AUSTRIA 2 LINK

Macro-econometric model for the Austrian economy

by

P. FLEISSNER and S. SCHLEICHER

presented to the 1971 European Meeting of Project LINK at Bellagio

Research Memorandum No. 53

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Soon after the publication of the first Austrian macro-econometric model AUSTRIA I the econometric research team of the Institute for Advanced Studies (IAS) was encouraged to carry on the work on an enlarged version of this model. The main incentives for this project came from many valuable discussions both from the academic field and empirically oriented economic research. An important event that occurred during the revision of the model was the invitation to the IAS to join project LlNK.

To realize such a project many different skills have to be formed to a team. Especially the authors draw many benefits from the members of the Computer Center of the IAS.

The authors give their thanks to the members of the Österreichisches Institut für Wirtschaftsforschung for their comments and goodwill during the process of collecting the data and specification of the equations.

Drs. J. J. Post from the Netherlands Central Planning Bureau who has been a consultant to the IAS for more than three years introduced our research team to the mysteries of model building and the authors admit with pleasure that many features of this model are based on his experiences.

In summer 1970 Prof. Lawrence R. Klein from the University of Pennsylvania gave at the IAS lectures on recent developments in econometric model building. The members of the econometric research team were very much inspired in their work by the many discussions with him and they wish to thank him for the time he spent together with them.

Vienna, April 1971

P. Fleissner    S. Schleicher
A.2 CHARACTERIZATION OF MODEL AUSTRIA 2 LINK

Model AUSTRIA 2 LINK is a short-term structural model for the Austrian Economy based on the experience of model AUSTRIA 1*. Annual data from 1954 to 1970 were used and the recent revision in the Austrian national account figures was taken into account. The complete model consists of 41 equations among them 20 stochastic equations partly with nonlinear terms.

* P. Fleissner, E. Fürst, E. Löschner, F. Schebeck, S. Schleicher, G. Schwödiauer, H. Winter: Model Austria 1, Research Memorandum No. 44 and 45 of the Institute for Advanced Studies, Vienna 1970, (German).

P. Fleissner, K. Hietler: Stability of linear econometric models Research Memorandum No. 51 of the Institute for Advanced Studies, Vienna 1970 (German).

S. Schleicher; Policy Simulation with Model Austria 1, Research Memorandum No. 50 of the Institute for Advanced Studies, Vienna 1970 (German)
A.3 Specific Features of Model Austria 2 Link

A.3.1 Disaggregation of Foreign Trade

According to LINK-decisions separate import functions were estimated for the commodity categories food, etc. (SITC 0-1), raw materials (SITC 2-4) and manufactures, etc. (SITC 5-9). The function for export of goods contains a world trade variable.

A.3.2 Variable Elasticities by Nonlinear Functions

As all variables in the model were transformed into relative first differences the estimated coefficients have the economic meaning of elasticities. For theoretical reasons it would be desirable to build a model with elasticities dependent on the extent of capacity utilization of the economy. This model tries to realize this concepts by introduction of quantitative terms for some variables as an approximation for the true nonlinear relationship.
B. LIST OF VARIABLES

Symbols without special indication refer to relative changes, levels are indicated by \( \sim \). Capital symbols refer, as a rule, to values and numbers of persons, lower-case symbols to volumes and prices.

- \( A \): number of unemployed
- \( C_{ci} \): commercial and industrial credits
- \( C^o \): public consumption
- \( C^p \): total private consumption
- \( C^{p2} \): squared function of \( C^p \) (cf. equation 34)
- \( d^c \): dummy variable for \( C^p \)
- \( d^{cp} \): dummy variable for \( I^{cp} \)
- \( d^{e1} \): dummy variable for \( p^{ie} \)
- \( d^{e2} \): dummy variable for \( p^{ie} \)
- \( d^h \): index of domestic harvests
- \( d^{ic} \): dummy variable for \( p^{ic} \)
- \( h \): percentage change in working hours
- \( I^c \): gross investment in construction
- \( I^{co} \): gross public investment in construction
- \( I^{cp} \): gross private investment in construction
- \( I^e \): gross investment in equipment
- \( I^{eo} \): gross public investment in equipment
- \( I^{ep} \): gross private investment in equipment
- \( i^i \): inventory changes
- \( i^i \): inventory changes (expressed as a percentage of \( \tilde{U}_w \)):
  \[
i^i = \frac{\Delta i^i}{\tilde{U}^w_{-1}}
\]
K: unit labour costs (ef. equation 28)
L^d: disposable labour income
L^o: gross wage bill in the public sector
L^p: gross wage bill in the private sector
L^p_I^p: labour income per employee in the private sector
M^o: world imports
M^0,1: import of foods, etc. (SITC 0 and 1)
M^2,4: import of raw materials, etc. (SITC 2 and 4)
M^3: import of oil, etc. (SITC 3)
M^5-9: import of manufactures, etc. (SITC 5-9)
M^w: total import of goods
N^a: persons in military service
N^f: foreign employees
N^o: employees in the public sector
N^p: employees in the private sector
N^th: native employees
N^w: population in working ages
p^c: implicit deflator of C^p
p^c': consumer price index
p^co: implicit deflator of C^o
p^ic: implicit deflator of I^c and I^cp
p^ie: implicit deflator of I^e and I^ep
p^mw: implicit deflator for total import of goods
p^m-y: margin between p^mw and p^y^-6/12
p^o: index of prices controlled by public authorities
p^u: implicit deflator of U^w
p^x: implicit deflator of X^w
p^y: implicit deflator of Y
S^x-m: net invisibles
S^x-m: changes in net invisibles (expressed as a percentage of U^-1):
S^x-m = \frac{\Delta S^x-m}{U^w^-1}
<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\tau^d_1$</td>
<td>direct taxes and social insurance of employees</td>
</tr>
<tr>
<td>$\tau^d_2$</td>
<td>direct taxes and social insurance of entrepreneurs</td>
</tr>
<tr>
<td>$t^i$</td>
<td>incidence of indirect taxes minus subsidies (expressed as a percentage value of $U^w$)</td>
</tr>
<tr>
<td>$\tau^{tp}$</td>
<td>transfer payments and total pensions</td>
</tr>
<tr>
<td>$U^w$</td>
<td>total output (less inventory changes and net invisibles)</td>
</tr>
<tr>
<td>$U^{w_2}$</td>
<td>squared function of $U^w$ resp. $u^w$ (cf. equation 35 and 36)</td>
</tr>
<tr>
<td>$X^w$</td>
<td>total export of goods</td>
</tr>
<tr>
<td>$Y$</td>
<td>gross national product, market prices</td>
</tr>
<tr>
<td>$y$</td>
<td>weighted real GNP of main European countries importing Austrian goods</td>
</tr>
<tr>
<td>$y^e$</td>
<td>weighted real GNP of main European countries importing Austrian goods</td>
</tr>
<tr>
<td>$Z$</td>
<td>gross non-labour income</td>
</tr>
<tr>
<td>$Z^d$</td>
<td>disposable non-labour income</td>
</tr>
<tr>
<td>$Z^{d_2}$</td>
<td>squared function of $Z^d$ (cf. equation 37)</td>
</tr>
</tbody>
</table>
C. EQUATIONS OF MODEL "AUSTRIA 2 LINK"

