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The Sources of Output Shocks in Finland and Other EU Countries

SUOMEN PANKIN KESKUSTELUALOITTEITA • FINLANDS BANKS DISKUSSIONUNDERLAG

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Abstract

This paper examines the sources of output shocks in Finland as compared to other EU countries. The data consists of output fluctuations in main industries in nine current EU countries for the period 1978–93. The sources of output shock are considered to consist of country-specific factors, sector-specific factors and a time factor, which is common to all countries and sectors. Fluctuation is partitioned using three-dimensional analysis of variance.

Output shocks in Finland are clearly more country-specific than in other EU countries. A separate examination of the time period preceding the 1990s demonstrates that the result is not due to the exceptional recession in the beginning of the 1990s. The more central role that the country-specific factor has in Finland as compared to other EU countries is explained by the fact that average output growth was higher in Finland than in other EU countries until the end of the 1980s. Differences in growth rates between sectors also were larger than in other countries. Examination of the time period including the recession revealed that idiosyncratic economic cycle was clearly a more significant source of disturbances in Finland than in other countries. Examining the time period covering the depression also underlines the large volatility of the sheltered sector in Finland.

Key words: output shocks, output by industry, variance partitioning, EU countries

Tiivistelmä

Tässä selvityksessä tarkastellaan Suomen ja muiden EU-maiden tuotannon vaihtelun lähteitä. Aineistona on tuotannon muutos kansantalouden päätoimialoilla yhdeksässä EU-maassa vuosina 1978–1993. Tuotannon vaihtelun lähteinä tarkastellaan maakohtaisia ja toimialatekijöitä sekä aikatekijää, joka on yhteinen kaikille maille ja toimialoille. Vaihtelun ositus tehdään kolmiulotteisen varianssianalyysin avulla.

Suomen tuotannon kasvun häiriöt ovat muiden EU-maiden häiriöihin verrattuna selvästi enemmän lähtöisin kotimaasta. Erillinen tarkastelu aikaperiodilta ennen 1990-lukua osoittaa, että tulos ei johdu 1990-luvun alun poikkeuksellisesta lamasta. Maakohtaisen tekijän muiden EU-maiden vastaavaa tekijää keskeisempi merkitys Suomessa selittyy sillä, että 1980-luvun loppuun saakka tuotannon keskimääräinen kasvu oli Suomessa nopeampaa kuin muissa EU-maissa. Myös toimialojen väliset kasvuvauhdin erot olivat suurempia kuin muissa maissa. Lamavuosien yli ulottuvassa tarkastelussa maakohtainen suhdannevaihtelu osoittautuu Suomessa selvästi suuremmaksi häiriölähteeksi kuin muissa maissa. Lamavuosien yli ulottuvassa tarkastelussa korostuu myös Suomen suljetun sektorin tuotannon suuri heilahtelevuus.

Asiasanat: tuotanto toimialoittain, häiriö, varianssihajotelma, EU-maat

Contents

1 Introduction

Development towards a single currency area has increased interest in examining economic disturbances. To minimize the cost of relinquishing national monetary and exchange policies, the disturbances faced by member countries in a currency union should be as similar as possible, ie symmetrical. In practice, however, symmetrical disturbances average so that internal, country-specific disturbances have a relatively small effect on output fluctuation and further that countries react to the disturbances of international economy in roughly the same manner.

The nature of disturbances has been studied statistically by examining fluctuations in total output or manufacturing output in selected country groups. A coarse perception of the nature of shocks can be obtained by studying how the economic cycles have coincided in various countries (eg Tarkka and Åkerholm, 1993; Ahonen and Pyyhtiä, 1996).

Partitioning the output fluctuation into country-specific or aggregate components gives a more detailed picture of the sources of disturbances; in this case it is assumed that country-specific factors and aggregate factors are not mutually dependent. If the share of country-specific factors in the total output fluctuation is small, it can be deduced that the disturbances faced by an examined country group are not country-specific (ie asymmetrical), and/or these countries react to aggregate sources of disturbances in roughly the same manner (Aoki partitioning).

However, partitioning does not show whether the source of disturbance is based on demand or on supply. Nor can it be used to separate disturbances to the economy from the fluctuations caused by reactions to these disturbances in economic policy. An attempt has been made to specify sources of disturbances to economic cycles by assuming that supply-side disturbances have a permanent effect on output and price level, and demand-side disturbances only have a permanent effect on price level (Bayoumi and Eichengreen, 1993).

Determining country-specific shocks using a residual method in which aggregate fluctuation of the examined country group is deducted from the output fluctuation of a single country, may however cause overvaluation of the country-specific disturbance factor. Country-specific shocks can be measured more accurately when the notion of aggregate fluctuation is expanded to incorporate industry-specific output fluctuation along with aggregate economic cycle. Industry-specific output fluctuation may result from eg technical development or from changing consumer preferences. It cannot result from idiosyncratic economic policy, and therefore there is no need to respond by adjusting monetary policy. The possibility of industry-specific sources of disturbances has been taken into account in the statistical analysis by assuming that output fluctuation is caused by three independent components, ie country-specific and industry-specific components as well as aggregate fluctuation (Bayoumi and Prasad, 1996).

