Eleven years have elapsed since the beginning of economic reform, but monetary and fiscal policy measures adopted in Slovakia (as well the system of economic policy measures) are still inadequately supported by forecasts of impacts on economic indicators, which are based on theoretical economic models. One such model, which has been tried and tested abroad, is the IS-LM (or IS-LM-PB) model. Although the IS-LM model is well known among economists (hence we pay particular no attention to its theoretical background), it was found difficult to apply it to Slovak conditions, especially during the initial period.

Under Slovak conditions, the aim of the model is:

- to measure the (mutual) influence and degree of effectiveness of NBS monetary policy (mainly through its effect on the money supply and demand for money) and the fiscal policy of the government (mainly through the effect on final consumption of general government and taxes) on economic indicators (interest rates, GDP, household consumption, etc.) in the given period;

- to simulate the effects of possible changes in monetary and fiscal policies on real interest rates and GDP and to determine, in the light of the proposed changes in the volumes of real money (M/P) and final consumption of general government (G), a combination of monetary and fiscal policies (restriction and/or expansion), which would affect the development of interest rates (R) and GDP, without causing imbalances in the economy.

By applying the IS-LM model to the conditions of Slovak economy, it is possible to determine and quantify not only the effects of monetary and fiscal policies on GDP and interest rates, but also for example the effect of interest rates on investment and demand for money. At the same time, the IS-LM model may be applied for analysis when the development of GDP and interest rates (respectively the interest margin) is stimulated so that it affects the money market for goods and services and also the money market are in equilibrium. If the expected base index of consumer prices P (average) is known and M (M2) and G are selected correctly for corresponding period, the decisions of the NBS, Government, and Parliament may positively affect the values of GDP and R.

The model is made up of five equations. The first equation concerns on the final consumption of households (C), which is dependent on the marginal propensity to consume and the positive value of GDP (marked Y in the text), adjusted by the tax coefficient. The second equation is for gross capital formation (I), which depends on the interest elasticity of investments and R1 (with a negative sign). The R1 variable represents the real interest margin for investment, calculated as the difference between the average real interest rate on new loans and the average real interest rate on time deposits. The third equation is a modified equation for net exports (NX), expressed as a function of the exchange rate E (SKK/USD) with a negative sign. The fourth equation presents demand for money (with the assumption that it equals the supply of money M/P), which is dependent on the income elasticity of demand for money; GDP (with a positive sign); the interest elasticity of demand for money; and on R2 (with a negative sign). The R2 variable represents the real interest margin for demand for money, calculated as the difference between the average real interest rate on new loans and the average real interest rate on total deposits. The relationship between R2 and R1 may be expressed as follows:

\[ R_2 - R_1 = \Delta \]

The fifth equation is the income identity, which means that gross domestic product (according to the expenditure-based method) equals the sum of final household consumption, gross capital formation, final consumption of general government, and net exports.

With the interest margin (R1) expressed in the final equation, it was possible to construct an IS curve, illustrating all combinations of interest rates with the levels of income at which the market for goods and services is in equilibrium. By expressing the R1 interest margin (derived from the relationship: R2 – R1 = Δ) using the equation for real money (M/P), we obtain an LM curve expressing all combinations of interest rates with the levels of income at

---

* The model was designed by a team of experts from Data Centrum (Viktínová, Valko) and the Ministry of Finance, Department for the Analysis of Budgetary Performance and Statistics (Orná, Gonda).

1 To find the most suitable inputs for reporting under Slovak conditions, the authors had tested versions of the model approximately during a two-year period. An example is the incorporation of the real interest margin into the model.

2 R stands for real interest margin in the model.

3 The expressed equation of the dependence of net exports on the exchange rate was incorporated into the model as a test; however, it is planned to be applied permanently in future. The intention is to make the IS-LM model more dynamic and adjust parameters to the real conditions of the Slovak economy, by adopting the IS-LM-PB model (applied, e.g. in the CR, ref. 6 and ref. 8), respectively and/or the IS-LM-PB-NX model (used also in the CR, ref. 5). However, the present authors are aware of the problem of interpreting the flexible exchange rate regime which was introduced in Slovakia only a short time ago (October 1998).
which the money market is in equilibrium. The intersection of IS and LM represents the point at which the market for goods and services and also the money market are in equilibrium. The x coordinate of this intersection may be calculated so that an equation is made from the right-hand sides of the equations for IS and/or LM, from which we express GDP. By entering the resulting (equilibrium) value produced as a share of the M/P and G ratios in the equation for GDP.

