Modelling Economies in Transition 2003
Lódz 2004, pp. 19–46

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THE STRUCTURE OF THE LONG-TERM W8D-2002 ECONOMETRIC MODEL OF THE POLISH ECONOMY

1. Introduction

Construction of the W8D model of the Polish economy within the years 1999–2001 led, in the Polish literature, to the emergence of the very first macroeconometric model regarding endogenous technical progress. This enabled an elaboration of preliminary policy scenarios within long horizons, up to the year 2025, in which were shown explicitly potential effects of total factor productivity resulting from absorption of both domestic and foreign R&D outlays as well as from increasing human capital accumulation. However, the option of stimulating endogenous growth would call for appropriate changes in macroeconomic policies, especially in the field of reallocation of budget expenditures to increase outlays on research and development activity (see W. Welfe (ed.) 2001).

The parameters of the W8D model were estimated, using a sample ending in the year 1998. Thus they were based only on a few observations concerning the transition period and as such could not be regarded as a pattern of behavior for the economic agents of the first quarter of the 21st century. To this end, the sample had to be extended, which was done by incorporating two more yearly data, 1999 and 2000 (at the moment the model was being re-estimated, data for the year 2001 were not available). The database for the W8 models was properly updated and extended, which is described in a separate paper (see W. Florczak 2002a).

Next, all the data – more than 300 time series – gathered in the database were subject to investigation into their integration order. It turned out – in line

with some previous research – that the majority of the analyzed series was stationary in their first differences (see W. Florczak 2002b). This is an invaluable hint for those running regressions with the use of those series.

The extended sample enabled then – in the process of running individual regressions – an examination of parameters' stability, and consequently resignation from calibration of some parameters (e.g. in the equation of investment outlays). This enabled also re-specification of some other equations, so as to include variables so far excluded from those equations. In particular, this referred to the functions of private consumption, in which an attempt was made to account for the welfare effect, of investment demand, in which FDI were explicitly introduced, and finally, of production to allow for the effects of imported technologies.

The new W8D-2002 model of the Polish economy is going to constitute a tool for elaborating *ex-ante* forecasts of long horizons, up to the year 2025, and for running alternative policy scenarios. The scenarios allow for various policy assumptions, including variable external economic environment and variants of a knowledge-based society.

2. The core and re-specified equations of the model

After having extended the sample to the year 2000, the re-estimation of all the initial equations followed. This enabled us to analyze the stability of individual relations. Adding two more observations from the transition period was of considerable importance for the accuracy of estimates, especially in the equations that previously had been estimated on short samples (e.g. in the sector of financial flows, whose data started in the 90-ies), and for piece-wise regressions. In the cases, in which data was abundant (such as in investment outlays or labor productivity) the changes in estimates were relatively minor. The estimates that previously used to be insignificant, frequently remained volatile even after extending the sample. This means that further updating is necessary in the future. Such a situation took place e.g. in the case of interest rates in the private consumption equation. Nevertheless, many times the extension enriched individual specifications through inclusion of additional variables. Below, most illustrative examples are given.

In analyses of consumer demand, especially those carried out in Great Britain, the increasing importance of the wealth factor has been accentuated. The wealth manifests itself in two forms: tangibles (mainly real estate) and financial goods, i.e. money stock (cash and deposits) and securities (bonds and shares). Tangibles are usually limited only to real estate, that, contrary to other tangibles, are valued and registered. So reduced tangibles used to enter equations of

consumer demand as an additional variable. Their increment stimulated households' expenditures on furnishings, household equipment, etc. and on repairs. As for the other tangibles some methods of an indirect assessment of their changes gained popularity (see e.g. J. R. N. Stone, D. A. Rowe 1957; L. D. Taylor, H. S. Houthakker 1970). However, the methods are rarely employed while constructing macroeconomic consumer demand functions (see I. Sujan et al. 1997, ch. 7).

The stock of financial assets also favorably affects the level of consumer expenditures – it enables purchases of luxurious goods, including tangibles. This hypothesis is confirmed by outcomes obtained in Great Britain, regarding the long-run elasticities, of order 0.3, of consumer expenditures with respect to tangibles. However, as far as the gross consumer demand is concerned, the elasticities with respect to real estate proved much lower, 0.07 (LBS), and only slightly higher with respect to financial stock, 0.14 (LBS) or 0.19 (NIESR). Those estimates come from investigations carried out in the early 90-ies (see J. Whitley 1994, p. 84).

All this made us to attempt at building a consumer demand function, *C*, allowing for the wealth effect. Unfortunately, we did not possess sufficiently long series concerning real estate. That is why we decided to rely on accumulated financial assets at constant prices, *SAV*. They include both cash stock and bank deposits, exclusive of securities.

The inclusion of the above-mentioned variable into the consumer demand function gave the expected sign, although its magnitude proved much lower than in the British models. The long-run elasticity of the consumer demand with respect to real financial assets equals only 0.012. On the other hand, the short-run elasticity is high but insignificant.

As a result of this novelty, we had to endogenize financial stocks, *SAV*, making them dependent upon accumulated households' savings, thus upon increment in real incomes, changes in interest rates on deposits, and finally, on inflation rate, whose increase discourages from keeping financial means at a hitherto level. The estimation outcomes are reported in Table 1.

Another important supplement to the specification of the W8D-2002 model's equations was introduction of foreign direct investment. However, this turned out not an easy task because of the duality of data sources. The level of FDI is computed either by means of balance of payments methodology or by means of surveys, comparing the volume of foreign capital invested in domestic enterprises at the beginning and at the end of a given year. Still, the estimates reported by those two sources differ very much both in levels and in dynamics. However, bearing in mind its higher comparability, we decided on adopting the balance of payments approach.

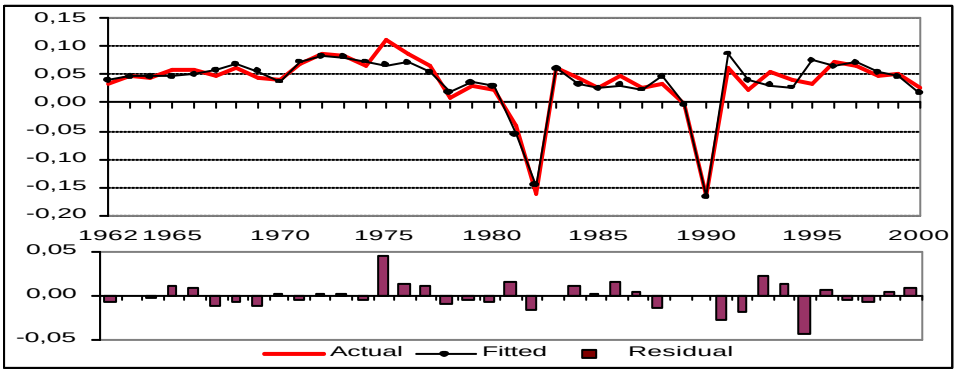
Table 1

Private consumption

ΔLOG(C) = A1
+ (LOG(C{1})-LOG(YDIS{1})-LOG((SAV{2}+SAV{1})/2))*(1-U6092)) * A2
+ LOG(YDIS{1})* A3 + LOG(YDIS/YDIS{1})* A4
+ LOG((SAV{2}+SAV{1}/2)) * (1-U6092) * A5
+ LOG(((SAV{1}+SAV)/2)/((SAV{2}+SAV{1})/2))*(1-U6092)*A6
+ LOG(I1) * A7 + LOG((1+RKFR)/(PC/PC{1})) * (1-U6090) * A8
+ U8182 * A9 + U83 * A10 + U89 * A11 + U90 * A12

Data	1962–2000	D–W	2,0266
Degrees of freedom	28	D–W – levels	2,1152
Adjusted R^2	0,9051	Lagrange Multiplier	0,0697
Adjusted R^2 – levels	0,9979	Jarque-Bera test	0,0522
MAPE	23,2657	Goldfeld-Quandt test	0,8377
MAPE – level	1,0104	Harvey-Collier test	–0,6524
Sum of squared residuals	0,0078	DF test of residuals	–6,2018

Parameter	Estimate	Standard deviation	*t*–Statistic	Significance level
A1	0,380544	0,121601	3,129455	0,004068
A2	–0,132436	0,079035	–1,675662	0,104938
A3	–0,029738	0,010420	–2,853795	0,008038
A4	0,401449	0,061990	6,476036	0,000001
A5	–0,129229	0,076034	–1,699628	0,100286
A6	0,379367	0,312016	1,215859	0,234190
A7	–0,002100	0,000841	–2,497985	0,018637
A8	–0,200000	–	–	–
A9	–0,070754	0,017414	–4,063088	0,000355
A10	0,049043	0,018919	2,592488	0,014976
A11	–0,055948	0,017570	–3,184226	0,003544
A12	–0,137404	0,021430	–6,411706	0,000001



Source: W. Florczak (2002c).

