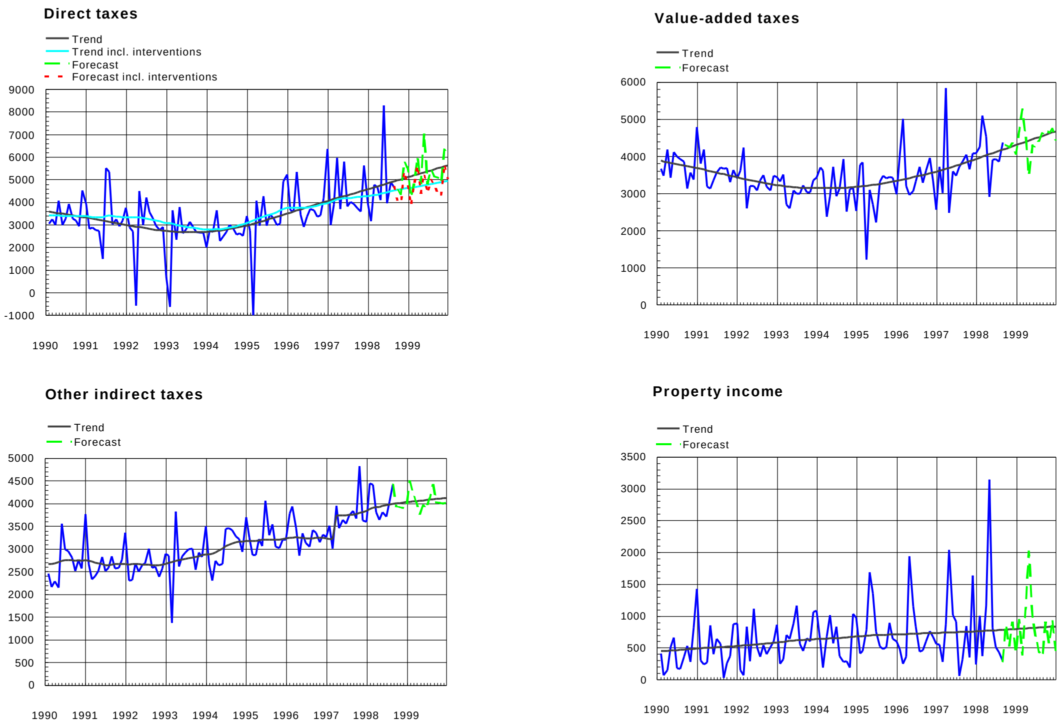
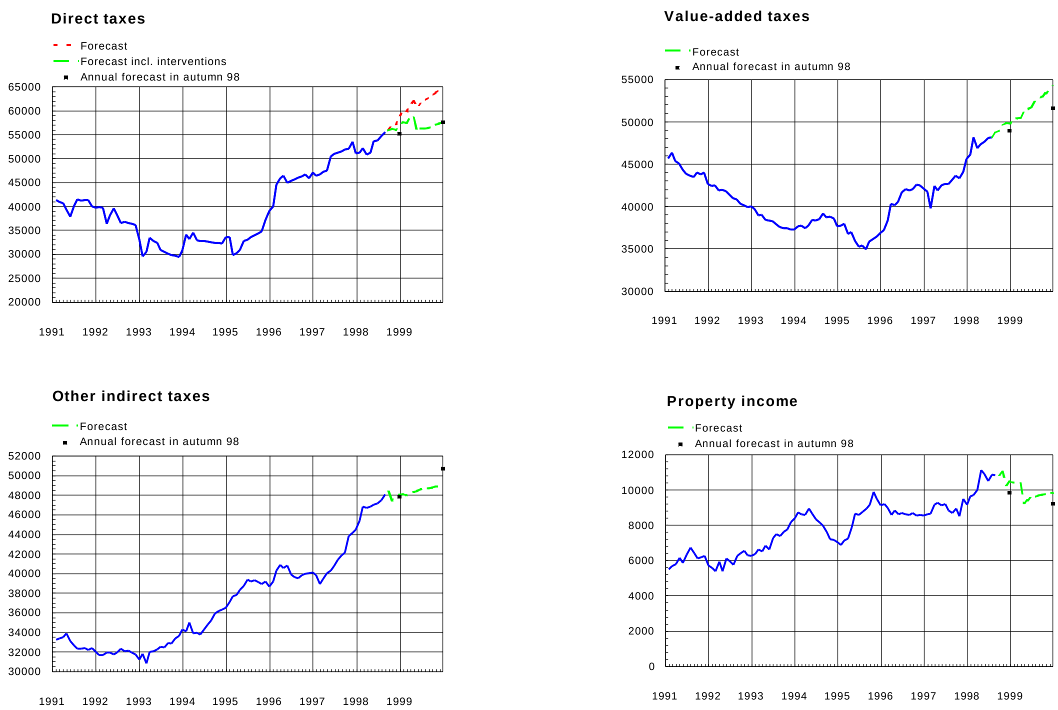


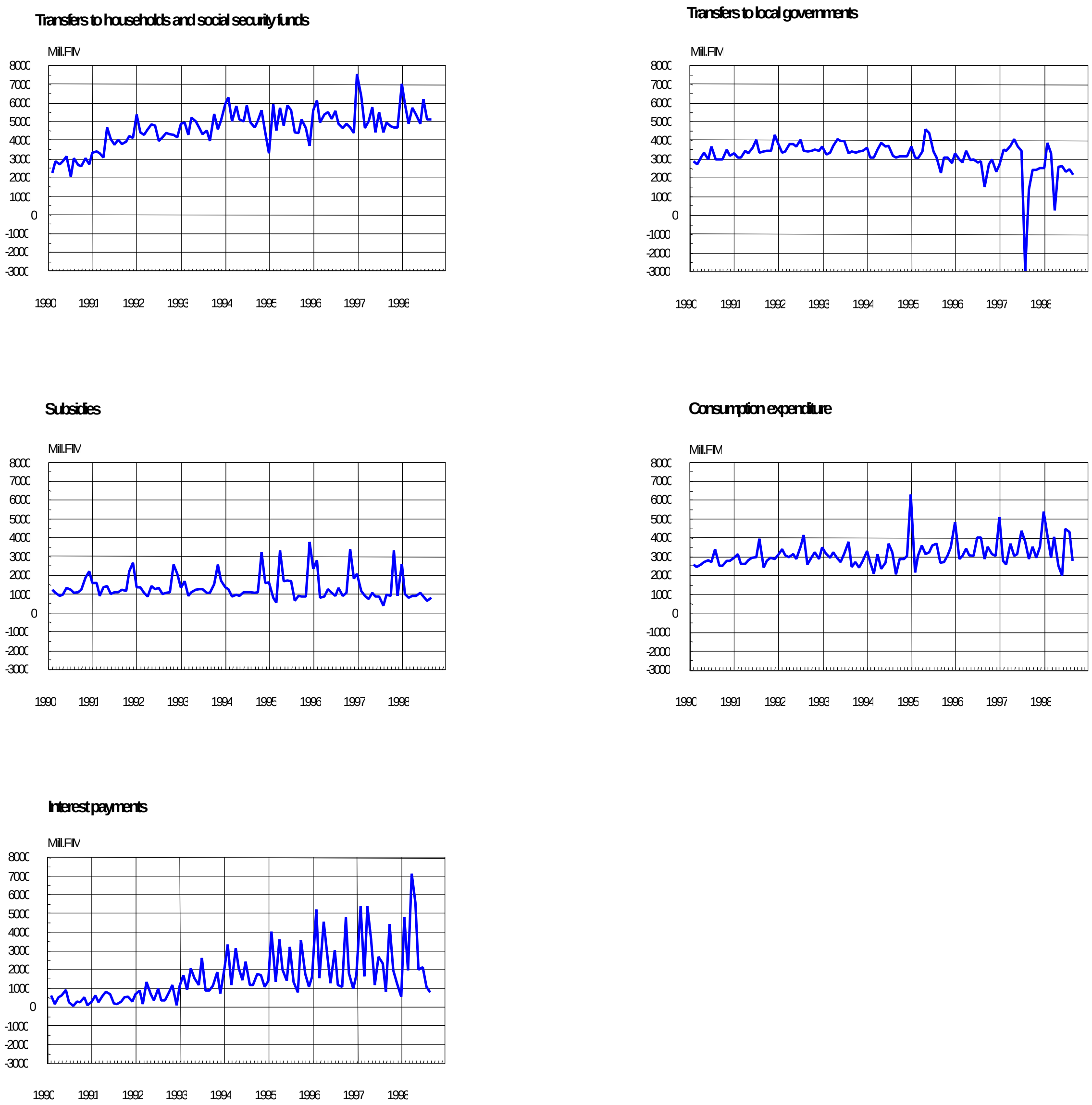
Chart 4. Time Series Projections and Annual Forecasts



Central Government Expenditure

Cash based data on government expenditure was classified into five time series, which have counterparts in SNA and which are forecasted on annual basis (Appendix 1 and Appendix 2). These series include transfers to households, transfers to local government, corporate subsidies, consumption expenditure and interest payments. The relative magnitude of these items is shown in Chart 5. The included expenditure items covered 93 per cent of total central government expenditures in 1997. As shown in Chart 5 the volatility of interest payments has increased considerably since 1993. Moreover, all series contain some extreme observations.

