

GLOBAL BANKING AND THE ROLE OF THE LENDER OF LAST RESORT

GLOBALNO BANKARSTVO I ULOGA POSLJEDNJEGA POSUDITELJA

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Abstract: *The paper analyses the role of the lender of last resort in a global economy. The crisis started in 2008 has shown that in global crisis the problem of banks is not only with liquidity, but also with the lack of capital. In order to fully understand the bank's need for capital it is necessary to understand the process of globalization and development of modern economic movements. The paper starts with the model of closed economies which resembles the "island model", in the second stage of the model the globalization is introduced and communication between the islands. The model created by the authors shows how globalization is not only limited to flow of goods, services and capital, but can also be seen as changes in the variables optimized by the participants in the economy. The model shows how globalization process has deeply changed economic relationships. Special attention is paid to changes in monetary economy during the globalization process. Authors conclude that special global lender of last resort for liquidity is not a guarantor of stability and a last lender as global source of capital during crisis is hard to put into practice in a highly globalized world. Considering this, the best path towards global stability is the control of the scope of monetary process and monetary multipliers which exist in the global world.*

Key Words: *Globalization, Monetary Economy, Real Economy, Optimization.*

Sažetak: *Rad analizira ulogu posljednjega posuditelja u kontekstu globalne ekonomije. Kriza iz 2008. pokazala da problem banaka u globalnim krizama nije samo problem likvidnosti nego je i nedostatak kapitala. Da bi smo mogli razumjeti potrebu banaka za kapitalom potrebno je prije svega razumjeti proces globalizacije i razvoj modernih ekonomski tokova. Rad kreće od modela zatvorene ekonomije koji je sličan takozvanome „modelu otoka“, u drugoj fazi modela se uvodi globalizacija i komuniciranje između otoka. Model koji su autori postavili pokazuje kako se proces globalizacije ne očituje samo u protoku roba, usluga i kapitala nego kompletno mijenja varijable koje optimiziraju sudionici u ekonomiji. Model pokazuje kako je proces globalizacije duboko promijenio ekonomske odnose unutar ekonomija. Posebno se analizira kretanje monetarne ekonomije u procesima globalizacije. Autori iznose stav da uloga jednoga globalnoga posljednjega posuditelja kao garantora likvidnosti nema smisla, a uloga globalnoga garantora kapitala banaka u slučaju krize je teško operativno provediva u visoko globaliziranome svijetu. Sukladno ovome najbolji put za globalnu stabilnost jeste kontrola opsega monetarne ekonomije i multiplikativnih procesa koji postoje u globalnim monetarnim ekonomijama.*

Ključne riječi: *globalizacija, monetarna ekonomija, realna ekonomija, optimizacija.*

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1. Introduction

The purpose of this paper is to understand the model hazard of the lender of the last resort in global economy and how has the crisis of 2008 changed the role of the lender of the last resort towards the banks in the global economy. The standard practice of the lender of the last resort is that the role of the lender of the last resort is fulfilled by the central bank, which is the also the only legal entity in the economy with the right to create money (and at the same time liquidity) in the economy. The central bank operates within a defined legal framework which gives her the ability to lend money to banks which are experiencing the liquidity problems. This mechanism turned out to be a key feature in the 2008 crisis when the economies around the world experienced a global monetary contraction and the central banks had to step in to be able to guarantee the liquidity of the whole economic system¹. An interesting question is does the existence of the lender of the last resort increase or decrease the risk of the country's banking system²? The existence of an entity which is willing to help banks when they have liquidity problems definitely should bring about the increase in the stability of the financial system, because all the participants in the economy know there is a guarantor of stability in case of crisis. The second side of this coin is the possibility that the banks will take on more risks seeing higher returns knowing there is an entity which will provide stability in case of crisis. In case the liquidity risk becomes too high for banks there is always a possibility to turn towards the lender of the last resort and stabilize their business. This duality clearly creates a classical possibility of moral hazard.

The financial and economic crisis which started in 2008 has brought to surface several new challenges which did not previously exist for the global economy. The first challenge is the fact that individual lenders of last resort in each country are sufficient when there is a crisis just in their economy, however the question remains is the sum of all individual lenders of the last resort enough to attack the problems brought about by crisis on the global level. The question is: It possible for individual cen-

tral banks to coordinate their activities and are all activities of the individual central banks in the same direction³?. In the aftermath of the crisis the fact remains the central banks have prevented the global collapse of liquidity. The second challenge was the control of the financial crisis and the prevention of the spill over of the crisis onto real economy, the central banks have failed to meet this challenge. The third challenge, which has remained unanswered, is that the crisis of 2008 was not only about the liquidity of the banks and the banking system, but was also about the capitalization of individual banks which has been heavily jeopardized by the spill over of the crisis into the real sector. The spill over back from real to financial sector has created a feed-back effect. The monetary crisis started in banks, has spilled over onto the real sector, then the crisis in the real sector caused losses for banks feeding back the crisis into the monetary system. Global economy was not ready for the fall of the banks due to lack of capital in those banks.

The crisis from 2008 in the perception of the authors is just a first global crisis and it represents a benchmark for any future business cycle oscillations. Because of this is it foremost important to understand what brought about the crisis, but also what are the possible future measures which can be undertaken in order to prevent the future crisis like the one from 2008. One of the measures proposed is the creation of a fund which would serve as lender of the last resort towards the banks which have problems with the liquidity or capital.

The objective of this paper is to show that the thesis of a global lender of last resort is not operationally feasible, at least not in the existing economic framework. In the global economy the rules and relationships between the individual players are different then the relationships within an individual economy. It is technically possible just to copy-paste the lender of last resort of liquidity and capital which can be found in one economy onto a global economy, however the practical functionality of this body is simply not possible. In order to be able to fully understand the role of the lender of the last resort of liquidity or capital it is necessary to understand the relationship between the monetary and the real economy. It is especially important to show how this relationship has changed and evolved over

¹ Reise (2010, 2010a) analyses the behavior of FED during the crisis of 2008 and proposes an alternative methods in increasing the liquidity of the economy.

² In an paper by Kareken (1983) the role of the insurer of deposits is analyzed and how the deposit insurance and the lender of the last resort create stability for the banking system.

³ German finance minister Wolfgang Schäuble has commented on the FED announcement of quantitative easing as „clueless“ http://www.huffingtonpost.com/2010/11/05/fed-bernanke_n_779393.html

time. An example of the investigation of the relationship of the real and monetary economy can be found in Sargent (2010) which shows the relationship of real and monetary economy from the foundation of the Federal Reserve System until today.

Parallel with the relationship of monetary and real economy it is necessary to analyze the relationship between the liquidity and capitalization of the banking system. The crisis of 2008 showed that simply increasing the liquidity of the system is not a solution for the crisis, an alternative solution for liquidity input was proposed by Reise (2010a) who shows the problem of the liquidity of the banking system, but does not analyze the problem of the capitalization of the banking system. During the crisis, because of the actions of the central banks the liquidity of the system has been preserved, but the lack of capital in banks has forced banks to ask for help from the government. The problem of the global capitalization of banks has been thoroughly investigated. This paper tries to contribute in exactly this way, but in order to understand how the global system has influenced banks it is necessary to understand the process of globalization as well.

This paper tries to model a group of closed economies and how opening of those economies has influenced the behaviour of participations in the economy. The second part of the paper sets up the model. The model starts with the model of closed economy, which is then opened to the processes of globalization. Part three analyzes the process of globalization and how this process has created framework for 2008 crisis. In our model the crisis which is manifested in decrease of consumption and lack of capital for banks is simply a part of the system. Part four concludes.