C.1 REACTION EQUATIONS

C.1.1 Expenditure categories

1. \( C^p = 0.517 \, L^d + 0.122 \, Z^d + 0.634 \, p^t + 1.978 \, d^c -9/12 \)

2. \( I^{ep} = 0.310 \, C^c_i + 0.499 \, Z^d -15/12 -1.508 \, p^i_e + 0.203 \, u^w_2 + + 0.265 \, \Delta u^w_2 \)

3. \( I^{cp} = 0.981 \, C^c_i + 0.019 \, Z^{d2} - 10.127 \, d^{cp} -1 \)

4. \( I^i = 0.461 \, u^w - 0.800 \, p^u - 0.890 \, \frac{I^i}{u^w} - 0.460 \, I^i + 0.018 \, d^h -2 -1 -1 \)

5. \( X^w = 0.698 \, M^0 + 0.704 \, y^e + 0.209 \, \Delta u^w_2 -9/12 -1 \)

C.1.2 Import of goods

6. \( M^w = 1.769 \, u^w + 0.139 \, u^w_2 + 1.781 \, I^i + 0.736 \, p^{mw} + -6/12 -6/12 -0.039 \, d^h -1 \)

6a. \( M^{0,1} = 0.129 \, C^{p2} - 0.969 \, d^h -6/12 \)

6b. \( M^{2,4} = 0.226 \, u^w_2 + 0.427 \, \Delta I^e + 0.511 \, I^i + 0.923 \, p^{m-y} \)

6c. \( M^{5-9} = 0.372 \, u^w_2 + 1.820 \, I^i \)
C.1.3 Employment and unemployment

7. $N^P = -0.198 \, l^P + 0.059 \, u^W - \frac{0.230}{h} - \frac{6}{12}$

8. $A = \frac{0.232}{A} + 6.501 \, N^W - 3.518 \, N^{th} - 4.052 \, \Delta l^P$

C.1.4 Income distribution

9. $L^P = 1.788 \, p^t + 0.227 \, u^W - \frac{0.230}{A}$

10. $Z = \frac{0.105}{u^2} - 3.30 \, k + 0.706 \, \Delta x^w - \frac{0.674}{t^i}$

C.1.5 Prices

11. $p^y = 0.306 \, u^w + 0.113 \, \Delta p^g + 0.136 \, l^P + \frac{0.174}{\Delta l^P +}$

   $\frac{0.043}{t^i} - \frac{0.037}{d^h}$

12. $p^x = 0.141 \, l^P + 0.111 \, \Delta x^w + \frac{0.430}{\Delta p^{mw}}$

13. $p^c = 0.264 \, C^P + 0.095 \, l^P + 0.085 \, p^o - \frac{0.011}{d^h} + \frac{0.155}{p^{mw}}$ - $\frac{6}{12}$

14. $p^{c'} = 0.310 \, \Delta C^P + \frac{0.150}{p^{mw}} + \frac{0.385}{l^P} - \frac{0.013}{\Delta d^h}$

15. $p^{c^o} = 0.457 \, C^o + 0.235 \, \Delta C^o + \frac{0.553}{p^y}$

16. $p^{ic} = 0.264 \, l^P + 0.256 \, p^{mw} + 1.454 \, d^{e1} - 1.971 \, d^{e2}$

17. $p^{ic} = 0.332 \, l^P + \frac{0.343}{\Delta N^f} + 5.395 \, d^{ic}$
C.2 DEFINITION EQUATIONS

C.2.1 Relations between value and volume variables

18. \( c^p = c^p - p^c \)

19. \( \dot{i}^{ep} = I^{ep} - p^{ie} \)