In the initial version of the W8D model the FDI, expressed in USD, *SJBUSD*, were made dependent upon the expected economic growth as well as on the economy's stability (expressed by inflation rate). Changes in FDI affect capital account and reserve assets. Yet, the FDI is not present in the equation of the exchange rate, as it is portfolio investment that plays the balancing role. In that version of the model the effects of FDI on the production sector were not accounted for, either. Still, those are vast. Direct effects stem from investment on fixed assets or from greenfield investment. Indirect ones are associated with improvement in technology and management, e.g. via taking-over the existing enterprises by means of purchasing their shares (like in the case of Polish banks). However, because of the lack of proper data on their allocation, the FDI effects could not be empirically split into the direct and indirect ones.

In the new version of the model, FDI has been included in the list of variables explaining both investment outlays on machinery and equipment as well as on buildings and structures. The estimation results of these equations are reported in Tables 2 and 3.

Moreover, increment in FDI indirectly entails also increase in investment imports, *M7*, that in turn, depends on investment outlays on machinery and equipment, *JV*. Growth of *M7* in relation to *JV* induces the effects of foreign outlays on R&D, *BIRMS*. One can also analyze changes in the import structure, however only in the context of the increasing shares of investment imports (see also M. Przybylinski 2000). Finally, increase in investment outlays on machinery and equipment as well as increase in R&D outlays favorably influences GDP and labor productivity[1]. The latter, however, reduces labor demand.

The effects of FDI might have been underestimated, especially that the hitherto specification did not allow for any improvement in managing the enterprise and bank sectors. This will call for another re-specification in the future. Besides, one should also account for new investment emerging due to the accession funds, that are supposed to be spent on public undertakings (infrastructure).

In the initial version of the model, the equation explaining fluctuations in the exchange rate PLN/USD, *WZLD*, was dependent – apart from relative prices – upon the ratio of exports over imports, such variable being responsible for fluctuations in demand and supply of foreign currencies. However, this proved insufficient to account for changes in the exchange rate, especially in the last years, when the exchange rate was mainly determined by inflows of foreign

[1] An attempt to directly introduce FDI into the labor productivity function can be found in M. Przybylinski, I. Swieczewska (2002), in the IMPEC model. This approach was applied in all sectors of the economy. However, their results are incomparable with ours because of different definitions of FDI and different price bases.

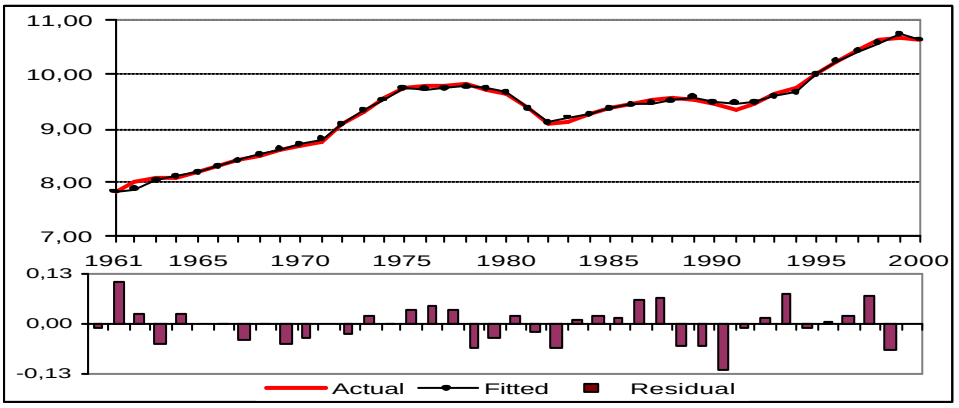
Table 2

Investment outlays on machinery and equipment

LOG(JV) = A1 + LOG(JV{1}) * A2 + LOG(X) * A3
+ LOG(WBP/8291/PJV) * A4 + LOG(WKZ) * A5
+ LOG(((1+RKFR)/(PJA/PJA{1}))*(PJV/PX))*(1-U6093) * A6
+ LOG((SJBUSD*WZLD)/PJV) * (1-U6089) * A7
+ U7275 * A8 + U8182 * A9 + U9596 * A10 + U2000 * A11

Data	1961–2000	D–W	1,2275
Degrees of freedom	29	D–W – levels	2,2516
Adjusted R^2	0,9947	Lagrange Multiplier	1,4752
Adjusted R^2 – levels	0,9934	Jarque-Bera test	12,3149
MAPE	0,3857	Goldfeld-Quandt test	0,2948
MAPE – level	3,5803	Harveya-Colliera test	3,0253
Sum of squared residuals	0,0862	DF test of residuals	–5,2439

Parameter	Estimate	Standard deviation	*t*-Statistic	Significance level
A1	–3,100314	1,867275	–1,660341	0,107622
A2	0,556024	0,087332	6,366808	0,000001
A3	0,606140	0,198823	3,048637	0,004869
A4	0,185680	0,090536	2,050908	0,049408
A5	0,896502	0,283157	3,166091	0,003618
A6	–0,260144	0,114100	–2,279961	0,030147
A7	0,026446	0,010613	2,491798	0,018676
A8	0,155468	0,037343	4,163229	0,000256
A9	–0,236834	0,056378	–4,200822	0,000231
A10	0,173814	0,048989	3,548039	0,001343
A11	–0,143488	0,064492	–2,224882	0,034030



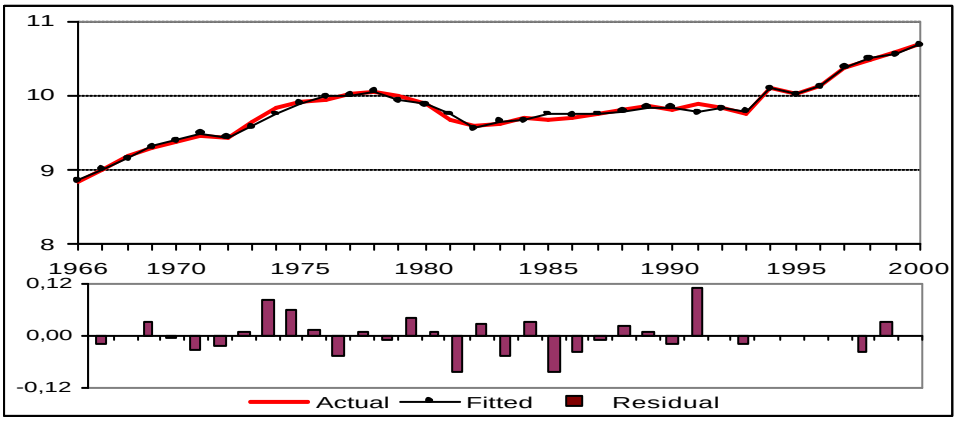
Source: W. Florczak (2002c).

Table 3
Investment outlays on buildings and structures

LOG(JJTF) = A1
+ LOG(JJTF{1}) * A2
+ LOG(X) * A3
+ LOG(WKZ) * A4
+ LOG(((1+RKFR)/(PJA/PJA{1}))*(PJJT/PX)) * (1-U6093) * A5
+ LOG((SJBUSD*WZLD)/PJJT) * (1-U6093) * A6
+ (U72+U7981+U82) * A7 + U95 * A8 + U96 * A9

Data	1966–2000	D–W	–0,3210
Degrees of freedom	26	D–W – levels	2,2770
Adjusted R^2	0,9866	Lagrange Multiplier	0,3090
Adjusted R^2 – levels	0,9916	Jarque-Bera test	5,1234
MAPE	0,2868	Goldfeld-Quandt test	2,8338
MAPE – level	2,7936	Harvey-Collier test	2,4199
Sum of squared residuals	0,0545	DF test of residuals	–6,0675

Parameter	Estimate	Standard deviation	*t*-Statistic	Significance level
A1	–0,468409	0,766412	–0,611171	0,546393
A2	0,779582	0,074582	10,452756	0,000000
A3	0,218104	0,110861	1,967365	0,059896
A4	0,395493	0,101252	3,906044	0,000597
A5	–0,602809	0,191899	–3,141292	0,004165
A6	0,060079	0,009274	6,478240	0,000001
A7	–0,141587	0,025777	–5,492793	0,000009
A8	–0,444033	0,081148	–5,471869	0,000010
A9	–0,305362	0,078285	–3,900630	0,000605



Source: W. Florczak (2002c).

currencies resulting from the increasing portfolio investment from abroad (see J. Brzeszczynski, R. Kelm 2002). The decisive role is played here by foreign portfolio investment. Still, we failed to account for changes in the portfolio investment even in the latest version of the model. However, we managed to incorporate a new variable into the exchange rate equation. The variable is a ratio of real domestic and foreign interest rates, the latter being represented by Germany's interest rate. Unfortunately, all the attempts to directly estimate the effects of that variable fell flat. As a result, a calibration process followed. The final estimate is –0.2, which differs from the long-term elasticity obtained in R. Kelm's model (–0.6). The latter result, however, was obtained on the basis of quarterly data, with a specification excluding the export-import ratio and with currency reserves instead (see J. Brzeszczynski, R. Kelm, 2002, ch. 6). The outcomes of the estimation of the exchange rate equation are reported in Table 4.

