The consequences of EU accession for Poland

Simulations using the MacSim system

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Abstract

The Macsim system (Augier P, Brillet JL, Cette G, Gambini R, 1999) is a simplified multi-country system, relying on small single country macro econometric models, linked through trade flows in both real and current terms. The set of countries chosen are European, with a sketchy Rest of the World.

Its main goal is teaching macroeconomics, but it can also be used for economic policy analysis, particularly on European issues such as EMU.

Simulations can use different rules for the exchange rate and interest rates, in addition to the participation to EMU.

In this paper, we modify the usual set of countries: Germany, France, UK, Italy, Netherlands, Sweden, by substituting Poland to the last one. After a short description of the system, we shall present the additional estimations, and compare the results to the previous set, both in values and statistical quality.

This framework will allow us to address two points :

- The consequences for Poland of changes in trade agreements with its new partners : decrease in tariffs and quotas (both applied to Polish products in the European Union and to EU products in Poland).
- The consequences of joining the European Monetary Union itself, in terms of sensitivity of the Polish economy to asymmetric shocks. This sensitivity will vary according to the rules defining the exchange rate and the interests rate.

In the present version of the paper, we shall only treat the first case. The results for the second are already available, and their presentation will be available very soon.

Part 1 : the model

We shall begin by a short description of the single country models, focusing on the originality of the two new countries. Then we shall describe, also shortly, the interactive system.

A more detailed presentation of both single country behaviours and international interactions can be found in (Augier P , Brillet JL Cette G, Gambini R (1999).

Introduction

The Macsim package is based on a set of simplified models, associated with some of the main countries in the European Union. It brings together single-country mechanisms, including some financial elements, and international trade, represented by bilateral flows.

It considers essentially the consequences of shocks, associated to fiscal and financial policies. For a single shock, the results will depend on the rules for determining the interest rate and the exchange rate, as well as the subset of countries belonging to the European Monetary Union.

The standard version of the model considers 6 countries:

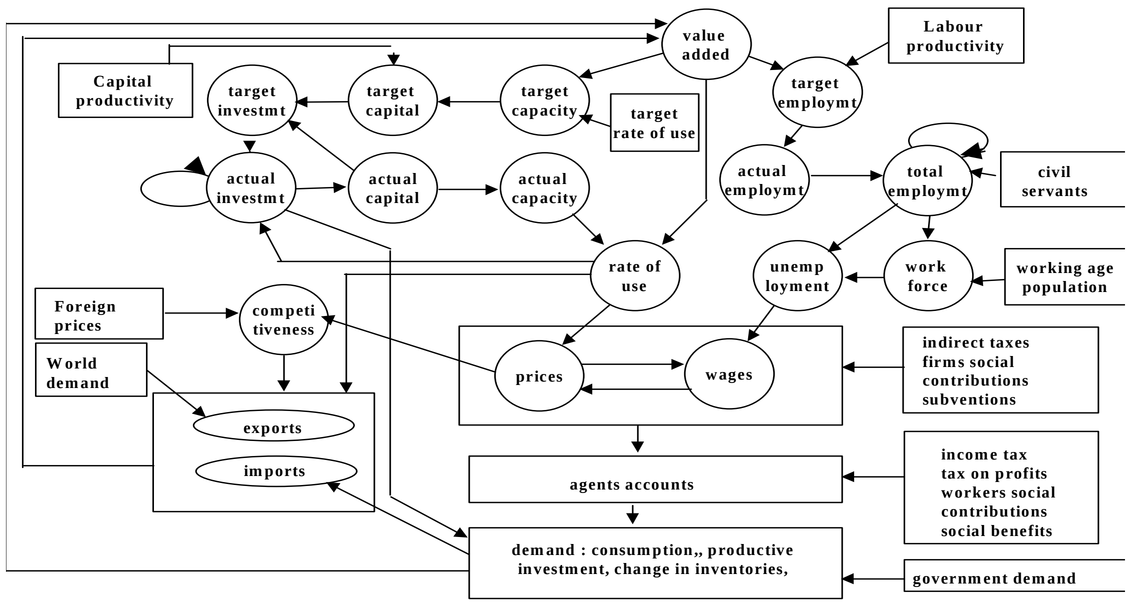
France, Germany, Italy, Netherlands, Sweden, United Kingdom.

But as we have said before, we are replacing Sweden by Poland. This introduces several problems, which we will present later..

The single-country basic model

The single country model uses the structure of the MicroDMS model (Brillet(1997a)) adding a few error correction mechanisms (Brillet(1997b)).

The single country model



We have associated behaviours to the following concepts:

Production factors: investment and employment, unemployment

Prices: wages, value added prices, export and import prices.

Firms: Changes in inventories.

Households: consumption

External trade: exports et imports.

Interest rate: real exogenous value in the base version

Exchange rate: exogenous in the base version

In all we shall estimate 11 equations per country.

When country models are assembled, it is clear that some estimations concerning external trade will lead to over identifications, imports by one country being composed of exports by other countries, which introduces constraints on quantities and values exchanged. We shall present however the full set of equations, which were useful for testing individual models.

We shall now present the main behaviors, and the estimations for the eight countries selected.

Productive investment

$$i_t / k_{t-1} = c1.i_{t-1} / k_{t-2} + c2.[(q_t - q_{t-1}) / q_{t-1} + ut_t / 0.85] - c3.tprob_t + c4$$

We suppose here that firms set an investment target, depending on:

- the profits rate, representing both the expected profits on new investments, and the potential to finance them.

- a desire to adapt productive capacity at the next period to the expected demand. The last element implies the expected growth for the next period, but also the present adaptation of capacities to production.
- and that this process is affected by a strong inertia

One can observe that the presence of the rate of use will ensure in the long run a full adaptation of capacity to production, at a level depending on the profitability of capital.

Results appear in **table 1**. If the lagged term and the «real » effect are almost always significant, the contribution of the profits rate shows often a poor quality. We have kept it nonetheless.

Employment

- We suppose that firms have a target labor productivity, associated with a structural trend. Knowing production this defines a target employment, to which actual employment adapts dynamically.
- Observing the graphs and using statistical breakpoint tests (Chow, Perron...) allows to identify **two** structural trends for labor productivity, with a negative break around 1973.

$$\Delta Log(le_t) = c1.\Delta Log(q_t) + c2.(Log(q_{t-1}/le_{t-1}) - c3.t - c4.t73) + c5$$

Where t73 is zero until 1972, then grows by 1 for each successive period.

Results appear in **table 2**.

They are always very significant, with rather close results from one country to another (lower for Italy). The first coefficient (immediate response) is almost always higher, and our new countries present the highest values. The break is also identified for all countries.

Unemployment

The variations of employment do not translate fully into unemployment, as an improved employment situation will attract to the labour market previously inactive persons. The work force (employed + unemployed) will increase.

As usual, we shall use an error correction framework).

$$\Delta cho_t = c1.\Delta le_t + c2.\Delta pop65_t + c3.(cho_{t-1} - c4.le_{t-1} - c5.pop65_{t-1}) - c6$$

Results are presented in table 3. They are generally good, with variable sensitivity to labor across countries.

The value added price

$$\Delta Log(pva_t) = c1.\Delta Log(c\sup_t) + c2.ut_t + c3.(Log(c\sup_{t-1}/pva_{t-1}) + c4$$

We shall suppose that firms use the price level to optimize between quantities sold (at a given capacity) and margins on each unit. This introduces a positive link between rate of use and margins. Going from one optimum to another due to changes in external conditions, firms will move both targets in the same direction.

As usual, we shall apply an error-correction mechanism.

Results are presented in **table 4**.

The trade prices

When defining their prices, exporters can take into account their own costs or the price of their competitors (in the same currency). The first behaviour will leave margins unchanged, but affect competitiveness. With the second behaviour, the reverse will happen.

In our model, all exporters will apply both behaviors, but favour the first (70% compared to 30%). This is consistent with most estimations.

The wage rate

$$\Delta Log(w_t) = c1.\Delta Log(pc_t) + c2.tcho_t + c4 + c3.Log(csup_{t-1}/pva_{t-1})$$

The equation contains

- A dynamic indexation of the wage rate on inflation.
- A role of tensions on the labor market, represented by the unemployment rate.
- An error correction term, ensuring the convergence of the share of wages (actually, the wage cost) in production to a target, depending on the level of unemployment.

Results (table 5) are generally acceptable, even if we had to fix the error correction term for Netherlands and Sweden.

The changes in inventories

Firms try to maintain an inventory level proportional to production. This means changes in inventories will depend on changes in production. Based on the last two years, we get:

$$dstoc_t = c1.\Delta q_t + c2.\Delta q_{t-1}$$

Results **(table 6)** are significant, with a rather stable coefficient.

Household consumption

$$\Delta Log(co_t) = c1.\Delta Log(rdm_t / pc_t) + c2.[0.5.\Delta Log(pc_t) + 0.5.\Delta Log(pc_{t-1})]$$
$$+ c3.\Delta Log(tcho_t) + c4.Log[rdm_{t-1} /(pc_{t-1}.co_{t-1})] + c5$$

The formulation (error correcting) combines:

- inertia in adapting to changes in purchasing power per capita
- inflation : financial savings are measured in (future) purchasing power, and must be increased with inflation.
- the fear of unemployment
- a long term unitary elasticity of consumption to revenue.

Results (**table 7**) are on the whole rather satisfying, with our two new countries well within the range as to coefficient values. However the price effect is seldom significant.

Imports

Of course, particular attention must be given to this equation.

$$Log(m_t) = c1.Log(df_t + 0.5 \cdot x_t) + c2.Log(1 - ut_t) + c3.Log(pim_t / pp_t) + c4$$

Imports are determined by:

- a constant elasticity to demand, not only domestic but also foreign (exports). Indeed, to export one must import intermediary goods, energy and equipment. But this impact is limited compared to local demand, as it is also satisfied directly by untransformed goods. We have set the coefficient to 0.5, a reasonable value.
- the capacity of local producers to face additional demand
- a comparison between local production and import prices..

Although this equation does not follow the error correction format, it is consistent with a long-term equilibrium. We can observe that it defines the share of imports in demand, as a function of terms that do reach a long-term target.

Results are presented in **table 8**. The capacity variable was seldom significant, but we have deemed its presence necessary, and in the full model we shall set the same influence for all countries, to avoid not necessarily justified discrepancies. As to competitiveness, its coefficient is generally significant but rather low.

The model for Poland

Estimating our model for Poland, we had to consider several issues.

For instance, the share in Polish trade of partner countries, both on imports and exports markets, has changed over the sample period, and will probably keep changing over the future.

But the main issue concerns the transition process. In Poland, full adaptation to the features of market economy has just been achieved, and even this can be argued. And it is clear that the MacSim framework, which we have just described, cannot represent the mechanisms of the socialist economy prevailing in Poland until the end of the eighties.

This means we should only use data from the start of the transition period, and even from the later moment at which we can consider that Poland does follow, in a general way, the mechanisms of market economy.

Moreover, the data provided by the local statisticians, in this case GUS, was established following a specific socialist methodology. In particular, the national accounts used social accounting matrixes and not accounting tables. This situation lasted for someg time, well into the transition period.

These observations will lead us to start estimations in 1994 or rather 1995.

However, data for these most recent periods is available, not only in yearly observations, but also quarterly. It means that with a sample starting in 1994 and ending in 2003 we do have 40 observations, a little less if we take into account the presence of lags. Even if moving from yearly to quarterly data does not multiply the information by four, it does increase it significantly.

We shall start to estimate a model for Poland, based on data between 1995 and 2003. The general framework should be the same as above, but we will accept small deviations. We shall use OECD data, the main reason being that we shall repeat this exercise for other accession countries, available in the same base with the same format.

We shall present only the estimated equations, the identities using exactly the same formulas as in the original Macsim system.

Labour

For labour, we start by supposing that the evolution of actual productivity can be decomposed into a constant trend, representing technical progress and the evolution of the share of labour in the productive process, and cyclical fluctuations coming from the inertia of labour to production. In other terms, actual productivity should be stationary around a trend.

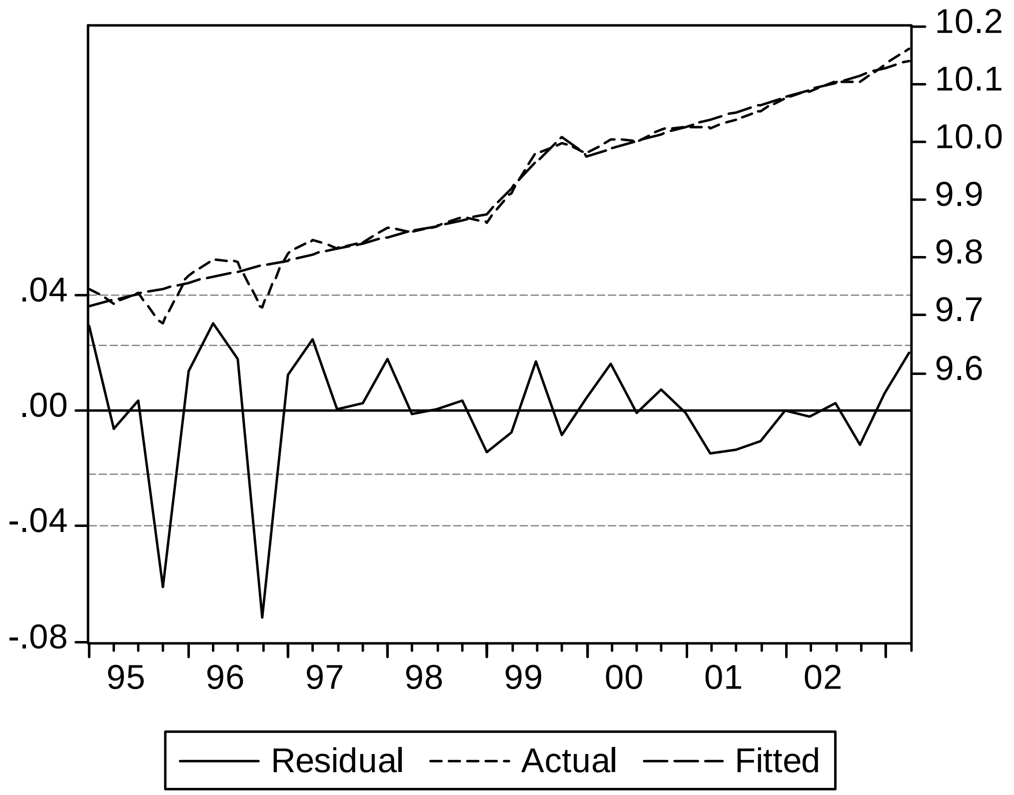
First, we shall estimate this trend based of actual values. Considering the length of the period, we will be allowed a single trend.

However, the data shows that to formulate this type of decomposition, we need to cut the period in two : 1995 to 1998 and 200 to 2003, and use a specific treatment for the year 1999. This seems due to data problems, as the values we use here look quite different from the ones we obtained from GUS some time ago.

Dependent Variable: LOG(PL_Q/PL_LE)
Method: Least Squares
Date: 05/06/04 Time: 18:11
Sample: 1995:1 2003:2
Included observations: 34
LOG(PL_Q/PL_LE)=C_PL_PROD(1)+C_PL_PROD(2)*(T-2003.5)
+C_PL_PROD(3)*(T-1999)*(T<=1999)+C_PL_PROD(4)*(T-1999)
(T>=1999)(T<2000)+C_PL_PROD(5)*(T>=2000)

	Coefficient	Std. Error	t-Statistic	Prob.
C_PL_PROD(1)	10.10207	0.028300	356.9660	0.0000
C_PL_PROD(2)	0.050793	0.005894	8.618337	0.0000
C_PL_PROD(3)	-0.011518	0.007274	-1.583484	0.1242
C_PL_PROD(4)	0.127328	0.029761	4.278318	0.0002
C_PL_PROD(5)	0.050847	0.019291	2.635851	0.0133

R-squared	0.977295	Mean dependent var	9.917925
Adjusted R-squared	0.974163	S.D. dependent var	0.138258
S.E. of regression	0.022223	Akaike info criterion	-4.640291
Sum squared resid	0.014322	Schwarz criterion	-4.415826
Log likelihood	83.88494	Durbin-Watson stat	2.180642



Now we shall estimate employment, using an error correction format as above.

