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UDK 330.5
330.834

APPLICATION OF THE MUNDELL-FLEMING MODEL ON A SMALL OPEN ECONOMY

November 2002.

ABSTRACT

The object of this paper is to investigate the applicability of a Mundell-Fleming model. The model was developed in 1960s with the main intention of opening the standard closed economy Keynesian IS-LM model and adjusting the variables for the capital flows and other shocks that might result from capital flow. The paper develops the models into detail, contrasts the closed economy and open economy IS-LM model. The paper also extents the model for the application to the standard rational expectations theory. After developing the model, I apply the model to a small open economy. In this case, I chose Croatia. Small open economy in the middle of Europe. The country was chosen because it is currently undergoing the transition from socialistic planed economy to open capitalistic economy and it is very susceptible to the capital flows. The model fits the data very good and proves on the data that monetary and fiscal pol-

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icy if used separately will have no effect on the economy because of the capital flows.

PART I = INTRODUCTION

The issue of how to model an open economy has always been one of the key interests for the economic research. With the Keynesian revolution that started with the publishing of Keynes' monumental work "General Theory of Money, Interest and Unemployment" the grounds were set to investigate the nature of a closed economy, but not until 1960s did the Keynesian economics had a substantial and credible answer to the questions how to model a small open economy. The answer came mostly through the research done by Robert Mundell; Nobel Prize winner, in economics, in 1999 for his research on the issues of the capital flow and behavior of the open economy.

The purpose of this paper is to apply the model proposed by Mundell, expand it and give empirical analysis of the model. The model will be analyzed through a small open economy, for the country I choose Croatia. Country in the middle of Europe with area of 56 000 square kilometers and population of 4.3 million people.

The model is called Mundell-Fleming model, it tires to adjust the standard Keynesian IS-LM model to a small open economy sucepptible to outside credit and real shocks. In order to do so Mundell added another variable to the standard IS-LM model. He called this variable the capital mobility line. By doing so and through the comparative static method he was able to perform new analysis of the existing problems and offer some interesting interpretations of the problems that could not be solved through the standard IS-LM analysis.

The specific part of the model that I will analyze will be the monetary and fiscal aspect. The main reason why I choose Croatia is the fact that Croatia is in the middle of transition from the socialistic planed economy to capitalistic open economy. In such enviroment capital mobility will be a crucial part of the development and the transition from a socialistic to the capitalistic market and adjustment to the world of free trade dominated by the ever-changing world of free movements of goods and capital.

Since it is a fact that the model is out of date and that lot of things have changed in a way we look at the macroeconomic variables from

1960s, I will try to update the model by adding some of the rational expectations theory. I will adjust both the Keynesian model and the standard Lucas based rational expectation model in order to get model that is both functional and applicable to the data and the problems that the Croatian or any other small open economy might face.

The other part of the completely Keynesian model is the labor market. In this paper, I will not go into depth analyzing the labor market. Although the unemployment in Croatia is significant problem and it is above 15% in the whole time period during which the data is analyzed. There is no point in trying to solve the problem of unemployment; since the unemployment is a derivative of the monetary and fiscal problems that the Croatian economy is experiencing.

The rest of the paper is separated in the following parts. The second part is the derivation and the explanation of the model. The model will be presented as a standard Keynesian model whose basic equation is Y=C+I+G+(EX-IM). GDP is presented as a function of five independent functions that all are dependent on several other variables. The standard IS-LM relationship will be given as the basis for the analysis of the data presented in part four.

In part three I will solve some practical problems that are encountered in a real economy and which can be solved by using the model presented in part two. The problems will be focused on monetary and fiscal sides of the economy. In this part there will be some interesting results concerning the decision-making in a small open economy.

Part 4 is the application part, where I will take the actual data from the Croatian economy and see is the economy behaving in a way the model predicts. In part, five I will give a conclusion about the whole analysis.

PART II = THE MODEL:

The model used is the basic Keynesian model used by Mundell. When Mundell approached the standard Keynesian model of aggregate demand presented through the IS-LM relationship, he realized that the model is insufficient and cannot be applied for an open economy that is subjected to currency oscillations, changes in real exchange rate and free flow of capital. In order to go around the problem Mundell introduced a capital mobility curve. This curve represented the real interest rate imposed upon the country from the rest of the

world. This line can naturally vary over time. For our analysis we will assume that it is fixed in the short run.

The model I will use is the standard Keynesian model with the assumptions about the aggregate supply: the supply curve is sloped upward and static. There are no real shocks. The shift in the aggregate demand curve will cause an increase in the GDP with an adjustment to the price level. That is the money can influence real variables, but there will be some increase in prices as well. The Hick's assumption of liquidity trap is strongly rejected. Furthemore all liquidity constraints are eliminated, because the country can borrow money from the rest of the world, thus the government deficit, government budget and capital spending by the government would be exogenous. The economy can undergo strong inflation due to devaluation of the currency on the foreign open market or due to an increase in the monetary base.

Further assumptions are that there are clearances in the markets and that the unemployment rate is involuntary. There is some level of unemployment were everybody in the economy can find a job if they are looking for it. The assumption about the unemployment comes directly from Keynes.

Here is the model. The basic function is that GDP has four separate functions: public consumption, investment, government spending (as usual here are only real spending and not government transfers) and the current account, which is composed of the import and export functions.

$$Y = C + I + G + (IM - EX)$$

Y - Gross domestic product

C - Consumption function

G - Government spending

IM - imports

EX - exports

2.1 THE CONSUMPTION FUNCTION

$C(Y, r, \pi, W/P, E/P)$

Consumption is the function of the following variables:

r – real interest rate

π - inflation rate

W/P - real wage and P is the price level

E/P - real exchange rate

The consumption has a positive relationship with the real wage. The reasons for this is simple; as the economy is producing more goods the consumption will go up. An increase in nominal wage will stimulate consumption in the short run through the inflation, while increasing the real wage will affect the variable part of consumption. The variable consumption function has an inverse proportional relationship with the real and nominal exchange rate, as well as the interest rate. This is only a small part of consumption, but nominal and real appreciation will decrease the demand for the foreign goods.

The consumption function can be written in the following format:

$C= c°(-r,y) + A + c(y, -r, -E/P, W/P)$

Where A is

$A = z + (y, E/P)$

c° is the autonomous consumption give as a function of c°(-r,y). "A" is the demand for imports, which is the function of the autonomous demand for imports z and the variable part which is a function of real GDP and real exchange rate.

Here I am making an assumption there will be always demand for some imports because we are dealing with a small open economy that is not self-sufficient.