20. \( \dot{i}^{cp} = I^{cp} - p^{ic} \)

21. \( u^w = u^w - p^u \)

22. \( y = Y - p^y \)

C.2.2 Total output and GNP

23. \( u^w = \frac{\bar{c}^p}{\bar{u}^w - 1} c^p + \frac{\bar{c}^o}{\bar{u}^w - 1} c^o + \frac{\bar{i}^{e}}{\bar{u}^w - 1} i^e + \frac{\bar{i}^{c}}{\bar{u}^w - 1} i^c + \frac{\bar{x}^w}{\bar{u}^w - 1} x^w \)

24. \( y = \frac{\bar{u}^w}{\bar{v}^w - 1} u^w + \frac{\bar{u}^w}{\bar{v}^w - 1} i^i + \frac{\bar{u}^w}{\bar{v}^w - 1} s^{x-m} - \frac{\bar{m}^w}{\bar{v}^w - 1} m^w \)

24a. \( y = \frac{\bar{u}^w}{\bar{v}^w - 1} u^w + \frac{\bar{u}^w}{\bar{v}^w - 1} i^i + \frac{\bar{u}^w}{\bar{v}^w - 1} s^{x-m} - \frac{\bar{m}^o,1}{\bar{v}^w - 1} m^o,1 - \frac{\bar{m}^2,4}{\bar{v}^w - 1} m^2,4 - \frac{\bar{m}^3}{\bar{v}^w - 1} m^3 - \frac{\bar{m}^{5-9}}{\bar{v}^w - 1} m^{5-9} \)

25. \( p^u = \frac{\bar{c}^p}{\bar{u}^w - 1} p^c + \frac{\bar{c}^o}{\bar{u}^w - 1} p^o + \frac{\bar{i}^{e}}{\bar{u}^w - 1} p^{ie} + \frac{\bar{i}^{c}}{\bar{u}^w - 1} p^{ic} + \frac{\bar{x}^w}{\bar{u}^w - 1} p^x \)
C.2.3 Total investment

![Equation for \( I^e \)]

\[
26. I^e = \frac{\hat{I}^{ep}}{\hat{I}^e_{-1}} I^{ep} + \frac{\hat{I}^{eo}}{\hat{I}^e_{-1}} I^{eo}
\]

![Equation for \( I^c \)]

\[
27. I^c = \frac{\hat{I}^{cp}}{\hat{I}^c_{-1}} I^{cp} + \frac{\hat{I}^{co}}{\hat{I}^c_{-1}} I^{co}
\]

C.2.4 Costs and margins

![Equation for \( K \)]

\[
28. K = L^P - U^w
\]

![Equation for \( p^{m-y} \)]

\[
29. p^{m-y} = p^{mw} - p^{y}_{-6/12}
\]

C.2.5 Incomes

![Equation for \( I^o \)]

\[
30. I^o = L^P - N^P
\]

![Equation for \( L^d \)]

\[
31. L^d = \frac{\hat{L}^p}{\hat{L}^d_{-1}} L^P + \frac{\hat{L}^o}{\hat{L}^d_{-1}} L^o - \frac{\hat{T}^d}{\hat{L}^d_{-1}} T^d + \frac{\hat{T}^{tp}}{\hat{L}^d_{-1}} T^{tp}
\]

![Equation for \( Z^d \)]

\[
32. Z^d = \frac{\hat{Z}}{\hat{Z}^d_{-1}} Z - \frac{\hat{T}^d}{\hat{Z}^d_{-1}} T^d
\]

C.2.6 Employment

![Equation for \( N^{th} \)]

\[
33. N^{th} = \frac{\hat{N}^P}{\hat{N}^{th}_{-1}} N^P + \frac{\hat{N}^o}{\hat{N}^{th}_{-1}} N^o + \frac{\hat{N}^a}{\hat{N}^{th}_{-1}} N^a - \frac{1}{\hat{N}^{th}_{-1}} \Delta \hat{N}^f
\]
C.2.7 Squared functions

34. \( C^2 = (C^p)^2 \) \( \text{sign} \ (C^p) \)
35. \( U^2 = (U^w)^2 \) \( \text{sign} \ (U^w) \)
36. \( u^2 = (u^w)^2 \) \( \text{sign} \ (u^w) \)
37. \( z^2 = (z^d)^2 \) \( \text{sign} \ (z^d) \)
**BALANCE OF RESOURCES AND EXPENDITURES**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\tilde{C}_p$</td>
<td>Total private consumption</td>
<td>178.112</td>
</tr>
<tr>
<td>$\tilde{C}_o$</td>
<td>Public consumption</td>
<td>44.120</td>
</tr>
<tr>
<td>$\tilde{I}^{ep}$</td>
<td>Gross private investment in equipment</td>
<td>29.551</td>
</tr>
<tr>
<td>$\tilde{I}^{eo}$</td>
<td>Gross public investment in equipment</td>
<td>3.629</td>
</tr>
<tr>
<td>$\tilde{I}^{cp}$</td>
<td>Gross private investment in construction</td>
<td>30.654</td>
</tr>
<tr>
<td>$\tilde{I}^{co}$</td>
<td>Gross public investment in construction</td>
<td>15.108</td>
</tr>
<tr>
<td>$\tilde{X}_w$</td>
<td>Total export of goods</td>
<td>51.708</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\tilde{U}_w$</td>
<td>Total output (less inventory changes and net invisibles)</td>
<td>352.882</td>
</tr>
<tr>
<td>$\tilde{I}_i$</td>
<td>Inventory changes</td>
<td>3.618</td>
</tr>
<tr>
<td>$\tilde{S}_{x-m}$</td>
<td>Net invisibles</td>
<td>10.625</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>367.125</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$L$</td>
<td>Wages</td>
<td>149.921</td>
</tr>
<tr>
<td>$\tilde{Z}^s$</td>
<td>Other income</td>
<td>75.583</td>
</tr>
<tr>
<td>$\tilde{T}^i$</td>
<td>Indirect taxes minus subsidies</td>
<td>43.469</td>
</tr>
<tr>
<td>$F$</td>
<td>Depreciation</td>
<td>33.256</td>
</tr>
<tr>
<td>$Y$</td>
<td>GNP market prices</td>
<td>302.229</td>
</tr>
<tr>
<td>$M^w$</td>
<td>Total import of goods</td>
<td>64.896</td>
</tr>
<tr>
<td></td>
<td></td>
<td>367.125</td>
</tr>
</tbody>
</table>
TOTAL PRIVATE CONSUMPTION