The quarterly equation gives dynamic values consistent with the MacSim annual estimations for the other countries.

However, we still observe problems around the year 1999.

Dependent Variable: DLOG(PL_LE)
Date: 03/22/04 Time: 18:55
Sample(adjusted): 1995:2 2003:2
Included observations: 33 after adjusting endpoints
DLOG(PL_LE)=C_PL_N(1)*DLOG(PL_LED)+ C_PL_N(2)
*LOG(PL_LED(-1)/PL_LE(-1))+ C_PL_N(3)+PL_N_EC

	Coefficient	Std. Error	t-Statistic	Prob.
C_PL_N(1)	0.225618	0.049895	4.521839	0.0001
C_PL_N(2)	0.398628	0.075961	5.247813	0.0000
C_PL_N(3)	-0.001464	0.001224	-1.195681	0.2412

R-squared	0.500145	Mean dependent var	-0.002284
Adjusted R-squared	0.466821	S.D. dependent var	0.009547
S.E. of regression	0.006971	Akaike info criterion	-7.007514
Sum squared resid	0.001458	Schwarz criterion	-6.871468
Log likelihood	118.6240	Durbin-Watson stat	1.296255

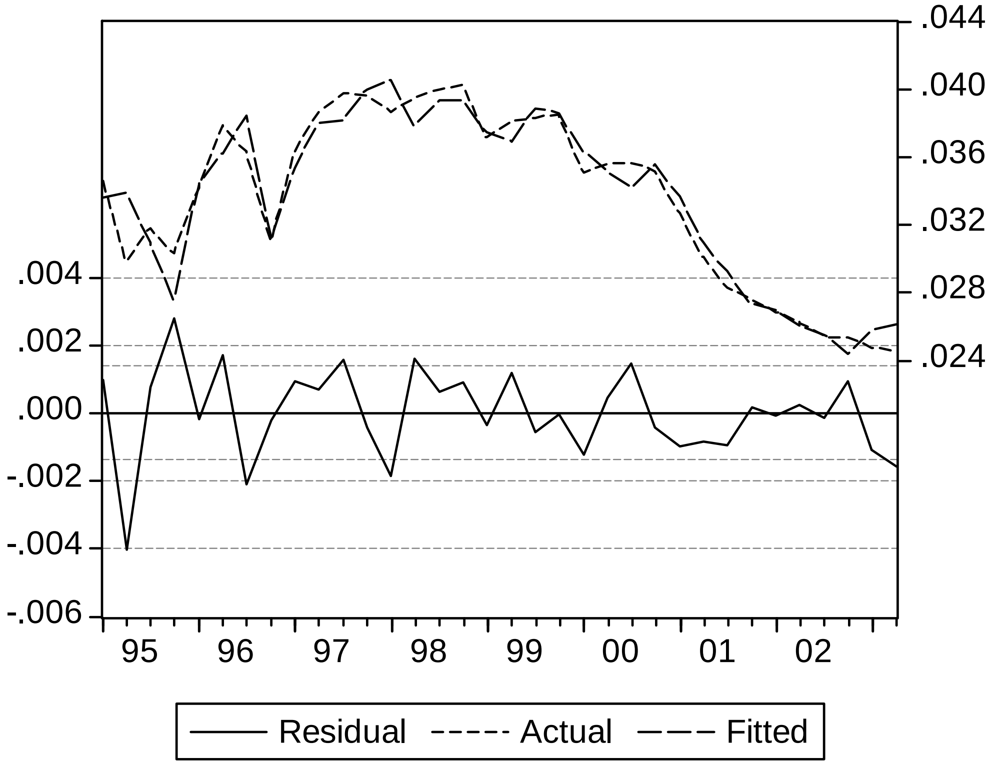
Investment

The standard equation works rather well, with a strong inertia coefficient explained by the shorter periodicity.

Dependent Variable: PL_I/PL_K(-1)
Method: Least Squares
Date: 03/22/04 Time: 18:55
Sample: 1995:1 2003:2
Included observations: 34
PL_I/PL_K(-1)=C_PL_I(1)*PL_I(-1)/PL_K(-2)+C_PL_I(2)*@PCH(PL_Q)
+C_PL_I(3)*PL_UT+C_PL_I(4)+PL_I_EC

	Coefficient	Std. Error	t-Statistic	Prob.
C_PL_I(1)	0.860973	0.075507	11.40255	0.0000
C_PL_I(2)	0.038152	0.010935	3.488846	0.0015
C_PL_I(3)	0.022882	0.010242	2.234150	0.0331
C_PL_I(4)	-0.019008	0.008462	-2.246389	0.0322

R-squared	0.934927	Mean dependent var	0.033643
Adjusted R-squared	0.928420	S.D. dependent var	0.005165
S.E. of regression	0.001382	Akaike info criterion	-10.22068
Sum squared resid	5.73E-05	Schwarz criterion	-10.04111
Log likelihood	177.7515	Durbin-Watson stat	2.222894



Unemployment

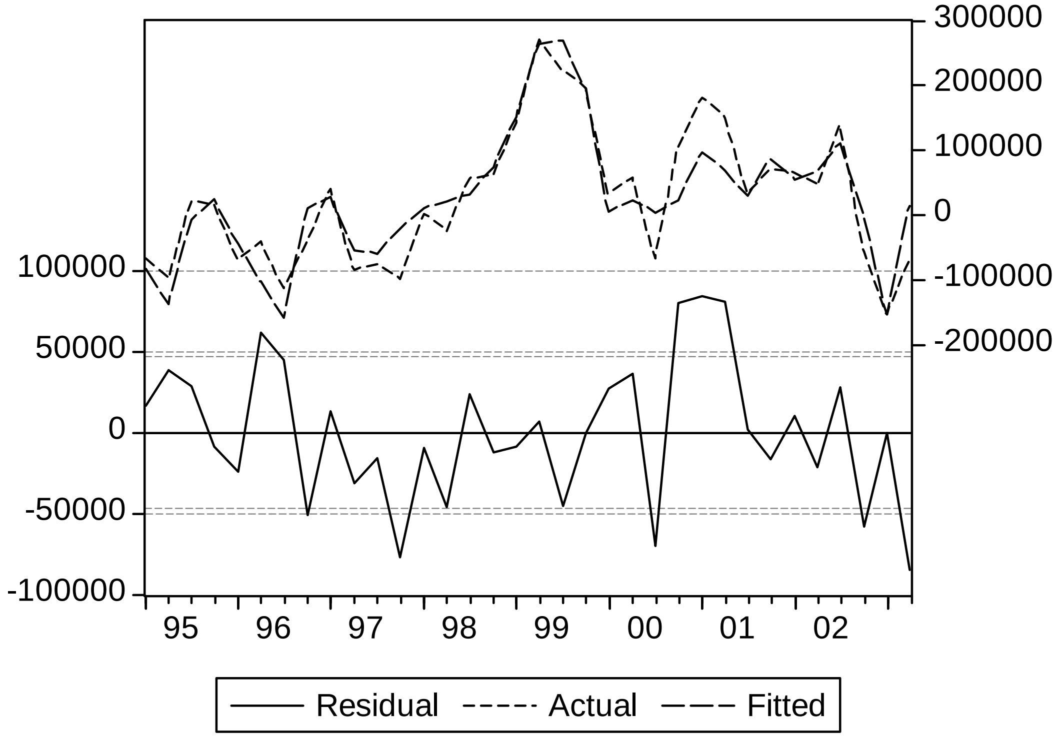
For this equation, we had to set the value for the error correction term (to -0.2), and for the role of potential active population. The two employment coefficients show high significativity, and high values too. This means that an increase in employment will call essentially for the unemployed, and not the inactive.

Dependent Variable: D(PL_CHO)
Method: Least Squares
Date: 03/22/04 Time: 18:55
Sample: 1995:1 2003:2
Included observations: 34
D(PL_CHO)=C_PL_U(1)*D(PL_LT)+C_PL_U2*D(PL_POP65)+
C_PL_U3*(PL_CHO(-1)- C_PL_U(4)*PL_LT(-1)- C_PL_U5
PL_POP65(-1)- C_PL_U(6))+C_PL_U(7)(T=1999.75)
+C_PL_U(8)*(T=2003)+PL_U_EC*(1*(T<=2003.5)+(1+TXN)^(4*(T
-2003.5)*(T>2003.5)))

	Coefficient	Std. Error	t-Statistic	Prob.
C_PL_U(1)	-0.671365	0.068414	-9.813266	0.0000
C_PL_U(4)	-0.734819	0.082220	-8.937274	0.0000
C_PL_U(6)	105606.0	1210339.	0.087253	0.9311
C_PL_U(7)	190815.5	48064.98	3.969949	0.0004
C_PL_U(8)	-240061.9	50346.66	-4.768179	0.0000

R-squared	0.827654	Mean dependent var	24756.02
Adjusted R-squared	0.803883	S.D. dependent var	105439.1
S.E. of regression	46693.88	Akaike info criterion	24.47567
Sum squared resid	6.32E+10	Schwarz criterion	24.70013

Log likelihood	-411.0863	Durbin-Watson stat	1.732963



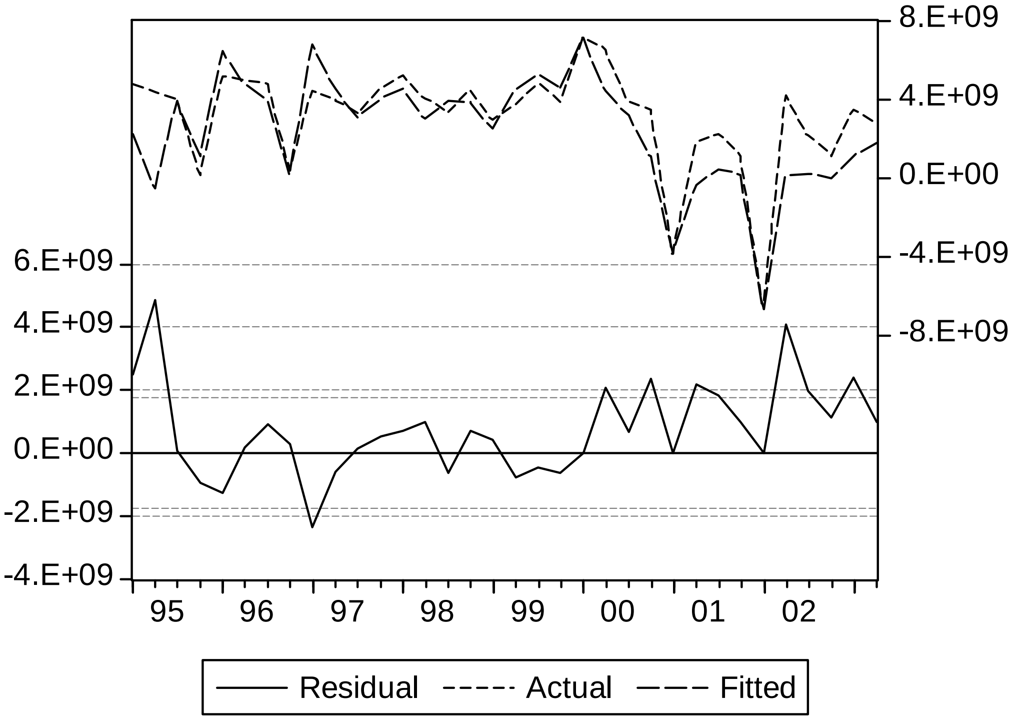
Change in inventories

To reach a satisfying formulation we need three dummies.

Dependent Variable: PL_DSTOC
Method: Least Squares
Date: 03/22/04 Time: 18:55
Sample: 1995:1 2003:2
Included observations: 34
PL_DSTOC= C_PL_D(1)*D(PL_Q)+C_PL_D(2)*(T=2000)+C_PL_D(3)
(T=2001)+C_PL_D(4)(T=2002)+C_PL_D(5)*(T>=1995.5)
(T<=2000.5)+PL_D_EC(1*(T<=2003.5)+(1+TXQ)^(4*(T-2003.5))
*(T>2003.5))

	Coefficient	Std. Error	t-Statistic	Prob.
C_PL_D(1)	0.173663	0.041000	4.235654	0.0002
C_PL_D(2)	4.72E+09	1.85E+09	2.549201	0.0163
C_PL_D(3)	-3.75E+09	1.77E+09	-2.114259	0.0432
C_PL_D(4)	-7.10E+09	1.78E+09	-3.995428	0.0004
C_PL_D(5)	3.33E+09	4.20E+08	7.930008	0.0000

R-squared	0.607124	Mean dependent var	3.12E+09
Adjusted R-squared	0.552934	S.D. dependent var	2.65E+09
S.E. of regression	1.77E+09	Akaike info criterion	45.56524
Sum squared resid	9.12E+19	Schwarz criterion	45.78971
Log likelihood	-769.6091	Durbin-Watson stat	1.065562



Value added deflator

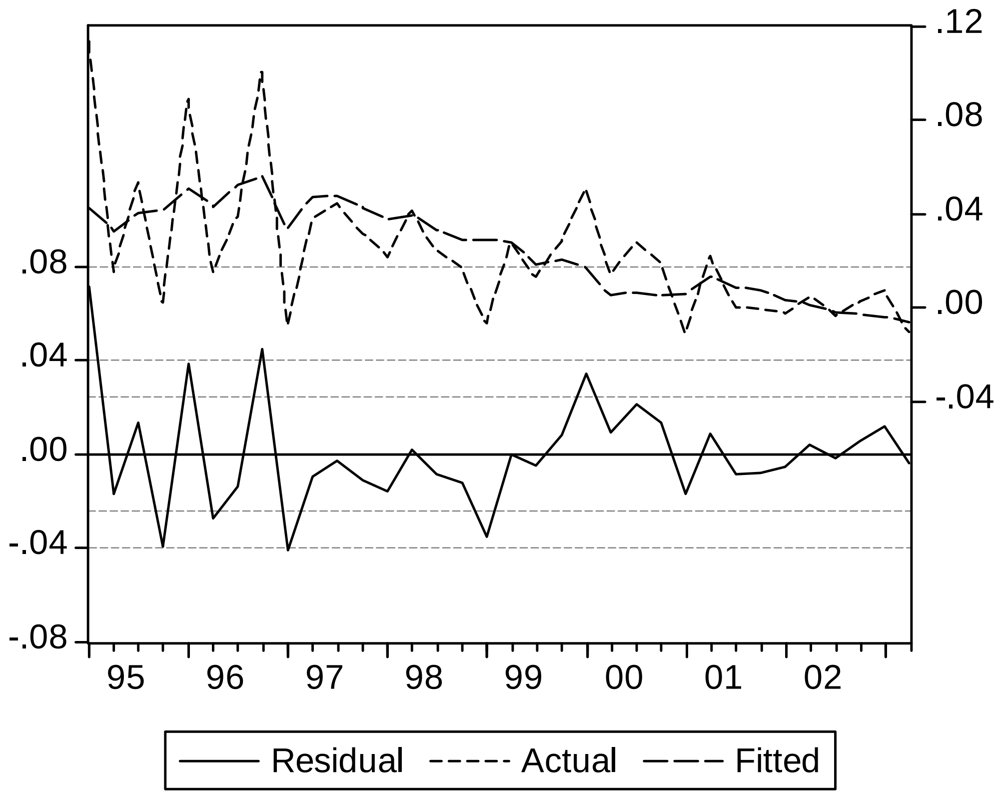
Again, the deflator uses the standard formulation, which works almost acceptably. The coefficient for the rate of use of capacity is accepted only at the 14% level.

The graph shows that most of the variance comes from the beginning of the period, which itself is also a problem, as we are more interested in explaining the end.