3. The simulation model and its structure

The simulation W8D-2002 model was constructed in a similar manner to its predecessor, W8D, as a result of consolidating stochastic equations and adding proper accounting identities.

The simulation system consist of the following blocks of equations:

a) final demand and foreign trade,
b) productivity factors and technical progress,
c) capacity output and employment,
d) prices and financial flows.

Basic equations of the simulation system stem from stochastic relationships, whose parameters were estimated on the sample ending in the year 2000. The starting observation for most of the series is the 60-ies. However, for some series, especially financial flows, the starting point is in the 90-ies. The majority of equations entered the simulation system with no changes, whereas some others, such as realizations, had to be transformed and modified, to get proper estimates of demand or potential variables. Those transformations, described in other papers, call for introducing additional identities. Thus, the simulation model contains also, apart from stochastic equations, a lot of bridge equations and identities, defining outlays of production factors both in constant and current prices. A small group of identities constitute auxiliary identities expressing the state of fixed assets and capital-labor ratio.

Table 4
Exchange rate PLN/USD

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LOG(WZLDR) =  A1
            + LOG(PX/PH) * A2
            + LOG(PX/PH)*(1-U6089) * A3
            + LOG(E/M)*(1-U6079)  * A4
            + (1-U6091) * ((RKFR-(PX/PX{1}-1))/(RKFNIEM -INFNIEM)) * -0.02
            + U6072 * A5
            + U8790 * A6
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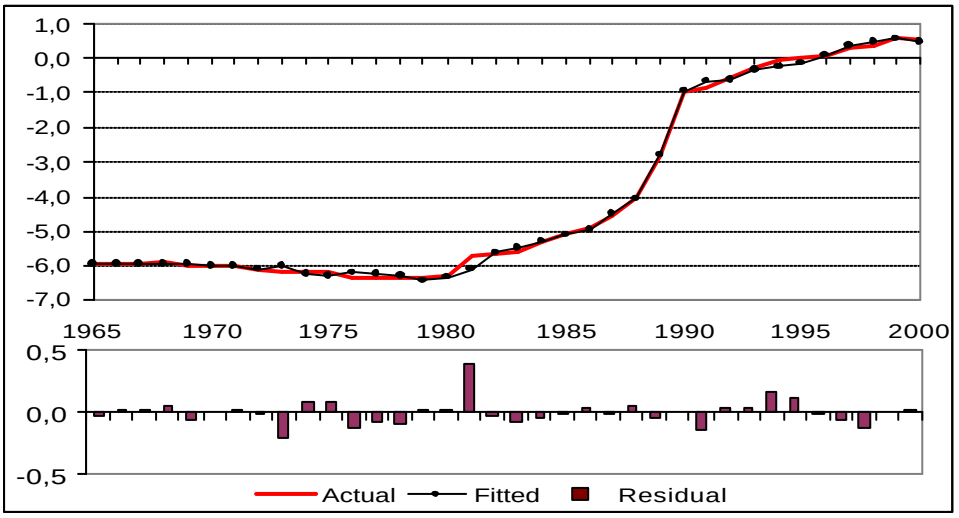
Data	1965–2000	D–W	1,8213
Degrees of freedom	30	D–W – levels	1,0935
Adjusted R^2	0,9984	Lagrange Multiplier	0,2964
Adjusted R^2 – levels	0,9917	Jarque-Bera test	26,1759
MAPE	11,2242	Goldfeld-Quandt test	0,7707
MAPE – level	6,3855	Harvey-Collier test	1,5591
Sum of squared residuals	0,3471	DF test of residuals	–5,3412

Parameter	Estimate	Standard deviation	*t*-Statistic	Significance level
A1	–0,060755	0,033654	–1,805258	0,081080
A2	0,933399	0,007668	121,725031	0,000000
A3	–0,364537	0,062247	–5,856268	0,000002
A4	–1,201611	0,224734	–5,346828	0,000009
A5	–0,296037	0,049157	–6,022289	0,000001
A6	0,342192	0,067808	5,046468	0,000020



Source: W. Florczak (2002c).

The full list of variables of the W8D-2002 model and its equations are given in Appendices 1–2. W8D-2002, just like its predecessor, W8D, is a medium-size model. Its simulation version contains 216 equations, of which 80 are stochastic and 136 are identities. Some stochastic equations are bridge or switch equations. This refers mainly to the relationships linking total values (aggregates) with their components, of which some information is unavailable (e.g. budget revenues are dependent only on some major taxes).

The number of strictly exogenous variables, exclusive of time and dummy variables, is 24. Those are:

a) 7 socio-demographic factors: total population, working-age population, people in respective school-age groups, share of elementary school graduates who continue their education, number of retirees and pensioners;
b) 6 variables describing external conditions: world exports, world prices, inflation rate in Germany, interest rates in Germany, GDP of six OECD countries, being main trading partners of Poland;
c) 4 disequilibrium indicators that for the 90-ies take the value of zero;
d) 1 variable of aggregate banking system: other liabilities; 1 variable expressing foreign portfolio investment in the balance of payments accounts;
e) 5 policy instruments: social mark-ups over wage costs, ratio of capital depreciation, average tax rate on wages, share of investment outlays from the state budge in the state budget expenditures, and effective customs tariff rate.

To allow for other policy instruments, such as changes in indirect taxes, ceiling prices or other financial instruments, one can change estimates in proper equations or exogenize some selected endogenous variables, such as the exchange rate or interest rate.

A considerable number of dummy variables (97) introduced into the model served mainly to account for specific sub-periods.

Both a general analysis of Poland's economic development and empirical verification of parameters' stability let us distinguish the following sub-periods:

a) accelerated growth in the first half of the 70-ies,
b) crisis at the turn of the 80-ies,
c) economic slowdown of the 80-ies (excluding the crisis year 1982),
d) beginning of transformation, covering – depending on a given phenomenon – the years 1989–1990 or 1990–1991,
e) starting with the economic recovery (since 1994), emergence of new tendencies, typical of developed market economies (e.g. increasing share of funding consumer expenditures by means of bank loans or growing importance of financial instruments),

f) economic slowdown resulting from tight money and fiscal policies, started in 1998 and since 2001 leading to a decrease in the rates of growth of GDP to 1% a year.

W8D-2002 is a highly simultaneous model and with a large number of dynamic feedbacks. It contains 24 prologue equations, 98 simultaneous equations, 94 epilogue equations and 8 feedback variables. The feedback variables are those in the production sphere: GDP, investment outlays on machinery and equipment, employment, as well as those in the inflationary nexus: GDP deflator, exchange rate, investment deflator, gross average nominal wages, and indirect taxes.

A relatively large number of epilogue equations results, amongst others, from the introduction of numerous identities that generate important macro characteristics in the form of relations (e.g. structural ratios or accounting identities). The formal structure of the simulation model is reported use where.

4. Further research recommendations

The updated version of the long-term W8D-2002 model of the Polish economy is going to be a starting point for elaboration of new forecasts of Poland's economic development up to the year 2025. The forecasts will constitute a benchmark for running alternative policy scenarios of medium-term horizons and of long-term strategies of socio-economic development of Poland.

Such analyses will be preceded by investigations aiming at the determination of the relationships existing in the Polish economy by means of *ex ante* multiplier analysis based on the W8D-2002 model. Their results will be compared with the outcomes obtained in previous versions of the W8 model.

While elaborating alternative scenarios of Poland's economic development we are going to take advantage of other official projections, including those by the Ministry of Finance, and the Ministry of Economy, as well as of the assumptions made by the Committee *Poland 2000+* PAN. Moreover, we are going to benefit from the suggestions formulated in the economic literature in the recent years.