The only time the autonomous demand for imports can change is if the economy becomes self-sufficient or there is a long-term constant depreciation of the real exchange rate. This will cause cause the agents to adjust their long term demand for imports.

2.2 INVESTMENT FUNCTION

I (E/P, A*, CM)

A* - foreign demand for the domestic (Croatian) goods

$I= i(-r)° + i(CM) – iA*(CM,E/P)$

The investment function is composed of the autonomous investments i(-r)°. Autonomous investment depends inversely on the medium term movements in the real interest rate. The second part of the investment function is the foreign investments. These investments will depend only on the capital mobility curve or the current level of real interest rate that is imposed on the country by the world. The third part of the investment function is the investments made abroad. These investments can be in the form of exports or actual contracts between the Croatian firms and the firms from other countries. The investment from Croatia to the rest of the world will depend on the temporary disequilibrium between IS-LM-CM and the long run trend in the real exchange rate. (note: long run changes in the real exchange rate will not be analyzed)

The main part I have to stress here is that we assume that there is a strong existence of the Feldstein-Horioka paradox. That is I?S. The country can run a deficit on its current account, without running a surplus on the capital account and vice versa. This is a necessary side effect of perfect capital mobility. Due to this effect, we have perfect capital mobility.

2.3 THE GOVERNMENT SPENDING

Like in most Keynesian models, this model assumes that the government spending is an exogenous variable. Although I will assume that, the government can determine its spending and run an unlimited amount of deficit through the foreign debt; Croatian reality is much more different and I will address the Croatian foreign debt and fiscal deficit as a separate issue because it is not just a long term, but a short-term problem.

The main assumption behind the government spending being exogenous is the fact that government collects taxes and all of the budget deficit can be financed through either domestic or foreign borrowing. Ricardian equivalence is ignored here and assumed to be undone like proposed in the (Barsky, Mankiew, Zeldes 1986).

2.4 IMPORT FUNCTION

Import as a function is dependent on the following variables:

IM (E, E/P, Y, CM)

Although there are only three variables, these three variables as will be shown when we go over the data, are essentially variables that are determining level of Croatian GDP. Import as a value is inversely correlated with the nominal and real exchange rate and positively correlated with the GDP. Thus as the currency is appreciating (the exchange rate is going up, for one Kuna we can get more of the foreign currency) the level of imports will rise. Although the nominal exchange rate is stable in Croatia, the real exchange rate has been appreciating considerable, thus causing constant increase in the level of imports. The third variable, GDP, has standard explanation. As the level of GDP is increasing, the purchasing power of the average citizen is rising and so is the demand for imports.

$IM = \Theta(y) + im^{\circ}(E/P) \pm \zeta(CM, E/P)$

$\Theta(y)$ is the consumption of imports that depends on the current level of real GDP, there is also an autonomous level of imports im°. im° depends on the medium and the long run oscillations in the real exchange rate. This part exists because our small economy is not self-sufficient and it depends on the long term changes in the real exchange rate. The last part will be equal to 0 for the equilibrium IS-LM-CM. It will be positive when $r_d > r_w$ the reason for this is the artificial boom caused by the influx of investments and it will be negative when $r_d < r_w$. In this case an outflow of capital will cause recession.

2.5 EXPORT FUNCTION

The export function follows standard Keynesian principles and it is dependent on the nominal, real exchange rates and the level of foreign demand for Croatian exports.

$EX (E, E/P, A^*)$

Where A^* is the level of foreign demand for the Croatian goods. Although A^* is a very significant and interesting variable for the model and for the study of a small open economy, in this particular case I will not take it into consideration and will assume that A^* is constant in the medium run. The reason for that is that in the time period that I am studying (1995-2001) the level of foreign demand did not change much. In general, this time period has been very prosperous periods in the history of the world. Both USA and Europe (where most of the Croatian exports and going) enjoyed very high levels of prosperity

and stability due to the supply shock caused by the technological improvements. Due to these facts, I will assume that the level of foreign demand has been constant and high through the period for which I am going analyze the data.

There might be some objections to these assumptions. They may arise from the fact that Croatia was in war and the some of the business relations have been lost due to the change in the political and economical climate in Croatia. Alas that is not an excuse that after the war was completely over in 1995 the new business connections were not made or that some positive effects from the above mentioned technological supply shock were not used and spilled over as a benefit for a Croatian producers.

The function for the exports looks just like the function for imports

$EX= A^*(y^*) + ex^\circ(E/P) \pm \zeta(CM, E/P)$

2.6 IS-LM RELATIONSHIP

The derivation of the IS and LM curves will be based on their standard derivations that can be used to derive the curves for a closed economy.

In a closed economy the goods produced are separated between three sectors

(1) $y = c + g + s$

So the agents can use their income in three ways. They can consume it, pay taxes and let government spent it and save it.

As for the expenditures, we can denote expenditure function in the following way

(2) $e= c + g + i$

In a closed economy, the agents will have three sources for expenditure. They can consume the goods they have produced. The government will spent all of t that it has collected from the consumers and the rest of the income can be invested in capital accumulation. In a closed economy, the equations (1) and (2) have to be equal because there is no influx or outflow of the goods and/or services. In the open economy, this does not hold. The formula for the aggregate expenditure and aggregate production will look like this

(1') $y = c + s + g + (ex\text{-}im)$

We have to augument the equation (1) for the open market. Same has to be done with the equation (2) which will give us

(2') $e = c + g + i + f - d$

The equation (2') has been augmented and now we have that the agents in the economy can spend goods, give it to government, invest it domestically or invest it into foreign assets (f), but at the same time the foreigners can come in and invest in domestic assets (d)

If we combine the equations (1) and (2) we get that i=s. This relationship can be used to combine (1') and (2'), so that we get

(a) $ex - im = f - d$

The result is very interesting. When the economy is running a current account surplus, it is effectively investing abroad into the foreign assets. On the other hand, if the economy is running a current account deficit it is effectively borrowing from abroad. The equation a is a medium and long run equilibrium, but in the short run the equation a can be in a disequilibrium while the capital inflow or outflow adjust to the IS-LM-CM equilibrium.

We shall assume that the government spending is always in equilibrium, which is $g = t + v$, where t is the amount of taxes collected and v is the variable government deficit or surplus. We shall denote autonomous government spending as $g°$. The issues of changes in government spending shall be discussed latter.