Dependent Variable: DLOG(PL_PVA)
Method: Least Squares
Date: 03/22/04 Time: 18:55
Sample: 1995:1 2003:2
Included observations: 34
DLOG(PL_PVA)= C_PL_V(1)*DLOG(PL_CSUP)+ C_PL_V(2)*PL_UT+
C_PL_V(3)*(LOG(PL_CSUP(-1)/PL_PVA(-1)))+ C_PL_V(4)
+PL_V_EC

	Coefficient	Std. Error	t-Statistic	Prob.
C_PL_V(1)	0.253060	0.109300	2.315286	0.0276
C_PL_V(2)	0.174680	0.116017	1.505637	0.1426
C_PL_V(3)	0.225730	0.097194	2.322464	0.0272
C_PL_V(4)	-0.095223	0.132716	-0.717495	0.4786

R-squared	0.404862	Mean dependent var	0.024051
Adjusted R-squared	0.345348	S.D. dependent var	0.030160
S.E. of regression	0.024402	Akaike info criterion	-4.478145
Sum squared resid	0.017864	Schwarz criterion	-4.298573
Log likelihood	80.12846	Durbin-Watson stat	2.252465



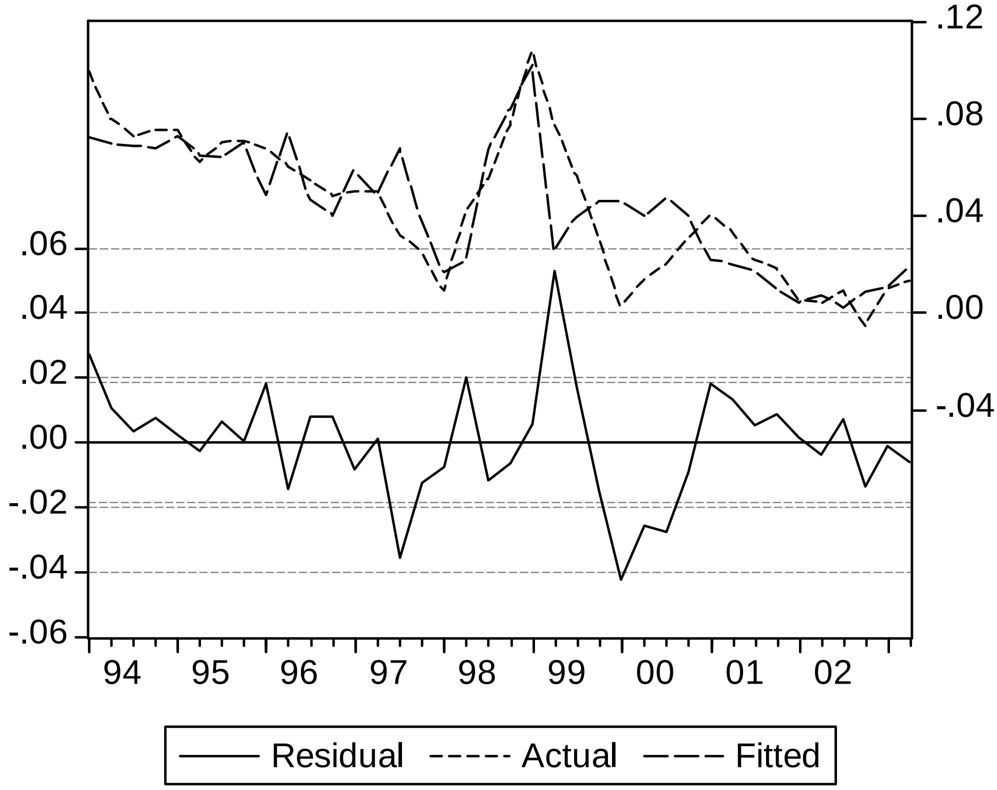
Wage rate

For the wage rate, we had to set again the error correcting term (to 0.2) and introduce two correcting elements, for 1998 and 1999. This allows the formula to follow the strange evolution of wages for that period, which again is not consistent with the GUS data. We shall have to address this problem in the future.

Dependent Variable: DLOG(PL_W)
Method: Least Squares
Date: 03/22/04 Time: 18:55
Sample: 1994:1 2003:2
Included observations: 38
DLOG(PL_W)=C_PL_W(1)*DLOG(PL_PC)+C_PL_W(2)*PL_TCHO-0.2
LOG(PL_CSUP(-1)/PL_PC(-1))+C_PL_W(4)+C_PL_W(5)(T
-1998)*(T>=1998)*(T<=1999)+C_PL_W(6)*(T-1999)*(T>=1998)
*(T<=1999)+PL_W_EC

	Coefficient	Std. Error	t-Statistic	Prob.
C_PL_W(1)	0.694186	0.131595	5.275156	0.0000
C_PL_W(2)	-0.507407	0.126382	-4.014860	0.0003
C_PL_W(4)	0.042014	0.021875	1.920677	0.0634
C_PL_W(5)	0.069340	0.016565	4.186008	0.0002
C_PL_W(6)	0.056536	0.015854	3.566145	0.0011

R-squared	0.643877	Mean dependent var	0.043849
Adjusted R-squared	0.600711	S.D. dependent var	0.029355
S.E. of regression	0.018550	Akaike info criterion	-5.014663
Sum squared resid	0.011355	Schwarz criterion	-4.799192
Log likelihood	100.2786	Durbin-Watson stat	1.250776



Household consumption

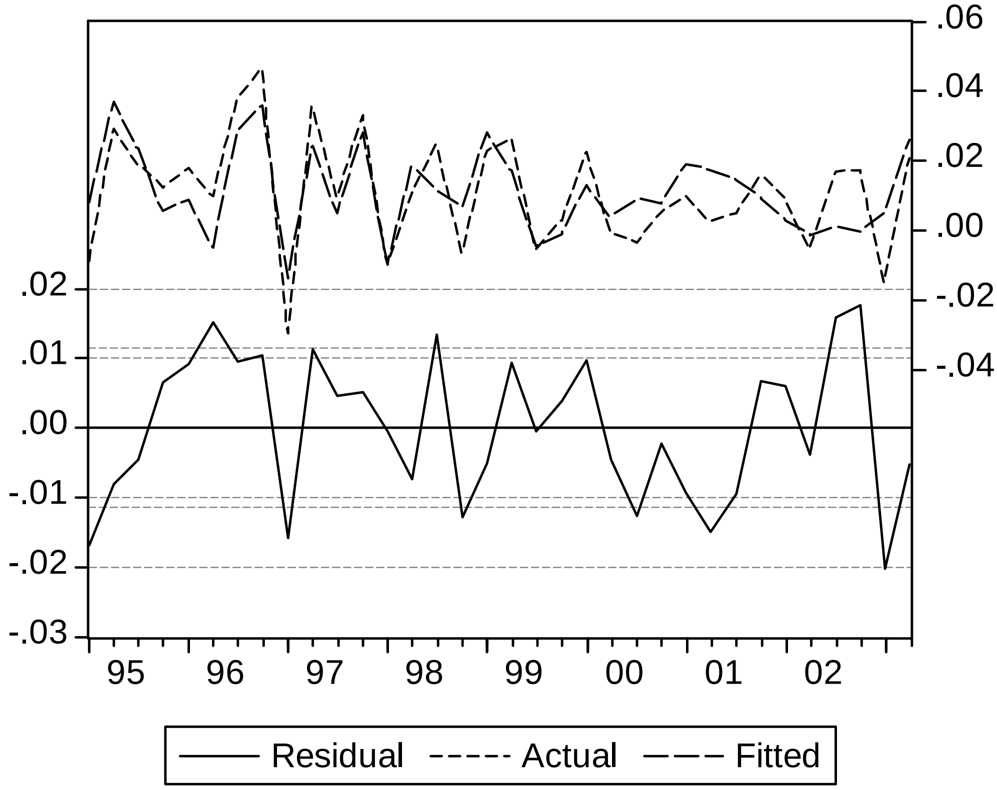
The consumption equation works rather well, with more or less acceptable results for the short and long term elasticities to revenue, to inflation and the rise in unemployment. The results are not so good for the interest rate, but this explanation is seldom validated for other countries.

Dependent Variable: DLOG(PL_CO)
Method: Least Squares
Date: 03/22/04 Time: 18:55
Sample: 1995:1 2003:2
Included observations: 34
DLOG(PL_CO)=C_PL_C(1)*DLOG(PL_RDR) + C_PL_C(2)*(0.5
*DLOG(PL_PC)+(1-0.5)*DLOG(PL_PC(-1)))+ C_PL_C(3)
*D(PL_TCHO)+ C_PL_C(4)*LOG(PL_RDR(-1)/PL_CO(-1))
+C_PL_C(5)*(PL_TIC-400*@PCH(PL_PC))+C_PL_C(6)
+PL_C_EC

	Coefficient	Std. Error	t-Statistic	Prob.
C_PL_C(1)	0.878744	0.225604	3.895067	0.0006
C_PL_C(2)	-0.315317	0.157265	-2.005000	0.0547
C_PL_C(3)	-0.834056	0.461578	-1.806966	0.0815
C_PL_C(4)	0.571118	0.175205	3.259713	0.0029
C_PL_C(5)	-0.000717	0.000589	-1.217961	0.2334
C_PL_C(6)	-0.034819	0.013386	-2.601196	0.0147

R-squared	0.593616	Mean dependent var	0.011144
Adjusted R-squared	0.521047	S.D. dependent var	0.016488
S.E. of regression	0.011411	Akaike info criterion	-5.949690

Sum squared resid	0.003646	Schwarz criterion	-5.680332
Log likelihood	107.1447	Durbin-Watson stat	1.712318



Imports

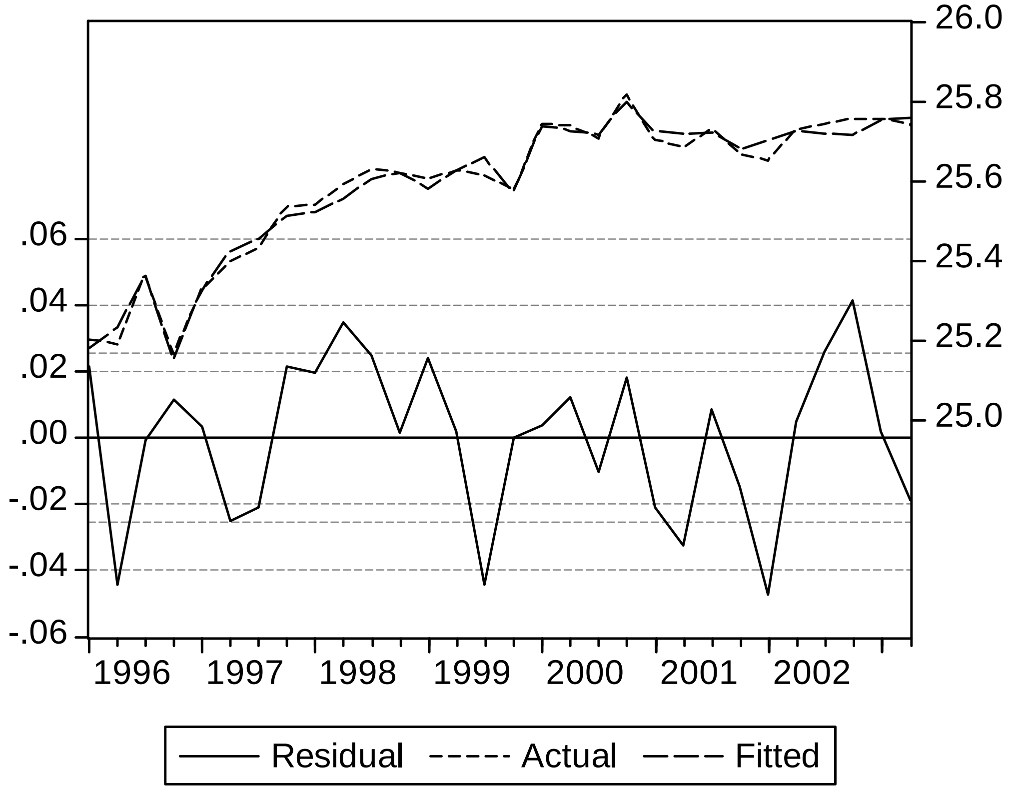
Imports are quite well explained by demand, capacity and competitiveness, although a dummy is needed for the last quarter of 1995.

(1-.85*PL_UT) represents the rate of unused capacities, PL_UT being the ratio of actual production to production at the "normal" rate of use, itself set at 0.85.

Dependent Variable: LOG(PL_M)
Method: Least Squares
Date: 03/22/04 Time: 18:55
Sample: 1996:1 2003:2
Included observations: 30
LOG(PL_M)= C_PL_M(1)*LOG(PL_DF+0.5*PL_X)+ C_PL_M(2)*LOG((1 -.85*PL_UT)*(1-.85*PL_UT(-1)))+ C_PL_M(3)*LOG(PL_COMPM)+ C_PL_M(4)+ C_PL_M(5)*(T=1999.75)+PL_M_EC

	Coefficient	Std. Error	t-Statistic	Prob.
C_PL_M(1)	1.806291	0.065616	27.52803	0.0000
C_PL_M(2)	-0.037253	0.013002	-2.865140	0.0083
C_PL_M(3)	-0.287500	0.116700	-2.463595	0.0210
C_PL_M(4)	-22.80193	1.775952	-12.83927	0.0000
C_PL_M(5)	-0.091468	0.028159	-3.248272	0.0033

R-squared	0.983210	Mean dependent var	25.58560
Adjusted R-squared	0.980524	S.D. dependent var	0.182384
S.E. of regression	0.025453	Akaike info criterion	-4.352951
Sum squared resid	0.016196	Schwarz criterion	-4.119418
Log likelihood	70.29426	Durbin-Watson stat	1.645816



Exports

For exports we use a measure of demand addressed to Poland. This variable is obtained by weighting the total imports of the partners of Poland by their share in Polish exports.

Price competitiveness works, with a higher coefficient than imports, which is quite usual and natural (the choice between foreign providers depends more on prices than the choice between local and foreign).

However, we could not evidence a role of capacities. This is quite usual for transition countries, where a large share of the capacity corresponds (at least in the beginning) to outdated processes which cannot be used to satisfy foreign demand.

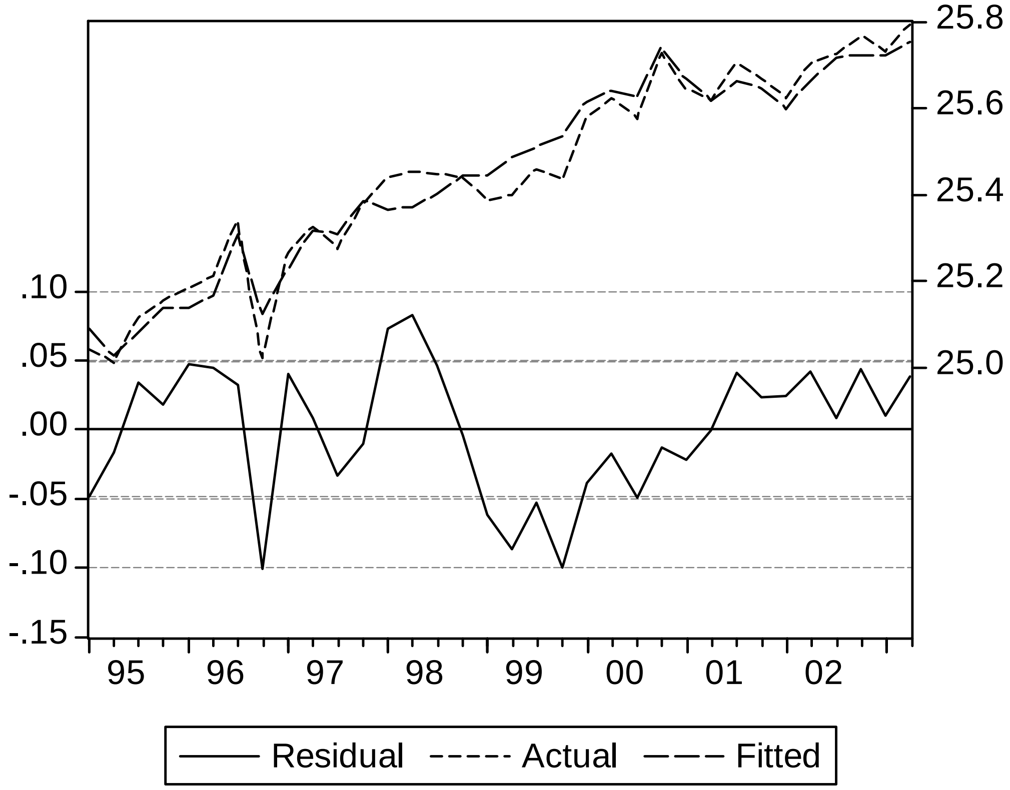
This equation is not actually too important, as we have to consider that it will disappear when the model is integrated to the MacSim system. It will be used only for single country simulations.