Chart 5. **Central Government Expenditure**



In estimations statistically significant seasonal variation was identified for each of the series and, besides, each of the series contained also auxiliary residuals, which were linked to either level or irregular component. Statistically significant trend estimates were found only for interest payments.[3]

The basic model for the transfers to households contained three auxiliary variables. The first one, which was timed to spring 1991, is attached to the level parameter and reflects the rapidly deteriorating situation in the labour market. The time points for other auxiliary residuals, December 1994 and 1996, were linked to irregular part of variation. The former was negative and stems from the cuts in government expenditure.

Model for transfers to local government was supplemented with two negative interventions for July 1997 and March 1998. In these months the municipalities, share of the education costs is subtracted from the transfers to local governments. Transfers to corporate sector constituted three intervention variable in 1995, which – as the statistically significant interventions in 1996 and 1997 are mostly derived from the timing of EU subsidies. Interest payments could be explained best by using two intervention variables for the level. First of these was positive and dated to spring 1993 and the second, negative one, dated to summer 1998. Intervention variables can be linked to the devaluation of Markka in the beginning of the 1990s and the second could be caused by decreased interest rate level.

Seasonal variation was statistically significant for all expenditure items (Chart 6). Seasonal components in the transfers to households were large in January, November and December. The first one is caused by raises in index based transfers like pensions. For the latter two it is difficult to identify specific reasons. Transfers for local government maintained large negative seasonal component for July, which is due to the above-mentioned netting in the share of local government in the education costs. For the transfers to corporate sector the systematic large value in October is caused by EU support. Consumption expenditures had high seasonal components in June and December. The former is caused by extra wage compensation owing to holiday time and the latter is a result of the practice to use the budgeted expenditures before the end of budget year. Seasonal variation in interest payments was due to timing of past borrowing.

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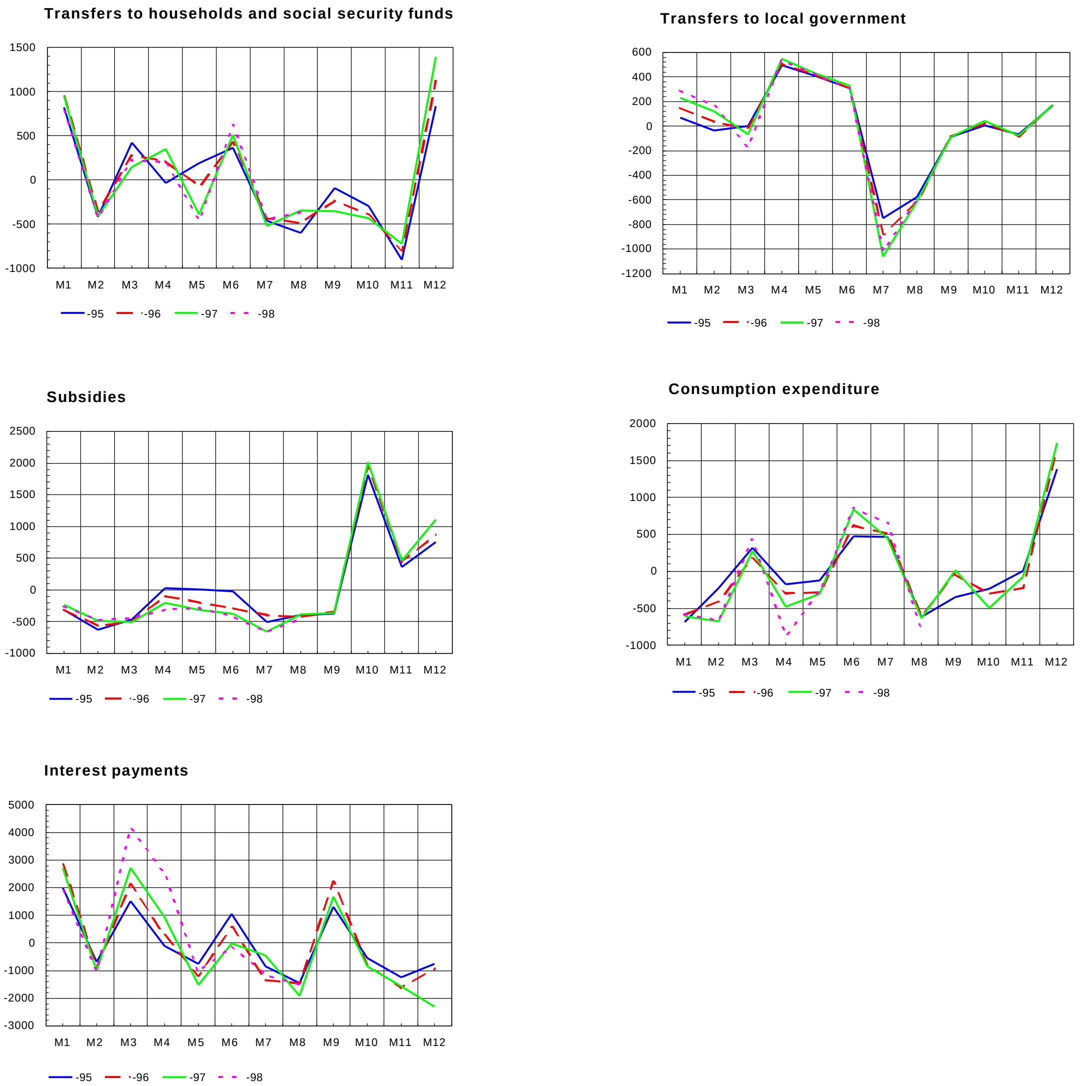
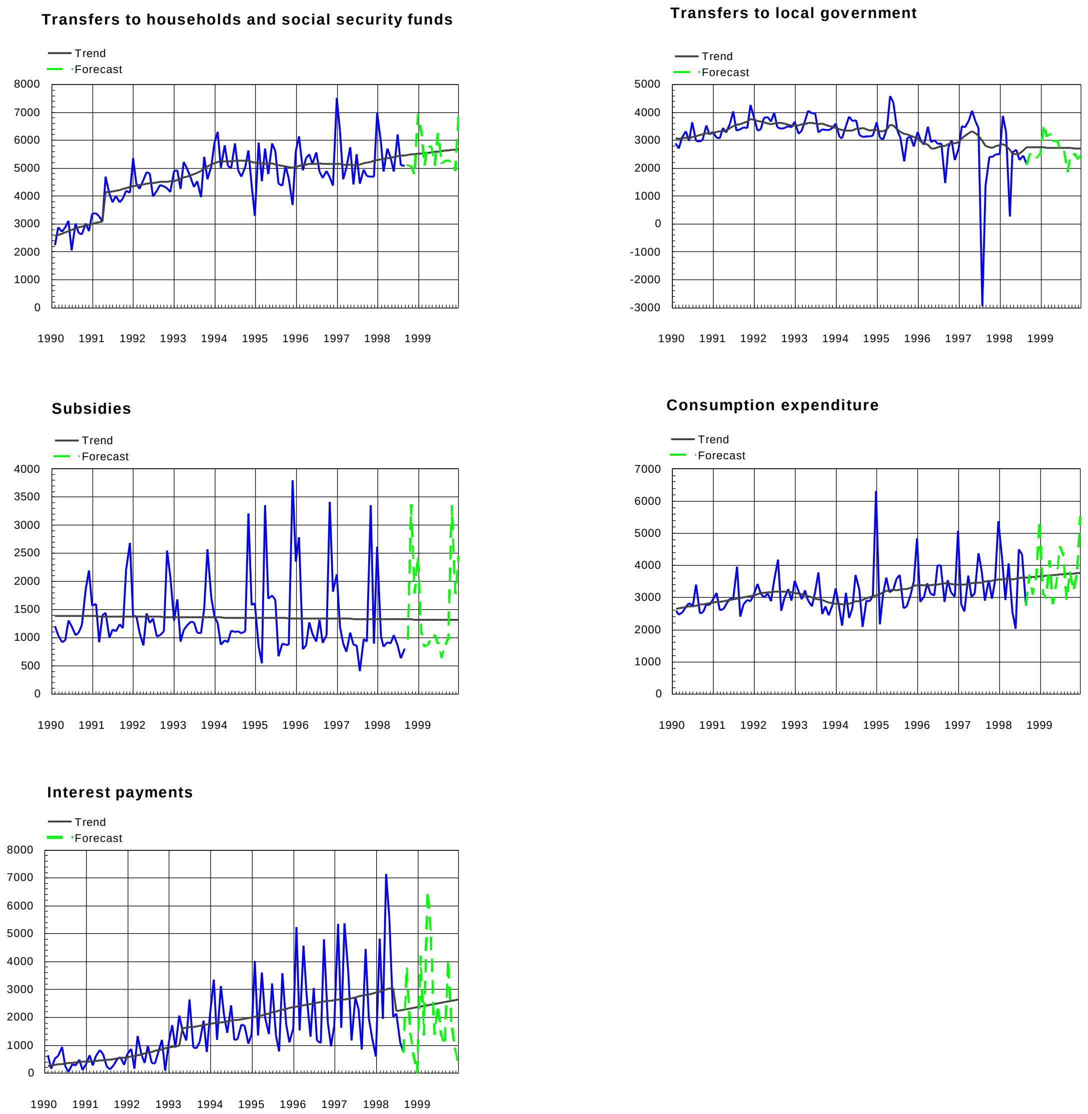
[3] The estimation results are reported in Appendix 3.