2. Model

The model created in this part has two roles. The first role is to show the behaviour and the differences in behaviour of economic agents in a closed and in an open economy. The second role of the model is to show the relationship between real and monetary economy in an open and closed economy.

The model which we are going to develop has to meet several criteria, the first criteria is to be able to represent set of closed economies which then gradually create economic relationships. In order to be able to do this we are going to use a premise developed by Lucas (1972, 1973, 1975). In these papers economy constrains a large number of

islands, each island has its own economy with its own characteristics. Lucas used this model in order to show how islands are not able to differential between real and monetary shocks to price level. Using these models Lucas showed how it is possible for prices to increase just on lack of information which cause wrong expectations, even if those expectations are created rationally. In our model we will analyse the behaviour of economic participants in highly globalized world, because of this Lucas' model can be a good starting point for creation and development of the model. Lucas starts with islands which have their own developed economies, this premise we will also use in our model, because each economy in the global system will be presented as a separate island. In this way it is possible to set up a thesis where each economy has its own characteristics, different from other economies with possibility of communication between the economies. The second premise which we are going to take from Lucas is the assumption of rational expectations, although the economies have different characteristics they all follow the same economic model. Because of the imposition of the rational expectations we do not need to model each economy by itself, it is enough to model one representative economy.

In the first step we are going to model a representative island which is a closed economy and without any contact with the other islands. Latter we are going to expand a model an introduce economic communication between the islands. The participants in the economy of each island are:

Households which save, take loans from banks, receive wages for labour. The households buy goods and services initially only produced on the island, but latter also imported goods and services.

Firms which produce goods and services which are initially only sold on the island, but latter can be exported.

Government which conducts fiscal policy and determines tax rates.

Banks which collect savings and give loans, in the open economy the banks can also import and export savings.

Central bank which conducts monetary policy.

In order to understand the behaviour of economic participants it is important to understand the difference between open and closed economy. It is especially important to understand the process of globalization and how the process of globaliza-

tion can change the behaviour of economic agents. It is important to differentiate the behaviour of central bank and banks in closed vs. open economies. In our model we are going to start from a model of closed economy (island) which we are going to gradually open towards other economies (islands), the process of transformation from open to closed economy is the process of globalization.

3. Closed economy

First we shall model closed economy and the move to modelling open economy. During this process we will emphasize the differences between the open and closed economy, since those differences are the main contribution of the paper. The main characteristics of the model of closed economies is that there is no economic communications between the islands. There is no exchange of goods and services and no flows of capital. In this setup each island is left for itself and can not spent more then it has produced. Limited market also limits the economy and consequently behaviour of each participant in the economy.

3.1 Households

Each island has a number of households which are infinitely lived and the number of households is constant. Each household is employed and receives a wage. Each households tries to maximize the present value of utility which comes from consumption. The household also receives disutility from work. Representative household tries to maximize the following problem:

$$\max V(A) = E \left[\sum_0^i \beta^t \left[\left(\frac{c_t}{1-\gamma} \right)^{1-\gamma} - \left(\frac{l_t}{1-\sigma} \right)^{1-\sigma} \right] \right] \quad (1)$$

Where c is consumption, l is labour, E is rational expectations operator, β is discount factor, and σ and γ are elasticities. Household in each time period has the following sources of income:

$$I_t^e = w_t^e + \tau * S_{t-1}^e + t_t \quad (2)$$

I are expected sources of funds, w is a net of taxes wage, S is savings inherited from the previous period, t are government transfers. In each period households has the possibility to liquidate a portion of savings in the amount of τ of total savings. Parameter τ has range $0 \leq \tau \leq 1$ implying the household can opt not to liquidate savings at all, liquidate a portion of existing savings or liquidate

the total amount of savings. Superscript e denotes expectations.

After defining the sources of income we can define the usage of funds. The household expenditures in each period can be defined as:

$$E_t^e = c_t^e + s_t + \kappa * \Phi_{t-1}^e \quad (3)$$

E are total used funds, c is consumption, s is savings in period t , and Φ is the total debt of the household. In each time period the household can used a portion of funds to repay a fraction of existing outstanding credit $\kappa\Phi$. Factor κ can have the value of $0 \leq \kappa \leq 1$ and has the same characteristics as the parameter τ . Of course τ and κ do not have to be the same in each period. it is important to note that new savings and repayment of credit are autonomous decision of the household and that there is a distinction between savings and repayment of credit.

In the model of closed economy credit is limited. Households can only have housing loans which they have received in the time period t_0 . Consumer loans or any kind of debt which can be used to finance the life above the means of the household do not exist in the closed economy. The households have only two possibilities to increase their consumption over time: increase of savings or increase of wage. The interest rate on both savings and loans for households is exogenous and variable in each period. The bank determines the interest rates in each period and the households have to except the interest rates as given. We are also going to assume the households are perfectly inelastic towards interest rates on both savings and loans.

The households have to buy a housing object and this purchase is done in t_0 , since the interest rate on loans is fixed for all time there is no change of behaviour of households due to change in the interest rate, nor does the household have any possibility to alter economic decisions because of the change in interest rate. This also implies savings and consumption are not related to interest rates, but to personal preferences of the households. Total used funds and total income have to be equal we have that $I = E$. Now we can define:

$$c^e = w_t^e + t_t + \tau * S_{t-1}^e - s_t - \kappa * \Phi_{t-1}^e \quad (4)$$

Total savings S in each time period is the summation of savings from each individual periods increased by the interest rates.

$$S_t = \sum_0^{t-1} s_{t-1} (1+r_t)^{t-1-i} \quad (5)$$

Credit has been separated from savings and has been designated as “necessary evil”. In model of closed economy a housing loan is a form of investment, because household is purchasing durable good. Because of the existence of collateral for each loan, credit in closed economy is completely based on real economic activity. Bellman equation for the household problem is:

$$V(A) = \max \left\{ u(c, l) + E \left[\sum_0^i \beta^i \left[\left(\frac{c_t}{1-\gamma} \right)^{1-\gamma} - \left(\frac{l_t}{1-\sigma} \right)^{1-\sigma} \right] \right] \right\} \quad (6)$$

With following conditions

$$c^e = w_t^e + t_t + \tau * S_{t-1}^e - s_t - \kappa * \Phi_{t-1}^e$$

$$I_t^e = w_t^e + t_t + \tau * S_{t-1}^e$$

$$\Phi_t = \Phi_0 - \sum_0^t (\kappa_t \Phi_t - i_t \Phi_t)$$

Model created is indirectly focused on the maximization of utility from consumption, because the consumption is determined through the decision of the level of savings, debt repayment and amount of liquidated savings. Consequently when the households decides on these three variables the amount of consumption is defined. So the policy function as solution for the problem of dynamic programming for households is:

$$f (s^*, \tau^*, \kappa^*) \quad (7)$$

Again it is important to emphasize the household can not live above its means and it can not consume more then it has. The consumption is limited through the growth of wage, which again is limited through the real economic growth. The uncertainty for households in closed economy comes only from the fact that household does not know what is the future wage. Other forms of uncertainty do not exist.

