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GÁBOR KÜRTHY

GLOBAL IMBALANCES

A THEORETICAL AND HISTORICAL APPROACH

Ph. D. dissertation

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Contents

1. Preliminary studies and the goals of the dissertation

Preliminaries

In my MSc thesis I dealt with the theoretical antecedents of the neoclassical theory of money in order to understand the hardness of integrating money into economic theory. My opinion then was that unusual characteristics of money was needed to be able to prove the existence of equilibrium situations with good properties, such as uniqueness and stability. The aim of connecting theory of money and economic equilibrium inspired me to join the PhD program. At the early stages of my studies I tried to approach the problem from the direction of the banking practice and monetary policy. Although this orientation has been accompanying my works, I realized that one must understand the relationship of money (the financial system) and state beyond the scope of the monetary system. For this I took part in researches dealing with tax systems and functioning of the state, from which – besides learning a lot about the working of these systems – it came clear that although the state, the market, and the financial system are in a strong relationship, our economic teaching often ignores it. In practice, however, these relationships are continuously challenged.

One of these challenges is the problem of global imbalances that I met first in 2005. At that time few people dealt with that problem, the more intensive research of the phenomenon began after the outbreak of the crisis in 2007. At first I thought global imbalances and the crisis are closely related but some researches convinced me that a more profound analysis of the nature of global imbalances was needed before connecting them with the crisis. Thus the main goal of my dissertation is understanding global imbalances by approaching them from a socioeconomic and money theoretic bases.

The problems and the goals of the research

The USA has been showing – except for two quarters – external financial deficit since the beginning of the 80s, after the millennium the second largest economy of the world, China, has become the biggest lender of the American balance. The two largest economies are mutually depending on each other, because the bulk of the Chinese external reserves are dollar denominated American treasury bills. Its value is about 3000 billion dollars (IFS data, 2010), which covers the magnitude of the net (negative) external investment position of the US. The relationship is not only financial, because it can be deduced from the export led growth of China and the external trade deficit of the USA.

The economic literature has been dealing with the phenomenon intensively since the mid 2000s, trying to explain it, and answering the question of sustainability and its potential dangers to the world economy. Notwithstanding the growing interest even the definition of global imbalances is controversial amongst economists. In the dissertation I used a narrow variant of the definition of **Bracke et al. [2008],** stating that global imbalances are the chronic external financial deficits and surpluses of systematically important (i.e. having great weights in the world economy) countries. On the ground of the definition the phenomenon can be approached through the accounting identities of the open economies. The external financial position is identical with the difference of the domestic savings and investments, the same identities can be written for the foreign economy, which gives more ways of analysis based on the real economy:

- the analysis of the domestic saving process,
- the analysis of the foreign saving process,
- the analysis of the current account balance that is defined by:
  - the external trade balance,
  - and the international income balance, primarily the balance of the income flows of the producing factors.

The classical economic argument states that financial markets are adapting the financial needs of the real economy, for this, the analysis of chronic deficits and their consequences comes down to one of the above ways. However, the minor and major crises of the last two decades showed us that as financial markets can set up for themselves, the relationship between the real side and the money side can roll over. Therefore the analysis shall be extended by the survey of the factors influencing investors' behavior, such as:

- the development of domestic and foreign capital markets,
- the quality of financial instruments,
- the analysis of the legal, regulatory and supervisory institutions.

The recited factors are influenced by the fiscal and monetary policies of governments and by tax policy and regulation as well. Put it in a nutshell: the analysis of the dynamics of the external balances is a complex task, so the researches are almost by necessity narrowed to some partial field. The contributions of the literature are worth to structure by the direction of the approaches. Some studies are analyzing the saving processes inside and outside of the US.

Several writings are deducing global imbalances from the differences of the developed and underdeveloped capital markets. The study of Hausmann and Sturzenegger [2006] inspired the researches dealing with the deficiencies of balance of payments statistics. There are systematic approaches considering the financial positions as the consequence of the structure of the global economic system. Some of the studies are building theoretical or econometric models to analyze the whole process or some part of it. The heterogeneity of this field of research can be apprehended by lining up the results of these models.

