LOCAL AND GLOBAL SHOCKS IN AUSTRIA
A VAR APPLICATION

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Abstract

We assume that fluctuations in regional contributions to GDP have two sources: (1) local shocks due to region specific disturbances and (2) global shocks due to nationwide disturbances. The two unobservable shocks are identified in a recursive VAR model for each region and several indicators for their relative importance are estimated with Austrian yearly data from 1961 to 1988. The estimated ratio of variances of global to total shocks varies from 27.7% (Salzburg) to 67.9% (Vorarlberg).

Zusammenfassung

Wir nehmen an, daß Wachstumsschwankungen der Regionalbeiträge zum Bruttoinlandsprodukt zwei Quellen haben: (1) Lokale Schocks, die auf regionalspezifische Besonderheiten zurückzuführen sind und (2) Globale Schocks, die österreichweite Wachstumsimpulse erfassen. Der geschätzte Anteil globaler Schocks an der Varianz von regionalen Wachstumsschwankungen liegt zwischen 27.7 % (Salzburg) und 67.9 % (Vorarlberg).

Content

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We assume that fluctuations in regional contributions to GDP have two sources: (1) local shocks due to region specific disturbances and (2) global shocks due to nationwide disturbances. The two unobservable shocks are identified in a recursive VAR model for each region and several indicators for their relative importance are estimated with Austrian yearly data from 1961 to 1988. The estimated ratio of variances of global to total shocks varies from 27.7% (Salzburg) to 67.9% (Vorarlberg).

Content

1. Introduction

A lot of recent empirical research is exploring the time series properties of real aggregate output in developed economies. The main outcome of these studies[1] accepts that real GNP is characterized as a unit root process. In this paper we apply this analysis to investigate the interaction between the fluctuations of aggregate and regional output indicators. We do not separate between transitory and permanent or real and monetary shocks, but distinguish between local and global shocks affecting regional output growth. The main question we want to answer is concerned with the relative importance of global and local sources for changes of economic conditions on a regional level. Additionally the contemporaneous and lagged relation between local shocks of different regions is of interest concerning the question how to aggregate regions properly.

Our analysis focuses on fluctuations, differences in average growth rates are therefore kept exogenous. Furthermore our analysis applies for permanent shocks only.

The technique used here and elsewhere[2] specifies a stationary time series as an outcome of adjustment to (uncorrelated) shocks of different origin. These shocks are identified by certain restrictions, which allow the estimation of otherwise unobservable variables. The strength and shortcomings of this approach are therefore directly related to the amount to which the basic assumptions are met. In order to test for the sensitivity of our results concerning the violation of a particular assumption we perform two different ways of stationarizing the original output data.

The paper proceeds as follows. The next chapter explains the identifying restrictions of our model and the estimation procedure. After this the empirical results for an application with yearly Austrian real GDP data from 1961 to 1988 are presented. All used data can be found in the appendix.

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1 See for instance Blanchard-Quah(1989) who distinguish two major shocks affecting US-GNP: A permanent supply shock and a transitory demand shock.

2 Lach-Schankerman(1989) explore the dynamic interaction between research and develeopment, capital investment and stock market performance. Pakes(1985) looks on the interaction between patent applications, research and development expenditures, and stock market returns. Johnson-Schembri(1990) Studies the economic interaction between the US and Canada.

2. The Model

Let us assume an economy with different, sufficiently small regions[3]. In all regions one economic indicator (x^i_t) can be observed and it can be aggregated (a_t) in a meaningful way. Both the aggregate and the regional indicators are assumed to be stationary variables with mean zero. The (one-way) interaction between the region and the national aggregate is modelled in the following way:

MA – representation

$$(1) \quad a_t = A(L)\alpha_t$$

$$(2^r) \quad x^r_t = B(L)\alpha_t + C(L)\beta^r_t$$

$r = 1, \ldots, N$ (region-index)
$t = 1, \ldots, T$ (time-index)

A(L) and C(L) are invertible lag polynomials. α_t and β^r_t are serially uncorrelated shocks: $COV(\alpha_t, \beta^r_t) = COV(\alpha_t, \alpha_{t-i}) = COV(\alpha_t, \beta^r_{t-i}) = COV(\beta^r_t, \beta^r_{t-i})$ $= 0$ for $i \neq 0$.

α_t is called a global shock, because it is assumed to affect both the aggregate and the economic indicator of all regions. β^r_t is called a local shock.

Having assumed A(L) and C(L) to be invertible we can rewrite (1) and (2^r) in the following way:

AR – representation

$$(3) \quad a_t = D(L)a_{t-1} + \alpha_t$$

$$(4^r) \quad x^r_t = E(L)a_{t-1} + F(L)x^r_{t-1} + \Gamma^r_t$$

Γ^r_t is the sum of the global shock affecting region r α^r_t and the local shock β^r_t:

$$(5) \quad \Gamma^r_t = \alpha^r_t + \beta^r_t = c^r\alpha_t + \beta^r_t$$

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3 We assume that the aggregate is not affected by a disturbance in one region.

Having made these assumptions and given the estimations of the lag polynomials, it is possible to identify all parameters of the model:

(6) $c^r = COV(\alpha_t, \Gamma^r_t)/VAR(\alpha_t)$

(7) $VAR(\beta^r_t) = VAR(\Gamma^r_t) - (c^r)^2 VAR(\alpha_t)$

This information can then be used to decompose the regional indicators into two components, one relating to present and past global shocks affecting the region and the other relating to present and past local shocks according to (2^r).

3. Empirical Results

The model (3) – (4^r) is estimated with yearly Austrian data from 1961 to 1988. The economic indicator mentioned in the previous chapter is the contribution to the nominal GDP in the 9 Austrian provinces. These series are available only at current prices. All series have therefore been deflated with the GDP–Deflator for the Austrian aggregate GDP. The assumption of stationarity and mean zero made it necessary to transform all series into first logarithmic differences and substract average growth rates. The symbols a_t and x_t^r have the following meaning:

a_t ... Deviation of growth rates of real aggregate GDP from its sample mean

x_t^r ... Deviation of growth rates of real (deflated with aggregate GDP–deflator) regional GDP from its sample mean

3.1 Tests for Stationarity

At first the series a_t and x_t^r have been exposed to stationarity tests. Table 1 exhibits the results of various unit root tests explained below.