3.2 Firms

There is a large number of firms on the island. Each firm produces goods or services. The production function for a representative firm is:

$$y_i = a^{1-\alpha-\beta} k^\alpha l^\beta \quad (8)$$

Production depends on the technology a , capital k and labour l , superscripts α and β mark the portion each factor participates in production. Firms have the cost of capital, which depreciates in

each time period and the cost of labour. The depreciation of capital is compensated through the investments in new capital, so the amount of capital in any firm over time is given with:

$$k_t = i_t + \delta k_{t-1} \quad (9)$$

Where i are the new investment, δk is the amount of depreciated capital from the previous time period. Cost of labour in each time period is equal to $l=wn$, where n is the number of workers the firm employs. Given the income and expenses the profit function for the firm is:

$$\pi_i = a^{1-\alpha-\beta} k^\alpha l^\beta - wn - i \quad (10)$$

We can now aggregate all the firm on the island to get

$$Y = \sum_1^n a_i^{1-\alpha-\beta} k_i^\alpha l_i^\beta = A^{1-\alpha-\beta} K^\alpha L^\beta \quad (11)$$

Y can also be interpreted as the gross domestic product on each island. Like we have aggregated the total production on the island we can also aggregate the total investments and total profit on the island. Total investments on the island in each period are equal to:

$$I_t = \sum_1^n i_t \quad (12)$$

Total profit on the island in each time period is:

$$\Pi = A^{1-\alpha-\beta} K^\alpha L^\beta - WN - I \quad (13)$$

After modelling the households and firm we will move on to model fiscal and monetary policy. First we are going to model fiscal policy.

3.3 Government

Government on the island is in change of the fiscal policy. The income of the government is generated through the taxation of consumption and taxation of corporate profits. The government in each time period can also issue bonds, but the bonds have to be repaid in the next time period. The total receipts the government collects in each time period are:

$$T_t = \theta \Pi_{t-1} + \sum_1^n \lambda c_t + B_t \quad (14)$$

The total government tax receipts are equal to the corporate profits taxed at fixed rate θ , taxa-

tion of consumption of each of the n household at the rate of λ and issued bonds. The usage of collected funds is distributed on government expenditure, government transfers and the repayment of bonds from the previous period, increased for the amount of interest r which has to be paid. So we have that:

$$T_t = G + t + rB_{t-1} \quad (15)$$

It is important to note in this construction of the government constraints we have a clear ricardian equivalence. Every increase in government consumption through the issuance of bonds has to be financed in the future through new taxes, increase of economic activity or increase in taxes. The government in this model does not have the ability to accumulate debt. The only possibility we are going to allow is the montarization of debt through the purchases of the central bank.

In case the central bank purchases the issued bonds, the government does not have to repay the bonds purchased by the central bank. When the central bank purchases the bonds, the bonds are automatically converted into no interest perpetuities. The government has the obligation to repay the debt in case the central bank decides to decrease the quantity of money in the economy though the sale of government bonds. In this case the government has to purchase the bonds, which is equivalent to repayment of the bonds since the bonds expire in the next period. It is understood the monetary and fiscal policy are separated and that fiscal policy can not force the monetary policy to purchase debt. In the model the households are allowed to save in banks, but the households are not allowed to purchase bonds. Only banks are allowed to purchase bonds as reserve of liquidity, but the banks simply can not lend long term money to government since debt has to be repaid in the next period.

3.4 Banks

Banks collect savings from households and have lend to households housing loans. In each period banks also can purchase government bonds, but only if they have enough of surplus liquidity. The bank's assets contain the following items: loans to households Φ , government bonds B and surplus of liquidity Γ . We shall assume that there is no reserve requirement or any other regulation imposed by the central bank. The bank's assets can be represented as:

$$A = \begin{bmatrix} \Phi \\ B \\ \Gamma \end{bmatrix} \quad (16)$$

In the bank's liabilities where is capital C and household's savings S , the bank's liabilities can be shown as:

$$L = \begin{bmatrix} S \\ C \end{bmatrix} \quad (17)$$

The bank keeps the profits and does not pay out any dividends. Profit for banks in each time period is:

$$\pi = [r_l \quad r_b] \begin{bmatrix} \Phi \\ B \end{bmatrix} - [r_s \quad 0] \begin{bmatrix} S \\ C \end{bmatrix} \quad (18)$$

The bank receives interest income on assets. The income comes from loans to households at rate r_l and government bonds at rate r_b . The bank does not have the cost of capital and the interest rate on savings is r_s . The bank tries to maximize the present value of future profits:

$$\max V(\pi) = E \sum_1^n \beta^t \omega A_t \quad (19)$$

For mathematical simplicity we are going to introduce parameters ω which is the net return on total assets of the bank. Bellman equation for banks is:

$$V(\pi) = \max_{\pi} \{u(r_l r_b r_s, \Phi, B) + E[V(\pi_{t+1})]\} \quad (20)$$

Policy function for banks is:

$$h(r_l^*, r_b^*, r_s^*, \Phi^*, B^*) \quad (21)$$

The existing model allows banks to determine the interest rates on assets and liabilities. The bank can determine its own structure of assets and liabilities and there is no regulation of the central bank which imposes the structure of assets and liabilities on the bank. The bank conducts credit policy on its own without pressure from the government or the central bank. The bank's interest rate in assets is only determined by its interest rate in liabilities and there are no cost of regulation so the interest rate in the economy will directly depend on the quantity of money in the economy.

3.5 Central bank

Central bank conducts the monetary policy autonomously, regardless of the fiscal policy or the credit policy of the banks. The central bank uses quantitative theory as the foundation for the conduct of monetary policy:

$$MV = PQ \quad (22)$$

We are going to assume V is constant and that the money in the economy is perfectly neutral. This was also given with the assumption of complete employment. The increase of quantity of money in the economy will only increase prices in the economy, unless there is an equivalent increase in the demand for money in the economy because of increase in the real economic activity. Demand for money is given with:

$$M^d = f(Q, r) \quad (23)$$

During the conduct of the monetary policy the central bank tries to solve what Sargent (1999) called a Phelps problem:

$$\min E \sum_0^T [(q_t - \bar{q})^2 (\pi_t - \bar{\pi})^2] \quad (24)$$

Where q is real rate of growth in some period, \bar{q} is a potential rate of economic growth, π is inflation, and $\bar{\pi}$ is the wanted rate of inflation. In order to solve the given problem central bank controls the quantity of money in the economy and not the interest rate in the economy. The central bank changes the quantity of money in the economy through the purchase and sale of government bonds.

The model presented in this part of the paper is the model for closed economy. Each participant in the economy bases its behaviour on real economic activity on the island. The banks only give loans to government and for housing loans, so the banks only fund real economic activity. It should also be noted that the companies are self financing and do not need banking loans. Firms also do not have accounts in the banks. Households can only consume what they have earned or saved in the past, government as well. The government deficit is not possible in the long run and the monetarization of debt is only possible if the central bank, on its own, decides to purchase bonds. Central bank monitors the economic activity and in accordance buys and sells government bonds, but this is done only if there an increase in the demand of money based on real economic activity.

Although there are may islands, each island is an economy onto itself. There is no flow of goods and services between the islands regardless of the size of the economy on each island or number of agents on each island. These restrictions are going to be relaxed in the next part of the paper.

4. Open economy

In the first part of the model the main assumption was that each island is an economy onto itself and that there is no communication with other islands. In this part we are going to remove the assumption and allow communication between the islands thus introducing the process of globalization. The process of globalization will be defined as the process of exchange of goods, services and capital between the islands. The level of globalization depends on the freedom of movements of goods, services and capital between the islands.

We shall assume the process of globalization is exponential and that once the process starts it can not be stopped or turned. However we are going to allow for each island to have its own level of globalization and speed of the globalization differ between the islands. Also the process of globalization for one island vis-à-vis other islands can differ, meaning an island can be more open towards one island or a cluster of islands then towards another island or another cluster of islands.