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Appendix I

LIST OF VARIABLES OF THE W8D-2002 ECONOMETRIC MODEL OF THE POLISH ECONOMY

A	– Raw materials – gross output ratio
ABPO	– graduates from elementary schools
ABSR	– graduates from secondary schools
ABWY	– graduates from higher schools
AFFP	– Mark-up over wage costs
AFZSP	– Financial statement (profits) of non-financial enterprises
AMKKP	– Ratio of capital depreciation
AT	– Technical raw materials – gross output ratio
BBGOP	– Budget outlays on education, exclusive of higher education
BCBWP	– Budget outlays on higher education
BCC	– Real current expenditures of the state budget
BCCP	– Current expenditures of the state budget
BCJP	– Expenditures of the state budget on investments
BCP	– Expenditures of the state budget, total
BDP	– Budget balance, current
BDPR	– Share of budget balance in GDP (current), percentage points
BEDOP	– Total outlays on education, exclusive of higher education
BEDOPX	– Total outlays on education, exclusive of higher education; share in GDP
BEDWP	– Total outlays on higher education
BEDWPX	– Total outlays on higher education; share in GDP

BIRK – Domestic outlays on R&D, total
BIRKB – Domestic outlays on R&D from state budget
BIRKBX – Domestic outlays on R&D from state budget, share in GDP
BIRKQ – Domestic outlays on R&D from non-financial corporations
BIRKS – Cumulated domestic outlays on R&D
BIRKSI – Index of cumulated domestic outlays on R&D
BIRKX – Domestic outlays on R&D, share in GDP
BIRM – Foreign outlays on R&D, weighted by imports
BIRMS – Cumulated foreign outlays on R&D, weighted by imports
BIRMSI – Index of cumulated imported outlays on R&D
BRP – Liabilities of the banking system
BRZFP – Foreign liabilities of the banking system
BYCCOEF – Effective customs tariff rate
BYCP – Revenues of the state budget due to import duties
BYIFP – Revenues of the state budget due to income taxes on legal persons (corporate taxes)
BYP – Revenues of the state budget, total
BYPFP – Revenues of the state budget due to personal income taxes
BYVP – Revenues of the state budget due to VAT taxes
BYVP_X – Revenues of the state budget due to VAT taxes, share in GDP
BZAKP – Assets of the banking system, total
BZNGP – Assets of the banking system due from non-financial corporate sector
BZNPP – Assets of the banking system due from individuals
BZPPP – Assets of the banking system due from securities
BZRESP – The other assets of the banking system
C – Private consumption, realisation, real
CD – Private consumption, demand, real
CEDOP – Outlays on education, exclusive of higher education, by households
CEDWP – Outlays on higher education by households
CP – Private consumption, realisation
CX – Share of private consumption in GDP (real), percentage points
CXP – Share of private consumption in GDP (current prices) , percentage points
CY – Share of personal incomes (total) in GDP (constant prices), percentage points
CYP – Share of personal incomes (total) in GDP (current prices), percentage points
DIFXVA – Difference between GDP and value added
DKKBT – Increment in fixed assets excluding machinery
DKKI – Increment in credit liabilities of non-financial enterprises
DKKM – Increment in machinery and equipment
DOP – Increment in money supply
DR – Inventories, realisation, real
DRD – Inventories, demand, real
DRP – Inventories, realisation
DRX – Share of inventories in GDP (real), percentage points
DRXP – Share of inventories in GDP (current prices), percentage points
DSRUSD – Changes in gross official reserves
E – Exports, total – according to the SNA classification, realisation, real
ED – Exports, total – according to the SNA classification, demand, real
EP – Exports, realisation
EPUSD – Exports, realisation, millions of current USD
ETUUSD – Exports of commodities and services by balance of payments
EX – Share of exports in GDP (real), percentage points
EXPP – Share of inventories in GDP (current), percentage points

FBP – Wage funds
G – Public expenditures, realisation, real
GD – Public expenditures, demand, real
GDPCAP – GDP in USD per capita
GP – Public expenditures, realisation
GX – Share of public expenditures in GDP (real), percentage points
GXP – Share of public expenditures in GDP (current prices), percentage points
H – World exports
HKLZ – Human capital indicator
I1 – Indicator of disequilibrium in consumer goods market
INFNIEM – Rate of inflation in Germany
IZZ – Indicator of disequilibrium in labour market
JA – Investment outlays, total, realisation, real
JAD – Investment outlays, total, demand, real
JAP – Investment outlays, total, realisation, current
JAX – Share of investment outlays in GDP (real), percentage points
JAXP – Share of investment outlays in GDP (current prices), percentage points
JJT – Total investment outlays excluding investments on machinery, realisation, real
JJTD – Total investment outlays excluding investments on machinery, demand, real
JJTF – Total investment outlays excluding investments on machinery and investment outlays from the state budget, realisation, real
JJTFD – Total investment outlays excluding investments on machinery and investment outlays from the state budget, demand, real
JJTFP – Total investment outlays excluding investments on machinery and investment outlays from the state budget, realisation
JJTFX – Share of investment outlays excluding investments on machinery and investment outlays from the state budget in GDP (real), percentage points
JJTFXP – Share of investment outlays excluding investments on machinery and investments from the state budget in GDP (current prices), percentage points
JPRIV – Investment outlays beyond budget
JPUB – Budget investment outlays
JV – Investment outlays on machinery, realisation, real
JVD – Investment outlays on machinery, demand, real
JVP – Investment outlays on machinery, realisation
JVX – Share of investment outlays on machinery in GDP (real), percentage points
JVXP – Share of investment outlays on machinery in GDP (current prices)
KIP – Unit costs
KJAW – Unit costs of education per student
KK – Fixed assets, total, real, end of year
KKBT – Fixed assets excluding machinery, end of year
KKIP – Credit liabilities of non-financial enterprises, end of year
KKM – Fixed assets in machinery, real, end of year
KKO – Current credits
KKOP – Current credits, current prices
KKP – Fixed assets, total, end of year
KM – Fixed assets in machinery, real, average
KWNXP – Labour unit costs
KZBP – Domestic debt of the state budget
KZBPXP – Domestic debt of the state budget, share in GDP
L – Population
L1518 – Population in the 15–18 age group
L1924 – Population in the 19–24 age group

L714 – Population in the 7–17 age group
LB – Job vacancies
LP – Population in productive ages
LZ – Job searchers
M – Imports, total – by the SNA classification, realisation, real, in USD, current prices
M7 – Imports of the SITC 7 commodity group
MD – Imports, total – by the SNA classification, demand, real
MP – Imports, total – by the SNA classification, realisation, current prices
MPUSD – Imports, total – by the SNA classification, realisation, millions of current USD
MTUUSD – Imports of commodities and services by balance of payments
MX – Share of imports in GDP (real), percentage points
MXP – Share of imports in GDP (current), percentage points
MZ – Imports of intermediate commodities, real
N – Employment, realisation
ND – Labour demand
NDT – Labour demand under technological productivity of labour
NER – Number of the retired and pensioners
NK – Labour demand under potential GDP (technological productivity of machinery)
NKLZ – Effective labour force
NKLZS – Effective labour supply
NPO – The employed with elementary education
NPOB – The employed with elementary education subject to balancing condition
NS – Labour force
NSR – The employed with secondary education
NSRB – The employed with secondary education subject to balancing condition
NTECH – Technical variable equal to total employment
NWY – The employed with higher education
NWYB – The employed with higher education subject to balancing condition
NZ – Employees
OP – Money supply, total, end of the year
OWXK – Absorption of assets
OWXKM – Absorption of assets
PC – Private consumption deflator
PDR – Inventory change deflator
PE – Exports deflator, transaction prices
PED – Exports deflator
PG – Public expenditures deflator
PH – World exports deflator
PH59 – World exports deflator of the SITC 5–9 commodity groups
PJA – Investment outlays deflator
PJJT – JJT deflator
PJV – JV deflator
PKK – Fixed assets deflator
PM – Imports deflator, transaction prices
PM7 – Imports deflator of the 7 SITC commodity group, transaction prices
PM7D – Imports deflator of the 7 SITC commodity group
PMD – Imports deflator
PQ – Deflator of gross production, total
PX – GDP deflator
PY – Personal incomes deflator