Finland was included in the examined country group as the asymmetry of shocks, ie sources of economic growth fluctuation, were studied by testing the symmetry of economic cycles (Tarkka and Åkerholm (1993), Bayoumi and Eichengreen (1993), Ahonen and Pyyhtiä (1996)). This paper examines sources of output shocks in Finland compared to other EU countries using a data set that also enables the separation of industry-specific fluctuation. A 1-digit industrial classification is used in order to be able to also examine fluctuations and the sources of fluctuation in the sheltered sector.

The variable under examination is output fluctuation by industry and by country. The data covers nine EU countries. The results are comparable to those of the analysis by Bayoumi and Prasad for the same industry classification is used. On the other hand, this paper examines a more recent period and the country group is somewhat larger.

The sources of fluctuations are examined by analysis of variance. This method was used by Peisa (1989) in his study based on industry data in Finland and Stockman (1988) in his analysis of country groups. Analysis of variance has traditionally been used relatively seldom in analysing economic time series. However, it is especially suited for examining the question of this study, for compared to eg the dummy technique it is clearly more illustrative method, and variables describing interaction effects of classification factors can easily be added to sources of fluctuation.

The study begins by examining the effects of country-specific, industry-specific and time factors to output fluctuation covering the whole data set using analysis of variance. The interaction effects of these factors are considered along with the main effects. Therefore eg country-specific factors may either have a direct effect on output fluctuation or they may have an interaction effect with the time factor, ie an idiosyncratic economic cycle. Country-specific factors may also be combined with industry-specific factors, in which case the fluctuation of average growth of industries is examined by country. Industry-specific and country-specific components are further partitioned by country and by industry. In addition to analysis of variance, the factors of output fluctuation in Finland are also examined visually.

2 Data set

Data series for the fluctuation of output by major industries were collected from OECD's "National Accounts." The following industries were examined:

1. Agriculture, hunting, forestry and fishing
2. Mining and quarrying
3. Manufacturing
4. Electricity, gas and water
5. Construction
6. Wholesale and retail trade, restaurants and hotels
7. Transport, storage and communication
8. Finance, insurance, real estate and business services
9. Community, social and personal services
10. Producers of government services.

Under this industry classification, data concerning the output fluctuation was available from nine countries: Austria, Denmark, Finland, France, Germany, Greece, Italy, Sweden and the United Kingdom. The study covered the years 1978–93. The total

number of observations concerning industry-specific output fluctuations by country was 1440.[1]

Analysis of economic growth on the basis of industry-specific data means in practice that aggregate fluctuation by country measures the average output growth by industry and not the fluctuation of total output. In other words, in the following analysis the industries are not weighted on the basis of their relative share.

The average output growth rate by country in the data set is 2.1% (Table 1). The distribution is not completely normal. It is, however, nearly symmetrical, but shows insufficient kurtosis. This may decrease the efficiency of statistical tests.

Table 1. **Basic statistics; Output growth in 9 European countries and in 10 industries in 1978–93**

Number of observations	1440
Mean	2.086
Median	2.259
Minimum	–23.12
Maximum	35.84
Variance	2.356
Skewness	0.0328
Kurtosis	6.081
Normality test	Chi^2 (2) = 779[0.000]***

3 Sources of output fluctuation

Partitioning output fluctuation into aggregate, industry-specific and country-specific fluctuations is examined using analysis of variance by interpreting country-specific and industry-specific factors as well as the time factor measuring aggregate component as independent grouping factors. The observations are classified according to these factors and are interpreted as consisting of mean deviations and residuals. The residuals are assumed to be normally distributed at zero mean.

The partitioning of fluctuation of output growth according to the above-mentioned three grouping factors results in six sources of fluctuation. Through variance analysis, we discern main effects and interaction effects. In this model the main effects are caused by country-specific, industry-specific and time factors. The interaction effects are caused by interaction of factors, ie time-country factor, time-industry factor and industry-country factor.

The estimation problem can be defined as determining the variance components to the following model (1).

(1) $y_{ijt} = a_i + b_j + c_t + d_{jt} + e_{it} + f_{ji} + u_{ijt}$,

[1] The data set was not complete. The observation of Great Britain's community, social and personal services for 1993 was lacking and was replaced by the growth rate of government services. As regards Italy, the community, social and personal services formed a single industry with finance, insurance, real estate and business service. Both industries were assumed to have grown at the same rate. In Denmark highly exceptional fluctuation in mining and quarrying in some years also presented a problem. To prevent this from distorting the results, anomalous observations were replaced by average fluctuation of the industry in question.

for j = 1...9, i = 1...10, t = 1978...1993. Here y is growth in output measured as a change in logarithm, j is country, i is industry and t time. Econometrically speaking, the problem lies in estimating the fixed effects of model (1).