DICKEY-FULLER / STOCK-WATSON UNIT ROOT / TIME TREND TESTS													
Number of Autoregressive Corrections = 1													
TEST Statistic											1%	5%	10%
	1	2	3	4	5	6	7	8	9	a	critical values		
qf-tausq(z)	-6.49	-15.1	-7.67	-9.54	-11.7	-11.2	-13.3	-10.0	-12.1	-9.54	-35.5	-27.9	-24.1
qf-tau(z)	-1.57	-3.16	-2.50	-1.65	-3.82	-1.84	-3.38	-3.00	-3.10	-2.19	-29.2	-21.7	-18.2
qf-mu(z)	-1.26	-1.48	-1.00	-1.06	-1.28	-1.37	-1.35	-1.08	-1.04	-1.11	-20.6	-14.1	-11.2
qf-tau(dz)	-21.0	-24.3	-19.9	-27.2	-20.0	-24.8	-23.5	-16.7	-23.7	-23.5	-29.2	-21.7	-18.2
qf-mu(dz)	-9.85	-13.3	-13.5	-19.9	-12.7	-18.7	-8.37	-10.0	-17.9	-12.3	-20.6	-14.1	-11.2
DF: t-tau(z)	-.084	-1.53	-.843	-.314	-1.51	-.411	-1.87	-1.03	-1.36	-.731	-4.38	-3.60	-3.24
DF: t-mu(z)	-2.55	-3.34	-1.81	-2.47	-2.17	-2.81	-3.95	-1.72	-2.46	-2.79	-3.75	-3.00	-2.63
DF:t-tau(dz)	-2.48	-3.43	-2.34	-3.36	-3.16	-3.71	-3.44	-2.58	-3.79	-2.92	-4.38	-3.60	-3.24
DF: t-mu(dz)	-1.53	-2.08	-2.03	-2.44	-2.43	-2.38	-1.68	-2.18	-2.74	-1.93	-3.75	-3.00	-2.63
time(z)	-.898	.644	.070	.027	.620	-.114	. 851	-.169	.824	.026	\ Tests for deter-		
constant(z)	4.19	4.62	2.77	2.87	3.78	3.26	6.26	3.40	3.12	3.92	} ministic terms in		
time(dz)	-2.65	-2.84	-1.62	-2.46	-1.75	-2.81	-3.33	-1.47	-2.14	-2.65	} levels and		
constant(dz)	2.45	2.61	2.76	3.38	2.42	3.01	2.28	2.20	3.14	2.80	/ differences		
Structural break of average growth rates in 1974/75													
qf-tausq(dz)	-26.10	-30.06	-24.5	-29.9	-24.4	-30.3	-26.4	-17.0	-24.2	-29.5	-35.5	-27.9	-24.1
qf-tau(dz)	-18.74	-29.74	-22.6	-28.3	-24.1	-28.6	-26.3	-15.7	-24.1	-27.8	-29.2	-21.7	-18.2
qf-mu(dz)	-17.91	-29.59	-22.4	-28.1	-24.3	-28.1	-25.9	-15.7	-24.0	-27.5	-20.6	-14.1	-11.2
DF:t-tau(dz)	-2.368	-3.851	-2.52	-3.69	-3.77	-4.38	-3.90	-2.35	-4.41	-3.52	-4.38	-3.60	-3.24
DF: t-mu(dz)	-2.115	-3.867	-2.54	-3.54	-3.89	-3.89	-3.85	-2.39	-4.28	-3.33	-3.75	-3.00	-2.63
time(dz)	-1.322	-.7014	-.470	-1.00	.046	-1.48	-.733	-.374	-.791	-1.13	} Tests for deterministic terms		
constant(dz)	.2816	.1711	.276	.287	.197	.684	-.019	.193	.329	.409	} in levels and differences		

Table 1

A test statistic with a z in brackets refers to the absolute level (here the logarithm of aggregate and regional real GDP), a dz in brackets indicates that the test has been applied after first differences have been taken. The columns represent the results for the nine provinces (numbered in alphabetical order, see Data Appendix for details) and the Austrian aggregate.

The Stock–Watson test statistic is called qf, the Dickey–Fuller test statistic is labeled DF. The abbreviations mu, tau and tausq indicate that a constant, a linear deterministic trend and a quadratic deterministic trend have been assumed. The four respectively two lines below the DF–test present the t–statistics of the constant and the trend variable.

If a deterministic trend is accounted for, the Stock–Watson–Statistic qf uniformly cannot reject a unit root in levels, but certainly rejects a unit root in differences. Without a trend this is not the case. We therefore repeated all estimations taking care of a structural break of GDP growth rates in 1974/75 and calculated deviations from average growth before and after 1974/75. As can be seen from the second half of Table 2 this transformation performs a sufficient stationarization. The time trends are no more significant, and the Stock–Watson statistic (mu–qf) rejects the hypothesis of an unit root in the deviations of GDP growth from average growth rates before and after 1974/75 in all cases.

3.2 Estimations of the AR–representation

The AR–representation (3) – (4^r) can be estimated with OLS. The choice of the lengt of the lag polynomials D(L), E(L) and F(L) is based on the log–determinant criterion (ldc = DET(VARCOVMAT(α_t,Γ_t^r) + 2*(NUMBER OF ESTIMATED COEFFICIENTS/(NUMBER OF OBSERVATIONS))[4]. Table 2 presents the values for this criterion for alternative lag length assumptions.

4 This is a multivariate extension of Akaike's well known information criterion. See for instance Nickelsburg(1985) for a comparison of different information criteria.

Log-determinant criterion				
	Lag-length of F(L)			
Region	Lag length of D(L) and E(L)	1	2	3
1	la = 1 la = 2 la = 3	−15.797 −16.245 **−16.479**	−15.953 −16.189 −16.434	−15.787 −16.053 −16.401
2	la = 1 la = 2 la = 3	−16.157 −16.235 **−16.491**	−16.139 −16.183 −16.444	−16.025 −16.102 −16.345
3	la = 1 la = 2 la = 3	−16.369 −16.417 **−16.564**	−16.269 −16.369 −16.497	−16.046 −16.124 −16.463
4	la = 1 la = 2 la = 3	−16.206 −16.285 −16.405	−16.084 −16.343 **−16.459**	−15.752 −15.976 −16.418
5	la = 1 la = 2 la = 3	−15.968 −16.115 −16.195	−15.905 −16.085 −16.198	−15.727 −15.860 **−16.244**
6	la = 1 la = 2 la = 3	−16.746 −16.940 **−17.019**	−16.657 −16.648 −16.896	−16.174 −16.316 −16.853
7	la = 1 la = 2 la = 3	−16.171 −16.226 **−16.442**	−16.083 −16.167 −16.400	−15.993 −16.062 −16.370
8	la = 1 la = 2 la = 3	−16.288 −16.351 −16.632	−16.178 −16.401 **−16.693**	−16.141 −16.369 −16.560
9	la = 1 la = 2 la = 3	−16.938 −17.057 **−17.159**	−16.827 −17.008 −17.053	−16.557 −16.622 −16.974

Table 2

In most cases a combination of three lags for the aggregate GDP and one lag for the regional GDP turned out to be sufficient. In regions 4 (Upper-Austria) and 8 (Vorarlberg) two lags and in region 5 (Salzburg) three lags for the regional GDP were chosen. The statistical properties of the estimated models are satisfactory. The adjusted R^2 varies between 0.23 (Vorarlberg) and 0.45 (Burgenland). The sgnificance level of the Q-statistic testing for autocorrelation is larger than 0.30 in all cases. The residuals can therefore be considered white noise. This property still holds when we account for a structural break in growth rates. The most significant differences refer to a considerable decline of the fit of the estimated models. Adjusted R^2 becomes zero or even negative in Burgenland, Carinthia, Upper-Austria, Tyrol, and Vorarlberg. Real growth in these provinces seems to be characterised by a random walk with (variable) drift. This could have consequences for the estimation of shock response functions because of overfitting[5], but does not affect the separation of local and global shocks on the regional level.