The following time series of quarterly data were used as the input value in the IS-LM model (Tab. 1) for application under conditions of the Slovak economy.

By means of the IS and LM curves, we determined the equilibrium values of GDP and the real interest margin (R) for the end of each period under analysis, i.e. the 4th quarter of 1998 (4Q 98); 2nd quarter of 1999 (2Q 99); 4th quarter of 1999 (4Q 99); and the 2nd quarter of 2000 (2Q 00) – see Tab. 2.

The changes observed in the actual values of G and M/P and the changes in the equilibrium values of GDP and R showed signs of interdependence. However, increased dependence on changes in monetary and fiscal policies was shown by changes in the values of R (real interest margin) during the period under review. The gradual fall in the equilibrium values of R in the two years (Tab. 2) was caused by a fall in the value of G (government consumption) in some quarters, but mainly by the gradual shift from a long-term restrictive monetary policy to a moderately expansive one (e.g. in the 2nd quarter of 2000, real money M/P showed a moderate increase of 0.3%, causing the real interest margin to diminish by 8.1% compared with the 4th quarter of 1999).

The effectiveness of the two policies in relation to their effects on interest rates and GDP\(^4\) may be assumed from the estimated ratios used in the equation of GDP in the case of the G and M/P variables (Tab. 3). The ratios directly express the increase in GDP where the relevant variable is changed by one unit. To express the mutual dependence between monetary and fiscal policies, the ratio can be introduced as a share of the M/P and G ratios in the equation for GDP.

Tab. 3 shows that the value of the M/P and G ratios ranges from 6.64 in the 4th quarter of 1998 to 2.32 in the 2nd quarter of 1999, Nobel Prize winner for economics in 1999, ref. 4).

\(^4\) The degree of effectiveness of monetary and fiscal policies in relation to their effects on R and GDP is, to a considerable extent, given by the interest elasticity of investment and the interest elasticity of demand for money. The principle is that the more effective the country's fiscal policy is in comparison with monetary policy, the less demand for money will react to interest rate fluctuation (and vice versa) and the more effective monetary policy is in comparison with fiscal policy, the less demand for money will react to interest rate fluctuation (and vice versa). The graph of the IS-LM curves shows that monetary policy is more effective when the IS curve is flat and the LM curve is steep. On the other hand, fiscal policy is more effective when the IS curve is steep and the LM curve is flat. However, the degree of effectiveness of the two policies in an open economy (in the IS-LM-PB model) is significantly affected by the exchange rate regime and the rate of capital mobility. In an environment of fixed exchange rates and (almost) perfect capital mobility, the fiscal policy is substantially more effective than monetary policy. On the other hand, in an environment of flexible exchange rates and (almost) perfect capital mobility, the monetary policy is much more effective than fiscal policy (R. Mandell, Nobel Prize winner for economics in 1999, ref. 4).
would happen with the values of GDP and R\(_1\) in the case monetary policy), we showed – in concrete examples – what fiscal policy combined with expansive or restrictive mo-
potential effects of the policies (expansive or restrictive
quarter of 2000.
70.2\% in the 4th quarter of 1999, to 50.4\% in the 2nd quarter of 2000. The period under review was dominated
by the influence of monetary policy, but it showed a tendency to weaken. This was indicated by the year-on-year
indices in the relevant periods, while the ratio of the influence of monetary policy to that of fiscal policy fell from
70.2\% in the 4th quarter of 1999, to 50.4\% in the 2nd quarter of 2000.
To demonstrate the strength of the IS-LM model and the potential effects of the policies (expansive or restrictive fiscal policy combined with expansive or restrictive monetary policy), we showed – in concrete examples – what would happen with the values of GDP and R\(_1\) in the case of individual combinations (Tab. 4). The comparison is based on the so-called equilibrium curves IS and LM (IS\(_1\) and LM\(_1\)). The intersection of the IS\(_1\) and LM\(_1\) lines in the 2nd quarter of 2000 (so-called equilibrium state when the market for goods and services and the money market are both in equilibrium) for G = 30.4, E = 42.254 and M/P = 380.7 is a point with the following coordinates: 171.65; 1.93\% (the intersection of red and purple lines in graphs 1, 2, 3, and 4). The authors of the model tried to simulate the potential strategies of monetary and fiscal pol-
cies using the effects of changes (increases or decreases by 3 units) in final consumption of general government (G) and changes (increases or decreases by 3 units) in real money (M/P). The results of simulation of fiscal and monetary policies are shown numerically in Tab. 4 and