Coefficient a_i is industry-specific factor, which is time and country invariant, b_j measures country-specific factor, which is industry and time invariant, and c_t measures the country and industry invariant time-specific variation. The term d_{jt} measures the industry invariant interaction effect of time and country, e_{it} measures the country invariant effect of time and industry, and f_{ji} measures the time invariant interaction effect of country and industry. Coefficient u_{ijt} is the idiosyncratic, normally distributed residual, which captures the interactive effects of all the three factors.

The coefficients of the variables in model (1) can be calculated by the deviations of different group means.

$$a_i = \sum_i (\bar{y}_{i..} - \bar{y}_{...})^2 / I$$

$$b_j = \sum_j (\bar{y}_{.j.} - \bar{y}_{...})^2 / J$$

$$c_t = \sum_t (\bar{y}_{..t} - \bar{y}_{...})^2 / T$$

$$d_{jt} = \sum_{j,t} (\bar{y}_{.jt} - \bar{y}_{.j.} - \bar{y}_{..t} + \bar{y}_{...}) / JT$$

$$e_{it} = \sum_{i,t} (\bar{y}_{i.t} - \bar{y}_{i..} - \bar{y}_{..t} + \bar{y}_{...}) / IT$$

$$f_{ji} = \sum_{j,i} (\bar{y}_{ji.} - \bar{y}_{i..} - \bar{y}_{.j.} + \bar{y}_{...}) / JT,$$

where I is the number of industries (=10),
J is the number of countries (=9) and
T is the number of years (=16).
$\bar{y}_{i..}$ is the average growth rate of each industry,
$\bar{y}_{.j.}$ is the average growth rate of each country,
$\bar{y}_{..t}$ is the average growth rate on each year,
$\bar{y}_{...}$ is the average growth rate of the entire data set.

The result of the variance partitioning is presented in Table 2. The sums of square decomposition (SSD) are coefficient estimates of different classification components (fixed effect), f is the number of degrees of freedom and s^2 are variance estimates. The significance of different effects is tested with variance ratio v(2), which is calculated as the ratio of the variance estimate for each factor and residual variance. The last column presents the critical values of F-test at different degrees of freedom.

Table 2. **The variance partitioning of output fluctuation in relation to three classification components**

Source of fluctuation	**SSD**	**F**	**s(2)**	**v(2)**	**$F_{0.005}$(f,1080)**
Variation					
Between countries (b_i)	0.01278	J–1=8	0.001598	0.92	2.76
Between industries (a_I)	0.18263	I–1=9	0.020292	11.74	2.64
Between years (c_t)	0.24753	T–1=15	0.016502	9.55	2.21
Interaction					
Countries and industries (f_{ii})	0.15088	(J–1)(I–1)=72	0.002096	1.21	1.51
Countries and time (d_{it})	0.40027	(J–1)(T–1)=120	0.003336	1.93	1.4
Industries and time (e_{it})	0.53250	(I–1)(T–1)=135	0.003944	2.28	1.37
Within sets	1.86712	(J–1)(I–1)(T–1)=1080	0.001729		
Total	**3.403961**	**1439**	**0.047898**		

Country-specific, industry-specific and time factors explained some 45% of the total variation of output fluctuation. The deviance of variance estimates of industry-specific factor (a_i), time factor (c_t), time-country factor (d_{jt}) and industry-time factor (e_{it}) from the residual variance was statistically significant.

The variance partitioning shows that in the EU countries under study aggregate factors have a stronger influence on output growth than country-specific factors. In variance analysis, time and industry-specific factors and their interaction effect are classified as country invariant aggregate source of variation. Jointly, these factors explain a third of the total output fluctuation. The share of country-specific factors is clearly smaller, ie 12%. The result roughly corresponds to results of a study by Bayoumi and Prasad using a similar data set, where general and industry-specific economic cycles explain 32–38% of the fluctuation of output growth, and country-specific factors explain 21–13% of the fluctuation.

The variance partitioning also shows (Table 2) that industry-specific factors affect output fluctuation in two ways. First, industries appear to exhibit typical growth rates (the variance ratio of a_i 11.4, $F_{0.005}$ = 2.64). Secondly, they would appear to be characterized by country invariant economic cycles. The coefficient estimate of the interaction effect of the industry-time factor is statistically significant (the variance ratio of e_{it} = 2.3, $F_{0.005}$ = 1.37). However, the interaction effect of the industry-country factor is not statistically significant (the variance ratio of f_{ji} = 1.2, $F_{0.005}$ = 1.51), which means that the average growth rates by industries are country invariant.

The average growth rate by industry reflects long term growth trends of different industries. We can see from Table 3 that growth rate has been faster than average in energy, transport and communication sectors as well as in private service and finance sectors. This result is natural, for in these industries the technological development has advanced most during the last decades, and also for the fact that demand typically concentrates on services as the standard of living rises. In construction sector the growth rate has been slower than average. The volatility in construction and transport and communication industries as well as in energy production has clearly exceeded the average variation. The growth rate was more stable than average in the trade sector and production of public services (Table 3; fluctuation measured by sum of square decomposition, SSD).