The reserve demand of emerging economies, especially since the financial crises of the 90s led to the so called global savings glut, which financed the deteriorating external balance of the US (**Bernanke [2005]**). **Gourinchas and Rey [2005]** stated that the situation was sustainable because of the highly developed American financial markets that could convert the capital inflows into profitable investments. Their arguments were supported by the yield differences between the investments of foreigners in the US and the yield of the American FDI outside the country. The yield difference made (has been making) it possible for the US to run external income surpluses. **Kitchen [2006]** argued that the yield difference was the result of the shrewd American investors, who could make more profitable investment decisions than their foreign counterparts. **Cooper [2006]** stated that the yield difference was supported by the expected productivity of the American economy, which means that the US will outgrow its debt in the future. **Hausmann and Sturzenegger [2006]** argued that the negative net external investment position and the income surplus was in contradiction with each other, in reality the investment position is much better because the official statistics lack the so called "dark matter". Dark matter is the unregistered American export like the liquidity services of the dollar or the insurance services of the US securities.

These explanations of global imbalances are conflicting each other (**Eichengreen [2006]**). The view of the "new economy", i.e. that the US will outgrow its debt and the dark matter view cannot be true simultaneously, for if the external income balance changes negative with the growing productivity then there cannot be any dark matter to insure the income surplus. If foreigners begin to collect the capital gains then the attractivity of the dollar will lessen: the situation is sustainable either because dollar investments bear real gains or because the gain cannot be expressed in the usual terms (black matter) but the two things cannot coexist. The new economy view and Kitchen's shrewd investor are contradictory as well because the latter argument states that the yield differences hold up on the long term, but then there cannot be productivity growth. And lastly, the yield difference cannot be caused simultaneously by the black matter and the judicious investment decision.

Dooley et al. [2003, 2004, 2009] are investigating global imbalances in a series of papers. They name the global monetary system Bretton Woods 2 because after 1989/90 the dynamics of the post second world war era have been recurring. West Germany and Japan played then the part of the export led periphery, their economic success was granted by the pegged exchange rate system. Since the nineties Central and Eastern European countries and more decisively emerging Asian economies have been catching up with the help of the same strategy. Today's exchange rate system is not declared but the discrete pegging decisions of the countries and their interventions serve the aims of the export led economic growth. The system is sustainable in this point of view: for making good their economic goals emerging countries are ready to finance the US. Therefore the system could survive the crisis because its main causes were the unsound risk management, the deficient regulatory and supervisory frameworks. The China-originated capital financing the US hasn't stopped so it couldn't led to the crises, moreover one of the conditions of the restoration is the maintaining of the export led growth of the emerging markets, which can be sustained till the convergence is fulfilled.

Blanchard et al. [2005] is the mostly referred paper amongst the ones that create a model to describe global imbalances and vision the sustainability of the situation. Goods and capital market imperfections are in the center of their model that is calibrated with empirical data. The model gives a good description of the story so far but its forecasts are very sensitive to the calibration.

Ferrero [2010] investigates global imbalances in a general equilibrium model by leaving out China, for considering the effects of the Chinese economy on the external positions only temporary. Amongst other **Bems et al. [2007]** and **Fratzscher et al. [2010]** are analyzing the situation on a pure technical base using VAR models to find US-originated explanatory factors such as technological shocks, asset prices, and economic policy. **Christopoulos and León-Ledesma [2010]** and **Forbes [2010]** constructed a comprehensive econometric model to explain global imbalances with capital market institutions.

Sun [2010] traces back external imbalances to the inland structural processes of the emerging economies. His study is worth to mention, because the bulk of the approaches are emphasizing only the export led growth strategy of China meanwhile ignoring the other socioeconomic developments. On the ground of Sun's statements we cannot expect the fast resolving of global imbalances, but his model bears results contradicting our empirical observations, as it reveals a negative relationship between economic growth and the current account position.

The review of the literature of global imbalances finds that there is no uniform model in which economists could analyze the problem. The approaches are partial and – maybe for this

– they contradict each other, besides the burden of readjustment (if it's diagnosed at all) is shifted to one of the sides (USA or China). On the ground of these findings I tried to contribute to the topic (maybe with some new findings) by searching for comprehensive explanations in three fields:

- by analyzing the conflicts of economic and social coordination mechanisms;
- by approaching the international financial and monetary system from a money theoretical base;
- by investigating the issue why mainstream economics cannot answer the question of sustainability.

