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LUCAS PARADOX IN THE LIGHT OF NEOCLASSICAL THEORY²

Abstract

In their analyses devoted to the directions of international capital flows, economists dealing with the subject often make references to conclusions reached by R. Lucas Jr, i.e., to the so called Lucas paradox. In literature, Lucas paradox provides the starting point for considerations on how neoclassical model works when it comes to the directions and volume of capital flowing among countries in modern global economy. This paper aims at discussing the rationale behind the study conducted by R. Lucas Jr and, consequently, the justification for his conclusion. Lucas paradox is considered in two approaches: classical, i.e., consistent with conclusions drawn by R. Lucas: capital flows between countries in amounts smaller than suggested by differences in marginal products of capital in individual countries and the flow does not equalise them; and contemporary: directions of capital flows in global economy are not consistent with those delineated by the neoclassical model, capital flows from poor (developing) countries to rich (developed) ones. Taking account of neoclassical model assumptions, in both approaches to Lucas paradox drawing „hard” conclusions with respect to directions of capital flows in contemporary economy based on quoted studies does not seem justified.

JEL Classification Code: **G32, G34, H41, L93.**

Keywords: Lucas paradox, international capital flows, neoclassical theory.

Foreword

In their analyses devoted to the directions of international capital flows, economists dealing with the subject often make references to conclusions reached by R.

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Neoclassical theory

Until the outbreak of the worldwide financial crisis (2008), the question of free movement of capital in global economy was clearly dominated with conclusions drawn from neoclassical economics. They served as a foundation for practical recommendations, in accordance with which countries should abolish the existing restrictions as quickly as possible. However, seeking to apply the conclusions of neoclassical theory to our contemporary reality, we need to realise that economic circumstances, on which theoretical model was built were very much diverse from our contemporary reality.

Neoclassical economic theory emerged in the age of the gold standard (1870-1914), where free flows of capital among countries were natural. The theory was consistent with the economic practice of those times – it unambiguously confirmed benefits resulting from international free movements of capital. In accordance with the neoclassical model, global economy may experience only one optimum condition, i.e., full liberalisation of capital flows. Any other option (partial or no liberalisation) were, and still are, perceived as suboptimum. It means that countries, which maintain any restrictions reap benefits below their potential. Changes that take place in domestic markets following the abolishing of restrictions vis-a-vis capital flows can be easily observed on the example of two countries in a static partial equilibrium model (Fig. 1, 2, and 3). Assumptions of the neoclassical model provide the starting point for this analysis³.

Country A has got less capital than country B and the price of capital is higher in country A than in country B. When markets of both countries are isolated, higher price of capital in A is maintained. In B the price of capital is lower than in A due to the existing restrictions.

Supply of capital (C) is marked on the abscissa, while its price, the interest rate (r), is marked on the ordinate. Curves DC_A and DC_B represent demand for capital in both countries at a given price of capital (respectively, r_A and r_B). Capital supply at prices r_A and r_B is represented by curves SC_A and SC_B . If there are barriers to the flow of capital between countries A and B, price of capital r_A is higher than the price of capital in country B – r_B . The situation continues until

³ Such as: two countries, no impact of other external factors, perfect competition and all factors of production are fully employed; 0-1 game (0-closure, 1-opening).

barriers to capital flows between A and B are removed. As a result, capital from country B will move to country A until prices of capital in both countries are equal $r_A = r_B = r$. Supply of capital in country B will drop from C_B to $C_{B'}$, while supply in country A will increase from C_A to $C_{A'}$, accompanied by appropriate adjustments in demand resulting from the changes in the price of capital. The process is illustrated in Fig. 2.