PYW – Wages deflator
Q – Gross output, real
QP – Gross output
RELBCJP – Share of investment outlays from the state budget in the state budget expenditures (current prices)
RKFNIEM – Nominal interest rate in Germany
RKFR – Nominal interest rate
RNPO – Share of individuals with elementary education
RNSR – Share of individuals with secondary education
RNWY – Share of individuals with higher education
SAV – Measure of wealth
SHZ – Trade balance, according to the SNA classification, real
SHZP – Trade balance, according to the SNA classification, current prices
SHZUSD – Net exports according to the SNA classification, millions of current USD
SHZXP – Share of trade balance in GDP (current), percentage points
SJBUSD – Foreign direct investment, net, balance of payments
SJBUSDX – Foreign direct investment, share in GDP
SJPUSD – Portfolio investment, net, balance of payments
SOBKFRES – Balance of payments, capital, financial and the other (except for current) specifications, net
SOBUSD – Balance of payments, current account, net
SOBUSDX – Balance of payments, share in GDP
SRUSD – Balance of payments, gross official reserves
SRUSDM – Share of official reserves in imports of commodities and services, by balance of payments
STUDPO – Students in elementary schools
STUDSR – Students in secondary schools
STUDWY – Student in higher schools
STUUSD – Balance of imports of commodities and services, by balance of payments
STUUSDX – Balance of imports of commodities and services, by balance of payments, share in GDP
TFP – Total factor p roductivity, dynamics
TFPCOMP1 – Total factor productivity due to human capital
TFPCOMP2 – Total factor productivity due to domestic R&D
TFPCOMP3 – Total factor productivity due to imported R&D
TFPLEVEL – Total factor productivity
TT – Linear trend
TU – Equipment ratio, total
TUM – Equipment ratio in machinery
U (two digits) – Dummy for a given year (last two digits of the year)
U (four digits) – Dummy for a period starting with the first two digits and ending in the last two digits
U (two digits)D – Dummy (equal to 1) for a given year (last two digits of the year) and –1 for the next year
UN – Unemployment
UNR – Rate of unemployment
UNRE – UNR, reciprocal
W – Annual average wages after tax, real
WAPOSR – Share of graduates from elementary schools that continue their education in secondary schools
WASRWY – Share of graduates from secondary schools that continue their education in

	higher schools
WBP	– Annual average wages before tax
WBPUSD	– Annual average wages before tax, current USD
WERP	– Average pension and retirement benefit
WKM	– Rate of capacity utilization
WKZ	– Rate of shift utilization
WN	– Ratio of effective to nominal men-hours of workers
WNB	– Average tax rate on wages
WNP	– Annual average after tax wages
WNT	– Ratio of potential to nominal men-hours of workers
WSTPO	– Scholarization ratio in the 7–14 age group
WSTSR	– Scholarization ratio in the 15–18 age group
WSTWY	– Scholarization ratio in the 19–24 age group
WXK	– Productivity of fixed assets
WXKM	– Productivity of machinery and equipment
WXKMT	– Technological productivity of machinery under full utilisation of shifts and working time
WXNM	– Labour productivity
WXNML	– Effective labour productivity (allowed for human capital)
WXNMLT	– Potential effective labour productivity
WXVA	– Labour productivity (value added)
WZLD	– Exchange rate (old ZL/USD)
X	– Gross Domestic Product, realisation, real
XD	– Gross Domestic Product, demand, real
XF	– Final domestic demand, realisation
XFD	– Final domestic demand
XKMT	– Potential GDP under technological productivity of machinery equipment
XNMT	– Potential GDP under technological labour productivity
XNSMT	–Potential GDP under technological labour productivity and full employment
XP	– Gross Domestic Product, realisation
XUSD	– GDP in millions of current dollars
XVA	– Value added, total
XVAP	– Value added, total, current prices
XW	– GDP in main trading partners of Poland
XX	– Labour productivity of employees for X/NZ > 0
Y	– Personal income, total, real
YBSP	– Social benefits
YDIS	– Personal disposable income
YP	– Personal income
YRPWOP	– Personal income of business

NOTES:

(i) "P" at the end of a given symbol means: current prices
(ii) Values in real terms are expressed in 1995 prices
(iii) Base year for all the deflators is 1995

Appendix II

LIST OF EQUATIONS OF THE W8D-2002 ECONOMETRIC MODEL OF THE POLISH ECONOMY FINAL DOMESTIC DEMAND, GDP AND FOREIGN TRADE (BY SNA)

```
YDIS    = (YP-BYPFP)/PY
CD             =  EXP(0.380544301
         + (LOG(C(-1))-LOG(YDIS(-1))-LOG((SAV(-2)+SAV(-1))/2)
        * (1-U6092))*-0.132435631
        + LOG(YDIS(-1))* -0.029737670
        + LOG(YDIS/YDIS(-1))* 0.401448754
        + LOG((SAV(-2)+SAV(-1)/2)) * (1-U6092) * -0.129229218
        + LOG(((SAV(-1)+SAV)/2)/((SAV(-2)+SAV(-1))/2))
        * (1-U6092) * 0.379367198
        + LOG((1+RKFR)/(PC/PC(-1))) * (1-U6090) * -0.2
        + U83 * 0.049042530) * C(-1)
C       =  CD*EXP(-0.002099590*I1+U8182*-0.070754105+U89*
        - 0.055948051 + U90*-0.137403905)
CX      = C/X*100
CP      = C*PC
CXP     = CP/XP*100
CYP     = CP/YP*100
CY      = (C/Y)*100
GD      = EXP(0.866118163+LOG(G(-1))*0.803895006+LOG(BCCP/PG)*
        * 0.109300616
        + LOG(BCCP/PG)*(1-U6090)*0.005735978+U7175*0.026571929)
G       =  GD*EXP(-0.074562790*U8081+-0.044459081*U89)
GP      = G*PG
GX      = (G/X)*100
GXP     = (GP/XP)*100
DRD     = 2258.03779
        + DR(-1) * 0.85192
        + (X-X(-1)) * 0.48685
        + WKZ * (1-U6089) * -10774.27340
        + U82 * 14454.28919
        + U90 * 15746.17994
DR      = DRD
DRX = DR/X*100
DRP     = XP-CP-GP-JAP-EP+MP
DRXP    = DRP/XP*100
JVD     = EXP(-3.100314003
        + LOG(JV(-1)) * 0.556024189
        + LOG(X) * 0.606139791
        + LOG(WBP/8291/PJV) * 0.185680103
        + LOG(WKZ) * 0.896501981
        + LOG(((1+RKFR)/(PJA/PJA(-1)))*(PJV/PX))*(1-U6093) *
        - 0.260143700
        + LOG((SJBUSD*WZLD)/PJV) * (1-U6089) * 0.026446090
        + U7275 * 0.155468378
        + U9596 * 0.173814382)
JV      = JVD*EXP(-0.236834405*U8182+-0.143487981 *U2000)
JVX     = JV/X*100
JVP     = JV*PJV
JVXP    = JVP/XP*100
JJTFD   = EXP(-0.468408546
        + LOG(JJTF(-1)) * 0.779582283
        + LOG(X) * 0.218103828
        + LOG(WKZ) * 0.395493325
        + LOG(((1+RKFR)/(PJA/PJA(-1)))*(PJJT/PX)) * (1-U6093) *
        - 0.602809232
        + LOG((SJBUSD*WZLD)/PJJT) * (1-U6093) * 0.060079064)
```

```
JTF     = JTFD*EXP((U72+U7981+U82)*-0.141587062+U95*-0.444033471+U96*
          -0.305361595)
JJTFX   = JJTF/X*100
JJTFP   = JJTF*PJJT
JJTFXP  = JJTFP/XP*100
JPRIV   = JV+JJTF
JPUB    = BCJP/PJJT
JJTD    = JJTFD+BCJP/PJJT
JJT     = JJTF+BCJP/PJJT
JAD     = JVD+JJTD
JA      = JV+JJT
JAP     = JA*PJA
JAX     = JA/X*100
JAXP    = JAP/XP*100
ED      = EXP(1.196021854
          + LOG(H) * 1.162777579
          + LOG(H) * U7579 * 0.016503602
          + LOG(H) * (1-U6094) * 0.029417099
          + LOG((PE/(WZLD/2.4244))/PH) * (1-U6080) * -0.110533111)
E       = ED*EXP(U81*-0.184631556+U95*-0.089504531)
EP      = E*PE
EXPP    = EP/XP*100
EX      = E/X*100
EPUSD   = EP/WZLD
MD      = EXP(-9.076695429
          + LOG(X) * 1.614130483
          + U8289 * LOG(X) * -0.017765120
          + U6090 * LOG(X) * -0.042415800
          + LOG(PM/PX) * -0.255974344
          + LOG(PM/PX) * (1-U6091) * -1.519717635)
MZ      = EXP(-4.959374637
          + LOG(MZ(-1)) * 0.368518170
          + LOG(Q) * 0.834130406
          + U78 * -0.329801511
          + U81 * -0.212415270
          + U92 * 0.215932038)
M7      = EXP(LOG(JV/JV(-1))  * 0.964682836
          + LOG(C/C(-1)) * (1-U6090) * 0.986241019
          + LOG((PM7/PJV)/(PM7(-1)/PJV(-1))) * -0.520221943
          + LOG((PM7/PC)/(PM7(-1)/PC(-1))) * (1-U6091) * -0.559994505
          + U78D * -0.127390419
          + U91D * 0.366723448) * M7(-1)
M       = MD
MP      = M*PM
MXP     = (MP/XP)*100
MX      = (M/X)*100
MPUSD   = MP/WZLD
SHZ     = E-M
SHZP    = EP-MP
SHZXP   = SHZP/XP*100
SHZUSD  = EPUSD-MPUSD
XD      = CD+GD+JAD+DRD+ED-MD
X       = C+G+JA+DR+E-M
XUSD    = XP/WZLD
GDPCAP  = ((XP/WZLD)/L)*1000
XFD     = CD+GD+JAD+DRD
XF      = C+G+JA+DR
XVA     = X-DIFXVA
DIFXVA  = EXP(2.041134507
```

```
       + LOG(M) * 0.673510357
       + (U72+U73+U74+U75+U76) * -0.084721587
       + U80 * -0.090825517
       + U90 * -0.126463770)
XP     = X*PX
Q      = X/(1-A)
QP     = Q*PQ
```