The interaction effect of time-industry factor, partitioned into industry-specific components, shows that the average economic cycle by industry (calculated across countries) has deviated in relation to average development especially in the primary

production and mining and quarrying industry. Energy and construction sectors represent the average economic cycle in the data set (their share of the total fluctuation is 11–12%). The economic cycles have been smaller than average in manufacturing and service industries (Table 3).

Table 3. **The partitioning of the output growth variation by industry**

The partitioning of average industry fluctuation	**Mean**	**SSD**	**% share**
1. Agriculture, hunting, forestry and fishing	1.48	0.0055	3.0
2. Mining and quarrying	1.15	0.0129	7.0
3. Manufacturing	1.40	0.0071	3.9
4. Electricity, gas and water	3.54	0.0299	16.3
5. Construction	0.07	0.0591	32.3
6. Wholesale and retail trade, restaurants and hotels	1.79	0.0014	0.8
7. Transport, storage and communication	3.70	0.0368	20.1
8. Finance, insurance, real estate and business service	3.07	0.0134	7.4
9. Community, social and personal services	3.10	0.0143	7.8
10. Producers of government services	1.71	0.0022	1.2
Total	**2.10**	**0.1826**	**100.0**
The partitioning of economic cycles by industry		**SSD**	**% share**
1. Agriculture, hunting, forestry and fishing		0.1447	27.2
2. Mining and quarrying		0.1399	26.3
3. Manufacturing		0.0239	4.5
4. Electricity, gas and water		0.0544	10.2
5. Construction		0.0676	12.7
6. Wholesale and retail trade, restaurants and hotels		0.0146	2.7
7. Transport, storage and communication		0.0312	5.9
8. Finance, insurance, real estate and business service		0.0092	1.7
9. Community, social and personal services		0.0302	5.7
10. Producers of government services		0.0168	3.2
Total		**0.5325**	**100.0**

The analysis of variance demonstrates that in the data set under study direct country-specific factors have no effect on output fluctuation. The deviation of the average growth rate by country from the average of the whole data set was not, therefore, statistically significant. The average growth rate was close to two per cent, with the exception of Sweden, where the growth rate was clearly slower. Indeed, Sweden causes a significant contribution to average fluctuation by country (Table 4, upper section).

Neither did the economic cycles show such systemic country-specific variation that would have significantly explained the growth fluctuation (the variance estimate of d_{jt} did not deviate significantly from residual variance). The partitioning of economic cycles by country shows, however, that there were differences between

countries in terms of the extent of variation caused by economic cycles. Finland with its clearly more pronounced economic cycles has deviated most from the average development of the countries examined. Also in Austria the economic cycles have been larger that average (Table 4, lower section).

Table 4. **The partitioning of the output growth variation by country**

The partitioning of average industry fluctuation	**Mean**	**SSD**	**% share**
Austria	2.19	0.00013	1.0
Denmark	1.91	0.00059	4.6
Finland	2.27	0.00044	3.5
France	2.33	0.00088	6.9
Germany	1.91	0.00059	4.6
Greece	2.18	0.00011	0.9
Italy	2.29	0.00059	4.6
Sweden	1.40	0.00785	61.4
United Kingdom	2.42	0.00160	12.5
Total	**2.10**	**0.01278**	**100.0**
The partitioning of economic cycles by country		**SSD**	**% share**
Austria		0.05604	14.0
Denmark		0.04562	11.4
Finland		0.11664	29.1
France		0.01358	3.4
Germany		0.03439	8.6
Greece		0.03390	8.5
Italy		0.01328	3.3
Sweden		0.04223	10.6
United Kingdom		0.04461	11.1
Total		**0.40027**	**100.0**

The volatility of Finland's economic cycles was more than three times that of Germany and ten times that of France. In the following we shall take a closer look into the factors underlying the deviating output developments of Finland.

4 The importance of domestic sources of shock in Finland

Under the examined period, the output growth rate in Finland was about the same as in the rest of the country group (see eg Table 4). Only in Sweden, whose growth rate was slower than in Finland, did the average growth rate deviate significantly. Compared to eg Germany and France, the difference in growth rates was insignificant. Examination by industry shows, however, that in Finland the growth rate in manufacturing deviated significantly from the average rate of other EU countries. In Finland the growth rate of manufacturing output in 1978–93 was markedly faster than the average rate in the countries examined. The difference is significant especially compared to France, Germany, Sweden and United Kingdom (Table 5a). In other industries the growth rate variation was clearly less deviant from the average rate.

The cross tabulation of growth fluctuation across countries and industries (Table 5b) shows that manufacturing output was somewhat more volatile in Finland. However, the difference was not statistically significant. On the other hand, the output growth rate in the sheltered sector industries deviated statistically significantly from the average rate of other countries. Construction industry also was more volatile in Finland, even though the deviation was not statistically significant compared to the average rate. Compared to Sweden the volatility was significantly larger only in trade sector.