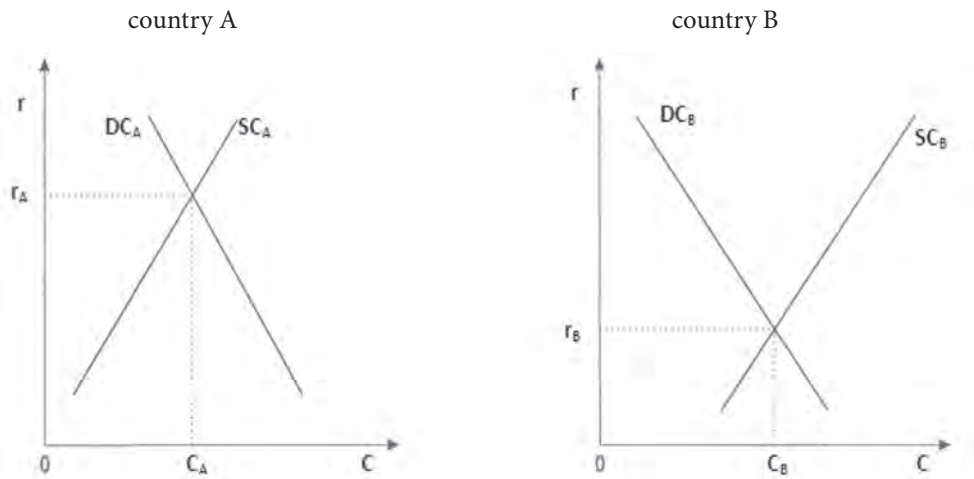


Figure 1. Situation before restrictions in capital flows in both countries have been abolished; partial analysis

Source: A. Czarczyńska, K. Śledziwska (2003), p. 66, McDonald, Dearden (1999), p. 52.

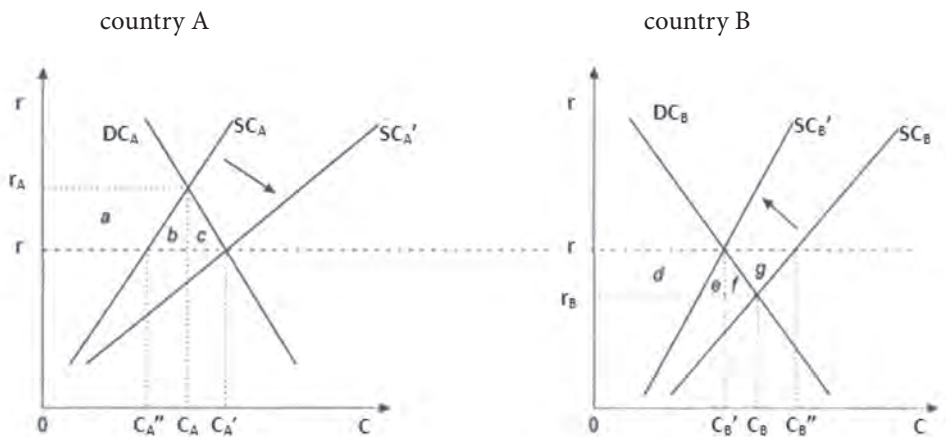


Figure 2. Full liberalization of capital flows, full convergence of prices, partial analysis

Source: A. Czarczyńska, K. Śledziwska (2003), p. 67, McDonald, Dearden (1999), p. 52.

Besides changes in the price of capital and the resulting change in demand for capital, changes will be observed in the welfare in countries A and B measured with economic rent of capital lenders and borrowers. Due to the inflow of capital into country A, the country receives net benefit delineated by areas b and c. It is the difference between the increase in economic rent of capital borrowers, who use more of cheaper capital (areas a+b+c) and reduced economic rent of capital lenders who receive smaller income although they lend the same amount of capital (area a). Welfare changes also in country B. Since the interest rate increased, economic rent of capital owners also increases (areas d+e+f+g), while the value of employed capital and economic rent of capital borrowers (area d+e+f) decrease. Net welfare in country B increases with g area, while combined welfare of both countries involved in liberalisation increases with the area b+c+g. As we can see, liberalisation of capital flows contributes to the increase in net welfare in both countries, however, the situation of capital lenders from countries relatively better equipped with capital will improve while in countries where this factor is relatively more scarce, capital lenders will experience the worsening of their financial performance.

Effects of partial liberalisation of capital flows are presented in Fig. 3.

