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Conflict and Peace in Autocratic and Democratic Regimes: The Case of Africa

Oluwole Owoye*

Abstract

This paper utilizes conceptual economics to explain the relationship between conflicts, peacebuilding, and economic development under autocratic and democratic regimes in Africa. Economists consider conflicts and peace as two socio-political "goods or services," characterized by positive and negative externalities. Both conflicts and peace have contagion effects in many countries and, in some cases, conflicts have morphed into regional and international problems. Conceptually, the monotonicity of conflicts and peace functions are invariant with respect to autocratic and democratic forms of governance in Africa. One of the main assertions of this study is that, whether we have stable autocratic and/or democratic forms of governance or not, protracted conflicts have a negative impact on sustainable economic growth in Africa. We also assert that peacebuilding through the establishment of Truth and Reconciliation Commissions (TRCs) may not actually enhance national unity in African countries. To confirm or refute these assertions, this paper utilizes historical data evidence to examine the trajectories of conflicts, peace, and economic growth in Africa since the 1950s. Given the proliferation of armed conflicts that have engulfed the African continent until recently, we found out that they followed positive and negative parabolic trajectories. More importantly, we found that these armed conflicts had statistically significant negative impact on Africa's economic growth and development. Furthermore, we found no statistically significant difference in the level of peacefulness between those African countries that did not use the TRCs and those that invested in TRCs to foster national unity.

Keywords

conflict, peace, autocratic, democratic, African countries

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1. INTRODUCTION

Since many African countries became independent, a tremendous attention has been paid to the rising level of conflicts within and between countries in the African continent. The rising level of conflicts has also led to the establishment of many institutions dedicated to studying those issues plaguing the African continent such as the upsurge in its conflicts and to helping people to peacefully resolve conflicts within and between countries in Africa.[1] This paper utilizes conceptual economics to explain the relationship between conflicts, peacebuilding as well as economic growth and development as many African countries gradually transitioned from autocratic to democratic regimes. The consensus among research scholars is that autocracy and democracy are two contrasting and distinct forms of governance and that the fundamental differences can be found in the processes through which executive power is acquired and transferred, political power is exercised and controlled, in the definition and preservation of social order, and the influence of public interests and opinions on the autocratic and democratic institutions of governance. Despite these primary differences, both forms of governance are often perceived to be comparably stable and effective in maintaining social order in the developing world.

One of the major shortcomings in social sciences research is that the theories of conflicts, collaborative-peace or peacebuilding, and economic development have largely evolved in isolation from one another even though they are intertwined. Economists consider conflicts and peacebuilding as two socio-political "goods and services" which are characterized by positive and negative externalities. Both conflicts and peace have contagion effects in many countries worldwide, and in some cases, local conflicts have morphed into national conflicts, then regional conflicts, and into global conflicts in the form of international terrorist attacks. Conceptually, the monotonicity of the conflicts and peacebuilding functions are invariant with respect to autocratic and democratic forms of governance in Africa. Furthermore, it is impossible for any country in Africa and elsewhere to avoid short-run and long-run socio-cultural or religious and political conflicts. One of the main assertions of this study is that whether or not we have stable autocratic and/or democratic forms of governance, prolonged conflicts will have a negative impact on sustainable economic growth and development in Africa. In addition, we assert that peacebuilding through the establishment and investment in Truth and Reconciliation Commissions (TRCs) may not actually enhance national unity in the TRC countries when compared to the non-TRC countries. The empirical tests confirm both assertions.

The rest of this paper is organized as follows. Section 2 discusses some of the causal or triggering factors in conflicts and peacebuilding in Africa. Section 3 uses the theoretical

marginal analysis from economics to show that there are different groups of countries in Africa with respect to their optimal choice or combinations of conflicts and peace. Section 4 provides data evidence to show the relationship between conflicts and economic growth in Africa since the 1950s, a period during which many countries transitioned from autocratic to democratic regimes. Section 5 concludes with some policy implications and recommendations.

2. THE CAUSAL FACTORS AND TRENDS IN CONFLICTS AND PEACEBUILDING IN AFRICA

The general consensus among the studies of global conflicts is that the countries in Sub-Saharan Africa (SSA) and the Middle East and North Africa (MENA) carry the largest conflict-burden per population. Given the arbitrary national borders that emerged from the scramble for Africa in the 1880s, one could easily surmise that these conflicts were related to border disputes between countries since many different ethnic nationalities that belonged to different geographical spaces were arbitrarily grouped together as a nation. Contrary to expectations, these conflicts are generally within and not between countries. Conflicts in African countries have economic, social, and political underpinnings with such reinforcing effects that it is virtually impossible to separate conflicts driven by economic factors from the social and political factors. Arguably, extreme poverty is one of the many contributing factors to conflicts in African countries. The general consensus among growth economists and the World Bank is that households who live on less than the international benchmark of $1.25 per day are considered to live under extreme poverty,[2] and that this tends to exacerbate income inequality, thus leading to internal social and violent political conflicts.

Another factor that contributed to conflicts in African countries was the gradual transition from the autocratic form of governance that permeated the continent in 1960s until the early 1990s. Between 1960 and 1990, there was the struggle for leadership, power and the control of natural resources by the greedy political leaders and warlords. During this period, nearly all African countries witnessed military incursions into the position of power. Political and social scientists considered this era in African history as a period of armed military conflicts through various successful, attempted, planned or plotted, and alleged[3] coups d'état. This was a period of confused political ideologies (or democratic deficit), thus armed military conflicts pervaded the African continent and many economies deteriorated because their scarce economic resources were diverted into the importation and provision of more military weapons instead of the essential capital and consumer goods needed for sustainable economic growth and development.

Many African countries succeeded in sustaining armed military conflicts because of the higher unemployment rates among the very young population [see Blattman and Annan

(2010)]. These large pools of unemployed youths[4] became the source of recruitment in the proliferation of armed conflicts in countries such as Burundi, Liberia, Sierra Leone, and Uganda. Armed military conflicts fuelled by greedy warlords and political leaders quickly spread across Africa. Collier and Hoeffler (1998), in their empirical seminar work at the World Bank, identified two potential categories of determinants of violence: greed and grievances. With respect to greed, Collier and Hoeffler (1998) argued that profit or rent-seeking political leaders would induce violence as a way to gain control over sources of wealth and looting, which are then used to finance more armed conflicts. For grievances, Collier and Hoeffler pointed out that grievances could be associated with the differences in ideological principles, religious hatred, ethnic fragmentation, inequality, social exclusion and alienation, and therefore the desire for retaliation and revenge.

There are other explanations put forward for the ceaseless conflicts in some regions in Africa: repeat violence, neighbourhood effect or conflict contagion. With repeat violence, the argument is that those countries or regions that once experienced large scale violence may become desensitized to conflicts; therefore, the tendency towards repeat violence is very strong. As for the neighbourhood effect of regional conflict contagion, neighbouring countries in conflict-ridden regions tend to be drawn into conflicts, either by becoming refugee camps on humanitarian grounds or through the organized regional peace-keeping efforts.[5] There are cases in which the regional peace-keeping organizations are directed by the United Nations peace-keeping efforts.

Given the new era of globalization, exportations and importations of conflicts are the new global phenomenon through terrorist attacks. Recently, Alain de Janvry and Elisabeth Sadoulet (2016) pointed out that the Global Terrorism Database at the University of Maryland showed that the number of attacks by groups connected with Al-Qaeda and the Islamic State increased from 200 per year over the period 2007-2010 to 600 in 2013. It is important to note that these international terrorist groups are now establishing bases in many parts of Africa, which means that an end to the global armed conflicts may not be in sight if the African continent, with its weak institutional structures, becomes the safe haven for different terrorist groups.

Finally, we hasten to add that there are two additional sources of violent conflicts between communities in towns, states, and countries in Africa that are rarely mentioned in conflict literature or given any scholarly debate. These are the national land tenure reforms and the enforcement of property rights, and both are related. Worldwide, Africa is known as an agrarian continent where land ownership and tenure have been very controversial because of the variations across communities, states, and countries; therefore, controversial land tenure reforms create tensions and conflicts between those who lose and those who gain from these land redefinitions. In Africa, Egypt, Ethiopia, Kenya, Namibia, South Africa, and Zimbabwe have a semblance of meaningful land tenure reforms in order to address the violent conflicts over land ownership between communities. Another issue is the effective enforcement of property rights, which does not exist in many African countries, hence the

violent conflicts between communities and regions.[6] For example, according to David (2016), the Fulani herdsmen in Nigeria continued to trespass, attack, and kill innocent owners of local farmlands across different states because the federal and state governments have no clearly defined and enforceable property rights. This enables these herdsmen to move from one state to another in search of green pasture to graze their cattle.

3. THE THEORETICAL ANALYSIS OF CONFLICTS AND PEACE

This paper asserts that countries cannot avoid socio-cultural-political conflicts and peace; therefore, we assume that conflicts and peace are two naturally non-complementary goods that countries consume in varying proportions. In other words, we assert that the optimal combination or consumption of conflicts and peace varies among countries based on the reality that some African countries today are more conflict-ridden with little room for peace, while others experience a more peaceful environment with less conflicts, and others are indifferent between both. To illustrate the varying optimal combinations of these two naturally non-complementary goods, we assume that each African country's utility or objective function (U) with respect to its socio-cultural-political conflicts (K) and peace (P) can be expressed as:

$$Ui = f(K_i, P_i) \qquad (1).$$

subject to the linear constraint

$$k_iK_i + p_iP_i = Y_i \qquad (2)$$

where k_i and p_i represent the prices/costs of K_i and P_i, thus k_iK_i[7] and p_iP_i are the total expenditures/costs of socio-cultural-political conflicts and peace, respectively; and Y_i is the gross domestic product in each country i. If we assume that both conflicts and peace entail substantial expenditures, then we can interpret $\frac{k_iK_i}{Y_i}$ and $\frac{p_iP_i}{Y_i}$ as the proportions of national income devoted as expenditures on conflicts and peace in each African country, and that these vary across countries depending on whether the country is conflict-ridden or peace-loving and vice-versa.

The Lagrangian function for a constrained maximization or a constrained minimization problem with the utility or objective function $f(K_i, P_i)$, given in equation (1) subject to the linear equality constraint that $k_iK_i + p_iP_i = Y_i$ given by equation (2), can be expressed as:

$$L(K_i, P_i, \lambda) = f(K_i, P_i) - \lambda(k_iK_i + p_iP_i - Y_i) \qquad (3)$$

where all variables are as defined earlier, and λ is the Lagrange multiplier. Solving the constrained optimization problem corresponding to the Lagrangian function given in equation (3) involves the solution to a system of equations, which includes the first-order

conditions for the Lagrangian function with respect to each of the argument variables of the utility or objective function and the linear equality constraint. That is:

$$\frac{\partial L(K_i, P_i, \lambda)}{\partial K_i} = f'(K_i) - \lambda k_i = 0, \text{and } \lambda = \frac{f'(K_i)}{k_i} \tag{4}$$

$$\frac{\partial L(K_i, P_i, \lambda)}{\partial P_i} = f'(P_i) - \lambda p_i = 0, \text{ and } \lambda = \frac{f'(P_i)}{p_i} \tag{5}$$

and

$$\frac{\partial L(K_i, P_i, \lambda)}{\partial \lambda} = k_i K_i + p_i P_i - Y = 0 \tag{6}.$$

Solving to remove λ in the first-order conditions derived in equations (4) and (5) yields:

$$\frac{f'(K_i)}{k_i} = \frac{f'(P_i)}{p_i} \tag{7}$$

and rearranging this relationship to obtain the optimal or ideal conflict (K_i*) and peace (P_i*) ratio, we have

$$\frac{K_i^*}{P_i^*} = \frac{f'(P_i)}{f'(K_i)} = \frac{p_i}{k_i} \tag{8}.$$

The optimal conflict (K_i*) and peace (P_i*) level or ratio derived in equation (8) varies across African countries; therefore, to highlight these variations, let us assume that there are three groups (A, B, and C) of countries. For simplicity in exposition, we assume that Group A consists of countries such as Botswana, Lesotho, Mauritius, Mozambique, Namibia, Tanzania, and Zambia among others who are averse to conflicts but peace-loving. Group B consists of countries such as Algeria, Cameron, Gabon, Guinea-Bissau, Mauritania, and Senegal among others that can be classified or considered as conflict-peace indifferent or neutral overtime. And Group C consists of the most conflict-ridden countries such as Central African Republic, Democratic Republic of Congo, Libya, Nigeria, Sudan, and South Sudan with less peace.

These groups of countries are depicted in Figure 1 in which the amount of conflicts (K) is measured along the vertical axis and the amount of peace (P) is measured along the horizontal axis. The feasible sets in this diagram are represented by the lines FF, which shows the combinations of K and P, say from the 1960s to the early 1970s; and $F'F'$, which shows the combinations of K and P, say from the 1980s to the current period. It is important to note that the points along lines FF and $F'F'$ satisfy the budget/cost constraint specified in equation (2). The slope of the conflict-peace budget/cost lines (FF and $F'F'$) is the ratio of the cost/price of conflicts relative to peace in each African country. That is,

$$\frac{dK_i}{dP_i} = \frac{p_i}{k_i} \tag{9}$$

The indifference curves U_A, U_B, and U_C, based on equation (1), represent the combinations of conflicts and peace that these three groups of countries experienced in 1960s and early 1970s, while the indifference curves U'_A, U'_B, and U'_C represent the combinations of conflicts and peace since the 1980s. Lines OA for Group A, OB for Group B, and OC for Group C represent the conflicts-peace expansion path as each group of countries has transitioned from either autocratic to democratic regime since the 1990s or has maintained the same form of governance since the 1960s. Furthermore, combinations K_A, P_A for Group A; K_B, P_B for Group B; and K_C, P_C for Group C are chosen based on the principle of equal marginal utility (MU), that is, these are the points where the marginal utility of conflicts (MU_K) and the marginal utility of peace (MU_P) are equal. These are indicated by the points where U_A, U_B, and U_C are tangent to line FF; and U'_A, U'_B, and U'_C are also tangent to line $F'F'$. The increase in combinations from K_A , P_A to K'_A, P'_A for countries in Group A; K_B, P_B to K'_B, P'_B for countries in Group B; and K_C, P_C to K'_C, P'_C for countries in Group C reflect the rise in both conflicts and peace as their national income or gross domestic products increased over the years. In essence, K and P are the naturally non-complementary goods which the developed and developing countries consume due to their socio-political behaviour.[8]

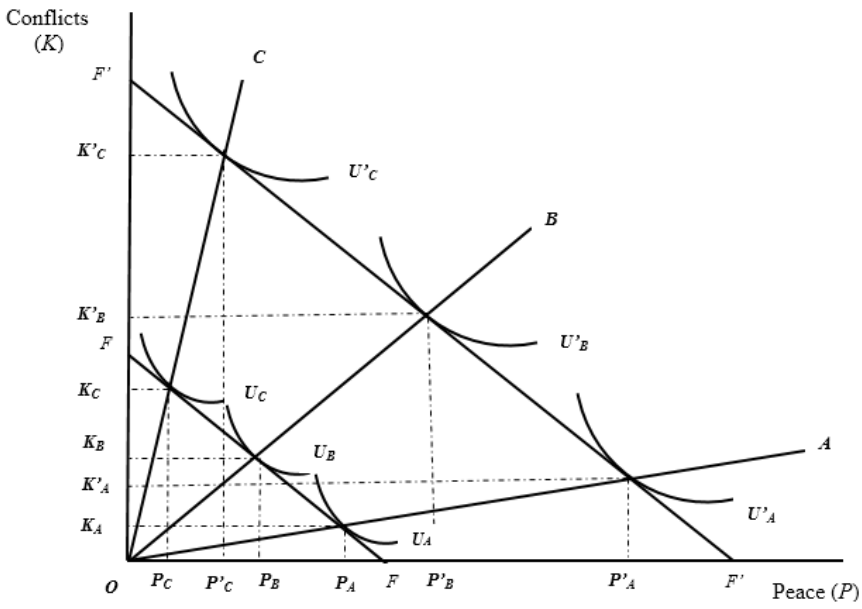

Figure 1: Constrained Optimization with Conflict-Peace Budget Lines and Indifference Curves

For the purpose of illustration, it is important to note that for the conflict-ridden or conflict-preferred countries in Group C, it is possible for P'_C to be less than P_C (that is, $P'_C < P_C$) as

national income or gross domestic products increased because the profiteering warlords and greedy political leaders can exacerbate conflicts they view as avenues for political power and control, rent-seeking, monetary gains, and wealth accumulation. It is also possible for the peace-loving countries in Group A to experience less conflicts as national income or gross domestic products increased, that is, $K'_A < K_A$ because of the conflict resolution mechanisms already established based on past experience. As economic theory suggests, when the demand for a good decreased as income increased, the good is considered to be an inferior good. Applying this concept here therefore means that for conflict-ridden countries, if $P'_C < P_C$ when national income increased, then peace is an inferior good for countries in Group C; and for the peace-loving countries in Group A, if $K'_A < K_A$ when their national income increased, then conflict is an inferior good. This is also applicable for the conflict-peace neutral countries.

3.1. The Impact of Conflicts on Social Welfare and Development in Africa

To show the impact of conflicts on economic welfare[9] in African countries, we utilize the simple concept from welfare economics in which the social welfare function (W) in each African country is assumed to take the form:

$$Wi = Wi\,[Ki, Pi, Gi(Ei)] \tag{10}$$

where G_i represents all capital and consumer goods that are essential to sustainable economic growth and development,[10] E_i represents the economic-social-political environment in which all the capital and consumer goods are produced, while K_i and P_i are as defined earlier in equations (1) and (2). Arguably, it is impossible to attain the optimal social welfare in conflict-ridden countries because of endless socio-political conflicts with little or no peace. Algebraically:

$$\frac{\partial W_i}{\partial K_i} \leq 0 \qquad (11),$$

$$\frac{\partial W_i}{\partial P_i} \geq 0 \qquad (12),$$

and

$$\frac{\partial W_i}{\partial G_i}\frac{\partial G_i}{\partial E_i} \leq 0 \qquad (13).$$

Interpretatively, equation (13) shows that social welfare deteriorates in conflict-ridden and less peaceful environments, that is $\frac{\partial W_i}{\partial G_i}\frac{\partial G_i}{\partial E_i} \leq 0$. In other words, in unstable environments where scarce economic resources such as physical capital and human capital are deployed

to execute civil or regional wars in conflict-ridden regions, the usual outcome is a drastic reduction in the production of the essential capital and consumer goods necessary for sustainable economic growth and development. In contrast to the deterioration of the social welfare that we normally observe in many conflict-ridden regions in Africa, $\frac{\partial W_i}{\partial G_i}\frac{\partial G_i}{\partial E_i} > 0$ in conflict-free, stable and more peaceful regions where scarce economic resources are optimally utilized in order to improve social welfare because the production of more capital goods and consumer goods will improve the standards of living if countries do not have to divert their scarce economic resources to execute civil wars and other political conflicts.

To show the impact of conflicts on economic growth and development in Africa, we utilize the aggregate production function, which is expressed as:

$$Y_i = T_i K_i F(H_i, L_i) \tag{14}$$

where Y_i is the gross domestic product, T_i is the level of technology, K_i is the level of conflicts as defined earlier, while H_i and L_i are the amount of physical capital and labour, respectively. In the real world, armed conflicts in many African countries altered the utilization of capital and labour in the production of goods and services. Expressing equation (14) in per-worker terms, we have:

$$y_i = T_i K_i f(h_i) \tag{15}$$

where y_i is output per-worker $\left(\frac{Y_i}{L_i}\right)$, h_i is capital per-worker or capital-labour ratio $\left(\frac{H_i}{L_i}\right)$.

Equation (15) states that the level of output per-worker in any African country depends on the capital-labour ratio used in the production process; and that this worker productivity is influenced positively by the level of technology (T_i). The general consensus among economic growth theorists is that technology, which could be in the form of product-innovations and process-innovations, shifts the per-worker production function upward as shown in Figure 2. The question is: How will armed military conflicts (K_i) in equation (15) impact the per-worker production function with respect to Africa?

In Figure 2, we show that the level of technology (T_i) in Africa shifts the per-worker production function upward, from y_0 to y_1, as predicted by economic theory but not by the same magnitude if compared to other developed continents where technology is far more superior. Based on the real world experience in the African continent, one can argue that prolonged armed conflicts (K_i) have negative impact on per-worker productivity and the standards of living, hence the downward shift in the per-worker production function, from y_0 to y_2, thus decreasing the standards of living from $y_{1|k=o}$ to $y_2|_{k>0}$ due to the endless armed conflicts experienced in Africa.

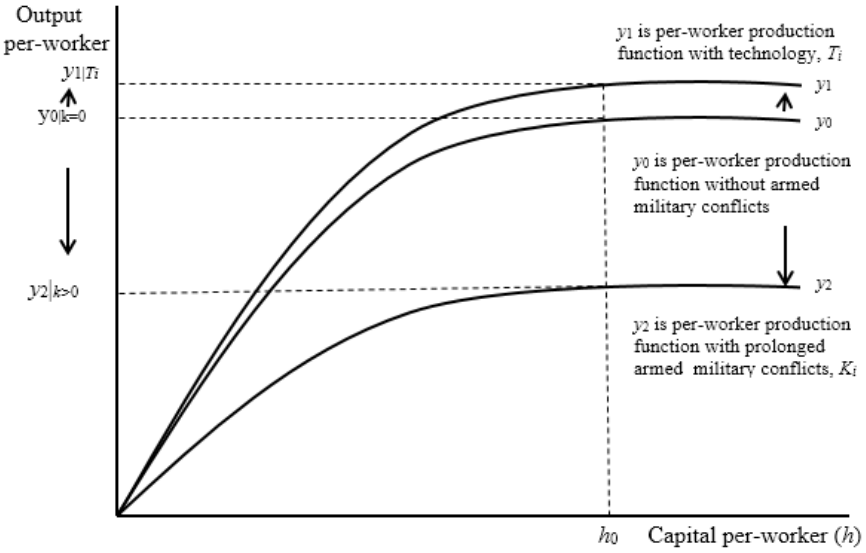

Figure 2: The Impact of Conflicts on Per-Worker Aggregate Production Function

We can also simplify this graphical analysis if we simply assume that all economic resources are used to produce two goods classified as capital goods and consumer goods. Using the simple concept of the production possibilities frontier (*PPF*) depicted in Figure 3, we can assume that along PPF_1, African countries are able to achieve economic efficiency – allocative, productive, and distributive – given their current levels of technology in the absence of armed conflicts. Several decades of armed conflicts shifted the production possibilities frontier from PPF_1 to PPF_2, hence the economic stagnation that we observe in many conflict-ridden countries.