In order to get total globalization we have to sum up all the individual stages of globalization of each island. For mathematical simplicity we are going to assume there are m islands. Globalization process shall be defined as:

$$f(y) = \sum_0^m (e_i^y - 1) = x \quad 0 < x < em$$

$$em = g \quad x = g \quad (25)$$

Where y is state of globalization of island q towards island x , parameter y has the value $0 \leq y \leq 1$. when $y=0$ the island q is closed towards island x , when we have that $y=1$, island q is completely open towards island x . When one island has the sum of openness towards all other islands $x=0$, globalization for that island does not exist. The island is not open towards any other island and does not have any connection with other islands. In this case the island behaves like a closed economy from the previous part of the paper. When an island has globalization of $x=m$ for all other islands then the process of globalization for this particular island is finished. The model of islands is build on the model from the previous part. This implies the island already has a developed economy before the process of globalization starts. The main differences between the islands before and after the process of globalization will be manifested in the behaviour of economic agents on the island. This will be reflected in the model we develop, special attention will be paid to

banks and central banks in order to see how does the flow of capital influence the behaviour of economic agents.

4.1 Households

The modelling will start with the household, which is a foundation of both closed and open economy. The most significant difference between open and closed economy for households will be that in the open economy we are going to allow households access to loans which are not only housing loans. Because of this ability the households have the possibility to increase their consumption through borrowing funds from the bank. Before the start of the process the households have the existing housing loan. Household in a time period t , after the start of the process of globalization has the following expected sources of funds:

$$I_t^e = w_t^e + \tau * S_{t-1}^e + \phi_t + t_t \quad (26)$$

I are expected sources of funds, w is a net of tax wage. In the model of globalization we are going to remove the assumption of full employment and introduce unemployment in the model. Globalization implies the possibility of importing goods and services, because of this there is a possibility the island does not need its own production, thus introducing the possibility of unemployment in the island economy. S is savings which is inherited from the previous period, ϕ are loans taken from the bank and t are the government transfers. In each period the household has the possibility to liquidate a portion of its savings and the parameter τ has the same values as in closed economy $0 \leq \tau \leq 1$, superscript e is expectations.

The funds the households use in each time period can be defined as:

$$E_t^e = c_t^e + s_t + \kappa * \Phi_{t-1}^e \quad (27)$$

E are total used funds, c is consumption, s savings, and Φ is total household debt which is in foreign currency⁴. In each time period the households can use portion of funds to repay the existing debt $\kappa\Phi$. Factor κ has values $0 \leq \kappa \leq 1$. Just like in case of the closed economies the households face risks because they have the exogenously imposed exchange rate and interest rate, while savings is autonomous decision of the household. Consider-

ing the expenditure have to be equal to the sources of funds we have $I = E$ so we can define:

$$c^e = w_t^e + \Sigma + \Gamma^e \quad (28)$$

Where we have:

$$\Sigma_t = \phi_t - s_t \quad (29)$$

$$\Gamma_t^e = \tau_t * S_{t-1}^e - \kappa_t \Phi_{t-1}^e \quad (30)$$

Σ is the net increase or decrease in savings. In case the households save more then they borrow the economy will have an increase in aggregate savings. In case the households borrow more then they save, the economy will have an increase in consumption. The parameter Γ represents the relationship between repayment of credit and liquidation of savings where values of S and Φ represent the changes in net credit exposure of the households. The positive value of implies the households are liquidating their savings more then they are paying off credit, while negative value of Γ implies the households are decreasing their credit exposure. It should also be noted that parameters κ i τ have their own subscripts so they can differ from time period to time period.

Before the start of the globalization process the households have a certain amount of loans and savings. After the start of the globalization the amount of household savings and debt will change as two separate process. The total amount of savings S in each time period is the sum of the total amount of savings s from previous time periods increased by the appropriate interest rate. The total amount of credit will depend on the new loans borrowed, repayment of the existing loans and the initial value of debt the household has before the start of the globalization.

$$\Phi_t = \Phi_0 + \sum_0^{t-1} [\phi_{t-1} (1 + r_t^*)^{t-1-i} - \kappa_t \Phi_{t-1}] \quad (31)$$

$$S_t = \sum_0^{t-1} [s_{t-1} (1 + r_t)^{t-1-i} - \tau_t S_{t-1}] \quad (32)$$

Just like in the closed economies, in open economies the households can have both savings and loans at the same time. The model presented here allows four possible changes⁵. Unlike in the case of closed economy in open economy the risk

⁴ Although this is not an universal approach households loans in foreign currency are very common in transition countries.

⁵ Increased savings, increased loans; decreased savings, decreased loans; increased savings, decreased loans; decreased savings, increased loans.

for households comes from three separate sources: exchange rate, interest rate and the value of wage. The risk from wage comes from the fact the household might or might not be employed in each time period. Risk from changes in the exchange rate affects the household value of the loan annuity, same as the changes in the interest rates. The changes in the value of annuity will affect the household's decision on amount of savings and consumption. In the model presented the source of the risk is not particularly important, it is much more important to have the existence of risk in the model.

The household tries to maximize the utility which comes from consumption, but the household also experiences the disutility from the fact it has to repay loans. So the maximization problem for households is:

$$V(A) = \max E \left[\sum_0^n \beta^i \{u(w_i^e + \phi_i - s + \tau_i * S_{i-1}^e) - \kappa_i \Phi_{i-1}^e\} \right] \quad (33)$$

$$\text{With restriction: } c^e = w_i^e + \Sigma + \Gamma^e$$

In the equation 33 it is shown the new loans increase the utility of the households, because household can use new loans to increase consumption, however the repayment of existing loans implies the household is experiencing disutility. The model is focused on household consumption only indirectly, because there is a whole other set of decisions which affect the choice of level of consumption. When the household makes decision on how much to save, get new loans, repay old debt or liquidate savings, then the household has the ability to chose the level of consumption. Because of this the control function of the household has the following form:

$$f(s, \phi, \tau, \kappa) \quad (34)$$

Having all components we can set up the dynamic programming problem for the households:

$$V(A_t) = \max_{s, \phi} \left[f(s, \phi, \tau, \kappa) + \sum_0^n \beta^i \{u(w_i^e + \phi_i - s + \tau_i * S_{i-1}^e) - \kappa_i \Phi_{i-1}^e\} \right] \quad (35)$$

With the constraints:

$$\Phi_t = \sum_0^{t-1} [\phi_{t-1} (1 + r_i^*)^{t-1-i} - \kappa_t \Phi_{t-1}] + \Phi_0$$

$$S_t = \sum_0^{t-1} [s_{t-1} (1 + r_i)^{t-1-i} - \tau_t S_{t-1}] + S_0$$

$$c^e = w_i^e + \Sigma + \Gamma^e$$

Following the recursive solution to the household's problem the household can derive the policy function which is going to be:

$$h(s^*, \phi^*, \tau^*, \kappa^*) \quad (36)$$

The households uses the variables in the policy function to determine the consumption level.

4.2 Firms

The model of firms is very similar for both open and closed economies. The only difference is that in the model for open economy we have to define the sources of demand for the goods and services produced by the firm, because now the firm can sell its goods and services in foreign markets as well. The production function of the firms is:

$$y_i = a^{1-\alpha-\beta} k^\alpha l^\beta \quad (37)$$

In closed economy the firms was only faced by demand which came from domestic households, so there was no need to explicitly define the demand for goods and services. But since in open economy the firm is also faced with foreign demand there is need to model the demand function as well. In case of the open economy the demand the firm has to meet can be defined as:

$$a^{1-\alpha-\beta} k^\alpha l^\beta = D_d + D_f \quad (38)$$

Where D is the quantity demanded and the subscripts d and f mark domestic and foreign demand for goods. In case the firm is competitive it will be able to sell its goods on other islands as well, in case the firm is not competitive not only will it not be able to sell its goods on other island, but it will not be able to sell the goods on its own island, which can lead to negative profits and ultimately to demise of the firm.