3.3 Separation of local and global shocks in regional output fluctuations

Figure 1 shows the estimated residual of equation (3) with and without a structural break in 1974/75. This series multiplied by the estimated coefficient c^r constitutes the regional global shocks. Local shocks for the nine provinces are presented in Figures 2a to 2i. All figures are placed in the Appendix.

The global shock series illustrates the innovations of the Austrian business cycle quite well. The two most important turning points took place in 1970, 1975 and 1981. Since 1982 no clear business cycle movement seems to have driven growth rates.

Tables 3 to 8 present the main results of our paper. All estimates have been carried out assuming no structural break in GDP growth fluctuations (left column) and a structural break in 1974/75 (right column).

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5 The lag-specification of the models is the same, regardless of the assumption if a structural break has been made or not.

Table 3 contains the estimations of the parameter c^r from (6).

Estimations of c^r		
Region	No Structural Break of Avergage Growth Rates	Break of Average Growth Rates in 1974/75
1	1.0325	1.2406
2	0.9212	0.7431
3	0.8247	0.9418
4	1.0907	1.2701
5	0.9791	0.7413
6	1.0840	1.0661
7	0.8170	0.6694
8	1.0594	1.2402
9	0.5882	0.6331

Table 3

The parameter c^r indicates whether innovations to output fluctuations on the aggregate national level are dampened or not when they become global shocks on a regional level. Without assuming a structural break only c^9 (Vienna) is well below the estimated levels of this parameter for other provinces. After adjustment for the structural break in growth rates differences between provinces become more pronounced. Burgenland, Upper-Austria and Vorarlberg (1,4,8) exhibit amplified global shocks, in Lower-Austria and Styria (3,6) the innovations in aggregate growth fluctuations contribute proportionally to the regional global shock and in Carinthia, Salzburg, Tyrol and Vienna (2,5,7,9) the global shocks are considerably dampened at the regional level.

Table 4 gives the estimated ratio of the variance of the global shock to the total variance of the innovations to regional GDP growth fluctuations evaluated at lag 0 and 10 both for deviations from average growth without a structural break (first two columns) and with a structural break in 1974/75 (last two columns). These ratios (evaluated at lag i) indicate how much of the variance of the i+1-step-ahead prediction error can be attributed to current and past (up to lag i) global shocks.

Estimations of variance ratio $[(c^r)^2 VAR(\alpha_t)/VAR(\Gamma_t^r)]*100$				
Region	No Structural Break of Avergage Growth Rates		Break of Average Growth Rates in 1974/75	
	Lag 0	Lag 10	Lag 0	Lag 10
1	57.695	78.164	54.888	53.391
2	52.217	65.135	40.875	50.528
3	48.046	66.423	51.773	60.953
4	59.867	54.168	65.659	60.421
5	52.134	48.456	33.139	27.701
6	71.738	67.785	68.662	64.110
7	45.622	62.059	30.908	32.823
8	64.849	73.271	68.348	67.879
9	47.288	47.345	52.222	64.130

Table 4

If no structural break in average growth rates is assumed the global shock ratio is in general about or above 50%. Global shocks contribute most to the total variance of innovations to growth fluctuations of regions in Burgenland, Vorarlberg, Styria, Lower-Austria and Carinthia (1,8,6,3,2). If deviations from average growth rates are adjusted for a structural break in 1974/75 then global shock ratios evaluated at lag 10 turn out to be quite similar (between 50% and 68%) for all provinces except Salzburg and Tyrol (5,7), where global shocks contribute only about one fifth to one third to the variance of growth rate fluctuations.

Estimations of variances of global shocks		
Region	No Structural Break of Avergage Growth Rates	Break of Average Growth Rates in 1974/75
1	2.7432	2.9742
2	2.1841	1.0672
3	1.7506	1.7141
4	3.0618	3.1171
5	2.4673	1.0621
6	3.0241	2.1962
7	1.7182	0.8659
8	2.8883	2.9721
9	0.8904	0.7747

Table 5

The variances of global shocks are highest in Upper-Austria and lowest in Vienna in both cases. The structural break in growth rates reduces estimated variances of global shocks mainly in Carinthia, Salzburg, Styria and Tyrol (2,5,6,7).

Estimations of variances of local shocks		
Region	No Structural Break of Avergage Growth Rates	Break of Average Growth Rates in 1974/75
1	2.0115	2.4444
2	1.9986	1.5437
3	1.8930	1.5967
4	2.0525	1.6303
5	2.2653	2.1428
6	1.1914	1.0024
7	2.0479	1.9357
8	1.5656	1.3764
9	0.9925	0.7088

Table 6

The estimated local shocks are not affected by the structural break in average growth rates. Variances of local shocks are low in Vienna, Styria and Vorarlberg (9,6,8) and high in Burgenland, Salzburg, Tyrol and Upper-Austria (1,5,7,4) both with or without a structural break.

The Tables 7 and 8 present correlation coefficients between contamporaneous and lagged local shocks.

Correlation coefficients between contemporary local shocks of provinces i and j no structural break in average growth rates								
	2	3	4	5	6	7	8	9
1	-.289	0.150	-.071	-.132	-.415	-.217	0.302	-.286
2		0.060	-.309	-.009	-.115	0.177	-.356	-.097
3			0.293	-.111	-.291	-.066	0.061	**-.359**
4				-.302	0.281	-.044	-.098	-.160
5					-.272	**0.619**	**0.372**	0.184
6						-.080	-.350	-.029
7							**0.283**	-.071
8								0.189
Correlation coefficients between contemporary local shocks of provinces i and j with a structural break in average growth rates in 1974/75								
	2	3	4	5	6	7	8	9
1	-.313	**0.363**	-.115	-.270	-.232	-.156	0.130	-.030
2		-.128	-.325	0.124	-.072	**0.293**	-.242	-.071
3			0.202	-.122	**-.424**	-.139	0.045	**-.436**
4				**-.338**	**0.297**	-.226	-.276	**-.327**
5					-.080	**0.650**	**0.408**	0.149
6						-.159	-.393	-.006
7							**0.507**	-.000
8								**0.336**

Table 7

Contemporaneous local shocks seem to be significantly related among the western provinces (5,7,8) of Austria (Salzburg, Tyrol and Vorarlberg). The capital province of Vienna (9) exhibits negatively correlated local shocks compared with Lower- and Upper-Austria (3,4). A weak positive relation appears between contemporaneous local shocks in Vienna and Vorarlberg. A similar relationship seems to work between Tyrol and Carinthia (8 and 2), two provinces with a high share of tourism.