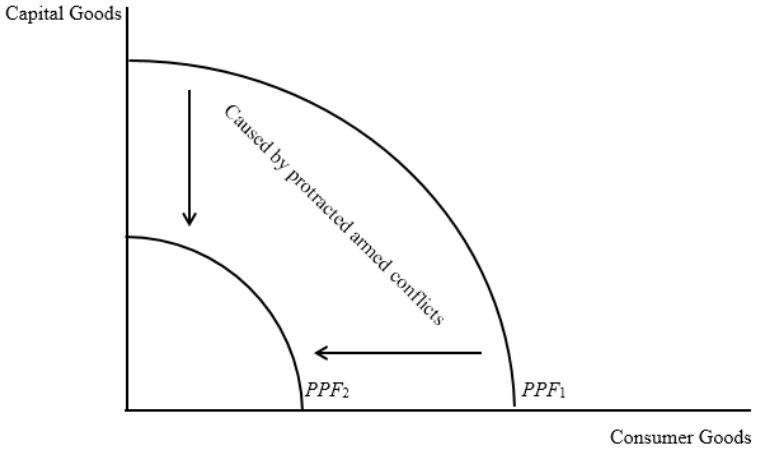

Figure 3: The Impact of Conflicts on Capital Goods and Consumer Goods

3.2. The Impact of Peacebuilding in Africa

As we explained earlier, peace is an important element in social welfare maximization because sustainable economic growth and development can only be achieved during the period of sustainable peace. Since the 1970s, many African countries reported in Table 1 have used different forms of truth and justice reconciliation commissions to foster national unity. In other words, these countries provide real world evidence regarding the importance of sustainable peacebuilding in national unity or nation building. Many research scholars such as Asmal (2000), Bickford (2007), Chapman (1999), Davenport and Armstrong II (2004), Groop (2012), Howard (1996), Igbuzor (2011), and Lerch (2000) have examined the usefulness as well as the effectiveness of these Truth and Reconciliation Commissions (TRCs) in fostering national unity: the main purpose for which these TRCs were established in these countries. The question for empirical analysis in this section is: Are the African countries reported in Table 1, the ones who invested monetary and manpower in TRCs and then implemented the findings and recommendations of their TRCs, significantly better than their non-TRCs counterparts?

Table 1: African Countries with TRCs

Country	Year Established	Year of Report Completion
Uganda*	1974	n. a.
Zimbabwe	1985	n. a.
Uganda*	1986	n. a.
Chad	1990/2002†	1992
Rwanda	1990	1993
Ethiopia	1993	n. a.
Burundi	1995	n. a
South Africa	1995	1998
Nigeria	1999	2001
Sierra Leone	1999	2004
Central African Republic	2002	n. a.
Ghana	2002	2004
Democratic Republic of Congo	2002	2006
Morocco	2004	2005
Liberia	2005	2010
Kenya	2008	2012
Mauritius	2009	2011
Togo	2009	n. a.
Tunisia	2014	n. c.

Sources: Complied by the author from various studies, including Wikipedia; see https://en.wikipedia.org/wiki/List_of_truth_and_reconciliation_commissions

Note: n. c. = not completed, n. a. = not available, † = TRC made permanent in 2002 in Rwanda, and * = country with more than one TRC and contemplating to establish another TRC.[11]

To answer this question, we compare the TRC countries with their non-TRC counterparts by examining their Global Peace Index (GPI) scores.[12] We test the null hypothesis that the TRC countries are not better than their non-TRC counterparts against the research or alternative hypothesis that the two groups differ with respect to peacebuilding and national unity. A *priori*, one can argue and conclude that the TRC-African countries identified in Table 1 would be more civil and peaceful than the non-TRC African countries based on the fact that the former group of countries would have benefited from using TRCs as instruments in fostering national unity.

Based on the estimated results,[13] we fail to reject the null hypothesis of no difference between the TRC-African countries that invested in peacebuilding and national unity through the establishment TRCs and the non-TRC African countries. This result supports those who question the veracity and usefulness of these TRCs in African countries because those countries with monetary and manpower investment in TRCs are not better in terms of peacebuilding than the non-TRC countries. In effect, peacebuilding through TRCs has not contributed to more peaceful countries and, according to Christine (2000: pp. 173-175), TRCs may be considered as therapeutic.

4. EVIDENCE OF THE IMPACT OF ARMED MILITARY CONFLICTS ON ECONOMIC GROWTH IN AFRICA

In this section, we focus on armed military conflicts because we can easily classify countries by the level of intensity in military conflicts since the 1950s. Before the recent waves of "democratization," the African continent was known for its armed military coups d'état; therefore, we use the data on successful (x_1), attempted (x_2), planned (x_3), and alleged (x_4) coups for identification. We let X be the sum of x_1, x_2, x_3, and x_4; and we consider countries as *low-intensity* X if X is between zero and 15; countries as *medium-intensity* X if X is between 16 and 45; and countries as *high-intensity* X if X is equal or greater than 46. Table 2 shows that there are 27 countries with *low-intensity* X, 20 countries with *medium-intensity* X, and seven countries with *high-intensity* X.

To show the relationship between conflicts and economic growth in Africa decade by decade since the 1950s, we provide the data in Table 3. As one can see from the data compiled in Table 3, the growth rates in Africa as a whole were much higher between the 1950s and 1960s and then peaked in the 1970s, and sharply decreased thereafter as armed military coups d'état intensified and became contagious and much protracted. The growth rates first became negative in the 1980s and then turned out to be five times more negative in the 1990s as armed military coups d'état escalated throughout Africa – both periods are the era now dubbed the lost two decades.[14]

Table 2: Level of Intensity of Armed Military Conflicts (X) by Country Groups

Low-Intensity X 0 ≤ X≤ 15	Medium-Intensity X 16 ≤ X ≤ 45	High-Intensity X 46 ≤ X ≤ 75
1. Botswana	1. Rwanda	1. Guinea-Bissau
2. Cape Verde	2. Somalia	2. Burundi
3. Egypt	3. Madagascar	3. Benin
4. Eritrea	4. Equatorial Guinea	4. Sierra Leone
5. Mauritius	5. Mali	5. Ghana
6. Morocco	6. Lesotho	6. Uganda
7. Namibia	7. Niger	7. Sudan
8. South Sudan	8. Congo, DR	
9. South Africa	9. Côte d'Ivoire	
10. Senegal	10. Guinea	
11. Malawi	11. Ethiopia	
12. Mozambique	12. Comoros	
13. Cameroon	13. Congo	
14. Libya	14. Chad	
15. Seychelles	15. Mauritania	
16. Angola	16. Burkina Faso	
17. Djibouti	17. Liberia	
18. Gabon	18. Central African Republic	
19. Kenya	19. Togo	
20. Zimbabwe	20. Nigeria	
21. Tanzania		
22. Tunisia		
23. Swaziland		
24. Zambia		
25. São Tomé & Príncipe		
26. Gambia		
27. Algeria		
N = 54		

Source: Coup d'état data were primarily sourced from "Conflict Trends in Africa (Marshall) Coups d'Etat in Africa, 1946-2004" (See Africa Atlas—Infoplease.com at http://www.infoplease.com/atlas/africa.html#ixzz28yNjuupY) and updated from 2004 to 2012 based on the African Development Bank article "Political Fragility in Africa: Are Military Coups d'Etat a Never-Ending Phenomenon?" by Habiba Ben Barka and Mthuli Ncube (September 2012).

Note: Countries in each group are not listed in the order of magnitude, and *N* is the number of countries in Africa.

Table 3: The Relationship between Armed Conflicts and Growth in Africa, 1950-2014

Decades	X	Average Growth Ratesa
1950s	3	1.62
1960s	46	1.78
1970s	56	1.94
1980s	84	-0.02
1990s	77	-0.10
2000s	29	2.36

Source: Same as in Table 1 above.

a *= Average growth rates decade by decade computed by the author based on the data obtained from various sources, particularly from Angus Maddison (2010), Historical Statistics of the World Economy, Paris: Organization of Economic Cooperation and Development.*

Now that democratization started to take a stronger foothold in the African continent, countries are experiencing what has apparently been a remarkable positive turnaround in economic growth and development since the 2000s. The relationship between economic growth and armed military conflicts in Africa depicted by the cursory visual data evidence in Table 3 is captured by estimating a correlation-regression equation of the form:

$$y_{it} = \beta_0 + \beta_{1it} X_{it} + \varepsilon_{it} \tag{16}$$

where y_{it} and X_{it} are the growth rates and conflicts in all countries in year t, respectively; β_o and β_{it} are the intercept and slope parameters to be estimated; and ε_{it} is the random error term.

The econometric estimation of the relationship between y_{it} and X_{it} in Africa, depicted in equation (16), showed the correlation coefficient (ρ) to be -0.74. The estimated β_0 is 2.532 while the estimated β_{it} coefficient is -0.026 and the absolute value of the t-ratio is 2.21. In addition, the estimated coefficient of determination or variation (R^2) is 0.549 at α = 0.05 level of significance. This estimated result is highly stable across specification and data sets, meaning that we can be confident in concluding that armed military conflicts played an important negative role in explaining Africa's economic growth and sustainable development between 1950s and 2000s.

4.1. Externalities from Conflicts and Peacebuilding in Africa

At this point, it is important that we elaborate on the positive and negative externalities that could be associated with conflicts and peace. As we pointed out with respect to the optimal mix of conflicts and peace, the peace-loving countries in Group A will still experience or choose some levels of conflicts as their national income increased. In other words, some African countries will experience more conflicts that are not necessarily

violent conflicts. This means that some non-violent conflicts such as those inevitable socio-political conflicts may actually have positive externalities. For example, one cannot simply view socio-political conflicts from the standpoint of hostility and/or antagonistic opposition because there is the potential of bringing together many opposing socio-political powers in order to solve the underlying socio-political problems. When socio-political conflicts force opposing socio-political powers into meaningful dialogues at local, state, and national levels, societies will benefit from the outcomes of those dialogues, leading to a more peaceful socio-political environment. Furthermore, one cannot underestimate the fact that armed military conflicts cause negative externalities, not only in terms of the loss of lives, but also regarding the destructions of private properties, public infrastructures, security, and trust; and at the same time, one can also argue that there are some positive externalities, especially concerning technological innovations with respect to how to reduce future conflicts.[15] In other words, national and international armed conflicts, even though costly, can be viewed as necessitating factors in technological changes generating positive externalities.

Similarly, one can argue that there are positive and negative externalities associated with peacebuilding efforts. Obviously, peacebuilding is the bridge required to regain the lost trust between two or more opposing parties after violent conflicts and to bring back the sense of security needed in those conflict-ridden environments. Peacebuilding can also enhance the efficient transactions not only at local, state, and national levels, but also at international levels, especially with respect to international trade and global tourism. By the same token, peacebuilding through the establishments of the Truth and Reconciliation Commissions (TRCs) that many African countries have experienced since the 1970s and 2000s can also cause negative externalities if there are too many administrative bureaucracies, no transparencies, and no accountabilities with respect to the findings of these TRCs [see Lamony (2011)].

For example, many Nigerians still questioned the veracity of the Oputa Panel of 1999 (also known as the Human Rights Violations Investigations Commission) because of its lack of accountability, true transparency and the truthfulness or sincerity of the participants who testified at the hearings; and as a result, the commission's findings and report have not been officially made public and the implementation of any of the suggestions or proposals contained in the final report has not been carried out. The result could be different from the Rwandan National Unity and Reconciliation Commission, which was also established in 1999 – the same year as the Oputa Panel – and the TRC of South Africa in 1995. Even though one can argue and conclude, based on the fact that since the Global Peace Indexes for Rwanda (2.323) and South Africa (2.316) differed slightly from that of Nigeria (2.877), that the TRCs in Rwanda and South Africa may have succeeded in unifying some of the opposing forces within both countries thus minimizing the incidence of armed conflicts better than Nigeria; however, the empirical test conducted earlier, with respect to no

difference or difference between the TRC and non-TRC countries, refutes this assertion. According to Mac Ginty and Williams (2016), the Rwandan TRC's "effectiveness has been less than impressive in terms of the numbers of those brought before it or punished." Also, they pointed out that "The post-Apartheid crime figures in South Africa (where hundreds of White farmers have been killed and the country has one of the highest murder rates of any country on the planet) suggest a society ill at ease with itself."

5. CONCLUSIONS AND POLICY IMPLICATIONS

In this paper, we employed different economic concepts to show that armed conflicts and peace are two existential naturally non-complementary goods that countries in Africa must choose optimally if the objective is to be on the frontiers of sustainable economic growth and development. Certain categories of conflicts are not avoidable because they confer positive externalities while others, such as prolonged armed military conflicts, confer negative externalities on society at large. Since armed military conflicts varied across African countries, we classified these countries into three groups based on the intensity of armed military conflicts: low, medium, and high. Based on this classification, we have found out that about half of the African countries have experienced low-intensity armed military conflicts while the other half have experienced medium to high-intensity armed conflicts since the 1950s. We have found that armed military conflicts increased monotonically between the 1950s and 1970s and peaked in the 1980s and decreased monotonically thereafter.

The results of the econometric estimation of the correlation-regression that examined the relationship between armed military conflicts and economic growth in Africa showed not only a high negative correlation, but also that armed conflicts had a negative impact on Africa's economic growth and development between 1950s and 2000s. Furthermore, we found out that more than one-third of the African countries invested both manpower and monetarily in peacebuilding efforts through the establishments of the Truth and Reconciliation Commissions since the 1970s. Many of the conflict-ridden countries viewed TRCs as the means by which to foster reconciliation and national unity. An econometric test as to whether these countries were more peaceful than their counterparts revealed that there was no statistically significant difference between those countries that utilized various forms of TRCs and those that did not.

If we put credence on the findings that armed conflicts had a negative impact on Africa's economic growth and development between the 1950s and 2000s and that the TRC African countries are not more peaceful than their non-TRC counterparts, then, Africa and its leaders must address some important issues. First, there is an urgent need to address the issue of poor leadership and governance across countries if the objective is to minimize some of the triggers such as extreme poverty, high unemployment rates of youths who may

be recruited into gangs and become active participants in armed conflicts. Second, the governance structures must show total inclusiveness, rather than one-ethnic or one-region superiority over others, in order to remove the perceptions of marginalization by certain ethnic groups because this is the only way every ethnic group can feel they have a voice in the governance structures. Third, leadership and governance must be seen as transparent and accountable to all the constituent parts. This would prevent the violent conflicts rooted in vengeance and the scramble for political power control.

Fourth, rather than wasting monetary and manpower investment in establishing opaque TRCs, African leaders must invest in building trust across communities as the means to bridge the gap between different ethnic groups. Finally, African countries must strengthen their immigration policies in order to prevent the establishments of strong terrorist camps. This may require a two-pronged approach: strong education at local, state, and national levels in order to prevent unproductive indoctrinations of the unemployed youths; and there must be a concerted effort to form international partnerships in order to weed out the perpetrators of armed conflicts.

NOTES

[1] See the Africa Center for Strategic Studies (ACSS), African Centre for the Constructive Resolution of Disputes (ACCORD), World Bank's Armed Conflict Location and Event Date (ACLED), Institute for Security Studies etc.

[2] See detailed discussion, see Bundervoet (2013).

[3] It is important to point out that, during this period, many military leaders in African countries used the "alleged" category of coups d'état to eliminate perceived enemies within and outside the military establishments.

[4] Child soldiers are most prevalent in poor countries such as Burundi, Liberia, Sierra Leone, and Uganda.

[5] There are many regional peace-keeping organizations such as the West African Economic Community Monitoring Group (known as ECOMOG) that was established in 1990 to intervene in the 1989-1996 civil wars in Sierra Leone.

[6] For a more detailed discussion on land tenure reforms in Africa, see Catherine Boone (2007), "Property and Constitutional Order: Land Tenure Reform and the Future of the African State, *African Affairs*, 106, pp. 557-586.

[7] For the enormous dollar-costs of violent conflicts in 50 of the 54 African countries, see Table A in Appendix A.

[8] See Appendix A for the 2016 combination of Ki and P_i for each country. Now, the term "naturally-normal" is used to explain the consumption of conflict and peace because they are existential with respect to human history. According to Mac Ginty and Williams (2016) conflicts and peace are parts and parcels of human existence. In microeconomics, goods are considered to be normal if the consumption or quantity demanded increased as income increased, and are considered inferior if the quantity demanded decreased when income increased.

[9] This section draws from the concepts of social welfare economics articulated by many economists such as Arrow (1950, 1951), Rawls (1972), Deaton (1997), Lambert (1993), and Champernowne and Cowell (1998). For detailed coverage of the essential concepts of welfare economics, see any standard intermediate microeconomics textbook.

[10] Capital goods are goods used to produce other goods and services – infrastructure investment in roads, bridges, power/electricity supply and many social amenities.

[11] For a more detailed discussion, see Stephon Lamony (2011), *Examining the Prospects of TRC in Uganda by Reviewing Past Efforts,* Lambert Academic Publishing.

[12] The Global Peace Index (GPI) Score, published by the Institute of Economics and Peace, uses the GPI, which ranges between 1 and 5 to a measure of how peaceful a nation is. GPI = 1 means most peaceful and GPI = 5 means less peaceful.

[13] The estimated mean of the Global Peace Index Scores for 18 TRC African countries = 2.291 while the estimated mean for the 32 non-TRC African countries = 2.260, and the mean difference = 0.031, N = 50 (excluding Cape Verde, Comoros, Sao Tome and Principe, and Seychelles due to unavailable data) with df = 18+32 – 2 = 48, and the estimated t-value = 0.221 is statistically insignificant.

[14] A time-series diagram (not shown here) of the armed military conflicts (coups d'état) reported in Table 3 showed an inverted U-shaped or parabolic trajectory, which means that armed coups d'état increased monotonically and peaked and then decreased monotonically as African countries transitioned from autocratic forms of governance and started to embrace democratic ideals in the later part of the 1990s and 2000s.

[15] For example, the use of electronic surveillance and body camera scans intensified globally in domestic and international airports because of the threats from international terrorist attacks/conflicts, which are now contagious. The Iron Dome used by Israel to shield itself against launched rockets and artillery shells can be viewed as positive externalities from its prolonged conflicts with its Arab neighbours.

APPENDIX A

Table A: Dollar Costs and the Combination of Conflict and Peace in African Countries, 2016

	Country	Cost of Conflicts ($)	K*	P*
1	Algeria	45,641,969,832	2.0	2.213
2	Angola	17,803,782,339	1.4	2.140
3	Benin	1,201,810,930	1.4	1.998
4	Botswana	3,233,167,099	1.0	1.639
5	Burkina Faso	1,948,852,006	1.4	2.063
6	Burundi	489,036,528	1.4	2.500
7	Cape Verde	*n. a.*	*n. a.*	*n. a.*
8	Cameron	4,389, 297,297	2.2	2.356
9	Central African Republic	540,100,672	3.4	3.354
10	Chad	1,976,258,695	2.1	2.464
11	Comoros	*n. a.*	*n. a.*	*n. a.*
12	Congo, Republic of the	2,999,553,589	1.6	2.249
13	Congo, Democratic Republic of the	6,171,986,824	3.2	3.112
14	Côte d'Ivoire	11,988,421,985	1.8	2.279
15	Djibouti	205,938,520	1.7	2.292
16	Egypt	62,530,876,695	2.5	2.574
17	Equatorial Guinea	2,413,903,694	1.4	1.940
18	Eritrea	874,819,585	1.8	2.460
19	Ethiopia	11,025,409,591	2.5	2.284
20	Gabon	2,684,137,658	1.6	2.033
21	Gambia, The	190,492,625	1.8	2.091
22	Ghana	5,512,459,150	1.5	1.809
23	Guinea	824,657,042	1.5	2.148
24	Guinea-Bissau	241,975,299	1.6	2.264
25	Kenya	9,820,037,312	2.5	2.379
26	Lesotho	622,028,557	1.4	1.941

	Country	Cost of Conflicts ($)	K*	P*
27	Liberia	212,507,205	1.4	1.998
28	Libya	15,021,279,586	3.0	3.200
29	Madagascar	1,058,314,364	1.4	1.763
30	Malawi	1,170,282,420	1.4	1.817
31	Mali	1,979,615,600	2.5	2.489
32	Mauritania	1,239,455,916	1.7	2.295
33	Mauritius	961,517,638	1.0	1.559
34	Morocco	12,545,934,107	1.8	2.086
35	Mozambique	610,594,000	1.6	1.963
36	Namibia	2,480,221,510	1.2	1.873
37	Niger	850,957,104	2.0	2.237
38	Nigeria	70,551,272,870	3.1	2.877
39	Rwanda	1,349,507586	2.0	2.323
40	Sao Tome and Principe	*n.a.*	*n.a.*	*n.a.*
41	Senegal	1,477,444,718	1.9	1.978
42	Seychelles	*n.a.*	*n.a.*	*n.a.*
43	Sierra Leone	682,047,712	1.5	1.805
44	Somalia	1,240,246,173	3.5	3.414
45	South Africa	66,654,038,875	1.6	2.316
46	South Sudan	3,584,906,489	3.7	3.593
47	Sudan	24,714,497,522	3.4	3.269
48	Swaziland	627,386,682	1.4	2.074
49	Tanzania	6,515,231,555	1.4	1.899
50	Togo	539,489,257	1.4	1.954
51	Tunisia	4,407,519,667	1.6	1.949
52	Uganda	2,951,593,562	1.8	2.148
53	Zambia	2,435,059,575	1.2	1.783
54	Zimbabwe	5,972,090,415	1.8	2.322

Source: Data obtained and compiled by the author from the Institute for Economic and Peace at http://www.visionofhumanity.org/#/page/indexes/global-peace-index.

Note: (a) Countries with $1 \leq K^* \leq 1.5 = 19$; countries with $1.5 < K^* \leq 2.9 = 29$; and with $K^* \geq 3 = 7$.