Here is the quick review of the model so far

(3) $y = c + s + g + (ex - im)$

(4) $e = c + I + g + (f - d)$

(5) $c = c°(-r,y) + A + c(y,- r, -E/P, W/P)$ $\quad A = z + (y, E/P)$

(6) $I = i(-r)° + i(CM) - iA*(CM, E/P) = i° + p$

(7) $im = c(y) + im° \pm\zeta(CM, E/P) = im° + m$

(8) $ex = ex°(E/P) + A*(y*) \pm \zeta (CM, E/P) = ex° + x$

(9) $g = g°$

we can combine the equations (3) and (5-9). We plug equations (5)-(9) into the equation (3) and we get

(10) $y = c°(-r,y) + c(y,-r, -E/P, W/P) + i°(-r) + g° + im° + ex° + [A + p + m + x]$

This equation is, in effect, an open economy equation for the IS curve. It specifies the locus of r and y values for which there is equilibrium in the commodity sector. All of the variables are constants except c(y,-r) and i(-r). therefore, the derivative the equation (10) is

(10') $\Delta r/\Delta y = -i'(-r) - c(y,-r, E/P, W/P)^* \Delta y/\Delta r$

Therefore, the slope is negative. This means the curve will be sloped downwards and it will have negative relationship between the output and real interest rate.

Since A+p+m+x are equal to 0 in a closed economy we get

$y= c° + c(y,r) - i°(r) + g° + im° + ex°$

Which is an IS relationship for the closed economy.

The LM relationship will be derived from the standard MV=PY relationship. That is

(11) $Y= MV/P$

if we log equation (11) we get

(12) $y= m + v - p$

The equation representing the demand for real money balances will be:

(13) $\frac{M}{P} = \frac{y^h L(r+\Pi)}{V}$

if we log the above equation we get

(13') $m - p = hy - l(r + \pi) - v$

we can now combine the $m - p + v = x$ representing the real money balances and solve for r to get

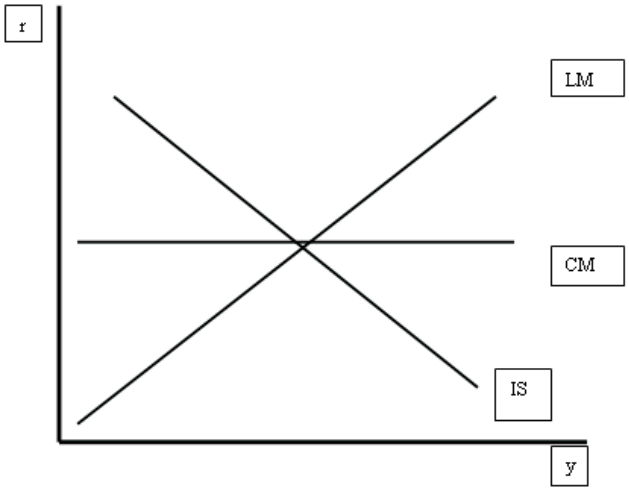
now we have a function that has a positive correlation with the output. That is as the output increases so will the real interest rate. The inflation and real money balances are constants and the changes in those variables will cause the LM curve to shift.

The last part of the model is the derivation of the CM curve.

(15) $CM= \mathring{u} + \acute{I}$

Where $\mathring{u}$ is the real interest rate imposed on the country from the rest of the world. The $\acute{I}$ is the expected change in w at some point in the future. Most of the times this variable is zero, but the changes in $\acute{I}$ will cause the CM curve to shift up or down.

In the end the graphical representation of the model looks like



PART III - PROBLEMS

In this part, I will solve some problems using this model. I will focus on the solutions that the model can provide through the comparative static method about the impact of monetary and fiscal policy in the economy. In this investigation, I have purposely ignored the labor market and I will not use it in any part of this paper, but the stated assumptions from part II about the labor market hold, although in the study of the model the labor market is irrelevant.

The main question of this part is: can growth in a small open economy be stimulated through the monetary and fiscal policy?

3.1 THE UNEXPECTED SHIFT IN THE CM CURVE

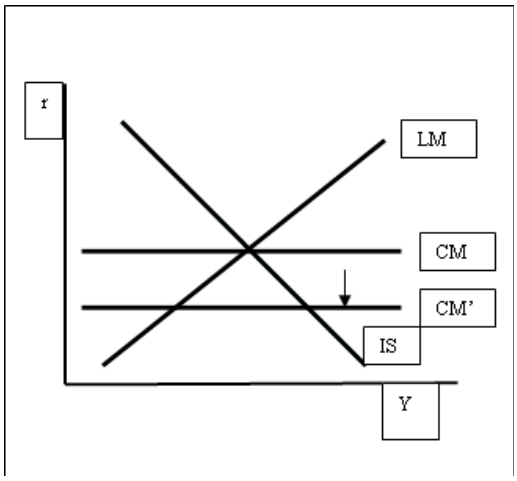
To start with some basic assumptions that will enable us to understand the model. In the world, there are two parts or we will call them countries. One is Croatia, because that is the country whose data I am studying and the "World". The "World" has many people that live in it and many companies that are interacting among themselves and with the companies from Croatia. They are interacting and engaging in all sorts of business transactions with no constraints on the capital mobility and no barriers on trade. The workers from the companies in the "World" are free to enter Croatia and leave Croatia when ever

they want, so many of them come to Croatia for a vacation. Same thing goes for the people in Croatia. However, there is one small catch and that is that all companies in the "World" know the real exchange rate and real rate of return on investments they are expecting when they invest in Croatia. All investors in the "World" have some expectations of the future real rate they can get from Croatia. All shifts in the expectations are simultaneous for all investors in the "World" although their immediate reactions to the change in expectations vary from investor to investor. The same thing holds for Croatia and investors in Croatia.

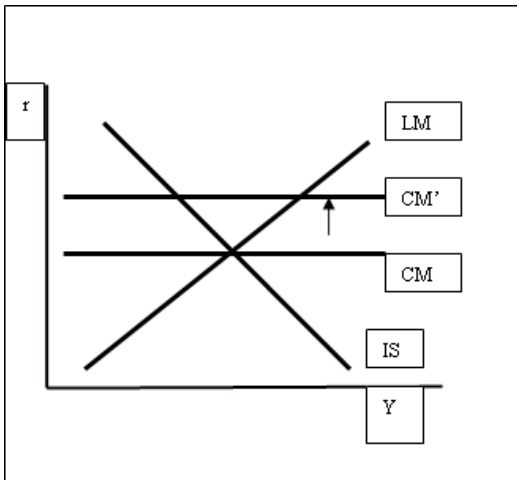
Since both the "World" and Croatia are stabile countries without any internal political, social or economic crisis and insecurities the main reason for the shift in the CM curve will be present or the expected change in the real level of the exchange rate or future expectations about the recession or a boom.