2. Methods of the dissertation

By review of the literature in the first chapter of the dissertations it comes clear that there is no unique, mutually accepted method of researching global imbalances. One of the main reasons of this finding is that neoclassical economic models let capital flow from underdeveloped economics to developed ones only by very strong assumptions (Lucas [1990]). Besides, the main challenge is to explain why emerging countries are net lenders of the developed economies. So the explanations have recourse to market imperfections and institutional differences that can "support" the direction of net capital flows outside some model framework. The discretion of choosing the explanatory factors make the analyzes partial and controversial.

The second and third chapter of the dissertation is descriptive, the results are put together in the formal framework of the fourth chapter where further questions are dealt with as well. The data were downloaded from the homepages of IFS (International Financial Statistics) and BEA (Bureau of Economic Analysis).

The starting point of the second chapter is that market logic and state led redistribution are coordinating the economies together, for this understanding empirical economic processes needs revealing the connection between these two mechanisms. This is true especially for China, because the economy is continuously transforming, which can be apprehended through the development of the institutional framework. Even seeing through the economic processes of the United States needs the analyzes of the connections of the real economy, the financial sector, and the state. In the third chapter of the dissertation I approached global imbalances by analyzing the international monetary and financial system on a money theoretical base.

In the fourth chapter of the dissertation I uses a stock-flow consistent model to describe global imbalances and to analyze the possible consequences of structural changes. The model can be understood by investigating the balance sheets and the transaction and financial flow matrices of its actors. In the middle of the model stands the principle of quadruple entry, because every transaction involves the movement of at least two flow variables at two actors. Complying with the quadruple entry principle the economic circuit is depictable and leads to through the series of temporary equilibria to the steady state equilibrium. I computed the equilibria "by hand", in order to simulate and plot the transition dynamics the model had to be programmed.

3. Results of the dissertation

*In the **2nd chapter** I dealt with the economic and social processes of China and the US, previously I had drafted the next hypothesis.*

Hypothesis I

The rolling back of state led redistribution in the Western world contributed to the growth of consumption credit demand that is financed by the precautionary reserve demand of the emerging states (for the reason of intertemporal redistribution), for this a mechanism can be detected that originates from the conflict of the market logic and the redistributive logic and that leads to global imbalances.

The results of the chapter are the next.

Result I

Displaying of the Chinese economic strategy cannot be simplified by describing the export oriented economic growth advocated by the exchange rate policy, because it, together with the social policy, serves the goal of the long term socioeconomic stability.

***The result is partially substantive**, the Chinese social and economic policy is accomplished by others, I connected the two strands in the 2nd chapter.*

The Chinese economic growth – led by the external trade surplus – is rather an instrument than a goal, because the latter can be described as constructing economic and social stability. On the economic side exchange rate policy was subordinated to this goal: the cautious steps since the nineties, the guarded and gradual introduction of convertibility reveals the stability oriented nature of the policy even without investigating the deeper social development.

There is a significant income difference between the modern producing regions and the underdeveloped inner areas. More flexible labor markets, urbanization and migration inside the country, and for the consequences of the "one child" policy relaxes the protective part of local communities. Despite prosperity, as the fruits of economic growth are distributed unequally the social discontent could bear the danger of instability. Since the beginning of the 2000s the Chinese social security system is being constructed, but the process can be characterized by reneging steps for the changes generate conflicts between the central government, the leaders of state owned corporations and the powerful local leaders of the developed regions.

The state takes significant part in the transformation of the financial system, because it is used to achieve economic stability. This observation is contradicting the arguments stating that one of the main reasons of global instability is the underdeveloped Chinese capital market. Chinese policy is connecting economic and social goals with the help of unordinary instruments, such as using corporate profits as fiscal incentives or channeling central bank reserves into commercial banks and social security funds. It gives us the conclusion that the dollar reserves hoarded in the central bank cannot be seen as pure precautionary savings, because it can be used to finance the real economy.

Result II

The American economic processes can be characterized with the term "financialization", in which the rolling back of redistribution and the extending of household credits caused partially by state pressure play a decisive part.

The result is partially substantive*, because the financialization process is described by Epstein [2001] and Folley [2007], the 2.3 subchapter of the dissertation points out that market processes are not independent from the social policies of the state even in the USA.*

Changes of the income (re)distribution processes of the US in the last three decades could have contributed to the deterioration of the economy's external financial position through the growing indebtedness of households. The wage share of business incomes has decreased, meanwhile the dividend payment ratio, profit-share of the financial sector and its contribution to value added production has increased substantially. The inequality of household incomes has risen, which is partially caused by the decline of the graded tax system and the decline of the upper marginal tax rates. As the saving propensity of households with higher income is supposedly higher, the investment spirit has slackened, thus economic growth could be secured by the debt-financed household consumption.

