Oesterreichische Nationalbank
Eurosystem

Workshops
Proceedings of OeNB Workshops

Macroeconomic Models and Forecasts for Austria

November 11 to 12, 2004

No. 5

The Macroeconometric Model LIMA

Helmut Hofer and Robert M. Kunst
Institute for Advanced Studies (IHS)

1. The LIMA Forecasting Model of the Institute for Advanced Studies Vienna

The LIMA model has grown out of the LINK project that aims at joining worldwide economic forecasting models into a common framework. Because many of the variables are only available at an annual frequency, the LIMA model also operates at this annual frequency. This can be troublesome for short-run prediction, as unofficial provisional data on main accounts aggregates come in on a quarterly basis. Therefore, LIMA is rarely run in its original form with zero residuals, and add factors play a key role. The model is routinely used for medium-term forecasting at horizons of one to five years. It is less often utilized for conditional forecasting and policy simulations. For these purposes, the LIMA model is occasionally augmented with additional reaction equations.

The LIMA model is a traditional macroeconometric prediction model with an emphasis on the economy's demand side. Thus, the model may be called a 'Keynesian' model. It has 78 equations, which implies 78 endogenous variables. As in most macroeconometric models, most equations are mere identities. Only 21 equations are 'behavioral' and contain estimated coefficients. With 78 endogenous variables and 21 structural equations, the LIMA model is a comparatively small macroeconometric model. LIMA's model structure is updated frequently when new data become available and suggest that an equation is no more adequate, or in order to adopt the most recent developments in econometrics.

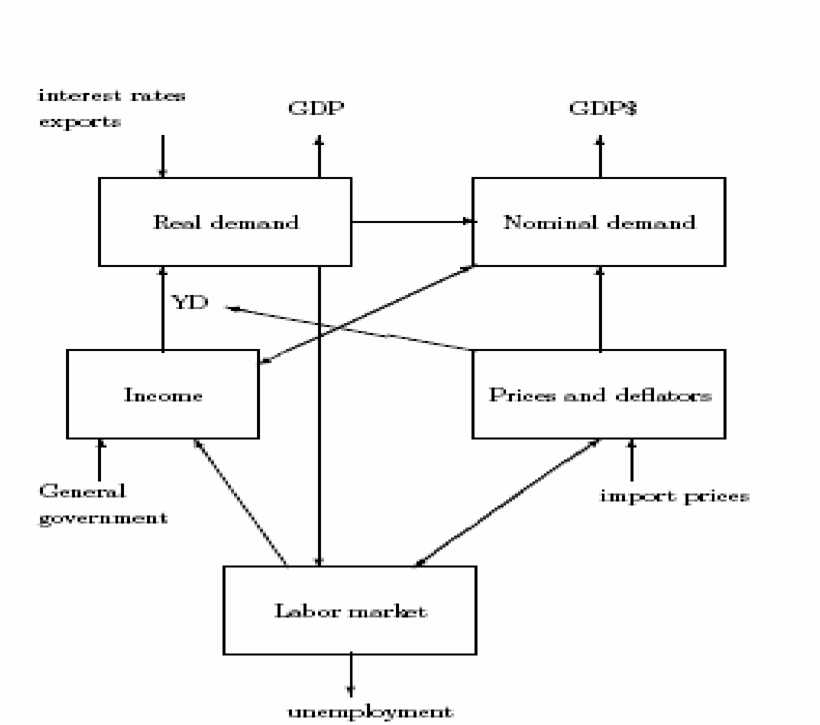
Parameter estimates are updated once a year, when the official provisional data for the previous year become available. 1976 is the earliest year, for which national accounts data are available that correspond to the ESA standard. All equations are estimated by ordinary least squares (OLS). Indications of mis-specification due to autocorrelation are adjusted by dynamic modeling rather than by GLS–type corrections. Thus, most behavioral equations are dynamic.

The model's center piece is the *domestic demand sector*. Demand aggregates are modeled in real terms, i.e. at constant prices, and sum up to real gross domestic product (GDP). Additional equations are used to determine *prices and deflators*.

By multiplying those deflators into the real aggregates, nominal variables and eventually nominal gross domestic product (GDP in U.S. dollar) are calculated.

This adding-up to obtain GDP requires export and import variables. The treatment of exports and imports is asymmetric. *Imports* are fully endogenous and respond to demand categories, such as consumer durables and equipment investment. By contrast, exports are mainly exogenous. Older LIMA versions considered modeling exports as depending on world demand but, unfortunately, data on world demand become available with a considerable time lag only, which excludes its usage for the practical purpose of forecasting. For export and import prices, the approach is reversed. Import prices are exogenous, as it is assumed that Austrians have to accept the world market's price level, while export prices are endogenous.

Chart 1: Structure of the Forecasting Model LIMA



Another component of GDP is public consumption. In the current version, public consumption is exogenous. In contrast to spending, several components of government revenues are modeled as endogenous variables, such as direct taxes or contributions to social security. From this *government sector*, balancing items such as the budget deficit can also be calculated.

The real and government sectors also interact with the *labor market sector*, which yields variables such as employment, the labor force, and wages. Other variables, such as the working-age population, are exogenous. In the *income sector*, wage income and certain nominal variables from the government sector, such as social insurance, add to form nominal disposable household income, which, after expressing it in constant prices, becomes the main determinant of private consumption. This important link is indicated by the letters YD in the diagram. The LIMA model does not include a *financial sector*. Financial variables that are influential for the goods market, such as exchange rates and interest rates, are supplied by specialists on the financial sector who use separate models.

2. Domestic Demand

2.1 Private Consumption

Consumer demand consists of three categories: consumer durables, consumption of other goods, and consumer services. Almost 50% of household expenditures are spent on services. The share of services in household consumption appears to be increasing in the longer run. Before 1980, it used to be below 45%.

As a general rule, demand equations use logarithmic growth rates as dependent variables. Logarithmic growth rates are fairly constant in the longer run, hence they come closer to fulfilling the assumption of stationarity than, for example, first differences. On the other hand, percentage growth rates are far less convenient to handle from an econometric model builder's viewpoint.

In all consumption equations, the principal explanatory variable is the growth rate of household disposable income YD. The real variable YD is obtained from deflating nominal household income by the consumption deflator. Therefore, the price index of total consumption deflates income, while a special price index for consumer services deflates the dependent variable. It is tempting to explain the demand for services by a relative price, reflecting the idea that services and goods are partial substitutes. However, such attempts fail to yield significant explanation.