Tab. 3 Development of estimated values of ratios used in IS-LM models

|---|---|---|---|---|
| Ratio at Y in the equa-
tion of the IS curve | -0.002086 | -0.002872 | -0.003044 | -0.004579 |
| Ratio at Y in the equa-
tion of the LM curve | 0.002366 | 0.002366 | 0.002366 | 0.007327 |
| Ratio at G for the equa-
tion Y | 0.741500 | 0.909300 | 0.869600 | 0.538700 |
| Ratio at M/P equa-
tion Y | 4.920400 | 4.182100 | 4.049800 | 1.248000 |
| Relationship between the ratios (M/P)/G | 6.64 | 4.60 | 4.66 | 2.32 |
| Indices of the ratios (M/P)/G in % | 70.2 | 50.4 |

Source: Authors of the model

The results of the model indicate that, an acceptable form of economic policy could be a combination of restrictive expenditure fiscal policy and expansive monetary policy. If, for example, the government reduces the level of its final consumption by 3 units and NBS stimulates the money supply (M/P) both by 3 units, the real interest margin (R) diminishes by 0.53 units and real GDP grow by 5.35 units (Tab. 4, Graph 1). However, the authors do not regard the practical application of this strategy as desirable, for the combination of two expansive policies could result in an number of risks, including an impact on price levels.

The results of the model indicate that, an acceptable form of economic policy could be a combination of restrictive expenditure fiscal policy and expansive monetary policy. In addition to a positive effect on interest rates and GDP, the application of a restrictive fiscal policy combined with a slightly expansive monetary policy would contribute to the depreciating of the exchange rate (thus positively affect ing the balance of net exports).

From the analysis of the IS-LM model under conditions of the Slovak economy, we may draw the conclusion for practical use.

A theoretically acceptable strategy (under unchanged conditions) is the combination of expansive fiscal and ex-
pansive monetary polices and the combination of restricti-
ve fiscal and expansive monetary polices. The model shows that if the strategy of two expansive policies is applied, i.e. if the government increases its final consumption (G) and NBS the money supply (M/P) both by 3 units, the real interest margin (R) diminishes by 0.53 units and real GDP grow by 5.35 units (Tab. 4, Graph 1). However, the authors do not regard the practical application of this strategy as desirable, for the combination of two expansive policies could result in an number of risks, including an impact on price levels.

The results of the model indicate that, an acceptable form of economic policy could be a combination of restrictive expenditure fiscal policy and expansive monetary policy. If, for example, the government reduces the level of its final consumption by 3 units and NBS stimulates the money supply (M/P) both by 3 units, the real interest margin (R) diminishes by 2.90\% (more than in the case of the previous combination) and real GDP increases by 2.12\% (Tab. 4, Graph 1). Although this strategy can be regarded as the most suitable for use under the present conditions in Slovakia\(^6\) the most acceptable solution in economic terms is the combination of a restrictive fiscal policy and a moder-
ately expansive (almost neutral) monetary policy. In addition to a positive effect on interest rates and GDP, the application of a restrictive fiscal policy combined with a slightly expansive monetary policy would contribute to the depreciating of the exchange rate (thus positively affect ing the balance of net exports).

From the analysis of the IS-LM model under conditions of the Slovak economy, we may draw the conclusion for practical use.

A theoretically acceptable strategy (under unchanged conditions) is the combination of expansive fiscal and ex-
pansive monetary polices and the combination of restricti-
ve fiscal and expansive monetary polices. The model shows that if the strategy of two expansive policies is applied, i.e. if the government increases its final consumption (G) and NBS the money supply (M/P) both by 3 units, the real interest margin (R) diminishes by 0.53 units and real GDP grow by 5.35 units (Tab. 4, Graph 1). However, the authors do not regard the practical application of this strategy as desirable, for the combination of two expansive policies could result in an number of risks, including an impact on price levels.