Dependent Variable: LOG(PL_X)
Method: Least Squares
Date: 03/22/04 Time: 18:55
Sample: 1995:1 2003:2
Included observations: 34
LOG(PL_X)=C_PL_X(1)*LOG(PL_DM)+C_PL_X(2)*LOG(PL_COMPX)

+C_PL_X(3)+PL_X_EC

	Coefficient	Std. Error	t-Statistic	Prob.
C_PL_X(1)	1.529007	0.080161	19.07426	0.0000
C_PL_X(2)	-0.669599	0.147106	-4.551808	0.0001
C_PL_X(3)	-7.872064	1.411257	-5.578050	0.0000

R-squared	0.958068	Mean dependent var	25.44822
Adjusted R-squared	0.955363	S.D. dependent var	0.230867
S.E. of regression	0.048776	Akaike info criterion	-3.119046
Sum squared resid	0.073753	Schwarz criterion	-2.984367
Log likelihood	56.02379	Durbin-Watson stat	1.051148



Simulating the Polish model

Of course the next stage was to check that the identities were consistent with the data, and that the response of the economic equilibrium to shocks was consistent with theory. This has been done but will not be presented here.

Adapting the model to MacSim

As we have shown, MacSim is at this time a yearly model. We had two options :

- Create a quarterly version of MacSim, which would have been made easier by the availability of the corresponding data. But this meant also re-estimating all the equations, and we could expect failure and difficulties for a good share of the cases.

- Transforming out Polish model into an annual one. This meant creating annual data from quarterly (a rather simple task) and adapting the estimated formulas to a yearly format. For the latter, the only problem comes from the presence of lags, but a simple solution can be found in most cases. In particular, the yearly speed of the error correction process can be computed from the quarterly speed, using simple assumptions.

We have started with the yearly option, obviously faster to implement. But we consider producing a quarterly version in the near future. This will allow us to have a quarterly MacSim at our disposal. It will be based on more reliable estimation techniques, which call for a large number of observations, and the description of the short term dynamics will be improved.

Integrating the financial variables

In the above version, the exchange rate and the real short-term interest rate are fixed, and the interest rates have almost no effect (only on the balances of agents). We shall now describe how we have given them a more important role, subject to a series of options.

One will observe that some of the options have been chosen with European Monetary Union in mind. And of course, the role of these options will appear essentially when we consider the accesion of Poland to this group.

<u>The options for the interest rate</u>

Actually, the options concern the short-term rate on new borrowings, from which the long-term and average rates are computed in a unique way.

The **<u>short-term rate</u>** for one country can be defined as:

- A nominal exogenous value.
- A real exogenous value.
- A Taylor rule
- The nominal rate of another country (Germany?)
- A common nominal interest rate with a set of countries (for the EMU).

Of course, the two last options can originate in any of the three first ones.

In the Taylor rule, the rate will depend partly on inflation, partly on the output gap, measured by the capacity utilization rate:

TIC = 150 . tx(PC) + 50 . b . (UT-UT*) + c

Where tx(PC) represents inflation, and the second term the output gap.

In short, the rationale for this formulation is the following (Taylor JB (1998)).

The National Bank (for instance, the Federal Reserve of the US) wants to control inflation, or the variability of inflation, or the variability of the couple inflation-growth. If it expects high inflation, it will increase the real interest rate. Symptoms for future inflation are: a present high rate, a high level of output compared to its potential value. In a backward looking framework, this leads to the above formula.

In the absence of potential output, we have introduced the rate of use of capacities. This option can be criticized, as it is constrained by the actual productive process, while potential output depends rather on human capital and resources.

Taylor has set the coefficients to the above values, which should represent the behaviour of the FED in the last two decades. However, they do not necessarily apply to other countries.

The **<u>long-term interest rate</u>** is a moving average:

$TIL = c \cdot TIC + (1-c)\, TIL_{-1}$

The **<u>mean borrowing rate</u>** is and average of both:

$TI = d\ TIL + (1-d)\ TIC$

The **mean rate paid** is a moving average:

$TIM = e\ TIM_{-1} + (1-e)\ TI$

For simulations we shall use the values:

c	0.5
d	0.5
e	0.8

The options for the exchange rate

The exchange rate can be defined as:

- Exogenous for a each country
- Following purchasing power parity for the country (based on the consumption price)[1].
- Exogenous for a set of countries (actually the same as the first case, except that a single assumption is made).
- Following purchasing power parity for a set of countries (based on the weighted consumption price of the countries).
- Following uncovered interest rate parity for one country.
- Following uncovered interest rate parity for a set of countries.

Uncovered interest rate parity will make the exchange rate depend on the interest rate (both real, or both nominal). The rationale is the following:

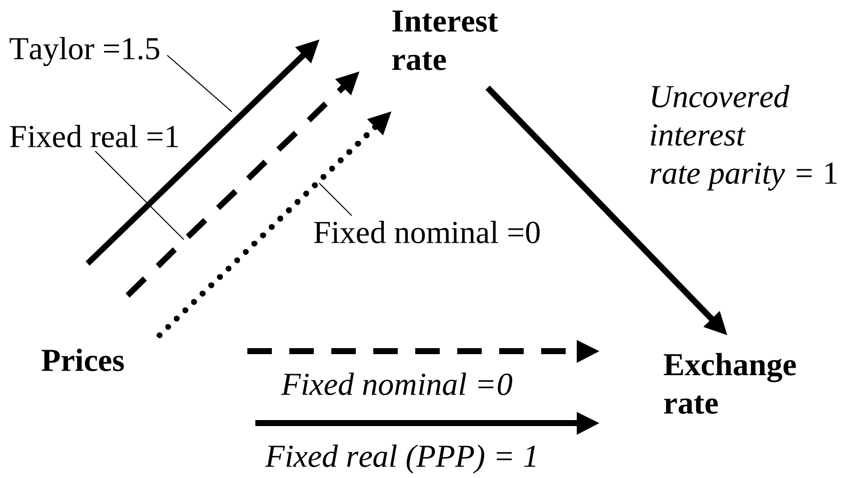
If the agents think that the currency of one country risks losing value in the future, they will ask for a higher interest rate than the international one. So the expected exchange rate will affect the present currency value. If returns are equalized, a one percent expected devaluation will increase the nominal rate by one point. In a backward looking framework, we shall use a simultaneous influence.

The sets of countries considered can be defined at simulation time. This allows in particular observing the consequences of a change in the composition of the EMU.

Summarizing the influences

The above influences can be summarized as follows:

[1] To avoid underidentification of the system, the exchange rate of the Rest of the World is actually fixed, and the other currencies follow purchasing power parity compared to it.



We can observe in particular:

- That combining a Taylor interest rate and Uncovered Interest Rate Parity leads to a 1.5 elasticity of the exchange rate to prices, representing devaluation in real terms. As the exchange rate itself has a highly positive influence on prices (imported inflation) this can lead (and actually will) to exploding properties. But one can question this juxtaposition, as the interpretation of the interest movements leading to UIP is quite different its the determination in the Taylor framework.
- That if the interest rate is fixed in real terms, PPP and UIP should give the same results (they will).

<u>Enhancing the role of interest rates</u>

Introducing a complex set of options for the interest rate was only efficient if its role was important, which was not the case in the base model. This led us to introduce it in two behaviors:

- Investment, through the long term real interest rate
- Consumption, through the short-term real interest rate.

Unfortunately, every estimation we tried failed (which is apparently rather common for this case). This led us to check other models, and we decided to use coefficients that gave to the associated equations properties similar to NiGEM. We have chosen the same value for all countries.

The equations become:

$$i_t / k_{t-1} = c1.i_{t-1} / k_{t-2} + c2.[(q_t - q_{t-1}) / q_{t-1} + ut_t / 0.85] - c3.tprob_t + c4$$
$$-0.0006 * (til_t - 100(pc_t - pc_{t-1}) / pc_{t-1}))$$

$$\Delta Log(co_t) = c1.\Delta Log(rdm_t / pc_t) + c2.[0.5.\Delta Log(pc_t) + 0.5.\Delta Log(pc_{t-1})]$$
$$+ c3.\Delta Log(tcho_t) + c4.Log[rdm_{t-1} /(pc_{t-1}.co_{t-1})] + c5$$
$$- 0.001.(tic_t - 100 * (pc_t - pc_{t-1}) / pc_{t-1}))$$

Of course, before applying these formulations, we have checked their influence, by observing the change in model properties with one addition or both (four cases). For this we have used two cases: an exogenous exchange rate with either a real interest rate or a Taylor rule, and applied shocks both to France and the full set. The results, which will appear in a separate paper, show a sizable but reasonable influence.
From now on, we shall only consider both additions. The package will not propose any other option.

Merging the models

The exchange block

We shall start by establishing a coherent system for trade prices.

We shall suppose that exporters base their price on their costs and the price of the target market:

$$Log(pex_{i,j})=aLog(pp_i)+(1-a)(Log(pp_j ch_i/ch_j)+bt+c$$

Where i is the exporter and j the client, and ch_i the price of the currency of country i compared to the US dollar.

$$pim_{j,i} = pex_{i,j} ch_j / ch_i$$

$$pim_j = \sum_i m_{j,i} pim_{j,i} \Big/ \sum_i m_{j,i}$$

For utilization rates, we use the same method.

$$utx_j = \sum_i m_{j,i} ut_i \Big/ \sum_i m_{j,i}$$

We can now determine the global imports of country i, by modifying slightly the equation from the single country model, to take into account the capacity of exporters :

$$Log(m_i) = aLog(df_i ouv_i) + b\left[Log(ut_i) - cLog(utx_i)\right] + dLog(pim_i / pp_i) + e$$

This means that a general decrease in the available capacity of exporters will reduce exports, through a substitution effect. The coefficient 0.5 takes into account the larger associated capacities.

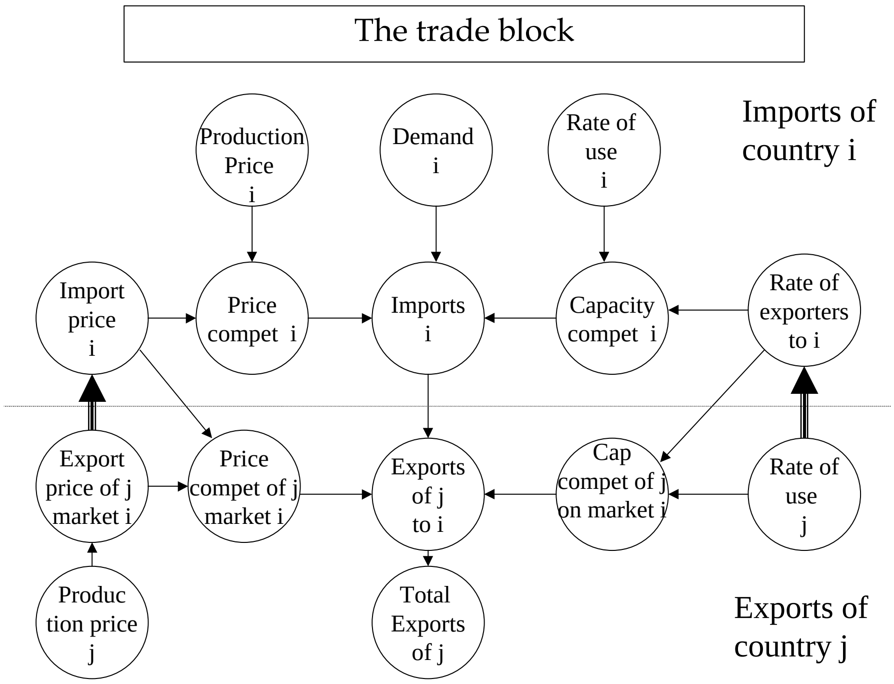
Finally, we separate imports into individual exports. Once again, we shall take into account relative competitiveness, and fluctuations in available capacities, relative to the above average. Actually, we shall again use set coefficients:

$$m_{i,j} = m_i \,.\, b_{i,j} \left[1 - a (pex_j \, ch_i \; / ch_j \; - \; pim_i) - b (ut_j \; - utx_i \;) \right]$$

which means that (as for the single country models) exporters to one country will increase a « natural » share with competitiveness and available capacity, this time relative to their competitors.

One will observe that this technique guarantees the identity of the sum of individual exports with its global value, without any correction. Of course, the coefficients can be different from one market to another, but not within one market.

The system can be summarized with this graph:



In addition to the above, we have introduced some accounting equations:

- Exports from country i to j:

$$x_{i,j} = m_{j,i} \cdot usd0_j \; / usd0_i$$

Where $usd0_i$ represents the base year value of the currency of country i, in US Dollars.

- Total exports computed as a sum

$$x_i = \sum x_{i,j}$$

- The average export price of country i:

$$pex_i = \sum b_{i,j} \, pex_{i,j}$$

The Rest of the World

The Rest of the World will not be associated with a model. Actually, we our goal will only be to give to its trade elements similar properties to the countries we consider. But this does not mean that we can keep its prices exogenous, or its capacities infinite: in case our six countries lead the same policy simultaneously (lowering the social contributions for example) we cannot assume that inflation and demand in the Rest of the World will remain unaffected.
We have chosen the following system, introducing the main mechanisms through a limited set of equations.

Production

We consider only production generated by exports. We start from the supply - demand equilibrium

Q = D + X – M

Ex ante, X generates Q = X.

Ex post, an increase in production will generate revenue and demand:

D = a Q

Of which a share b will be imported.

M = b FD

Finally we get:

Q = 1/(1-a (1-b) X

Final demand will be defined as

FD = c a Q + (1-c) FD0

where FD0 represents the part of final demand independent from trade.

In the absence of investment and capital, the rate of use follows an autoregressive behavior:

$Log(UT) = c\ [d\ Log(UT_{-1}) + e\ Log(Q/(Q_{-1}(1+txq)))] + (1-c)\ Log(UT0)$

As above, the share of production concerned with trade is treated endogenously. It separates two effects :

- the previous disequilibrium on capacities at a normal growth of production (it disappears gradually through additional investment)
- the present gap on production between the actual level and the one associated with a normal growth.

The production price differs from an exogenous track through the evolutions of the rate of use, and the import price (actually their deviations from a base track).

$$Log(pp_t) = Log(pp0_t) + f.Log(ut_t / ut0) + g.Log(pim_t / pim0_t)$$

The export price will use exactly the same equation as country models.

Finally, the import equation uses the same framework as the single counties, except that it is not estimated:

$$Log(m_t) = c1.Log(df_t.ouv_t) + c2.Log(1 - ut_t) + c3.Log(pim_t / pp_t) + c4$$

Part 2 : the using the model for describing the accession process

Our goal is to address two independent issues.

First, we shall present the consequences for Poland of the changes in the trade conditions, which can be expected from joining the Union. For the time being, we shall not try to describe fully the consequences of the process, using the actual decisions and timetable. We shall just consider four shocks :

- Two on tariffs : on EU products in Poland, and on Polish products in the EU.
- Two on quotas : on EU products in Poland, and on Polish products in the EU.

These shocks will be made under the simplest assumptions : fixed exchange rate and fixed real interest rate.

Second, we shall consider the consequences of joining the European Monetary Union. This time, we shall use standard shocks, one on demand and one on supply. But we shall activate the different rules for the exchange rate and the interest rate, as presented above.

As we have said above, the associated conclusions will be presented in the next version of the paper.