Table 5a. **The average output growth rate in 1978–1993 by industry and by country, %**

	AT	DKR	FIN	FR	GER	GRE	IT	SWE	UK	TOTAL
PRM	0.98	2.50	**0.55**	2.07	1.67	0.94	1.34	1.01	2.27	**1.48**
MIN	0.10	3.00	**3.98**	0.50	-2.13	2.58	2.20	-2.06	2.22	**1.15**
MANU	2.05	1.32	**3.00**	0.45	0.77	0.44	2.59	0.97	0.97	**1.40**
ELEC	2.60	4.34	**3.52**	4.78	2.22	4.91	1.09	3.99	4.42	**3.54**
CONST	1.06	-1.64	**-0.59**	0.30	0.15	-0.39	0.23	0.49	1.05	**0.07**
SALE	2.31	1.61	**1.14**	1.35	2.08	1.75	2.15	1.54	2.14	**1.79**
TRANS	3.98	3.32	**3.56**	4.39	3.75	4.06	4.37	3.26	2.59	**3.70**
FIN	3.40	1.81	**3.69**	3.04	3.45	3.71	3.32	2.26	2.91	**3.07**
SERV	3.56	0.80	**1.74**	4.30	5.56	2.30	3.32	1.10	5.19	**3.10**
GOV	1.88	2.01	**2.07**	2.17	1.56	1.55	2.30	1.43	0.39	**1.71**
TOTAL	**2.19**	**1.91**	**2.27**	**2.33**	**1.91**	**2.18**	**2.29**	**1.40**	**2.42**	**2.10**

Table 5b. **The variance of output growth rate in 1978–1993 by industry and by country, %**

	AT	DKR	FIN	FR	GER	GRE	IT	SWE	UK	TOTAL
PRM	0.25	0.57	**0.37**	0.36	0.78	0.69	0.15	0.26	0.51	**0.42**
MIN	1.92	0.29	**0.30**	0.58	0.47	0.25	0.03	1.67	0.69	**0.69**
MANU	0.08	0.09	**0.22**	0.07	0.14	0.10	0.11	0.13	0.13	**0.12**
ELEC	0.26	0.91	**0.08**	0.12	0.08	0.10	0.13	0.40	0.67	**0.30**
CONST	0.12	0.72	**0.68**	0.12	0.09	0.41	0.07	0.18	0.36	**0.29**
SALE	0.06	0.11	**0.41**	0.03	0.12	0.07	0.03	0.08	0.14	**0.11**
TRANS	0.04	0.25	**0.13**	0.05	0.06	0.07	0.08	0.23	0.07	**0.10**
FIN	0.01	0.17	**0.11**	0.06	0.01	0.02	0.02	0.03	0.05	**0.05**
SERV	0.03	0.05	**0.08**	0.02	0.04	0.04	0.02	0.03	0.65	**0.13**
GOV	0.01	0.05	**0.06**	0.01	0.01	0.11	0.03	0.04	0.01	**0.04**
TOTAL	**0.28**	**0.33**	**0.25**	**0.16**	**0.21**	**0.20**	**0.08**	**0.31**	**0.33**	**0.24**

PRM = Agriculture, hunting, forestry and fishing AT = Austria

MIN	=	Mining and quarrying	DKR	=	Denmark
MANU	=	Manufacturing	FIN	=	Finland
ELEC	=	Electricity, gas and water	FR	=	France
CONST	=	Construction	GER	=	Germany
SALE	=	Wholesale and retail trade, restaurants and hotels	GRE	=	Greece
TRANS	=	Transport, storage and communication	IT	=	Italy
FIN	=	Finance, insurance, real estate and business service	SWE	=	Sweden
SERV	=	Producers of government services	UK	=	United Kingdom

The larger than average country-specific shocks in Finland become more prominent upon examining the share of country-specific sources of output fluctuation by country (Table 6). The share of country-specific fluctuation in Finland is in a league of its own compared to the other examined countries. The country-specific factors explained more than one third of output fluctuation in Finland, whereas the share in Austria, Sweden, United Kingdom, Greece and Denmark was about 12–14%. The share in Italy was above 20%, but in France only about 9%.

Table 6. **The share of country-specific factors in output fluctuation by country, %**

	Source of fluctuation			Total
	Country-specific factor	Country-industry factor	Country-time factor	
Austria	0.0	1.6	12.8	14.3
Denmark	0.1	4.6	8.8	13.5
Finland	0.1	5.8	29.3	35.2
France	0.3	3.2	5.3	8.9
Germany	0.2	9.1	10.3	19.6
Greece	0.0	3.2	10.7	13.9
Italy	0.5	12.3	11.1	23.9
Sweden	1.6	3.5	8.4	13.5
United Kngdom	0.3	3.1	8.5	12.0

The domestic origin of disturbances in Finland has also come up in other studies. Tarkka and Åkerholm concluded in their study that aggregate fluctuations with the other EU countries were relatively rare and that country-specific disturbances had a central role in total output fluctuation. They examined the output growth rates in OECD countries in 1973–90. In his study Starck (1990) estimated that country-specific factors account for more than half of the short-term fluctuation of total output in Finland; his study covered the years 1960–88. On the other hand, Ahonen and Pyyhtiä concluded in their study that shocks to manufacturing output in 1973–94 were transmitted to Finland, Sweden and Germany at the same time.