Chart 6. **The Seasonal Components for Expenditure Components**



Trend estimates for expenditure components were statistically insignificant except for interest payments. Stochastic trend estimates for the transfers to the local government and for the consumption expenditures were slightly increasing at the end of the estimation period. Trend parameter for the interest payments was negative (Chart 7).

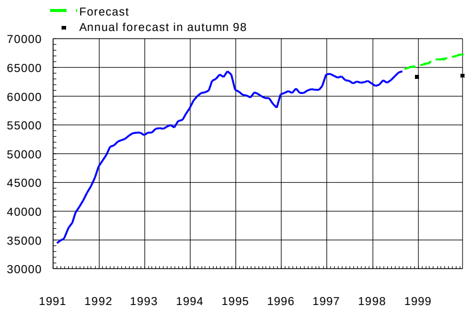
Chart 7. **Estimated Trends and Forecasts for Central Government Expenditure**



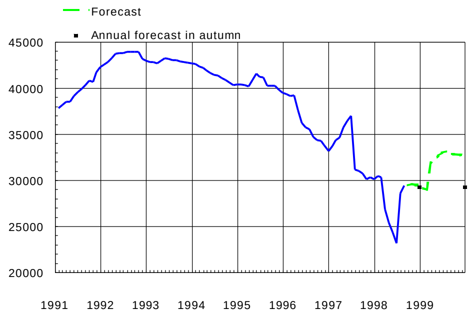
The comparison of annualised cash data with the annual forecasts shows clearly the nature of these short-term projections. The short-term projections are based on an implicit assumption of unchanged policy. For example, according to time series forecasts all transfers would overestimate developments in 1999, because of the expenditure cuts, which are included in the annual fiscal forecasts. For the current year, instead, the differences between short-term projections and the annual fiscal forecasts are only minor (Chart 8).

Chart 8. **Short Term Projections and Annual Forecasts**

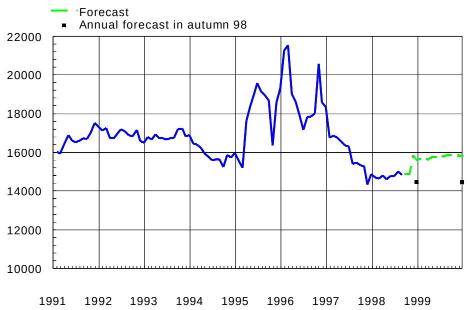
Transfers to households and social security funds



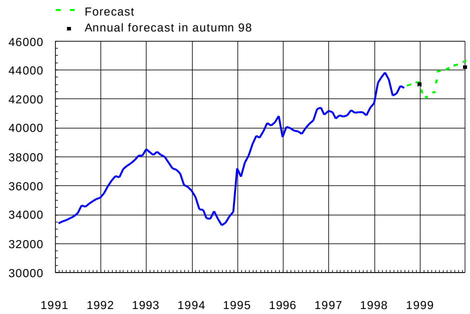
Transfers to local government



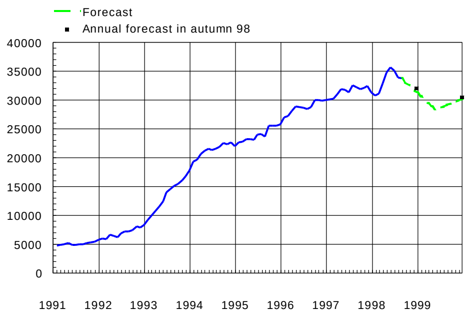
Subsidies



Consumption expenditure



Interest payments



Indicators for Net Lending

From the economic policy point of view, the primary interest is naturally in the question of the short-term developments in the general government net position. Problem is that for the local government and social security funds high frequency data are not widely available. In Finland these sectors constitute a prominent share of the public sector. However, some indicators for the general government net lending as a whole are possible to construct.

For the local government, tax income and transfers from the central government to local governments are available on monthly basis. These items cover the major part of the local governments' revenue side. From the expenditure side only annual data are available. Hence, monthly estimates for the local government net lending can be compiled only by using forecasted values for the expenditures. Accordingly, it has to be assumed that expenditures remain constant from month to month.

For the social security funds no monthly data are available. On quarterly basis some data on minor expenditure items are available. A rough indicator for the revenues can be built by using the information that the revenues are highly dependent on the wage sum. In addition, because the expenditures mainly consist of pension expenditures, there is good reason to assume a stable growth rate for them in the short term.

Table 1 shows the results of the experiment. Actual monthly observations exist for the local government and the central government revenues whereas other items are projected using the above mentioned approach. To avoid the seasonal effects the figures are expressed as cumulative sums. Of the developments on the revenue side this approximation provides relatively reliable picture assuming that the contribution to the social security funds are taken properly into account. Of the general government expenditures reliable monthly observations cover only about half of the total expenditures. In the table, monthly estimates for the expenditures of the central government and the social security funds are derived from the annual fiscal forecasts.

Table 1. **General Government Net Lending**

1997	Revenue Bill.FIM	%	Expenditure Bill.FIM	%	Net Bill.FIM
Central Government	164,8	8,4	192,8	-1,3	-28,0
Local Government	100,0	-0,8	99,9	1,5	0,2
Social Security Funds	137,5	0,0	119,7	1,1	17,8
Total	**402,3**	**3,1**	**412,4**	**0,3**	**-10,0**

Indicator for 12- month moving totals 1998, August	Revenue Bill.FIM	%	Expenditure Bill.FIM	%	Net Bill.FIM
Central Government	178,2	11,7	198,0	1,2	-19,8
Local Government	100,6	-1,7	101,2	1,8	-0,6
Social Security Funds	141,9	3,3	120,0	0,6	21,9
Total	**420,8**	**5,4**	**419,3**	**1,2**	**1,4**

Estimates are based on annual forecasts

1998, Forecast	Revenue Bill.FIM	%	Expenditure Bill.FIM	%	Net Bill.FIM
Central Government	177,2	7,5	194,2	1,3	-17,1
Local Government	101,6	1,6	101,9	2,0	-0,3
Social Security Funds	143,3	4,2	120,2	0,4	23,1
Total	**422,1**	**4,9**	**416,4**	**1,0**	**5,7**

Concluding Remarks

Structural time series analysis is used to clarify the applicability of the central government cash data as indicators for government revenue and expenditure developments. The decomposition of time series into systematic and random walk components demonstrated the volatile character of monthly cash series. In most cases trend components were insignificant. But, nevertheless, estimated time series models produced quite plausible forecasts for the short-term developments of the central government income and expenditure items.