FIXED ASSETS AND MATERIAL USE

```
DKKBT  = 1400.74936
       + -3303.16975 *  U8089
       -16283.99013 *  TR9000
       -7494.95881 *  U95
       + 0.25652 *  JJT
       + 0.22401 *  JJT(-1)
       + 0.19151 *  JJT(-2)
       + 0.15900 *  JJT(-3)
       + 0.12650 *  JJT(-4)
       + 0.09400 *  JJT(-5)
       + 0.06149  *  JJT(-6)
KKBT   = 0.9865*KKBT(-1)+DKKBT
DKKM   = 2345.906777
       + DKKM(-1) * 0.688125
       + JV * 0.208657
       + U80 * -7046.207641
       + U96 * 7643.000782
KKM    = 0.91*KKM(-1)+DKKM
KM     = (KKM+KKM(-1))/2
KK     = KKM+KKBT
KKP = KK*PKK
A      = EXP(-0.957292119
       + TT * 0.007905336
       + TT * U6079 * -0.018127636
       + TT*TT * U6079 * 0.000855110
       + U8089 * 0.041382927)
AT     = A*(1-0.031309422)
```

LABOR AND CAPITAL PRODUCTIVITIES, POTENTIAL GDP AND TFP

```
TU     = WKZ*KK/N
TUM    = EXP(-0.442419898
       + (LOG(TUM(-1))-LOG(PJV(-1)/WBP(-1)/8291)) * -0.076592134
       + LOG(PJV(-1)/WBP(-1)/8291) * -0.108972800
       + TT(-1) * 0.001777797
       + LOG((PJV/WBP/8291)/(PJV(-1)/WBP(-1)/8291)) * -0.016276805
       + U7479 * 0.058558006
       + U8184 * -0.037583195) * TUM(-1)
WXNML = EXP (0.007473485
       + LOG((TUM/HKLZ)/(TUM(-1)/HKLZ(-1)))  * 0.400362881
       + LOG(WN/WN(-1)) * 1.159465972
       + LOG(BIRKSI/BIRKSI(-1)) * 0.181402079
       + ((M7/JV)*LOG(BIRMSI)-(M7(-1)/JV(-1))*LOG(BIRMSI(-1)))*
0.040864262
       + U7981 * -0.091761159
       + U8384 * 0.034300822
       + U90 * -0.069750263) * WXNML(-1)
WXNMLT = EXP (0.007473485
       + LOG((TUM/HKLZ)/(TUM(-1)/HKLZ(-1))) * 0.400362881
       + LOG(WNT/WNT(-1)) * 1.159465972
```

```
       + LOG(BIRKSI/BIRKSI(-1)) * 0.181402079
       + ((M7/JV)*LOG(BIRMSI)
       - (M7(-1)/JV(-1))*LOG(BIRMSI(-1))) * 0.040864262
       + U7981 * -0.091761159
       + U8384 * 0.034300822
       + U90 * -0.069750263) * WXNMLT(-1)
WXKMT  = EXP(LOG((TUM/HKLZ)/(TUM(-1)/HKLZ(-1)))  * -0.520881961
       + LOG(WN/WN(-1)) * 1.167246903
       + LOG(BIRKSI/BIRKSI(-1)) * 0.137559893
       + ((M7/JV)*LOG(BIRMSI)
       - (M7(-1)/JV(-1))*LOG(BIRMSI(-1))) * 0.051528961
       + U7981 * -0.087855198
       + U8384 * 0.038334276
       + U90 * -0.071672336) * WXKMT(-1)
TFP    = EXP(--0.520881961*LOG(HKLZ/HKLZ(-1))
       + 0.137559893*LOG(BIRKSI/BIRKSI(-1))
       + 0.051528961*((M7/JV)*LOG(BIRMSI)-(M7(-1)/JV(-1))*
       * LOG(BIRMSI(-1))))
TFPCOMP1 = EXP(0.520881961*LOG(HKLZ/HKLZ(-1)))
TFPCOMP2 = EXP(0.137559893*LOG(BIRKSI/BIRKSI(-1)))
TFPCOMP3 = EXP(0.051528961*((M7/JV)*LOG(BIRMSI)
       - (M7(-1)/JV(-1))*LOG(BIRMSI(-1))))
TFPLEVEL = TFPLEVEL(-1)*TFP
WXKM   = X/KM
WXK    = X/KK
OWXKM  = KM/X
OWXK   = KK/X
WKZ    = (WXKM/WXKMT)**(1/0.852583293)
XKMT   = X/(WKM/100)
WKM    = (WKZ**0.852583293)*100
NKLZS  = NS*HKLZ
XNMT   = WXNMLT*NKLZ
XNSMT  = WXNMLT*NKLZS
WXNM   = X/N
WXVA   = XVA/N
XVAP   = XVA*PX
WN     = (((WXNM/(WXNMLT*HKLZ))*((WXNMLT(-1)
       * HKLZ(-1))/WXNM(-1)))**(1/1.159465972)
       * WN(-1)*WNT)/WNT(-1)
WNT    = EXP(-0.054343363
       + TT * -0.001294839
       + U8184 * -0.003786649
       + U9598 * 0.026399827
       + (1-U6098) * 0.039277016)
```