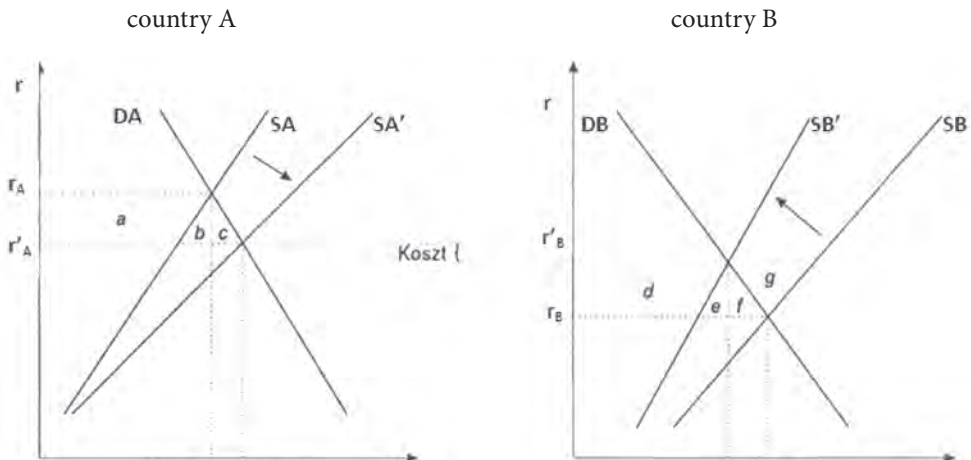


Figure 3. Partial liberalisation of capital flows, incomplete price convergence, partial analysis

Source: A. Czarczyńska, K. Śledziwska (2003), p. 68.

Under such circumstances, there will be no full convergence of the prices of capital – interest rate in country A will be reduced compared to its initial level but it will remain higher than the interest rate in country B. Analogous situa-

tion will be experienced in country B – the interest rate will increase from r_B to r'_B , remaining, however, at the level lower than the interest rate in country A – r'_A . Similarly to the situation when prices of capital are equal in both countries (Fig. 2), incomplete convergence of prices impacts the welfare in both countries. The area representing net welfare ($b+c+g$) is nevertheless smaller than when price convergence is full. It means that also under incomplete convergence of prices of capital total net welfare increases in countries engaged in liberalisation although it is smaller than when prices of capital are equal.

Neoclassical model, built on many unrealistic assumptions, reflects an ideal situation unattainable in contemporary real economy. Taking account of the fact that the model explained economic processes in the period of gold standard system, its main characteristics are worth recalling. Brief analysis presented below clearly demonstrates that differences between the model and our present reality are relevant enough to prevent any direct import of model solutions, which derive from the gold standard system, to our reality:

1. Primarily, in the gold standard monetary system, gold, or its substitutes that could be converted to gold, fulfilled the role of national and international currency – all forms of money in circulation were only symbols that made references to a particular commodity (commodity money).
2. No country, at least theoretically, was privileged when it comes to issuing money, which was strictly dependent on reserves of gold it owned.
3. All countries established a parity of their national currencies in gold, while the exchange rates resulted from the relation between parities. It means the problem of fluctuating exchange rates and oversupply of money did not exist; each country could supply only as much money as much gold it had in its reserves.
4. Capital was flowing freely among countries.
5. In gold standard system there were no profits connected with changing exchange rates and interest rates, size and directions of capital flows were primarily the function of:
 - private financial resources accumulated in individual countries
 - derivative of the balance of trade of countries.

From the point of view of our analysis, three aspects are essential: absence of active monetary policy and exchange rate policy (system of fixed parity-based exchange rates, commodity currency) of the state, genuinely free capital flows at international scale and the lack of public resources in international financial markets.

Neoclassical model built on the experiences of gold standard monetary system, clearly and unambiguously identifies directions of international capital flows: capital flows from the surplus country to the deficit country until marginal products of capital (or, to put it simply, rates of return) become the same. In the gold standard monetary system the surplus „rich” countries were developed countries while deficit, „poor” countries were developing countries. The direction of in-

ternational capital flows under this system, in line with neoclassical model, i.e., from developed to developing countries, is confirmed by the study⁴ conducted by M. Schularick (2006).