\[ C^p = 0.517 L^d + 0.122 Z^d + 0.694 p^{c'} + 1.976 d^c \]

Explanation of variables

- \( C^p \): total private consumption
- \( L^d \): disposable labour income
- \( Z^d \): disposable non-labour income
- \( p^{c'} \): consumer price index
- \( d^c \): dummy variable for total private consumption
### Independent Variables

<table>
<thead>
<tr>
<th>$X_i$</th>
<th>$L^d$</th>
<th>$Z^d_9/12$</th>
<th>$\rho^c$</th>
<th>$d^c$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\hat{\beta}_l$</td>
<td>0.517</td>
<td>0.122</td>
<td>0.694</td>
<td>1.978</td>
</tr>
<tr>
<td>$\hat{\beta}_0$</td>
<td>0.057</td>
<td>0.032</td>
<td>0.146</td>
<td>0.475</td>
</tr>
<tr>
<td>$</td>
<td>\hat{\beta}_l</td>
<td>/\hat{\beta}_0</td>
<td>$</td>
<td>11%</td>
</tr>
</tbody>
</table>

---

**Prediction** --- **Realization**

$R^2 = 0.862$

---

**Residuals**

$DW = 2.30$
\[ I_{ep} = 0.310 C_{ci}^{3/12} + 0.499 Z^d_{-15/12} + 0.265 \Delta u^{w2}_{-1} + 0.203 u^{w2}_{-1} - 1.508 p_{ep}^{ep}_{-1} \]

**Explanation of symbols**

- \( I_{ep} \): gross private investment in equipment
- \( C_{ci} \): commercial and industrial credits
- \( Z^d \): disposable non-labour income
- \( p_{ep} \): implicit deflator for gross private investment in equipment
- \( u^{w2} \): squared function of total output (less inventory changes and exports of services)
**Independent Variables.**

<table>
<thead>
<tr>
<th>$X_i$</th>
<th>$\hat{c}_i$</th>
<th>$\frac{Z_d}{5/12}$</th>
<th>$\hat{\beta}_i$</th>
<th>$\hat{\beta}_L$</th>
<th>$\Delta u^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\hat{\beta}_i$</td>
<td>.310</td>
<td>.499</td>
<td>-1.508</td>
<td>.203</td>
<td>.265</td>
</tr>
<tr>
<td>$\hat{\beta}_L$</td>
<td>.140</td>
<td>.220</td>
<td>.452</td>
<td>.079</td>
<td>.037</td>
</tr>
<tr>
<td>$\hat{\Delta \beta}/\beta_i$</td>
<td>45%</td>
<td>44%</td>
<td>30%</td>
<td>34%</td>
<td>14%</td>
</tr>
</tbody>
</table>

**Prediction --- --- Realization --- --- $R^2 = .963$**

**Residuals**

**DW = 2.12**
$$I^{CP} = 0.981 C^{ci} + 0.019 Z^{d2} - 10.127 d^{cp}$$

**Explanation of symbols**

- $I^{CP}$: gross private investment in construction
- $C^{ci}$: commercial and industrial credits
- $Z^{d2}$: squared function of disposable non-labour income
- $d^{cp}$: dummy variable for gross private investment in construction
**Independent Variables**

<table>
<thead>
<tr>
<th>$X_i$</th>
<th>$\hat{c}_{ci}$</th>
<th>$\hat{Z}_{dl}^{2}$</th>
<th>$c^{cp}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\hat{\beta}_i$</td>
<td>.981</td>
<td>.019</td>
<td>-10.127</td>
</tr>
<tr>
<td>$\hat{\delta}^{\beta}_i$</td>
<td>.108</td>
<td>.012</td>
<td>2.836</td>
</tr>
<tr>
<td>$</td>
<td>\hat{\delta}^{\beta}_i / \hat{\beta}_i</td>
<td>$</td>
<td>11 %</td>
</tr>
</tbody>
</table>

**Prediction --- --- Realization --- --- $R^2=.869$**

**Residuals**

**$I^{cp}$ $\varepsilon 3.2$**

**DF = 10**
\[ I^i = 0.461 \ U^w - 0.800 \ p^u - 0.890 \ \bar{\gamma}_i^{i+1} / \bar{\zeta}^{i+1}_w - 0.460 \ I^i_i + 0.018 \ d^h \]