The change of capital over time in will is:

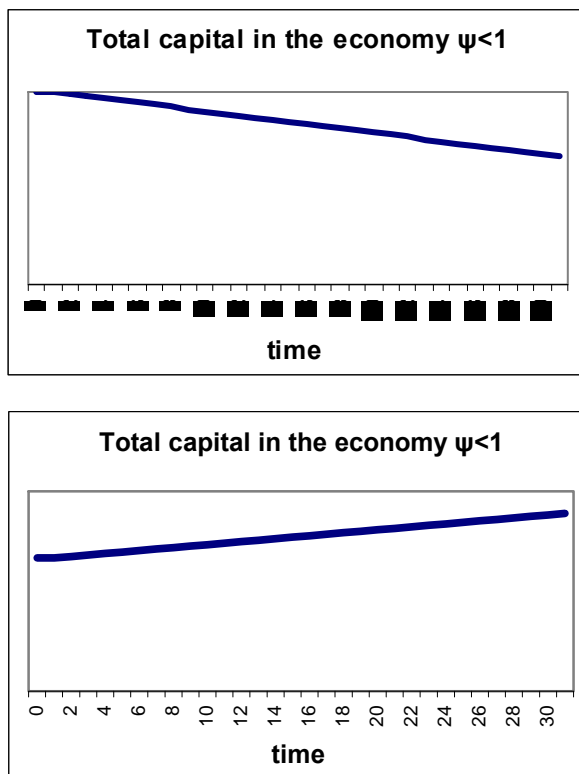
$$k_t = i_t + \delta k_{t-1} \quad (39)$$

The quantity of capital the firm needs will depend on the demand for the good the firm is producing. The firm which can compete with equivalent firms from other islands will increase its investments into capital in order to meet the increase in demand. The firm which is not able to compete with equivalent firm from other islands will over time decrease its need for capital. Because of this process the islands with more competitive firms will have need for more capital, while islands with less competitive firms will have a diminishing

need for capital. Higher competitiveness will increase the aggregate investment rate, while smaller competitiveness will equivalently decrease the aggregate investment rate. The total amount of capital on the island in certain period can be modelled as autoregressive process:

$$K_t = \psi K_{t-1} + \varepsilon \quad (40)$$

The total amount of capital K on some island will over time change according to some factor ψ . In case the value of ψ on the island is $\psi > 1$ the total amount of capital will increase, while in case the value if ψ is $\psi < 1$ the amount of capital on the island will decrease. The picture 1 shows the value of capital on two islands with different values of ψ ⁶.



Picture 1. Total capital in the economy

Through this particular construction we have allowed increase or decrease of the amount of capital on particular island where the only reason for the change in the amount of capital in the economy is the process of globalization.

⁶ Interesting empirical analysis of this problem can be found in Stojanov (2008, 2009) who analyses how now developed countries have protected their industries (prevented globalization) until their industries were able to be highly competitive in the global economy.

4.3 Government

Considering the island firms can sell its goods on home and foreign islands there is a need to make adjustments in behaviour of movement during the process of globalization. The inflow of goods and services has an important impact on the sources of funds and the total amount of taxes the government collects.

The sources of funds remain the same for the government in both closed and open economy, the government can levy taxes on firms and consumption, issues bonds, but in open economy the taxation of consumption has to be expanded for tax receipts from consumption of foreign goods⁷. The government is also no longer limited to issuing bonds for one period of domestic markets, because of the globalization the government can issue bonds for longer periods and on other islands. This in effect also allows government to accumulate debt over time. In open economy the total funds received for government are:

$$T_t = \theta \sum_n^n \pi_{t-1} + \sum_1^n \lambda_t (c_f + c_d) + B_t^f + B_t^d \quad (41)$$

The tax receipts for government come from the firm's profits from the previous period. the sum of all firms profits from n firms in the economy in the last period is taxed at the rate θ . Household's consumption is taxed at rate λ . The government taxes consumption regardless of the origins of goods. The government can also collect funds through the issuance of bonds B, the bonds can be issued on domestic and on foreign markets, which is respectively noted by the superscripts d and f.

The paradox of globalization is that if there is an increase in imports the automatic effect on the government's revenue will also be increase. It is also possible for the government to have increase in receipts from taxing consumption funded by retail loans as presented in Vidaković (2010). Of course the increase in the government revenue because of the increase in household's credit activity only has short term positive effect on the government's tax receipts and it can not be the long term source of income.

The government can use its collected funds in three ways: government expenditures G, government transfers t and repayment of the existing debt or interest payment on existing debt:

⁷ For the explanation how the imported goods affect the tax revenues in case of Croatia great example is Santini (2007).

$$T = G + t + (r_b + \kappa) \sum_0^{t-1} B_i \quad (42)$$

The government has to pay interest rate r on the amount of outstanding bonds issued in previous periods and has to repay a certain portion of the existing debt. The amount of repayment of the existing debt is given with the parameter κ which has a standard property of $0 \leq \kappa \leq 1$. The equality between government inflows and outflows has to hold in each period:

$$\theta \Pi_{t-1} + \sum_1^n \lambda_t (c_f + c_d) + B_t^f + B_t^d = G + t + (r_b + \kappa) \sum_0^{t-1} B_i \quad (43)$$

The equation 43 shows how easy it is for government to have deficit problems when there is a decrease in consumption due to decrease of credit activity, so the government is left with increase in outstanding debt, increase of taxes or decrease of expenditures. The openness of the economy also creates a problem of moral hazard because it creates a possibility for government to increase debt and have income from consumption of imported goods. This creates opportunity for government to spent more funds then it should.

4.4 Banks

The bank's business in open economy changes on both assets and liabilities side. The loans to customers are not longer only housing loans, but the bank can also give spending loans to retail. In the balance sheet the bank can also have domestic bonds, bonds from other islands, bonds created by securitization and surplus of liquidity Γ . The bank can lend surplus of liquidity to other banks and to other banks on other islands. The bank's assets are:

$$A = \begin{bmatrix} \Phi_s \\ \Phi_c \\ B_d \\ B_f \\ B_s \\ \Gamma \end{bmatrix} \quad (44)$$

The banks are also allowed to securitize a portion of their portfolio. The conditions for securitization are that in order to securitize a portion of loans the bank has to obtain guarantee. The guarantee obtained by the bank has to be issued by another bank from another island. The bank can not obtain the guarantee on its own island. The bank

can also issue a guarantee for securitization to a bank on another island and such guarantee are booked in bank's off-balance sheet.