In principle estimated models can be used for several purposes. In monitoring process new observations can be analysed easily by checking what kind of changes new information causes to trend and short term forecast. For a longer term time series models are not satisfactory. This would require additional analysis information on macroeconomic developments and policy changes. This information can easily be included in structural time series models by adding exogenous variables to models. Structural time series models use both time series information that puts emphasis on latest developments and exogenous information.

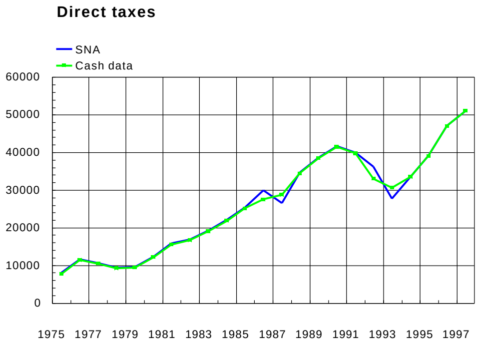
For the time being, the short-term indicators for the general government are only tentative demonstrating the data set at hands. Extremely rough estimates for the general government net lending were based on actual high frequency observations only for the central government complete cash data and the local government revenues. More reliable indicators require at least the data on the local government expenditure. Actually, data on local governments' consumption and investment spending would be available on quarterly basis but with a relatively long time lag. Also some data on social security funds would be available on quarterly basis but in practise the developments of social security funds is easy to forecast.

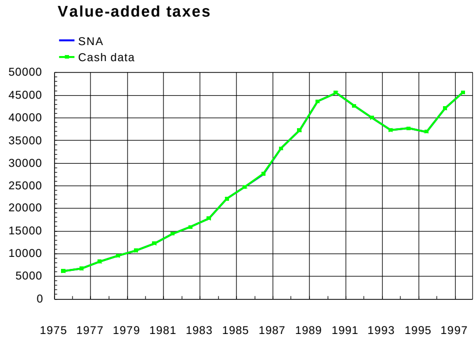
References

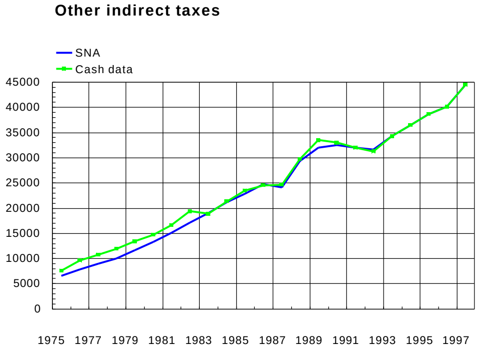
Harvey, A. C. (1990) **Forecasting, structural time series models and the Kalman filter**. Cambridge.

Appendix 1

Chart A1. **Central Government Revenue**







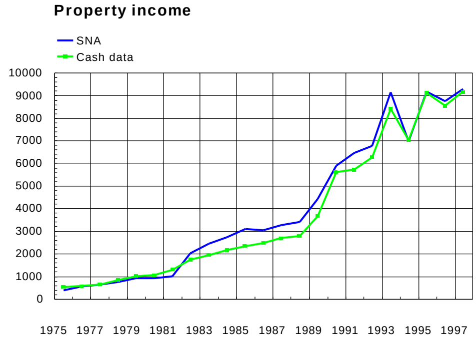
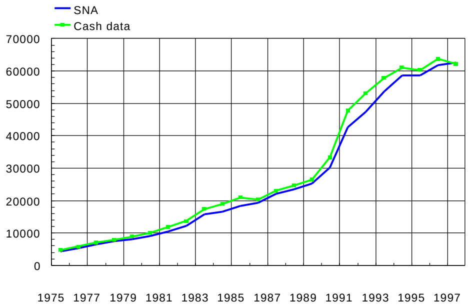
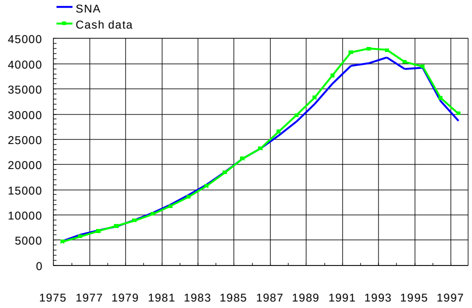


Chart A2. **Central Government Expenditure**

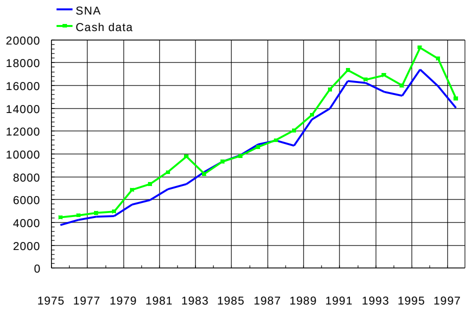
Transfers to households and social security funds



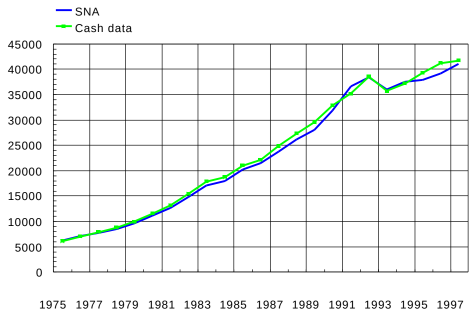
Transfers to local government



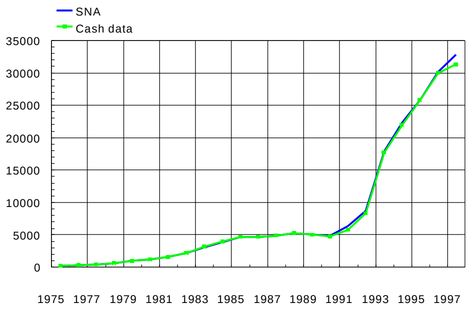
Subsidies



Consumption expenditure



Interest payments



Appendix 2

Table A1. **The Correspondence between SNA and Cash Concepts**

Revenues

National account, annual	**Cash based, monthly**
Direct taxes	Income and wealth tax + Other taxes based on income and property – Inheritance tax
Indirect taxes	VAT + Other taxes based on sales + Customs duties and import charges + Excise duties + Stamp duties + Motor car tax + Tax on vehicles using gasoil + Tax on capital transfers + Other taxes and similar revenue + Municipal VAT refund (annually) + VAT revenues to Social Insurance Institution (annually)
Property income	Interest income and withdrawals of profit + Bond issue gains
Miscellaneous income (residual) = Factor incomes +Requited current transfers less property income + Contributions to social security schemes + Other current transfers	
Total income	

Expenditure

Subsidies = Commodity subsidies + Other subsidies + Other transfers to firms + Net capital transfers to firms	State aid to industries
Transfers to households = Unfunded employee welfare benefit + Social security benefits + Social security grants + Other current transfers to social security funds + Other current transfers to households + Other current transfers to non-profit institution + Net capital transfers to households	State aid to households + Transfers to Social Insurance Institution + Pensions + Other transfer expenditure
Transfers to local governments = Other current transfers to local governments + Net capital transfers	= State aids to municipalities
Consumption expenditure	Total consumption expenditure – pensions
Interest expenditure	Interest payments on state debt + Bond issue gains
Other expenditure	
Total expenditure	