Modern foreign exchange system, referred to as the multi-currency one, is based on completely different principles, e.g., there is fiat money, capital flows are not liberalised globally, countries pursue active exchange rate/monetary policy. Why should we come back to the neoclassical model as a basis to explain directions of capital flows in global economy? It is connected with processes that started in the global economy in the 1980s (the beginning of the so called second wave of liberalisation of financial markets) and a change in dominant theoretical trend (from Keynesism to monetarism), return to liberal ideas and the belief that free market is better than state interventionism. These ideas revived the conviction that, both from the point of view of countries and all of the global economy, full liberalisation of capital flows is beneficial. Interestingly, economists who explore processes in global economy using the neoclassical model relatively rarely, if ever, would ask a question fundamental from the point of view of these analyses: in the face of diverse operating conditions of modern global economy, can we justify „overlapping” contemporary economic processes with the neoclassical model?

At this very point, I wish to explain that the problem does not lie in model assumptions, which cannot be met *ex definitione*, as in the model global economy consists of only two countries, there is perfect competition, no external impact, etc. The issue, which from the point of view of our study on directions of international capital flows is fundamental concerns the existence of full freedom of capital flows among countries. One needs to bear in mind, however, that restrictions imposed on this freedom, which started in the 1930s, intensified after WWII while elimination of restrictions that accompanied the second wave of financial market liberalisation did not cover all countries equally and took place mainly in developed countries.

3. Famous study by R. Lucas Jr

In 1990 R. Lucas Jr published a paper, in which he questioned the applicability of conclusions from the analysis of theoretical neoclassical model (Lucas 1990, pp. 92-96). „Contrary to what is suggested by neoclassical economy, global resources do not flow from rich to poor countries but are invested mainly in rich, but also in the richest, countries e.g., the United States.” (Singh 2002, p. 20). The

⁴We also need to note that studies on gold standard period are hampered by very limited data resources and difficult access to them.

incoherence of theory and practice is known as Lucas paradox. Against our expectations, capital does not flow from rich to poor countries or, more precisely, it flows in amounts much smaller than what differences in marginal products of capital in these countries would suggest.

In his research, R. Lucas compared two countries: United States and India. Adopting standard assumptions of neoclassical theory he proved that in 1988 marginal product of capital in India was 58 times bigger than that in the U.S. Under such circumstances, in accordance with neoclassical theory, capital should flow from India to the United States until marginal products of capital in both countries would be the same. In practice that did not happen at all, neither were there premises for claiming that the process has ever taken place. Conclusions reached by R. Lucas helped challenge the applicability of marginal product of capital as a factor explaining directions of global capital flows and opened up a discussion that has been going on until now about what is their main determinant. Economists made an attempt to identify reasons, why economic theory diverges, as R. Lucas demonstrated, from economic reality. Lucas himself rejected the most probable option: higher than the average risk of investing in developing countries, in this case in India. However, justification for this rejection is not easy to digest. He claimed that because many developing countries were colonies of developed economies before WWII, colonial empires imposed their legal orders upon them and, thus, risk connected with legal and organisational infrastructure in countries covered by the study is very similar. According to him, the major reason for the divergence between theoretical and practical conclusions consists in imperfections of the so called human capital in developing countries, which make benefits from capital invested in them lower than expected. Lucas's arguments are not convincing. Occupying powers (colonial countries) transfer their own economic models to countries they occupy (colonies) only to the extent indispensable for the occupied country to operate and meet its needs. Hence, it does not mean full implementation of laws and adoption of organisational patterns of the colonial power. On top of that, colonies may be unable to fully embrace these models due to the advancement of their social and economic development, they may also be uninterested in their adoption because of their origin.

Studies conducted by R. Lucas in 1990 inspired many economists who wanted to answer the question what, if not differences in marginal product of capital, determines international capital flows. Here are some examples.

M. Clemens (2002) pointed out that not only rich countries export capital to other rich countries but also capital borrowers from poor countries have relatively difficult access to domestic capital since capital lenders from poor countries prefer investing abroad rather than at home. This derives from market failures in developing countries. Importantly, however, capital borrowers from developing

countries are treated like capital lenders from rich and poor countries, meaning they do not get enough incentives to invest in developing countries.

C.M. Reinhart and K.S. Rogoff (2004) highlight another reason for Lucas paradox. According to them, the main problem is the frequent inability of poor countries to meet their financial obligations connected with servicing and repaying their foreign debts. That is the reason why investors do not perceive them as safe investment targets. Thus, not so much modest investments of rich countries in poor countries but the fact that these investments (especially credits) are made, especially in countries, which have already failed to pay their debts on time is a paradox.