Correlation coefficients between local shocks of province i with lagged local shocks of province j									
	1	2	3	4	5	6	7	8	9
1	0.133	–.430	–.113	0.200	0.229	–.100	–.005	0.322	0.489
2	0.059	–.396	–.036	0.010	0.094	–.114	0.095	0.375	–.018
3	–.036	–.316	0.332	0.323	–.029	0.042	–.185	0.122	–.184
4	–.010	0.121	0.122	0.368	–.507	0.093	–.294	–.133	–.424
5	–.085	–.020	0.004	0.112	0.026	0.213	–.030	–.374	–.007
6	–.294	0.434	–.143	–.034	–.388	0.250	–.058	–.283	–.055
7	0.059	0.213	0.065	0.200	–.303	–.027	–.221	–.372	–.059
8	0.076	–.002	0.039	0.345	0.160	0.040	0.038	–.267	–.128
9	–.300	0.270	0.220	0.156	0.178	0.106	0.447	–.342	–.275

Correlation coefficients between local shocks of province i with lagged local shocks of province j structural break of growth rates 1974/75									
	1	2	3	4	5	6	7	8	9
1	–.079	–.253	–.112	0.212	0.260	0.217	0.095	0.227	**0.502**
2	–.117	–.087	–.100	–.025	0.159	–.248	0.269	**0.356**	0.036
3	–.106	–.394	0.207	**0.340**	0.058	0.159	–.254	0.041	–.069
4	–.065	0.013	0.026	0.303	**–.549**	0.099	**–.467**	–.187	–.306
5	–.203	**0.304**	0.050	0.098	0.211	0.176	0.071	–.389	–.305
6	–.131	**0.432**	–.331	–.165	–.148	0.106	–.064	–.303	0.068
7	–.077	**0.343**	0.118	**0.305**	–.157	–.009	0.008	–.289	–.123
8	–.142	0.070	0.101	**0.372**	–.008	0.207	–.014	–.484	–.218
9	–.026	0.070	0.244	0.160	0.128	0.013	0.321	–.166	–.330

Table 8

Concerning causal relationships between provinces (Table 8) only the correlation between the lagged local shock in Vienna (9) and the current local shock in Burgenland (1) is significant and makes sense. A weak influence seems to work between the lagged local shock in Upper–Austria (4) and the contemporaneous local shocks in Lower–Austria, Tyrol and Vorarlberg (3,7,8). The same type of relationships works between Carinthia (2) and Salzburg, Steiermark and Tyrol (5,6,7). The negative relations between Upper–Austria (4) on the one hand and Salzburg and Tyrol (5,7) on the other hand are difficult to understand.

4. Conclusions

A separation of global and local shocks driving regional output fluctuations allows the following conclusions:

(a) Global shocks account for one third to two thirds of total variance of innovations to regional shock fluctuations. This ratio is high in Vorarlberg, Vienna and Styria and low in Tyrol and Salzburg.

(b) The estimations do not support the much used regional aggregation scheme (East, West and South). The contemporary local shocks are only somewhat related among the western provinces, a sensibly interpretable lagged relationship can only be found between Vienna and Burgenland.

(c) The structural break in real growth rates in 1975 does effect quantitative estimations of global shocks, but not so much local shocks. The slowdown in growth rates seems to have been a global phenomenon.

5. Literature

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6. Data Appendix

The regional contributions to the GDP in Austria are subject to a statistical break in 1972/73. After January 1, 1973 a value added tax system has been introduced. Since this time the value added tax is no more part of regional contributions to the GDP. In the contrary, before 1973 the sales tax has been part of the regional GDP. This break has been taken care by interpolating growth rates in 1973.

Provinces in text tables are numbered according to their German initials:

REGION	German label	English label
1	Burgenland	Burgenland
2	Kärnten	Carinthia
3	Niederösterreich	Lower–Austria
4	Oberösterreich	Upper–Austria
5	Salzburg	Salzburg
6	Steiermark	Styria
7	Tirol	Tyrol
8	Vorarlberg	Vorarlberg
9	Vienna	Vienna

Nominal Regional BIP - BIP-Deflator											
JAHR	1	2	3	4	5	6	7	8	9	A	P
61	2392.3	8440.1	24258.1	23304.6	7994.4	20903.8	9816.8	5718.2	56333.8	159162.0	47.6
62	2677.2	9168.6	26137.4	25241.5	8851.4	21765.9	10920.3	6388.2	60752.4	171903.0	49.4
63	2932.1	9819.1	28542.2	27556.6	9773.9	23345.0	12064.9	7245.5	64848.7	186128.0	51.2
64	3223.6	10907.9	31307.9	30433.2	10897.4	25374.4	13324.6	7986.9	69818.1	203274.0	52.9
65	3560.1	12378.4	34391.6	33352.2	12279.0	27739.5	15310.2	8712.4	75898.5	223622.0	55.9
66	4016.3	13668.2	37770.7	36833.3	13735.2	30223.1	17480.8	9744.6	82034.6	245507.0	57.6
67	4327.4	14780.7	40065.2	39028.6	14867.5	32085.8	18861.8	10307.7	87674.2	261999.0	59.5
68	4737.5	15976.4	42399.3	42074.0	16155.6	34949.9	20791.7	11156.9	94689.7	282931.0	61.1
69	5165.6	17585.3	45857.5	46507.9	18106.8	38170.3	22789.3	12233.7	103502.7	309919.0	62.8
70	5862.6	19809.8	51375.7	53440.0	20542.6	42797.1	25402.7	13931.2	115449.1	348611.0	65.8
71	6846.4	22022.8	59562.1	61174.5	24149.1	48021.0	29664.3	16163.6	125350.1	392953.9	69.9
72	7980.9	25538.8	68828.3	69636.8	28692.7	54804.4	34159.7	18958.7	140304.7	448905.1	75.2
73	9280.7	29305.1	79904.3	80903.6	32717.5	63012.1	38966.0	21651.8	156349.3	512090.4	81.2
74	10901.1	33692.0	94364.0	97137.0	36253.8	73906.7	44583.9	24379.3	175640.2	590858.0	88.9
75	11922.0	35589.6	101477.6	102324.5	38643.6	77253.1	49000.5	26557.7	191252.2	634020.7	94.7
76	14185.0	39073.3	113465.0	113646.2	42706.9	85333.2	53289.3	29893.6	212650.3	704242.9	100.0
77	15874.4	42343.4	123353.2	127826.0	48866.3	93750.7	59305.2	33631.6	232584.7	777535.4	105.3
78	17098.6	45089.8	132228.4	137690.6	51647.1	97993.4	63654.2	36697.4	242968.2	825067.8	110.8
79	18686.2	50799.2	145124.7	152152.4	56838.8	108305.5	71173.4	39935.5	260660.1	903675.8	115.4
80	19890.8	54693.5	154809.2	161915.7	62180.1	118243.4	78458.9	43905.4	284894.4	978991.5	121.3
81	21964.0	58749.4	165024.9	174294.8	66437.1	125528.6	84531.4	47344.0	302890.8	1046765.0	129.0
82	23464.0	64062.3	180326.9	187858.4	72943.0	134414.8	91824.3	50395.4	323158.5	1128447.6	136.9
83	24541.5	66712.0	189987.9	201507.6	78091.6	140902.4	96778.7	52732.1	343836.1	1195089.8	142.0
84	25703.6	71647.7	197305.9	210806.9	82484.3	147856.5	103668.8	54855.9	362870.2	1257199.9	149.0
85	27184.7	74314.0	207269.2	229600.6	87360.1	158033.5	110501.4	58027.5	385549.3	1337840.2	153.4
86	28864.1	78901.6	226834.4	237109.9	93202.7	163071.5	118453.4	62693.7	410767.4	1419898.7	159.7
87	29941.8	82247.6	234073.5	247125.4	97668.9	168797.6	124933.4	66049.3	430493.0	1481330.7	163.8
88	31813.1	87827.5	251566.6	265172.0	105783.9	178731.7	132011.6	70333.6	452916.9	1576157.0	166.2