**Explanation of symbols**

- \( I^i \): inventory changes (expressed as a percentage of total output less inventory changes and net invisibles)
- \( U^w \): total output (less inventory changes and net invisibles)
- \( p^u \): implicit deflator of total output \( U^w \)
- \( d^h \): index of domestic harvests
### Independent Variables

<table>
<thead>
<tr>
<th>( x_i )</th>
<th>( u^w )</th>
<th>( u^t )</th>
<th>( \frac{\hat{I}_i}{\hat{u}^w} )</th>
<th>( \hat{I}_{i-1} )</th>
<th>( d^h )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \hat{\beta}_i )</td>
<td>.461</td>
<td>-.800</td>
<td>-.397</td>
<td>-.460</td>
<td>.018</td>
</tr>
<tr>
<td>( \hat{\sigma}^2_{\beta_i} )</td>
<td>.065</td>
<td>.152</td>
<td>.125</td>
<td>.133</td>
<td>.006</td>
</tr>
<tr>
<td>(</td>
<td>\hat{\sigma}^2_{\beta_i}/\hat{\beta}_i</td>
<td>)</td>
<td>14%</td>
<td>19%</td>
<td>14%</td>
</tr>
</tbody>
</table>

**Prediction --- Realization ---**

\( R^2 = .906 \)

### Residuals

\( DW = 1.10 \)
\[ X^w = 0.698 M^o + 0.704 y^e + 0.209 \Delta u^{w2} \]

**Explanation of symbols**

- \( X^w \): total exports of goods
- \( M^o \): world imports
- \( y^e \): weighted real GNP of main European countries importing Austrian goods
- \( u^{w2} \): squared functions of total output (less inventory changes and exports of services)
**Independent Variables**

<table>
<thead>
<tr>
<th>$X_i$</th>
<th>$M_{-9/12}$</th>
<th>$y^b_{-1}$</th>
<th>$\Delta u_{-2}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\hat{\beta}_i$</td>
<td>.698</td>
<td>.704</td>
<td>.209</td>
</tr>
<tr>
<td>$\hat{\delta}^i_i$</td>
<td>.175</td>
<td>.275</td>
<td>.329</td>
</tr>
<tr>
<td>$</td>
<td>\hat{\delta}^i_i/\hat{\beta}_i</td>
<td>$</td>
<td>25 %</td>
</tr>
</tbody>
</table>

**Prediction ——— Realization ———**

$R^2 = .886$

**Residuals**

$DW = 1.70$
Scatter Diagram

\[ X^{w} \quad E \quad S \quad 3 \]

\[ Y^{incr.} = 0.7858E+00 \quad X^{incr.} = 0.3907E+00 \]

\[ X^{w} \]

\[ 0.213E \quad 0.173E \quad 0.134E \quad 0.951E \quad 0.558E \quad 0.165E \quad -0.227E \quad -0.620E \]

\[ Y^{w} \]

\[ 0.0 \quad 0.0 \quad 0.0 \quad 0.0 \quad 0.0 \quad 0.0 \quad 0.0 \quad 0.0 \]

\[ \Delta u^{w^2} \]

\[ M^{d} = 9/12 \]
\[ M^w = 1.769 \, u^w + 0.139 \, \Delta u^{w2} + 1.781 \, I^i -6/12 + 0.736 \, p^{mw} -6/12 - 0.093 \, d^h -1 \]

**Explanation of symbols**

- \( M^w \): total import of goods
- \( u^w \): total output (less inventory changes and net invisibles)
- \( u^{w2} \): squared function of total output (less inventory changes and net invisibles)
- \( I^i \): inventory changes (expressed as a percentage of total output less inventory changes and net invisibles)
- \( p^{mw} \): implicit deflator for total import of goods
- \( d^h \): index of domestic harvests
### Independent Variables

<table>
<thead>
<tr>
<th>$X_i$</th>
<th>$u^w$</th>
<th>$\Delta u^{w2}$</th>
<th>$I_i^{1-6/12}$</th>
<th>$p^{-6/12}$</th>
<th>$d^{-1}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\hat{\beta}_i$</td>
<td>1.769</td>
<td>0.139</td>
<td>1.781</td>
<td>0.736</td>
<td>-0.093</td>
</tr>
<tr>
<td>$\hat{\sigma}_i$</td>
<td>0.106</td>
<td>0.025</td>
<td>0.730</td>
<td>0.236</td>
<td>0.033</td>
</tr>
<tr>
<td>$</td>
<td>\hat{\sigma}_i / \hat{\beta}_i</td>
<td>$</td>
<td>6%</td>
<td>18%</td>
<td>41%</td>
</tr>
</tbody>
</table>

---

**Prediction -- REALIZATION**

$R^2 = 0.955$

---

**Residuals**

$DW = 2.05$
\[ M^{0.1} = 0.129 \, C^{P2} - 0.969 \, d^h \]

Explanation of symbols

- \( M^{0.1} \): import of foods, etc. (SITC 0 and 1)
- \( C^{P2} \): squared function of total private consumption \( C^P \)
- \( d^h \): index of domestic harvests
### Independent Variables

<table>
<thead>
<tr>
<th>$X_i$</th>
<th>$C_i^2$</th>
<th>$d_i^{6/12}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\hat{\beta}_i$</td>
<td>.129</td>
<td>-.969</td>
</tr>
<tr>
<td>$\hat{\theta}_i$</td>
<td>.028</td>
<td>.213</td>
</tr>
<tr>
<td>$</td>
<td>\hat{\delta}_i / \beta_i</td>
<td>$</td>
</tr>
</tbody>
</table>