Here the variable ε become important. Due to the trends in real appreciation or depreciation the investors from the "World" might demand different real rate on their investments then they are currently getting.

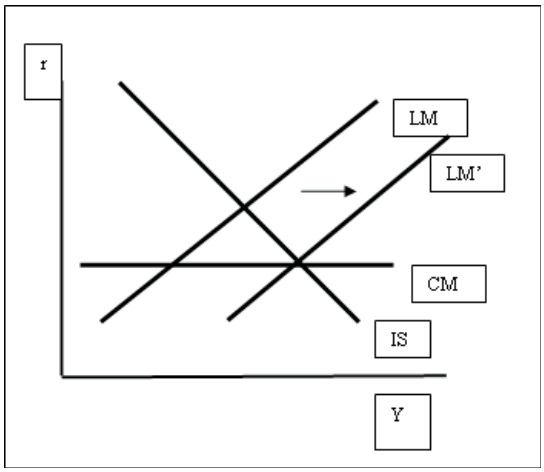
3.1.1 The shift down



the shift up



When the world decides that the real interest rate imposed upon Croatia is too large and the rate should be lowered. Possibilities why this might occur in the real world might be multiple: Croatian credit rating (currently BBB- according to Standard and Poors) might improve, Croatia might gain even more stability in the eyes of the investors due to joining NATO or EU. In that case the CM curve will shift down and it will not be in the equilibrium with the IS and LM curve. There is only one optimal policy to regain equilibrium and that is increase in x (the real money balances) and shift of the LM curve to the right.

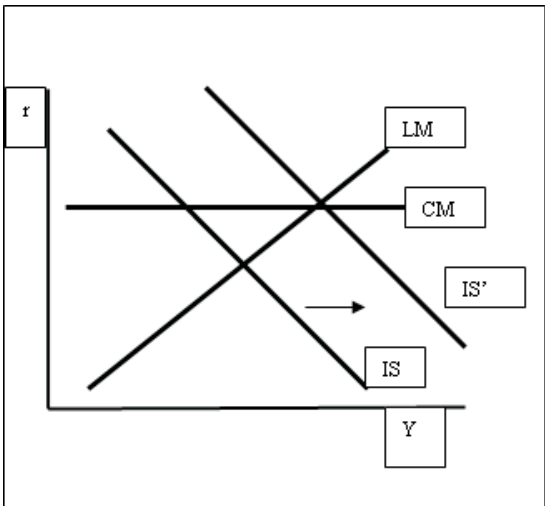


As the graph shows, the LM curve should be shifted to the right, by increasing the money supply in the economy. The increase in the money supply would shift the LM curve, lower the level of real interest rates and restore the IS-LM-CM equilibrium

The other policy to establish the equilibrium would be to contract the government spending, shift the IS curve to the left. This would produce a new stabile equilibrium, but at the cost of lower level of Y. Since this policy is not pareto optimal and it is in effect a contractionery policy I will assume that such policy would never be pursued by the government or monetary authority. Because of the negative nature of such policies they will not be considered any more.

3.1.2 The shift of the CM curve up

In case that the "World" decides to increase the interest rates imposed on Croatia, that is that the CM curve shifts up the standard IS-LM-CM curve will be out of equilibrium. Although this seems bad because of the rise in the real interest rates, the remedy is quite simple.



As the graph shows the IS curve should be shifted to the right. This would indeed cause a rise in the interest rates, but the increase in government spending will have a positive effect on the aggregate expen-

diture and the end result will be a higher interest rate, but the higher level of Y as well.

Although this has not happened in real life, it is still an interesting case.

3.2. THE EXPECTATIONS

Here I would like to expand our model with the rational expectations. The standard assumptions that I have stated above are still valid. As I have stated above the expectations are formed at once and are all changed at once.

The assumptions that Croatian economy will have an endogenous or exogenous stochastic shock that will occur one year from now.

If now the time period is T the shock will occur at T+1 or any other interger time point in the future. The investors in the "World" know the occurrence of this shock and the shift in their expectations is immediate, but the investors in Croatia do not know it at the same time. The lag effect does exist, but I will assume that the length of the lag is minimal due to the information flow from the "World" to Croatia, same goes for vice versa shocks. So if the investors in the world know at time T that the shock is going to occur at time T+1, Croatian investors find out about the occrence of the shock also at time T.

The knowledge about the shock will cause the investors from the "World" to change their expectations and the increase or to decrease the imposed interest rate depending on the nature of the stochastic shock. This will cause investors to demand to future level of capital mobility to be changed. This change in expectations about the real interest rate imposed on Croatia will cause CM curve to shift.

When investors in Croatia and the "World" fully adjust their expectations the shift in the CM curve that should have occurred at time T+1 period will happen in the time period T. This will cause the expectations in this model to work in the form of self-fulfilling prophecies. Since the future shocks are known at time period T the change in variables will occur at T so when the shocks does hit it will cause no change at all. This is consistent with the theory of rational expectations and Lucas critique.

3.2.1 The formation of the expectations

We can model the past expectation of the current data in the following way

(16) Et [E [Θt-1] | Θt-1]

The explanation of the notation is the following. Et is the expectation at time T, the current time period when the expectations are formed. E [Θt-1] represents the expectation of some variable Θ that occurred at time t-1 (r any other past period) conditioned on the actual data Θ from the period t-1, but we have obtained the data at the current period. The variables such as this one can be charategorized as the backward looking indicators. So the expectations are formed on the basis were the predictions about some past data correct.

If we were interested in the expectations for this period, we would write
(17) Et [E [Θt] | Θt]

This is in fact current expectation of the current data. Since we are assuming that, the time is in integers we are getting information about some economic variable at time t and that variable will happen at time t.

In fact, the equation (16) is neutral of the examples of expectations that I gave at the beginning.

We assume that agents are both forward and backward looking given the nature of the expectations, but we also assume that they have strong time preferences. The agents will value more the data that is closest to time period t. Because of this the expectations are discounted. The rate of discount will be λ= (1-q) this is in effect the determinant of how forward looking are the agents. If q is very large that would imply the agents are looking only several period ahead of q is very small that would imply the agents are looking many periods ahead. I will get back to some further interpretation of the λ.