Deflated Regional Bip - Rates of Growth										
JAHR	1	2	3	4	5	6	7	8	9	A
62	7.54	4.57	3.75	4.27	6.47	0.33	6.94	7.37	3.84	3.99
63	5.52	3.28	5.22	5.20	6.33	3.42	6.39	9.01	2.95	4.37
64	6.21	7.25	5.98	6.66	7.61	5.07	6.66	6.48	4.12	5.55
65	4.41	7.13	3.88	3.64	6.42	3.40	8.37	3.18	2.83	4.02
66	9.06	6.92	6.38	6.93	8.21	5.58	10.26	8.20	4.78	6.34
67	4.21	4.58	2.65	2.54	4.68	2.74	4.36	2.37	3.40	3.26
68	6.40	5.13	3.01	4.86	5.66	5.90	7.09	5.26	5.04	5.03
69	5.91	6.85	5.10	7.27	8.66	6.07	6.43	6.47	6.15	6.37
70	7.99	7.24	6.70	9.23	7.95	6.77	6.19	8.33	6.26	7.10
71	9.47	4.55	8.74	7.47	10.13	5.47	9.46	8.82	2.18	5.93
72	8.02	7.50	7.15	5.65	9.93	5.90	6.80	8.64	3.96	6.00
73	7.41	6.08	7.25	7.32	5.45	6.28	5.49	5.61	3.15	5.49
74	7.03	4.89	7.57	9.23	1.20	6.89	4.41	2.80	2.57	5.25
75	2.63	-.84	0.95	-1.12	0.06	-1.89	3.13	2.24	2.20	0.73
76	11.93	3.89	5.72	5.05	4.55	4.50	2.95	6.39	5.16	5.06
77	6.09	2.87	3.19	6.59	8.31	4.24	5.53	6.62	3.80	4.74
78	2.34	1.19	1.86	2.34	0.44	-.67	1.99	3.63	-.72	0.84
79	4.81	7.85	5.24	5.92	5.51	5.94	7.10	4.39	2.96	5.03
80	1.26	2.40	1.47	1.23	4.00	3.79	4.76	4.49	3.90	3.02
81	3.76	1.00	0.24	1.21	0.47	-.18	1.30	1.39	-.03	0.54
82	0.66	2.71	2.92	1.55	3.40	0.90	2.33	0.30	0.53	1.57
83	0.83	0.40	1.56	3.36	3.16	1.06	1.60	0.87	2.54	2.08
84	-.19	2.33	-1.03	-.30	0.66	0.01	2.07	-.86	0.58	0.25
85	2.69	0.74	2.02	5.63	2.83	3.75	3.47	2.71	3.15	3.31
86	1.97	1.97	5.00	-.81	2.45	-.89	2.92	3.71	2.31	1.93
87	1.13	1.62	0.61	1.60	2.15	0.92	2.79	2.68	2.16	1.70
88	4.61	5.11	5.75	5.59	6.53	4.26	4.06	4.83	3.62	4.75

Deflated Regional Bip - Rates of Growth (Deviations from sample mean)										
JAHR	1	2	3	4	5	6	7	8	9	A
62	2.59	0.52	-0.28	-0.10	1.54	-2.99	1.95	2.70	0.75	0.13
63	0.56	-0.77	1.19	0.82	1.40	0.11	1.39	4.35	-0.14	0.51
64	1.26	3.20	1.95	2.29	2.68	1.75	1.67	1.81	1.03	1.68
65	-0.54	3.09	-0.15	-0.73	1.49	0.08	3.38	-1.49	-0.25	0.16
66	4.11	2.87	2.34	2.56	3.28	2.26	5.27	3.54	1.69	2.48
67	-0.74	0.54	-1.38	-1.83	-0.26	-0.58	-0.64	-2.29	0.31	-0.60
68	1.45	1.08	-1.02	0.48	0.72	2.58	2.09	0.60	1.96	1.17
69	0.95	2.81	1.06	2.90	3.72	2.75	1.44	1.81	3.07	2.51
70	3.04	3.20	2.66	4.85	3.02	3.46	1.20	3.66	3.17	3.24
71	4.52	0.50	4.71	3.10	5.20	2.16	4.47	4.15	-0.91	2.07
72	3.07	3.46	3.12	1.27	5.00	2.59	1.81	3.98	0.87	2.14
73	2.46	2.04	3.21	2.94	0.52	2.96	0.49	0.94	0.06	1.63
74	2.08	0.85	3.54	4.85	-3.73	3.57	-0.59	-1.86	-0.51	1.39
75	-2.32	-4.89	-3.08	-5.49	-4.87	-5.21	-1.87	-2.43	-0.89	-3.13
76	6.98	-0.15	1.69	0.67	-0.38	1.18	-2.05	1.72	2.07	1.20
77	1.13	-1.17	-0.84	2.22	3.37	0.93	0.54	1.95	0.71	0.88
78	-2.62	-2.85	-2.18	-2.03	-4.49	-3.98	-3.01	-1.03	-3.81	-3.02
79	-0.14	3.81	1.21	1.54	0.58	2.62	2.10	-0.28	-0.13	1.17
80	-3.69	-1.64	-2.56	-3.14	-0.94	0.48	-0.23	-0.17	0.81	-0.84
81	-1.19	-3.05	-3.80	-3.16	-4.47	-3.49	-3.69	-3.28	-3.12	-3.32
82	-4.29	-1.33	-1.11	-2.83	-1.54	-2.42	-2.66	-4.36	-2.56	-2.29
83	-4.12	-3.65	-2.47	-1.02	-1.77	-2.26	-3.40	-3.79	-0.54	-1.78
84	-5.14	-1.72	-5.06	-4.68	-4.27	-3.31	-2.93	-5.53	-2.51	-3.61
85	-2.26	-3.30	-2.02	1.25	-2.10	0.43	-1.52	-1.95	0.06	-0.55
86	-2.98	-2.08	0.96	-5.18	-2.49	-4.20	-2.07	-0.95	-0.78	-1.93
87	-3.82	-2.43	-3.43	-2.77	-2.79	-2.40	-2.20	-1.98	-0.93	-2.16
88	-0.35	1.06	1.72	1.22	1.59	0.95	-0.94	0.17	0.53	0.89