Compared to previous results this study underlines the essential role of the sheltered sector as regards growth shocks. The growth fluctuation in some sheltered sector industries, such as trade and construction, has been larger than in other countries and in manufacturing, which indicates that country-specific factors have had an essential role as sources of shocks in Finland. The large volatility of the sheltered

sector cannot result from aggregate factors, which should have a more immediate effect especially in sectors involved with foreign trade, ie manufacturing. Aggregate factors can in principle only have an indirect effect to sheltered sector industries.

The economic development in Finland at the beginning of 1990, which deviated in all respects from the other EU countries, may also have affected the result of this study, ie that country-specific factors have an essential role as sources of disturbances. To prevent this anomalous time period from leading us to wrong conclusions, a variance analysis was performed using a data set ending in 1989. The result can be regarded as unexpected. The exclusion of period of depression did not decrease the significance of country-specific disturbances; quite the contrary, the relative effect of country-specific sources increased (Table 7). However, the results were different in the sense that the relative weight of country-specific factors changed in relation to each other. The importance of general economic cycle decreased, but that of time and industry invariant country-specific factor increased. In addition, the importance of industry-country factor increased markedly, demonstrating that in Finland the average growth rates of industries have deviated more than in the EU countries on average.

Table 7. **The share of country-specific factors in output shock by country, % (in 1978–89)**

	Source of shock			Total
	Country-specific	Country-industry	Country-time	
Austria	1.4	10.4	2.2	14.0
Denmark	0.3	9.9	5.5	15.7
Finland	13.1	12.8	19.0	44.9
France	0.1	5.2	8.8	14.0
Germany	3.2	3.4	9.2	15.8
Greece	0.2	10.8	7.5	18.5
Italy	0.1	12.0	19.7	31.7
Sweden	0.7	7.6	5.9	14.1
United Kingdom	0.4	6.9	3.6	10.9

The exclusion of period of depression from the data set decreased essentially the variance of growth in the sheltered sector industries. It turns out that actually the variation in sheltered sector industries in Finland in 1980s was smaller than the EU average (Appendix 1).

The charts for output growth by industries confirm the results (Appendix 2). Growth in most industries was above average in the examined country group throughout most of the 1980s. The charts also show that the consequences of the recession in the 1990s were especially heavy in the sheltered sector. The recession was very deep in the trade and construction industries.

5 Conclusions

The result of this analysis is that sources of output shocks are clearly more country-specific for Finland than for other EU countries. Excluding the recent recession from the data set affects this result with regards to the nature of disturbances, but does not decrease the relative importance of country-specific sources of output shocks. Finland differed from other EU countries until the end of 1980s due to its higher than average growth rate. Variation in average growth rate by industry was also larger than in other countries, and Finland's general economic cycle caused larger idiosyncratic output shocks than in other EU countries. Examination of the time period including the recession revealed Finland's idiosyncratic economic cycle as an essential source of these disturbances. Even when the anomalous period of depression is excluded from the study, the result of country-specific factors being the main sources of disturbances does not change significantly. However, the exclusion does affect the results, in that prior to the 1990s, variation in the sheltered sector was not larger than the EU average.

Naturally, these results are conditional on the selected country group and also on the examined time period. It is possible that including the rest of the EU countries, ie the Netherlands, Belgium, Portugal and Spain, could have changed the results. In addition, the result as regards the manufacturing sector could have been different had data been available by each manufacturing industry. The main reservation about interpretation of these results is that since variation is examined by industry, variation calculated on the basis of average growth rate by industry does not necessarily correspond to variation of total output. Therefore, the effect of country-specific factors to total output may deviate from these results.

These reservations do not, however, undermine the finding that in Finland country-specific factors have had a larger role in economic development than in other countries. This factor can be an idiosyncratic economic policy, and/or idiosyncratic reactions to disturbances to international economy. The data set does not give clear indications of the background of disturbances. Peisa and Haaparanta (1997) concluded in their study that the economic policy pursued in Finland in 1970–80 resulted in more severe economic cycles instead of stabilizing the economy. They arrived at this conclusion after having examined in detail the disturbances to Finnish economy and the related economic policy decisions. They take the view that, to retain competitiveness, economic policy needed to take into account the United Kingdom and Sweden, which, during the period 1970–80, pursued a looser monetary policy than Germany or the USA. This resulted in a number of devaluations in Finland, which have led to an unstable economic policy. The authors claim that the tight monetary policy pursued in the mid-1970s, the loose fiscal policy at the end of the 1980s and the loose monetary policy in connection with the liberalization of capital movements at the end of the 1980s all exacerbated the economic cycles.