Simulation context

We shall now observe the properties of the full model. For this we need :

- A base simulation. To make the diagnosis easier, we shall produce it on the future, using simplified assumptions. We shall suppose that the economy grows at structural rates, the same for each country.

Growth rate of population: 0.5 % per year.
Growth rate of labour productivity: 2.0 % per year.
Growth rate of prices: 2 % per year.

For this analytic simulation, we shall use a long period, for several reasons :

- o We want to control the presence of a long-term equilibrium, and of a steady state path. We do not necessarily believe conclusions drawn from the text of the equations.
- o We want to free the results from any short-term fluctuations. As the model is not linear, an irregular base solution could disturb the sensitivities to shocks, and make the diagnosis less clear. If everything goes well, we should get regular curves, easier to interpret. On the opposite, any irregular trajectory will be attributed to the model.

Our simulations will be conducted on a 100 years period, which appears to guarantee long term convergence. Shocks will start in 2004.

- A definition of the « structural » shares of partner countries in imports and exports of a given country.

o For the first five countries, we have used the definition equations for the foreign markets of one country, presented by the NiGEM model (produced by the National Institute for Economic Science and Research, UK), and the global imports from the year 1995.

o For Poland we have used shares coming from the Chelem database, produced and maintained by the French institute CEPII (Centre d'Etudes Prospectives et d'informations Internationales).

The shares of partners in the exports of our six countries (and of the Rest of the World by difference) give in turn :

- Imports by the Rest of the World from each country, then total imports of the Rest of the World
- Imports of countries from each single country, then individual imports from the Rest of the World (by difference), then total exports of the Rest of the World.

In the following table, each line gives the share of each market in the exports of the associated country. Of course, only the lines and columns associated to the new countries and the rest of the world will be affected.

Table 9 : export market shares by exporting country

Market	Germ	UK	Fran	Ital	Neth	Poland	RoW
Exporter							
Germany	.	0,080	0,120	0,075	0,075	0,024	0,627
UK	0,121	.	0,094	0,047	0,066	0,059	0,647
France	0,168	0,097	.	0,092	0,045	0,020	0,587
Italy	0,190	0,065	0,131	.	0,029	0,030	0,576
Netherlands	0,281	0,093	0,105	0,052	.	0,027	0,452
Poland	0,296	0,056	0,054	0,091	0,036	.	0,467
Rest of World	0,227	0,158	0,167	0,230	0,152	0,084	.

The consequences of trade agreements

We shall start in 2004 by applying four separate changes in the assumptions of the model.

1 : A one point decrease in tariffs applied by Poland to European Union products.
2 : A one point decrease in tariffs applied by the European Union to Polish products.
3 : A decrease in Polish quotas, represented by ex ante one point increase in Polish demand for EU products.
4 : A decrease in EU quotas applied to Poland, represented by an ex ante one point increase in EU imports from Poland

Technical elements

Implementing these shocks introduce several problems and options.

- The Rest of the World in MacSim contains several countries from the European Union (actually, 15 - 5 = 10, or 25 - 5 = 20, if one considers the newly accessed ones). This means for instance that we should apply a partial decrease to tariffs applied by the rest of the world to Poland. If we consider only 10 countries, they represent more or less 5% of Polish imports and exports. This applies actually to all shocks.

- For quotas, we have to decide which type of supply will be replaced by the additional Polish or EU exports. For Polish exports, they can replace supply from local producers or the other exporters. For EU exports, they can replace Polish production or imports from other countries.

For the time being, we have used the most simple assumptions : we shall limit the EU to our five countries (which include the four largest) and suppose that substitution occurs only between exporters.

1 : A decrease in tariffs applied to Polish products in the EU.

We shall first consider a decrease in these tariffs, by one point of the Polish export price. Our model considers two export prices: we first define the price asked by the Polish exporters, then we apply the tariffs rate to get the price paid in foreign countries by the buyers of Polish goods. We shall only apply the change to the second variable. The untaxed export price will not change ex ante, as well as the trade balance, but the competitiveness of Polish exports will increase by one point.

Actually this option can be questioned. One can suppose that Polish exporters, faced ex ante with a gain of 1% in competitiveness, will spend it in part to improve their margins through an increase in their own export price.

The consequences of this shock might appear strange at first look (Figures 1a and 1f). Measured in real terms, the trade balance improves only in the beginning, then the sign changes in the medium term, to stabilize around -0.02 %, as imports show a larger increase. The explanation is simple: according to our model, an increase in exports will have a strong influence on imports. This effect comes both directly, as exporting finished goods calls for imports of raw materials and energy products, and indirectly through local final demand, as the additional capacities needed to meet the new exports call for investments and job creation, the latter increasing households consumption.

So the main improvement concerns Polish activity itself: both GDP and local final demand show a significant increase, stabilizing in the long run around 0.2%. The initial inertia on productive factors limits at first the increase in investment and consumption, the latter following also the gains in the purchasing power of the wage rate. In the long run, the economic improvement will stabilize, and the increase in investment will follow the rest of the economy, including GDP and capital.

But if we think in current terms, external trade does improve for all periods. This comes from the fact that the increased local activity brings inflation (Figure 1d), to which we know that export prices are more sensitive: the terms of trade improve significantly (Figure 1g), and their contribution is decisive to the global diagnosis.

We can observe of course that this inflationary effect limits the gains on price competitiveness, and on the balance in real terms. Without this effect (for instance if we used a Purchasing Power Parity assumption, which our model allows), we lose the gains on the terms of trade, but the trade balance in real terms shows a permanent improvement over the period..

Actually, the dynamics of exports can be explained in the following way :

- The expected initial gain should combine the change in tariffs (one point) with the share of affected markets (53%) and the elasticity to price competitiveness : 0.8. This gives 0.4%. The actual gain is quite lower, which comes essentially from the limits on available capacity.

- In the medium term, inflation appears, which reduces the competitiveness gains (Graph 1d). The increase in the export price reaches 0.2% then stabilizes. But at the same time capacity builds up, and the rate of use goes back to its base value.

- In the long run, firms will accept a decrease in the rate of use. This is a usual property for this type of model. The cost of capital, part of which is imported, increases less than the production price. This improves the profitability ex ante, and investment and capital will build up until the cost of capital meets again the gains obtained from production. As production increases less than capital, the equilibrium rate of use is lower than before.

Of course, a lower rate of use means also a higher share of local and foreign markets.

As to the State budget, it is not directly affected, but taxes will profit somewhat from the improved activity. The gain is progressive and quite small (about 0.15 points of GDP).

If we now look at the situation in other countries, we see (graphs 1h and 1i) that if the reduction in EU tariffs actually increases its imports, it has also a favourable impact on its production. This is true in particular for Germany, the country with the strongest ties to Poland. This positive impact on GDP of decreases in local tariffs will be explained in detail in the next case, as it happens also for Poland.

Conclusion : a decrease in tariffs applied to Polish products improves GDP, the trade balance and the State budget. But the increase in imports and local inflation limits the gains on trade.

2 : A decrease in Polish tariffs applied to EU products

We have already considered a decrease in tariffs applied to Polish products, with consequences clearly beneficial for Poland, over the whole period. But this measure is a part of a global agreement, in which Poland should also decrease the tariffs it applies to foreign products.

We shall now reduce this tariffs rate by one point, in one step. This means that ex ante the cost of imports will decrease by a little less than one percent. Again, we suppose that exporters to Poland do not change their own prices, using the situation to improve their margins.

For this shock, the mechanisms are more complex.

We still have a competitiveness effect, now favouring imports, with a lower ex ante intensity due to the smaller coefficient (0.5 instead of 0.8). However, the first year consequence on trade is higher than before (an increase in imports of 0.3 %).

The maon explanation is the following : now the decrease in tariffs will also affect local inflation directly, through the share of imported products in demand. For firms, equipment goods will become cheaper, increasing ex ante the profitability of capital. For households, this will mean a higher purchasing power, and a lower effort to maintain the purchasing power of savings. In the medium term, the indexation of wages on a reduced CPI will also profit to firms, which will reduce their own prices and improve their competitiveness, both on the local and foreign markets.

This is the reason for the increased impact on trade : while the increase in exports in case 1 was limited by domestic growth and local tensions, here the increase in imports does not reduce growth (and tensions).

This effect appears essentially in the second period : demand goes up, increasing imports further, but also GDP. This mechanism amplifies in the medium term, with the building up of capacities (Graph 2c) and the progress of deflation (2d). And profitability of capital improves again : this time deflation makes the import price decrease less than the local GDP deflator, but this is more than compensated by the decrease in taxes). The long term rate of use decreases again, with the same favourable effects on trade.

As to the trade balance itself, we have of course to consider pre-tax imports. Using this notion, the import price decrease will be very limited, and Poland will lose on the terms of trade. Compared to the evolution of real trade, the ratio decreases much more (Figure 2g).

Concerning the state budget, the ex ante cost of around 0.35 GDP points is reduced in the short run by lower inflation and additional revenue, but remains significant

Looking at the evolution in the other countries, we observe (this was more natural than in the previous case) that all countries, especially Germany but this time also the Rest of the World[2], profit from the change.

Conclusion : a decrease in tariffs reduces inflation, and increases GDP after a few periods, but at a price on the trade balance and the budget deficit.

We can already notice that both (symmetrical) reductions in tariffs have a positive effect on Polish GDP. This might look strange, as applying to a world model a general and identical decrease in tariffs in each of its countries would bring a rather small effect on each individual GDP. The main reason is that our model considers that Poland is a "small" country dealing with a much larger Rest of the World, which is not really influenced by the evolutions of Polish economy (as Poland represents a small part of its global trade). For instance, we do not consider the effect on RoW prices, either of the decrease in tariffs applied to Polish products, or of a decrease in their inter-country tariffs.

3 : A reduction of quotas applied by the EU to Polish products

First, let us observe that in our case, the increase in demand addressed to Poland leaves unchanged such external assumptions as foreign inflation and foreign available capacities. We are not considering an increase in global EU demand, which would modify the whole economic equilibrium, but a higher appeal for Polish products, all things being equal. By entering European Union, Poland will increase the market for its products, independently from competitiveness or supply.

This will actually shorten our comments: in our model, a decrease in quotas applied to Polish products and a decrease in tariffs (Case 1 above) have extremely similar consequences. Ex ante, both elements affect only exports, either through the role of tariffs in the competitiveness element, or the ex ante share of Poland in the EU market. The differences come only from the initial size of the impact, and the specific dynamics.

Ex ante, imports by EU from Poland increase in the present case by 1%, while in the previous case a 1% gain in competitiveness increasedthe Polish share in EU imports by 0.8%, and EU imports themselves by 0.5 times the global loss in import competitiveness of the EU countries, rather limited except perhaps for Germany. This will be reduced by the local disinflation coming from cheaper imports from Poland (itself limited).

The decrease by one third of the impact of the shock looks quite reasonable. In the final version of this paper, we will give an extensive decomposition of these effects.

As to the evolution in foreign countries, this time the impact is negative. This will be the only time this happens, just as a decrease in Polish quotas for EU products will be the only negative case for Poland.

Conclusion: as expected, all local elements improve, apart from prices, which follow the local increase of activity. The results are quite similar to the shock on foreign tariffs. EU activity decreases, for the only time in the study.

[2] We have to remember that for the Rest of The World, value added is limited to the productive units which trade with the MacSim countries.

4 : A reduction of quotas applied by Poland to EU products

One could expect to obtain results similar to the previous shock, but with opposite signs. This is mostly the case, but not on trade variables, for reasons easy to explain.

As in the previous case, we are facing ex ante a demand shock, this time negative. We have seen that the most important consequences of this shock (and also actually of Shock 1) came through imports. In the previous shock, the ex post increase in imports reduced the efficiency. Now the ex ante increase in imports is also limited by its own secondary consequences.

In the first periods, the changes in the supply-demand equilibrium are quite similar, if we exchange exports for imports, and if we exchange the sign for both GDP and final demand. The main short term ex post effects come from demand elements and the rate of use, which show the same sensitivity to ex ante identical shocks on the supply – demand equilibrium.

The change in the trade elements will be much lower, but their balance will move in a similar way, both in level and dynamics (with and opposite sign, however).

Let us use this case to explain the role of the rate of use of capacities, as it looks as the most natural place to do it.

The ex ante shock of 1% is largely dampened by the internal evolution of the Polish economy. At first, the main reason can be found in the immediate increase in available capacities. There are two justifications for this influence.

- First, it is possible that among new imports, demand for some goods could not be satisfied fully, whether by local producers or by imports. Global demand for these goods will increase, substituting for other products, part of which were previously imported. For instance, if the imported cars quota is increased, local car factories can still work full time, if market conditions are met. Polish consumers could switch their purchases to cars from TV sets, which are often imported. Using figures, if the global share of imports in demand is 30% for all goods, an increase of 1000 of imports for one good for which demand is much higher than supply could translate completely into demand for that good, reducing demand for other goods by 1000. Global imports would only increase by 1000 - 0.3*1000 = 700.

- Second, one can assess that importing some goods which were previously produced locally allows firms to propose other goods, more or less similar, and for which potential demand was not satisfied. This implies that a certain degree of substitution is possible within the local production process.

Of course, the change in imports and exports is further reduced by disinflation and gains in competitiveness, as firms try to regain market shares by limiting price increases. This effect will grow with time, as the unemployment reduces the wage demands of workers. For the same reason, gains on exports keep growing.

In the short term, exports also increase through this competitiveness effect, but the combined loss on real trade brings GDP and local demand down, particularly investment, as the need for additional capacities decreases. This further decreases imports, but we must remember that imports depend also on exports, which grow in this case.

In the long run, the change in imports stabilizes, as disinflation is compensated by an increase in the rate of use of capacities, for the usual reasons.

On the whole, the loss on real trade (Figure 4g) is limited, going through an almost negligible value in the medium run. But this is partly due to local disinflation, which also brings a loss on the terms of trade. The current ratio presents a permanent degradation, averaging 0.3% in the latter periods, a much lower figure however than the ex ante loss of 1%.

As to the State budget, the limit on the ex-post effects make the loss quite small.

Concerning the other countries, the EU economy improves a little, especially Germany, while the Rest of the World is negatively affected in the medium term by losses in Polish trade, even if it profits from the growth in EU.

Conclusion: as expected, all local elements are negatively affected, apart from prices, which are reduced following the local decrease of activity.

Conclusion

At this stage of the study, our conclusion will be short.

A reduction in Polish barriers, whether though a decrease in tariffs or quotas, expands significantly Polish external trade, with strong dynamic effects on both supply and demand. On the whole, it has a positive influence on Polish growth, but the Governement balance keeps negatively affected by the reduction in tariffs.