DF = 1.2

---

**Prediction — — Realization**

$R^2 = .671$

---

**Residuals**

DW = 2.31
\[ M^{2,4} = 0.226 \ u^{w2} + 0.427 \Delta I^e + 4.511 \ I^i + 0.923 \ p^{m-y} \]

**Explanation of symbols**

- \( M^{2,4} \): import of raw materials (SITC 2 and 4)
- \( u^{w2} \): squared function of total output (less inventory changes and exports of services)
- \( I^i \): inventory changes (expressed as a percentage of total output less inventory changes and net invisibles)
- \( I^e \): gross investment in equipment
- \( p^{m-y} \): margin between \( p^{mw} \) and \( p^y \)

-6/12
### Independent Variables

<table>
<thead>
<tr>
<th>$x_i$</th>
<th>$u_i^2$</th>
<th>$\Delta I^e$</th>
<th>$i^i$</th>
<th>$p_{m-y}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta_i$</td>
<td>.226</td>
<td>.427</td>
<td>4.511</td>
<td>.923</td>
</tr>
<tr>
<td>$\delta_{eta_i}$</td>
<td>.047</td>
<td>.175</td>
<td>1.759</td>
<td>.360</td>
</tr>
<tr>
<td>$</td>
<td>\delta_{eta_i}/\beta_i</td>
<td>$</td>
<td>21%</td>
<td>.41%</td>
</tr>
</tbody>
</table>

**Prediction** --- **Realization**  
$R^2 = .895$

**Residuals**

$DW = 2.25$
\[ M^{5-9} = 0.372 \cdot u^2 + 1.820 \cdot I^i \]

**Explanation of symbols**

- \( M^{5-9} \): Import of manufactures, etc. (SITC 5 - 9)
- \( u^2 \): Squared function of total output (less inventory changes and net invisibles)
- \( I^i \): Inventory changes (expressed as a percentage of total output less inventory changes and net invisibles)
### Independent Variables

<table>
<thead>
<tr>
<th>$x_i$</th>
<th>$\nu^2$</th>
<th>$I_i$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta_i$</td>
<td>0.372</td>
<td>1.820</td>
</tr>
<tr>
<td>$\delta \beta_i$</td>
<td>0.015</td>
<td>0.601</td>
</tr>
<tr>
<td>$</td>
<td>\widehat{\delta \beta_i}/\beta_i</td>
<td>$</td>
</tr>
</tbody>
</table>

DF = 12

Prediction --- Realization

$R^2 = 0.940$

Residuals

$DW = 1.89$
NUMBER OF EMPLOYEES IN PRIVATE SECTOR

\[ N^P = .059 \, w^2 - .198 \, l^P - .230 \, h \]

Explanation of symbols

- \( N^P \): number of employees in private sector
- \( w^2 \): squared function of total output (less inventory changes and net invisibles)
- \( l^P \): gross wage bill in the private sector
- \( h \): percentage change in working hours
**Independent Variables**

<table>
<thead>
<tr>
<th>$x_i$</th>
<th>$\hat{w}^2_{i-6/12}$</th>
<th>$l^P_{i-1}$</th>
<th>$n_i$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\hat{\beta}_e$</td>
<td>0.059</td>
<td>-0.198</td>
<td>-0.230</td>
</tr>
<tr>
<td>$\hat{\gamma}_{\hat{\beta}_e}$</td>
<td>0.009</td>
<td>0.040</td>
<td>0.099</td>
</tr>
<tr>
<td>$</td>
<td>\hat{\delta}_{\beta_e}/\hat{\beta}_e</td>
<td>$</td>
<td>15%</td>
</tr>
</tbody>
</table>

**Prediction** ——— **Realization**

$R^2 = 0.807$

**Residuals**

$DW = 1.36$
\[ A = 0.232 A + 6.501 N^w - 3.518 N^h - 4.052 \Delta l^p \]

**Explanation of symbols**

- **A**: number of unemployed
- **N^w**: population in working ages
- **N^h**: native employees
- **l^p**: gross wage bill in private sector
### Independent Variables

<table>
<thead>
<tr>
<th>$X_i$</th>
<th>$A_{-1}$</th>
<th>$N^W$</th>
<th>$N^{th}$</th>
<th>$\Delta l^D$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\hat{\beta}_i$</td>
<td>0.232</td>
<td>6.501</td>
<td>-3.518</td>
<td>-4.052</td>
</tr>
<tr>
<td>$\hat{\beta}_c$</td>
<td>0.058</td>
<td>1.300</td>
<td>0.528</td>
<td>0.324</td>
</tr>
<tr>
<td>$</td>
<td>\hat{\beta}_c/\hat{\beta}_i</td>
<td>$</td>
<td>25%</td>
<td>20%</td>
</tr>
</tbody>
</table>

**Prediction --- Realization**

$R^2 = 0.973$

### Residuals

$DW = 1.94$
\[ L^P = 1.788 \ p^C - 0.227 \ U^W - 0.230 \ A \]

Explanation of symbols:

- \( L^P \): gross wage bill in private sector
- \( p^C \): consumer price index
- \( U^W \): total output (less inventory changes and net invisibles)
- \( A \): number of unemployed
### Independent Variables