Another potential source of explanation comes from error-correction relationships. While economic theory and plausibility dictate that the long-run elasticity of consumption with respect to income should be one, this is not so for consumer sub-aggregates. For example, a co-integrating regression of log *consumer services* on log income

$$cs_t = b_0 + b_1 yd_t + u_t$$

yields $\hat{b}_1 = 1.117$, slightly in excess of unity. Here and in the following, we use small letters to denote logarithms of variables in capitals, for example

$cs = \log(CS)$. In theory, unit elasticity for total consumption should be imposed on the model. This is technically difficult, however, due to the implied non-linear restriction structures. Therefore, this important long-run restriction is ignored in estimation. The co-integrating regression is estimated by least squares, and the resulting error-correction variable $cs - \hat{b}_1 yd$ is then used as an additional regressor.

Table 1: Behavioral Equation for Consumer Services

regressor	coefficient	t–value
constant	–0.239	–2.720
$\log(CS_{t-1}) - 1.117 * \log(YD_{t-1})$	–0.186	–2.984
$\log(YD_t/YD_{t-1})$	0.291	3.217

$R^2 = 0.441$, DW=1.916

Note: Estimation Time Range is 1978–2002. Dependent Variable is $\log(CS_t/CS_{t-1})$.

The estimation results are acceptable. All regressors are significant, and the (here, not very reliable) Durbin-Watson statistic does not indicate any serious specification error. Neither interest rates at any lags nor lags of the dependent variable yield a significant explanatory contribution.

For *consumer non-durables*, the analogous long-run equation is

$$cnd_t = b_0 + b_1 yd_t + u_t,$$

which yields $\hat{b}_1 = 0.701$, less than unity, indicating that the share of non-durables will decrease in the longer run. The short-run equation is estimated in analogy with services.

Table 2: Behavioral Equation for Consumer Non-durables

regressor	coefficient	t –value
constant	0.100	2.292
$\log(CND_{t-1}) - 0.701 * \log(YD_{t-1})$	–0.308	–2.147
$\log(YD_t / YD_{t-1})$	0.452	3.943

$R^2 = 0.449$, DW=1.844

Note: Estimation time range is 1977–2002. Dependent variable is $\log(CND_t / CND_{t-1})$.

Similarly as in the case of services, additional regressors do not appear to have any explanatory power. The R^2 is almost identical to the services equation.

For *consumer durables*, the long-run equation

$$cd_t = b_0 + b_1 yd_t + u_t$$

yields $\hat{b}_1 = 1.541$, the largest elasticity among all sub-components. The short-run equation for consumer durables reflects the influence of the interest rate.

Table 3: Behavioral Equation for Consumer Durables

regressor	coefficient	t –value
constant	–3.009	–3.358
$log(YD_t / YD_{t-1})$	1.846	3.285
$log(CD_{t-1}) - 1.541 * \log(YD_{t-1})$	–0.659	–3.388
$INT1_t$	–0.034	–2.118

$R^2 = 0.536$, DW=1.862

Note: Estimation time range is 1977–2002. Dependent variable is $\log(CD_t / CD_{t-1})$.

In contrast to the other consumption sub-aggregates, consumer reaction to interest rates plays a role in the durables segment. The real interest rate $INT1$ is constructed as a ten-year bond rate deflated by the consumption deflator:

$$INT1 = SMR10J - 100 \frac{\Delta(PC)}{PC}.$$

The significance of demand reaction in this sector may be due to the fact that consumer durables usually require larger single amounts of spent money, such that consumers are more willing to weigh the costs and benefits of purchases. Also, consumer durables, by their very nature, are utilized over a longer time span. In some cases, a purchase can be weighed against the alternative of renting equipment, such as cars and carpet cleaners. Therefore, an economic theory similar to that of fixed investment may apply. We also note that R^2 attains the highest value for this sub-aggregate.

Compared with the consumption of households, the consumption by non-profit institutions is small. The reaction of this aggregate is specified by a simple linear dependence on household consumption of the form

$$\Delta cnp_t = a + b\Delta c_t + u_t,$$
$$C_t = CND_t + CD_t + CS_t,$$

where we use the notation $c = \log C$. Additionally, a local dummy was inserted for an exceptional year. The empirical results show that the hypothesis $(a,b) = (0,1)$ cannot be rejected. We nevertheless use the unrestricted form in the LIMA model.

Table 4: Behavioral Equation for Consumption by Non-profit Institutions Serving Households

regressor	coefficient	t–value
constant	0.002	0.371
$log(C_t/C_{t-1})$	0.973	4.976
$d97$	–0.128	–8.103

$R^2 = 0.804$, DW=2.107

Note: Estimation time range is 1977–2002. Dependent variable is $\log(CNP_t/CNP_{t-1})$.

2.2 Investment Demand

Besides consumption, investment or 'gross fixed capital formation' is another important component of aggregate demand. While the ESA system disaggregates investment into a larger number of subcomponents, LIMA only considers equipment investment, which includes machinery and transportation equipment, and construction investment, which includes business as well as residential construction. *Equipment investment* is the slightly smaller part but its equation is more important than the construction investment counterpart, as construction may be influenced strongly by public funding and policy.

While the basic idea for consumption modeling is dynamic error correction, investment demand equations often rely on factor demand specifications that are derived from specific forms of production functions. In all concepts, a primary determinant of investment is current output growth, which is interpreted as indicating the short-run tendency in demand that should be satisfied by production, which in turn requires investment. The current investment function specifications in LIMA are more data-driven and they focus on error correction, in analogy to consumption functions.

The long-run elasticity of equipment investment with respect to GDP is estimated as 1.3919 from a co-integrating regression. The implied equilibrium relation

$$ife - 1.3919 gdp$$

is preferred to the more traditional log share in output. Using the logged share of equipment investment in total output as a regressor would assume that the share of equipment investment in total output is fairly constant in the longer run. This is not necessarily true and is not really backed by theory. Economic theory yields a constant share of *total* investment in output only.

Economic theory suggests a negative influence from real interest rates on investment demand. Unfortunately, such an influence is not backed by empirical evidence. The current specification $INT2$ is a 10–year bond rate that was deflated by the investment deflator. While this ‘real interest rate’ fails to become significant, it still shows the strongest influence among diverse alternative specifications for real and nominal rates.

Table 5: Behavioral Equation for Equipment Investment

regressor	coefficient	t–value
$\log(IFE_{t-1}) - 1.3919 * \log(GDP_{t-1})$	–0.451	–3.179
$\log(GDP_t / GDP_{t-1})$	2.607	4.218
$INT2_t$	–0.005	–1.372
$d8283$	–0.088	–3.373

$R^2 = 0.662$, DW=1.496

Note: Estimation time range is 1980–2002. Dependent variable is $\log(IFE_t / IFE_{t-1})$.

A sizeable aberration requires the usage of a dummy variable for two years in the early 1980's. Clearly, the introduction of such dummy variables should be restricted to occasions where they are absolutely necessary.