The results of the model indicate that, an acceptable form of economic policy could be a combination of restrictive expenditure fiscal policy and expansive monetary policy. If, for example, the government reduces the level of its final consumption by 3 units and NBS stimulates the money supply to increase by 3 units, the real interest margin (R) diminishes by 2.90\% (more than in the case of the previous combination) and real GDP increases by 2.12\% (Tab. 4, Graph 1). Although this strategy can be regarded as the most suitable for use under the present conditions in Slovakia\(^6\) the most acceptable solution in economic terms is the combination of a restrictive fiscal policy and a moder-
ately expansive (almost neutral) monetary policy. In addition to a positive effect on interest rates and GDP, the application of a restrictive fiscal policy combined with a slightly expansive monetary policy would contribute to the depreciating of the exchange rate (thus positively affect ing the balance of net exports).

From the analysis of the IS-LM model under conditions of the Slovak economy, we may draw the conclusion for practical use.

A theoretically acceptable strategy (under unchanged conditions) is the combination of expansive fiscal and ex-
pansive monetary polices and the combination of restricti-
ve fiscal and expansive monetary polices. The model shows that if the strategy of two expansive policies is applied, i.e. if the government increases its final consumption (G) and NBS the money supply (M/P) both by 3 units, the real interest margin (R) diminishes by 0.53 units and real GDP grow by 5.35 units (Tab. 4, Graph 1). However, the authors do not regard the practical application of this strategy as desirable, for the combination of two expansive policies could result in an number of risks, including an impact on price levels.

The results of the model indicate that, an acceptable form of economic policy could be a combination of restrictive expenditure fiscal policy and expansive monetary policy. If, for example, the government reduces the level of its final consumption by 3 units and NBS stimulates the money supply (M/P) both by 3 units, the real interest margin (R) diminishes by 2.90\% (more than in the case of the previous combination) and real GDP increases by 2.12\% (Tab. 4, Graph 1). Although this strategy can be regarded as the most suitable for use under the present conditions in Slovakia\(^6\) the most acceptable solution in economic terms is the combination of a restrictive fiscal policy and a moder-
ately expansive (almost neutral) monetary policy. In addition to a positive effect on interest rates and GDP, the application of a restrictive fiscal policy combined with a slightly expansive monetary policy would contribute to the depreciating of the exchange rate (thus positively affect ing the balance of net exports).

From the analysis of the IS-LM model under conditions of the Slovak economy, we may draw the conclusion

---

5 Neutral policies and/or moderate (or increased) expansions or restricti-
one in the presented policies (i.e. changes by 3 units) were not considered
by the authors.

6 Similar recommendations for economic policy (to apply a combination of restrictive fiscal policy and an expansive monetary policy) are being used by some economists in the Czech Republic (Tomšík, V. ref. 8)
that, if the economic policy of the government is to be effective, monetary and fiscal policy measures must be coordinated. At the same time, the analysis has shown that a considerably expansive expenditure fiscal policy combined with restrictive monetary policy in 1997 and 1998 caused a marked rise in real interest rates and, subsequently, with some time lag, a slowdown in the rate of growth in GDP. Under conditions of the Slovak economy, the IS-LM model may in future be used for simulating the economic policy of the government. The model is expected to be supplemented with an extension for the balance of payments, especially to net exports, which at the same time should provide a better overview of the relations in the economy.

Source: Statistical Office of SR, NBS, Authors of the model

Note: Results of simulation of fiscal policies correspond simulation of expenditure fiscal policies only.

Graph 1 Expansive fiscal and expansive monetary policies
(2nd quarter 2000)

Graph 2 Expansive fiscal and restrictive monetary policies
(2nd quarter 2000)

Graph 3 Restrictive fiscal and expansive monetary policies
(2nd quarter 2000)

Graph 4 Restrictive fiscal and restrictive monetary policies
(2nd quarter 2000)

References:

9. Data from the National Bank of Slovakia and the Statistical Office of the SR.

---

7 IS1 and LM1 correspond to the initial curves, IS2 and LM2 to simulated expansive strategies, and IS3 and LM3 to simulated restrictive strategies.