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Table 1 : Productive investment

	see/dw	c1	c2	c3	c4	c5
United Kingdom	**0,0025**	**0,85**	**0,02**	**0,02**	**0,05**	**-0,020**
	1,20	fixed	2,56	same	2,70	-2,70
Germany	**0,0042**	**0,88**	**0,10**	**0,02**	**0,14**	**-0,025**
	0,77	48,79	2,76	fixed	1,20	-2,92
France	**0,0029**	**0,70**	**0,20**	**0,02**	**0,14**	**-0,003**
	1,31	10,11	8,49	1,67	1,20	-0,33
Italy	**0,0035**	**0,78**	**0,12**	**0,02**	**0,14**	**-0,016**
	1,97	10,40	5,22	1,15	1,67	-1,24
Netherlands	**0,0034**	**0,63**	**0,06**	**0,02**	**0,12**	**-0,008**
	1,78	5,64	1,64	1,03	2,73	-0,43
Sweden	**0,0016**	**0,58**	**0,02**	**0,02**	**0,20**	**0,016**
	2,24	20,98	1,43	same	2,82	1,12

I/k(-1)=c_i(1)*I(-1)/K(-2)+ c_I(2)*@PCH(Q)+ c_I(3)*UT/0.85+ c_I(4)*TPROB+ c_I(5)

Table 4 : Value added deflator

	See/DW	c1	c2	c3	c4
United Kingdom	**0,02**	**0,80**	**0,20**	**-0,28**	**0,079**
	0,81	12,57	fixed	-3,24	1,30
Germany	**0,02**	**0,59**	**0,20**	**-0,19**	**0,098**
	0,46	4,63	fixed	-5,43	4,86
France	**0,01**	**0,50**	**0,16**	**-0,17**	**-0,065**
	1,75	11,50	4,85	-7,27	-2,37
Italy	**0,01**	**0,72**	**0,25**	**-0,10**	**-0,170**
	1,33	15,42	3,20	-2,57	-2,65
Netherlands	**0,01**	**0,32**	**0,33**	**-0,31**	**-0,208**
	1,27	4,21	4,18	-6,19	-3,26
Sweden	**0,03**	**0,59**	**0,20**	**-0,20**	**0,164**
	1,04	5,96	fixed	-4,19	2,39

Dlog(pva)= c_v(1)*dLOG(CSUP)+ c_n(2)*UT+c_n(3)*LOG(PVA(-1)/CSUP(-1))+ c_n(4)

Table 2 : Employment

	see/dw	c1	c2	c3	c4	c5
United Kingdom	**0,01**	**0,47**	**0,57**	**0,04**	**-0,03**	**42,321**
	1,29	6,95	7,03	36,52	-20,89	6,56
Germany	**0,01**	**0,43**	**0,18**	**0,05**	**-0,04**	**15,561**
	1,18	7,54	5,63	19,76	-14,42	5,03
France	**0,00**	**0,58**	**0,39**	**0,05**	**-0,02**	**32,461**
	2,00	9,04	3,00	23,38	-11,32	2,72
Italy	**0,01**	**0,23**	**0,19**	**0,05**	**-0,03**	**93,633**
	1,30	2,65	2,22	9,00	-3,67	8,14
Netherlands	**0,01**	**0,39**	**0,20**	**0,05**	**-0,04**	**0,447**
	2,70	4,73	2,97	1,71	-1,32	3,61
Sweden	**0,02**	**0,33**	**0,36**	**0,04**	**-0,02**	**22,290**
	1,10	2,81	4,44	13,76	-4,82	3,84

Dlog(LE)=c_n(1)*DLOG(Q)+ c_n(2)*(LOG(Q(-1)/LE(-1))
- c_n(3)*t-c_n(4)*(t-1973)*(t>=1973))+ c_n(5)

Table 3 : Unemployment

	See/DW	c1	c2	c3	c4	c5	c6
United Kingd	**134720,76**	**-0,75**	**0,74**	**-0,10**	**-0,91**	**9,42E-01**	**-9,42E+06**
	0,82	-12,61	3,60	-12,44	17,53	-6,20	-1,76
Germany	**120535,45**	**-0,31**	**0,30**	**0,00**	**-0,51**	**5,15E-01**	**-6,22E+06**
	0,96	-5,71	7,29	-7,65	11,49	-20,42	-0,01
France	**85999,03**	**-0,62**	**0,18**	**0,00**	**-0,33**	**4,51E-01**	**-6,56E+06**
	1,18	-7,14	1,13	-3,38	12,69	-5,56	0,00
Italy	**88872,33**	**-0,31**	**0,28**	**-0,18**	**-0,39**	**4,29E-01**	**-6,15E+06**
	1,42	-4,92	2,47	-2,51	-1,52	5,36	-1,97
Netherlands	**25659,19**	**-0,76**	**0,20**	**-0,16**	**-0,18**	**4,03E-01**	**-2,38E+06**
	1,65	-9,87	fixed	-1,94	4,78	-2,71	-1,42
Sweden	**13290,98**	**-0,45**	**0,10**	**-0,19**	**-0,06**	**2,93E-01**	**-1,15E+06**
	1,79	-13,35	0,66	-3,48	-0,82	3,00	-3,20

d(cho)=c_u(1)*d(LT)+ c_u(2)*d(POP65)+ c_u(3)*(CHO(-1)- c_u(4)*LT(-1)- c_u(5)*POP65(-1)- c_u(6)*DU)

Table 5 : Wage rate

	See/DW	c1	c2	c3	c4
United Kingdom	**0,02** 2,21	**0,89** 13,85	**-0,38** -3,33	**-0,19** -2,72	**-0,001** -0,06
Germany	**0,02** 1,20	**0,27** 1,49	**-0,94** -6,83	**-0,09** -0,95	**0,060** 3,25
France	**0,01** 2,20	**0,93** 18,99	**-0,54** -9,87	**-0,06** -2,01	**0,046** 5,47
Italy	**0,02** 1,64	**0,79** 13,79	**-0,99** -6,09	**-0,08** -0,98	**0,102** 9,20
Netherlands	**0,02** 0,81	***1,00*** fixed	**-0,54** **-3,37**	***-0,15*** fixed	**0,054** 1,76
Sweden	**0,02** 1,14	**0,42** 3,80	**-0,92** -5,20	***-0,15*** fixed	**0,078** 4,60

Dlog(w)= c_w(1)*dLOG(PC)+ c_w(2)*tcho+ c_w(3)*LOG(W(-1)*LE(-1)*(1+TCSE(-1))/QVAL(-1))+ c_w(4)

Table 6 : Change in inventories

	see/dw	c1
United Kingdom	**3,075E+09** 1,14	**0,25** 5,78
Germany	**7,337E+09** 0,55	**0,17** 4,40
France	**4,964E+09** 0,66	**0,37** 4,32
Italy	**4,713E+09** 1,17	**0,38** 6,63
Netherlands	**2,382E+09** 0,39	**0,50** 6,73
Sweden	**1,283E+10** 1,09	**0,27** 3,38

DSTOC= c_d(1)*d(Q)

Table 7 : Household consumption

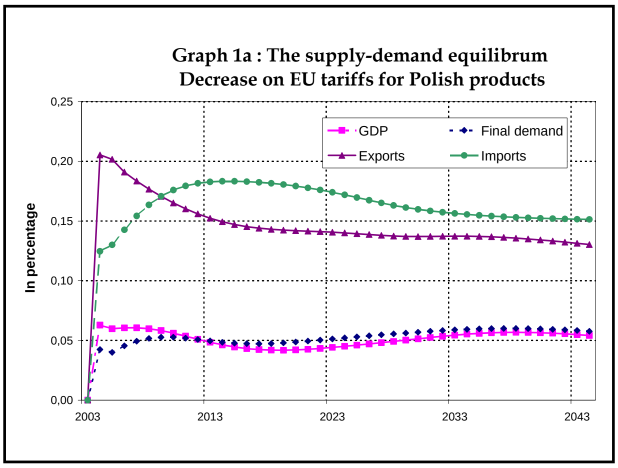
	see/dw	c1	c2	c3	c4	c5
United Kingd	**0,012**	**0,57**	**-0,09**	**-0,65**	**-0,16**	**0,04**
	1,53	5,15	-1,79	-2,90	-1,66	2,95
Germany	**0,007**	**0,66**	**-0,16**	**-0,31**	**-0,32**	**0,02**
	1,50	10,51	-1,58	-1,24	-3,59	4,08
France	**0,011**	**0,55**	**-0,04**	**-0,48**	**-0,18**	**0,02**
	1,93	6,10	-1,51	-2,27	4,38	3,04
Italy	**0,023**	**0,59**	**-0,24**	**-1,66**	**-0,20**	**0,04**
	0,98	0,30	-3,86	4,83	fixed	6,82
Netherlands	**0,013**	**0,25**	**0,11**	**-1,05**	**-0,22**	**0,02**
	1,20	2,08	-3,22	-1,87	5,81	3,40
Sweden	**0,014**	**0,18**	**-0,34**	**-1,48**	**-0,14**	**1,93**
	1,97	1,81	-3,38	-4,55	-1,78	3,40

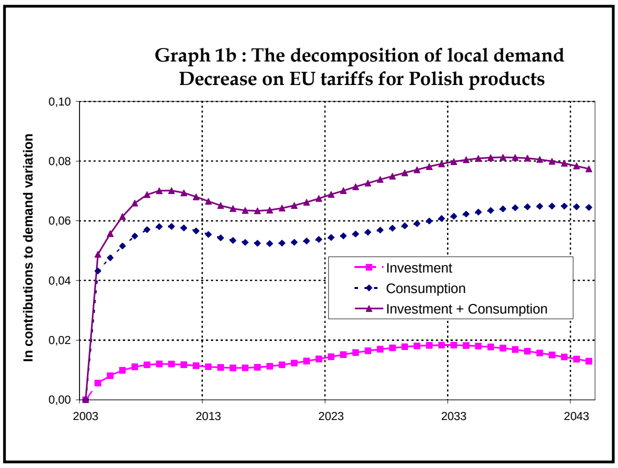
dlog(co)=c_c(1)*DLOG(RDM/PC) + c_c(2)*(0.5*DLOG(PC)+(1-0.5)*dLOG(PC(-1)))
+c_c(3)*d(TCHO)+c_c(4)*LOG((CO(-1)*PC(-1))/RDM(-1))+ c_c(5)

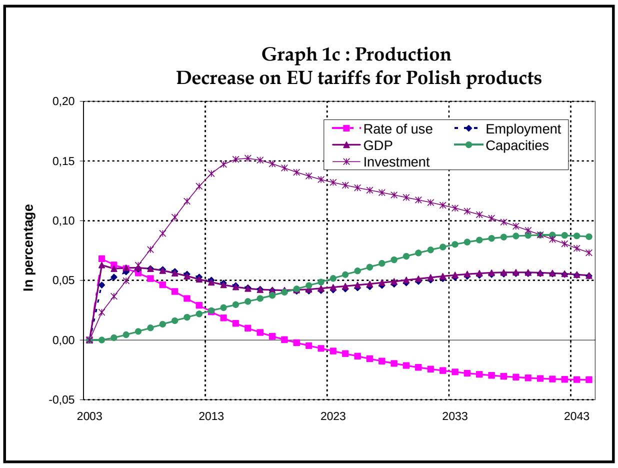
Table 8 : Imports

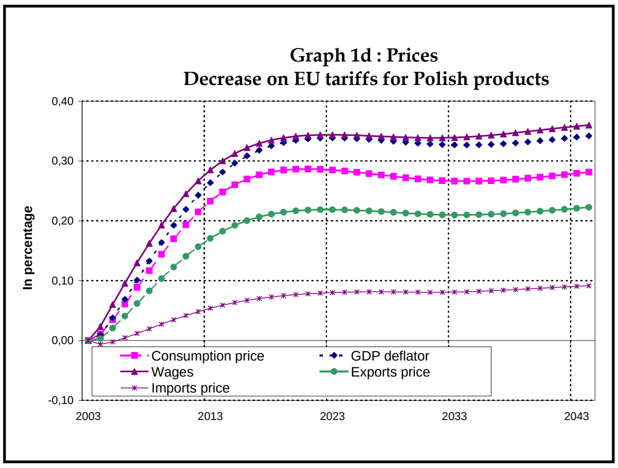
	see/dw	C1	c2	c3	c4
United	**0,07**	**0,60**	**0,02**	**-0,37**	**9,804**
Kingdom	0,36	22,42	0,06	-3,66	13,73
Germany	**0,11**	**0,69**	0,50	**-0,39**	**9,669**
	0,15	15,60	fixed	6,25	9,01
France	**0,05**	**0,76**	**0,51**	**-0,29**	**5,530**
	0,63	52,10	4,83	-3,94	13,97
Italy	**0,07**	**0,72**	**0,29**	**-0,30**	**6,488**
	0,46	38,98	1,00	-3,54	12,68
Netherlands	**0,04**	**0,61**	**0,78**	-0,30	**8,697**
	0,47	47,08	4,07	fixed	12,02
Sweden	**0,05**	**0,65**	**1,22**	**-0,17**	**9,252**
	0,70	44,12	7,61	-2,01	2,28

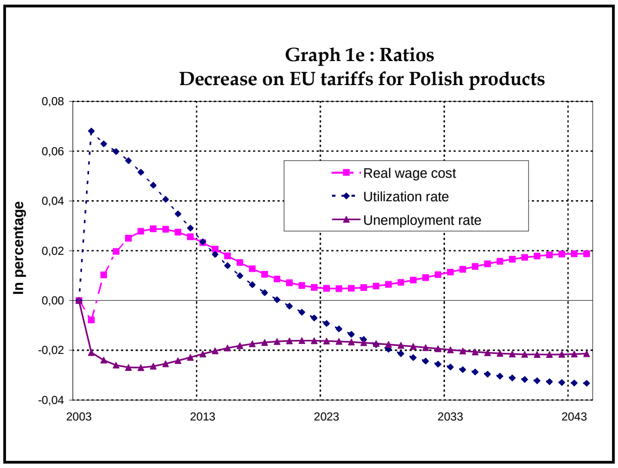
log(m)= c_m(1)*LOG(DF*OUV)+ c_m(2)*LOG(UT)+ c_m(3)*LOG(COMPM)+ c_m(4)

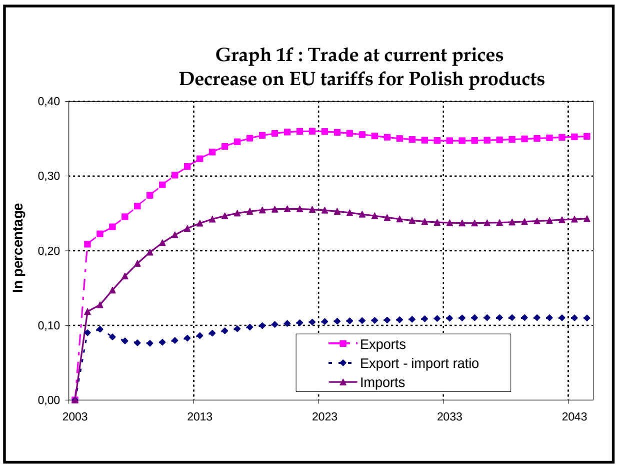

Graph 1a : The supply-demand equilibrum
Decrease on EU tariffs for Polish products
In percentage
0,25
0,20
0,15
0,10
0,05
0,00
2003
2013
2023
2033
2043
GDP
Final demand
Exports
Imports

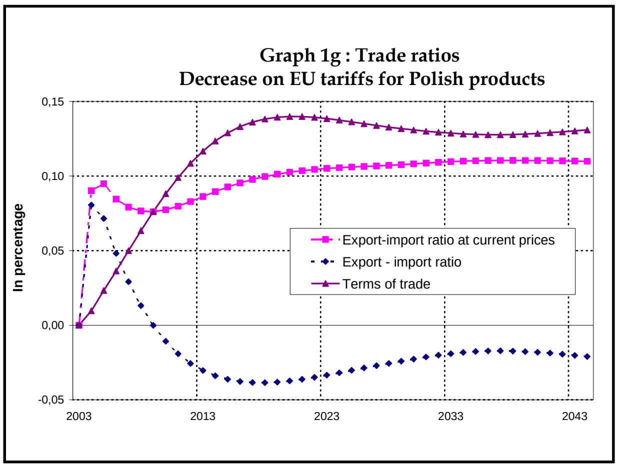

Graph 1b : The decomposition of local demand
Decrease on EU tariffs for Polish products
In contributions to demand variation
0,10
0,08
0,06
0,04
0,02
0,00
2003
2013
2023
2033
2043
Investment
Consumption
Investment + Consumption


Graph 1c : Production
Decrease on EU tariffs for Polish products
In percentage
0,20
0,15
0,10
0,05
0,00
-0,05
2003
2013
2023
2033
2043
Rate of use
Employment
GDP
Capacities
Investment

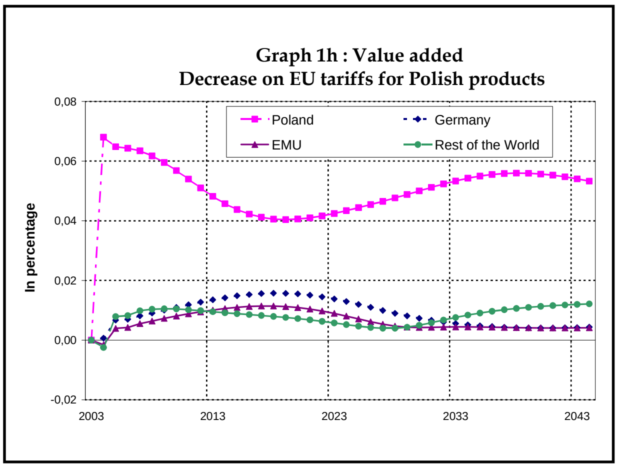

Graph 1d : Prices
Decrease on EU tariffs for Polish products
In percentage
0,40
0,30
0,20
0,10
0,00
-0,10
2003
2013
2023
2033
2043
Consumption price
GDP deflator
Wages
Exports price
Imports price