L. Alfaro, S. Kalemli-Ozcan and V. Volosovych claim that broadly understood institutional quality of social, economic and political environment and economic policy pursued by a given country (Alfaro, Kalemli-Ozcan, Volosovych, 2005), are among major determinants of capital inflow. It means they have adopted the hypothesis which R. Lucas challenged about investment risk in developing countries at levels above those that would justify making an investment.

Vast majority of analyses focused on Lucas paradox assume that marginal product of capital in developing countries is higher than in developed countries. The foregoing is contradicted, however, by results obtained by F. Caselli and J. Feyrer (2006), in accordance with which the product is very similar in all countries. These authors analysed not only domestic labour and capital resources, usually considered on similar occasions, but also land and natural resources.

A plethora of studies on Lucas paradox is available.. Relatively short paper by R. Lucas Jr is quoted practically in all publications on international flows of capital. This paper, however, does not attempt to explain what is the principal determinant of global capital flows but discusses the validity of conclusions drawn by R. Lucas based on his study. Before coming to the point, I would like to indicate that the term „Lucas paradox” can be interpreted in two ways:

- 1) in classical approach, i.e., in accordance with conclusions drawn by R. Lucas: capital flows among countries in quantities smaller than suggested by differences in marginal product of capital in individual countries and the flows do not eliminate the differences;
- 2) in contemporary approach: directions of capital flows in global economy do not concur with those identified by neoclassical model; capital flows from poor (developing) countries to rich (developed) countries.

Analysis of conditions of Lucas paradox suggests, however, that the paradox can hardly be perceived in classical Lucas's approach and in its expanded version concerning directions of capital flows in global economy.

4. Lucas paradox – classical approach

To start with, I would like to address classical approach to Lucas paradox, in accordance with which neoclassical model „does not work” in contemporary global economy because marginal products of capital do not fully equalise among countries. First and foremost, we need to stress that R. Lucas does not negate the usefulness of neoclassical theory from the point of view of directions of capital flows and only stresses that too little capital is flowing among countries to arrive at equal marginal products of capital in all countries covered by the study.

The key issue, to my surprise left aside by R. Lucas and other economists invoking the „paradox”, is the fact that examining how neoclassical theory works in modern global economy on the example of United States and India was unjustified. Precondition for a complete convergence of marginal products of capital in these countries is full liberalisation of capital flows between them. If such liberalisation does not exist, expecting that capital flows will continue until rates of return in the two countries are equal cannot be justified even on theoretical grounds. Restrictions imposed upon free movement of capital isolate domestic market from international markets and limit relative freedom of the country in question to exercise monetary policy, including establishing the interest rate (when stabilising the exchange rate of domestic currency - it is consistent with the so called macroeconomic trilemma).

Under such circumstances, to validate a theory we should select countries which abolished restrictions in capital flows. Only then could we reasonably expect that marginal products of capital become equal, the process is theoretically reflected in neoclassical model of general equilibrium⁵ (Fig. 4). The model is based on short-term analysis of production function. Producer decides how much capital is needed, depending on the revenue he/she receives from using an additional unit of capital, thus the analysis is based on marginal product of capital⁶. Optimum amount of engaged capital depends on marginal product of capital and on its price. As you cannot justify the employment of additional capital when its price exceeds profit obtained by the producer, optimum amount of engaged capital is reached when the price of capital equals its marginal product.

Country A has got relatively less capital than country B, meaning in country A at the price of capital r_A used capital is represented by $0_A C_1$ area, while in

⁵ Also in this case we used simplified assumptions: the study covers only two countries, perfect competition, full employment of other factors of production and constant production curve, there are barriers to the flow of goods, no external environment and two extreme options are researched – full closure and full opening (0-1 system).