There is also an analogous equation for *construction investment*. Here, an additional lag term becomes significant, while real interest fails to do and is kept for theoretical reasons only. The long-run elasticity of construction is set at 0.7918, according to a preliminary co-integrating regression. This implies that the share of construction in total investment is declining. Dummy variables have not been found necessary. It appears that the dynamic behavior of construction investment has been subjected to what looks like structural breaks and shifts in the recent past. However, trends or sophisticated dummy constructions may prove to be detrimental in longer-run forecasting, while they just improve in-sample fit. Therefore we abstained from artificially increasing R^2 using such methods.

Table 6: Behavioral Equation for Construction Investment

Regressor	coefficient	t–value
constant	–0.187	–2.363
$\log(IFC_{t-1}) - 0.7918 * \log(GDP_{t-1})$	–0.181	–2.144
$\log(GDP_t / GDP_{t-1})$	1.245	3.315
$\log(IFC_{t-1}/IFC_{t-2})$	0.339	2.148
$INT2_t$	–0.002	–0.429

$R^2 = 0.484$, DW=2.146

Note: Estimation time range is 1978–2002. Dependent variable is $\log(IFC_t/IFC_{t-1})$.

Adding the exogenous real changes in inventories II to fixed investment yields total investment or gross capital formation I via

$$I = IFE + IFC + II. \qquad (1)$$

3. Imports and Exports

As can be seen from chart 1, LIMA treats imports as endogenous, as import demand depends on domestic demand, where imports partly satisfy the needs for intermediate input and partly are utilized directly in consumption and investment. In contrast, exports are exogenous, as export demand depends on activities on the world market, as domestic goods and services are used by non-resident producers and consumers. For special simulation purposes, effects of changing relative prices on export demand must be calibrated into assumptions on future exports behavior.

3.1 Import Demand

According to economic theory, import demand reacts to domestic demand and to relative prices. Empirically, there is a longer-run tendency for the import quota to rise, although it is difficult to determine the eventual limiting behavior of this tendency. There is also a sizeable reaction to export demand. Import demand varies across the components of GDP. Equipment investment and consumer durables have the highest import contents. Particularly for longer-run projections, import equations have a certain tendency to cause instabilities, as it is not easy to accommodate theoretical, econometric, and purely observational issues simultaneously.

We chose the way to define a variable WMD, which is defined as weighted import demand from domestic demand according to

$$WMD = 0.245 * C + 0.060 * (CP + CNP) + 0.174 * IFC$$

$$+0.638 * IFE + 0.374 * II + 0.480 * X. \qquad (2)$$

The weights have been determined from Austrian input-output tables. The elasticity of import demand with regard to WMD turns out to be larger than one. The import demand system is estimated in two stages. In the first stage, the long-run reaction is determined by a co-integrating regression. In the second stage, the error-correction term is introduced as a regressor in a short-run import-demand equation.

The co-integrating regression is shown in table 7. It displays the typical features of co-integrating regressions. All t–values are extremely large, R^2 is high, and the Durbin-Watson statistic points to serious autocorrelation.

Table 7: Long-run Equilibrium for Real Goods Imports

regressor	coefficient	t–value
constant	0.794	19.536
$\log(WMD_t) + \log\{(M_t/GDP_t)/(M_{02}/GDP_{02})\}$	0.766	70.042
$R^2 = 0.994$, DW=0.594		

Note: Estimation time** range **is 1976–2002. Dependent variable is** $\log(MG_t)$**.

The equation for *goods imports* in table 8 satisfies the criterion of stability within the LIMA model as well as statistical criteria. The sum of coefficients with regard to WMD is 1.35, which is a medium-run elasticity. The relative import content of domestically produced goods and services, which include exports, increases due to stronger international integration. However, the error-correction term serves as a break and tends to avoid over-reaction to demand expansion. Reaction to terms of trade is less pronounced but also significant.

Table 8: Behavioral Equation for Real Goods Imports

regressor	coefficient	t–value
constant	–0.247	–1.764
$\log(WMD_t/WMD_{t-1})$	1.173	10.790
$\log(MG_{t-1})-0.68*\log(VD_{t-1})–0.49*\log(XG_{t-1})$	–0.167	–1.777
$\Delta\log(PMG_{t-1}/PXG_{t-1})$	–0.423	–2.205
$\log\left(WMD_{t-1}/WMD_{t-2}\right)$	0.180	1.723
$d93-d94$	–0.041	–3.959

$R^2 = 0.931$, DW=1.964

Note: Estimation time range is 1978–2002. Dependent variable is $\log(MG_t/MG_{t-1})$.

A separate equation describes the behavior of *imports of tourist services*. Tourist imports depend on relative prices, on total household consumption, and on a long-run equilibrium condition. The long-run equilibrium condition shows an elasticity of 1.34 with respect to household consumption. Traveling abroad becomes increasingly attractive, as income levels rise. The short-run elasticity is almost identical. Interestingly, immediate reaction to increased relative prices is stronger (–1.99) than longer-run reaction (–0.78). Expensive holiday resorts deter Austrian tourists for one season only.

The two remaining categories of imports, *other service imports* MSO and *adjustment for imports than cannot be separated into goods and services* $MADJ$, are exogenous in LIMA. Therefore, total imports M evolve from their components as

$$M = MG + MSO + MST + MADJ. \tag{3}$$

Table 9: Behavioral Equation for Real Service Imports in Tourism

regressor	coefficient	t–value
constant	–1.860	–3.107
$\log(MST_{t-1}) - 1.34 * \log(CR_{t-1})$	–0.461	–3.062
$\log(C_t/C_{t-1})$	1.393	3.165
$\log(PMST_{t-1}/PC_{t-1})$	–1.987	–5.709
$\log(PMST_{t-2}/PC_{t-2})$	1.208	3.098
$d87$	0.153	5.195
$d94$	0.089	2.387

$R^2 = 0.843$, DW=2.402

Note: Estimation time range is 1978–2002. Dependent variable is $\log(MG_t/MG_{t-1})$.

3.2 Export Demand

While usually exports are exogenous variables in the LIMA model, for the purpose of certain simulations an export reaction equation is added. In this equation, *goods exports* are determined by the demand on Austrian export markets and also by terms of trade.

Table 10: Behavioral Equation for Real Goods Exports

regressor	coefficient	t–value
constant	0.016	1.652
$\log(XMKT_t/XMKT_{t-1})$	1.115	6.620
$\Delta\log(PXG_t/PMG_t)$	–0.238	–0.789

$R^2 = 0.657$, DW=2.459

Note: Estimation time range is 1977–2002. Dependent variable is $\log(XG_t/XG_{t-1})$.

The elasticity coefficient of 1.11 expresses a longer-run tendency of Austrian exporters to increase their presence on foreign markets. In contrast, price reaction is small and statistically not significant. One might presume that Austrian exporting firms target competition by quality rather than competition by prices.