So the past expectations of the current data is weighted by ë will be

Current expectations of the future data can be modeled in a similar way. So for the first time period we would have:

$$E[\Gamma] = \lambda E[E[\Theta_{t-1}] \mid \Theta_{t-1}] + \lambda^2 E[E[\Theta_{t-2}] \mid \Theta_{t-2}] + \lambda^3 E[E[\Theta_{t-3}] \mid \Theta_{t-3}] + \ldots\ldots + \lambda^n E[E[\Theta_{t-n}] \mid \Theta_{t-n}] + ad \inf initum \quad (18)$$

(19) Et [E [Čt+1] | Čt+1]

Following the derivation used for the past data we can use the same procedure to derive the current expectation of the future data. This would give;

$$E[\Omega] = \lambda E[E[\Theta_{t+1}] \mid \Theta_{+1t}] + \lambda^2 E[E[\Theta_{t+2}] \mid \Theta_{t+2}] + \lambda^3 E[E[\Theta_{t+3}] \mid \Theta_{t+3}] + \ldots\ldots + \lambda^n E[E[\Theta_{t+n}] \mid \Theta_{t+n}] \ldots ad \inf initum \quad (20)$$

If we were to graph the expected values of E[Γ] and E[Ω] over time we would get a normal distribution with the mean μ and standard deviation σ. The value of the μ is the equation (17). So we get:

(21) μ = Et[E [Θt] | Θt]

In addition, it is important to note the distribution is normal and symmetrical. Therefore, the agents weigh equally the curren expectation of the past data and the current expectation of the future data. From this, we can get the equation for the formation of ε.

$$\varepsilon = \frac{E[\Gamma] + E[\Omega]}{2} \quad (22)$$

So if the system is stabile and there are no shocks to the CM curve; it will not move. That is the agents will ask for the same interest rate in any future time period as they are getting now.

The next issue that comes up is why does the CM curve move. If the world is static, there are no changes in the expectations, that is if the expectations are always correct the distribution will be normal, everything in the world would be predicted and there would be no need to increase or decrease the imposed interest rate. However, if there is some shock to the distribution the expectations do now turn out to be correct; the agent will have to readjust. This readjustment will cause in effect the CM curve to move up or down.

Following this logic, we can write the equation for the CM curve in the following way

(23) $CM_{t+1} = CM_t + \Delta\varepsilon$

Notice that this equation is fundamentally different from the equation (12). The main difference is that the future CM curve is based on the present curve plus the changes in the expectations.

Since the natural equilibrium of the system is for the CM=CMt+1 , that is if there are no shocks to the system the changes in the expectations will not exist and $\Delta\varepsilon=0$. Any adjustment in the expectations will serve the purpose to equalize the CM curve for the next period shifting it up or down depending on the expectation change, thus neutralizing the changes in expectations.

The indicator of the frequency and the impact of shocks and the changes in the CM curve is the variable λ. If λ is close to 1, this would imply that the data coming from distant past or about the distant future is not discounted by much and the agents are very forward looking. This implies that the system is very stabile and agents are very forward looking. On the other hand if λ is close to one this implies that the data coming from the past or about the distant future is very heavily discounted and neglected. Λ very small would imply the system is very unstable. Such instability would make the system much more susceptible to the shocks and the agents would have to adjust much more often and in much larger size them if λ was close to zero.

As we can see, the suceptability to shocks comes directly from the variable λ. This is the main reason why some countries have so little capital mobility and other have so much. The size of the capital flow will indicate how stabile the country is. To this effect the λ is the variance of the capital mobility or we can even call it the security of investment into the foreign country.

3.2.2 Conclusion about the expectations

Although this section was a slight digression from the rest of the paper I have included it into the paper so that I would clarify to the reader what I meant under the term “expectations”. As I have pre-

sented in the previous section; expectations are formed in the same way for all agents equally weighting both the past and the future. The interesting thing is that the CM curve will move only if there are some changes in those expectations due to the information flow and the changes to the future or the past data. This passage is still incomplete and it will be the matter of my future research.

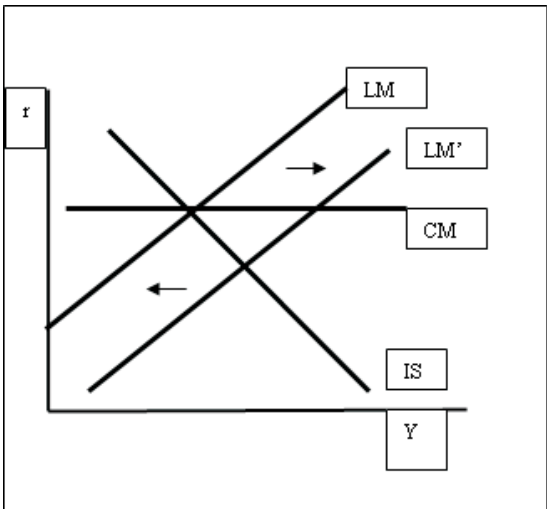
3.3 MONETARY POLICY

The monetary policy in a small open economy is significantly different from the one in large open and closed economy. The differences are mostly advantages in suppressing inflation and the main disadvantage is the fact that the economy in corpore is very open to both cost-push and demand-pull inflation.

The main purpose of monetary policy in a small open economy (like Croatia) is to keep depreciating real exchange rate in a long run to stimulate the exports and depress the imports; to keep the inflation at a acceptable rate and naturally to provide leadership, guidance and maintenance of the monetary and banking system with in the economy.

Let us first examine first the prediction of standard IS-LM model when we have a shift in the LM curve. The shift in the LM curve will decrease the interest rates thus causing the increase in the level of investments. This will in turn stimulate aggregate demand, shift the AD curve to the right and produce higher level of output. However, in the case of IS-LM-CM this is not the case.

Like in the standard IS-LM model in the case of Mundell-Fleming model with an expansionary monetary policy the LM curve will shift to the right and the interest rates will decrease because of the increase of the amount of currency in circulation. However, this shift will cause disequilibrium between the IS-CM curves on one side and the LM curve on the other side. The direct result of this will be the fact that because the domestic interest rate is smaller than the one that the "world' is imposing upon a country there will be a capital outflow, causing increase in r and the LM curve will shift back. In one sentence: In a small open economy with high capital mobility, monetary policy will be ineffective.



The opposite will occur when the Central Bank undertakes a contractionery monetary policy. That is, the LM curve will shift to the left, because the currency has been taken out of the economy and the real interest rates are now higher. There will be a discrepancy between the IS-CM curves and LM curve. The domestic real interest rate will be higher than the one the "World" is imposing on a small open economy, causing the domestic investment to be more attractive to the foreign investors. This will attract foreign capital, causing capital inflow and the LM curve will shift back to its original position and equilibrium with the IS-CM curves. Again we can see that the contractionary monetary policy in a small open economy with high capital mobility is also ineffective.