Graph 1e : Ratios
Decrease on EU tariffs for Polish products
In percentage
0,08
0,06
0,04
0,02
0,00
-0,02
-0,04
2003
2013
2023
2033
2043
Real wage cost
Utilization rate
Unemployment rate

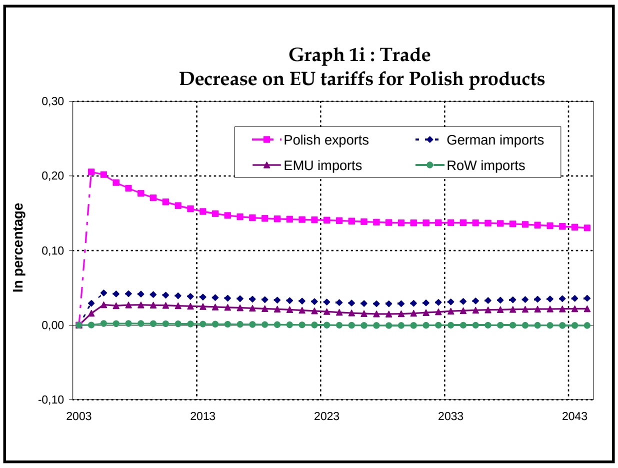

Graph 1f : Trade at current prices
Decrease on EU tariffs for Polish products
In percentage
0,40
0,30
0,20
0,10
0,00
2003
2013
2023
2033
2043
Exports
Export - import ratio
Imports



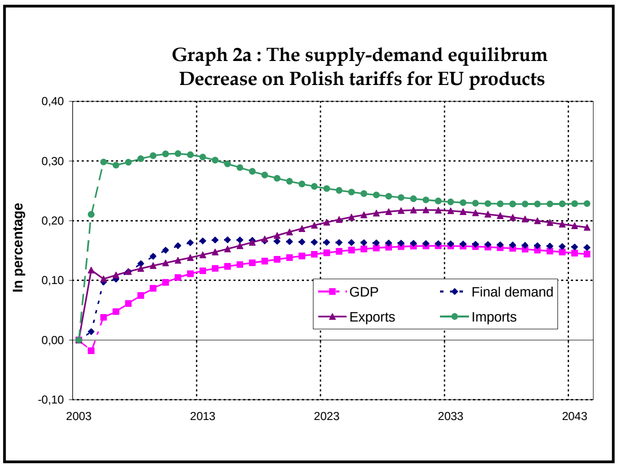
Graph 1g : Trade ratios
Decrease on EU tariffs for Polish products



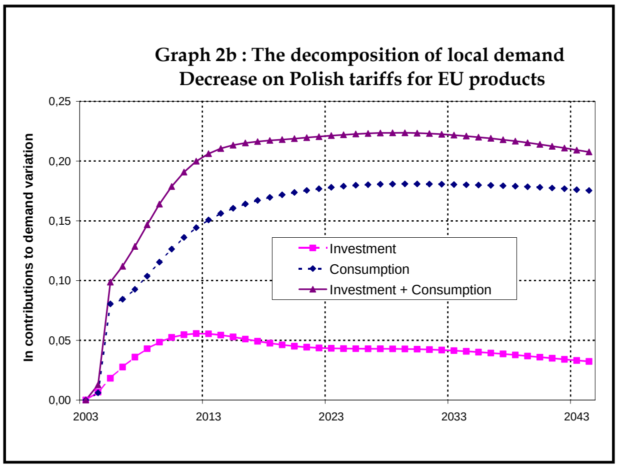
Graph 1h : Value added
Decrease on EU tariffs for Polish products



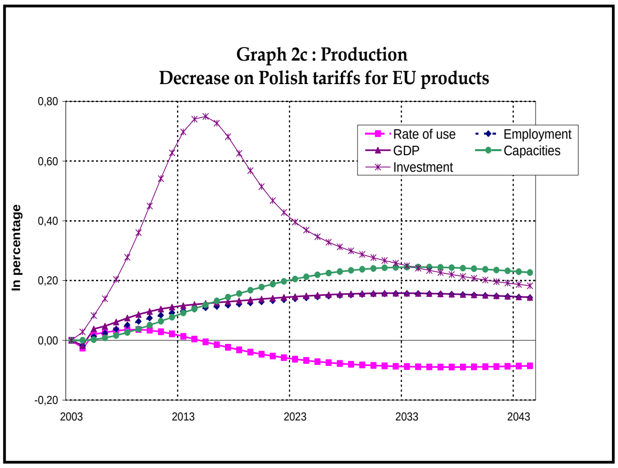
Graph 1i : Trade
Decrease on EU tariffs for Polish products



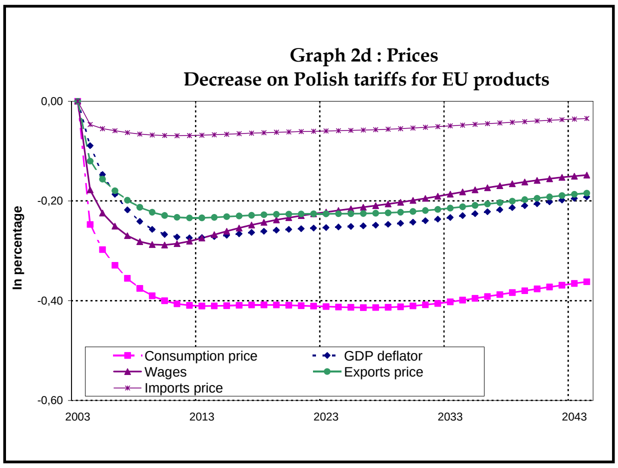
Graph 2a : The supply-demand equilibrum
Decrease on Polish tariffs for EU products



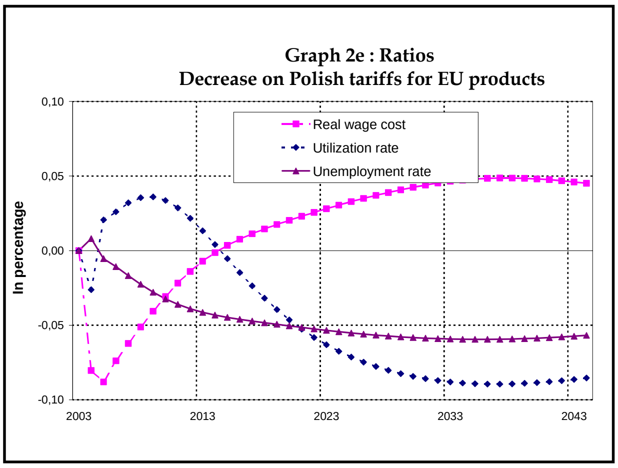
Graph 2b : The decomposition of local demand
Decrease on Polish tariffs for EU products



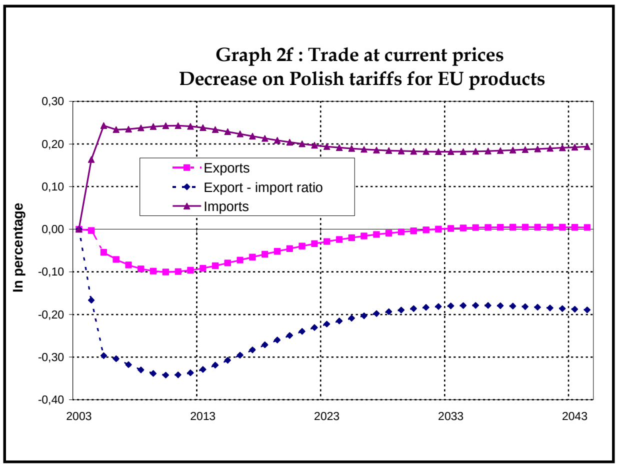
Graph 2c : Production
Decrease on Polish tariffs for EU products



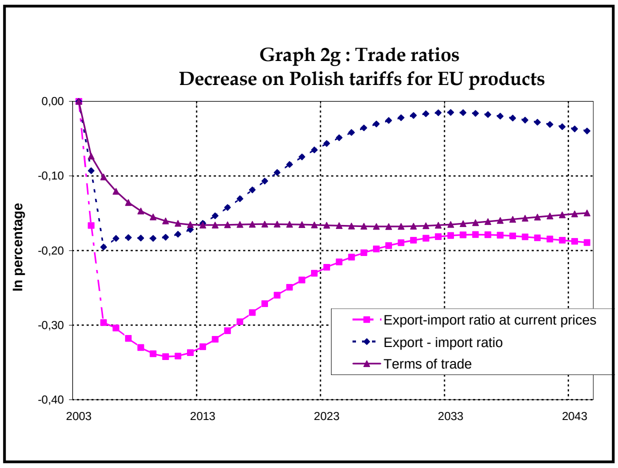
Graph 2d : Prices
Decrease on Polish tariffs for EU products



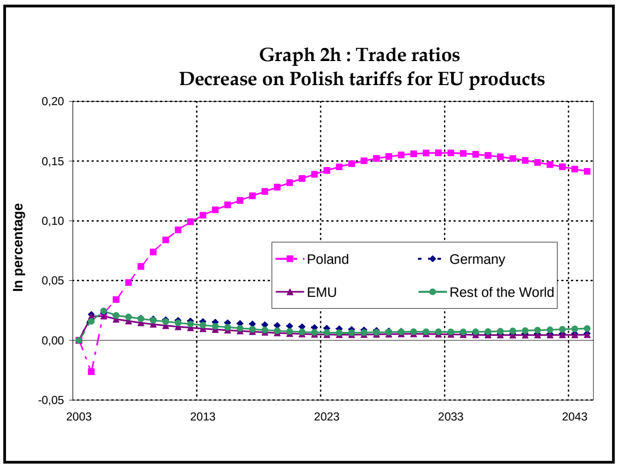
Graph 2e : Ratios
Decrease on Polish tariffs for EU products



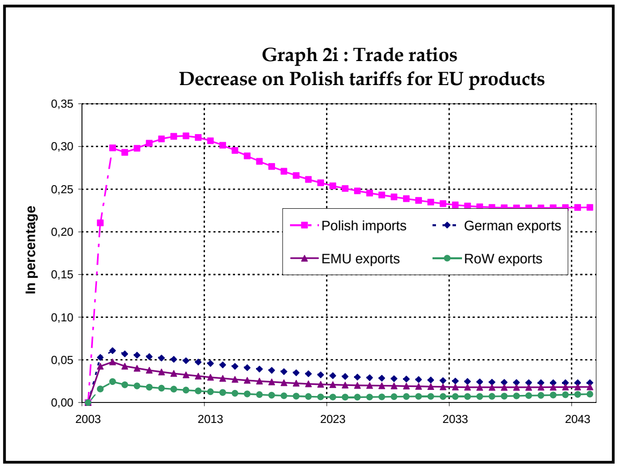
Graph 2f : Trade at current prices
Decrease on Polish tariffs for EU products



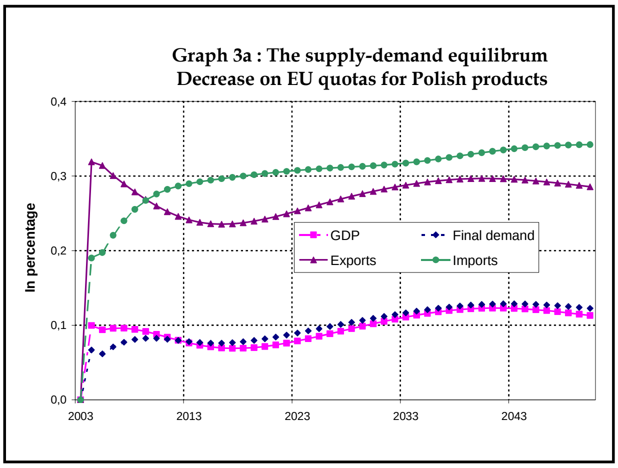
Graph 2g : Trade ratios
Decrease on Polish tariffs for EU products

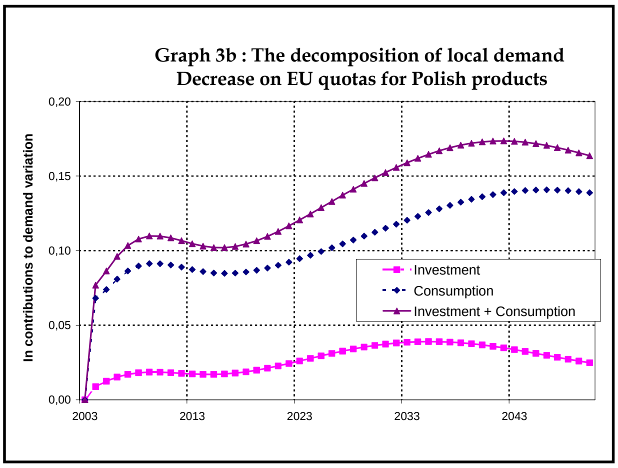


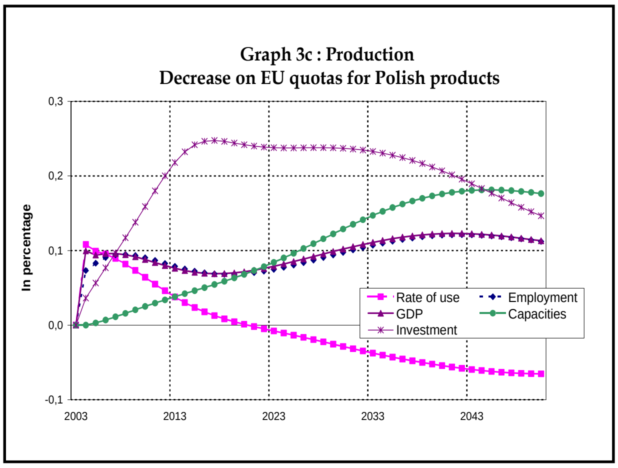
Graph 2h : Trade ratios
Decrease on Polish tariffs for EU products

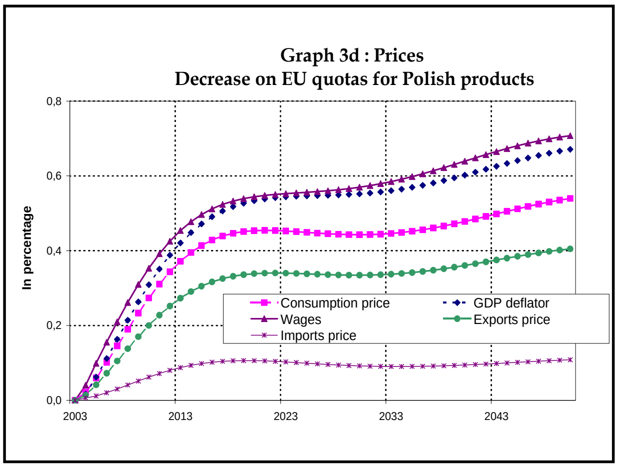


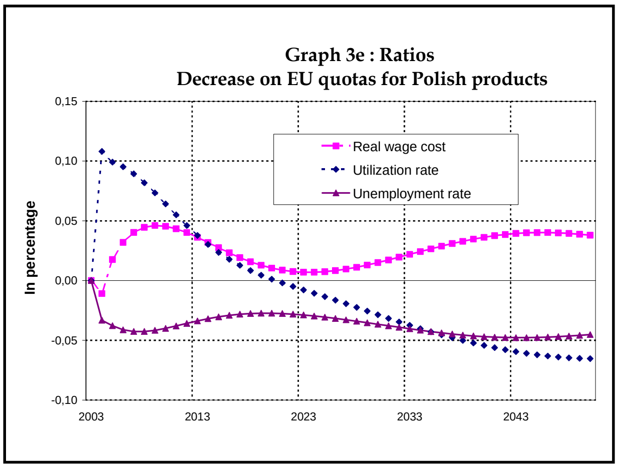
Graph 2i : Trade ratios
Decrease on Polish tariffs for EU products