Appendix 3A Estimation results: Central Government Revenues

Direct Taxes

Equation 1. **TAXDIR = Trend + Trigo seasonal + Irregular**

```
 Estimation report
 Model with  4 hyperparameters ( 2 restrictions).
 Parameter estimation sample is 1990. 1 - 1998. 8. (T =  104).
 Log-likelihood kernel is -6.378305.
 Very strong convergence in  13 iterations.
 ( likelihood cvg 5.597847e-013
   gradient cvg   2.009948e-007
   parameter cvg  9.165058e-007 )

 Eq  1 : Diagnostic summary report.
 Estimation sample is 1990. 1 - 1998. 8. (T =  104, n =   91).
 Log-Likelihood is -663.344 (-2 LogL = 1326.69).
 Prediction error variance is 1.28125e+006

        Summary statistics
                 TAXDIR
 Std.Error        1132.
 Normality        4.897
 H( 30)         0.69923
 r( 1)        -0.010996
 r( 9)        -0.025725
 DW               2.004
 Q( 9, 6)         2.855
 Rsý            0.41866

Hyperparameters

Eq  1 : Estimated standard deviations of disturbances.
 Component         TAXDIR (q-ratio)
 Irr               894.48 ( 1.0000)
 Lvl              0.00000 ( 0.0000)
 Slp               7.8160 ( 0.0087)
 Sea               52.951 ( 0.0592)


 Eq  1 : Estimated coefficients of final state vector.

 Variable      Coefficient      R.m.s.e.       t-value
 Lvl              4933.7        327.97         15.043  [ 0.0000]**
 Slp              44.554        30.987         1.4378  [ 0.1539]
 Sea_ 1          -107.79        257.67      -0.418319  [ 0.6767]
 Sea_ 2          -227.62        265.81      -0.856327  [ 0.3941]
 Sea_ 3          -474.52        257.72        -1.8413  [ 0.0688]
 Sea_ 4           30.390        263.50       0.115334  [ 0.9084]
 Sea_ 5           221.18        257.76       0.858085  [ 0.3931]
 Sea_ 6          -190.35        263.13      -0.723386  [ 0.4713]
 Sea_ 7           433.96        257.83         1.6831  [ 0.0958]
 Sea_ 8           315.21        263.14         1.1979  [ 0.2341]
 Sea_ 9          -47.399        258.13      -0.183625  [ 0.8547]
 Sea_10          -454.05        263.87        -1.7208  [ 0.0887]
 Sea_11          -314.30        218.84        -1.4362  [ 0.1544]
```

Eq 1 : Seasonal analysis (at end of period).

Seasonal Chiý(11) test is 17.6004 [0.0913]   .

	Seas 1	Seas 2	Seas 3	Seas 4	Seas 5	Seas 6
Value	-918.1	-420.9	742.8	-438.0	1714.	-542.2
	Seas 7	Seas 8	Seas 9	Seas 10	Seas 11	Seas 12
Value	39.64	-288.9	-424.1	-643.4	731.5	447.5

Eqation 2. **TAXDIR = Trend + Trigo seasonal + Interv + Irregular**

Estimation report
Model with 4 hyperparameters (1 restrictions).
Parameter estimation sample is 1990. 1 - 1998. 8. (T = 104).
Log-likelihood kernel is -5.625997.
Very strong convergence in   6 iterations.
(likelihood cvg 1.578704e-016
  gradient cvg   1.317761e-007
  parameter cvg 1.357993e-012)

Eq 2 : Diagnostic summary report.

Estimation sample is 1990. 1 - 1998. 8. (T = 104, n =   91).
Log-Likelihood is -585.104 (-2 LogL = 1170.21).
Prediction error variance is 510314

Summary statistics

	TAXDIR
Std.Error	714.4
Normality	10.43
H(30)	0.73889
r(1)	0.039603
r(9)	0.10932
DW	1.900
Q(9, 6)	4.143
Rsý	0.76846

Eq 2 : Estimated standard deviations of disturbances.

Component	TAXDIR (q-ratio)
Irr	560.13 (1.0000)
Lvl	93.416 (0.1668)
Slp	4.5884 (0.0082)
Sea	34.120 (0.0609)

Eq 2 : Estimated coefficients of final state vector.

Variable	Coefficient	R.m.s.e.	t-value	
Lvl	4529.4	272.23	16.638	[0.0000]**
Slp	26.121	23.668	1.1036	[0.2727]
Sea_ 1	-149.68	168.94	-0.885976	[0.3780]
Sea_ 2	-111.79	180.42	-0.619639	[0.5370]
Sea_ 3	-130.51	174.22	-0.749105	[0.4557]
Sea_ 4	64.940	170.89	0.379998	[0.7048]
Sea_ 5	101.53	167.29	0.606895	[0.5454]
Sea_ 6	-421.98	176.49	-2.3909	[0.0189]*
Sea_ 7	310.05	172.45	1.7979	[0.0755]
Sea_ 8	241.80	169.53	1.4263	[0.1572]
Sea_ 9	-35.142	165.37	-0.21251	[0.8322]
Sea_10	-181.59	176.77	-1.0273	[0.3070]
Sea_11	-184.12	144.87	-1.271	[0.2070]

Eq 2 : Estimated coefficients of explanatory variables.

Variable	Coefficient	R.m.s.e.	t-value	
Irr 1992. 3	-3817.0	684.62	-5.5753	[0.0000]**
Irr 1992.12	-2616.1	686.21	-3.8123	[0.0003]**
Irr 1993. 1	-3256.4	680.46	-4.7856	[0.0000]**
Irr 1995. 2	-4144.0	678.96	-6.1034	[0.0000]**
Irr 1996.12	2126.6	701.17	3.0329	[0.0032]**
Irr 1998. 5	3381.4	771.55	4.3826	[0.0000]**

Eq 2 : Seasonal analysis (at end of period).

Seasonal Chiý(11) test is 19.7513 [0.0489] * .

	Seas 1	Seas 2	Seas 3	Seas 4	Seas 5	Seas 6
Value	771.3	78.70	897.3	-293.6	496.1	-375.1
	Seas 7	Seas 8	Seas 9	Seas 10	Seas 11	Seas 12
Value	167.7	-87.87	-438.4	-560.5	753.3	133.7

Value-added Taxes

Equation 3. **Taxva = Trend + Trigo seasonal + Interv + Irregular**

Estimation report
Model with 4 hyperparameters (2 restrictions).
Parameter estimation sample is 1990. 1 - 1998. 7. (T = 103).
Log-likelihood kernel is -5.313972.
Very strong convergence in 18 iterations.
(likelihood cvg 5.014206e-016
gradient cvg 2.571721e-007
parameter cvg 1.250144e-008)

Eq 3 : Diagnostic summary report.
Estimation sample is 1990. 1 - 1998. 7. (T = 103, n = 90).
Log-Likelihood is -547.339 (-2 LogL = 1094.68).
Prediction error variance is 167440

Summary statistics

	Taxva
Std.Error	409.2
Normality	2.511
H(30)	1.302
r(1)	-0.024519
r(9)	0.032710
DW	2.008
Q(9, 6)	4.454
Rsý	0.69788

Eq 3 : Estimated standard deviations of disturbances.

Component	Taxva (q-ratio)
Irr	293.86 (1.0000)
Lvl	0.00000 (0.0000)
Slp	3.7366 (0.0127)
Sea	25.031 (0.0852)

Eq 3 : Estimated coefficients of final state vector.

Variable	Coefficient	R.m.s.e.	t-value	
Lvl	4129.2	121.43	34.006	[0.0000] **
Slp	29.441	13.747	2.1416	[0.0349] *
Sea_ 1	-253.89	103.40	-2.4555	[0.0160] *
Sea_ 2	92.044	108.51	0.848226	[0.3986]
Sea_ 3	235.15	102.94	2.2843	[0.0247] *

Sea_ 4	293.79	107.30	2.738	[0.0075]	**
Sea_ 5	-19.656	103.80	-0.189357	[0.8502]	
Sea_ 6	-335.34	106.57	-3.1465	[0.0022]	**
Sea_ 7	-195.35	102.99	-1.8968	[0.0611]	
Sea_ 8	175.87	107.25	1.6399	[0.1045]	
Sea_ 9	51.887	103.89	0.499449	[0.6187]	
Sea_10	49.660	107.27	0.462932	[0.6445]	
Sea_11	65.053	88.069	0.738664	[0.4620]	

Eq 3 : Estimated coefficients of explanatory variables.

Variable	Coefficient	R.m.s.e.	t-value		
Irr 1995. 3	-1683.9	371.97	-4.5271	[0.0000]	**
Irr 1997. 2	-1719.8	378.76	-4.5406	[0.0000]	**
Irr 1997. 3	2136.3	382.56	5.5842	[0.0000]	**

Eq 3 : Seasonal analysis (at end of period).
Seasonal Chiý(11) test is 45.5662 [0.0000] **.