Summa summarum of this analysis is the fact that in a small open economy monetary policy, in either direction, is ineffective. The capital mobility from the "World" and into the "World" offset any policy measures imposed by the Central Bank. This is a very powerful conclusion when it comes to the decision making inside the walls of a central bank.

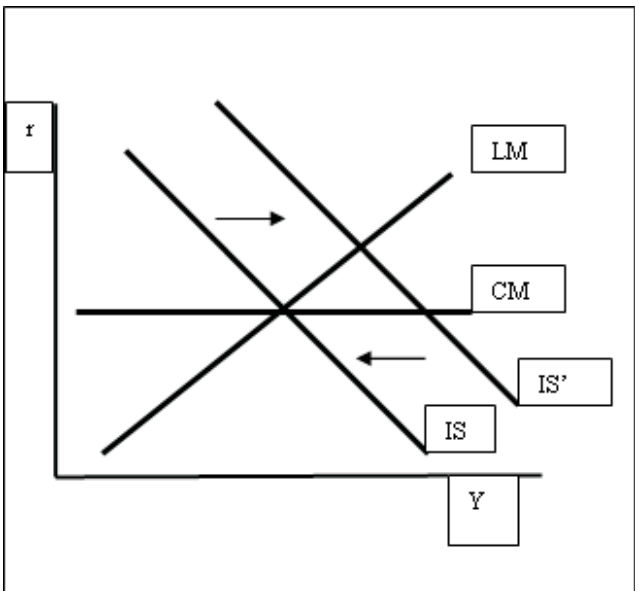
3.4 FISCAL POLICY

Now I will turn my focus to the government side of policymaking.

Recall that the government spending equation is g = g° and g° = t + v. The government revenues are composed of taxed collected from consumers, firms, and the v part, which is borrowing.

In a closed economy model the government is responsible for the IS part of the model. That is in the case the country is in recession the government can increase the spending the thus through the multiplication effect increase the aggregate demand in the economy and increase the level of GDP.

The increase in the government spending will cause the shift in the IS curve to the left. Now the IS curve will be out of the LM-CM equilibrium. The interest rates in the country will be higher that the one that is imposed by the world. The domestic investment will be very attractive to the foreign investors and this will cause an inflow of capital. This capital inflow will decrease the interest rates and the IS curve will shift back into the original IS-LM-CM equilibrium.

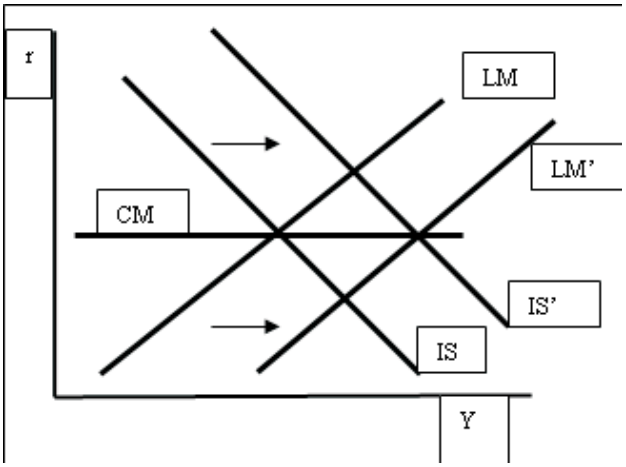


Here like in the case of monetary policy the fiscal policy is also ineffective. This is very interesting for a small open economy and it essentially shows that the government structures because of the increase in the world globalization have to pay attention to the decision making when it come to fiscal policy as well.

3.5 MONETARY AND FISCAL POLICY

Reader that is more careful has probably by now already concluded that the only way to stimulate aggregate demand in the economy is through the use of the IS-LM-CM model is to have coordinated move by both the government and the Central Bank.

The only way to stimulate the aggregate demand and to increase the level of GDP is to have simultaneous increase in the government spending and expansionary monetary policy. This can be done very easily, when the budget is made for the following year both monetary and fiscal policies are matched and there will be a simultaneous shift in the IS and LM curve along the CM curve. The new IS-LM-CM equilibrium will be established along the CM curve, but at the higher level of GDP.



This is the only way that the government and Central Bank can stimulate the aggregate demand and thus offset the existence of the CM curve.

3.6 CONCLUSIONS ABOUT MONETARY AND FISCAL POLICY

From the three examples that I have presented above it is clear that upon a small open economy strong limitations have been imposed due to the capital fluctuation and capital mobility. Such mobility is

very good when the government wants to stimulate the foreign investment, but it can also be an inhibitor when it comes to the movement in IS and LM variables.

In reality, the capital mobility and the CM curve are forcing separate parts of the system to function together.

4. INTRODUCTION TO DATA ANALYSIS

In the previous part, I have analyzed the model and some problems that can be solved using the model. In this part I will take an in depth look into the correlation of the data and the model. The main objective of this part is to see does the data fit the predictions made by the model

4.1 FISCAL POLICY

Fiscal policy has been very strong and important in Croatia. Most of that importance is the perception. In central planning economy like Yugoslavia the government was the integral part of life. The government owned all of the firms and bureaucracy was the Big Brother. Now that Croatia is an open capitalist economy the government is trying to change its role, but still a lot of people's perception of the government is the same.

Croatia is still in a post war period, the government has taken an active roll as a source of investment. The government capital expenditures are per years: 569 million dollars in 1995, 928 million dollars in 1996, 782 million dollars in 1997, 1023 million dollars in 1998, 1252 million dollars in 1999, 644 million dollars in 2000 and 468 million dollars in 2001.

As it is obvious, from the data, the capital expenditures peaked in 1999 and have been falling down in last two years. There are two main reasons for that. The first one is the fact Croatia is getting massively indebted. As a percentage of the GDP, foreign debt was 20.2% in 1995, but in 2001, it was 57.4%. The obligation to repay that debt has put a tremendous strain on the government budget and it caused cuts in government spending. (The data about the government debt is in the appendix). In fact for the 2003 the debt repayment has been projected to be 20% of the government budget.

The data shows that the government has been shifting strongly the IS curve to the right in order to stimulate investments and increase the GDP. The model predicts that such behavior will cause massive influx of the foreign investments due to a higher real rate then the one given by the CM curve.

Unfortunately the data is incomplete and it goes back only to 1998. However, there is still enough data to see the pattern and the fact that the model is correct in predicting the flow of capital.