With regard to EMU participation, the importance that country-specific factors had in the past is not problematic when they are due to domestic economic policy. The results of this study are not contradictory to the analysis of Peisa and Haaparanta. The faster than average growth rate at the 1980s may have resulted from loose monetary and fiscal policy, and the essential effect of idiosyncratic economic cycles on output shocks may be the result of the change of economic policy at the beginning of the 1990s. It is probable that economic policy continues to have different effects on

different industries, which partly explains why the average growth rate by industry has varied more in Finland than in other countries.

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Appendix 1.

Average output growth in 1978–89 by industry and by country, %

	AT	DKR	FIN	FR	GER	GRE	IT	SWE	UK	TOTAL
PRM	1.81	3.49	**1.25**	3.03	1.54	1.65	1.40	1.83	2.46	**2.05**
MIN	-0.47	3.56	**6.25**	-0.96	-2.28	4.00	2.72	-2.39	2.15	**1.40**
MANU	2.35	1.73	**4.41**	0.99	1.21	1.36	3.50	2.01	2.01	**2.18**
ELEC	2.44	4.01	**3.98**	5.45	2.55	5.45	0.69	5.26	4.88	**3.86**
CONST	-0.21	-0.71	**3.07**	1.00	0.03	-0.27	0.58	1.89	2.34	**0.86**
SALE	2.22	1.55	**4.23**	1.77	1.53	2.38	2.72	2.34	2.99	**2.42**
TRANS	3.78	2.69	**4.35**	4.87	3.65	4.36	4.77	3.68	3.11	**3.92**
FIN	3.36	2.85	**5.13**	3.76	3.46	3.56	3.60	2.69	3.72	**3.57**
SERV	3.45	0.77	**2.84**	4.51	4.97	2.27	3.60	1.33	5.91	**3.30**
GOV	1.80	2.61	**3.10**	2.18	1.57	2.67	2.73	2.13	0.24	**2.12**
TOTAL	**2.05**	**2.26**	**3.86**	**2.66**	**1.82**	**2.74**	**2.63**	**2.08**	**2.98**	**2.57**

Output variance in 1978–89 by industry and by country, %

	AT	DKR	FIN	FR	GER	GRE	IT	SWE	UK	TOTAL
PRM	0.26	0.57	**0.34**	0.33	0.61	0.43	0.15	0.22	0.66	**0.37**
MIN	0.94	0.34	**0.13**	0.50	0.40	0.23	0.02	2.15	0.87	**0.66**
MANU	0.07	0.11	**0.07**	0.06	0.07	0.09	0.10	0.10	0.10	**0.09**
ELEC	0.35	0.72	**0.09**	0.13	0.07	0.07	0.17	0.46	0.89	**0.33**
CONST	0.09	0.91	**0.23**	0.09	0.10	0.51	0.05	0.09	0.35	**0.26**
SALE	0.06	0.14	**0.05**	0.01	0.05	0.05	0.02	0.07	0.14	**0.07**
TRANS	0.04	0.28	**0.10**	0.04	0.05	0.08	0.10	0.13	0.06	**0.10**
FIN	0.02	0.13	**0.01**	0.05	0.01	0.01	0.02	0.01	0.02	**0.03**
SERV	0.04	0.05	**0.01**	0.02	0.02	0.04	0.02	0.04	0.83	**0.13**
GOV	0.01	0.05	**0.01**	0.01	0.01	0.05	0.02	0.02	0.01	**0.03**
TOTAL	**0.19**	**0.32**	**0.11**	**0.15**	**0.17**	**0.17**	**0.08**	**0.34**	**0.39**	**0.21**

PRM = Agriculture, hunting, forestry and fishing

MIN = Mining and quarrying

MANU = Manufacturing

ELEC = Electricity, gas and water

CONST= Construction

SALE = Wholesale and retail trade, restaurants and hotels

TRANS= Transport, storage and communications

FIN = Finance, insurance, real estate and business services

SERV = Community, social and personal services

GOV = Producers of government services

AT = Austria

DKR = Denmark

FIN = Finland

FR = France

GER = Germany

GRE = Greece

IT = Italy

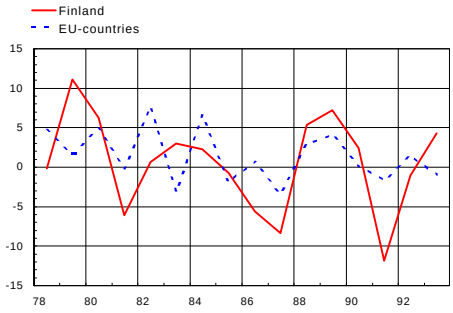
SWE = Sweden

UK = United Kingdom

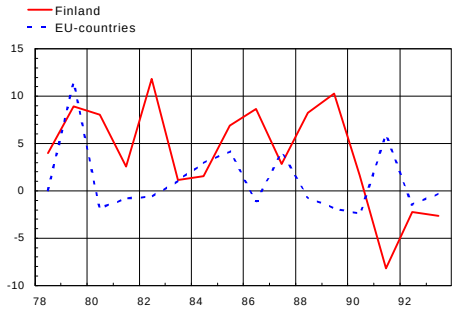
Appendix 2.