	Seas 1	Seas 2	Seas 3	Seas 4	Seas 5	Seas 6
Value	326.5	1086.	191.9	-972.6	-175.0	-256.9
	Seas 7	Seas 8	Seas 9	Seas 10	Seas 11	Seas 12
Value	-116.8	27.65	102.6	-18.52	61.08	-256.2

Other Indirect Taxes

Equation 4. **TAXINDO = Trend + Trigo seasonal + Interv + Irregular**

Estimation report
Model with 4 hyperparameters (2 restrictions).
Parameter estimation sample is 1990. 1 - 1998. 8. (T = 104).
Log-likelihood kernel is -4.815162.
Very strong convergence in 8 iterations.
(likelihood cvg 2.582363e-014
gradient cvg 2.220446e-010
parameter cvg 9.282785e-008)

Eq 4 : Diagnostic summary report.

Estimation sample is 1990. 1 - 1998. 8. (T = 104, n = 91).
Log-Likelihood is -500.777 (-2 LogL = 1001.55).
Prediction error variance is 70020.1

Summary statistics

	TAXINDO
Std.Error	264.6
Normality	1.741
H(30)	0.83873
r(1)	0.019275
r(9)	-0.074729
DW	1.939
Q(9, 6)	7.972
Rsý	0.69523

Eq 4 : Estimated coefficients of final state vector.

Variable	Coefficient	R.m.s.e.	t-value		
Lvl	4004.5	97.949	40.883	[0.0000]	**
Slp	7.9220	5.1151	1.5487	[0.1249]	
Sea_ 1	-44.996	73.432	-0.612755	[0.5416]	
Sea_ 2	70.982	81.337	0.872684	[0.3851]	
Sea_ 3	216.40	70.688	3.0613	[0.0029]	**
Sea_ 4	-93.331	76.137	-1.2258	[0.2234]	

```
 Sea_ 5          -3.2572        74.651    -0.0436324  [ 0.9653]
 Sea_ 6           63.262        71.130      0.889388  [ 0.3761]
 Sea_ 7           72.979        70.044        1.0419  [ 0.3002]
 Sea_ 8          -71.798        75.323     -0.953203  [ 0.3430]
 Sea_ 9           92.837        70.123        1.3239  [ 0.1888]
 Sea_10          -9.9515        75.785     -0.131312  [ 0.8958]
 Sea_11          -26.361        60.950     -0.432492  [ 0.6664]

 Eq  2 : Estimated coefficients of explanatory variables.

 Variable      Coefficient      R.m.s.e.       t-value
 Irr 1993. 2     -923.55        237.30        -3.892  [ 0.0002] **
 Irr 1993. 3      1203.1        237.00        5.0762  [ 0.0000] **
 Irr 1995. 6      800.30        236.41        3.3853  [ 0.0011] **
 Irr 1996. 2      901.62        237.89        3.7901  [ 0.0003] **
 Lvl 1997. 3      519.11        151.12        3.4351  [ 0.0009] **
 Irr 1997.10      1120.7        285.74        3.9222  [ 0.0002] **

 Eq  2 : Seasonal analysis (at end of period).

 Seasonal Chiý(11) test is 23.4464  [0.0153] * .

        Seas 1    Seas 2    Seas 3    Seas 4    Seas 5    Seas 6
Value    454.2     218.4    -19.35    -287.0    -114.8    -195.3
        Seas 7    Seas 8    Seas 9   Seas 10   Seas 11   Seas 12
Value    27.93     307.6    -70.53    -92.43    -119.3    -109.5
```

Property Income

Equation 5. **Korkotul = Trend + Trigo seasonal + Interv + Irregular**

```
 Estimation report
 Model with  4 hyperparameters ( 2 restrictions).
 Parameter estimation sample is 1990. 1 - 1998. 8. (T =  104).
 Log-likelihood kernel is -5.014632.
 Very strong convergence in  11 iterations.
 ( likelihood cvg 8.802734e-014
   gradient cvg   9.325873e-010
   parameter cvg  9.156385e-007 )

 Eq  5 : Diagnostic summary report.
 Estimation sample is 1990. 1 - 1998. 8. (T =  104, n =   91).
 Log-Likelihood is -521.522 (-2 LogL = 1043.04).
 Prediction error variance is 70763.6

        Summary statistics
               korkotul
 Std.Error        266.0
 Normality        1.751
 H( 30)         0.77866
 r( 1)       -0.0042464
 r( 9)         -0.15616
 DW               1.990
 Q( 9, 6)         9.114
 Rsý            0.66609

Eq 5 : Estimated standard deviations of disturbances.
 Component       korkotul (q-ratio)
 Irr               169.15 ( 1.0000)
 Lvl               9.7453 ( 0.0576)
 Slp              0.00000 ( 0.0000)
 Sea               22.066 ( 0.1305)
```

Eq 5 : Estimated coefficients of final state vector.

Variable	Coefficient	R.m.s.e.	t-value		
Lvl	785.90	52.113	15.081	[0.0000]	**
Slp	3.2435	1.2265	2.6445	[0.0096]	**
Sea_ 1	-217.53	75.970	-2.8634	[0.0052]	**
Sea_ 2	-233.35	88.120	-2.648	[0.0095]	**
Sea_ 3	-216.25	82.172	-2.6316	[0.0100]	**
Sea_ 4	299.68	82.068	3.6516	[0.0004]	**
Sea_ 5	196.50	80.805	2.4317	[0.0170]	*
Sea_ 6	59.637	83.772	0.711899	[0.4783]	
Sea_ 7	-144.28	82.705	-1.7445	[0.0845]	
Sea_ 8	-116.62	82.761	-1.4091	[0.1622]	
Sea_ 9	-0.926768	76.589	-0.0121005	[0.9904]	
Sea_10	259.19	88.560	2.9267	[0.0043]	**
Sea_11	-68.071	69.799	-0.975242	[0.3320]	

Eq 5 : Estimated coefficients of explanatory variables.

Variable	Coefficient	R.m.s.e.	t-value		
Irr 1997.11	797.81	289.08	2.7598	[0.0070]	**
Irr 1998. 4	1162.9	289.13	4.022	[0.0001]	**

Eq 5 : Seasonal analysis (at end of period).

Seasonal Chiý(11) test is 59.5041 [0.0000] **.

	Seas 1	Seas 2	Seas 3	Seas 4	Seas 5	Seas 6
Value	133.7	-406.6	305.6	1205.	173.8	-127.5
	Seas 7	Seas 8	Seas 9	Seas 10	Seas 11	Seas 12
Value	-386.6	-450.6	75.60	-259.6	106.2	-369.2

Appendix 3B Estimation results: Central Government Expenditure

Transfers to Households

```
Equation  1. TSKOTIT = Trend + Trigo seasonal + Interv + Irregular

 Estimation report
 Model with  4 hyperparameters ( 1 restrictions).
 Parameter estimation sample is 1990. 1 - 1998. 8. (T =  104).
 Log-likelihood kernel is -5.339905.
 Very strong convergence in   9 iterations.
 ( likelihood cvg 2.012575e-014
   gradient cvg   2.279658e-009
   parameter cvg  4.020391e-007 )

 Eq  1 : Diagnostic summary report.

 Estimation sample is 1990. 1 - 1998. 8. (T =  104, n =   91).
 Log-Likelihood is -555.35 (-2 LogL = 1110.7).
 Prediction error variance is 174485

        Summary statistics
                TSKOTIT
 Std.Error        417.7
 Normality        1.627
 H( 30)           1.621
 r( 1)         -0.10644
 r( 9)         0.049713
 DW               2.162
 Q( 9, 6)         3.693
 Rsý            0.66668

Eq  1 : Estimated standard deviations of disturbances.
 Component       TSKOTIT (q-ratio)
 Irr              262.49 ( 1.0000)
 Lvl              73.884 ( 0.2815)
 Slp              2.3853 ( 0.0091)
 Sea              27.461 ( 0.1046)


 Eq  1 : Estimated coefficients of final state vector.

 Variable      Coefficient      R.m.s.e.       t-value
 Lvl              5462.3        155.78        35.063  [ 0.0000] **
 Slp              13.665        14.205      0.961984  [ 0.3386]
 Sea_ 1          -368.26        108.94       -3.3803  [ 0.0011] **
 Sea_ 2           26.562        115.84      0.229301  [ 0.8191]
 Sea_ 3          -65.346        104.47     -0.625481  [ 0.5332]
 Sea_ 4          -393.23        109.15       -3.6025  [ 0.0005] **
 Sea_ 5           244.98        104.61        2.3419  [ 0.0214] *
 Sea_ 6           152.03        106.86        1.4228  [ 0.1582]
 Sea_ 7          -491.75        103.38       -4.7568  [ 0.0000] **
 Sea_ 8           255.64        107.43        2.3796  [ 0.0194] *
 Sea_ 9           154.77        103.60        1.4939  [ 0.1387]
 Sea_10          -9.9043        108.05    -0.0916669  [ 0.9272]
 Sea_11           162.74        88.534        1.8381  [ 0.0693]
```

Eq 1 : Estimated coefficients of explanatory variables.