<table>
<thead>
<tr>
<th>$X_i$</th>
<th>$p_{c't}^{-6/12}$</th>
<th>$U_{-1}^w$</th>
<th>$h$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\hat{\beta}_i$</td>
<td>1.788</td>
<td>.227</td>
<td>-.230</td>
</tr>
<tr>
<td>$\hat{\sigma}_{\hat{\beta}_i}$</td>
<td>.215</td>
<td>.084</td>
<td>.021</td>
</tr>
<tr>
<td>$</td>
<td>\hat{\sigma}_{\hat{\beta}_i} / \hat{\beta}_i</td>
<td>$</td>
<td>12 %</td>
</tr>
</tbody>
</table>

**Prediction — — — Realization — — — $R^2 = .893$**

**Residuals**

$DW = 1.48$
GROSS NON-LABOUR INCOME

\[ Z = 0.105 \frac{U^{w2}}{9/12} - 3.038 \frac{K}{9/12} + 0.706 \frac{\Delta X^w}{9/12} - 0.674 \frac{t_i}{-4/12} \]

**Explanation of symbols**

- \( Z \): gross non-labour income
- \( U^{w2} \): squared function of total output (less inventory changes and net invisibles)
- \( K \): unit labour costs
- \( X^w \): total export of goods
- \( t_i \): incidence of indirect taxes minus subsidies
### Independent Variables

<table>
<thead>
<tr>
<th>$x_i$</th>
<th>$u_{-9/12}$</th>
<th>$K_{-9/12}$</th>
<th>$\Delta x^w$</th>
<th>$t_{-4/12}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\hat{\beta}_i$</td>
<td>.105</td>
<td>-3.038</td>
<td>.706</td>
<td>-.674</td>
</tr>
<tr>
<td>$\hat{\delta}_{\beta_i}$</td>
<td>.017</td>
<td>.486</td>
<td>.071</td>
<td>.290</td>
</tr>
<tr>
<td>$</td>
<td>\hat{\delta}_{\beta_i}/\beta_i</td>
<td>$</td>
<td>6%</td>
<td>16%</td>
</tr>
</tbody>
</table>

### Prediction --- --- Realization ---

$R^2 = .886$

### Residuals

$DW = 2.13$
IMPLICIT DEFlator OF GNP

\[ p^Y = 0.306 U^w - \frac{3}{12} + 0.113 \Delta p^o + 0.136 I^P + 0.174 \Delta I^P + \]
\[ + 0.043 t^i - 0.037 d^h \]

Explanation of symbols

- \( p^Y \): implicit deflator of gross national product
- \( U^w \): total output (less inventory changes and net invisibles)
- \( p^o \): index of prices controlled by public authorities
- \( I^P \): labour income per employee in the private sector
- \( t^i \): incidence of indirect taxes minus subsidies
- \( d^h \): index of domestic harvests
### Independent Variables

<table>
<thead>
<tr>
<th>$X_i$</th>
<th>$U_{-3/12}^W$</th>
<th>$\Delta p^o_{-1}$</th>
<th>$i_{-1}$</th>
<th>$\Delta l^o_{-1}$</th>
<th>$i_{-1}$</th>
<th>$a^h$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\hat{\beta}_i$</td>
<td>0.306</td>
<td>0.113</td>
<td>0.136</td>
<td>0.174</td>
<td>0.043</td>
<td>-0.037</td>
</tr>
<tr>
<td>$\hat{\theta}_{\beta_i}$</td>
<td>0.049</td>
<td>0.025</td>
<td>0.054</td>
<td>0.073</td>
<td>0.028</td>
<td>0.004</td>
</tr>
<tr>
<td>$</td>
<td>\hat{\theta}_{\beta_i}/\beta_i</td>
<td>$</td>
<td>16%</td>
<td>22%</td>
<td>40%</td>
<td>42%</td>
</tr>
</tbody>
</table>

---

**Prediction**  
---  
**Realization**  

$R^2 = 0.967$

---

**Residuals**  

$DW = 1.94$
\[ p^x = 0.141 \, l^P + 0.111 \, \Delta x^w + 0.430 \, \Delta p^{mw} \]

**Explanation of symbols**

- \( p^x \): implicit deflator of total export of goods
- \( l^P \): labour income per employee in the private sector
- \( x^w \): total export of goods
- \( p^{mw} \): implicit deflator of total import of goods
### Independent Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>( L L )</th>
<th>( \Delta X_{-1} )</th>
<th>( \Delta \alpha_{lw} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \hat{\beta}_1 )</td>
<td>0.141</td>
<td>0.111</td>
<td>0.430</td>
</tr>
<tr>
<td>( \hat{\alpha}_{lw} )</td>
<td>0.027</td>
<td>0.028</td>
<td>0.074</td>
</tr>
<tr>
<td></td>
<td>19%</td>
<td>25%</td>
<td>17%</td>
</tr>
</tbody>
</table>

### Prediction vs. Realization

\[ R^2 = 0.870 \]

### Residuals

\[ DW = 2.20 \]
Scatter Diagram
IMPLICIT DEFLATOR FOR TOTAL PRIVATE CONSUMPTION

\[ p^c = 0.264 \, \text{CP} + 0.095 \, l^p + 0.086 \, p^o - 0.011 \, d^h + 0.155 \, p^{mw}_{-6/12} \]

**Explanation of symbols**

- \( p^c \): implicit deflator for total private consumption
- \( CP \): total private consumption
- \( l^p \): labour income per employee in the private sector
- \( p^o \): index of prices controlled by public authorities
- \( d^h \): index of domestic harvests
- \( p^{mw} \): implicit deflator for total import of goods
### Independent Variables