OUTPUT GROWTH IN FINLAND AND IN EU-COUNTRIES ON AVERAGE , %

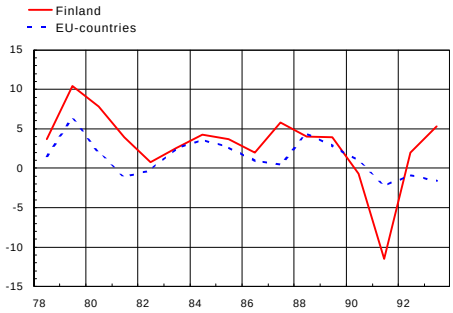
Agriculture and forestry



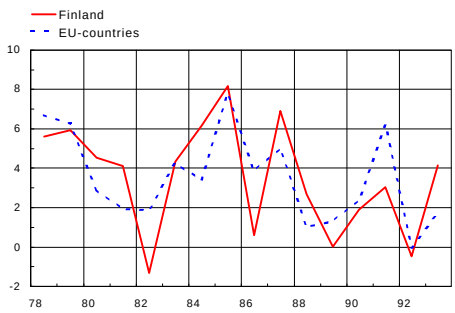
Mining



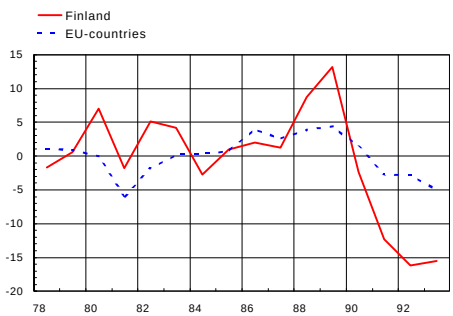
Manufacturing



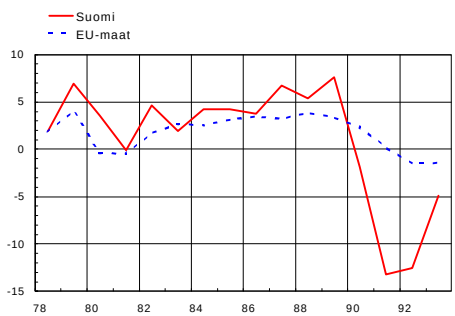
Electricity, gas and water



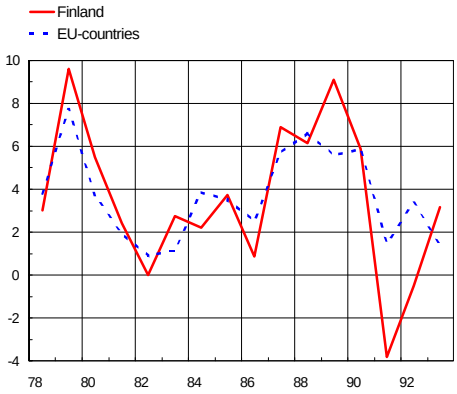
Construction



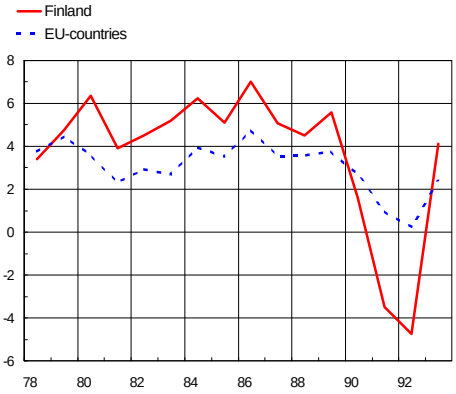
Wholesale and retail trade, restaurants and hotels



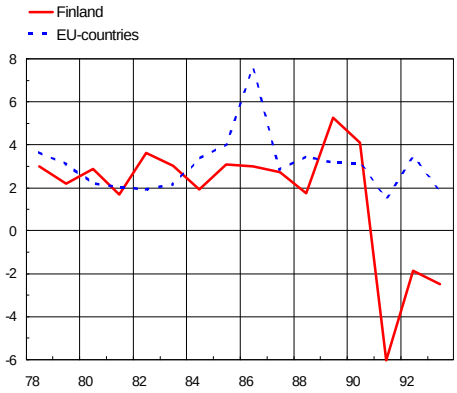
Transport, storage and communication



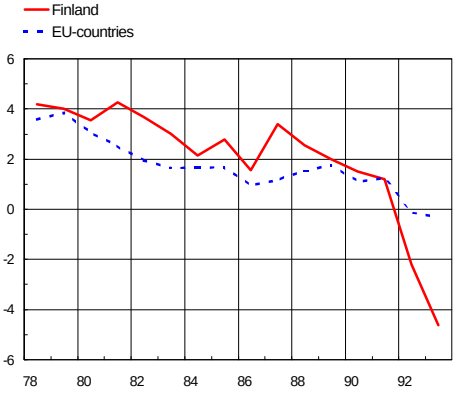
Finance, insurance, real estate and business service



Other private services



Producers of government services



Total