In any LIMA variant, total exports evolve as the sum of four sub-aggregates, in analogy to total imports in 3 as

$$X = XG + XSO + XST + XADJ.$$

4. Aggregate Output

The main output variable GDP, i.e. gross domestic product, evolves as the sum of all demand aggregates, just as in the SNA account zero, by way of

$$GDP = C + CNP + CP + I + DIF + X - M \tag{4}$$

A part of this is also *domestic demand* VD, which is obtained in an analogous way as

$$VD = CR + CNP + CP + I + DIF. \tag{5}$$

The discrepancy between demand and production accounting DIF is set exogenously. Analogous equations are used for the nominal quantities $GDP\$$ and $VD\$$:

$$GDP\$ = C\$ + CNP\$ + CP\$ + I\$ + DIF\$ + X\$ - M\$, \tag{6}$$

$$VD\$ = C\$ + CNP\$ + CP\$ + I\$ + DIF\$. \tag{7}$$

These equations finally yield price deflators for the total output aggregates

$$PGDP = \frac{GDP\$}{GDP} * 100, \tag{8}$$

$$PVD = \frac{VD\$}{VD} * 100. \tag{9}$$

5. Prices

5.1 Consumption Prices

For each demand aggregate, two behavioral equations must be specified: an equation for real demand and an equation for the price deflator. In the case of private consumption, the corresponding price deflator is named PC, for 'prices of *c*onsumption'. The consumption deflator PC is usually taken as the most significant price variable, as it represents the average price level as it is seen by consuming households. In a sense, PC is still the Paasche counterpart to the Laspeyres cost-of-living indexes. This interpretation, however is subject to an imminent modification, as the new SNA chaining concept will be put into practice. The institute's regression equation lets PC depend on labor costs and on import prices.

Table 11: Behavioral Equation for the Deflator of Private Consumption

regressor	coefficient	t–value
constant	0.009	3.597
$\log(ULC_t/ULC_{t-1})$	0.279	4.181
$\log(ULC_{t-1}/ULC_{t-2})$	0.190	3.014
$\log(PM_t/PM_{t-1})$	0.312	5.344
$D83$	0.018	2.350
$\log(GDP_t/GDPTS\_HP_t)$	0.115	1.031

$R^2 = 0.845$, DW=1.693

Note: Estimation time range is 1978–2002. Dependent variable is $\log(PC_t/PC_{t-1})$.

Consumer prices react with a proportionality factor of around 0.5 to labor costs and with a factor of around 0.3 to imported inflation. The lag distribution with regard to wage inflation reflects the mechanism of wage rounds. In the absence of shocks, inflation tends to stabilize, as the sum of coefficients is less than one. A reaction to a measure for the output gap has been built into the equation for theoretical reasons. It fails to achieve statistical significance.

Table 12: Behavioral Equation for the Deflator of NPIsH Consumption

regressor	coefficient	t–value
$\log(PC_t/PC_{t-1})$	0.396	3.289
$\log(YWGLEA_t/YWGLEA_{t-1})$	0.562	6.653
$d93$	0.029	4.807

$R^2 = 0.906$, DW=1.685

Note: Estimation time range is 1977–2002. Dependent variable is $\log(PCNP_t/PCNP_{t-1})$.

Price indexes for consumer sub-aggregates are not modeled in LIMA: There is an equation for NPIsH consumption prices, however, which expresses inflation in $PCNP$ as a function of inflation in the main price index PC and in wages, as the largest part of NPIsH consumption concerns services. The equation is estimated without a constant, reflecting statistical insignificance of the intercept as well as the observation that an autonomous source for $PCNP$ inflation does not exist.
The popular Laspeyres-type consumer price index PLC is linked to the consumption deflator by a reaction function.

Table 13: Behavioral Equation for the Consumer Price Index

regressor	coefficient	t–value
constant	0.003	1.916
$\log(PC_t/PC_{t-1})$	0.939	21.186

$R^2 = 0.949$, DW=2.335

Note: Estimation time range is 1977–2002. Dependent variable is $\log(PLC_t/PLC_{t-1})$.

The consumer price segment of LIMA is completed by an equation for the deflator of public services PCP. PCP inflation depends on general PC inflation, on wage inflation (salaries of public employees), and on a dynamic time lag expressing persistence in inflation.

Table 14: Behavioral Equation for the Deflator of Government Consumption

regressor	coefficient	t–value
constant	–0.006	–2.059
$\log(PC_t/PC_{t-1})$	0.258	2.297
$\log(YWGLEA_t/YWGLEA_{t-1})$	0.583	4.804
$\log(PCP_{t-1}/PCP_{t-2})$	0.268	2.605

$R^2 = 0.933$, DW=1.433

Note: Estimation time range is 1981–2002. Dependent variable is $\log(PCP_t/PCP_{t-1})$.

Note that the Durbin-Watson statistic indicates serious problems of autocorrelation. Unfortunately, the search for further explanatory variables in order to isolate the effects of that correlation proved unsuccessful.

Price deflators allow defining nominal demand aggregates. While nominal consumer sub-aggregates are not modeled, nominal private consumption is defined by

$$C\$ = C * PC/100, \tag{10}$$

and similar definitions yield $CNP\$$ and $CP\$$:

$$CNP\$ = CNP * PCNP/100, \tag{11}$$

$$CP\$ = CP * PCP/100. \tag{12}$$

5.2 Investment Prices

A large part of equipment investment demand is satisfied by imported goods, therefore the price deflator should be influenced directly by import prices. Another explanatory variable is ULC, unit labor costs, which stems from the labor market sector of the LIMA model. Substantial autocorrelation in the deflator also requires the insertion of lags. Thus, the $PIFE$ equation is a severely dynamic regression equation. As a general rule, dynamic equations support the stability of the model, while static equations may result in unstable behavior. Finally, the output gap, which is determined as the difference of realized GDP and a Hodrick-Prescott filtered GDP in lieu of potential output, may exert some pressure on prices. While this variable remains insignificant statistically, its influence is kept in the equation for theoretical reasons.

Table 15: Behavioral Equation for the Deflator of Equipment Investment

regressor	coefficient	t–value
$\log(PIFE_{t-1}/PIFE_{t-2})$	0.321	1.837
$\log(ULC_{t-1}/ULC_{t-2})$	0.247	2.447
$\log(PMG_t/PMG_{t-1})$	0.148	2.021
$\log(PMG_{t-1}/PMG_{t-2})$	0.097	1.210
$\log(GDP_t/GDPTS\_HP_t)$	0.105	0.680

$R^2 = 0.685$, DW=2.537

Note: Estimation time range is 1978–2002. Dependent variable is $\log(PIFE_t/PIFE_{t-1})$.