HUMAN CAPITAL, OUTLAYS ON R&D

```
RNPO   = NPOB/N
RNSR   = NSRB/N
RNWY   = NWYB/N
HKLZ   = (RNWY*1.75+RNSR*1.2 +RNPO*1)
NKLZ   = N*HKLZ
NPO    = EXP(-0.217697684
       + LOG((1-0.025) * NPO(-1)+(1-WAPOSR)* ABPO) * 1.024710293
       + U9092 * -0.074957316
       + U96 * 0.059223970
       + U99 * -0.070557903)
NTECH  = NPO+NSR+NWY
NPOB   = NPO/(NTECH/N)
```

```
NSR    = EXP( -0.344826695
       + LOG((1-0.025) * NSR(-1)+ (1-WASRWY)* ABSR) * 1.035984262
       + U9093 * -0.031529259
       + (1-U6093) * 0.047201390)
NSRB   = NSR/(NTECH/N)
NWY    = EXP( -0.152490185
       + LOG((1-0.025) * NWY(-1)+ ABWY) * 1.022282403
       + (1-U6098) * -0.069018963)
NWYB   = NWY/(NTECH/N)
ABPO   = EXP( -5.532168268
       + LOG((STUDPO(-8)+STUDPO(-7)+STUDPO(-6)+STUDPO(-5)
       + STUDPO(-4)+STUDPO(-3)+STUDPO(-2)+STUDPO(-1))/8) *
       * 1.400246537 + U8284 * -0.053572854
       + (1-U6097) * 0.072220311)
ABSR   = EXP(0.378840875
       + LOG((STUDSR(-1)+STUDSR(-2)+STUDSR(-3)+STUDSR(-4))/4) *
       * 0.816342097 + U70 * -0.235677210
       + U7381 * 0.110433032
       + U91 * -0.145797220
       + (1-U6091) * -0.299720978)
ABWY   = EXP( -3.874096676
       + LOG((STUDWY(-1)+STUDWY(-2)+STUDWY(-3)+STUDWY(-4)
       + STUDWY(-5))/5)*1.342816082
       + U6668 * -0.110987844
       + (U7374+U75) * 0.138665711
       + U77 * -0.125655741
       + (1-U6092) * -0.177304678)
WSTSR  = 1/(1+3.074851146*EXP( -0.095654706*TT))
       + U7477 * 0.048318528
       + U8289 * TT * -0.008665849
       + U81  * -0.099684839
       + U85 * 0.253740058
       + (1-U6095)  * 0.027661472
WSTWY  = STUDWY/L1924
WASRWY = 1.38389631
       + 1/TT * -34.43874492
       + (1-U6096) * 0.14079919
WSTPO  = 0.998
STUDPO = WSTPO * L714
STUDSR = WSTSR * L1518
STUDWY = (BEDWP/PX)/KJAW
KJAW   = EXP(0.73379830
       + TT * 0.03643454
       + (1/TT) * (1-U6092) * -23.99643036
       + U7479 * 0.18408741
       + (U91+U92) * -0.41329638
       + U9395 * 0.33687264
       + (1-U6097) * -0.47117002)
BEDOP  = BBGOP+CEDOP
BBGOP  = EXP( -2.978428482
       + LOG(BCCP) * 1.104695599
       + LOG(BCCP) * U7175 * 0.057792929
       + LOG(BCCP) * U7881 * -0.036046242
       + (1-U6098) *  0.205157330)
CEDOP  = EXP(  -5.254181285
       + LOG(CP) * 0.985563043
       + (1-U6098) * -0.325524181)
BCBWP  = EXP( -4.312346451
       + LOG(BCCP) * 1.072567392
```

```
        + LOG(BCCP) * U6570 * -0.055769398
        + LOG(BCCP) * U7377 * 0.025848615
        + U8081 * -0.185096977
        + U8990 * 0.191586649
        + U9495 * -0.220450751
        + (1-U6098) * 0.180774660)
CEDWP   = EXP( -4.597764601
        + LOG(CP) * 0.985563043
        + (1-U6098) * -0.325524181)
BEDWP   = BCBWP + CEDWP
BIRKB   = EXP(2.594729853
        + LOG(BCC) * 0.411139799
        + LOG(BCC) * U7079 * 0.047523829
        + LOG(BCC) * U8389 * -0.051437600
        + LOG(BCC) * (1-U6095) * 0.007590369
        + U87 * -1.495013405
        + U89 * -1.035049841
        + U90 * -1.898057303
        + U91 * 0.415830416)
BIRKQ   = EXP(2.188365084
        + LOG(AFZSP/PX) * 0.511099117
        + LOG(AFZSP/PX) * U7079 * 0.061462995
        + U8081 * 0.654396950
        + U8285 * -0.766276518
        + U91 * -1.907290856
        + LOG(AFZSP/PX) * (U9097) * -0.051597470)
BIRK    = BIRKB+BIRKQ
BIRM    = EXP( -18.12501528
        + LOG(XW) * 1.69850328
        + U8289 * LOG(XW) * -0.04348594
        + (1-U6091) * LOG(XW) * 0.01982577
        + U78 * -0.91463358
        + U7980 * -0.29106066
        + U8889 * 0.35132009
        + (U99+U2000) * -0.23499548)
BIRKS   = BIRKS( -1)-0.05*BIRKS( -1)+BIRK
BIRMS   = BIRMS( -1)-0.05 *BIRMS(-1)+BIRM
BIRKSI  = BIRKS/59463.140201571
BIRMSI  = BIRMS/188932.06438815
```

LABOUR MARKET

```
NS      = (1.050543573
        + LOG(YBSP/YP) * -0.089737979
        + LOG(WNP/PYW) * -0.046073395
        + UNR( -1) * 0.000899891
        + U8082 * 0.012012130
        + U90 * -0.018618581
        + (1-U6096) * -0.019560428) * LP
NDT     = X/(WXNML*HKLZ)
NK      = XKMT/WXNM
N       = IF ( NS < ND & NS < NK ) THEN 0.98*NS
           ELSE IF ( NS > ND & NK > ND ) THEN ND
           ELSE IF ( NS > NK & ND > NK ) THEN NK  ELSE 0.98*NS
UN      = (IF (0.98*NS > N) THEN NS-N ELSE 0.02*NS)*(1-U6089)
UNRE    = IF (UNR > 0) THEN 1/UNR ELSE 0
UNR     = (UN/NS)*100*(1-U6089)
ND      = EXP(0.057413004
        + (LOG(ND(-1))-LOG(NDT(-1))
```

```
        - LOG(LB(-1)/LZ(-1))* U6089) * -0.403825272
        + LOG(LB(-1)/LZ(-1)) * U6089 * -0.398686856
        + LOG(NDT/NDT(-1)) * 0.787044470) * ND(-1)
NZ      = EXP(-5.863730808
        + LOG(N) * 1.564672202
        + LOG(N) * U6070 * 0.003568497
        + LOG(N) * U7180 * 0.006244477
        + LOG(N) * U8190 * 0.003451122
        + LOG(N) * (1-U6095) * -0.005607899
        + U91 * 0.034643828)
```

WAGES AND INCOMES

```
XX      = IF (WXNM > WXNM(-1) ) THEN  (WXNM/WXNM(-1))  ELSE 1
WBP     = EXP(LOG(PC/PC(-1)) * 0.97
        + LOG(XX) * 0.670770360
        + IZZ * 0.898999326
        + UNRE * 0.454379126
        + U75 * 0.092156310
        + U82 * -0.269844523
        + U89 * 0.119878056
        + U90 * -0.259604436) * WBP(-1)
W       = WBP/PYW
WNP     = WBP*(1-WNB)
WBPUSD  = WBP/WZLD
FBP     = EXP (-0.040218028
        + LOG(WBP*NZ/1000) * 0.993600952
        + LOG(WBP*NZ/1000) * (1-U6089) * 0.025787327
        + U8083 * -0.026357973
        + U90 * -0.290760883)
WERP    = EXP(-0.025460911
        + LOG(WBP/WBP(-1)) * U6094 * 1.056086335
        + LOG(PC/PC(-1)) * (1-U6094) * 1.129617533
        + U75 * -0.139417996
        + U82 * 0.367722756
        + U83 * -0.127786389
        + U99 * 0.114855101) * WERP(-1)
YBSP    = (WERP*NER)
YRPWOP  = EXP(-0.895343283
        + (LOG(YRPWOP(-1))-LOG(XP(-1))) * -0.761156661
        + LOG(XP(-1)) * -0.027140477
        + LOG(XP/XP(-1)) * 1.142325020
        + U81 * 0.215234272
        + U99 * -0.325802753) * YRPWOP(-1)
YP      = YRPWOP+FBP+YBSP
Y       = YP/PY
```