(b) Countries with $1 \leq P^* \leq 2.0 = 17$; countries with $2.0 < P^* \leq 2.9 = 27$; and with $P^* \geq 3 = 6$.

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The Systematic Component of Monetary Policy in Open Economy SVARs

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Abstract

We propose a new identification method in open economy models by restricting both the systematic component of monetary policy and the IRFs to a monetary policy shock, at the same time, remaining agnostic with respect to the effects of monetary policy shocks on output and open economy variables. We estimate the model for the U.S./U.K. economies and find that a U.S. monetary shock has a significant and permanent effect on output. Quantitatively, a 0.4% annual increase in the interest rates causes output to contract by 0.12%. This contradicts the findings of Uhlig (2005) and Scholl and Uhlig (2008). We compute the long-run multipliers implied by the monetary policy reaction function and compare our identification with to the ones proposed by Uhlig (2005), Scholl and Uhlig (2008) and Arias et al. (2015). We argue that the latter overestimates the effects of the shock while the first two identifications imply a counterfactual behaviour of monetary policy. We also find that the delayed overshooting puzzle is a robust feature of the data no matter what identification is chosen.

Keywords

SVAR, open economy, monetary policy, shocks

JEL Classification:

C32, E52, F41

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1. INTRODUCTION

This paper is meant to contribute on two fronts. First, it includes a new approach to the identification of monetary policy shocks in structural vector autoregressions (SVARs). This part relies heavily on the method developed by Arias et al. (2014). That method is an improvement upon the agnostic identification procedure originally presented by Uhlig (2005). Second, the aim is to contribute to the particular strain of empirical research initiated by the Dornbusch model. This literature focuses on the effects of monetary policy on currency exchange rates and has yielded some puzzling results. Most notably, the so-called delayed overshooting puzzle. The Dornbusch model and the empirical puzzles are described in more detail in Section 2.

Scholl and Uhlig (2008) study the effects of monetary policy in an open economy SVAR using the Uhlig (2005) methodology. They find substantial evidence of delayed overshooting. Furthermore, their results suggest that this puzzle is not simply a manifestation of wrongly identified monetary policy shocks. The motivation for our study comes from the fact that Arias et al. (2014) present a new algorithm to draw from the correct posterior uniform distribution on the set of orthogonal matrices conditional on the zero restrictions. Uhlig (2005) originally applied his method to study the real effects of the U.S. monetary policy. He found that contractionary monetary policy shocks had no clear effect on the real GDP, thus providing empirical support for money neutrality. However, using the improved methodology, Arias et al. (2015) recover the real effects, simply by drawing from the correct posterior distribution. This beckons the question: Do the impulse responses of currency exchange rates to contractionary monetary policy shocks still display a delayed overshooting of the long-run appreciated value if the improved methodology of Arias et al. (2014) is applied? Or will the puzzle disappear?

We identify monetary policy shocks by imposing sign and zero restrictions on the monetary policy reaction function and sign restrictions on the impulse response functions. We do not restrict the responses of output and open-economy variables, so we remain agnostic with respect to the effects on these variables. We find that monetary policy shocks have a significant and permanent effect on the level of output and that the exchange rate manifests a delayed overshooting under our baseline identification.

The remainder of this paper is organized as follows. In section 2 we review the literature of empirical research following Dornbusch's model. In section 3 the SVAR model and the identification technique are laid out. Results are reported in section 4. Section 5 concludes.

2. LITERATURE REVIEW

In his seminal paper, Dornbusch (1976) sets out to explain a tendency of exchange rates to overshoot on impact their long term depreciation, following expansionary shocks to monetary policy. To this end, he develops a rational expectations model. The model assumptions include a liquidity effect of monetary policy shocks, uncovered interest rate parity (UIP) and long-run purchasing power parity (PPP). Assuming sticky prices but flexible exchange rates and asset prices, the initial overshooting of the exchange rate is derived as an outcome. In the model, overshooting is shown to hinge on the behaviour of real output. If real output is fixed, the exchange rate initially overshoots its long-run depreciation in response to an expansionary shock. On the other hand, if real output is responsive to aggregate demand, the exchange rate may no longer overshoot, although it still depreciates in the long-run. Empirical studies in the early and mid 1990s failed to provide support for the Dornbusch model. Instead, they indicated that the peak overshooting did not occur contemporaneously to a contractionary monetary policy shock. There was rather a gradual appreciation, followed by gradual depreciation. The peak appreciation is delayed by one to three years, before the exchange rate converges on its long term appreciated value. This has become known as the 'delayed overshooting puzzle'. This also implies a 'forward discount puzzle'. It is characterized by persistent increases in the forward discount premium conditional on contractionary domestic monetary policy shocks. The premium is the gain due to the policy shock, from borrowing foreign currency for k periods at the time of the policy shock, exchanging it for US dollars, investing it at the US rate, and exchanging it back to the foreign currency at horizon k. It therefore incorporates both the compounded interest rate differential over the k periods following the policy shock, and the (foreseen) movement in nominal exchange rates between horizons 0 and k. It represents a failure of the UIP (Uncovered Interest Parity) condition. It has been debated whether the two puzzles are only twin appearances, or if they can arise independently of one another.

Eichenbaum and Evans (1993) use three different methods to identify U.S. monetary policy shocks in a VAR. First, they identify monetary policy shocks as innovations to the ratio of non-borrowed reserves to total reserves (NBRX). Second, they identify such shocks as orthogonalized shocks to the federal funds rate. Lastly they identify the shocks using the Romer and Romer (1989) framework. They find that expansionary shocks to monetary policy lead to sharp, persistent depreciations in the U.S. nominal and real exchange rates, and can account for more than 20% of the exchange rate variance. Furthermore, they find the maximal depreciation to occur up to more than two years after impact. Clarida and Gali (1994) attempt to explain real exchange rate fluctuations in the

post-Bretton Woods era, using nominal shocks to supply, demand and money. They use a Cholesky decomposition identification in structural VARs for the US-German, Japanese, British and Canadian bilateral cases. Following Blanchard and Quah (1989), they also apply a long run zero restriction on the response of output to aggregate demand shocks. For the US-Germany and US-Japan regressions the results fit the Dornbusch model relatively well. There is an initial real depreciation of the dollar (3.8% for Germany, 3.5% for Japan). The real exchange rate effects of a nominal shock die out after 16 to 20 quarters for Germany, and 12 to 16 quarters for Japan. The nominal exchange rate overshoots substantially. In the long run the dollar depreciates (by 1.7% against the DM, 1.2% against the yen), while initially the nominal exchange rate depreciates (by more than 4% against the DM, by more than 3.5% against the yen). However, the results depart from the Dornbusch model in that the nominal exchange rate keeps depreciating for some time following the shock (4 quarters for Germany, 2 quarters for Japan). For Britain and Canada the results are qualitatively similar.

The authors also perform forecast error variance decomposition and find that nominal shocks explain a substantial part of the variance in the USD to DM and USD to yen real exchange rates, 41% and 35% respectively. They find less such evidence for the real exchange rates against Canada and the UK. Grilli and Roubini (1996) focus on 'liquidity models' where money has real effects without an assumption of sticky prices or wages. They present the results of a recursively identified 7-variable VAR where they use the differential between short- and long-term interest rates instead of just the short-term rate, for France, Germany, Japan, Canada, Italy and the U.K. In each case the U.S. is used as the foreign country. In four of these countries (not the U.K. and Italy), delayed overshooting appears. The maximal appreciation occurs several months after the contractionary shock. The authors note the limitations to their analysis. The recursive structure of the identification restrictions is unrealistic. It requires that the exchange rate come after the domestic interest rate in the VAR ordering. This implies that monetary policy does not contemporaneously respond to shocks to the exchange rate. Also their approach only solves the price puzzle partially.

Kim and Roubini (2000) develop an identified VAR approach for open economy models and apply this approach to the same G-7 countries as Grilli and Roubini (1996). The structural identification implies that the model is composed of several blocks. The first two equations describe the money market equilibrium. The next two describe the domestic goods market equilibrium (output and price determination equations). The fifth and sixth equations represent the exogenous shocks coming from the world economy, the U.S. interest rate and the oil price shocks. The last equation describes the exchange rate

market. The impact effect of the monetary contraction on the exchange rate is a significant appreciation, with the exception of France. In almost all cases, after the initial impact appreciation, the exchange rate starts to depreciate quite quickly. Although the depreciation does not start right after the impact, the authors do not observe the same delay in the overshooting as previous research did.

In empirical studies of small open economies, Cushman and Zha (1997) argue that delayed overshooting arises as a result of an inappropriate identification of monetary policy for such economies. The recursive Cholesky decomposition approach is plausible for the U.S. because its economy is large and relatively closed. It implies that the policy does not respond to contemporaneous changes in the exchange rate. The monetary authority in a small open economy is, however, likely to respond quickly to the exchange rate as well as to both home and foreign interest rates. The authors, therefore, propose to explicitly model the features of small open economies in structural VARs. Using data for Canada and the U.S. for the period 1974-1993 they model Canada as the small open economy and use the U.S. as a proxy for the rest of the world. In the identification the foreign policy maker is restricted from reacting to Canadian variables by a block exogeneity restriction. The foreign block is kept in its reduced form with normalization in lower-triangular form. No other restrictions on the coefficients of lagged variables are imposed. The specification assumes that the Bank of Canada can react to the exchange rate, interest rates in both countries, money stock M1 and commodity prices in the U.S. contemporaneously, but not to output, CPI or trade flows contemporaneously. With this identification, no exchange or interest rate puzzle arises. The exchange rate response resembles the Dornbusch-type initial overshooting. UIP deviations are found to have been very small, significantly different from zero for only four months (not consecutive) over the whole 4 year horizon. The authors view this as a confirmation of the UIP condition.

Kim and Roubini (2000) are critical of the recursive identification method, when there is reason to believe that monetary policy responds to exchange rate movements contemporaneously. They find little evidence of a forward discount puzzle and delayed overshooting.

Kim and Roubini (2000) examine the international transmission of the U.S. monetary policy. The foreign world is represented by the non-US G7 economies. The authors use both the recursive Cholesky decomposition approach and the non-recursive one suggested by Blanchard and Watson (1986), Bernanke (1986) and Sims (1986), with models including the trade balance, exports, imports, the nominal exchange rate and the terms of trade. The nominal exchange rate is the effective rate against a basket of currencies of 17 industrial countries. When allowing for contemporaneous effects of

monetary policy shocks and identifying them as shocks to the Federal Funds Rate, they find an impulse response of the nominal exchange rate compatible with the initial overshooting. Identifying the shocks as innovations to NBRX, however, the authors find delayed overshooting, with the maximal response occurring after close to two years.

Kalyvitis and Michaelides (2001) examine the effects of the U.S. monetary policy on the exchange rate using the Bernanke and Mihov (1998) indicator of monetary policy (B-M indicator). It nests many VAR-based indicators and takes into account changes in FOMC operating procedures and policy targets. They modify Eichenbaum and Evans' (1993) original specifications to include relative output and relative prices. Relative output captures the relative business cycle position of the US and the foreign country, and helps determine short-run exchange rate movements. Relative prices capture long-run exchange rate adjustment based on PPP. They use data for all observations available for the B-M indicator, 1975:1 to 1996:12 and run a five variable SVAR for the Germany, Japan, Italy, France and UK bilateral cases. They find evidence of initial overshooting. There is a significant appreciation of the USD for around 3 months for all currencies. The appreciation is instantaneous and not delayed. The only country that shows a different impulse response is Britain. Even though delayed overshooting does not arise in this setup, UIP is still found to be violated.

Faust and Rogers (2003) criticize the preceding literature for using implausible identifying restrictions, such as restricting policy from responding contemporaneously to the financial variables. Policy makers have access to real time data on them. The authors ask whether delayed overshooting is special to recursive formulations with dubious restrictions, or if it also holds for other plausible formulations. They run a VAR comparable to that of Eichenbaum and Evans (1993). The data ranges from 1974:1 to 1997:12. Six lags and a constant are included, and the system is estimated for the US-UK and US-Germany bilateral cases. The shock to NBRX is interpreted as the monetary policy shock. All implausible restrictions against contemporaneous effects are then dropped, and the effects of monetary policy shocks checked across all identifications consistent with the restrictions left standing. This follows a method developed by Faust(1998). They find that delayed overshooting is sensitive to dubious assumptions. It is possible to identify 'reasonable' monetary policy shocks that have a nearly contemporaneous maximal exchange rate response to monetary policy. This is compatible with the initial overshooting. However, they also find the possibility of overshooting delay of up to three years.

Also, every possible identification of monetary policy shocks, when dubious restrictions are dropped, is found to yield large UIP deviations, mostly between 30 and 90 basis

points. The authors are unable to reject the existence of large and variable UIP deviations, but find no evidence for the existence of plausible money shocks that produce small deviations. The forward discount puzzle is therefore found not to be simply a twin appearance of delayed overshooting.

The authors also run a 14 variable VAR for the same time period, including more foreign variables. The results from that regression are similar with regard to overshooting and the forward discount puzzle. It however suggests that monetary policy accounts for a smaller portion of exchange rate volatility than previously thought, in the 7 variable model at horizon 48, about 10-50%. In the 14 variable model, however, monetary policy is estimated to account for merely 2-6% in the US-UK case, and 2-13% for the US-Germany case. Upper bound estimates are around 30% for both cases.

Kim (2005) does not see delayed overshooting as a puzzle, but as a plausible outcome for small open economies. His explanation rests on the foreign exchange policy reaction to monetary policy. In response to a contractionary monetary policy shock, the exchange rate appreciates, but the foreign exchange policy mitigates the appreciation initially as 'leaning against the wind' intervention, so that the impact appreciation becomes weak. When the effect of the foreign exchange policy on the exchange rate is short-lived but the effect of monetary policy is more prolonged, the exchange rate may further appreciate as the effect of the foreign exchange policy disappears, and the maximum effect is only found in delay. The author runs a structural VAR for Canada, with the U.S. representing the foreign sector. Data range from 1975:1 to 2002:2. He includes foreign exchange reserves of the Bank of Canada, Canadian money aggregate, short-term interest rates, CPI and industrial production, as well as the exchange rate (CAD price of one USD) and the US Federal Funds Rate. The Bank of Canada is assumed not to react contemporaneously to output and prices or to the federal funds rate at all. The Federal funds rate is only seen as a concern for the Bank of Canada because of its effect on the exchange rate, which the bank is allowed to react to contemporaneously. In the monetary policy it possibly reacts to the monetary aggregate and exchange rate. Contemporaneous interactions of the two policies are allowed for. The results show typical delayed overshooting, with maximal appreciation after 20 months. The effect stays significant for almost 4 years. However, the author also estimates impulse responses to such a shock to foreign exchange policy and finds that it leads to a sharp depreciation in the exchange rate. That effect, however, is relatively short lived and dies out after about 10 months. Subtracting the impulse response of the exchange rate to foreign exchange policy from the impulse response to monetary policy yields an overall outcome roughly consistent with the Dornbusch-type initial overshooting.

Scholl and Uhlig (2008) find delayed overshooting in a Bayesian VAR of the same type as Eichenbaum and Evans (1993). They apply an agnostic identification method following Uhlig (2005). Domestic contractionary monetary policy shocks are assumed to lead to increases in neither domestic price level nor the ratio of non-borrowed reserves to total reserves for 12 months. Also, they are assumed not to decrease domestic short term interest rates for 12 months. The impulse response of exchange rates is not restricted. Thus, in their own view, the authors remain agnostic about it. Sizeable and robust evidence of a delayed overshooting puzzle is found for all bilateral exchange rates (USD-GBP, USD-DM and USD-JPY) and to a lesser extent for the exchange rate of USD to a basket of currencies of the G7 economies. The maximal appreciation of both nominal and real exchange rates, in response to a contractionary shock, is realized after 1 to 2 years. In this case a forward discount puzzle also appears.

To check whether the forward discount puzzle appears even when delayed overshooting is restricted away, the identification of monetary policy shocks is restricted even further. The impulse response of the domestic vs. foreign (3 month) interest rate differential is restricted to be positive following a contractionary shock. Also, exchange rates are restricted to appreciate on impact and then depreciate monotonically to the long-term value. A sizeable and persistent forward discount premium occurs. The evidence is strongest in the USD-DM case, where the premium is significant over the whole 5 year horizon of the impulse response. In the other cases of USD-GBP, USD-JPY and USD-G7 the forward premium is less pronounced, but still significant at the 1 year horizon. This means that the UIP condition is violated even when delayed overshooting does not occur. The authors interpret this as an indication that the delayed overshooting puzzle is not simply a manifestation of wrongly identified monetary policy shocks. Forecast error variance decomposition indicates that the U.S. monetary policy shocks account for roughly 10% of the movements of all the bilateral nominal exchange rates. For the G7 currency basket, the shocks are found to account for about 20% of the movements. This is consistent with Kim and Roubini (2000) and Faust and Rogers (2003). It however contrasts Clarida and Gali (1994) and Eichenbaum and Evans (1993).

3. ECONOMETRIC METHODOLOGY

This section is organized in three parts. First we present the methodology introduced by Arias, Rubio-Ramirez, and Waggoner (2014) (ARRW henceforth). Secondly, we describe the identification procedure of the monetary policy shock. The last section presents the estimation strategy and the dataset.

3.1. The Model

Consider the following reduced form VAR(p):

$$\mathbf{y_t} = c + \sum_{l=1}^{p} B_l \mathbf{y_{t-l}} + u_t \quad \text{for } 1 \le t \le T \tag{1}$$

where $\mathbf{y_t}$ is a $n \times 1$ vector of variables, B_l are $n \times n$ matrices of coefficients to be estimated, and u_t is a $n \times 1$ vector of residuals with covariance matrix Σ. The model in 1 can be rewritten in a more compact form as

$$\mathbf{y_t} = B_+ x_t + u_t \quad \text{for } 1 \le t \le T \tag{2}$$

where $B_+ = (B_1 \dots B_p \;\; c)$ and $x_t' = (y_{t-1}' \dots y_{t-p} \;\; 1)$. The dimensions of B_+ and x_t are $n \times (np+1)$ and $(np+1) \times 1$. Letting P denote the lower Cholesky factor of Σ, by premultiplying equation 2 by P^{-1} and taking the transpose we arrive at the structural representation of the VAR model:

$$\mathbf{y_t}' A_0 = x_t' A_+ + \varepsilon_t' \quad \text{for } 1 \le t \le T \tag{3}$$

where $A_0 = (P^{-1})'$, $A_+ = B_+'(P^{-1})'$ and $\varepsilon_t' = u_t'(P^{-1})'$. Notice that $\mathbf{E}[\varepsilon_t \varepsilon_t'] = I$. The matrices (A_0, A_+) are the structural parameters while B_+ and Σ are the reduced-form parameters. Defining Q as any orthonormal matrix of dimension $n \times n$, the structural parameters (A_0, A_+) and $(A_0 Q, A_+ Q)$ are observationally equivalent in the sense that they produce the same reduced form VAR representation.

Proof. $\mathbf{y_t}' A_0 Q = x_t' A_+ Q + \varepsilon_t'$. The reduced form parameters are:

$\mathbf{B} = A_+ Q Q' A_0^{-1} = B_+' A_0 A_0^{-1} = B_+'$ where we have used the fact that $QQ' = \mathbf{I_n}$.

$\Sigma^r = \mathbf{E}[(A_0^{-1})' Q \varepsilon_t \varepsilon_t' Q' A_0^{-1}] = (A_0^{-1})' A_0^{-1} = PP' = \Sigma$

Since the identification strategy involves sign and zero restrictions on A_0 and on the impulse-response functions, we next define the IRF and the methodology used for identification. Given the structural parameters (A_0, A_+) the IRF of the $i'th$ variable to the $j'th$ structural shock at horizon h is given as the element from row i, column j of the matrix

$$L_h(A_0, A_+) = [F^h]_{nn} (A_0^{-1})' = [F^h]_{nn} P \tag{4}$$

where

$$F = \begin{bmatrix} B_1 & \dots & B_{p-1} & B_p \\ \mathbf{I_n} & \dots & 0 & 0 \\ \vdots & \ddots & \vdots & \vdots \\ 0 & \dots & \mathbf{I_n} & 0 \end{bmatrix}$$

and $[\ ]_{nn}$ is an operator that selects the $n \times n$ upper left block. From 4 it can be easily seen that $L_h(A_0 Q, A_+ Q) = [F^h]_{nn} PQ = L_h(A_0, A_+)Q$. Assuming we want to impose restrictions on A_0 and on the IRF at several horizons, define the $n(k+2) \times n$ matrix

$$f(A_0, A_+) = \begin{bmatrix} A_0 \\ L_0(A_0, A_+) \\ \vdots \\ L_k(A_0, A_+), \end{bmatrix}$$

where k represents the horizon. Sign and zero restrictions can be implemented with the matrices S_j, Z_j for $1 \leq j \leq n$ which have the same number of columns as rows in $f(A_0, A_+)$. The j index represents the shock and each row of S_j, Z_j will have exactly one nonzero element. Since (A_0, A_+) and $(A_0 Q, A_+ Q)$ are observationally equivalent, the structural parameters will satisfy the zero and sign restrictions if

$$Z_j f(A_0, A_+) Q e_j = 0$$

$$S_j f(A_0, A_+) Q e_j > 0,$$

where e_j represents the $j'th$ column in the identity matrix $\mathbf{I_n}$.

For convenience, we reproduce here the main results from the ARRW methodology. The idea is to draw an orthonormal matrix Q which satisfies the zero restrictions and then to check if the sign restrictions are also satisfied. Theorem 4 in ARRW reformulates the Gram-Schmidt recursive algorithm such that the resulting orthonormal matrix Q will satisfy the zero restrictions. The resulting structural parameters $(A_0 Q, A_+ Q)$ will then represent a draw from the correct posterior distribution conditional on the zero restrictions, given a specific prior density. We now formalize the above argument. Define

$$R_j(A_0, A_+) = \begin{bmatrix} Z_j f(A_0, A_+) \\ Q'_{j-1} \end{bmatrix}$$

where $Q_{j-1} = [q_1 \dots \ q_{j-1}]$ and $q_j = Q e_j$.