In line with most price equations, the $PIFE$ equation does not have a constant term. This implies that individual demand aggregates do not have an inflationary core of their own but that they just pick up price developments of their inputs.

For construction investment, imports play a far lesser role. Therefore, construction prices $PIFC$ are modeled as depending on domestic influences only. The coefficient of lagged $PIFC$ inflation reflects the high degree of dynamic persistence in the prices of this sector. While the output gap appears to be more important for $PIFC$ than for $PIFE$, it again fails to attain statistical significance.

Table 16: Behavioral Equation for the Deflator of Construction Investment

regressor	coefficient	t–value
$\log(PIFC_{t-1}/PIFC_{t-2})$	0.727	8.773
$\log(ULC_t/ULC_{t-1})$	0.279	3.094
$d8384$	–0.013	–1.771
$d89$	0.030	3.097
$\log(GDP_t/GDPTS\_HP_t)$	0.213	1.465

$R^2 = 0.817$, DW=2.122

Note: Estimation time range is 1978–2002. Dependent variable is $\log(PIFC_t/PIFC_{t-1})$.

Just as for consumption, nominal investment demand is constructed from the real variables and the price deflators, i.e.

$$IFE\$ = IFE * PIFE/100, \tag{13}$$

$$IFC\$ = IFC * PIFC/100, \tag{14}$$

$$II\$ = II * PII/100. \tag{15}$$

Finally, total nominal investment evolves from adding up its components

$$I\$ = IFE\$ + IFC\$ + II\$. \tag{16}$$

From the real and nominal total investment aggregates, the investment price deflator PIF is calculated as

$$PIF = I\$/I * 100. \tag{17}$$

Note that it really is the price deflator for total investment and not just for fixed investment. However, the II part is small, therefore the difference can be ignored. Another related and completely exogenous price deflator is the one for the statistical discrepancy DIF

$$PDIF = DIF\$/DIF * 100. \tag{18}$$

5.3 Export Prices

While import prices are assumed exogenous and a similar assumption is adopted for goods export prices, which are mainly determined on the world market, a simple regression equation ties the *deflator of exports in tourist services* to the consumption deflator.

Table 17: Behavioral Equation for the Deflator of Service Exports in Tourism

regressor	coefficient	t–value
$d8283$	–0.013	–2.876
$\log(PC_t/PC_{t-1})$	1.059	28.090

$R^2 = 0.879$, DW=2.478

Note: Estimation time range is 1978–2001. Dependent variable is $\log(PXST_t/PXST_{t-1})$.

In the end, export and import deflators for the total categories are then determined indirectly according to the following pattern. Firstly, nominal exports within the sub-aggregates (goods, services in tourism, other services, adjustment for items that cannot be separated into goods and services) are determined by multiplying deflators into the real quantities

$$XG\$ = XG * PXG/100, \tag{19}$$

$$XST\$ = XST * PXST/100, \tag{20}$$

$$XSO\$ = XSO * PXSO/100, \tag{21}$$

$$XADJ\$ = XADJ * PXADJ/100. \tag{22}$$

Then, the total nominal aggregate is formed as

$$X\$ = XG\$ + XSO\$ + XST\$ + XADJ\$. \tag{23}$$

Finally, the total exports deflator is determined from

$$PX = \frac{X\$}{X} * 100. \tag{24}$$

An analogous system of equations is used for imports and import deflators:

$$MG\$ = MG * PMG/100, \tag{25}$$

$$MST\$ = MST * PMST/100, \tag{26}$$

$$MSO\$ = MSO * PMSO/100, \tag{27}$$

$$MADJ\$ = MADJ * PMADJ/100. \tag{28}$$

$$M\$ = MG\$ + MSO\$ + MST\$ + MADJ\$. \tag{29}$$

$$PM = \frac{M\$}{M} * 100. \tag{30}$$

6. The Labor Market

6.1 Employment

The LIMA employment equation specification uses error correction and relative factor prices. The main determinant of employment, however, is real output growth. The coefficient on real output growth shows the effects that are otherwise known as Okun's Law.

Table 18: Behavioral Equation for Employment Excluding Self-employment

regressor	coefficient	t–value
constant	0.325	2.561
d83	–0.021	–3.387
$\log(GDP_t/GDP_{t-1})$	0.435	4.274
$\log(LEA_{t-1}/GDP_{t-1})$	0.228	2.670
$\log(YWGLEA_{t-1}/PGDP_{t-1})$	–0.273	–2.697
$R^2 = 0.683$, DW=1.997		

Note: Estimation time range is 1981–2002. Dependent variable is $\log(LEA_t/LEA_{t-1})$.

All regressors are significant and have the expected signs. Unfortunately, the inclusion of a dummy variable was necessary. Fortunately, it is located in the earlier years and may have only small effects on forecasting.

The short-run Okun-type coefficient has the plausible value of around 0.4. Note that it is not exactly the same as in Okun's law, due to some non-linear transformations and due to the omission of the labor-supply effects that are also captured in the original Okun coefficient. Error correction has a sizeable impact, which implies that the long-run unit elasticity shows its effects after fey years already. In other words, a sudden recession has only small effects on employment, while the full negative effects are felt if the recession does not end soon.

The negative effects of real wages, i.e. the relative price of the production factor labor, are also quite strong. The variable $YWGLEA$ is the *per capita* gross wage. Technically, it counteracts the tendency of employment to grow proportional to output, which would imply an absence of technological progress. However, the long-run growth of real wage puts a brake on unlimited employment expansion. Thus, the employment equation is a stabilizing component in the LIMA model.

In order to construct an unemployment rate, we first determine *total labor force* TLF as a fraction of the exogenous working-age population $POPWAT$ by

$$TLF = \frac{TLFPR}{100} * POPWAT. \tag{31}$$

The factor $TLFPR$ is an endogenous and important variable. Its behavioral equation is shown in table 19. It is modeled using the logit transformation.

Table 19: Behavioral Equation for Participation Rate

regressor	coefficient	t–value
constant	0.205	2.338
d98	0.032	2.606
$\log\{TLFPR_{t-1}/(100-TLFPR_{t-1})\}$	0.871	19.816
$\log(LEA_{t-1}/TLF_{t-1})$	0.490	1.379
$\log(DLFFOR_t/DLFFOR_{t-1})$	0.198	6.151
$\log(LENACT_t/LENACT_{t-1})$	0.049	2.115

$R^2 = 0.963$, DW=1.060

Note: The domestic Estimation time range is 1977–2002. Dependent variable is $\log(\frac{TLFPR}{100-TLFPR})$.