In the bank's liabilities there is capital C , household's savings S and secondary sources of funds Ξ . The secondary sources of funds for banks are funds which have been collected from other islands. The bank's liabilities can be shown as:

$$L = \begin{bmatrix} S \\ \Xi \\ C \end{bmatrix} \quad (45)$$

The profit for bank in each time period can he shown as

$$\pi = \begin{bmatrix} r_s & r_c & r_d & r_f & r_s^b & r_\Gamma \end{bmatrix} \begin{bmatrix} \Phi_s \\ \Phi_c \\ B_d \\ B_f \\ B_s \\ \Gamma \end{bmatrix} - \begin{bmatrix} r_s^S & r_\Xi & 0 \end{bmatrix} \begin{bmatrix} S \\ \Xi \\ C \end{bmatrix} \quad (46)$$

Just like in closed economy there is no regulation balance sheet. Subscripts s, c, d, f, Γ indicated active interest rate on housing loans, expenditure loans, domestic and foreign bonds, purchased securitized bonds, domestic savings and surplus of liquidity. In open economy the bank controls larger number of variables then in closed economy so the bank's control function is now:

$$u(r_s, r_c, r_\Gamma, B_d, B_f, B_s, \Gamma, r_s^S, \Xi) \quad (47)$$

Bank in open economy not only has to plan interest rate, but also has to decide n the balance sheet sizes and the structure of assets and liabilities. The main objective for the bank is to maximize the present value of expected profits which is merged as return on total bank's assets:

$$\max V(\pi) = E \sum_1^n \beta^t \omega A_t \quad (48)$$

In closed economies the bank decided on the interest rates in both assets and liabilities, but it did not have any effect on the size of the banks assets and liabilities, because the size was constrained by the quantity of money in the economy. The sector distribution of loans was also limited by the constraints in the economy. These particular restrictions no longer hold in open economy. In open economy the bank has the ability to control both the interest rates and the structure of the balance sheet, because the bank now has the ability to im-

port funds from other islands. The quantity of domestic money on the island is not longer the only determinant of the size of the bank's balance sheet as a matter of fact the domestic quantity of money does not play any role for banks on the island any more since they can freely import and export funds.

From the model which was set up it can easily be seen how the process of globalization has affected the banks and has removed the restrictions imposed by the existence of closed economy. Banks in open economies can import and export both their assets and their liabilities. The banks also have much more options in terms of where to place their assets which additional affects the business decisions.

Like it can be seen in the question 47 the bank in open economy controls both interest rates and the size of the bank's assets and liabilities as well as the composition structure of the balance sheet. Because of the possibility to have secondary sources of funding the size of the bank's balance sheet is not limited. The bellman equation for the bank's dynamic programming problem is:

$$V(A) = \max \left\{ u(r_s, r_c, r_f, B_d, B_f, B_s, \Gamma, r_s^s, \Xi) + E[V(A_{t+1})] \right\} \quad (50)$$

Bank's policy function is consequently:

$$u(r_s^*, r_c^*, r_f^*, B_d^*, B_f^*, B_s^*, \Gamma^*, \Xi^*) \quad (51)$$

Through the solution of the dynamic programming problem the bank can optimize its balance sheet in order to achieve maximum possible profit. The issue of securitization and the impact of the guarantee constraint (guarantee has to be from another island) will be further analyzed in the part three of the paper.

4.5 Central bank

In the model of closed economy it has been postulated the central bank conducts monetary policy based on a simple quantitative equation with the main goal of achieving the wanted rate of inflation and rate of economic growth. This mechanism functions very well in closed economies; the neutrality of money guarantees that the changes in the quantity of money only reflect increase in the real demand for money based on changes in real economic activity.

In open economy this particular model of conduct of the monetary policy breaks down and it can not longer function properly. The main reason

for the breakdown is the fact both the government and the banks can obtain funds from the other islands. The banks have the ability to lend funds to other islands, thus effectively taking money out of the system. Because of the freedom of capital flows and the breakdown of restrictions the banks have in closed economies the central bank has to reject the control of monetary aggregates has is left with two option. The first option is to turn towards control of the interest rate in the economy as it has been demonstrated in Woodford (2003, 2010a, 2010b). The second option is to control the expectations through the mechanism of inflation targeting. Both options show the control of quantity of money, monetary and credit aggregates in the economy is not possible because of the globalization process. The main effect of the globalization is the central bank's loss of ability to control the size of the banks balance sheets..

However even with the existing constraints now imposed on the central bank, the main goal of the central bank even during the process of globalization remains the same and it was given with the equation 24,

$$\min E \sum_0^t [(\pi_t - \bar{\pi})^2 (y_t - \bar{y})^2]$$

But the policy function of the central bank changes and it can now, for example, be presented as a Taylor rule as shown in Taylor (1993)

$$i_t = \pi_t + r^* + \alpha_\pi (\pi_t - \pi_t^*) + \alpha_y (y_t - \bar{y}_t) \quad (52)$$

Interest rate is equal to the inflation, plus the wanted real interest rate, adjusted for difference of inflation and wanted inflation and adjusted for the difference between the existing economic growth and wanted economic growth. The focus of the central bank in open economies is no longer the quantity of money, but level o interest rate, without adding importance to the quantity of money in the economy of the needs of economy for money, thus effectively abandoning even in theory ability to control the size of the bank's balance sheets.

Central bank in open economies is no longer a follower of the real economic activity, but the central bank separates the monetary economy from real economy with the goal of stabilization of interest rate of expectations. This policy will necessary lead that over time the central bank as agent of monetary policy separates itself more and more from the real economy and real economic activity.

5. Lender of the last resort and the securitization process

After setting up the model for both open and closed economies and showing the differences between the two economies it is possible to analyse the role of the lender of the last resort and determine what is the main difference in the role of the lender of the last resort in closed and in open economies.

In closed economy the central bank is directly responsible for the quantity of money in the economy and the overall liquidity of the economy. In closed economy the monetary economy is derivative of the real economy and follows the real economic activity. The behaviour of banks is limited to lending to households and government. The loans to households are covered by existing homes and the loans to government are short term. Monetary policy tries to satisfy the real economic need for money. In case of a recession all of the bank's loans are covered by existing real-estate collateral and the loans to government are short term. The central bank also has the mechanism to increase or decrease the quantity of money in the economy in case there is need for change in the quantity of money in the economy. Because of this economic set-up there is actually a limited need for the lender of the last resort.

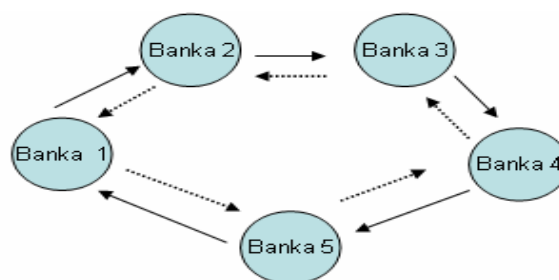
In the open economy there is an explicit need for the lender of last resort because the liquidity of the banking system is not guaranteed and the loans are not covered by real economic activity. The liquidity of the banking system is especially limited with the fact a portion of bank's assets has been loaned to banks on other islands and that this liquidity has left the domestic island. Because of the connection between the banks balance sheets economic disturbances can very easily spill from one island to the other island. In the model of open economy the problem of banking system is no longer liquidity, but the quality of assets and total capitalization of banking system. Because of the interconnection between the banks in case of an economic crisis on one island it is possible for the economic crisis on this island⁸ to cause banking crisis on another island, so the role of the lender of the last resort in global economy is no longer the

lending of liquidity, but there is a need for a lender of last resort of capital.

It should be clearly shown what does the process of securitization does to the banks in our model. Banks in our model of open economy are allowed to buy and issue securitized debt. The only condition we have imposed is that the securitized debt has to have a guarantee issued by a bank on another island.

Let us now look at a simple case of five different banks from five different islands which are involved in the process of issuing securitization guarantees and issuing of securitized bonds. The mutual relationships between the five banks are given with the picture below:

Picture 2. Relationship of banks during the process of securitization



Picture number 2 shows the relationship between five banks which are participating in the process of securitization. The full arrows show the path of securitized assets and cut-off arrows show the path of guarantee issuances. In this particular set up Bank 1 issues its securitized bonds to Bank 2 and obtains a guarantee for the issue from Bank 5. Bank 1 also buys securitized bonds from Bank 5 and Bank 5 have obtained a guarantee for the issue from Bank 4. The problem which is presented in this closed circle is that the Bank 1 can not know what is the exposure of Bank 1 towards Bank 3 because of multiple securitization of assets. In business books of Bank 1 there are only issued bonds towards Bank 2 and issued guarantee towards bank 5 and the guarantee is in off balance sheet.