Deflated Regional Bip - Rates of Growth (Deviations from sample mean with a break at 1974/75)										
JAHR	1	2	3	4	5	6	7	8	9	A
62	0.68	-1.28	-1.89	-1.90	-0.35	-4.58	0.11	1.02	-0.10	-1.30
63	-1.35	-2.57	-0.42	-0.98	-0.49	-1.48	-0.45	2.67	-1.00	-0.91
64	-0.65	1.41	0.34	0.49	0.79	0.16	-0.17	0.13	0.18	0.26
65	-2.45	1.29	-1.77	-2.53	-0.40	-1.51	1.54	-3.17	-1.11	-1.26
66	2.20	1.07	0.73	0.76	1.39	0.67	3.43	1.85	0.84	1.06
67	-2.65	-1.26	-2.99	-3.63	-2.15	-2.17	-2.48	-3.98	-0.54	-2.03
68	-0.46	-0.72	-2.64	-1.32	-1.17	0.99	0.25	-1.09	1.10	-0.25
69	-0.96	1.01	-0.55	1.10	1.83	1.16	-0.41	0.12	2.21	1.08
70	1.13	1.40	1.05	3.05	1.13	1.87	-0.65	1.98	2.31	1.81
71	2.61	-1.30	3.10	1.30	3.31	0.56	2.63	2.47	-1.76	0.64
72	1.16	1.66	1.51	-0.53	3.11	1.00	-0.03	2.29	0.02	0.72
73	0.55	0.24	1.60	1.14	-1.37	1.37	-1.35	-0.74	-0.79	0.21
74	0.17	-0.95	1.93	3.05	-5.62	1.98	-2.43	-3.54	-1.37	-0.04
75	-0.55	-3.22	-1.59	-3.82	-3.12	-3.73	-0.16	-0.86	-0.10	-1.81
76	8.75	1.52	3.19	2.34	1.37	2.66	-0.34	3.29	2.86	2.52
77	2.91	0.50	0.66	3.89	5.13	2.40	2.25	3.52	1.50	2.20
78	-0.84	-1.18	-0.68	-0.36	-2.74	-2.50	-1.30	0.53	-3.02	-1.70
79	1.63	5.48	2.70	3.22	2.33	4.10	3.81	1.29	0.66	2.49
80	-1.92	0.03	-1.06	-1.47	0.82	1.95	1.47	1.39	1.61	0.48
81	0.58	-1.38	-2.30	-1.49	-2.71	-2.01	-1.98	-1.71	-2.33	-2.00
82	-2.52	0.34	0.39	-1.15	0.22	-0.94	-0.95	-2.80	-1.76	-0.97
83	-2.35	-1.98	-0.97	0.65	-0.02	-0.78	-1.69	-2.22	0.25	-0.46
84	-3.37	-0.05	-3.57	-3.00	-2.52	-1.83	-1.22	-3.96	-1.72	-2.28
85	-0.49	-1.63	-0.52	2.93	-0.35	1.91	0.19	-0.39	0.86	0.77
86	-1.21	-0.41	2.46	-3.51	-0.73	-2.73	-0.36	0.61	0.01	-0.61
87	-2.05	-0.76	-1.93	-1.10	-1.03	-0.92	-0.49	-0.42	-0.14	-0.84
88	1.43	2.73	3.22	2.89	3.35	2.43	0.77	1.73	1.33	2.21

7. Figures

The Figure 1 presents the global shock series from 1965 to 1988 without (solid line) and with a structural break (broken line) in average growth rates in 1974/75. Figures 2a to 2i show the local shocks for the 9 Austrian provinces again without (solid line) and with a structural break in average growth rates.