The domestic labor force $TLFNAT$ is obtained by subtracting the labor force provided by foreigners $DLFFOR$

$$TLFNAT = TLF - DLFFOR, \tag{32}$$

while the so-called *dependent labor force* DLF evolves as

$$DLF = TLF - SEG, \tag{33}$$

i.e. by subtracting the self-employed. The *unemployed* among the dependent labor force are determined as

$$UN = TLF - SEG - LEA - LENACT, \tag{34}$$

i.e. after an additional adjustment for the non-active employees $LENACT$.
From UN, the *unemployment rate* UR is calculated as

$$UR = \frac{UN}{LEA + LENACT + UN} * 100.$$

This calculation yields the traditional unemployment rate according to the domestic definition, which may differ from the international rate, which is published within the framework of the ESA/SNA accounts.

Another interesting variable from this part of the LIMA model is *labor productivity*, which evolves as

$$PRLEA = \frac{GDP}{LEA} * 100. \tag{35}$$

6.2 Wages

The main wage variable $YWGLEA$ is modeled to parallel prices on its long-run expansion path. In the short run, however, price elasticity may differ from unity and actually does so in the estimated equation, although not strongly. There is a slight Phillips-type pressure from tightness in the labor market.

6.3 Nominal Income

From the *per capita* wages $YWGLEA$ and employment LEA, a wage sum $YWGG\$$ is calculated as

$$YWGG\$ = \frac{YWGLEA * LEA}{1000}.$$

Table 20: Behavioral Equation for per Capita Nominal Wages

regressor	coefficient	t–value
constant	0.013	6.025
$1/UR_t$	0.017	1.406
$\log(PGDP_t/PGDP_{t-1})$	0.969	9.808
$\log(YWGLEA_{t-1}) + 2.623 - \log(PGDP_{t-1})$	–0.286	–3.399
$d84$	–0.020	–3.565
$d01$	–0.021	–4.136
$R^2 = 0.947$, DW=1.561		

Note: Estimation time range is 1977–2002. Dependent variable is $\log(YWGLEA_t/YWGLEA_{t-1})$.

This wage sum, in turn, appears as the main component in determining *net national income* (NNI)

$$Y\$ = YWGG\$ + BUSE + PASUB + YF\$ - DEP\$. \tag{36}$$

The remaining components are: gross operating surplus $BUSE$, net production taxes $PASUB$, border-crossing primary income $YF\$$, and depreciation $DEP\$$. Subtracting depreciation results in a net income. While the generation of $YWGG\$$ has already been described, we now turn to the remaining components.

The operating surplus $BUSE$ is obtained as the balancing item from the primary income account, just as in national accounting

$$BUSE = GDP\$ - YWGG\$ - PASUB. \tag{37}$$

Net production taxes $PASUB$ is an endogenous variable. A simple regression equation models it as evolving in parallel to GDP.

Table 21: Behavioral Equation for Production Taxes Minus Subsidies

regressor	coefficient	t–value
$\log(GDP\$_t / GDP\$_{t-1})$	0.967	11.007
$dd9495$	0.035	1.934
$dd9798$	0.041	2.279

$R^2 = 0.499$, DW=2.270

Note: Estimation Time Range is 1977–2002. Dependent variable is $\log(PASUB_t / PADUB_{t-1})$.

Border-crossing primary income $YF\$$ is an exogenous variable.

Depreciation or *consumption of fixed capital* is determined as a fraction of the capital stock CST , which is priced at the current investment price deflator PIF , i.e.

$$DEP\$ = \frac{FDEP * CST * PIF}{100}. \tag{38}$$

The exogenous factor $FDEP$ is exogenous. Currently, it has been set at 4.14% annually.

If $Y\$$ is adjusted for border-crossing secondary incomes—i.e. transfers—the *net national disposable income* is obtained as

$$NE\$ = Y\$ + YT\$. \tag{39}$$

Another set of bookkeeping equations is required to determine the *household disposable income*, which is an important explanatory variable for consumer demand in the real sector. Firstly, primary household income is the sum of wage and other income. While all wage income is distributed to households, only a fraction of 'profits' becomes effective in this regard, while the remainder is used for firms' saving. The quota $FBUSE$ is an exogenous variable in

$$YHH\$ = YWGG\$ + FBUSE * BUSE. \tag{40}$$

When primary household income is adjusted for transfers, disposable household income is obtained as

$$YD\$ = YHH\$ + TRANSV - TDHV - SVB. \tag{41}$$

Note that the negative transfers $TDHV$ and SVB are calculated in the public sector part of LIMA, while positive transfers $TRANSV$ are exogenous. From disposable income $YD\$$ and consumption, a *household saving rate* can be constructed via

$$SQ = \frac{YD\$ + PP\$ - C\$ - CNP\$}{YD\$ + PP\$} * 100. \tag{42}$$

The variable $YWGG\$$ is also used to determine *unit labor costs* ULC, which are an important input to the price module of LIMA

$$ULC = YWGG\$/GDP. \tag{43}$$

7. External Balances

These pure accounting equations serve to derive entities for the current accounts position of the balance of payments. Firstly,

$$BPG = XG\$ - MG\$ + BPGA \tag{44}$$

determines the trade balance for goods. Then,

$$BPST = XST\$ - MST\$ + BPTSA, \tag{45}$$

$$BPSO = XSO\$ + XADJ\$ - MSO\$ + MADJ\$ + BPSOA, \tag{46}$$

yield the trade balance for services. Each of these equations contains an exogenous adjustment term. The sum of the trade positions and the net positions for primary and secondary income yields the current accounts balance

$$BPC = BPG + BPST + BPSO + BPOP + BPTR. \tag{47}$$

8. Public Sector

This part of the LIMA model yields aggregate direct taxes—i.e. taxes on income—and aggregate social insurance contributions. These variables $TDHV$ and SVB

are then used in the income sector. If the government budget is to be predicted, this module is augmented by a more refined set of behavioral and definitional equations. For the purpose at hand, it is more restricted.

Table 22: Behavioral Equation for Social Insurance Contributions

regressor	coefficient	t –value
constant	–0.005	–1.355
$\log(YWGG\$_t / YWGG\$_{t-1})$	0.981	13.838
$\log(SVBSA_t / SVBSA_{t-1})$	0.813	7.109
$\log(HVBG_t / HVBG_{t-1})$	0.287	3.274
$R^2 = 0.951$, DW=2.191		

Note: Estimation time range is 1982–2002. Dependent variable is $\log(SVB_t/SVB_{t-1})$.

While the behavioral equation for social insurance contributions SVB shown in Table 22 has a rather straight forward structure, aggregate taxes are obtained via a sophisticated functional form. The average tax rate depends on time-dependent indicators of the tariff structure and on taxable income per capita.