The data presented here are the net investments. That is, the investments made by Croatia to other countries minus the investments from other countries made into Croatia. If the model is correct, this number should be negative. There should be more capital flowing into Croatia then flowing out. And not to a surprise, the data clearly confirms the model's prediction. In 1998 net investments were -5145 million dollars, in 1999 the net investments were -6334 million dollars, in 2000 net investments were -6862 million dollars and in 2001 the net investments were -5295 million dollars. The surprising fact is that the capital inflow is much greater than the capital expenditures done by the government in the same period. There are several reasons why this occurred. The prime suspects are the real appreciation and the negative current account, but further analysis of those issues is beyond the scope of this paper. The main point I would like to point out is the fact that the model predictions turned out to be correct and the stimulations of the IS curve to increase the GDP are ineffective.

4.2 MONETARY POLICY

The monetary policy data is analyzed from 1995. There are several reasons for that, the first one is the fact that in the early 1990s Croatia suffered from high inflation rates. The inflation rates were several hundred percent per year. At the end of 1993 the inflation rate was 1150%. The second main reason is the fact that the complete data in only accessible from 1994. The main thing that has to be said even before we analyzed the data are yearly variances and variances per period. The variance of changes in M1 in period from 1995 to 2001 is 25%. The per year average variance is 35%. The variance within the time period varies from 109% in 2001 to 9% in 1996. The main reason for this is the fact that the Board of Governors of Croatian Central Bank behaves like the currency board whose main objective is to keep

the nominal exchange rate constant or within the a small rage of 3%. Croatian National Bank is committed to something like gold standard, but we can call it the "currency standard" where Croatian Kuna is fixed with the Deutsche Mark and now with the Euro. Although this does provide monetary stability and correlates the inflation to the inflation in the Eurozone it limits the monetary authority to seriously commit to contractinary or expansionary monetary policy.

The main question in our analysis is: how does this explain the model? This fact goes strongly along with what the model predicts. The policy committed to fixed exchange rate makes sure that the LM curve is constantly balanced with the IS and CM curve. When Central Bank adjusts the exchange rate of Croatian Kuna with euro, it is effectively putting the LM curve back into the equilibrium. Since Croatia is small, in monetary terms, the changes and shifts in LM curve occur very fast and the curve is pushed back into equilibrium in matter of days.

If there is a disturbance in the exchange rate due to the speculative attack or because of changes in supply and demand, the Croatian National Bank will notice it and act upon it in a matter of days. This is why the variance is so high and the changes in M1 are so big and so often. (look at the data in appendix)

4.3 OMOS IN CROATIA

The main way for a large economy to increase the currency in circulation in order to decrease the interest rate and to stimulate the growth through the spending in the economy is through the purchases of debt instruments issued by the central government. The prime example of this is the USA and the behavior of the Federal Reserve System. When the Fed decides the economy needs some stimulus the FOMC will declare the Fed's target interest rate is going to be lowered. In order to achieve this in the market the Federal Reserve brokers will go into the open market and purchase the government bonds. The bonds are purchased for the cash Fed prints. This is pretty much the main operating framework for the increase of the currency in the circulation. When the Fed decides the economy is undergoing a significant inflationary pressure, the Fed will do the opposite in order to retract the money from the economy, decrease the currency in circulation and

decrease the money aggregates thus stopping or preventing the inflation.

Similar mechanisms can be used in Croatia. The Central bank can also buy and sell the debt instruments that are issued by the Ministry of Finance. The main disadvantage of this is the fact that the government can use such system for seniorage in order to finance the budget deficit. Such behavior will naturally be counter productive and will cause inflationary pressure in the economy.

In order to prevent such scenario and potential abuse of the system Croatia has slightly different system of controlling money aggregates. The main idea is still to buy something and increase the amount of currency in the economy and the levels of money aggregates. Since the Central bank does not buy the government debt, they buy so-called "hard currency" in the case of Croatian National Bank they mostly buy Euros and before that, they would by the Deutsche Marks.

The principal is still the same. When the demand for currency is large, like in the middle of summer because of the tourist season the central bank will go to into the open market and buy Euros from commercial banks since Croatia does not have a Forex market. In winter when the demand for Kunas is smaller, the Central Bank will buy Kunas by issuing short-term debt instruments, which will pay very small interest rates but are attractive to commercial banks that do not want to hold lot of cash just sitting around. The debt instruments are essentially certificates of deposits at the Central Bank. The deposits are sold through the Dutch auction to whoever offers the smallest interest rate on them.

The mechanism is rather specific, but at the same time, it is very good because the amount of foreign reserves is constantly increasing. The reader has probably noticed that when the central bank is putting money into the economy, it is buying Euros, but when it is taking money out of the economy, it is issuing CDs that are sold in open market. This in effect has the ability to constantly increase the foreign reserves of the Croatian Central Bank. The latest data goes to the December of 1992 when the foreign reserves were 166.8 million of dollars. In August of 2002 those reserves were 5.7 billion dollars.

Another benefit of a small open economy is the fact that there is not much currency in circulation. Currently the value of pieces of paper the which it says Kuna is only around 21 billion Kunas (July 2002) or

something like 2.8 billion dollars (1 Kuna = 7.5 $, November 2002). So in order to keep the system stabile the Central bank needs around 1 billion dollars, but now they have 5.7 billion dollars and that money is doing nothing except sitting in the vaults. .

4.3.1 Has the monetary policy been used properly?

Croatian monetary aggregates have been stable and for nine years. There has been no significant increase in the rate of inflation and the rate of inflation per see has been very stabile, within the levels that are more then acceptable to an average macroeconomist. In 1998 inflation was 5.4% and in subsequent years 4.4%,7.4% and in 2001 it was, a record low, 2.6%. (for more data see the appendix)

Although Central Bank is the main contributor, the monetary stability it has still failed to be a significant contributor the growth of Croatian economy.

Here is an interesting discrepancy between small and large open economy. In a big open economy like the United States monetary policy does not have a long-term impact on growth. In fact, we assume monetary neutrality much before capital has time to adjust to the monetary shocks. However, in a small open economy, heavily depending on export markets like Croatia and due to the model presented, if properly used monetary policy has much a lot of power on long-term growth through the manipulation of the real exchange rate. The long term depreciation of the real exchange rate will have a positive effect on the exports and negative effects on the imports. This export-imports tradeoff can be positively used to fuel the long term growth.

Unfortunately the model I created is a short term model and does not make predictions about the long term movements in the real exchange rate.