⁶ Marginal product of capital is a relation of anticipated (not current) net income from an additional unit of a factor to its price.

country B at the price $r_B - 0_B C_1$, at the total value of capital $0_A 0_B$. When restrictions are imposed on capital flows, country A manufactures global production represented by area $0_A I H C_1$, and capital owners receive $0_{Ar_A} H C_1$, and owners of other factors of production – $H I r_A$. Situation is identical in country B – global production is $0_B D F C_1$, out of which $0_B r_B F C_1$ is taken over by owners of capital leaving $r_B D F$ to the rest. When barriers to flow are eliminated, situation changes in both countries. Country A, which had less capital starts receiving it, as a result of which prices of capital decrease. A reverse situation takes place in country B, from which capital outflows leading to price increases. After some time, prices of capital equal r in both countries. Country A receives capital, profitability rate drops from r_A to r , but the value of global production increases from $0_A I H C_1$ to $0_A I E C_2$ (some manufacturing $C_1 C_2 E G$ is taken over by foreign investors). At the same time, income of capital lenders in the country decreases – from $0_{Ar_A} H C_1$ to $0_{Ar} G C_1$, and incomes of owners of other factors of production increase from $r_A I H$ to $r I E$. Capital is leaving country B, production volume in this country is $0_B D E C_2$, and capital, which left the country generates production in country A the value of $C_1 C_2 E G$. Since some capital moved abroad, National Product in country B increases reaching $0_B D E G C_1$ and is higher than the previous one by EGF . Income of capital lenders in country B increases and amounts to $0_B r G C_1$, while income of owners of other factors of production decreases to $r E D$. Increase in net welfare in the area where capital flows have been liberalised is illustrated by the triangle EFH ($EGH + EGF$). Convergence of prices of capital will positively impact countries, which decide to eliminate barriers to capital flows and will improve overall performance of global economy.

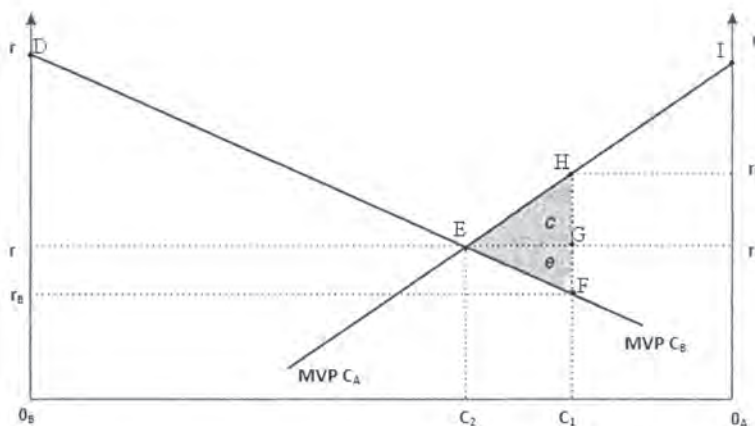


Figure 4. Neoclassical model of general equilibrium – production and income effects under free flows of capital

Source: A. Czarczyńska, K. Śledziwska (2003), p. 72.

Referring to R. Lucas's choice of countries, while the U.S. can be considered open, meaning the key assumption of neoclassical model is met, India has never been an open economy. It means, waiting for rates of return on capital in India and in the U.S. to become equal (even leaving profit/risk indicator aside) was and is simply ungrounded. As demonstrated by I. Patnaik and A. Shah (2012) restrictions of crossborder flows were imposed in India by the British back in 1942. Then, the system of restrictions on transactions from current and financial accounts was expanded and first changes were introduced as late as in 1991!⁷ Full liberalisation of transactions included in the current account and gradual liberalisation of capital flows took place in 2000. The authorities were very much preoccupied with the stability of the exchange rate as until 1990 India had a fixed exchange rate. Step-by-step approach was followed to switch to market-determined exchange rate and for Indian authorities it was difficult to approve fluctuating rupiah's exchange rate. That explains why restrictions in free movement of capital were either maintained or restored so that they could actively impact the volume of capital movements, when, and if, necessary from the point of view of exchange rate policy (Patnaik, Shah, 2012). Lucas's survey was conducted in 1988 when Indian economy was practically closed for free movements of capital and Indian currency was not convertible. I must admit, it is really ununderstandable to me how, under such circumstances, can one expect equal rate of return on capital invested in the United States and in India. The choice of India for the study is also difficult to understand since the country did not meet the major assumption of neoclassical model, i.e., absence of restrictions in financial flows.