It's essential to understand, that the process hasn't been generated by pure market forces. The role of the state is asymmetrical, as on the one hand the redistribution has declined, but on the other hand the state has inspired the indebtedness by extending the lending facilities through its flat-agencies. This extension often involved state pressure on the private financial business as well. Therefore the argument that global imbalances were caused by the underdeveloped, state influenced Chinese capital markets, and the savings outflow from China that were naturally absorbed by the most developed, free financial system can be shadowed. Emphasizing this observation helps understand that market coordination could bear instability without the state led redistribution, because inequalities caused by market competition (rivalry) can set back economic growth. Moreover: till now the Chinese institutional and social structure generated savings that have been leading to external surplus and have been financing the American household consumption and the external deficit of the US. On the long run, however, as the Chinese society is growing older, and other structural changes are on their path (for example urbanization) the situation turns unsustainable.

In the ***3rd chapter*** *I analyzed the links between the evolving global imbalances and the dollar as world currency that is one of the main characteristics of today's international monetary system; previously I had drafted the next hypothesis.*

Hypothesis II

Endogenous money that is asset and liability simultaneously and the growing global economy's growing money demand makes it possible and necessary the increasing external imbalance and debt of at least one of the economic actors, therefore the monetary system and global imbalances are consistent with each other.

The results of the chapter are the next.

Result III

The reserve policy of the Chinese central bank and the monetary expansion of the USA lead together to one-sided and chronic external financial positions, because American treasury bills are perfect substitutes of the dollar currency in its hoarding function.

The result is partially substantive*, because the idea was given by Costabile [2009], and I think that the money theoretic thoughts of subchapter 3.1 help a lot to understand it.*

An imperative characteristic of an economy operated by the market logic i.e. by the chain of changes is the usage of money. For this I think that without understanding the essentials of money and involving it into economic thinking it is impossible to analyze monetized economies. I tried to prove this statement in the 3rd chapter using the functional definition of money and pointing to the drawbacks of the modeling techniques that oversimplify the creation of money and its role in the economy. Most of the contributions use a closed economy framework, whereas the world currency is a requisite of the global economy as much as national currencies. This role has been fulfilled by the American dollar since 1944, which, as the dollar is a national currency simultaneously, bears contradictions since the beginning. I tried to understand it by reviewing the operation of the Bretton Woods system. As the dollar remained the world currency after the collapse of the Bretton Woods system, more of the asymmetries has been conserved: there is no technical obstacle to finance the US import, the country doesn't need to hoard international reserves, it practice loose (looser than others) fiscal and monetary policies, meanwhile the opposites are true for the users of the dollar.

The transaction and hoarding functions of the world currency are bearing a contradiction, because the previous necessitates a non increasing, the latter necessitates a non decreasing exchange rate. Therefor, two characteristics of the Chinese economic policy becomes understandable: the pegging of their national currency to the dollar and changing the dollar currency to dollar denominated bills amongst their reserves. The latter transaction, however, redirects the import financing dollar to its originator country, thus it can finance more imports. Thus in the function of the reserve policy – depending on the aimed ratio of the dollar denominated bills – the schoolbook process of money multiplication can be detected. There are two more multiplications: first through the dollar purchases of the Chinese central bank, because it creates monetary base, and second through the increasing international liquidity market participants can involve in more leveraged transactions.

Result IV

On the ground of the money theoretic or technical drawbacks of the possible alternative monetary systems the full fledged change of today's monetary system – based on the world currency role of the dollar – cannot be expected.

The result is partially substantive, as its retracement and understanding is based on the money theoretic works of others.

The possibility of the spontaneous or actively planned changing of the international monetary system has been raised by mane. I analyzed the alternatives from a money theoretic and technical point of view. In order the euro (or some other national currency) to become world currency or effective rival of the dollar, the external position of the Eurozone should be redirected to more deficit, as only this way could the demand for transaction tools and precautionary reserves of the world be satisfied. The ambitions of the European Union to inspire state budgets and households to save more aren't enhancing this possibility. If it changed, no mechanism could be found to guarantee that today's asymmetries wouldn't evolve in the future.