The problem which can easily develop in this particular system is that there is nothing preventing Bank 2 to further securitize the purchased bonds which have already been securitized and to securitize the bonds already securitized. In case the Bank 2 securitizes the securities purchased from Bank 1 and the Bank 3 does the same thing with the securitized bonds purchased from Bank 2 we can

⁸ In reality this is precisely what has happened to Iceland and Ireland where there was large withdrawal of funds which destabilized the banking system, but the real economy has remained stable.

easily have a paradox in which the Bank 1 purchases from Bank 5 securities which contain original loans from Bank 1 which the Bank 1 has securitized. Thus through the mechanism of securitization there is a possibility of a paradox in which the Bank 1 purchases the securitized bonds containing the loans which Bank 1 has originally securitized.

Each step in the securitization process open a new step in the multiplier process which has less and less foundation in the real economic activity. Bank 1 has securitized its loans which has a house as a collateral, the Bank 2 has securitized an already securitized bonds and this new bond does not have any foundation in the real economic activity and no real collateral. Because of the securitization process there are now two items in banks assets which are funded on only one real collateral. The further process of securitization on diminishes the real value of the collateral inside the increasing bank's assets. However on paper each new securitization created bond will have a perfect credit rating since it is fully covered by a bank's guarantee. Clearly there is a discrepancy between what is good on paper and what is covered by real economic activity. One the first loan has real tangible collateral in form of a house, all other securitized loans only have paper backing in form of a issued guarantee, but nothing real or substantial which can be used as collateral.

Thought the process of monetary multiplication of bank's assets as presented in example the process of securitization which does not have any real economic backup we can come to a simple conclusion: monetary economy has outgrown real economy and monetary economy is no longer a derivative of the real economy, but has a life of its own.

6. Implications of the model

The model has tried to show how the structures of the open and close economies are completely different. Closed economies do not have the ability to develop monetary process which only have a purpose onto itself. We can say that in closed economies both central bank and commercial banks are governed by the so called "real bills doctrine". In the model of closed economy the monetary economy is a derivative of the real economy. In the model of open economy the model has shown how it is easy for the monetary economy to spin out of control and for the real economy to become the derivative of the monetary economy. On

a simple model of securitization we have shown that the securitization processes have multiplicative effects and that the process of multiplication in monetary economy are much faster then processes in real economy. With each step during the process of securitization there is an exponential decrease of the total value of the real collateral behind the securitized bonds. So after fourth securitization there is only 25% of collateral for each outstanding monetary item.

The case when real economy becomes the derivative of monetary economy creates a paradox in the whole economic system; the fiat money through multiplication leads to the fact that even the real economy becomes fiat⁹ because there is a diminishment of the value of collateral used as the foundation for the credit processes.

Another especially dangerous process is lending of consumer loans to households, because this process can create a short term unreal increase in the aggregate demand. This increase in aggregate demand will create an illusion of the better economic conditions then they actually are in the economy. In "the good life" through credit activity all economic agents are involved: households consume more, government collects more tax revenues and banks increase profitability. Of course once the credit activity stops things turn out to be completely different: households standard of living decreases, government has lower revenues and banks have bad loans.

With the process of globalization monetary economies between the islands are increasing in velocity and their speed of connection is much faster then connection of trade. Special attention should be paid to be connection between the balance sheets between the banks on different islands. Banks are connected to each other through both assets, liabilities and off balance sheet. This kind of connection between the banks is a fertile soil for expansions of problems and the lack of real collateral for bank's assets makes possible for a significant portion of bank's assets to turn into bad loans very fast.

The problem of the relationship between real and monetary economy is created in the moment when the credit risk in the balance sheet of banks increases and banks have to write off their

⁹ The authors are aware of the paradox of using the term that the real economy is fiat, but considering the results of the crisis from 2008 we do not think that any other term can properly describe the situation.

bad loans. The problem with writing off loans in our model does not create a problem of liquidity since banks have liquidity reserves in their balance sheets and they can always get liquidity through central bank facilities. The problem with writing off of bad loans is a decrease in bank's capital and decrease in overall measure of bank's capital adequacy. The bank which has to write off loans does not necessarily have to have problems with liquidity, but it will have problems with lack of capital.

6.1 Crisis from 2008

It is not hard to draw a parallel between the model presented in this paper and the real world. The islands in the model can easily be replaced with real world countries. The level of globalization which differs between the islands differs between the countries. Today there are economies which are completely closed, but there are also economies which are completely open. Most countries are somewhat in between, but with constant increase in the level of openness.

The crisis from 2008 has started in the banking system, the first real sign of the crisis was the collapse of the Lehman Brothers. The reaction to the crisis was the decrease of the liquidity in USA, subsequent decrease of the interest rates and global increase of liquidity once other central banks stepped in with unprecedented liquidity measures. The downfall of large investments bank did not cause a major systemic crisis like it has happened in 1929. In order to protect from further erosion of the system and regain control of the liquidity (in spite of the measures undertaken by the central banks) the banks decreased lending. Lack of credit put pressure on business activities and caused monetary crisis to spill over into real economy. Because of the lack of credit business came under pressure to continue with their normal activity, causing increase in bad loans in bank's portfolios. The increase in bad loans has worsened the capitalization of banking system. Of course when the bank's went under so did the insurance companies which have guaranteed the securitized loans. Decrease of lending has only started a negative explosive spiral first as businesses went under then as retail started having problems with mortgage payments. Because the companies started to lay off workers, the laid off workers were not able to pay for their mortgages. Not paying of mortgages has further caused the decrease in the quality of the bank's portfolio and because due to multiple securi-

tization the banks were not able to cover their loans through collateral. The lack of collateral for loans has only further increased the negative spiral and affected the quality of bank's assets. Although the securitized bonds were covered by guarantees the insurance companies were not able to cover all of the issued guarantees at once.

It did not take long for the crisis from USA to spill over into Europe, because of the connection between the financial systems. The global connection between the banks has only made it easier for crisis to spill from monetary to real economy and make the crisis global.

The end result of the crisis is well known, the central banks have moved aggressively to increase the global liquidity and decrease interest rates, while the government have stated to create plans in order to bail out the banking system. The central banks have managed to preserve the liquidity of individual and global economy, but the government plans have failed. The deficits have exploded and in some cases have become unbearable. The banks were saved, but the damage to the real economy has been done. The events showed the central banks as lender of last resort for liquidity have been successful, but the lenders of last resort for the capital of banks have failed because the price paid was too high.

6.2 Global lender of the last resort as guarantor of the stability of the global system

The role of the lender of last resort of liquidity in terms of global economy can not be seen as a stabilizing factor, as a matter of fact the lender of the last resort in highly globalized world is nothing but a smoke screen in order to create an element of perceived stability. As the model has shown due to interlocking of the banks balance sheets it is not possible to maintain stability by having an institution which is in charge of making sure the liquidity needs of the system are met.

In the model of closed economy each island has its own central bank and the central bank serves as guarantor of stability. The central bank is the only institution which has the right to create money and can provide liquidity for the banks. In case of a banking crisis, the central bank can temporarily provide liquidity to the banks until they can sell the collateral. The liquidity problems in closed economy can only be solved by the central bank. In the globalized banking system the power of the central bank is greatly diminished, because the central

bank does not control the size of the banks balance sheets. The banks can change the size of their balance sheet when ever they want because the banks can import funds from other islands. The free flow of funds between the islands is the reason the central banks have abandoned the control of the monetary aggregates and have turned towards control of the interest rates and expectations in the economy. The evolution of monetary behaviour from Friedman's k rule towards the control of interest rates and expectations is nothing more but a necessary evolution of the central bank in closed to central bank in open economy. But what the model and real life show is the evolution of the central banking was not towards stability, but in fact towards instability because the central banks have lost control of the banks.