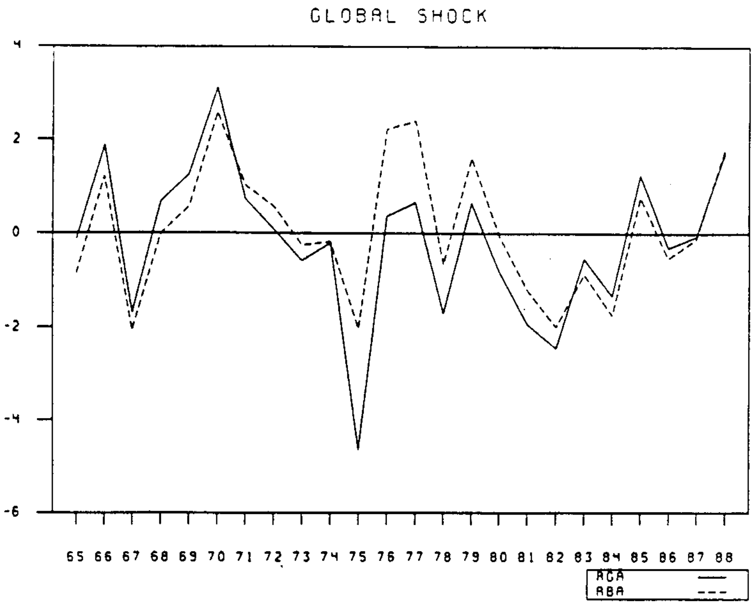

Figure 1

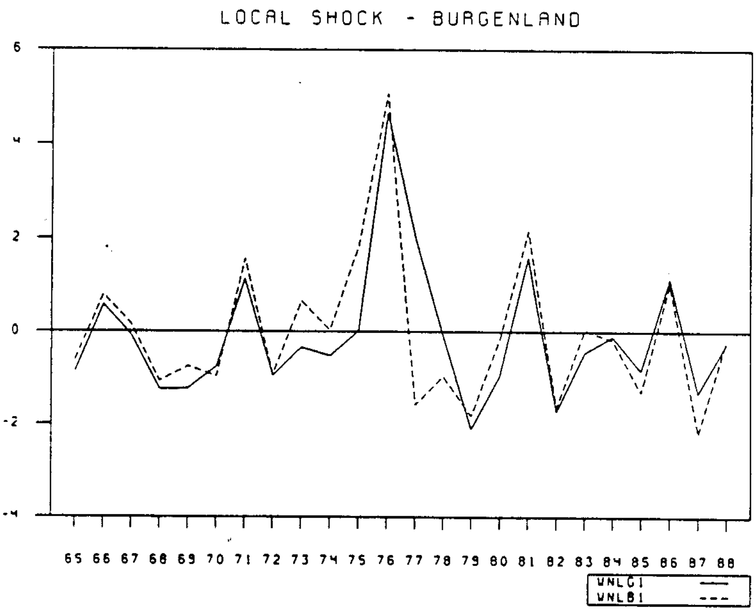

Figure 2 a

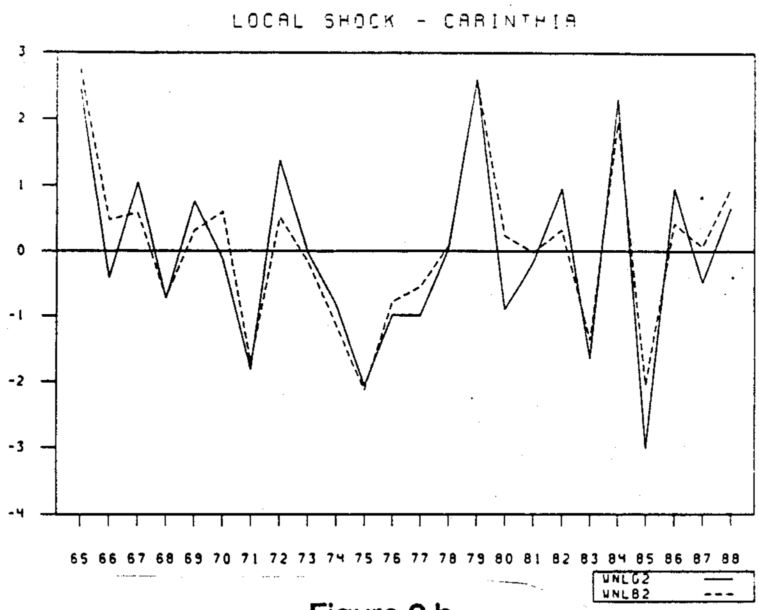

Figure 2 b

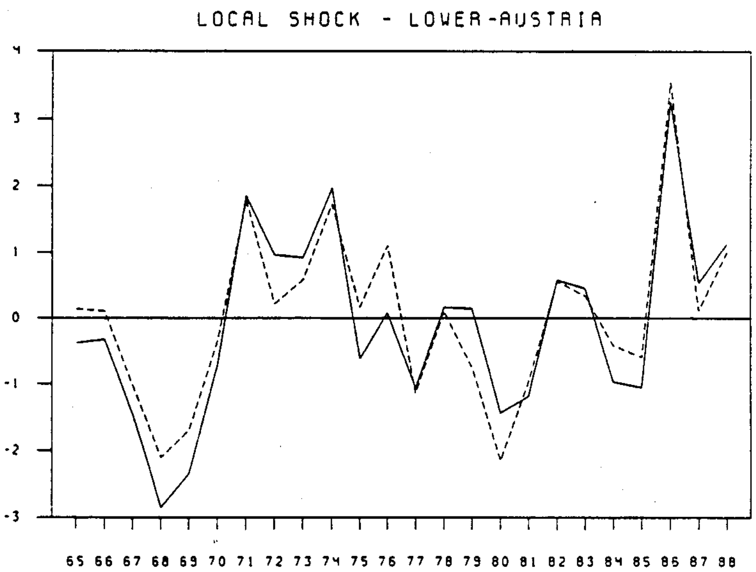

Figure 2 c

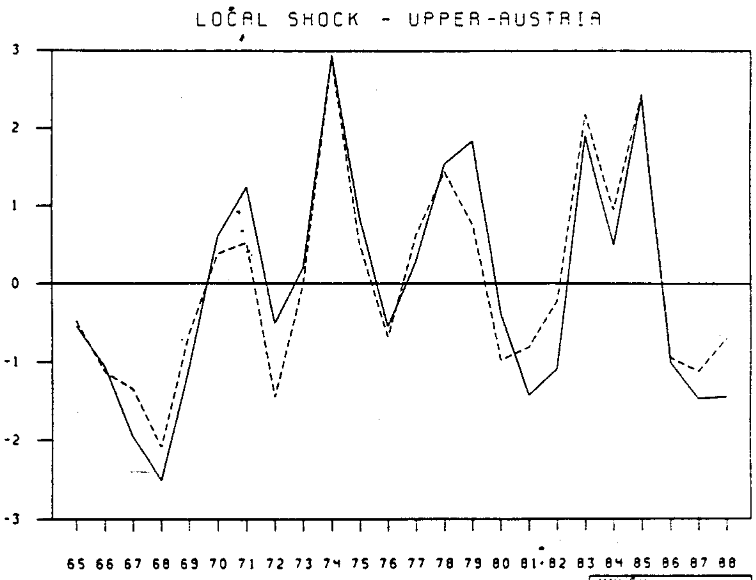

Figure 2 d