Variable	Coefficient	R.m.s.e.	t-value		
Lvl 1991. 4	1030.7	246.20	4.1863	[0.0001]	**
Irr 1994.12	-2661.1	368.69	-7.2175	[0.0000]	**
Irr 1996.12	1260.4	377.97	3.3347	[0.0012]	**

Eq 1 : Seasonal analysis (at end of period).

Seasonal Chiý(11) test is 72.7335 [0.0000] **.

	Seas 1	Seas 2	Seas 3	Seas 4	Seas 5	Seas 6
Value	782.9	-425.8	223.9	199.5	-453.8	619.9
	Seas 7	Seas 8	Seas 9	Seas 10	Seas 11	Seas 12
Value	-443.7	-362.9	-361.3	-440.8	- 724.5	1387.

Transfers to Local Government

Equation 2.
tskunta = Trend + Trigo seasonal + Interv + Irregular
Estimation report
Model with 4 hyperparameters (2 restrictions).
Parameter estimation sample is 1990. 1 - 1998. 8. (T = 104).
Log-likelihood kernel is -5.304543.
Very strong convergence in   8 iterations.
(likelihood cvg 1.674373e-016
gradient cvg   6.514789e-008
parameter cvg 7.05022e-013)

Eq 2 : Diagnostic summary report.

Estimation sample is 1990. 1 - 1998. 8. (T = 104, n =   91).
Log-Likelihood is -551.672 (-2 LogL = 1103.34).
Prediction error variance is 143324

Summary statistics	tskunta
Std.Error	378.6
Normality	9.944
H(30)	4.684
r(1)	0.15914
r(9)	0.11273
DW	1.553
Q(9, 6)	13.27
Rsý	0.81728

Eq 2 : Estimated coefficients of final state vector.

Variable	Coefficient	R.m.s.e.	t-value		
Lvl	2759.3	181.70	15.186	[0.0000]	**
Slp	-3.0062	13.496	-0.222746	[0.8242]	
Sea_ 1	-474.37	112.34	-4.2224	[0.0001]	**
Sea_ 2	-169.88	115.54	-1.4703	[0.1449]	
Sea_ 3	49.116	94.904	0.517534	[0.6060]	
Sea_ 4	-13.419	103.93	-0.129117	[0.8976]	
Sea_ 5	-157.74	88.830	-1.7758	[0.0791]	
Sea_ 6	127.41	101.10	1.2602	[0.2108]	
Sea_ 7	-138.11	89.957	-1.5353	[0.1282]	
Sea_ 8	-109.74	98.692	-1.1119	[0.2691]	
Sea_ 9	13.643	94.449	0.14445	[0.8855]	
Sea_10	5.7351	93.222	0.0615211	[0.9511]	
Sea_11	-125.97	79.025	-1.5941	[0.1144]	

Eq 2 : Estimated coefficients of explanatory variables.

Variable	Coefficient	R.m.s.e.	t-value		
Irr 1997. 7	-5859.4	316.75	-18.499	[0.0000]	**
Irr 1998. 3	-2903.7	373.64	-7.7714	[0.0000]	**

Eq 2 : Seasonal analysis (at end of period).

Seasonal Chiý(11) test is 43.406 [0.0000] **.

	Seas 1	Seas 2	Seas 3	Seas 4	Seas 5	Seas 6
Value	794.2	403.5	490.2	226.6	230.3	-85.42
	Seas 7	Seas 8	Seas 9	Seas 10	Seas 11	Seas 12
Value	-141.7	-833.4	-264.4	-222.8	-352.8	-244.4

Transfers to Enterprises

Tsyrit = Trend + Trigo seasonal + Interv + Irregular

```
Estimation report
Model with  4 hyperparameters ( 3 restrictions).
Parameter estimation sample is 1990. 1 - 1998. 8. (T =  104).
Log-likelihood kernel is -4.904088.
Very strong convergence in   6 iterations.
( likelihood cvg 9.2366e-015
  gradient cvg   1.328715e-007
  parameter cvg  5.455335e-009 )
```

Eq 3 : Diagnostic summary report.

```
Estimation sample is 1990. 1 - 1998. 8. (T =  104, n =   91).
Log-Likelihood is -510.025 (-2 LogL = 1020.05).
Prediction error variance is 73942.9
```

Summary statistics

	Tsyrit
Std.Error	271.9
Normality	3.160
H(30)	1.284
r(1)	0.076315
r(9)	-0.037160
DW	1.770
Q(9, 6)	12.55
Rsý	0.85211

Eq 3 : Estimated coefficients of final state vector.

Variable	Coefficient	R.m.s.e.	t-value		
Lvl	1325.8	42.440	31.24	[0.0000]	**
Slp	-0.631337	0.689488	-0.91566	[0.3623]	
Sea_ 1	22.634	78.085	0.289862	[0.7726]	
Sea_ 2	726.21	86.784	8.368	[0.0000]	**
Sea_ 3	-528.89	84.969	-6.2244	[0.0000]	**
Sea_ 4	166.28	81.438	2.0418	[0.0441]	*
Sea_ 5	-130.69	78.491	-1.665	[0.0994]	
Sea_ 6	-40.581	88.107	-0.460592	[0.6462]	
Sea_ 7	-182.29	85.337	-2.1361	[0.0354]	*
Sea_ 8	-128.03	81.848	-1.5643	[0.1212]	
Sea_ 9	117.05	78.886	1.4837	[0.1413]	
Sea_10	-386.89	89.171	-4.3387	[0.0000]	**
Sea_11	247.49	70.126	3.5293	[0.0007]	**

Eq 3 : Estimated coefficients of explanatory variables.

Variable	Coefficient	R.m.s.e.	t-value		
Irr 1995. 3	2476.2	250.77	9.8744	[0.0000]	**
Irr 1995.10	-2293.5	252.59	-9.0801	[0.0000]	**
Irr 1995.11	2095.3	258.07	8.1191	[0.0000]	**
Irr 1996. 1	1753.4	252.27	6.9507	[0.0000]	**
Irr 1997.11	-892.88	309.77	-2.8824	[0.0049]	**

Eq 3 : Seasonal analysis (at end of period).

Seasonal Chiý(11) test is 181.515 [0.0000] **.

	Seas 1	Seas 2	Seas 3	Seas 4	Seas 5	Seas 6
Value	-243.1	-472.7	-435.0	-306.5	-280.8	-415.2
	Seas 7	Seas 8	Seas 9	Seas 10	Seas 11	Seas 12
Value	-664.8	-454.7	-340.4	2022.	479.0	1112.

Consumption Expenditure

Equation 4.
Kulutus = Trend + Trigo seasonal + Irregular
Estimation report
Model with 4 hyperparameters (2 restrictions).
Parameter estimation sample is 1990. 1 - 1998. 8. (T = 104).
Log-likelihood kernel is -5.569055.
Very strong convergence in 8 iterations.
(likelihood cvg 0
gradient cvg 6.110668e-008
parameter cvg 2.226778e-013)

Eq 4 : Diagnostic summary report.

Estimation sample is 1990. 1 - 1998. 8. (T = 104, n = 91).
Log-Likelihood is -579.182 (-2 LogL = 1158.36).
Prediction error variance is 204018

Summary statistics

	Kulutus
Std.Error	451.7
Normality	1038.
H(30)	3.689
r(1)	-0.087918
r(9)	0.041759
DW	2.163
Q(9, 6)	7.997
Rsý	0.49508

Eq 1 : Estimated coefficients of final state vector.