For $1 \leq j \leq n$, let Z_j represent the zero restrictions ordered so that $z_j \leq n - j$ where z_j is the number of restrictions associated to shock j ($z_j = rank\,(Z_j)$). Let (A_0, A_+) be any value of the structural parameters. The orthonormal matrix Q is obtained as follows:

1. Let $j = 1$.
2. Find a matrix N_{j-1} whose columns form an orthonormal basis for the null space of $R_j(A_0, A_+)$.

3. Draw x_j from a standard normal distribution on $\mathbf{R}^{\mathbf{n}}$.
4. $q_j = N_{j-1}(N'_{j-1}x_j / \| N'_{j-1}x_j \|)$.
5. If $j = n$ stop; otherwise let $j = j + 1$ and move to step 2.

3.1.1. Algorithm for sign and zero restrictions

1. Draw (B'_+, Σ) from the posterior distribution of the reduced form parameters.
2. Use Theorem 1 to draw an orthonormal matrix Q such that the structural parameters $((P^{-1})'Q, B'_+(P^{-1})'Q)$ satisfy the zero restrictions. Theorem 5 in ARRW states that if π is the prior density for the reduced-form parameters then the structural parameters $((P^{-1})'Q, B'_+(P^{-1})'Q)$ are a draw from the posterior with respect to the prior $\hat{\pi}(A_0, A_+) = \pi(B'_+, \Sigma) 2^{\frac{-n(n+1)}{2}} |det(\Sigma)|^{\frac{2n+np+2}{2}}$, conditional on the zero restrictions.
3. If there are only sign restrictions replace step 2 with this algorithm. Let $\mathbf{X}$ be a $n \times n$ random matrix with each element having a standard normal distribution. Compute matrix Q from the $\mathbf{QR}$ decomposition:[1] $\mathbf{X} = QR$.
4. Keep the draw if $S_j f(P^{-1})', B'_+(P^{-1})')q_j > 0$, where q_j represents the $j'th$ column of Q.
5. Return to Step 1 until the required number of draws from the posterior distribution conditional on the sign and zero restrictions has been obtained.

3.2. Identification Strategy

The first choice to consider is the selection of variables. Following the literature on open-economy SVAR we adopt the Eichenbaum and Evans (1993) specification. In particular we use data for industrial production, y_t; prices, p_t, foreign industrial production, y_t^*;, federal funds rate, i_t; foreign interbank rate, i_t^*; real exchange rate, rer_t; and the ratio of non-borrowed reserves to total reserves, $nbrx_t$. Christiano and Eichenbaum (1991) found that the ratio of non-borrowed reserves to total reserves was closely related to monetary policy choices, which represents an advantage of this specification. In this paper we use an agnostic identification procedure, in the sense that we do not impose any restrictions to the responses of open-economy variables and output. Most of the literature focuses on identifying monetary policy shocks by restricting the responses of inflation, interest rates and monetary aggregates to such shocks. Christiano and Eichenbaum (1991) restrict the responses of interest rates, prices and reserves to a monetary policy shock. Arias et al. (2015) argue that this identification scheme implies a counterfactual systematic component of monetary policy and suggests placing restrictions directly on the monetary

policy reaction function. We adopt both views and argue that the identification of monetary policy shocks implies restricting both the systematic component of monetary policy and the responses of interest rates, reserves and prices. Identifying monetary policy shocks by imposing only restrictions on the systematic component results in long-run multipliers of prices and output which are hard to reconcile with the monetary theory. Our identification is consistent with Taylor-type rules and implies that the federal funds rate responds only to output and prices, and the response is positive. In addition, we also restrict the responses of prices, reserves and interest rates.

3.2.1. Identification 1

1. The federal funds rate is a monetary policy instrument and it reacts contemporaneously only to output and prices. The response coefficients of output and prices are non-negative.
2. For k periods the responses of prices and reserves are non-positive while the response of interest rates is non-negative.

Our identification entails imposing sign and zero restrictions on the matrix of structural parameters A_0 and on the impulse response functions. Without the loss of generality, we label the first equation in the SVAR model as the monetary policy equation. The first equation of the SVAR model given by 3 is

$$\mathbf{y_t}'a_{0,1} = x_t' a_{l,1} + \varepsilon_{1t} \quad \text{for } 1 \leq t \leq T \tag{5}$$

where $a_{l,1}$ denotes the first column in matrix A_l and ε_{1t} denotes the first element of ε_t. Taking into account that we focus on the contemporaneous reaction of the monetary policy instrument, we can abstract from the lags and write equation 5 as[2]

$$i_t = \phi_y y_t + \phi_{y^*} y_t^* + \phi_p p_t + \phi_{nbrx} nbrx_t + \phi_{rer} rer_t + \phi_{i^*} i_t^* + a_{0,71}^{-1}\varepsilon_{1t} \tag{6}$$

where $\phi_y = -a_{0,71}^{-1} a_{0,11}$, $\phi_{y^*} = -a_{0,71}^{-1} a_{0,21}$, $\phi_p = -a_{0,71}^{-1} a_{0,31}$, $\phi_{nbrx} = -a_{0,71}^{-1} a_{0,41}$, $\phi_{rer} = -a_{0,71}^{-1} a_{0,51}$, $\phi_{i^*} = -a_{0,71}^{-1} a_{0,61}$ and $a_{l,ij}$ represents the element on column j, row i from matrix A_l. Part 1 of our identification implies $\phi_y > 0$, $\phi_p > 0$, $\phi_{y^*} = 0$, $\phi_{nbrx} = 0$, $\phi_{rer} = 0$ and $\phi_{i^*} = 0$. The monetary policy reaction function becomes:

$$i_t = \phi_y y_t + \phi_p p_t + a_{0,71}^{-1}\varepsilon_{1t} \quad \text{with} \quad \phi_y > 0 \quad \text{and} \quad \phi_y > 0. \tag{7}$$

For the second part of the identification strategy we use a horizon of 12 periods, as in Scholl and Uhlig (2008). Using the methodology described in the first section of this section, the above restrictions can be implemented using the following matrices:

$$f(A_0, A_+) = \begin{bmatrix} A_0 \\ L_0(A_0, A_+) \\ L_1(A_0, A_+) \\ \vdots \\ L_{10}(A_0, A_+) \\ L_{11}(A_0, A_+) \end{bmatrix}, Z_1 = \begin{pmatrix} 0 & 1 & 0 & 0 & 0 & 0 & \dots & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & \dots & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & \dots & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & \dots & 0 \end{pmatrix}, S_1 = \begin{bmatrix} S_1^0 \\ S_1^{nbrx} \\ S_1^p \\ S_1^i \end{bmatrix}$$

where

$$S_1^0 = \begin{pmatrix} -1 & 0 & 0 & 0 & 0 & 0 & 0 & \\ 0 & 0 & -1 & 0 & 0 & 0 & 0 & \mathbf{O}_{3,84} \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & \end{pmatrix}$$

represents the block corresponding to sign restrictions on matrix A_0 and $\mathbf{O}_{i,j}$ a block of dimension $i \times j$ containing 0 elements. The rest of the (12×91) blocks, S_1^{nbrx}, S_1^p and S_1^i correspond to the sign restrictions associated to non-borrowed reserves, prices and interest rates and each row of each block will contain exactly one nonzero element: -1 for p_t and $nbrx_t$ and 1 for i_t. The dimension of Z_1 is 4×91.

Our identification strategy imposes restrictions only on the contemporaneous coefficients of the monetary policy rule given by 7 while it abstracts from the lags of the other variables included in our model. In practice, the coefficients of lagged prices and output could be negative which is not consistent with a monetary policy reaction function guided by the Taylor principle. We check the consistency of our identification by computing the long-run multipliers of prices and output. Considering the lags of prices and output, equation 7 becomes:

$$(1 - a_{0,71}^{-1} \sum_{i=1}^{p} a_{i,71} L^i) i_t = (a_{0,71}^{-1} (\sum_{i=1}^{p} a_{i,11} L^i - a_{0,11})) y_t + (a_{0,71}^{-1} (\sum_{i=1}^{p} a_{i,31} L^i - a_{0,31})) p_t \quad (8)$$

where p denotes the lag length and L is the lag operator. The long-run multipliers are the partial derivatives of the steady state solution, $y_t = y^*$, $p_t = p^*$, $i_t = i^*$:

$$\Phi_y = \frac{\partial i^*}{\partial y^*} = \frac{(a_{0,71}^{-1} (\sum_{i=1}^{p} a_{i,11} - a_{0,11}))}{1 - a_{0,71}^{-1} (\sum_{i=1}^{p} a_{i,71})} \quad (9)$$

$$\Phi_p = \frac{\partial i^*}{\partial p^*} = \frac{(a_{0,71}^{-1} (\sum_{i=1}^{p} a_{i,31} - a_{0,31}))}{1 - a_{0,71}^{-1} (\sum_{i=1}^{p} a_{i,71})} \quad (10)$$

We compare our baseline identification with the ones proposed by Scholl and Uhlig (2008) and Arias et al. (2015). Identification 2 implies only restricting the coefficients of the monetary policy rule while Identification 3 implies restricting the impulse responses of the monetary policy shock.

3.2.2. Identification 2

The federal funds rate is the monetary policy instrument and it reacts contemporaneously only to output and prices. The response coefficients of output and prices are non-negative.

The matrices $f(A_0, A_+)$, Z_1 and S_1 now take the following form:

$$f(A_0, A_+) = [A_0],\ Z_1 = \begin{pmatrix} 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 \end{pmatrix},\ S_1 = \begin{pmatrix} -1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix}.$$

3.2.3. Identification 3

For 12 periods, the responses of prices and reserves are non-positive while the response of interest rates is non-negative.

Under this identification there are no zero restrictions and we only have to define matrices $f(A_0, A_+)$ and S_1:

$$f(A_0, A_+) = \begin{bmatrix} L_0(A_0, A_+) \\ L_1(A_0, A_+) \\ \vdots \\ L_{10}(A_0, A_+) \\ L_{11}(A_0, A_+) \end{bmatrix},\ S_1 = \begin{bmatrix} S_1^{nbrx} \\ S_1^{p} \\ S_1^{i} \end{bmatrix}$$

where each of the sub-blocks of the matrix S_1 is of dimension (12×84).

3.3. Estimation

We estimate equation 1 with 6 lags using Bayesian techniques with a Normal-Wishart prior as in Uhlig (2005). Thus the prior is uninformative and the posterior will be centred around the OLS estimator. We use 1000 draws of the reduced-form parameters (B_+, Σ) from the Normal-Wishart posterior and of the orthonormal matrix Q. Our dataset includes monthly variables for the U.S. and U.K. and is obtained from the St. Louis Fed Database. Our dataset spans from 1978M1 to 2007M11 and includes: the U.S. industrial production (INDPRO), the U.S. consumer price index (CPIAUCSL), the U.S. non-borrowed reserves (BOGNOBOR), the U.S. total reserves (TRARR), the federal funds rate (FEDFUNDS), the nominal exchange rate U.S./U.K. (EXUSUK), the U.K. industrial production (GBRPROINDMISMEI), the U.K. consumer price index (GBRCPIALLMINMEI), the U.K. interbank interest rate (IRSTCI01GBM156N). Except for interest rates, all the other variables are seasonally adjusted and are in $100log$. For plotting we use 68% confidence intervals and the closest to median IRF. Following Fry and Pagan (2007), we use the closest to median IRF instead of the median for 2 reasons.

First, the median as a way of summarizing the data could be misleading since it is a mixture of structural parameters from different models. Secondly, this permits us to retrieve the shock that generated the closest to median IRF since the latter is generated by a single model. Since we are interested in only one shock, define Θ_t as a $n \times t$ matrix containing the IRF of the monetary policy shock up to horizon t. Let Θ_{med} and Θ_{std} represent the median impulse responses and the standard deviation of the impulse responses across the 1000 draws. Define the standardized impulses response function as:

$$\tilde{\Theta}_t = (\Theta_t - \Theta_{med}) \emptyset \, \Theta_{std} \tag{11}$$

where $\emptyset$ denotes the Hadamard matrix division (elementwise). The closest to median IRF is defined as the one that minimizes $vec(\tilde{\Theta}_t)' vec(\tilde{\Theta}_t)$ where vec is the vectorization operator.

4. RESULTS

In this section, we present the impulse response functions to a monetary policy shock corresponding to our baseline identification. We also report the shock that generated the closest to median IRFs and the forecast error decomposition. We compare our results to two related identification schemes: Arias et al. (2015) and Scholl and Uhlig (2008). The former uses only part 1 of our identification while the latter uses part 2 with different specifications of the model. We argue that the identification of the monetary policy shock is accomplished only by merging the two schemes which represent our baseline model. To support our methodology, we then compute the distribution of the long-run multipliers of prices and output implied by our identification strategy and the one of Arias et al. (2015). Figure 1 presents the impulse response functions corresponding to Identification 1. The liquidity puzzle and the price puzzle were avoided by construction. The latter will be relaxed later. The shock corresponds to a 0.4% annualized increase in the federal funds rate. The U.K. interbank market seems to respond rather fast to the U.S. monetary policy shock, the increase in interest rates becoming significant 3 months after the shock. The real exchange rate decreases on impact and continues to appreciate for another 6 months after which it starts depreciating. The response is significant for 25 months after the shock. There is clearly a delayed overshooting in the exchange rate, in contrast with the theory developed by Dornbusch and in line with the results reported by Scholl and Uhlig (2008). The response of the U.S. output is not significant on impact or for the year following the monetary policy shock, confirming the fact that the effects of monetary policy shocks are transmitted with lags to the real economy. The decrease builds up over time reaching its lowest point two and a half years after the shock. Monetary policy responds by lowering interest rates in line with the systematic component implied by the model but the response is not enough to counteract the decrease in output. Overall, the

effects of a monetary policy tightening have a long-lived and significant effect on the level of output. Quantitatively, a 0.4% annualized increase in the interest rates decreases output by 0.12%, 5 years after the shock.

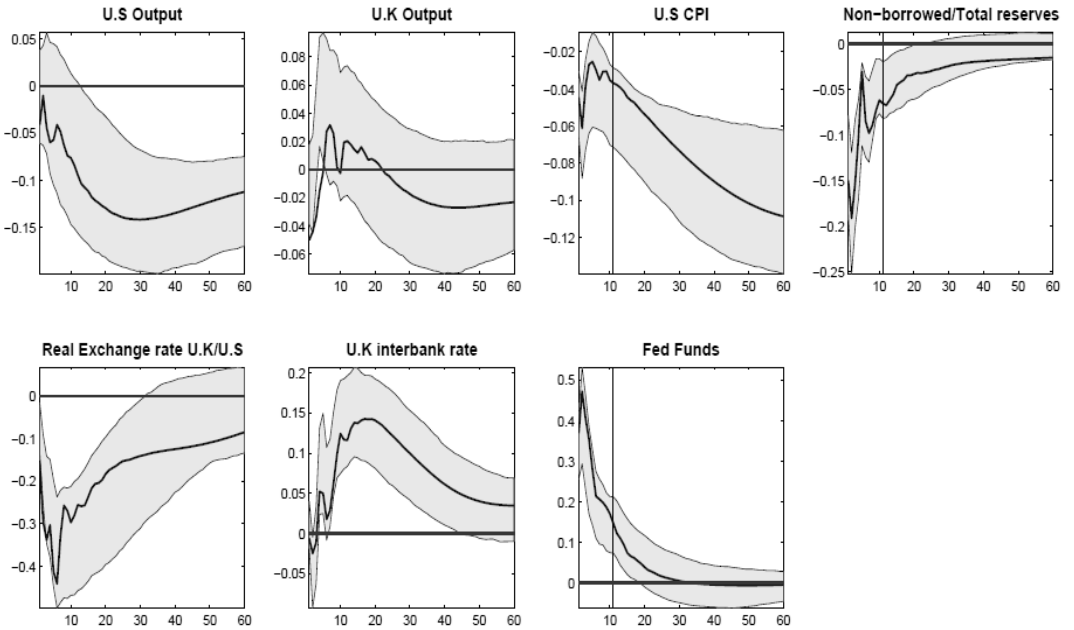

Figure 1: IRFs to a monetary policy shock: Identification 1

Note: the vertical bars denote the horizon up to which the sign restrictions were imposed.

The monetary policy shock implied by the closest to median IRF is plotted in Figure 2. It can be seen that the volatility of the shock decreases from 1984 onwards. It appears that monetary policy stability has also contributed to the great moderation period.

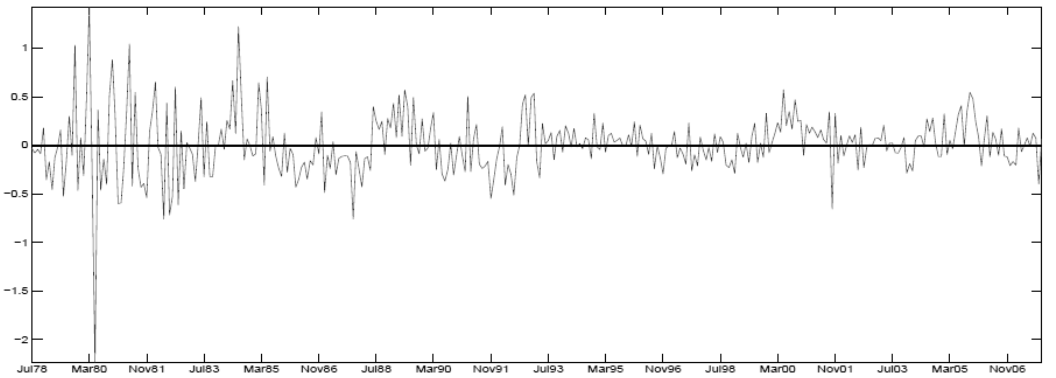

Figure 2: Monetary Policy Shock Implied by Identification 1

As argued in Section 2, the lagged coefficients of inflation and output could turn out to be negative in the Taylor type rule equation. This would not be consistent with the Taylor rule principle and would represent a counterfactual behaviour of monetary policy for the U.S. economy. We check the consistency of our identification with the Taylor rule principle by computing the long-run price and output multipliers given by equations 9 and 10.

Table 1: Long-run Multipliers for the Closest to Median IRF

	Φ_y	Φ_p
Multiplier	2.27	6.46

Table 1 presents these long-run multipliers associated to the closest to median IRF. Notice that while both multipliers are larger than 0, the central bank responds three times more aggressively to price fluctuations than to output fluctuations. Furthermore, the price multiplier is larger than 1 which is in line with the Taylor rule principle. Figure 3 displays the distributions of the long-run multipliers across all the 1000 models (draws).

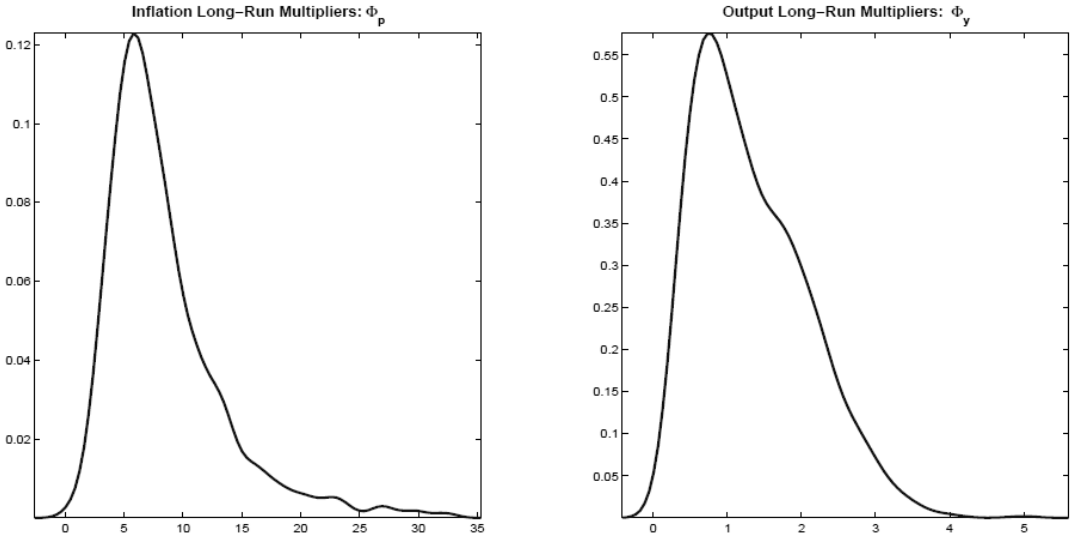

Figure 3: Distribution of long-run Multipliers under Identification 1

Both distributions have their mass above 0, implying that the Taylor principle is satisfied across almost all models, not just for the closest to median one. Table 2 presents the empirical probabilities of the multipliers taking specific values.

Table 2: Empirical probabilities of the multipliers under Identification 1

i	$P(\Phi_i > 0)$	$P(\Phi_i > 1)$	$P(\Phi_i > 5)$	$P(\Phi_i > 10)$	$P(\Phi_i > 20)$	$P(\Phi_i > 50)$
Φ_p	1	0.9960	0.7650	0.2650	0.0390	0
Φ_y	1	0.5820	0	0	0	0

The first row contains the probabilities of the inflation multipliers taking values larger than 0, 1, 10, 20 and 50. The implied long-run multipliers of inflation are greater than 0 for all models and larger than 1 for 99.6% of the models. The probability of having a large multiplier, bigger than 20, is only 4%. This is encouraging since our identification yields promising results not only for the close to median model, but across all models. As regards the probabilities of the output multipliers, all the models imply values larger than 0 and smaller than 5. Figure 4 presents the variance explained by the monetary policy shock. As expected, the monetary policy shock explains a large portion of the variation in the federal funds rate. Monetary policy appears to be effective in stabilizing inflation with nearly 20-30% of the variability in this variable accounted for by this shock, following the first months after the impact. The exchange rate volatility is also partly explained by the monetary shock. However, it seems that there are other factors more important that determine the exchange rate dynamics. The explanatory power for variations in output increases over time reaching 18% after 5 years.