Conclusions draw by Lucas still today provide a reference point for economists who analyse the possibility to apply the neoclassical model to modern global economy. If we consider initial conditions, i.e., restrictions in the Indian economy, the fact that rates of return on capital did not equalise is not surprising. It would be surprising if under such circumstances returns were equalised. Hence, it is hard to acknowledge that R. Lucas considerations prove that neoclassical model does not work in modern global economy. Neither does it seem justified to question marginal product of capital as a leading determinant of international capital flows. Preconditions for drawing such a conclusion were not met.

5. Lucas paradox – contemporary approach

As we have already mentioned, original conclusions of R. Lucas have been distorted and currently Lucas paradox is interpreted as a situation when, contrary to neoclassical theory, global capital flows from developing to developed countries.

⁷ As a result of reforms consulted with the IMF.

At this point a question emerges: is this direction of capital flows really inconsistent with neoclassical theory? Neoclassical theory teaches us that capital flows from surplus to deficit countries, and this direction is maintained in contemporary economy. Interpretational problems with the theory arise somewhere else. In the age of gold standard, when neoclassical model emerged, surplus, rich countries were developed countries while poor, deficit countries were developing ones. Capital actually flew from developed and rich countries to countries which were developing and poor. Countries did not pursue any active monetary policy, did not accumulate meaningful currency reserves, did not interfere with foreign exchange markets and in international markets private not public funds were invested.

Nowadays, the above circumstances have changed. Developing countries pursue active monetary and exchange rate policies, accumulate currency reserves, restrict free movements of capital. For all these reasons, even with relatively low GDP per capita, they have become surplus countries – they not only run surpluses on current account but also have huge currency reserves. Under such circumstances, capital flows in accordance with neoclassical model from surplus (developing) countries to deficit (developed) countries, which develop at their cost. Neoclassical model does not explore the source of capital (public-private) but is interested in financial resources of countries. This is, of course, atypical as flows of resources from currency reserves are not classical investment flows. Currency reserves are invested mainly with safety and liquidity criteria in mind with profit playing less prominent role. Since flows of public funds are not predominantly guided by profit, they do not equalise marginal rate of return between countries. Moreover, restrictions in capital flows are not abolished – e.g. China invest their currency reserves in various countries worldwide, mainly in the U.S. and maintain restrictions on capital flows.

One aspect remains obvious, capital flows from countries which have it in abundance to those suffering due to its scarcity. Neoclassical theory does not distinguish between poor and rich countries. China invest significant financial resources in the U.S. market. According to data, GDP per capita at the end of 2014 in China was USD 3,886 and in the United States 46,405 (GDP per capita PPP – USD 12,609 and USD 52,118, respectively); China currency reserves, ca. USD 3.85 trillion, while the U.S. currency reserves ca. USD 120 bn. China run current account surplus (2.0% GDP), while United States a deficit (2.4% GDP)⁸. No doubt, China are still a developing country while United States a developed economy. But the answer to the question which country is more wealthy is not an easy one. The structure of a contemporary international currency system is very

⁸ Data for individual countries after: www.tradingeconomics.com

much different from that of the gold standard, just as much as economic policy presently exercised by countries of global economy, where the key role is played by managing the domestic market (taking care of economic growth and active combating unemployment – Keynesian ideas, alien to neoclassical theory) differs from economic policy of countries in the age of gold standard. Thus, simply saying that at present capital flows against the direction specified by neoclassical theory, i.e., from poor to rich countries, seems a too far-reaching simplification. The situation can hardly be referred to as „paradox” as neoclassical model makes references to capital resources only, not to their sources. Beyond any doubt, the rates of return on invested capital do not equalise, which is due to the specificity of operating conditions in contemporary economy. However, if we replaced India with China we would still have problems with employing the neoclassical model: China maintain restrictions on free movement of capital.

Conclusion

Lucas paradox has been discussed in specialist literature for years and I do not expect that to change. My paper strives to demonstrate that drawing „hard” conclusions based on quoted studies seems to be ungrounded. In my opinion, the biggest paradox is the fact that R. Lucas drew a correct conclusion that in contemporary global economy marginal products of capital have ceased to be the leading determinant of capital flows but he did not develop the justification to his conclusion to identify how neoclassical model can be related to the reality of global economy, with particular attention paid to involved economies. For we may say that a theory does not work but saying that it does not reflect the reality and it simply does not make sense to apply it, is a different matter.

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