Variable	Coefficient	R.m.s.e.	t-value		
Lvl	3576.0	142.77	25.048	[0.0000]	**
Slp	8.7015	6.2754	1.3866	[0.1689]	
Sea_ 1	-52.646	117.47	-0.448176	[0.6551]	
Sea_ 2	245.95	123.94	1.9844	[0.0502]	
Sea_ 3	-69.486	114.91	-0.60471	[0.5469]	
Sea_ 4	-598.67	119.32	-5.0174	[0.0000]	**
Sea_ 5	89.763	114.44	0.784368	[0.4349]	
Sea_ 6	-307.04	118.47	-2.5917	[0.0111]	*
Sea_ 7	-616.41	114.34	-5.3908	[0.0000]	**
Sea_ 8	488.81	118.34	4.1306	[0.0001]	**
Sea_ 9	-80.024	114.66	-0.6979	[0.4870]	
Sea_10	-93.024	119.17	-0.780581	[0.4371]	
Sea_11	-2.2616	98.028	-0.0230714	[0.9816]	

```
Eq  1 : Seasonal analysis (at end of period).

Seasonal Chiý(11) test is 105.075  [0.0000] **.

        Seas 1    Seas 2    Seas 3    Seas 4    Seas 5    Seas 6
Value    116.6    -645.2     387.4    -738.6    -1005.     832.8
        Seas 7    Seas 8    Seas 9   Seas 10   Seas 11   Seas 12
Value    625.2    -731.1    -26.29    -463.6    -84.69     1732.


kulutse1 added to database



Equation  5.

Kulutus = Trend + Trigo seasonal + Interv + Irregular

Estimation report
Model with  4 hyperparameters ( 2 restrictions).
Parameter estimation sample is 1990. 1 - 1998. 8. (T =  104).
Log-likelihood kernel is -5.08639.
Very strong convergence in   8 iterations.
( likelihood cvg 2.198449e-013
  gradient cvg   1.332268e-010
  parameter cvg  6.55876e-007 )

Eq  5 : Diagnostic summary report.

Estimation sample is 1990. 1 - 1998. 8. (T =  104, n =   91).
Log-Likelihood is -528.985 (-2 LogL = 1057.97).
Prediction error variance is 97335.9

       Summary statistics
               Kulutus
Std.Error        312.0
Normality      0.29287
H( 30)           1.836
r( 1)        -0.073756
r( 9)          0.23622
DW               2.125
Q( 9, 6)         24.58
Rsý            0.75910


Eq  5 : Estimated coefficients of final state vector.

Variable      Coefficient      R.m.s.e.       t-value
Lvl              3619.5        121.83        29.708  [ 0.0000] **
Slp              9.4967        6.2030         1.531  [ 0.1292]
Sea_ 1           56.302        93.024      0.605236  [ 0.5465]
Sea_ 2           77.991        101.11      0.771358  [ 0.4425]
Sea_ 3          -244.77        93.401       -2.6207  [ 0.0103] *
Sea_ 4          -516.13        93.045       -5.5471  [ 0.0000] **
Sea_ 5           67.384        81.337      0.828453  [ 0.4096]
Sea_ 6          -303.22        105.81       -2.8657  [ 0.0052] **
Sea_ 7          -441.92        91.665        -4.821  [ 0.0000] **
Sea_ 8           629.58        91.630        6.8709  [ 0.0000] **
Sea_ 9          -179.04        88.360       -2.0263  [ 0.0457] *
Sea_10          -271.84        95.864       -2.8357  [ 0.0056] **
Sea_11          -47.354        79.648     -0.594542  [ 0.5536]
```

```
 Eq  5 : Estimated coefficients of explanatory variables.

 Variable      Coefficient      R.m.s.e.       t-value
 Irr 1994.12      2227.4        259.93        8.5691  [ 0.0000] **
 Irr 1998. 1      1194.9        328.52        3.6374  [ 0.0005] **
 Irr 1998. 5     -1305.9        331.87       -3.9349  [ 0.0002] **

 Eq  5 : Seasonal analysis (at end of period).

 Seasonal Chiý(11) test is 214.891  [0.0000] **.

         Seas 1    Seas 2    Seas 3    Seas 4    Seas 5    Seas 6
 Value   -556.3    -678.7     440.5    -870.4    -259.2     856.5
         Seas 7    Seas 8    Seas 9   Seas 10   Seas 11   Seas 12
 Value    651.6    -789.4     47.85    -522.0    -40.42     1720.
```

Interest Payments

```
Equation  3.
 korot = Trend + Trigo seasonal + Interv + Irregular

 Estimation report
 Model with  4 hyperparameters ( 3 restrictions).
 Parameter estimation sample is 1990. 1 - 1998. 8. (T =  104).
 Log-likelihood kernel is -5.545437.
 Very strong convergence in  20 iterations.
 ( likelihood cvg 1.601638e-016
   gradient cvg   8.881784e-011
   parameter cvg  1.992974e-008 )

 Eq  3 : Diagnostic summary report.

 Estimation sample is 1990. 1 - 1998. 8. (T =  104, n =   91).
 Log-Likelihood is -576.725 (-2 LogL = 1153.45).
 Prediction error variance is 241087

        Summary statistics
                  korot
 Std.Error        491.0
 Normality        10.98
 H( 30)           3.443
 r( 1)          0.13554
 r( 9)         -0.14329
 DW               1.680
 Q( 9, 6)         10.18
 Rsý            0.79798

 Eq  3 : Estimated coefficients of final state vector.

 Variable      Coefficient      R.m.s.e.       t-value
 Lvl              2282.2        247.41        9.2243  [ 0.0000] **
 Slp              22.300        3.9735        5.6122  [ 0.0000] **
 Sea_ 1          -986.78        179.30       -5.5036  [ 0.0000] **
 Sea_ 2          -912.18        165.19       -5.5219  [ 0.0000] **
 Sea_ 3           627.71        146.60        4.2818  [ 0.0000] **
 Sea_ 4           1299.7        174.95        7.4288  [ 0.0000] **
 Sea_ 5           125.95        138.56      0.908929  [ 0.3658]
 Sea_ 6           169.13        160.35        1.0547  [ 0.2943]
 Sea_ 7          -1338.0        139.23       -9.6099  [ 0.0000] **
 Sea_ 8           122.25        153.12       0.79836  [ 0.4267]
 Sea_ 9           613.23        145.69        4.2091  [ 0.0001] **
 Sea_10           741.39        160.20        4.6278  [ 0.0000] **
 Sea_11          -560.33        131.87       -4.2492  [ 0.0001] **
```

Eq 3 : Estimated coefficients of explanatory variables.

Variable	Coefficient	R.m.s.e.	t-value		
Lvl 1993. 4	577.57	139.99	4.1257	[0.0001]	**
Lvl 1998. 6	-842.50	295.01	-2.8559	[0.0053]	**

Eq 3 : Seasonal analysis (at end of period).

Seasonal Chiý(11) test is 448.059 [0.0000] **.

	Seas 1	Seas 2	Seas 3	Seas 4	Seas 5	Seas 6
Value	1781.	-1023.	4077.	2559.	-1065.	-105.6
	Seas 7	Seas 8	Seas 9	Seas 10	Seas 11	Seas 12
Value	-1158.	-1518.	1473.	-930.3	-1745.	-2344.

Eq 3 : Forecasts for korot.

Period	Forecast	R.m.s.e.	- Rmse	+ Rmse
1998. 9	3777.1	533.20	3244.0	4310.3
1998.10	1396.5	535.01	861.48	1931.5
1998.11	603.82	535.28	68.544	1139.1
1998.12	27.160	536.47	-509.31	563.63
1999. 1	4174.8	536.68	3638.1	4711.5
1999. 2	1393.0	537.36	855.64	1930.4
1999. 3	6514.8	537.52	5977.3	7052.3
1999. 4	5019.8	537.83	4482.0	5557.6
1999. 5	1417.5	537.94	879.53	1955.4
1999. 6	2399.6	538.01	1861.6	2937.6
1999. 7	1369.8	538.05	831.78	1907.9
1999. 8	1031.6	538.03	493.56	1569.6
1999. 9	4044.7	760.64	3284.1	4805.4
1999.10	1664.1	761.62	902.47	2425.7
1999.11	871.42	761.88	109.54	1633.3
1999.12	294.76	762.47	-467.71	1057.2
2000. 1	4442.4	762.68	3679.7	5205.1
2000. 2	1660.6	762.97	897.63	2423.6
2000. 3	6782.4	763.13	6019.3	7545.5
2000. 4	5287.4	763.22	4524.2	6050.6

1/99	Helvi Kinnunen Cash data for the Central Government: Time Series Analysis, 36 p. 8.2.1999