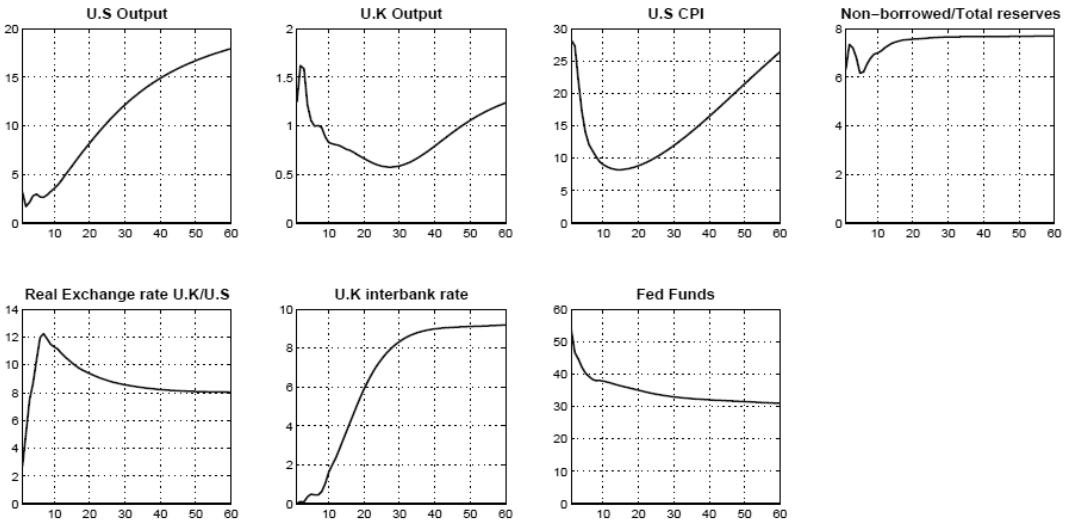

Figure 4: FEVD for the Closest to Median Model under Identification 1

We now turn to the two alternative identification schemes proposed by Uhlig (2005), Scholl and Uhlig (2008) and Arias et al. (2015).

4.1. Monetary Policy Shocks under Identification 2

Figure 5 presents the impulse response implied by this identification (baseline identification in Arias et al. (2015)). The response of output and interest rates closely follows the one reported in their paper. Nevertheless, it is hard to believe that this identification captures *only* the effects of a monetary policy shock. First, under this scheme an increase in the annualized interest rate of 0.2% causes output to fall by 0.1-0.15% in the first year following the shock, which is quantitatively double than under identification 1. We believe that this overestimates the true effect of a monetary policy shock on output and that the decrease in output captures other factors than the monetary policy shock. Secondly, the response of the federal funds rate is not significant at any horizon. It is hard to justify a contractionary monetary policy shock that does not significantly affect interest rates, neither on impact nor over time.

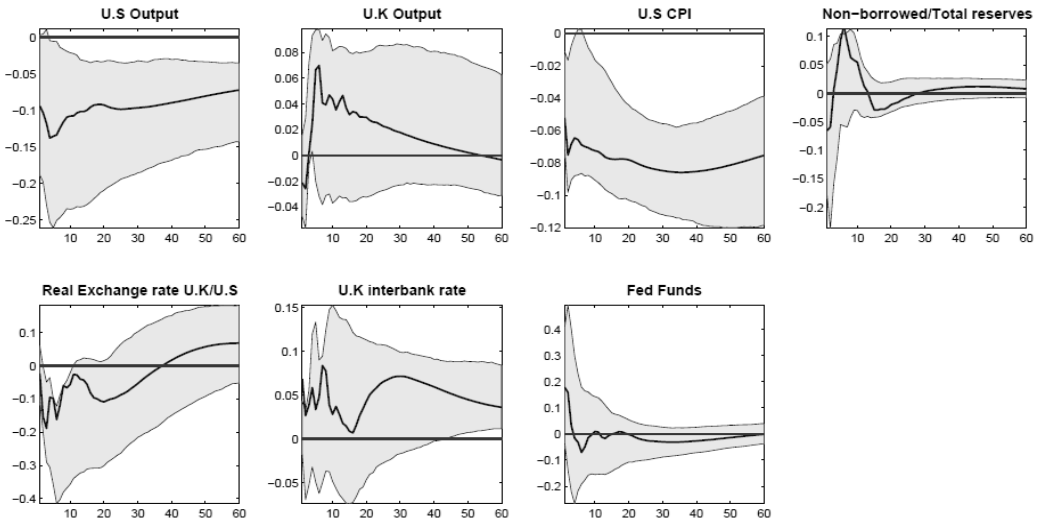

Figure 5: IRF from a Monetary Policy Shock under Identification 2

Figure 6 plots the explanatory power associated with the monetary policy shock under Identification 2. The monetary policy shock explains 13% on impact and 2% after 1 year of the variation in the interest rate. It is widely accepted that, during the time period covered in our sample, the Federal Reserve has used the federal funds rate almost continuously as a monetary policy instrument[3]. Thus a shock that explains only 13% on impact and 2% in the long-run of the variations in the federal funds rate is not indicative of a monetary policy shock.

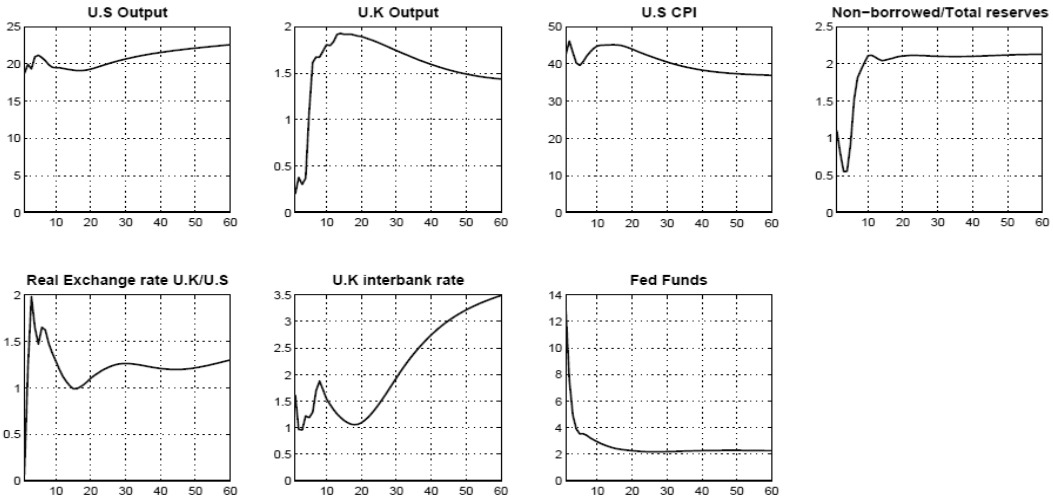

Figure 6: FEVD of the Monetary Policy Shock under Identification 2

In line with our previous analysis, we compute the empirical distributions of the long-run multipliers implied by Identification 2. The results are plotted in figure 7. Both distributions have their mass above 0. The values of the long-run multipliers implied by the closest to median model are very similar to those under Identification 1: 6.2 for inflation and 2.1 for output. What is important to note is the support of these distributions. Table 3 presents the probabilities that these multipliers take values greater than some thresholds.

Table 3: Empirical Probabilities of the Multipliers under Identification 2

i	$P(\Phi_i > 0)$	$P(\Phi_i > 1)$	$P(\Phi_i > 20)$	$P(\Phi_i > 50)$	$P(\Phi_i > 100)$	$P(\Phi_i > 150)$	$P(\Phi_i > 200)$
Φ_p	0.995	0.943	0.226	0.101	0.059	0.038	0.029
Φ_y	0.994	0.860	0.073	0.033	0.014	0.009	0.006

The distributions of the long-run multipliers have fatter tails than the ones under Identification 1. The probability of drawing a negative multiplier for inflation or output is around 0.5%. What is more suspect is that the probability of having a large multiplier is very high. Table 2 shows that the probability of having an inflation multiplier larger than 50 or 100 is 10% and 6% respectively. It is not clear for us how a value of 100 for the inflation multiplier can be interpreted or justified. We believe that this identification captures something else besides the monetary policy shock and that the systematic

component of monetary policy is not entirely separated from other factors affecting interest rates. Under Identification 1 both of the above probabilities are 0.

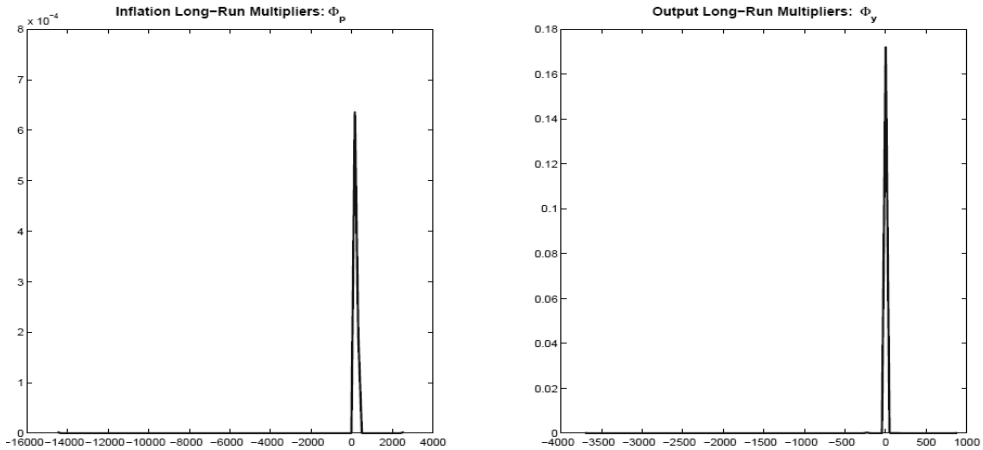

Figure 7: Distribution of the Long-run Multipliers under Identification 2

4.2. Monetary Policy Shocks under Identification 3

The impulse response functions to a monetary policy shock under Identification 3 are presented in Figure 8. The shock corresponds to a 0.25 percentage point increase in the annualized interest rate. This identification corresponds to the one used in Scholl and Uhlig (2008) but implemented using the new methodology proposed by Arias et al. (2015), which draws the coefficients from the correct posterior distribution. There is one notable difference in the results from the two methodologies. In Scholl and Uhlig (2008), the response of output to a monetary policy shock is not significant at any horizon of the impulse response functions. This result supports the view that a contractionary monetary policy cannot significantly influence the real economy. Figure 8 tells a different story. Using the same identification scheme but with the refined methodology, the effect of a contractionary monetary policy shock on output is positive and significant over the first 7 months following the shock. Under this identification scheme contractionary monetary policy shocks do not operate with lags, instead they have a contemporaneously significant positive effect on the level of output. This result cannot capture the true effects of a monetary policy tightening. It is hard if not impossible to justify that an increase in the interest rates causes output to increase in the short-term. Moreover, this identification is very similar to the one used by Uhlig (2005) but with sign restrictions imposed at different horizons. Arias et al. (2015) showed that the identification used by the latter

implied a counterfactual behaviour of the monetary policy for the United States and it did not identify monetary policy shocks correctly.

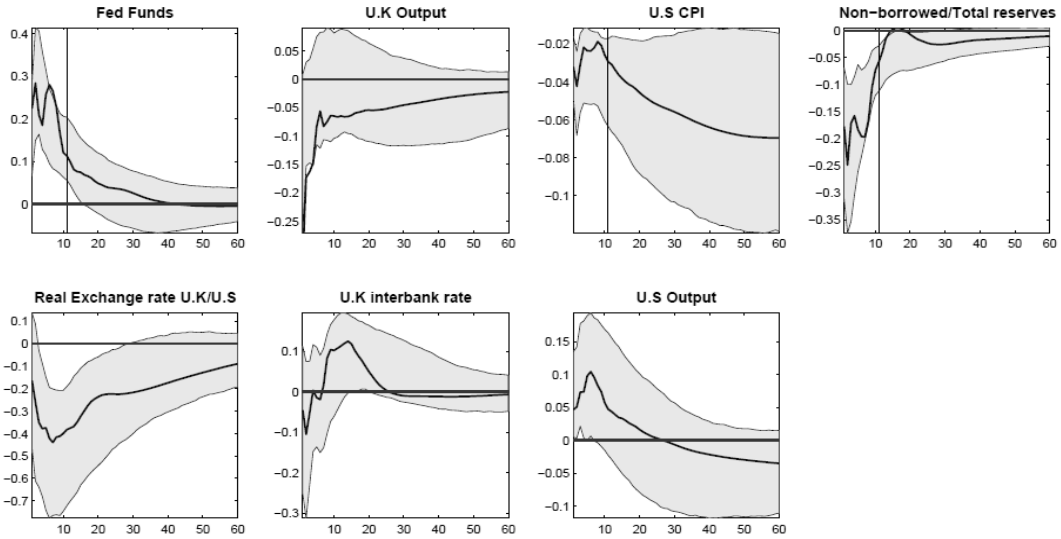

Figure 8: IRF from a Monetary Policy Shock: Identification 3

5. CONCLUSIONS

We propose a new agnostic identification scheme for monetary policy shocks in open economy SVARs restricting both the systematic component of monetary policy and the impulse response functions. We also analyse two related identification methods proposed by Arias et al. (2015) and Uhlig (2005), Scholl and Uhlig (2008). The former restricts only the systematic component of the monetary policy reaction function. We find that this identification yields very large values for the long-run multipliers of inflation and output that are hard to interpret or reconcile with empirical evidence. Furthermore, we argue that, under this identification scheme, monetary policy effects on output are overestimated and that this procedure does not fully identify monetary policy shocks. The latter implies the counterfactual behaviour of the U.S. monetary policy; the impulse response functions under this identification showed that a contractionary monetary policy shock had a positive and significant effect on output during the first 7 months following the shock. We use the refined methodology proposed by Arias et al. (2014) and impose zero and sign restrictions on the systematic component of the monetary policy and sign restrictions on the responses of interest rate, inflation and reserves. Thus, we remain agnostic about the response of output and open-economy variables. We find that an annual increase of 0.4-0.5 percentage

points in the federal funds rate causes output to contract by 0.12% in the long run. Under our identification, monetary policy affects the real economy with lags and the effect on output is significant and permanent in the long-run. The delayed overshooting puzzle is present under all three identification methods and it appears to be robust regardless of the identification chosen. Under our baseline identification the delay is around 5-6 months, in line with the findings of Scholl and Uhlig (2008).

NOTES

[1] The diagonal elements of matrix R have been normalized to be positive
[2] The ordering of the variables is $(y_t, y_t^*, p_t, nbrx_t, rer_t, i_t^*, i_t)$
[3] See Bernanke and Blinder (1992), Sims and Zha (2006)

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Computing Sentiments: An Empirical View on Credit Scoring

Radu Rizoiu*

Motto: "*Trust, but verify*."
Ronald Reagan

Abstract

The paper briefly addresses the results collected from several prominent Romanian banks in relation to their credit scoring policies and criteria. Starting from certain sociological evidence on the structure of trustworthiness in local Romanian culture, the paper looks for links with the current domestic banking practices while forwarding certain predictions on changes to be announced by the implementation of the new Basel III prudential rules. This primer analysis is only opening the door to a different viewpoint on credit scoring techniques, focusing more on the trust between the bank and the client rather than on the figures expressing the net worth of the client. The initial results show that most local banks continue to rely heavily on weighting the asset value rather than the personal reliability of the client.

Keywords

trust, credit scoring, credit risk, Capital Requirements Directive

JEL Classification:

D01, D12, G21, K22

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1. INTRODUCTION

It has always been a puzzle why people choose between secured and unsecured credit products. All theories developed to solve this "puzzle" (however complicated they were) turned to the same fundamental item: credit is a function of trust. Our own research has shown that credit is nothing more than crystalized trust embodied in a contract. This was a "discovery" that reopened the age-old discussion on the etymology of credit from the Latin credere meaning trust.

We will try to test these initial views with an empirical research into the way Romanian banks run their credit scoring mechanisms in order to verify the trustworthiness of their clients. In order to do so, we shall first make a brief presentation of trust as a sentiment (I) going further on how trust relates to (modern days) credit techniques (II) before moving on to modalities of finding formulae for evaluating trust (III). Based on this theoretical background, we shall then present the results of my empirical study on credit scoring in Romanian banking market (IV).

2. TRUST AS A SENTIMENT

2.1. What is Trust?

Although I am a legal scholar, I will not use the term "trust" for its specialized meaning as a legal technique of segregating assets[1]. Surprisingly enough (for some lawyers) we will rather use the word in its plain meaning, i.e. "assured reliance on the character, ability, strength, or truth of someone or something"[2]. We even expand this specific meaning with the secondary one (the equivalent of hope[3]): "dependence on something future or contingent"[4].

On this basis, trust appears as a feeling someone has over someone else or something else. We will focus herein on interpersonal trust, namely the trust someone puts in someone else. It looks like this kind of trust is the basis for friendship[5] (but it does not always become friendship[6]). As a feeling, trust seems to have nothing to do with any attempt to be submitted to reason. However, as Aristotle subtly noted, ethics resides in that part of the soul that is based on desire but could be influenced by reason[7]. As such, to a certain extent, trust could be harnessed under a rational approach. It looks like this power of the reason over the senses is what gives us humans the imprint of our humanity[8].

Taking these observations as a starting point, one could state that trust is a sentiment with a basis in the irrational part of the soul but which could be managed by a human

being by using the rational part of the soul. Hence, when taking a look at trust in order to analyse it, it could be divided into two parts: the basic trust built in the (unconscious part of any) man and the informed trust each person develops by using his intellect and applying the rational thought to the pre-existing basic trust.

2.2. Do we Trust?

When asking this question, we need to specify the object of the trust. As we have already limited our discussion to interpersonal trust, this effort is easier. For the purposes of our (limited) analysis, we shall use three types of trust, defining different levels of interpersonal trust: personal trust, collective trust and institutional trust[9]. In this classification, we start from the basic observation that groups of people (whether formally organized as a legal entity[10] or not) are mere elevations of individual human beings, so that they could be used as (interpersonal) objects of trust.

As a prerequisite for all other types of trust, *personal trust* is the main relation between two (natural) persons that trust each other. Most of the time, trust is not bidirectional, but unidirectional, i.e. a person trusts another person (whether or not this trust is reciprocal). This trust has the personal charisma (irrational side) of the trust object as a trigger that could be complemented by the (professional) track record (rational side). Take the example of Bernie Madoff in the U.S. or the local (now fugitive) broker Cristian Sima[11].

At a more general level, *collective trust* is generated by the fabric of the society itself. People learn to trust each other because this is the only way to live in a community. Without this sort of trust, no society is possible. Some find this trust could be an intrinsic feature of human beings[12] (viewed as *zoon politikon*)[13]; others consider it an adaptation to the social structures[14] (and the people who do not fit in are called sociopaths[15])[16]. This type of trust is omnidirectional[17] (not necessarily reciprocal) and is based on the idea that trusting the others is the best way to make sure that they will trust us back. This kind of trust is the basic tenet for the existence of the State, but it could also be used in smaller (or differently defined) collectivities. Take the example of the Nobel Peace Prize winner Muhammad Yunus' Grameen Bank in Bangladesh. The concept of this "popular bank" is that it advances (small amounts of) money to women in a paternalistic men-based culture with little or no security, based on the fact that the non-repayment would outcast the debtor from the collective life.

The most complex type of (interpersonal) trust is *institutional trust*. The paradox is that, when it reaches the full development, institutional trust becomes impersonal as a main characteristic, i.e. people put their trust in an institution irrespective of who the

persons leading (or working for) such institution are. This level of trust is generally associated with the constitutional institutions a State puts forward under the 'rule of law' concept[18]. However, it could be used in relation to (some) economic functions the State has delegated to private businesses as well. Trust in the (financial and) banking system[19] is a type of institutional trust. It deals with the basic fabric of the "blood" that feeds the market economy. While State intervention in the economy is not compatible with the market[20], the State has the right to supervise the banking sector in order to avoid a potential systemic risk from happening.

Recent studies seem to indicate that trust is a basic built-in feeling in (most) human beings[21]. Apparently[22], the brain associates the confirmed trust with pleasure and it generates pain when trust proves to have been misplaced. In other words, people are born trusty and they only learn to distrust later on. This enables the conclusion that (statistically) trust is a basic attitude for everyone.

While the very idea of a "national" psychology is contested[23], for the purposes of this study, it is useful to look into the Romanians' perceptions of trust at different levels. As a general view, the World Values Survey places Romania in the middle of trusting people, with an average trust of 20%[24]. We use the results of a few polls that have recently addressed the issue. We have chosen to use the polls from a single agency (i.e. Institutul Român pentru Evaluare şi Strategie – IRES[25]) in order to have comparable results. As a general view, Romanians mainly declare themselves mainly optimistically (45%) with a balanced portion of reservation (38%), while the pessimists represent a minority of 15%[26]. Moreover, 73% of the respondents declared they trusted in what the future would bring[27]. The same poll shows that (in September 2011) 40% of the population was happy while 47% was unhappy. However, 81% of the respondents considered that the economic situation in Romania was bad.

A general study focusing on trusted persons (January 2016)[28] showed that the average Romanian mainly put his trust in close family members[29] (with some degrees varying from spouse and children to parents[30]) and had little trust in anyone else[31]. The figures match the sociological observations according to which Romania is going through an interim period of transition from a primarily rural structure (the interwar status) to a modern urban type[32]. Therefore, the trusted circle is the traditional one (i.e. family[33]) like in the traditional village, while the territorial community is no longer to be trusted[34] because people changed their stable location from village to town. Apart from the close family and friends, 60% of the population trusts nobody. As such, for Romanians, personal trust requires (at least) friendship[35], a reciprocated trust[36]. An

earlier study (September 2011) showed similar results, people reckoning other people are not to be trusted (78%) and only 18% turning out to be trusting respondents[37]. However, this general mistrust was not perceived as a big worry since only 6% of the people considered it was making them insecure. This means Romanians consider that not trusting other people is a normal status.

In terms of non-reciprocated trust, high regards are shown to day-to-day public servants (like firemen, teachers[38]), while businessmen are ranking very low[39], despised less only compared to top politicians. These figures match those provided for the workgroup and they also show that collective trust is at low levels within the working[40]/business area.

In terms of institutional trust, the Church remains at high levels with 55%, closely followed[41] (surprisingly after the financial crisis) by the National Bank of Romania with 50%[42]. Again, companies are not Romanians' favourites: Romanian (private) companies are credited with 33% trust, foreign (private) companies with 28%[43] and Romanian (state-owned) companies with only 23%[44]. In this landscape, banks are keeping the pace with 28%. This mistrust in market institutions is revealed by one of the perceived causes for the lack of trust – the fact that the wealthy class has acquired this position by using unfair practices (76%)[45] because the State was unable to ensure fair competition (68%)[46], while corruption was unbearable (87%).