DEFLATORS

```
BYVP_X  = BYVP/X
KIP     = BYVP_X+PM*(1+BYCP/MP+(1-U6089)*BYVP_X)*(MZ/X)+(AMKKP*KKP(-1))/X
        + (((WBP*(1+AFFP*U6090+AFFP*3*(1-U6090))*NZ))/1000)/X
        + (RKFR*BZNGP(-1))/X
KWNXP   = (((WBP*(1+AFFP*U6090+AFFP*3*(1-U6090))*NZ))/1000)/X
PX      = EXP(0.169855416
        + 0.98078684*((AFZSP(-1)/XP(-1))*(LOG(AFZSP/(KIP*X))*U6090
        + LOG(WKZ)*(1-U6090))
        + LOG(0.20*KIP+0.80 *KIP(-1)))
        + U81 * -0.213716471
        + (U8388+U91) * 0.233960053
```

```
        + U8990 * 0.805796838)
PC      = EXP( -0.011415827
        + (LOG(PX)*X/(X+M)+LOG(PM*(1+BYCP/MP))*M/(X+M)) *
        * 0.902439592 + (LOG(PX)*X/(X+M)
        + LOG(PM*(1+BYCP/MP))*M/(X+M)) * (1-U6092) * 0.124448147
        + LOG(BYVP_X)  * 0.083165104
        + U6770 * 0.032297890
        + U88 * -0.07117512 + U92 * 0.128469910
        + (1-U6092) * 0.178373343)
PG      = EXP( -0.528368094
        + (LOG(PX)*X/(X+M)+LOG(PM*(1+BYCP/XP))*M/(X+M)) *
        * 0.875327622 + U8084 * -0.245149154
        + (1-U6089) * 0.522245113)
PJA     = PJV*JV/JA+PJJT*(1-JV/JA)
PJV     = BYVP_X + EXP(-0.103506848
        + LOG(PX) * 0.621940269
        + LOG(PM) * 0.286733324
        + LOG(PX) * U6069 * -0.018994673
        + LOG(PM) * U8088 * 0.048303429
        + (1-U6096) * -0.481331232)
PJJT    = BYVP_X + EXP(0.237585785
        + LOG(PX) * 0.678676094
        + LOG(PM) * (1-0.678676094)
        + U80 * -0.191011699
        + U81 * -0.330312687
        + (U94+U95+U96) * -0.350821748
        + (1-U6096) * 0.125809192)
PDR     = DRP/DR
PED     = EXP(LOG(PH/PH(-1)) * 0.426413961
        + LOG((PX/(WZLD/2.4244))/(PX(-1)/(WZLD(-1)/2.4244)))*
        * 0.574253284 + (U80+U81) * -0.217822841
        + U89 * -0.139848963) * PED(-1)
PE      = PED*(WZLD/2.4244)
PMD     = EXP(LOG(PH/PH(-1)) * 0.513240585
        + U81D * -0.481501754
        + U99D * -0.115690551) * PMD(-1)
PM      = PMD*(WZLD/2.4244)
PM7D    = EXP( -0.015332819
        + LOG(PH59/PH59(-1)) * 0.868486254
        + (U79+U80+U81) * -0.310757002) * PM7D(-1)
PM7     = PM7D*(WZLD/2.4244)
PYW     = EXP( -0.002055301
        + LOG(PC/PC(-1)) * 1.028528310
        + U80 * -0.064217730
        + U92 * 0.177555140
        + U99 * 0.193484700) * PYW(-1)
PY      = EXP( -0.000580587
        + LOG(PC/PC(-1)) * 1.003673545
        + U91 * -0.132826812
        + U97 * -0.041689998) * PY(-1)
PKK     = EXP( -0.172546714
        + LOG(PKK(-1)) * 0.480419146
        + LOG(PJA) * 0.502628427
        + U90 * 1.930781076
        + (U95+U96) * 0.379711731)
PQ      = EXP(0.054636618
        + LOG(A(-1)*PQ(-1)) * 0.094117115
        + LOG(PX) * 0.845093523
        + U8088 * -0.158205669
```

```
       + U9091 * 0.136733454)
RKFR   = 0.024569103 + (((PY-PY(-1))/PY(-1)+
       + (PJA-PJA(-1))/PJA(-1))/2) * 1.159123211
       + U97 * -0.102464028
       + (U99+U2000) * 0.101948542
WZLD   = EXP(-0.060754515
       + LOG(PX/PH) * 0.933398547
       + LOG(PX/PH)*(1-U6089) * -0.364536850
       + LOG(E/M)*(1-U6079)  * -1.201611368
       + (1-U6091) * ((RKFR-(PX/PX(-1)-1))/(RKFNIEM-INFNIEM)) *
       * -0.02 + U6072 * -0.296036755
       + U8790 * 0.342192487) * 2.4244
```

MONEY MARKET

```
DKKI   = 14842.67576
       + JA  * 0.04805
       + ((1+RKFR)/(PJA/PJA(-1))) * (1-U6089) * -4256.30001
       + (KKIP(-1)/PJA(-1)) * -0.21245
       + U90 * -2396.43618
       + ((1+RKFR)/(PJA/PJA(-1))) * (1-U6098) * -2870.53449
KKIP   = KKIP(-1)+DKKI*PJA
DOP    = 3394.06952
       + (0.09*(YP-YP(-1))+0.45*(YP-CP)
       + 0.02*XP+6000*WZLD*((RKFR-(PX-PX(-1))/PX(-1))
       - (RKFNIEM-INFNIEM))) * 1.03423
       - 13336.42701 * U2000
OP     = OP(-1)+DOP
BZNPP  = 8712.39762
       + (C-C(-1)) * 0.39426
       + ((1+RKFR)/(PC/PC(-1))) * -4933.11234
       + U6098 * -4392.66136) * PC + BZNPP(-1)
BZPPP  = EXP(-23.75135928
       + TT * 1.69338303
       + TT*TT * -0.02026492
       + U92 * -0.26165781)
BZAKP  = BRP
BRP    = EXP(1.5687193764
       + LOG(BRZFP+OP) * 0.9227010114)
KKO    = EXP(-15.51730326
       + LOG(X) * 1.23538341
       + LOG((1+RKFR)/(PX/PX(-1))) * -1.28041962
       + U96D * 0.20861828) * KKO(-1)
KKOP   = KKO*PX
BZNGP  = KKIP+KKOP
BZRESP = BZAKP-(BZNPP+BZNGP+BZPPP)
AFZSP  = EXP(0.611642909
       + LOG(XVAP-(BYVP+(((WBP*(1+AFFP*U60
       + AFFP*3*(1-U6090))*NZ))/1000)+RKFR*BZNGP(-1)))*0.928983856
       + LOG(XVAP-(BYVP+(((WBP*(1+AFFP*U6090
       + AFFP*3*(1-U6090))*NZ))/1000)+RKFR*BZNGP(-1)))
       * U6072 * -0.302660519
       + LOG(XVAP-(BYVP+(((WBP*(1+AFFP*U6090
       + AFFP*3*(1-U6090))*NZ))/1000)+RKFR*BZNGP(-1)))
       * (1-U6091) * -0.088713729
       + U91 * -0.915203108
       + (U98+U99) * -0.569428271)
SAV    = EXP(LOG(YDIS/YDIS(-1)) * 0.941567922
       + (RKFR-(PY/PY(-1)-1)) * 0.733384633
```

```
       + LOG(PY) * -0.102662922) * SAV(-1)
```

STATE BUDGET

```
BCP    = EXP( -0.065135890
       + LOG(BCP(-1)) * 0.044689887
       + LOG(BYP) * 0.969480441
       + U7678 * -0.095079638
       + U81 * 0.087706440
       + U89 * 0.113152009
       + U92 * 0.129602795)
BCJP   = RELBCJP*BCP
BCCP   = BCP-BCJP
BCC    = BCCP/PG
BDP    = BYP-BCP
BDPR   = BDP/XP*100
BYP    = EXP (0.769428892
       + LOG(BYVP+BYIFP+BYPFP+BYCP) * 0.939944411
       + U7173 * -0.152903896
       + U7681 * 0.206140395
       + U8289 * -0.151781258)
BYVP   = EXP( -1.557639514
       + LOG(CP+MP+BYCP)  * 0.957689594
       + U73 *  -0.158274468
       + U8384 * 0.180440604
       + U9092 * -0.306537444
       + U9496 * 0.123229317)
BYPFP  = EXP( -0.309300547
       + LOG(0.2*YP)*(1-U6091)*0.961035124
       + LOG(0.2*FBP)*U6091*1.022452371
       + LOG(0.2*YP)*(1-U6098)*-0.055274852
       + U7881 * -0.589883919
       + U91 *  -0.740377836)
BYIFP  = EXP( -0.392358580
       + LOG(AFZSP) * 1.025524467
       + LOG(AFZSP) * U7478 *  -0.136614758
       + LOG(AFZSP) * U8388 *  -0.075305567
       + LOG(AFZSP) * U9497 *  -0.055803783
       + U80 * 0.633562618
       + U89 *  -1.310990729
       + U92 * 0.852897313)
BYCP   = BYCCOEF*MP
KZBP   = 54832.886231
       + (KZBP(-1)+(-BDP)) * 0.809801
```

BALANCE OF PAYMENTS

```
ETUUSD = EXP( -0.681093822
       + LOG(EP/WZLD) * 1.001551204
       + LOG(EP/WZLD) * (1-U6089) * 0.043245401
       + U2000 * -0.259381072)
MTUUSD = EXP( -1.298536366
       + LOG(MP/WZLD) * 1.067843140
       + LOG(MP/WZLD) * (1-U6089) * 0.049673997
       + U89 * 0.333197433
       + U91 * -0.186978212
       + U2000 * -0.281830502)
STUUSD = ETUUSD+MTUUSD
STUUSDX = STUUSD/XUSD
```

```
SOBUSD = -1941.040978
       + (EP/WZLD-MP/WZLD)  * 0.660189
       + U8990  * -2973.994947
       + U95  * 6351.839974
SOBUSDX = (SOBUSD/XUSD)*100
SJBUSD = EXP( -57.5865875
       + (((PX-PX(-1))/PX(-1))*100-100) * -0.04557626
       + LOG(X) * 4.87073695)
SOBKFRES =  EXP(1.6992039179
       + LOG(SJBUSD+SJPUSD) * 0.8462804254)
DSRUSD = (SOBUSD+SOBKFRES)
SRUSD  = SRUSD(-1)+DSRUSD
SRUSDM = SRUSD/MTUUSD
BIRKX  = (BIRK/X)*100
SJBUSDX = (SJBUSD/XUSD)*100
BEDOPX = (BEDOP/XP)*100
BEDWPX = (BEDWP/XP)*100
KZBPXP = (KZBP/XP)*100
BIRKBX = (BIRKB/X)*100
```