Table 23: Behavioral Equation for Aggregate Taxes on Income

regressor	coefficient	t –value
ΔTYB_t	5.126	5.876
$\Delta(TYA_t + TYB_t * \log(YWGG\$_t + TRANSV_t) - \log(LEA_t))$	0.342	5.602
$R^2 = 0.570$, DW=1.660		

Note: Estimation time range is 1977–2002. Dependent variable is $\Delta \frac{TDHV - GST + GSTKG}{YWGG\$ + TRANSV}$.

9. Simulations

In this section simulation results are presented to illustrate the most important transmission mechanisms in the model and to allow comparisons with the OeNB and the WIFO-model. First, we consider two demand shocks (public consumption and exports), then a monetary shock (interest rate) is simulated. In the first two simulations the demand shocks last for five years, in the last simulation the interest rates fall back to their baseline level after two years. Simulations cover ten years. The results are presented either as percentage or percentage point deviations from the baseline. Tables 1–3 in the appendix show the result of our simulations.

9.1 Increase of Government Consumption for Five Years

In the first five years public consumption is increased by one percent of (initial) real GDP. Because the purpose of these simulations is to show the direct effects of a positive demand shock, no financing of the increase in public consumption is considered. Nominal interest rates are assumed to remain constant at their baseline levels over the whole simulation period. Real transfers and the ratio of taxes paid by households to GDP are kept constant.

Higher public consumption leads to an increase in output. The impact multiplier is greater than 1. Crucial for this result is our specification of the import equation, which takes into consideration that the share of public consumption imported from abroad is very low compared to the other demand components. Real investment activity is boosted by the accelerator effect. The increase in disposable income leads to higher private consumption, partly offset by a rise in the savings rate in the first year. Due to higher domestic demand imports expand, implying a deterioration of the trade balance. Demand side pressures lead to pick up in inflation with a lag of one year. After five years the unemployment rate is half of a percentage point below the baseline value and real wages increase in line with productivity. The fall-back of government consumption after five years to the baseline reverse most of the results. GDP returns to the baseline value immediately. Because of a fall in the savings rate consumption expenditures remain above the baseline values, this effect is offset by higher imports. The prices are sticky and inflation is significantly above the baseline values at the end of the simulation period.

9.2 Increase in World Demand for Five Years

This simulation investigates the effects of a demand shock due to external growth of world demand. We incorporate this shock in our model by an exogenous increase in exports by 1 percentage point of (initial) GDP for five years. This positive demand shock leads to an increase in output and in all demand components. In contrast to simulation 1 the interim multiplier is below one. This is caused by the higher import content of exports. The initial impact of net exports amounts to 0.35 percentage of GDP. Due to higher employment consumption expenditures increase, the acceleration effect leads to higher investment demand. Demand side pressure implies higher inflation. The unemployment rate declines by 1/3 of a percentage point. Real wages grow in line with productivity. After five years world demand falls back to its baseline level. This negative demand shock triggers reverse adjustment processes. GDP returns to the baseline level immediately. The accelerator effect implies a reduction in investment expenditures. Consumption drops only marginally and remains above the baseline values for the whole simulation period. This effect is offset by higher import expenditures. Due to higher unit labor costs inflation is above the baseline value until the end of the simulation period.

9.3 Increase of Short-term Interest Rates for Two Years

In this simulation the impact of a monetary shock is investigated. Nominal short-term interest rates are increased by 100 basis points for a two years period. According to the common assumptions the effect on long-term interest rates is very small. In the first (second) year the interest rate is 16.3 (6.3) basis points above the baseline value. The exchange rate appreciates according to the uncovered interest rate parity. The appreciation amounts to 0.16 and 0.063 percentage points, respectively.

The small monetary shock has almost no macroeconomic effect in our model. GDP is reduced by 0.05 percentage points in the first two years. The increase in the real interest rate causes a small fall in consumption expenditures (–0.07) and a slightly stronger effect for investment demand (–0.15 percentage points). A critical assumption is here that consumption and investment depend mainly on real long-term interest rates in our model. A stronger transmission of the rise in the short-term interest rates would imply a larger effect. The appreciation of the exchange rate leads to a small improvement in the terms-of-trade. However, the appreciation is so small that the trade balance is not significantly affected.

Appendix

Table A1: Increase of Government Consumption for Five Years

	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Prices	*Levels, percentage deviations from baseline*									
VPI	-0.04	0.17	0.68	1.19	1.69	2.18	2.42	2.38	2.32	2.26
Consumption deflator	-0.05	0.18	0.72	1.27	1.80	2.32	2.58	2.53	2.47	2.41
GDP deflator	0.05	0.37	0.98	1.64	2.32	2.88	3.23	3.31	3.33	3.34
Investment deflator	0.07	0.43	1.10	1.96	2.92	3.91	4.63	5.07	5.33	5.49
Unit labour costs	-0.78	-0.06	0.72	1.52	2.25	3.62	3.60	3.53	3.42	3.35
Compensation per employee	0.08	0.61	1.32	2.04	2.73	3.27	3.41	3.37	3.31	3.28
Productivity	0.86	0.66	0.60	0.52	0.47	-0.34	-0.19	-0.16	-0.10	-0.07
Export deflator	0.00	0.02	0.07	0.12	0.17	0.22	0.25	0.24	0.24	0.24
Import deflator	-0.01	-0.01	0.00	0.03	0.05	0.08	0.10	0.11	0.10	0.11
GDP and components	*Levels, percentage deviations from baseline*									
GDP	1.53	1.52	1.56	1.49	1.42	-0.02	-0.07	-0.18	-0.17	-0.14
Consumption	0.54	0.79	1.09	1.25	1.37	0.94	0.80	0.60	0.54	0.55
Investment	2.87	2.79	2.77	2.56	2.40	-0.34	-0.34	-0.41	-0.29	-0.17
Of which: construction investment	1.91	2.43	2.49	2.30	2.08	0.18	-0.41	-0.57	-0.47	-0.31
Government consumption	5.85	5.82	5.79	5.71	5.62	0.00	0.00	0.00	0.00	0.00
Exports	0.00	-0.01	-0.02	-0.04	-0.04	-0.06	-0.09	-0.12	-0.14	-0.16
Imports	0.76	0.91	1.04	1.14	1.24	0.64	0.56	0.49	0.45	0.43
Contributions to shock	*Percentage of GDP, absolute deviations from baseline*									
Domestic demand	1.99	2.08	2.22	2.23	2.23	0.43	0.35	0.22	0.22	0.25
Inventories										
Trade balance	-0.46	-0.56	-0.66	-0.74	-0.81	-0.45	-0.42	-0.40	-0.39	-0.40
Labour market	*Levels, percentage deviations from baseline, except unemployment: percentage points, absolute deviations from baseline*									
Total employment	0.57	0.73	0.82	0.83	0.82	0.27	0.10	-0.02	-0.06	-0.07
Employees in employment	0.66	0.85	0.95	0.97	0.95	0.32	0.12	-0.02	-0.07	-0.08
Unemployment rate	-0.60	-0.67	-0.68	-0.61	-0.53	0.07	0.21	0.27	0.24	0.20
Household accounts	*Levels, percentage deviations from baseline, except the savings rate: percentage points, absolute deviations from baseline*									
Disposable income	1.10	1.04	0.64	0.17	-0.28	-1.68	-1.98	-1.96	-1.86	-1.76
Saving rate	0.46	0.39	0.23	0.14	0.11	-0.32	-0.25	-0.09	0.00	0.04

Source: Authors' calculations.