As anyone can see from these general indicators, trust is not necessarily a strong point in Romania especially as far as businesses (including banks[47]) are concerned. We will now turn to see the specific perception of trust towards the financial sector in Romania. In doing so, we will use both an IRES study on banking activity and a study ordered by the Romanian Banking Association (ARB) and run by GfK[48]. As a general view, only 3% of the population was concerned (in September 2011) about the (financial and) economic crisis and only 0.7% viewed it as a personal problem[49].

In accordance with the IRES National Banking Index preview (January 2011)[50], only 3% of Romanians (urban population) have great trust in banks, 41% have moderate trust, while 40% have little trust and 13% really distrust banks[51]. Over half of the respondents are using banking services and, out of them, more than 70% are happy with the services received from their bank. The mostly used criterion in choosing a particular bank is the trust such bank inspires to the client (47%). However, 76% of the respondents said they would rather avoid working with banks and 90% of them considered that the standard agreements used by the banks were drafted in the favour of the financial institution (and against the interest of the client). A poll run by GfK for

ARB in the same period (July 2011) showed a different pattern, with 33% of the population trusting the banks and 42% distrusting them[52]. The ARB poll was updated in May 2016, showing a slight improvement[53], with 40% of the population trusting the banks and 36% distrusting them[54].

To conclude, Romanians (on average) trust in banks greatly (or other businesses for that matter), being focused on family (i.e. personal) trust instead. The result is that there is a fair chance a Romanian debtor will be prone to cheat the bank if this helps himself and his family live a better life. Consequently, banks should be more careful in evaluating the financial good standing of their clients in order to be able to qualify them as clients for loans. Moreover, banks should try to embed in their scoring processes certain 'soft' elements pertaining more to the psychology of their clients than to their 'objective' financial standing.

2.3. Are we Trustworthy?

The other side of the coin is the extent to which institutions trust individuals. The main difficulty here is that a legal entity (banks included) cannot assess the trustworthiness of each of its (individual) clients by becoming friends with them or (at least) by having some personal knowledge of their character[55].

Banks have two main channels to assess the trustworthiness of their clients: running some statistical assumptions and basing their decision on the personal opinion of the credit officer who met the (potential) client in person. Each approach has its advantages and flaws. The use of statistics could prove wrong if they are not calibrated to the type of people accessing the services of that specific bank. This is one of the reasons why the European Union asked each bank to prepare its own statistics related to (non-performing) credit risk based on the past experience from its own activity. Using "personal touch" is tricky when the trust in your own employees is not high[56]. Moreover, it is difficult to implement a workable system of reporting a personal assessment of the trustworthiness level from the credit officer[57] to the credit committee.

The first move in coping with these challenges was for the Romanian banks to gather together in order to share (mainly negative) reports on their clients, thus preventing free-riders. Nowadays, it is a standard process for the bank to run a status check with the Credit Bureau before deciding on extending a credit to an individual[58]. Apart from this (private) database system, the National Bank of Romania keeps a "black list" of failed banking operations where any bounced check is recorded for further reference.

The second move was accelerated by the incorporation of Basel III rules into the European Regulation[59]. Under these rules, each bank should carefully manage its credit

risk by implementing internal procedures to evaluate the trustworthiness of its clients in advance. The European Banking Agency also developed these rules by asking banks to focus in these procedures not only on the assets the debtor uses as collateral, but also on the financial position of the debtor and its ability to maintain a reasonable cash flow during the life of the loan[60].

All these steps lead to a stringent need for the banks to find a way of evaluating the trustworthiness of each client individually, not only as a global/statistical figure, which brings them to the formidable challenge of assigning a value (i.e. risk ratio) to a sentiment (i.e. trust).

3. CREDIT AS CRYSTALIZED TRUST

3.1. The (Legal) Concept of "Credit"

While Romanian law does not contain a general definition[61] of "credit" [62] or "credit agreement"[63], it does use some specific references as well as a general rule offering a sense of the concept. In this section, we will try to find the general traces that are characteristic to the legal concept of credit[64].

In the process of European integration, Romania has adopted some domestic regulations transposing the European *acquis* in the past 10 years. In implementing Directive 2008/48/EC of 23 April 2008 on credit agreements for consumers[65] and, later on, Directive 2014/17/EU of 4 February 2014 on credit agreements for consumers relating to residential immovable property, certain definitions of "credit agreement" were inserted into domestic law[66]. While these definitions have a scope limited to the context of (certain) consumer credit operations, they prove useful in shaping the general features of the credit agreement.

The Romanian Civil Code does not define the credit agreement[67], but it defines the loan agreement[68]. In detailing the legal regime of the loan agreement, the Romanian Civil Code provides that "The legal provisions related to the interest-bearing loan are also applicable *mutatis mutandis* any time when an agreement provides for an obligation subject to a deferred payment related to money or other generic goods, unless special rules are provided for the validity of enforceability of such obligation"[69]. Behind this strange extension of the legal status of the interest-bearing loan, the regulation actually tries to grasp the more general concept of credit, i.e. any operation meant to defer the payment of a (monetary) obligation.

As such, credit could be defined (from the legal point of view) as any valid understanding whereby the creditor of a monetary obligation accepts to defer the payment[70] thereof for a certain period of time, regularly against a price (i.e., the interest)[71]. In the next sections, we will use this basic definition of the credit in order to explain its relation with trust.

3.2. Focus on the Debtor

It is true that any relationship that should endure over time needs to be built on trust on both sides. In any credit-like relationship, however, trust should exist, first and foremost, on behalf of the creditor. This is because the creditor is the one assuming (most of) the risk in "selling" time to the debtor. Generally, the debtor "buys" time from the creditor because it receives an immediate benefit in exchange for a future payment.

Nowadays, credits come in handy enough to allow potential debtors to choose from a multitude of (professional) creditors. However, credit markets still embed their original fabric: it is the creditor who decides whom to extend credits to. It is interesting to note that it is more important for the creditor to assess trust. For example, when taking a loan from the bank, the client considers the stability of the bank as the fifth most important factor in choosing the bank (56%), while when the same client deposits money to the bank he considers the same stability as the most important criterion in choosing the depositary bank (76%)[72]. This means that the creditor actually chooses the debtor and not the other way around.

The observation is relevant because the new perception in the legal writings is that the credit agreement is based on personal trust (i.e. it is an *intuitu personae* agreement) on behalf of the client towards the bank and, therefore, the bank is banned from assigning the loan to a third party without the express acceptance of the client. Moreover, from our perspective, this means that the banks (as creditors) need to focus on assessing the trustworthiness of the clients (as debtors).

3.3. Credit Risk and Loan Assessment

Credit risk became a star in the aftermath of the financial crisis started in 2007. This sentence is trivial if one looks into the history of (modern) lending. Any period of inflated optimism was followed by a crash with exacerbated pessimism[73]. As such, the idea of anticyclical measures was formulated. Romania made no exemption from this rule[74].

Yet credit risk received renewed attention from the regulators worldwide and Basel III regulation addressed the issue (too[75]) seriously. In Europe (Romania included), these

rules were implemented through the so-called Capital Requirements Directive ('CRD IVIV') package[76] (including Directive 2013/36/EU and Regulation 575/2013) which entered into force on 17 July 2013. One of the focal points of Basel III (and CRD IV) is for each lending instiution to implement personalized credit risk assessment internal procedures. While the regulation offers quite a detailed basis for the algorithm to be used, each bank should define particular formulae adapted to the specifics of its clients' risk profile.

As stated before, a credit basically implies a deferred payment. This means that the creditor should be confident that the debtor will be able (and willing[77]) to (re)pay the debt at maturity, i.e. sometime in the future. In a very interesting speech, Professor Valeriu Stoica mentioned that "[t]rust is basically an expectation. An expectation that the trusted party will meet the same values as the trusting one".[78] He continued by saying that „[a]ny society is only powerful to the extent to which its trusting index is a high one"[79]. In a more specific sense, the (then) State Counsellor of the Romanian Prime-minister, Ioana Petrescu wrote: "[t]he scene shows that trust is essential for the good functioning of the banking system"[80].

In this landscape, assessing the risk of the banking client becomes an exercise of discerning the particulars of each individual fro0m the background of a class or nation's traits. Given the high rates of mistrust in banks at the level of the general population, the risk of moral hazard is also to be taken into account.

4. HOW TO PUT TRUST IN FIGURES

4.1. What does "Scoring" Mean?

Scoring is the most used tool in the assessment of the risk of a client performed by a financial institution. However frivolous this term is in the lending industry, it looks like it is almost unknown by the subjects of scoring[81]. Evidently, this is not the place to define scoring. It would be anyhow difficult, since any basic concept eludes a clear definition. We will just provide a working definition of the concept to be used throughout this paper.

For the purposes of this analysis we will define 'scoring' as the process of using certain mathematical algorithms to classify the degree of trust in each client. An alternative approach would be to say that scoring assigns a certain risk grade to each client. In the context of the present analysis, the two approaches are equivalent in the sense that the greater the trust level, the lower the risk involved. In other words, risk is inversely

proportional with trust.

As the name suggests it, 'scoring' requires putting a figure (or other conventional sign) to define the rank of a particular client on the scale that measures the trust (or, inversely, risk) the bank associates with that client. In order to ascribe such a score to each client, a specific formula (or algorithm) should be defined and employed. As CRD IV package suggests it, the results of the application of this algorithm should be verified against the real-life outcomes of the processed portfolio of clients. If the *ex ante* scoring is not confirmed by the *ex post* realities, then either the algorithm should be changed or the formula should be adjusted with a new variable capturing the error percentage. Therefore, banks are constantly testing their scoring algorithms against real life events in order to make sure their scoring mechanism is adapted enough to the real market[82].

4.2. What does the Scoring Compute?

The main problem with scoring techniques is that they are based on the assumption that a mathematical formula could be defined to calculate trust/risk as applied to a person. Since trust is a sentiment (and risk is just the corollary of trust), this assumption could be read as enabling the transformation of a sentiment into some mathematical formulae. Just the thought of it could give thrills...

A more acceptable approach would be to take into account the duality of trust: the rational calculation of the subject on the costs and benefits is over posed onto the emotional (i.e. irrational) background in order to take a certain decisional path. If we focus on the second element of trust, it is possible to consider each person as a maximizer of his/her utility (the *homo œconomicus* standard) and this could be transformed into mathematical formulae to some extent. However, the irrational basis of the sentiment will not disappear. One could either ignore it (being impossible to compute) or address it at a more general scale as a statistical value. In this latter case, the bank could group its clients into classes based on certain common traits in terms of risk adversity. In doing so, it could then determine a statistical ratio of the risk to be assigned to each class. This generic ratio could be then used as a correction factor in the formula for individual trust/risk assessment (i.e. scoring).

4.3. Scoring vs. Trustworthiness

However complex or mathematically based the scoring formula might be, scoring should not be confused with the actual trust because trust remains a sentiment and it is unconceivable in a purely objective environment. Computers do not trust each other[83].

In the attempt to close the gap of operational risk, banks are keen on imposing an

'objective' approach on scoring. Since scoring is closely linked with trust in a personal relation, it should be clear that no objective formula can be found. The more objective the scoring process is, the more it departs from measuring the trust level.

One way to go around this vicious circle is to define loose categories of trust/risk in the scoring model. In other words, instead of looking for a particular scoring for each client, the banks could generate classes of scoring under which multiple clients (with a similar if not identical risk appetite) could fall. This approach could level out (some of) the asperities of the imperfections in the scoring formula.

In practice, each type of trust receives a certain ratio in the scoring formula. For example, since any country in the global(ized) economy is evaluated from its financial trustworthiness standpoint, this value could be used to emulate institutional trust[84]. Also, the general amount of non-performing loans in a bank's portfolio could be an indication of the collective trust that the bank defines in the pool of clients. These two generic parameters could be used to adjust the raw personal trust scoring of each client.

At the end of the day, the bank is an impersonal structure where individual personalities of people working in and for the company fade in favour of the corporate policies. Scoring is a modality to institutionalize the assessment of trust addressed to clients.

5. EMPIRICAL ANALYSIS

5.1. Methodology

In this empirical analysis, we used a quantitative approach based on a questionnaire form[85] addressed to several major Romanian banks[86]. The answers to the questionnaire were meant to evaluate the perception each bank had on certain elements considered relevant in a scoring process.

We then used the collected data to calculate a weighted average[87] for each factor dependent on the market share of the respondent bank. The formula used was a function of indicated grade adjusted with the impact the respondent bank had in the pool of banks. The impact factor was determined by the ratio the bank's assets had in the pool of assets of all respondent banks (i.e. the total is equal to 50% of the assets in the Romanian banking sector). Hence, the formula used was

$$Wa = \frac{\sum_1^n (G_i \times F_i)}{n}$$

where:

Wa – the weighted average that is shown in Table 1 below[88];

n – the number of responding banks (i.e. six);

G_i – the grade bank i gave to the criterion;

F_i – the impact factor of bank i, which was measured as pro rata with the assets of that bank:

$$F_i = \frac{A_i}{\sum_1^n A_i}$$

where A_i – the assets of bank i.

In addition to the answers to certain questions we also received qualitative results, in the sense that there were general comments regarding the respective classes of questions. We have used these comments as qualifiers to the rough numbers in ascribing meaning to the results.

Not all items in the questionnaire generate relevant results. For this paper, we limited the analysis to only two areas (relevant in analysing trust): credit scoring and interest differential between secured and unsecured loans.

5.2. Rough Results

Most of the answers received from banks showed that they were paying attention to all the items indicated in section A of the questionnaire. The resulting weighted means are presented in Table 1 below[89].

Table 1: Importance of Various Personal Factors in Credit Scoring

Criterion	Result
Employment Duration	5.55
Job Type	4.82
Residence Duration	2.03
Income	6.02
Tax Income	3.89
Current Exposure	6.28
Owner or Tenant	2.82

It becomes apparent that the greatest impact in credit scoring is attributed to the existing indebtedness level of the client and his/her income level. These criteria are closely followed by the employment duration and job type. The type of title for using the residence (homeowner or tenant) is less relevant and the period one lived in the same

place is quite irrelevant.

As far as the credit cost is concerned, the credit extended through a credit card is considered the riskiest product followed by the unsecured general-purpose loan, while the general-purpose mortgage-backed loan has the same cost as the residential mortgage loan virtually speaking.

Table 2: Difference in Interest Rate for Credit Products compared to Residential Mortgage Loans

Product	Interest Differential
Credit Card	17%
Unsecured Loan	7%
Mortgage Loan	1%

5.3. Meaning of the Results

These empirical results could shed some light on the modalities in which banks try to assess the trustworthiness of their clients. Of course, no bank will completely reveal its scoring process in order to avoid free-riders using such information to improve their trustworthiness image by artificially adapting some of their behaviours in the areas tested by the scoring formula. Therefore, the research was designed on very basic features without going into too much detail. The downside of this approach is that the results could be quite rough and important details could be overlooked.

Despite the basic approach, some of the results could be considered relevant. For example, the financial information on the client tends to have the greatest use in the scoring algorithms. One possible explanation is that it is quite easy to process figure-based information in a mathematical formula. Another explanation is that banks are usually piggybacking on other financial institutions for assessing the trustworthiness of their clients. For example, banks formed their own blacklisted clients' database (Biroul de Credite S.A.) to share credit risk information of some sort (i.e. the negative ones). Also, banks have come to an agreement with the Tax Authority to share financial information on individual clients in order to reduce frauds made by clients falsely declaring their income.

Other pieces of information that determine the inclusion of a client in a certain risk class are considered second-ranking data that could be used in the process of allotting the groups of clients to certain risk categories with some impact on their general scoring levels.

Lastly, the behavioural type of information is not considered reliable and has little impact on scoring. This approach could change in the future when recently obtained results in behavioural economics are integrated in the scoring formulae. This is in clear

contrast with the paramount importance trust has to play in banking activity. It looks like banks changed their approach to banking business from a trust-based lending policy to a managed-risk lending policy. It is like saying that a client who has enough money to repay the loan will surely do so. These days, such sentence is not always true. The moral hazard generated by recent legal developments (either enacted laws or draft laws under debate) stirred in some clients the idea of obtaining a standstill until the law allows them to reduce the payment obligations. Therefore, just looking at the client's wealth is not enough to infer his/her repayment trustworthiness[90].

As far as trust is concerned, the questionnaire shows that banks continue to rely heavily on (real estate) mortgages to secure their loans. The significant differential in the credit cost between the unsecured credit (credit card and regular general-purpose loans) on the one hand and the secured credit (secured general purpose loans and residential mortgage loans) on the other hand is a strong argument for the approach of the banks. This could be explained by the relative ease of ascribing a value (i.e. the liquidation value) to the mortgaged property[91] compared with the difficult task of predicting the cash flow variations in the client's income over time.

6. INTERIM CONCLUSION

Since this is a primer on the subject, no final conclusion could be reached. The general (albeit interim) conclusion of the study is that financial institutions found several elements that could be used as (indirect) indications of a risk in relation to a client. By using these elements and ascribing numerical values to each of them, they could try to predict how trustworthy each client is based on a scoring algorithm. The results predicted by scoring should be validated later on in real life by comparing the initial estimates of credit risk with the actual results over time.

The most frequently used parameters in scoring formulae are related to financial elements like indebtedness, income and property value. The most important element is the value of the (mortgaged) real estate. However, one may predict that this approach will change in the future, since the CRD IV package is now taking the emphasis away from assessing the property value (the static approach) and is rather stressing the assessment of the financial soundness of the client (the dynamic approach)[92].

However, as we tried to explain in the first part of the study, the focus should rather be on the trustworthiness of the client than on his/her good financial prospects. The more the clients trust the bank, the less prone they will be to miss paying their debts. Future will show if behavioural factors[93] start having a relevant impact on the scoring algorithm or whether scoring will become our everyday nightmare[94].

ANNEX 1 – FORM OF THE QUESTIONNAIRE

Elements that could affect the cost of credit

Please indicate (using a scale from 0 to 10, where 0 signifies lack of relevance and 10 signifies an element that could exclude the client from extending the credit) which of the following elements have an influence on credit cost:

A. Types of *scoring* information:

1. Duration of employment
2. Job type
3. Duration of residing at the same address
4. Income confirmed by employer
5. Income confirmed by Tax Authority
6. Current indebtedness
7. Owns or rents the home

B. Categories of information

1. Evidenced by documents
2. Declared by applicant
3. Verified with third parties

C. How the credit application is filled in

1. At the bank
2. Sent by post
3. Online

D. Types of products *(please indicate for each product the mean differential in cost compared with the non-subsidized residential mortgage loan)*

1. Credit card (with or without security interest over the balance of the bank account)
2. Unsecured general purpose loan
3. Mortgage-backed general purpose loan

E. Types of debtors

1. Individuals
2. SMEs
3. Corporate

F. Other elements *(please indicate other elements considered relevant for extending a credit or influencing the credit cost)*

NOTES

[1] This legal use is nonetheless based on the same common sense meaning of 'a confidence reposed in some other'. For the general explanation of the homonymy see G. Moffat, G. Bean, J. Dewar, *Trusts Law. Text and Materials*, fourth edition, Cambridge University Press, Cambridge, 2005, pp. 1-3.

[2] See "Trust", Merriam-Webster.com. Merriam-Webster, n. d. Web. 6 Jan. 2018.

[3] In the New Testament (Heb. 11:1), hope is associated with faith as Paul the Apostle puts it: "faith is confidence in what we hope for and assurance about what we do not see". The concept of *hope* was analysed in medieval Europe in relation to God, but it also accepted the trust in man's powers. See Thomas Aquinas, *Summa Theologiae*, Second Part of the Second Part, Q. 17, Article 4: "It is, however, lawful to hope in a man or a creature as being the secondary and instrumental agent through whom one is helped to obtain any goods that are ordained to happiness".

[4] *Id.*

[5] See Aristotle, *Nicomachean Ethics*, book VIII, part 4: "it is among good men that trust and the feeling that 'he would never wrong me' and all the other things that are demanded in true friendship are found".

[6] For a general view on trust as a requirement for friendship, see M. Alfano, *Friendship and the Structure of Trust*, in A. Masala, J. Webber (eds.), *From Personality to Virtue*, Oxford University Press, Oxford, 2016, pp. 186-206.

[7] See Aristotle, *Nicomachean Ethics*, book I, part 13: "the appetitive and in general the desiring element [of the soul] in a sense shares in [a rational principle], in so far as it listens to and obeys it". The same discussion was repeated in early Christian thought. See Nemesius of Emesa, *On the Nature of Man*, chapter 16: "Of the non-rational [part of the soul], one part does not obey reason, the other is capable of obeying reason. Further what is capable of obeying reason is divided into two, the desirous and the spirited".

[8] See Aristotle, *On the Soul*, book III, part 10: "a principle of reason and a desire are contrary and is possible only in beings with a sense of time (for while mind bids us hold back because of what is future, desire is influenced by what is just at hand: a pleasant object which is just at hand presents itself as both pleasant and good, without condition in either case, because of want of foresight into what is farther away in time)". *Adde* Thomas Aquinas, *On the Uniqueness of Intellect against Averroists*, no. 80: "the proper operation of man as man is understanding: it is in this that he differs from the other animals".

[9] For a similar approach, see A. Almakaeva, N. Griesshaber, *Disentangling Trust and Perceived Trustworthiness: Towards a more distinguished analysis of trust*, available at http://www.worldvaluessurvey.org/WVSPublicationsDocuments.jsp?PUB=113 (last

visited on January 21, 2018).

[10] Under article 25 para (2) of the Romanian Civil Code, "The legal entity is any form of organization which, by observing the conditions prescribed by the law, may have rights and obligations".

[11] In this case, a prominent client declared that he "trusted the good faith of the [man]".

[12] See P.J. Zak, *The Moral Molecule: The Source of Love and Prosperity*, Dutton, New York, 2012 (Romanian edition: *Molecula morală. Sursa iubirii și a prosperității*, Humanitas, Bucharest, 2015, p. 37 and p. 48).

[13] See Aristotle, *Politics*, I, 2, 1253a2 where it says that "[h]ence it is evident (...) that man is by nature a political animal". Before him, Plato had already said that "no one is self-sufficing, but all of us have many wants" in *Republic*, Book II.

[14] The general theories of "the social contract" are a reflection of this view. See Jean Jacques Rousseau's *The Social Contract* or John Locke's *Two Treatises on Government*.