The equations in the part two of this paper heavily depend on the real exchange rate. In part three I showed the monetary policy shocks will be offset by capital inflows or outflows, but that does not stop the Central Bank to depreciate currency several points above the inflation rate each year. This becomes even easier to do when the open market operations are set up the way they have been in Croatia. Since the market is very small, it is relatively easy to affect nominal exchange

rate. This kind of slow real depreciation will cause A* to increase and open new markets to Croatian producers.

The imports are a problem because the imports of the goods that could be produced in the country cause the destruction of the domestic industry through the real exchange rate. The main reason for this is the overvalued currency. The overvaluation of currency exhibits itself through the constant real appreciation of the Croatian currency. The data shows that the real exchange rate did not change much in the six year period analyzed.

4.4 EFFECTS OF MONETARY AND FISCAL POLICY

In part three of this paper the model predicted the only way for the monetary and fiscal policy to be effective is to have them work together, at the same time and to be approximately the same size. We have seen that due to the way Croatian monetary authority conducts monetary policy the LM curve is constantly kept in the IS-LM-CM equilibrium. On the other hand, the government is undergoing constant shocks to the government expenditures trying to stimulate the aggregate demand, but the net effect has been zero. The model predicts the government policies to be offset by the capital inflow and that the end effect is exactly what has been happening making in turn government policies ineffective.

Such policies and the discrepancy between the way monetary and fiscal policies are conducted is inhibiting the long term growth.

CONCLUSION

In this paper, I have developed a macroeconomic model for a small open economy. The focus of the model was the impacts the monetary and fiscal policy have on a small open economy give the fact that the capital is free to flow in and out of the country. The data used was from Croatia, a small country is the middle of Europe that I perceive is a good subject to see if the model works.

The data is very consistent with the model. The model predicted monetary and fiscal policy, unless used together will not have any effect the aggregate demand and output and in fact, the predictions were consistent with the data.

SAŽETAK

Cilj ovoga rada je istražiti primjenjivost Mundell-Flemingova modela. Taj je model razvijen 1960-ih godina s namjerom otvaranja standardno zatvorenih ekonomija kejnezijanskog IS-LM modela i prilagođavanje varijabli za tijek kapitala i ostale šokove koji iz njega mogu proizići. Rad detaljno istražuje modele te uspoređuje IS-LM model zatvorene i otvorene ekonomije. Isto tako, proširuje model za primjenu na standardnu teoriju racionalnih očekivanja. Nakon izvođenja modela, primjenjujem ga na malu otvorenu ekonomiju. U ovom sam slučaju izabrao Hrvatsku – malu otvorenu ekonomiju usred Europe. Hrvatska je izabrana zato što prolazi tranziciju iz socijalističke planirane ekonomije prema otvorenoj kapitalističkoj ekonomiji te je vrlo podložna tijekovima kapitala. Ovaj model vrlo dobro odgovara podacima i dokazuje da monetarna i fiskalna politika, ako se primjenjuju odvojeno, neće imati utjecaja na ekonomiju zbog tijekova kapitala.

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DATA APPENDIX

GDB (in mil. USD, nominal)								
1993.	**1994.**	**1995.**	**1996.**	**1997.**	**1998.**	**1999.**	**2000.**	**2001.**
10.903	14.585	18.811	19.872	20.109	21.628	19.906*	18.427*	19.536*

GDB –changes per year (nominal)								
1993.	**1994.**	**1995.**	**1996.**	**1997.**	**1998.**	**1999.**	**2000.**	**2001.**
-8,0	5,9	6,8	5,9	6,8	2,5	-0,9*	2,9*	3,8*

GDB -per capita (in USD)								
1993.	**1994.**	**1995.**	**1996.**	**1997.**	**1998.**	**1999.**	**2000.**	**2001.**
2.349	3.137	4.029	4.422	4.398	4.805	4.371*	4.153*	4.403*

Inflation (% at the end of the period)								
1993.	**1994.**	**1995.**	**1996.**	**1997.**	**1998.**	**1999.**	**2000.**	**2001.**
1.149,7	-3,0	3,7	3,4	3,8	5,4	4,4	7,4	2,6

Population (in mil.)								
1993.	**1994.**	**1995.**	**1996.**	**1997.**	**1998.**	**1999.**	**2000.**	**2001.**
4,6	4,6	4,7	4,5	4,6	4,5	4,6	4,4	4,4

Exports (in % of GDP)								
1993.	**1994.**	**1995.**	**1996.**	**1997.**	**1998.**	**1999.**	**2000.**	**2001.**
56,8	49,8	37,1	40,1	39,9	39,5	40,8*	47,0*	49,3*

Imports (in % of GDP)								
1993.	**1994.**	**1995.**	**1996.**	**1997.**	**1998.**	**1999.**	**2000.**	**2001.**
52,9	47,4	48,7	49,7	56,6	48,7	49,2*	52,1*	54,7*

Current account (in % of GDP)								
1993.	**1994.**	**1995.**	**1996.**	**1997.**	**1998.**	**1999.**	**2000.**	**2001.**
5,8	4,9	-7,5	-4,8	-12,5	-6,7	-7,0*	-2,4*	-3,2*

Foreign debt (in mil. USD, at the end of the period)								
1993.	**1994.**	**1995.**	**1996.**	**1997.**	**1998.**	**1999.**	**2000.**	**2001.**
2.638	3.020	3.809	5.308	7.452	9.586	9.872	11.002	11.216*

Foreign debt (in % of GDP)								
1993.	**1994.**	**1995.**	**1996.**	**1997.**	**1998.**	**1999.**	**2000.**	**2001.**
24,2	20,7	20,2	26,7	37,1	44,3	49,6*	59,7*	57,4*

Debt repayment (in % of exports)								
1993.	**1994.**	**1995.**	**1996.**	**1997.**	**1998.**	**1999.**	**2000.**	**2001.**
9,9	9,0	10,1	9,0	9,9	12,5	20,7*	23,0*	22,6*

Foreign reserve of the Croatian National Bank (in mil. USD, at the end of the period)								
1993.	**1994.**	**1995.**	**1996.**	**1997.**	**1998.**	**1999.**	**2000.**	**2001.**
616	1.405	1.895	2.314	2.539	2.816	3.025	3.525	4.704

Average exchange rate (HRK : 1USD)								
1993.	**1994.**	**1995.**	**1996.**	**1997.**	**1998.**	**1999.**	**2000.**	**2001.**
3,5774	5,9953	5,2300	5,4338	6,1571	6,3623	7,1124	8,2768	8,3391