As presented in the model when the islands were allowed to create connections between each other same thing has happened in the real world. Today there are different stages of globalization for each country and the openness between the countries is different. Some countries are more some a less open, also clusters of countries might be more open towards each other then towards some other countries. However one thing has remained the same in both open and closed economies: the role of the lender of last resort has only been focused on liquidity of banks, not capital needs of banks. Like in the times of the closed economies the central bank serves as the lender of last resort of liquidity. However there are two problems with this role.

The first problem is that the liquidity has become less and less of a problem for banks in global system. The interbank market is so developed and communication between the banks is so easy that transfer of funds is no longer a problem. In the model and in the real world the problem of banks is capital. The crisis from 2008 has clearly shown there is a separate need for capital and separate need for liquidity in times of crisis. During the crisis of 2008 the central banks got involved as providers of liquidity (as lenders of last resort), but it was the fiscal policy which had to step in as provider of capital. The solution for the crisis of 2008 is self evident: there is a need for a lender of last resort, but not a lender of last resort of liquidity, but lender of last resort of capital.

The second problem is the issue of how will the lender of last resort for capital function in practice. In our model the role of the lender of last resort is not possible and the authors suspect it the

same in the real world. For a global lender of last resort to function such institution would have to have vast amount of capital at its disposal. The source of this capital (banks themselves or government) is not immediately relevant. It is more important what the institution will do with these funds. The funds can not be kept in the government bonds, because in the times of crisis the institution will need liquidity, but so will the government. So trying to obtain funds from the government of through the sale of bonds will only add oil to the fiscal fire during the times of crisis. At the same time such institution could not keep the funds in the banks. The funds kept in the banks would indicate to the banks that in the case of crisis the banks can perform a simple debt for equity swap and increase their capital. The existence of debt for equity option for banks would only increase bank's risk appetites and create a clear ground for moral hazard, since the banks would know the fresh capital can easily be obtained to recuperate irresponsible behaviour. Also if the funds are kept in the bank in case of crisis these funds would have to be taken out of the one bank and transferred to another bank, which would be an impact on liquidity of good banks. Moving around funds would also increase the need for more liquidity in the system again pressuring the central banks.

The measure of increasing the capital adequacy for banks will also have not impact since the capital adequacy should reflect the need for bank for capital as determined by the bank's business, however there is not way to determine what is the bank's need for capital in case of crisis since the real danger for banks is in off balance sheet, not in the balance sheet. Because of the securitization process it is impossible to determine what is the true exposure for the bank, just as it is impossible to determine what is the possible fall out from a crisis. The banks balance sheets are interconnected in several steps, not just one.

From the analysis it is clear the lender of last resort of capital is nothing more then a smoke screen which looks good on news headlines, but in reality has multiple tactical problems. Although lot of attention in this paper has been given to how the world has changed with the process of globalization and how globalization has changed behaviour of economic participants the main problem of the new global economy has not been raised that that is: how to return the monetary economy back into bounds of real economy? No economy can be

based on monetary growth and production through monetary multiplications. Economy and its prosperity have to be based on real economic activity. Precisely because of this the only guarantor of long term stability can only be the control of the size of monetary economy and return to the principle: monetary economy has to be derived from real economy, not the other way around. The process of return to real economy is necessary precisely because the process of globalization can not be stopped.

$$f(y) = \sum_0^m (e_i^y - 1) = x \quad 0 < x < em$$

$$em = g \quad x = g$$

Case where $x=g$ for all islands is only a question of time. In our model the process of globalization and increasing communication between the islands has a paradox. Large number of small islands which are perfectly connected eventually become an equivalent of a single island. The process of globalization as the ultimate effect creates a global closed economy. The economic system of many closed islands moves towards many open islands and in the end there is one global union of all islands. It is just a question of time when there is going to be a global closed economy. In this case the return to economic foundations of real economic activity in case it is not planned and gradual will happen through economic cataclysm, because it not possible to base economy and economic activity on production of fiat money.

7. Conclusion

The paper analysis the development of modern economy through model of islands. At the beginning each island is a closed economy. In the second step process of globalization is introduced and islands open towards other islands. At the beginning the process of globalization is gradual but the process itself is exponential. The paper shows how that process of globalization has changed the behaviour of economic agents by changing the variables the economic agents try to optimize. Special attention is paid to households, banks and central banks. The model has shown that banks have a key role in the process of globalization because the banks through credit mechanism allow households to increase debt and consumption above their means. Banks also participate in the process of securitization which allows the multiplication of excis-

ing amount of credit in the economy without any support in the real economic activity. In the model presented it has been show the process of globalization creates enormous growth of monetary economy which leads to the state where monetary economic outgrows the real economy and the structure of the monetary economy can be the source of the global instability.

One of the solutions proposed for the economic problems caused by real economy is a global institution which would guarantee financial stability. As the model has shown there is no need for a global institution to guarantee liquidity, but there is a need for a global institution to guarantee capital. Authors are sceptical towards this option and can not see how this institution could function during the time of the crisis. There is also an open possibility that the existence of such institution would increase the risk taking of banks. The main problem which the authors have pointed out is that the process of globalization in itself leads that the world will transform from set of separate islands into one truly global economy, but the new economy will be a closed global economy. Precisely because of this path of globalization the only way to create a long term stable solution is to decrease the size of the monetary economy and revert monetary economy again within the bounds of real economy.

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Zaključak : Rad analizira razvoj moderne ekonomije preko modela otoka. U početku svaki otok je samostalan sam za sebe i funkcionira kao zatvorena ekonomija, kasnije autori uvode proces globalizacije i otvaranje prema drugim otocima. U početku je proces globalizacije postupan, ali se razvija eksponencijalno. Rad pokazuje kako je proces globalizacije promijenio ponašanje ekonomskih agenata tako što je promijenio varijable koje ekonomski agenti nastoje optimizirati. Posebna pažnja je dana kućanstvima, bankama i centralnoj banci. Model koji smo razvili pokazao je da banke imaju ključnu ulogu u procesu globalizacije, jer preko kreditnoga mehanizma omogućuju građanima zaduživanje i potrošnju iznad realnih mogućnosti. Banke također učestvuju u procesu sekuritizacije koji omogućava multiplikaciju kredita bez realne podloge za takve kredite. Model koji smo analizirali pokazuje kako proces globalizacije uzrokuje enormno bujanje monetarne ekonomije što dovodi to toga da monetarna ekonomija može nadjačati realnu ekonomiju i zbog toga uzrokovati globalne nestabilnosti.

Jedno od rješenja problema nestabilnosti uzrokovane monetarnim rastom jeste i globalna institucija koja bi garantirala financijsku stabilnost. Kao što smo pokazali modelom, nema potrebe za globalnom institucijom koja bi garantirala likvidnost, jer to rade centralne banke ali može postojati potreba za globalnom institucijom koja bi garantirala kapital. Autori su skeptični prema takvom mogućnosti i ne vidi se jasno kako bi takva institucija mogla funkcionirati u slučaju krize. Također je otvorena mogućnost da bi upravo postojanje takve institucije moglo samo po sebi uzrokovati rizičnije ponašanja banaka. Temeljni problem koji su autori istaknuli je da proces globalizacije sam po sebi vodi ka tome da će današnja zajednica otvorenih ekonomija uskoro postati jedna globalna zatvorena ekonomija. Upravo zato je potrebno da se monetarna ekonomija smanji i svede unutar realnih okvira.