[15] In older cultures, people seeking a solitary life away from the crowd were considered saints. From Buddhist *gurus*, through Middle-East Christian *stylites* and Muslim *faqirs*, up to East orthodox *hesychasts*, they were revered as the wise men any society needs to turn to for solving communal problems from an outside view. For a presentation of the role of these solitary wise men in early Christianity, see D. MacCulloch, *A History of Christianity. The First Three Thousand Years*, Penguin Books, London, 2010, pp. 207-208.

[16] One could also mention the opinions presenting trust as a personified deity that should be obeyed in order to ensure the survival of the community. See, for example, the Old Testament statement from Jeremiah 17:5: "Cursed is the man who trusts in man and makes flesh his strength, whose heart departs from the LORD". We consider this a form of omnilateral trust, the reference to "man" being to a particular individual instead of the whole mankind.

[17] For an application of this kind of trust in the area of property, namely to ensure the workable possession system, see L. M. Austin, *Possession and the Distraction of Philosophy*, in J. Penner, H.E. Smith (eds.), *Philosophical Foundations of Property Law*, Oxford University Press, Oxford, 2013, pp. 191-195: "an omnilateral relation would take the form: everyone's power to possess is the ground of the liability that everyone has to fall under an obligation to refrain from interference with those things acquired by other's exercise of that power" (*id.* at 193).

[18] See M. Krygier, *Rule of Law*, in M. Rosenfeld, A. Sajo (eds.), *The Oxford Handbook of Comparative Constitutional Law*, Oxford University Press, Oxford, 2013, pp. 235-237. For a historic approach, see N. Fergusson, *The Great Degeneration: How Institutions Decay and Economies Die*, Penguin Books, London, 2014, *passim*.

[19] Note that (at least in mainland Europe) the State maintained a close supervisory control over the (private) banking institutions. In Romania, the National Bank of Romania, as a central bank, has the duty to supervise all banking institutions doing business in Romania and to look after their prudential policies. See article 4 of the Government Emergency Ordinance no. 99 of 2006 on banking activity and capital adequacy.

[20] European Union treatment of State aid is a clear indication on the limits the State has in being involved in the market. For an example on such treatment, see the press release of the Romanian Competition Council on the process of authorizing the capital increase of the Romanian state-owned CEC Bank SA, available at http://www.renascc.eu/documente/Comunicat%20CEC%20-%20forma%20finala%20-%20ENG_526en.pdf (last visited on February 17, 2018).

[21] See P.J. Zak, *cit. supra*, note 15, *passim*. *Adde* M. Delgado, *To Trust or Not to Trust: Ask Oxytocin*, available at https://www.scientificamerican.com/article/to-trust-or-not-to-trust/ (last visited on January 21, 2018). Similar experiments are shown in the TV show *Brain Games* (season 3, episode 3, *Trust Me*).

[22] But see A. Markman, *Is Oxytocin the "Trust Molecule"?*, available at https://www.psychologytoday.com/blog/ulterior-motives/201512/is-oxytocin-the-trust-molecule (last visited on January 21, 2018).

[23] See V. Mihăilescu, *Narcis şi psihologia poporului*, in V. Mihăilescu, *Apologia pârleazului*, Polirom, Iaşi, 2015, pp. 113-116; V. Mihăilescu, *Scutecele naţiunii sau despre mentalitatea românului*, in V. Mihăilescu, *Scutecele naţiunii şi hainele împăratului. Note de antropologie politică*, Polirom, Iaşi, 2013, pp. 87-88. For the opinion defending the concept of national psychology, see D. David, *Psihologia poporului român. Profilul psihologic al românilor într-o monografie cognitiv-experimentală*, Polirom, Iaşi, 2015, *passim*.

[24] See the data on http://www.worldvaluessurvey.org/WVSDocumentationWVL.jsp, *apud* P.J. Zak, *cit. supra*, note 15, p. 197.

[25] The choice was also influenced by the fact that IRES announces a National Banking Index together with the Romanians' Trust Barometer. These polls are the closest public data available for the topic of this study.

[26] See IRES, *Romania, the country of the big unrest*, available at http://ziuadecj.realitatea.net/Document_Files/Articole/00075163/gptrr_ires_romania-marilor-nelinisti_2011.pdf (last visited on January 21, 2018).

[27] Oddly enough, out of the 95% respondents declaring they believe in God, 85% declared they counted on God's help when in trouble. This huge percentage shows that *hope* (which is purely irrational) outscores *trust* (which also has a rational component) by far.

[28] See IRES, *Romania – limited trusting company?*, available at

http://www.ires.com.ro/articol/311/romania---societate-cu-incredere-limitata (last visited on January 21, 2018).

[29] An impressive 91% general trust is shown in this respect. The percentage shows a rise from a March 2010 poll indicating "only" 88%. See IRES, *Romanians' Trust Barometer*, available at http://www.ires.com.ro/uploads/articole/barometrul-increderii-romanilor.pdf (last visited on January 21, 2018).

[30] The figures go down from 76% for spouse to 58% for parents.

[31] Friends are credited with only 39%, neighbours with 31% and the working group with even lower figures ranging from 25% (boss) down to 21% (colleague). Moreover, in the March 2010 poll, it was evident that trust required time, since only 6% considered a recent acquaintance could be trusted. See IRES, *Romanians' Trust Barometer*, *cit. supra*, note 31. However, similar levels (34%) are recorded in developed countries such as the United States of America (*apud* P. J. Zak, *cit. supra*, note 15, p. 203).

[32] See V. Mihăilescu, *Urmașii lui Ienăchiță Văcărescu*, in V. Mihăilescu, *Scutecele naţiunii şi hainele împăratului...*, *cit. supra*, note 25, pp. 104-106.

[33] This could explain why people are not feeling bound by a written contract concluded with a stranger. Moreover, the type of oral tradition associated with the Romanian traditional culture perceived the written document as a 'stranger' in itself. See V. Mihăilescu, A. Dumitrescu, Șt. Dumitrescu, *„Descurcăreți... dar încurcați în timp" sau despre avatarurile supraadaptabilității*, în V. Mihăilescu (ed.), *De ce este România astfel? Avatarurile excepționalismului românesc*, Editura Polirom, Bucharest, 2017, pp. 291-292, explaining that the written norm is perceived by the ordinary people as something alien compared to their customs.

[34] Only 26% trust their neighbours, while 46% distrust them. See IRES, *Romanians' Trust Barometer*, *cit. supra*, note 28.

[35] Personal trust implies knowing the other person. However, the polls show that only 27% trust the people they know (outside their family) and 33% distrust them. See IRES, *Romanians' Trust Barometer*, *cit. supra*, note 31.

[36] For friendship as reciprocated trust, see M. Alfano, *cit. supra*, note 9.

[37] See IRES, *Romania, the country of the big unrest*, *cit. supra*, note 26. The figures were improving compared with a similar poll from March 2010 showing 85% distrust over 13% trust in other people (generally). See IRES, *Romanians' Trust Barometer*, *cit. supra*, note 31.

[38] Ranking top scores of 90% and 77% respectively.

[39] Ranking very low – 23%. However, it shows an increase from the March 2010 poll when the figures were equal to 17%.

[40] Note, however, that workers top a 76% trust, engineers 65% and IT specialists 61%.

These figures echo the half of century of communism when the intensive industrialization of Romania took place.

[41] After the medical system (54%) and educational system (52%).

[42] However, there is a decrease in trust compared to 66% from the March 2010 poll.

[43] In the March 2010 poll, the overall percentage for private companies was of 27% which shows a slow increase for 2016.

[44] A staggering decrease compared with the March 2010 poll when the trust level was at 41%.

[45] In September 2011, the same perception amounted for 91% of the respondents, showing a decrease in distrust over 5 years.

[46] A similar 68% of the population thinks that there is no much justice in Romania.

[47] In the March 2010 poll, the figures were slightly lower (25%).

[48] See ARB, *Romanians' Financial Education Level*, July 2011, available at http://www.educatiefinanciara.info/wp-content/uploads/2015/03/Studiu-GFK.pdf (last visited on January 21, 2018).

[49] See IRES, *Romania, the country of the big unrest*, *cit. supra*, note 28.

[50] See IRES, *National Banking Index*, available at http://www.ires.com.ro/uploads/articole/ires_cercetare_national-banking-index_v.pdf (last visited on January 21, 2018).

[51] Even a former Prime-Minister stated (while in office) his distrust in banks quite bluntly. See https://www.agerpres.ro/politica/2017/08/29/premierul-tudose-am-refuzat-sa-imi-pun-leafa-pe-card-consider-ca-nu-merita-22-59-10.

[52] See ARB, *Romanians' Financial Education Level*, *cit. supra*, note 48.

[53] While an increase by 7 points in the trust level (from 33% up to 40%) could be quite material, the levels remain low for an industry where trust is paramount for its functioning.

[54] See the results in ARB, *Press Conference*, available at http://www.arb.ro/wp-content/uploads/prezentare%20ARB%2026%2005%202016.pdf (last visited on January 21, 2018).

[55] This kind of information (if technically possible) could be sanctioned as being too intrusive. See the recent debate on Big Data processing by IT companies or the reaction to the proposed "personal scoring" project announced by China for its citizens.

[56] The main priority identified by Romanian banks in 2014-2016 is the management of operational risk, which means the banks are concerned about the trustworthiness of their own employees. See ARB, *The Banking Barometer*, available at

http://www.arb.ro/barometrul-bancar-arb-ey-2016-creste-interesul-pentru-achizitionarea-de-active-si-parteneriate/ (last visited on January 21, 2018).

[57] In addition, the financial crisis revealed that the officer himself could be subject to perverse incentives (i.e. maximizing the market share at any cost) which could bias his feed-back to the bank.

[58] Biroul de Credit SA is a company, incorporated by 25 major Romanian banks, designed to store and provide its members with information about the credit history of clients of banking services. See http://www.birouldecredit.ro/index.htm (last visited on January 21, 2018).

[59] See Directive 2013/36/EU and EU Regulation 575/2013.

[60] See European Banking Agency, *Guidelines on credit risk management practices and accounting for expected credit losses*, especially paragraph 36 thereof, available at http://www.eba.europa.eu/regulation-and-policy/accounting-and-auditing/guidelines-on-accounting-for-expected-credit (last visited on January 11, 2018).

[61] While legal scholars are still keen to cite Iavolenus' quote from Digesta (50.17.202) "*Omnis definitio in iure civili periculosa est: parum est enim, ut non subverti posset*", the Romanian Civil Code, which entered into force in 2011, contains a handful of definitions since it was mainly drafted by a team of university law professors.

[62] On the critique of this lack of precision, see L. Bercea, *Creditul bancar. O încercare de conceptualizare*, in L. Bercea (ed.), *Contractul de credit bancar. Principiile, legea, uzanțele*, Universul juridic, Bucharest, 2013, pp. 36-38.

[63] A quite broad concept was defined for the credit agreement under the former Romanian Banking Act (1998) repealed in 2006.

[64] For a more detailed approach, see P. de Lestapis, *La notion juridique de crédit. Etude de droit civil français*, Imprimerie Bière, Bordeaux, 1940, *passim*.

[65] Article 7 point 2 of the Romanian Government Ordinance no. 50/2010 provides that "the credit agreement [is] an agreement whereby a creditor grants or promises to grant to a consumer credit in the form of a deferred payment, loan or other similar financial accommodation, except for agreements for the provision of services on a continuous basis or for the supply of goods of the same kind, where the consumer pays for such services or goods for the duration of their provision by means of instalments".

[66] Article 3 point 3 of the Romanian Government Ordinance no. 52/2016 provides that "the credit agreement [is] an agreement whereby a creditor grants or promises to grant, to a consumer, a credit falling within the scope of Article 2 in the form of a deferred payment, loan or other similar financial accommodation".

[67] Article 2193 RCC only defines the revolving credit facility as "the agreement where a credit institution (...) commits itself to maintain a certain amount of money at the

disposal of the client for a certain duration that is determined or determinable".

[68] Article 2158 RCC defines the loan agreement as "the agreement where the lender transfers to the borrower an amount of money or other generic consumption goods while the borrower commits to repay after a certain period of time the same amount of money or the same quantity of similar goods".

[69] Article 2167 RCC.

[70] In legal vocabulary, "payment" means any form of willful performance of one's obligation (article 1469 RCC). Therefore, the repayment of a loan is a form of payment.

[71] See R. Rizoiu, *Garanțiile reale mobiliare. O abordare funcțională*, Editura Universul juridic, București, 2011, pp. 38-39.

[72] See ARB, *Romanians' Financial Education Level*, *cit. supra*, note 48.

[73] For a classical presentation of the economic cycles, see H. Minsky, *Stabilizing an Unstable Economy*. McGraw-Hill Professional, New York, 1986, *passim*.

[74] For a multidisciplinary analysis of the way general Western ideas are valid in Romania as well, see V. Mihăilescu (ed.), *De ce este România astfel. Avatarurile excepționalismului românesc*, *cit. supra*, note 342, *passim*.

[75] From the few pages of the Basel I Accord, the core of the Basel III Regulation comprises hundreds of pages. The Regulation is so detailed and complex that even financial professionals have difficulties in making sense of some of its mechanisms. There are voices saying that these regulations will put too much pressure on the preventive actions of the banks shifting their focus from extending loans to people. For a set of diverse views from lawyers, see *Is Basel III Good for Banking?*, available at https://www.bankdirector.com/index.php/issues/legal/is-basel-iii-good-for-banking/ (last visited on February 17, 2018). For a scholarly critique, see A.R. Admati, *The Missed Opportunity and Challenge of Capital Regulation*, in "National Institute Economic Review", vol. 235, issue 1, pp. R4-R14.

[76] On an earlier view of the credit risk under the CRD IV package, see R. Rizoiu, *Credit risk and value of collateral – how can CRD IV be used to mitigate adverse case law*, in "Central Bank Journal of Law and Finance" no. 1/2014, pp. 115-135.

[77] An interesting distinction between debtors unable to pay and those unwilling to pay is made in the Romanian Constitutional Court Decision no. 623/2016, at § 116.

[78] See V. Stoica, *Consolidarea încrederii în SAL prin expertiză, imparțialitate și independență*, speech delivered during the conference *Soluționarea alternativă a litigiilor din domeniul financiar bancar*, Bucharest, 5 October 2017 (headlines available at https://www.csalb.ro/noutati/conferinta-solutionarea-alternativa-a-litigiilor-din-domeniul-financiar-bancar-5-10-2017/, last visited on January 9, 2018).

[79] *Id.*

[80] See I. Petrescu, *Încrederea, spiritul Crăciunului şi economia*, in „Ziarul Financiar" of 29 December 2013 (available at http://www.zf.ro/opinii/increderea-spiritul-craciunului-si-economia-11831010, last visited on January 9, 2018).

[81] It was reported that 94% of the Romanian population did not understand the term "scoring". See the ARB poll of July 2011, *cit. supra*, note 47.

[82] Some banks have even outsourced this service in order to cope with any subjective alterations made by the bankers.

[83] The reader could be familiar with the various warnings the computer software uses when the user tries to connect from another device or tries to access an uncertified network. It is the human who is asked to give the verdict as far as trustworthiness is concerned.

[84] This is the reason why Credit Default Swap levels are used for ascribing a trust value to a particular country.

[85] The form is attached herein as Annex 1.

[86] The sample covers 6 top banks amounting more than 50% of the market share as of 2016.

[87] As indicated in the form submitted to the respondents (see Annex 1 below), the scoring was based on a scale where 0 means 'irrelevant' and 10 means 'extremely relevant'.

[88] Note that not all banks answered each question.

[89] The scale was 0 to 10. See note 88 *supra*.

[90] In an attempt to control such rogue behaviour, the Constitutional Court considers that a client who has money and yet does not pay is acting in bad faith, as opposed to one who is unable to pay because of lack of funds. See Constitutional Court of Romania, Decision no. 623/2016, §116.

[91] See R. Rizoiu, *Totul sau nimic: despre valoarea ipotecii*, forthcoming.

[92] *Id.*

[93] Of course, separate research should look into the impact the recent EU General Data Protection Regulation (GDPR) has on processing behavioural data.

[94] See the already launched Chinese Social Credit System (A. Shankar, *What's your citizen 'trust score'? China moves to rate its 1.3 billion citizens*, available at https://www.usatoday.com/story/news/world/2017/11/10/whats-your-citizen-trust-score-china-moves-rate-its-1-3-billion-citizens/851365001/, last visited on February 18, 2018).

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Developing a Dynamic Stochastic General Equilibrium Model for Analysing Domestic Policies in a General-Equilibrium, Multi-Country Setup (RO-EAGLE)

Tudor Grosu*

Abstract

We develop a 4-region macroeconomic model of the Romanian economy and the world economy (Euro area, the U.S. and the rest-of-the-world). The model builds upon the version developed at the ECB (Euro Area and Global Economy Model, EAGLE), based on the New Area Wide Model (NAWM), and is calibrated using information from the global trade matrix and domestic variables. We investigate the sensitivity of the model by running a standard productivity shock in the tradable sector, in a perfect foresight environment. Thus, we are able to disentangle the transmission mechanism of shocks in Romania on both the domestic and foreign variables (spillover effects).

Keywords

open-economy macroeconomics, DSGE models, trade matrix, simulation, shocks

JEL Classification:

C53, E32, E52, F41, F47

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1. GENERAL MOTIVATION

Over the past years, we have seen a wealth of academic and applied literature capitalizing on the "*New Open Economy Macroeconomics*" (NOEM) framework. For a long time, there has been a wide gap between the models favoured by the academic literature and those utilized in most central banks. In particular, whereas the central bank policy models put a heavy emphasis on empirical features, the academic models stressed methodological imperatives that punctuated the optimizing-agent foundations, the use of model consistent expectations and so on. Far too often, the focus on the latter came at the expense of empirical realism.

Recently, the interest has moved towards developing optimization-based models that are more suited to fitting the data. For instance, an important work by Christiano [15] shows that models including both sticky prices and various other types of adjustment costs are quite successful in accounting for the estimated effects of a monetary policy shock. In his turn, Smets [30] has produced evidence demonstrating that the forecasting ability of an optimization-based model is comparable to that of an unconstrained Bayesian VAR. As a result, the gap between theoretical focus and empirical realism has certainly started to close fast.

Traditionally, the literature on the *open economy* framework has mostly focused on simplified "two-country" models. As a novelty, the model we present here is an extension of the NOEM strand of literature using a "multi-country" setup. Precursors of this type of models are Obstfeld ([26], [27]), Corsetti and Pesenti ([9], [10]), Corsetti and Dedola [16], Bacchetta [1], Benigno [5], Cönen [8], Kollman [23], Benigno [6] or Baxter [3].

We develop a multi-country, open economy, DSGE-type (Dynamic Stochastic General Equilibrium) model with the main purpose of investigating quantitative policy questions. Specifically, the model adapts the structure of the European Central Bank's EAGLE model (Gomes [18]) to the Romanian economy, hence the name (RO-EAGLE). The model encompasses a representation of trade, macroeconomic and financial linkages between a small open economy (Romania) and the global economy. In order to model realistic commercial and international financial linkages, the latter is split into three regions: the United States (US), the Euro area (EA) and the rest-of-the-world (ROW). The model includes a number of nominal and real frictions, building upon the empirically relevant features of closed economy models (e.g. Christiano [15], Smets [30]). In addition, given the specific setup of our model - multi-country and multi-currency - we are able to incorporate a wealth of other nominal rigidities and/or adjustment costs than in a closed economy setup.

2. MODELLING CHOICES

The model accounts for some idiosyncratic features of small open economies which are important from the perspective of the monetary policy implementation and for the realism of simulations that can be accommodated by the setup.

The **faster productivity growth in tradable versus non-tradable sectors** can contribute to domestic inflation and to inflation differentials that these countries exhibit vis-à-vis the more advanced economies (the so-called *Balassa-Samuelson* effect). Therefore, the model will account separately for the existence of both tradable and non-tradable goods.

Nominal rigidities and costly disinflation. We use the Calvo [11] mechanism augmented with backward indexation, as in Christiano [15], to generate endogenous inflation inertia in both prices and nominal wages. This device gives rise to price stickiness, which is in line with empirical evidence; at the same time, we maintain steady-state monetary superneutrality, while the price dynamics is in line with that of the Phillips curve setup. This backward indexation makes disinflation costly in terms of losses in real economic activity, hence the particular trade-off.

Exchange rate disconnect. If prices do not respond sufficiently to exchange rates then neither do quantities, and the traditional *expenditure-switching* role of exchange rates is belittled. We achieve realistic disconnect of excessive nominal exchange rate fluctuations from the real economy and prices by making specific assumptions about export and import price setting and international currency pricing. The use of an additional distribution sector in the model (which is, however, not described in this paper) can explain the segmentation of world markets even for tradable goods (which, by conventional assumption, should see their prices equalized across markets).

Real rigidities. The empirically observed hump-shaped and delayed reactions of real consumption and investment to both temporary and permanent shocks are generated by two standard mechanisms: *external habit* in consumption and the *time-to-build* constraint on capital accumulation. Both devices are, as previously shown, important in monetary-policy models.

3. STRUCTURE OF THE MODEL

The model builds upon the ECB's EAGLE model (Gomes [18]), which, in its turn, draws heavily on the *New Area Wide Model - NAWM* (see Cönen [8]). In addition to the NAWM, RO-EAGLE has the following novel dimensions: *(i)* the euro area is formalized as a monetary union. Romania is a country outside the EA, with an independent monetary

policy reacting to domestic developments as well as to potential spillovers from external developments; *(ii)* the global nature of the model, as there are three blocks of countries in addition to Romania (EA, US and the ROW). This allows the investigation of the role played by the domestic nominal exchange rate and the extra-trade in shock propagation[1]; *(iii)* the model includes both tradable and non-tradable goods. This distinction allows the investigation of the dynamics of international relative prices and trade flows.

The following scheme presents the main blocks and interactions within the model.