<table>
<thead>
<tr>
<th>$x_i$</th>
<th>$c^p$</th>
<th>$l_{-1}^p$</th>
<th>$c^o$</th>
<th>$d^h$</th>
<th>$p^{mw}$</th>
<th>$p_{-6/12}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\hat{\beta}_i$</td>
<td>.264</td>
<td>.095</td>
<td>.086</td>
<td>-.011</td>
<td>.155</td>
<td></td>
</tr>
<tr>
<td>$\hat{\delta}_{\beta_i}$</td>
<td>.042</td>
<td>.050</td>
<td>.040</td>
<td>.004</td>
<td>.033</td>
<td></td>
</tr>
<tr>
<td>$</td>
<td>\hat{\delta}_{\beta_i}/\beta_i</td>
<td>$</td>
<td>16 %</td>
<td>53 %</td>
<td>47 %</td>
<td>38 %</td>
</tr>
</tbody>
</table>

### Prediction --- Realization

- $R^2 = .937$

### Residuals

- $D.W = 2.73$
Scatter Diagram

\[ YINC = 8.449E-01 \]

\[ XINC = 1.838E+00 \]

\[ p^C \]

\[ E 13.3 \]
\[ p^{c'} = 0.310 \Delta c^p + 0.150 p^{mw} + 0.385 l^p - 0.013 \Delta d^h \]

**Explanation of symbols**

- \( p^{c'} \) consumer price index
- \( c^p \) total private consumption
- \( p^{mw} \) implicit deflator for total import of goods
- \( l^p \) labour income per employee in the private sector
- \( d^h \) index of domestic harvests
### Independent Variables

<table>
<thead>
<tr>
<th>$x_i$</th>
<th>$\Delta C$</th>
<th>$p_{-1}$</th>
<th>$\Delta p_{-1}$</th>
<th>$\Delta d^h$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\hat{\beta}_i$</td>
<td>0.310</td>
<td>0.150</td>
<td>0.365</td>
<td>-0.013</td>
</tr>
<tr>
<td>$\hat{\hat{\beta}}_i$</td>
<td>0.102</td>
<td>0.069</td>
<td>0.019</td>
<td>0.005</td>
</tr>
<tr>
<td>$</td>
<td>\hat{\hat{\beta}}_i/\beta_i</td>
<td>$</td>
<td>33 %</td>
<td>46 %</td>
</tr>
</tbody>
</table>

Prediction — — — Realization — — — $R^2 = 0.796$

Residuals $\text{DW} = 1.70$
\[ p^{co} = 0.457\ C^o + 0.235\ D\ C^o + 0.553\ p^y_{-4/12} \]

Explanation of symbols

- \( p^{co} \) implicit deflator of public consumption
- \( C^o \) public consumption
- \( p^y \) implicit deflator of gross national product
### Independent Variables

<table>
<thead>
<tr>
<th>$X_i$</th>
<th>$c^o$</th>
<th>$\Delta c^o$</th>
<th>$\beta^y_{-4/12}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\hat{\beta}_i$</td>
<td>.457</td>
<td>.235</td>
<td>.553</td>
</tr>
<tr>
<td>$\hat{\delta}_{\psi}$</td>
<td>.091</td>
<td>.061</td>
<td>.254</td>
</tr>
<tr>
<td>$</td>
<td>\hat{\delta}_{\psi} / \beta_i</td>
<td>$</td>
<td>20%</td>
</tr>
</tbody>
</table>

**Prediction -- -- --. Realization ———  $R^2 = .911$**

**Residuals  DW = 1.23**
IMPLICIT DEFlator OF GROSS PRIVATE INVESTMENT IN EQUIPMENT

\[ p_{ie} = 1.454 d_{e1} - 1.971 d_{e2} + .256 p_{mw} + .264 l^p \]

Explanation of symbols

- \( p_{ie} \)  implicit deflator of gross private investment in equipment
- \( d_{e1} \) and \( d_{e2} \) dummy variables for \( p^{ep} \)
- \( p_{mw} \) implicit deflator of total import of goods
- \( l^p \) labour income per employee in the private sector
\[ p^{ic} = 5.395 d^{ic} + 0.332 \, l^p + 0.343 \Delta N_f^-1 \]

**Explanation of symbols**

- \( p^{ic} \): implicit deflator of gross private investment in construction
- \( d^{ic} \): dummy variable of gross private investment in construction
- \( l^p \): labour income per employee in the private sector
- \( N_f \): foreign employees
### Independent Variables

\[ DF=11 \]

<table>
<thead>
<tr>
<th>( X_i )</th>
<th>( d_{ic} )</th>
<th>( \hat{l}_{-1} )</th>
<th>( \Delta N^f )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \hat{\beta}_i )</td>
<td>5.395</td>
<td>0.332</td>
<td>0.343</td>
</tr>
<tr>
<td>( \hat{\theta}_{\hat{\beta}_i} )</td>
<td>1.780</td>
<td>0.056</td>
<td>0.062</td>
</tr>
<tr>
<td>( \hat{\theta}_{\hat{\beta}_i}/\hat{\beta}_i )</td>
<td>33 %</td>
<td>17 %</td>
<td>18 %</td>
</tr>
</tbody>
</table>

---

**Prediction -- -- -- Realization**

\[ R^2=0.806 \]

---

**Residuals**

\[ DW=2.64 \]