Table A2: Increase in World Demand for Five Years

	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Prices	*Levels, percentage deviations from baseline*									
VPI	-0.07	0.02	0.27	0.53	0.79	1.12	1.31	1.36	1.40	1.44
Consumption deflator	-0.07	0.02	0.29	0.56	0.84	1.19	1.40	1.44	1.49	1.53
GDP deflator	-0.12	0.02	0.31	0.64	0.98	1.47	1.72	1.85	1.96	2.06
Investment deflator	0.02	0.18	0.51	0.95	1.46	2.02	2.48	2.83	3.10	3.33
Unit labor costs	-0.58	-0.18	0.16	0.54	0.91	1.82	1.85	1.94	1.99	2.06
Compensation per employee	-0.10	0.15	0.50	0.85	1.22	1.69	1.85	1.93	2.00	2.09
Productivity	0.49	0.33	0.34	0.31	0.30	-0.12	0.00	-0.01	0.01	0.02
Export deflator	-0.06	-0.05	-0.02	0.00	0.03	0.11	0.13	0.14	0.14	0.15
Import deflator	-0.03	-0.03	-0.02	-0.01	0.00	0.04	0.06	0.06	0.06	0.07
GDP and components	*Levels, percentage deviations from baseline*									
GDP	0.86	0.78	0.85	0.86	0.87	0.12	0.18	0.10	0.10	0.10
Consumption	0.24	0.34	0.52	0.62	0.69	0.56	0.54	0.45	0.44	0.45
Investment	1.60	1.42	1.50	1.47	1.45	0.03	0.20	0.13	0.17	0.22
Of which: construction investment	1.08	1.27	1.34	1.30	1.25	0.27	0.07	-0.01	0.03	0.10
Government consumption	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Exports	1.58	1.50	1.42	1.38	1.34	0.00	0.00	0.00	0.00	0.00
Imports	1.09	1.18	1.20	1.21	1.23	0.31	0.25	0.26	0.28	0.30
Contributions to shock	*Percentage of GDP, absolute deviations from baseline*									
Domestic demand	0.52	0.53	0.64	0.69	0.72	0.31	0.34	0.27	0.28	0.30
Inventories										
Trade balance	0.35	0.25	0.21	0.18	0.14	-0.19	-0.16	-0.17	-0.18	-0.19
Labor market	*Levels, percentage deviations from baseline, except unemployment: percentage points, absolute deviations from baseline*									
Total employment	0.32	0.38	0.44	0.47	0.48	0.21	0.15	0.10	0.08	0.07
Employees in employment	0.38	0.45	0.52	0.55	0.56	0.24	0.18	0.11	0.09	0.08
Unemployment rate	-0.34	-0.35	-0.37	-0.35	-0.33	-0.01	0.02	0.06	0.05	0.04
Household accounts	*Levels, percentage deviations from baseline, except the savings rate: percentage points, absolute deviations from baseline*									
Disposable income	0.59	0.54	0.36	0.15	-0.07	-0.78	-0.96	-1.00	-1.01	-1.02
Saving rate	0.25	0.19	0.11	0.08	0.06	-0.16	-0.11	-0.03	0.01	0.03

Source: Authors' calculations.

Table A3: Increase of Short-term Interest Rates for Two Years

	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Prices	*Levels, percentage deviations from baseline*									
VPI	-0.01	-0.01	-0.01	-0.04	-0.05	-0.06	-0.06	-0.06	-0.06	-0.06
Consumption deflator	-0.01	-0.01	-0.01	-0.04	-0.05	-0.06	-0.06	-0.06	-0.06	-0.06
GDP deflator	0.04	0.04	-0.01	-0.05	-0.06	-0.07	-0.08	-0.08	-0.08	-0.08
Investment deflator	0.00	-0.01	-0.03	-0.06	-0.08	-0.10	-0.11	-0.12	-0.13	-0.13
Unit labor costs	0.07	0.06	-0.01	-0.06	-0.08	-0.08	-0.08	-0.08	-0.08	-0.08
Compensation per employee	0.04	0.03	-0.02	-0.06	-0.07	-0.08	-0.08	-0.08	-0.08	-0.08
Productivity	-0.03	-0.03	-0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Export deflator	0.00	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Import deflator	-0.08	-0.07	-0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GDP and components	*Levels, percentage deviations from baseline*									
GDP	-0.05	-0.07	-0.05	-0.02	-0.01	0.00	0.00	0.00	0.00	0.00
Consumption	-0.08	-0.06	-0.04	-0.03	-0.02	-0.02	-0.01	-0.01	-0.01	-0.01
Investment	-0.13	-0.17	-0.11	-0.05	-0.02	-0.01	0.00	0.00	0.00	-0.01
Of which: construction investment	-0.06	-0.13	-0.12	-0.07	-0.03	-0.01	0.00	0.00	0.00	0.00
Government consumption	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Exports	-0.01	-0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Imports	-0.06	-0.03	-0.01	-0.02	-0.02	-0.02	-0.01	-0.01	-0.01	-0.01
Contributions to shock	*Percentage of GDP, absolute deviations from baseline*									
Domestic demand	-0.08	-0.07	-0.05	-0.03	-0.02	-0.01	-0.01	-0.01	-0.01	-0.01
Inventories										
Trade balance	0.02	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Labor market	*Levels, percentage deviations from baseline, except unemployment: percentage points, absolute deviations from baseline*									
Total employment	-0.02	-0.03	-0.03	-0.02	-0.01	0.00	0.00	0.00	0.00	0.00
Employees in employment	-0.02	-0.04	-0.03	-0.02	-0.01	0.00	0.00	0.00	0.00	0.00
Unemployment rate	0.02	0.03	0.02	0.01	0.00	0.00	-0.01	-0.01	0.00	0.00
Household accounts	*Levels, percentage deviations from baseline, except the savings rate: percentage points, absolute deviations from baseline*									
Disposable income	0.02	-0.01	-0.02	0.02	0.04	0.05	0.05	0.05	0.04	0.04
Saving rate	0.08	0.04	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00

Source: Authors' calculations.