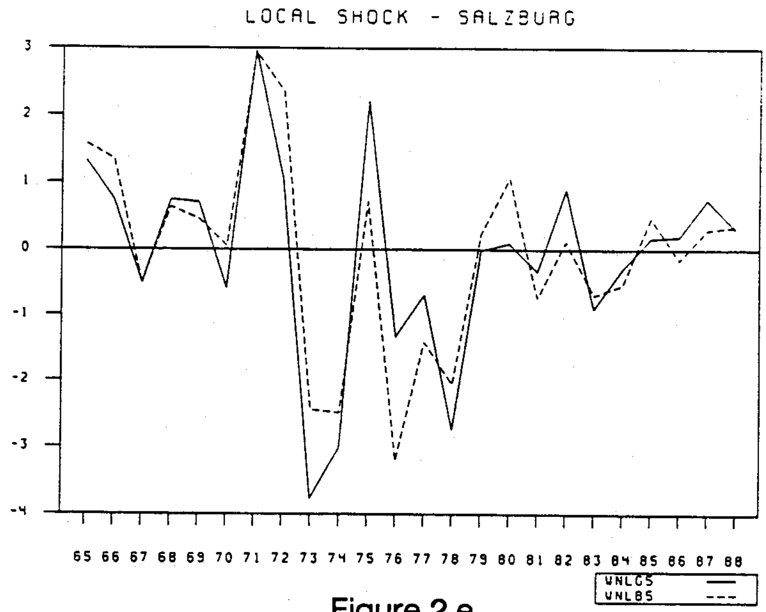

Figure 2 e

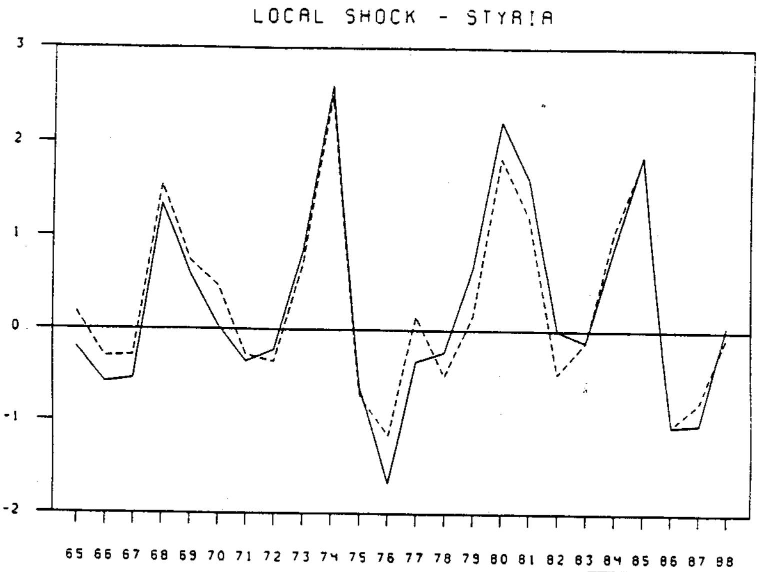

Figure 2 f

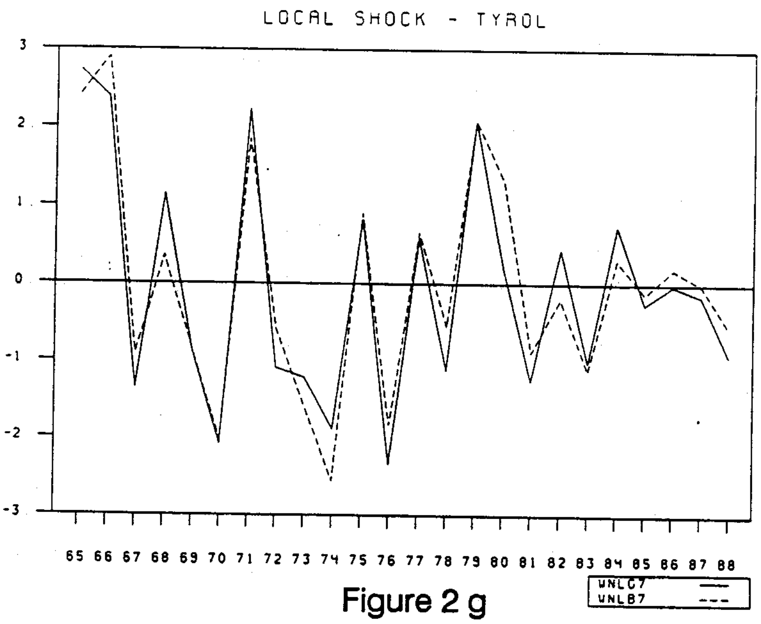

Figure 2 g

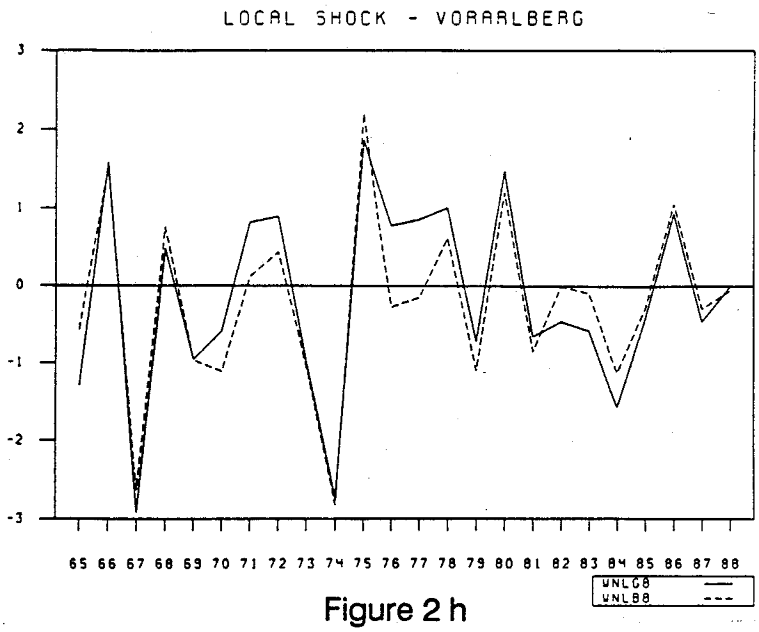

Figure 2 h

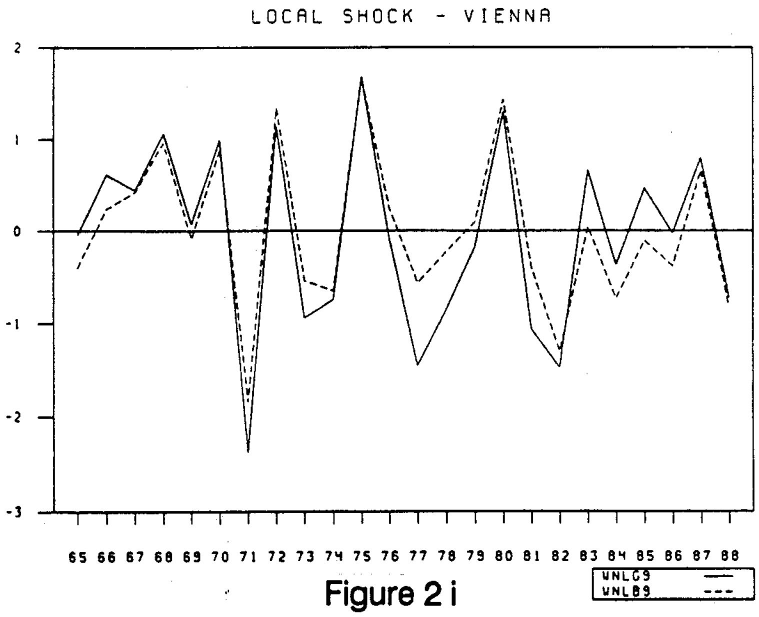

Figure 2 i