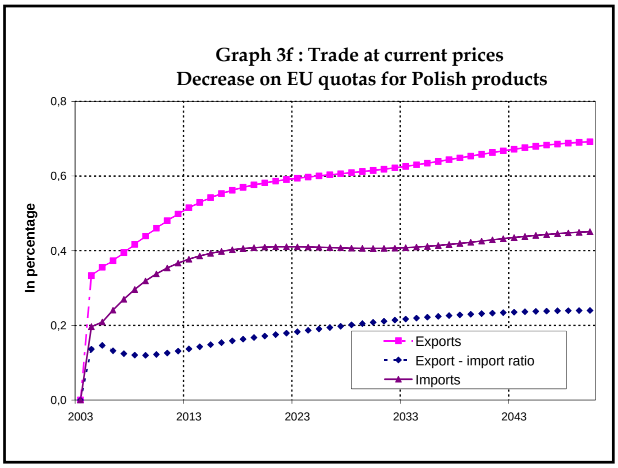

Graph 3a : The supply-demand equilibrum
Decrease on EU quotas for Polish products
In percentage
0,4
0,3
0,2
0,1
0,0
2003
2013
2023
2033
2043
GDP
Final demand
Exports
Imports

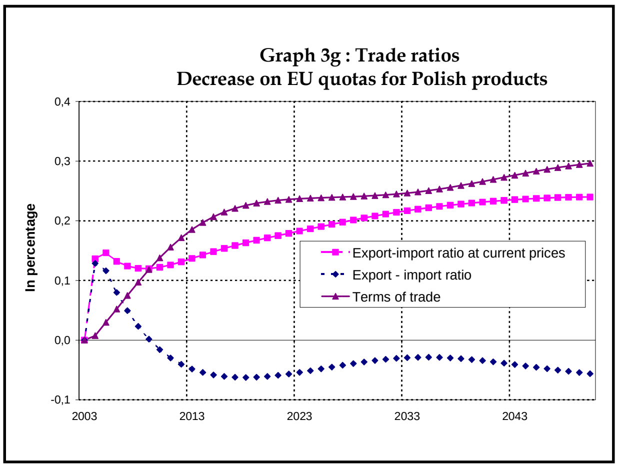

Graph 3b : The decomposition of local demand
Decrease on EU quotas for Polish products
In contributions to demand variation
0,20
0,15
0,10
0,05
0,00
2003
2013
2023
2033
2043
Investment
Consumption
Investment + Consumption

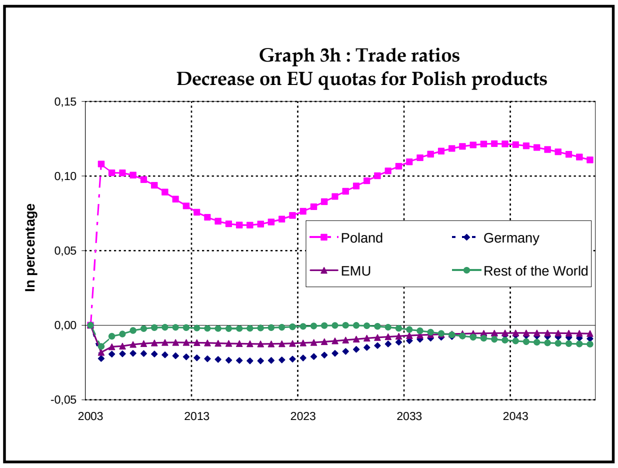

Graph 3c : Production
Decrease on EU quotas for Polish products
In percentage
0,3
0,2
0,1
0,0
-0,1
2003
2013
2023
2033
2043
Rate of use
Employment
GDP
Capacities
Investment

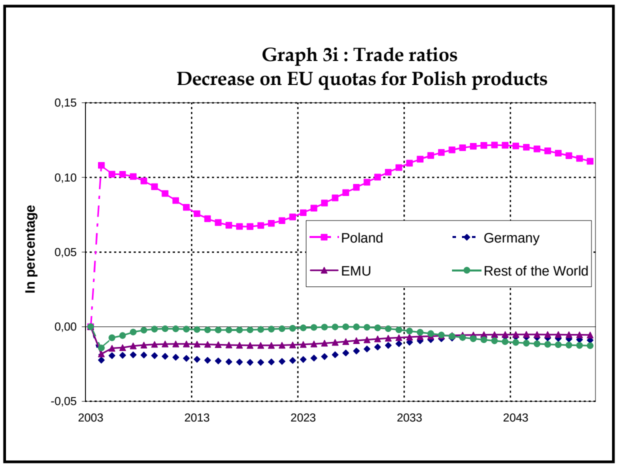

Graph 3d : Prices
Decrease on EU quotas for Polish products
In percentage
0,8
0,6
0,4
0,2
0,0
2003
2013
2023
2033
2043
Consumption price
GDP deflator
Wages
Exports price
Imports price

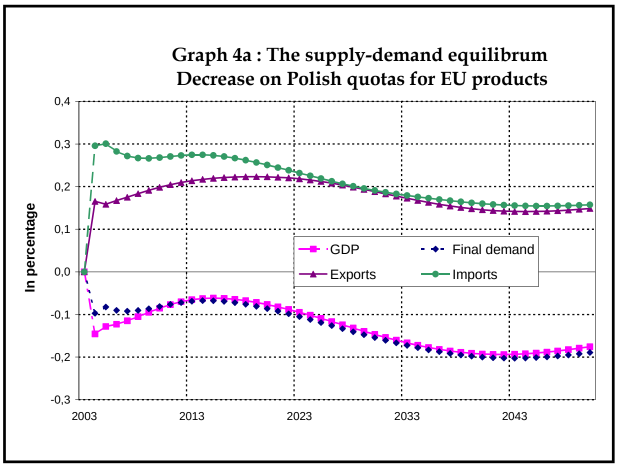

Graph 3e : Ratios
Decrease on EU quotas for Polish products
In percentage
0,15
0,10
0,05
0,00
-0,05
-0,10
2003
2013
2023
2033
2043
Real wage cost
Utilization rate
Unemployment rate

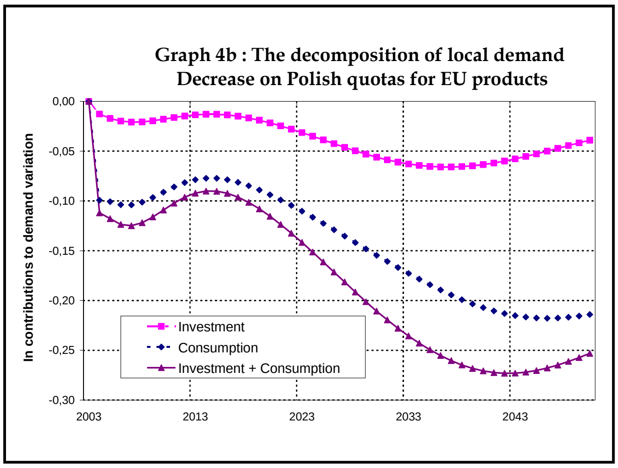

Graph 3f : Trade at current prices
Decrease on EU quotas for Polish products
In percentage
0,8
0,6
0,4
0,2
0,0
2003
2013
2023
2033
2043
Exports
Export - import ratio
Imports

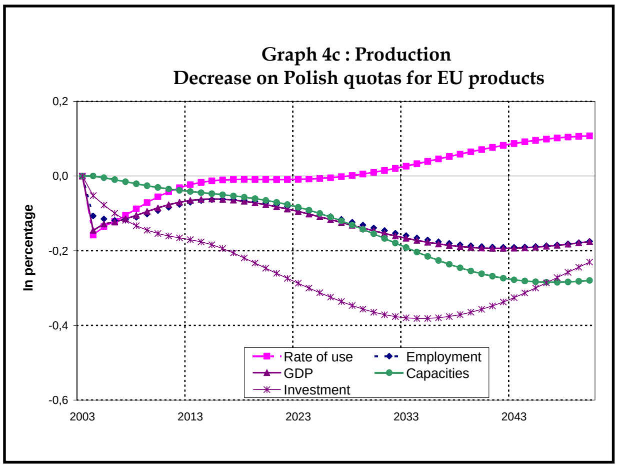

Graph 3g : Trade ratios
Decrease on EU quotas for Polish products
In percentage
0,4
0,3
0,2
0,1
0,0
-0,1
2003
2013
2023
2033
2043
Export-import ratio at current prices
Export - import ratio
Terms of trade

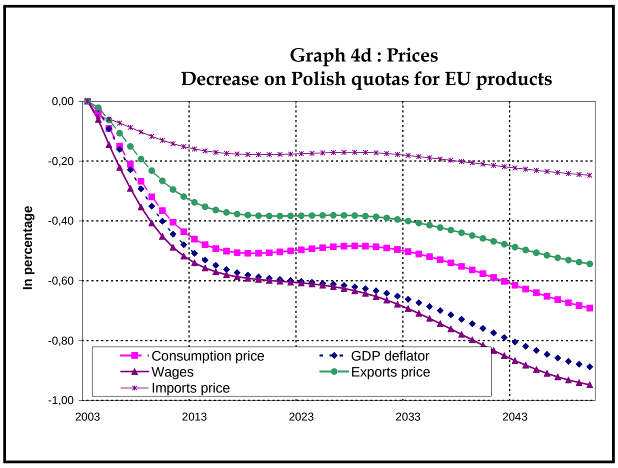

Graph 3h : Trade ratios
Decrease on EU quotas for Polish products
In percentage
0,15
0,10
0,05
0,00
-0,05
2003
2013
2023
2033
2043
Poland
Germany
EMU
Rest of the World


Graph 3i : Trade ratios
Decrease on EU quotas for Polish products
In percentage
0,15
0,10
0,05
0,00
-0,05
2003
2013
2023
2033
2043
Poland
Germany
EMU
Rest of the World

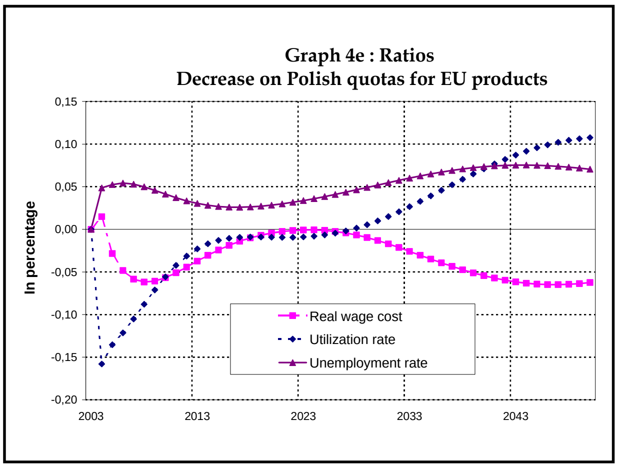

Graph 4a : The supply-demand equilibrum
Decrease on Polish quotas for EU products
In percentage
0,4
0,3
0,2
0,1
0,0
-0,1
-0,2
-0,3
2003
2013
2023
2033
2043
GDP
Final demand
Exports
Imports


Graph 4b : The decomposition of local demand
Decrease on Polish quotas for EU products
In contributions to demand variation
0,00
-0,05
-0,10
-0,15
-0,20
-0,25
-0,30
2003
2013
2023
2033
2043
Investment
Consumption
Investment + Consumption

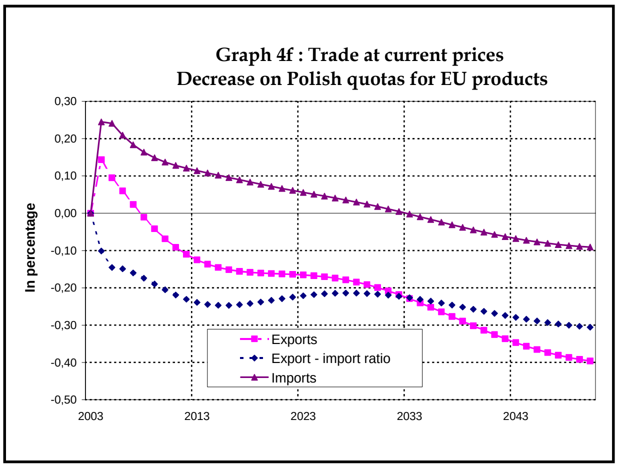

Graph 4c : Production
Decrease on Polish quotas for EU products
In percentage
0,2
0,0
-0,2
-0,4
-0,6
2003
2013
2023
2033
2043
Rate of use
Employment
GDP
Capacities
Investment



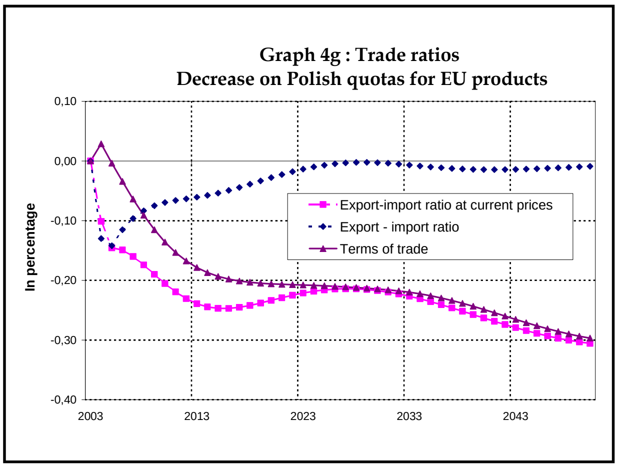
Graph 4d : Prices
Decrease on Polish quotas for EU products



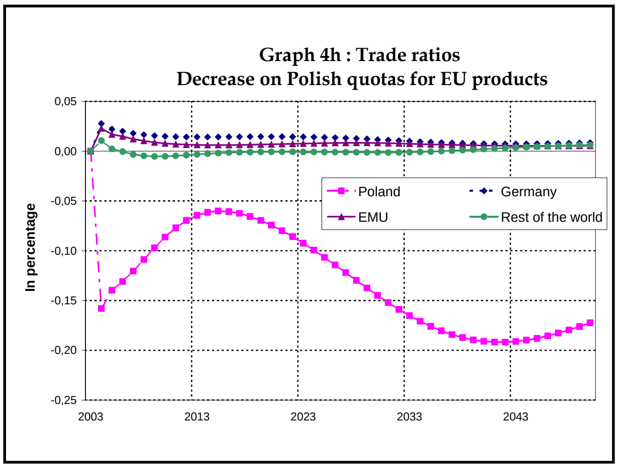
Graph 4e : Ratios
Decrease on Polish quotas for EU products



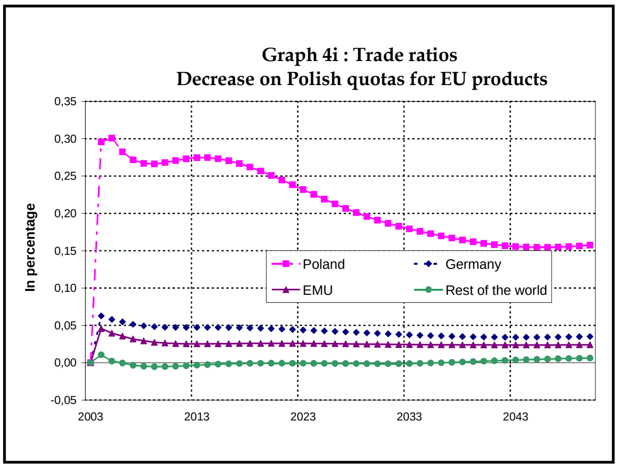
Graph 4f : Trade at current prices
Decrease on Polish quotas for EU products



Graph 4g : Trade ratios
Decrease on Polish quotas for EU products



Graph 4h : Trade ratios
Decrease on Polish quotas for EU products



Graph 4i : Trade ratios
Decrease on Polish quotas for EU products