The dollar on the international market could be changed for a supranational currency or some clearing system or mutually rivaling currencies. These possibilities, however, would be such limitations that would impede the smooth liquidation of market transactions, which contradicts the elemental motive of money-usage.

*In the **4th chapter** I addressed the issue why mainstream (neoclassical) models can't answer the question of sustainability of global imbalances, and after drawing the critiques I approached the processes introduced in the previous chapters in a stock-flow consistent, post-Keynesian model; previously I had drafted the next hypothesis.*

Hypothesis III

The question of sustainability, i.e. that whether global imbalances are consistent with the model equilibrium, cannot be decided in the neoclassical model framework.

The results of the chapter are the next.

Result V

The conception of the neoclassical economic models bears a contradiction in terms, because it assumes unimpeded decision makers and at the same time it necessitates an external institution that controls the agents in order to reach equilibrium.

The result is substantive, it leads to the better understanding of global imbalances so that it helps to accept the argument stating that the research of the field with models bearing implicit equilibrium won't be possible.

One of the main inspirations of Adam Smith's Wealth of Nations was to show, that there were mechanisms in the unimpeded, ungoverned civic societies that construct equilibrium, and transparent, operational systems. The concept of the "invisible hand" wasn't much emphasized by Smith, nevertheless it's a fact that in his work he named it as an institution leading men without their intentions. In the deductive economics of the 20th century the invisible hand and it descendants – such as the walrasian auctioneer, the perfect foresight or the perfect rationality – have become central institutions, because they can guarantee the development of the model equilibrium. At the same time they are in conflict with the simultaneous assumption of the existence of self-sufficient economic agents.

Result VI

Global imbalances as accounting identities can be consistent with the model equilibria of economic approaches that are built on the assumption of utility maximizing representative households with infinite time horizons.

***The result is substantive** and important because reckoning it helps to recognize that the empirical accounting catalogs won't be appropriate to control for disequilibrium situations of the mainstream models.*

The conditions of the equilibrium in general equilibrium models are the clearing of the markets and the fulfillment of the intra- and intertemporal budget constraints. At the end of the time horizon economic agents cannot have claims (and debts neither), because it wouldn't be consistent with their supposed utility maximizing behavior. The fulfillment of the intertemporal budget constraints means that the current financial positions must fluctuate around zero. However, as we don't know how far the time horizon is, the fluctuations can be quite long with fairly big amplitudes. The question of sustainability of global imbalances is whether the empirically observed chronic financial positions, i.e. the accounting imbalance is consistent with the long term model equilibrium. As these models don't specify the length of the time horizon, the above question cannot be answered even with the available accounting catalogs (balance of payments or flow of funds statistics).

There are further inconsistencies between the practice of making up empirical accounting systems and the neoclassical economic models, because models using exogenous money cannot be accounted with the help of the double or quadruple entry principles. With the help of complete accounting systems that contain a financial sector creating money such financial circuits can be constructed that generate deficits without changing the position of the real economy. If we had the chance to use flow of funds or balance of payment statistics to control for theoretical models, even then we'd have difficulties. It is so, because the techniques of tax evasion (offshore, transfer pricing) and derivative products priced out of the market, distort significantly the data bases compiled by statistical offices and central banks. The distortions may appear at goods- and capital items, and at the international income flows as well.

Result VII

Some features of global imbalances can by described with a modified version of the stock-flow consistent model of Godley and Lavoie.

The result is substantive*, solving the original model, modifying and interpreting it is an own work.*

The original model of Godley and Lavoie [2007: pp.: 170-186] introduces an economy with two regions, each containing a household sector and a production sector, and a common central bank and government. In my modified model the South region forms a separate economy without a central bank or a government, because they belong to the North region. The deduction of the solution of the original model, as it is technical in nature, can be found in the F1 Appendix of my dissertation. (The book lacks this solution, so it can be seen as a new result, but merely technical indeed.) The central bank of the North economy creates money that is world currency and fulfills the transaction and hoarding functions. The quantity of money becomes endogenous depending on the saving and portfolio decisions of households. Money can be substituted in its hoarding function with government bond that is the debt of the North government. The system starts to operate with government expenditures, the transactions follow the post-Keynesian circuit as their liquidation needs money. The model has two kinds of equilibrium: the long term steady state equilibrium can be approached through the series of short term temporary equilibria. Stock and flow variables are consistent with each other only in the long term equilibrium, a departure from this consistency generates fast or slow but not immediate readjustment.

With the proper choice of consumption and portfolio parameters and the import ratios the model gives back some important features of global imbalances that were discussed in the first three chapters of the dissertation:

- the South economy (China) is emerging that is helped by its export;
- the South economy (China) is hoarding claims, the bulk of them are treasury bills denominated in the world currency created by the central bank of the North economy (USA), a minor part of the reserves is currency;
- the trade balance of the North economy (USA) is in deficit, but its income balance is in surplus as the capital income inflow is higher than the interest income outflow.

Result VIII

The above features of the model make it feasible to analyze the possible long and short term consequences of expected structural changes by comparing different steady states and by simulating the dynamics of the transitions.

The result is substantive, *it was a difficult but fruitful task to program the model, without it the dynamics of the transitions couldn't have been analyzed.*

During the simulations I changed the parameters of the model in order to mirror the structural changes that are expected and the ground of the analysis of the Chinese and American economic processes. These are: the rise of the Chinese consumption, the decline of the propensity of hoarding bills, the rise of the US productivity, the decline of the American consumption and import (the Chinese export) and fiscal policy austerities. The new long term equilibrium is better than the original if the productivity of the US is rising or its propensity to consume is declining. Every other possibilities, i.e. fiscal austerity (rising tax rates or reducing government expenditures), the growing Chinese consumption or the declining ratio of bonds in the Chinese reserves lead to negative long term consequences, recessions in both economies and the deterioration of China's relative position. These results show the differences between two steady states, the model can't tell us how much time is needed to reach the new equilibrium. Therefore the analysis of the dynamics of the transitions seems more important.

After changing the parameters I analyzed the dynamics of the trade and current account balances, the external debt of the North economy (USA), the structure of reserves of the South economy (China), the incomes (GDPs) and the income ratio (convergence). The results show that global imbalances (the external debt of the North (USA) in the model) could be moderated significantly by the rise of the Chinese consumption parameters relating to disposable income and wealth, and the decline of the Chinese bill-hoarding propensity.

Global imbalances would drastically moderate if all the parameters changed simultaneously, but that would push the Chinese economy into a deep recession (depression). The American economy would fall back in this scenario as well, but more slightly than China. This case confirms the guarded and judicious Chinese economic policy, because sudden changes could lead to grave damages.

4. Possible utilization of the results and further researches

The dissertation doesn't deal with the relationship of global imbalances and the recent economic crisis. The two processes aren't independent, the introduction of the financialization of the American economy and the asset price enhancing effects of dollar liquidity could be possible linkages. However, the economic crisis hasn't tempered global imbalances. Though the current account deficit of the US and the surplus of China declined, the flow positions haven't turned over, the external stock positions are cumulating continuously.

The further stock-flow consistent analysis of global imbalances and the crisis seems a good way to extend the present work, which can be combined with the more profound research of the empirical accountings, the flow of fund matrices and balance sheets. The models could be refined with tendencies picked out from these catalogues, enhancing their prediction power. This is supported by Bezemer [2009], who accurately investigates the method of the economists who predicted the crisis on some theoretical base. The common element was that each of them used the data of accounting systems and analyzed the dynamics of wealth assets and liabilities.

The relationship of the Eurozone and the European Union with global imbalances can be analyzed as well. It is worth to mention that the original version of the dissertation's model can be feasible to analyze the processes of the monetary zone, because its structure – different regions with a common central bank – resembles it.

5. Own publications

Studies

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Globális egyensúlytalanság? (*Global Imbalances?)* 2009. október 30. BCE, A Közgazdasági Doktori Iskola V. Éves Konferenciája

Egy zárt gazdaság egyensúlytalanságai pénzelméleti szempontból. (*Imbalances of a Closed Economy from a Money Theoretic Point of View)* 2010. április 27. BCE, A Közgazdaságtudományi Kar 2010. évi konferenciája

Other

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http://sfc-models.net/models/from-gabor-kurthy/attachment/model-reg-_-solution-_-g_kurthy/

The programs used to the simulations:
http://sfc-models.net/models/from-gabor-kurthy/attachment/sfc_modelreg_g_kurthy/

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