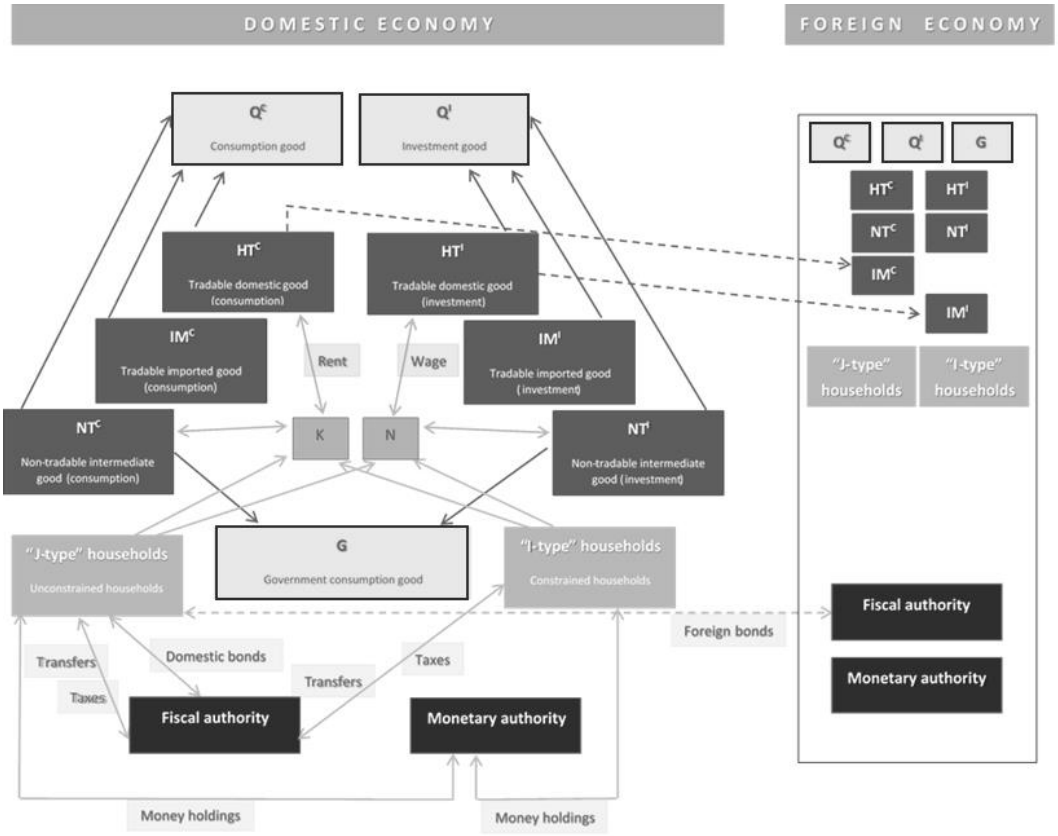

Figure 1: Main Blocks and Interactions within the Model

In each country there are two types of firms. The first ones produce *final* non-tradable goods under *perfect competition*; final goods are used for private consumption (Q^C), private investment (Q^I) and government consumption (G). The second ones act under *monopolistic competition* and produce intermediate goods used as inputs in the production of final goods; intermediate goods are either tradable (domestic, HT, or imported, IM) or non-tradable (NT), produced using domestic labour (N^D) and capital (K^D). These firms set nominal prices to maximize profits. Nominal prices are sticky, which

implies a non-trivial stabilization role for monetary policy. For tradable intermediate goods sold abroad, prices are set according to the "*local currency pricing*" assumption, i.e. the currency of the destination country; as a result, the pass-through of the nominal exchange rate into import prices is incomplete in the short run, in line with the evidence from the data.

Consistent with literature and the empirical evidence regarding the impact of the fiscal policy on the economy (see e.g. Baxter [4]), the model is populated by two types of households in each country, thus allowing for the presence of non-Ricardian effects. The *I-type* households have access to financial and money markets, accumulate physical capital (which is then rented to domestic firms) and supply labour. They domestically trade a riskless bond denominated in domestic currency and internationally a riskless bond denominated in U.S. dollars. For this type of household, an uncovered interest parity condition holds, linking the interest rate differential to the expected change in the exchange rate of the domestic currency against the worldwide core currency (U.S. dollar). The *J-type* households are liquidity constrained and have access only to the domestic money market. Their only source of income consists of wages from the supplied labour and the transfers from the fiscal authority.

Finally, in each country there are a monetary authority and a fiscal authority (in the case of the euro area there is a common monetary authority, the European Central Bank). The *monetary authority* sets the nominal interest rate (R) according to a standard Taylor rule, reacting to domestic inflation rate (Π), output growth rate (Y_{gr}) and, possibly to nominal exchange rate changes (S). The *fiscal authority* makes public expenditure for purchases of goods (fully biased towards domestic non-tradable intermediate goods, in line with empirical evidence) and for paying lump-sum transfers. These are financed by raising taxes or public debt, issued on domestic and external financial markets. Taxes are either lump-sum or distortionary (the latter are charged on labour income, capital income and consumption). A fiscal rule guarantees the stability of public debt in the medium term. In the case of the monetary union, the monetary and nominal exchange rate policies are shared at union level. However, fiscal policies are region-specific.

As a *multi-country* model, it can account for different degree of openness (asymmetric *home-bias* in demand) and country size (see Section 4.4). We will infer the model's parameters via calibration, based on empirical features present in the data or the consensus values borrowed from literature. The strategy of estimating the model is not feasible due to the high dimensionality problem.

4. THE MODEL

4.1. The Domestic Macroeconomy in Partial Equilibrium

4.1.1. Firms

Final goods production. There is a continuum of symmetric *home* firms producing *home* final non-tradable goods, acting under *perfect competition* and using three types of intermediate goods: domestic (HT), imported tradable goods (IM) and non-tradable goods (NT). The final goods are allocated for private consumption (Q^C) and investment (Q^I). For instance, in the production of the consumption goods, firms are indexed by x ($x \in [0, s^H]$), where s^H is the size of the *home* country and $\sum s^H=1$ (world size). The production is based on a nested constant elasticity of substitution (CES) technology:

$$Q_t^C(x) = \left\{ \left((1-\nu_C)^{\frac{1}{\mu_C}} NT_t^C(x)^{\frac{\mu_C-1}{\mu_C}} + \nu_C^{\frac{1}{\mu_C}} \left[(1-\nu_{TC})^{\frac{1}{\mu_{TC}}} IM_t^C(x)^{\frac{\mu_{TC}-1}{\mu_{TC}}} + \right.\right.\right.$$
$$\left.\left.\left. + \nu_{TC}^{\frac{1}{\mu_{TC}}} HT_t^C(x)^{\frac{\mu_{TC}-1}{\mu_{TC}}} \right]^{\frac{\mu_{TC}}{\mu_{TC}-1}} \right)^{\frac{\mu_C-1}{\mu_C}} \right\}^{\frac{\mu_C}{\mu_C-1}} \tag{1}$$

μ_C and ν_C stand for the long-run intratemporal elasticity of substitution between intermediate tradable and non-tradable goods and, respectively, the weight of the intermediate tradable good in the production of the final consumption good. μ_{TC} and ν_{TC} are the long-run intratemporal elasticity of substitution between the bundles of domestic and foreign tradable intermediate goods and, respectively, the weight of domestic tradable intermediate goods. The parameter ν_{TC} is directly related to the degree of *home bias* in preferences and is thus an index of openness of the domestic economy.

The production function of the investment sector is isomorphic to that in the consumption sector. In calibrating the model, we allow for (possibly) different import intensities and elasticities of substitution ($\nu_I \neq \nu_C$, $\mu_I \neq \mu_C$, $\nu_{TI} \neq \nu_{TC}$, $\mu_{TI} \neq \mu_{TC}$).

Acting in perfect competition, final goods' firms take the prices of their inputs (intermediate goods) as given and optimally choose the quantities demanded, such as to minimize the money value of their expenditures. The optimal relative demand for tradable vs. non-tradable intermediate goods can be expressed as depending on their relative prices:

$$\frac{NT_t^C(x)}{HT_t^C(x)} = \frac{1-\nu_C}{\nu_C} \left(\frac{P_{NT,t}}{P_{TT^C,t}} \right)^{-\mu_C} \tag{2}$$

According to standard results, the cost-minimizing prices are of the following form:

$$P_{C,t} = \left[\nu_C P_{TT_t^C}^{1-\mu_C} + (1-\nu_C) P_{NT_t^C}^{1-\mu_C}\right]^{\frac{1}{1-\mu_C}} \tag{3}$$

Similar results hold for the producers of investment goods.

Demand for intermediate goods. Intermediate inputs (tradable and non-tradable) are produced in different varieties by firms acting under *monopolistic competition*. For instance, the basket NT_t^C is a CES index of domestic varieties produced by various firms (with θ_N being the elasticity of substitution among varieties of intermediate non-tradable goods). As usual, the demand for intermediate varieties of goods comes from so-called 'intermediate aggregators' which act on *competitive markets*.

The final producers take the prices of the intermediate goods as given and minimize production costs, given the production technology, determining in effect the demand for such varieties of goods. For instance, the demand for varieties of intermediate goods by the final producers is of the form:

$$NT_t^C(x,n) = \frac{1}{s^H}\left(\frac{P_t(n)}{P_{NT_t}}\right)^{-\theta_N} NT_t^C(x) \tag{4}$$

Supply of intermediate goods. Intermediate goods (producers indexed by h for tradable goods and by n for non-tradable goods) are obtained by a continuum of *monopolistically competitive* firms. Each of these firms produces differentiated varieties of goods using Cobb-Douglas technology, subject to fixed costs of production:

$$\begin{aligned} F\left(z_{N,t}, K_t^D(n), N_t^D(n)\right) &= z_{N,t} K_t^D(n)^{\alpha_N} N_t^D(n)^{1-\alpha_N} \\ F\left(z_{T,t}, K_t^D(h), N_t^D(h)\right) &= z_{T,t} K_t^D(h)^{\alpha_T} N_t^D(h)^{1-\alpha_T} \end{aligned} \tag{5}$$

The intermediate producers use capital services $\left(K_t^D(h), K_t^D(n)\right)$ - paying rents to households in fully *competitive* markets - and differentiated labour services $\left(N_t^D(h), N_t^D(n)\right)$ that are supplied in *monopolistically competitive* markets[2]. $z_{N,t}$ and $z_{T,t}$ are transitory, sector-specific technology shocks that affect the total factor productivity[3]. We assume there are no factor-specific productivity shocks affecting labour or capital. The sector-specific fixed costs of production are calibrated such that, in steady-state, they

guarantee the '*zero profits*' condition. The production functions are homogenous of degree one, concave and strictly increasing in the arguments.

Inputs and marginal costs. Given the rental rate of capital ($R_{K,t}$) and the aggregate wage index (W_t), the intermediate-good firms minimize the total costs subject to the production function. The optimal conditions of the firm's cost minimization problem with respect to capital and labour can be nested as follows (τ_t^W are firms' contribution to social security, identical across firms):

$$\frac{R_t^K}{W_t} = \frac{\alpha_T}{1-\alpha_T}\left(1+\tau_t^W\right)\frac{N_t^D(h)}{K_t^D(h)} \tag{6}$$

Since by definition all firms face the same input prices and have access to the same production technology, nominal marginal costs are identical across firms ($MC_{T,t}(h) = MC_{T,t}, MC_{N,t}(n) = MC_{N,t}$), with, e.g.:

$$MC_{T,t} = \frac{1}{z_{T,t}\left(\alpha_T\right)^{\alpha_T}\left(1-\alpha_T\right)^{1-\alpha_T}}\left(R_t^K\right)^{\alpha_T}\left(\left(1+\tau_t^W\right)W_t\right)^{1-\alpha_T} \tag{7}$$

Labour-market setup. In each country, labour inputs come in different 'skills' or varieties. Firms in the intermediate sector use CES bundles comprising the labour provided by two types of households:

$$N_t^D(h) = \left[(1-\omega)^{\frac{1}{\eta}} N_{I,t}^D(h)^{\frac{\eta-1}{\eta}} + \omega^{\frac{1}{\eta}} N_{J,t}^D(h)^{\frac{\eta-1}{\eta}}\right]^{\frac{\eta}{\eta-1}} \tag{8}$$

where ω is the share of *J-type* households and $(1-\omega)$ is the share of *I-type* households. Each household supplies as many labour services as needed in order to accommodate the labour demand. The optimal demand for labour services of the firm producing the intermediate tradable good is:

$$N_t^D(h,i) = \frac{1}{s^H}\left(\frac{W_t(i)}{W_{I,t}}\right)^{-\eta_I}\left(\frac{W_{I,t}}{W_t}\right)^{-\eta} N_t^D(h) \tag{9}$$

Each household sets its wage to maximize utility. The elasticity of substitution between labour varieties determines the related market power. If we assume that prices are fully flexible, the optimal wage rate is given by a *markup* rule of the real after-tax wage charged

over the households' marginal rate of substitution between consumption and leisure, thus reflecting the existence of monopoly power on the part of households:

$$\left(1-\tau_{tk}^{N}-\tau_{tk}^{W_h}\right)\frac{\widetilde{W}_{I,t}}{P_{C,t}}=\frac{\eta_I}{\eta_I-1}\left[\frac{N_t}{\Lambda_t}\right] \tag{10}$$

where: $\widetilde{W}_{I,t}/P_{C,t}$ is the real wage (expressed in units of domestic consumption), Λ_t is the marginal utility of consumption and the markup (η_I/η_I-1) depends negatively on the elasticity of substitution between labour varieties, η_I. So, the higher the degree of substitutability, the lower the implied markup and the higher the employment in terms of hours, for a given wage. As such, the markup reflects the imperfect competition in the labour market[4].

Price setting in the intermediate goods sector. The key element is the presence of nominal rigidities. They are modelled in terms of sluggish price adjustment via staggered Calvo-type price contracts. Each firm takes the demand for its product as given and sets the nominal price to maximize the present discounted value of profits. However, not all firms get the optimization signal each period. The firms that get the signal choose the same (optimal) price. The firms that do not receive the signal adjust their prices according to a geometric average of past (gross) inflation and the target (gross) inflation set by the monetary authority. Firms maximize the sum of the expected nominal profits, where the discount factor is the I-type household's pricing kernel ($\beta E_t\,[\Lambda_{I,t,t+k}]$, with $\Lambda_{I,t,t}=1$). The following illustration uses the firms producing the intermediate non-tradable goods

$$max\left(E_t\left[\sum_{k=0}^{\infty}(\xi_N)^k\,\Lambda_{I,t,t+k}\left(P_{t+k}(n)NT_{t+k}(n)-MC_{N,t+k}\left(NT_{t+k}(n)+\psi_N\right)\right)\right]\right) \tag{11}$$

subject to the demand for their products and, respectively, the indexation scheme of non-optimizing agents.

The first order condition is:

$$\frac{\widetilde{P}_{NT,t}}{P_{NT,t}}=\frac{\theta_N}{\theta_N-1}\frac{\sum_{k=0}^{\infty}(\beta\xi_N)^k\,\Lambda_{I,t,t+k}\left[\prod_{s=1}^{k}\left(\Pi_{NT,t-1}^{\chi_N}\overline{\Pi}^{1-\chi_N}\right)\right]^{-\theta_N}MC_{N,t+k}NT_{t+k}(n)\left(\Pi_{NT,t+k}\right)^{1+\theta_N}}{\sum_{k=0}^{\infty}(\beta\xi_N)^k\,\Lambda_{I,t,t+k}\left[\prod_{s=1}^{k}\left(\Pi_{NT,t-1}^{\chi_N}\overline{\Pi}^{1-\chi_N}\right)\right]^{1-\theta_N}NT_{t+k}(n)\left(\Pi_{NT,t+k}\right)^{1+\theta_N}} \tag{12}$$

If prices are fully flexible (i.e. $\xi_N=0$), the optimal price is set by the intermediate firm as a *markup* over the nominal marginal cost:

$$\frac{\tilde{P}_{NT,t}}{P_{NT,t}} = \frac{\theta_N}{\theta_N - 1}\frac{MC_{N,t}}{P_{NT,t}} \tag{13}$$

where: $\tilde{P}_{NT,t}/P_{NT,t}$ is the relative price of the non-tradable intermediate good and $MC_{N,t}/P_{NT,t}$ is the real marginal cost of producing the intermediate good. As in the case of the labour market, the markup $(\theta_N/\theta_N - 1)$ depends negatively on the elasticity of substitution between different products, θ_N. So, the higher the degree of substitutability, the lower the implied markup and the higher the production level, for a given price.

Provided θ_N is large enough ($\theta_N \rightarrow \infty$), that is, in a perfect competition regime, the optimal price moves in tandem with the shocks affecting marginal costs, $P_{N,t} = MC_{N,t}$; if, on the other hand, $\theta_N = 1$ (monopolistic competition), firms are able to charge a markup over the marginal cost. That is, when marginal costs change due to cyclical conditions (e.g. they increase), firms find it optimal to keep the prices relatively stable and absorb the changes via the markup. In other words, when θ_N is small, firms are able to keep their prices well above marginal costs and accommodate changes in demand through supply adjustments, without corresponding changes in prices. Therefore, the markup reflects imperfect competition[5].

For achieving the incomplete exchange rate pass-through, in line with empirical evidence, the producers of intermediate tradable goods will adopt different optimal pricing decisions for goods sold in the foreign markets and, respectively, for those sold in the domestic market (see Section 4.2).

4.1.2. Consumer Preferences

In each country, there is a continuum of households. The I-type households ('Ricardian' or 'forward-looking') have access to financial markets, where they buy and sell domestic and internationally traded government bonds, accumulate physical capital, rent its labour services to firms and hold money for transaction purposes. These agents maximize the utility subject to an *intertemporal* budget constraint (hence, their 'forward-looking' dimension). The J-type households ('non-Ricardian' or 'liquidity-constrained') cannot trade in financial or physical assets but can smooth consumption by intertemporally adjusting their money holdings.

We show the typical budget constraint of the *I-type* households, whereas that of the *J-type* agents is only a particular case. In general, for each household, the combined expenditure on goods and the net accumulation of financial assets must equal their disposable income:

$$
\begin{aligned}
&\left(1+\tau^{C}+\Gamma_{v}\left(\nu_{t}(i)\right)\right) P_{C,t} C_{t}(i)+P_{I,t} I_{t}(i)+R_{t}^{-1} B_{t+1}(i)+ \\
&+\left(\left(1-\Gamma_{B^{US}}\left(\frac{S_{t}^{H,US} B_{t+1}^{US}}{P_{Y,t} Y_{t}} ; rp_{t}\right)\right) R_{t}^{US}\right)^{-1} S_{t}^{H,US} B_{t+1}^{US}(i)+M_{t}(i)+\phi_{t}(i)+\Xi_{t}= \\
&=\left(1-\tau_{t}^{N}-\tau_{t}^{W_{h}}\right) W_{t}(i) N_{t}(i)+\left(1-\tau_{t}^{K}\right)\left(R_{K,t} u_{t}(i)-\Gamma_{u}(u_{t}(i)) P_{I,t}\right) K_{t}(i)+ \\
&+\tau_{t}^{K} \delta P_{I,t} K_{t}(i)+\left(1-\tau_{Dt}\right) D_{t}(i)+T R_{t}(i)-T_{t}(i)+B_{t}(i)+S_{t}^{H,US} B_{t}^{US}+M_{t-1}(i)
\end{aligned}
\tag{14}
$$

where:

R_t and R_t^{US} are the riskless (gross) returns on domestic government bonds and internationally traded bonds (denominated in U.S. dollars); S_t is the exchange rate of the *home* country.

The short-term nominal rates are directly controlled by the monetary authorities. We introduce a financial friction (Γ_{BUS}), which is the cost of domestic households undertaking positions in the international asset market; this device guarantees that the net asset position follows a stationary process and the economies converge asymptotically to a steady-state (Benigno [7]).

Households provide labour services, $N_t(i)$, in monopolistically competitive markets, at a wage rate $W_t(i)$, and rent capital services, $u_t(i)K_t(i)$, at the rental rate $R_{K,t}$, to domestic intermediate firms. $u_t(i)K_t(i)$ are effective capital services, depending on the rate of utilization of capital ($u_t(i)$). Varying the intensity of physical capital utilization, $u_t(i)$ is subject to a proportional cost, $\Gamma_u(u_t(i))$, defined as in Christiano [15].

Gross investment before depreciation is denoted by I_t. We use the usual law of motion of capital and assume that capital accumulation is subject to *investment adjustment costs*.

Finally, the purchase of the consumption goods is subject to a proportional transaction cost, $\Gamma_v(v_t(i))$, which depends on the inverse of the household money to consumption ratio. Agents optimally choose the stock of real money holdings, $M_t(i)$, such that, at the margin, shopping costs measured in terms of foregone consumption be equal to the benefits from investing in yield-bearing assets.

The term $D_t(i)$ represents dividends paid to the *I-type* households, the owners of the firms. These are assumed to be taxed at the household level (τ_{Dt}). The fiscal authority levies taxes on the household's gross income and spending: distortionary consumption tax rate on consumption purchases and distortionary tax rates on wage income, rental capital income and dividends from firms' ownership. The model includes an additional (distortionary) pay-roll tax rate, i.e. households' contribution to social security. The

variable $TR_t(i)$ represents lump-sum transfers received from the government and $T_t(i)$ lump-sum taxes.

Households gain utility from consumption, $C_t(i)$, and disutility from working, $N_t(i)$. As in Smets [30], we allow for the possibility of external habits, where each household member cares about its consumption relative to lagged average consumption level of households of type I, $C_{I,t-1}$. Households' preferences are additively separable in consumption and labour effort:

$$E_t\left[\sum_{k=0}^{\infty}\left(\frac{1-\kappa}{1-\sigma}\left(\frac{C_{t+k}(i)-\kappa C_{I,t+k-1}}{1-\kappa}\right)^{1-\sigma}-\frac{1}{1+\zeta}N_{t+k}(i)^{1+\zeta}\right)\right] \tag{15}$$

where: $0<\beta<1$ is the discount factor, $\sigma>0$ is the inverse of the intertemporal elasticity of substitution and $\zeta>0$ is the inverse of the elasticity of work effort with respect to the real wage. The parameter $0\leq\kappa\leq1$ measures the degree of external habit formation in consumption.

Each household maximizes its lifetime utility by choosing the consumption and investment goods, $C_t(i)$ and $I_t(i)$ respectively, the level of the physical capital stock, $K_{t+1}(i)$ and its utilization rate, $u_t(i)$, holdings of domestic government bonds and internationally traded bonds and holdings of money, $M_t(i)$. Moreover, households act as wage setters for their differentiated labour services $N_t(i)$ in monopolistically competitive markets. There is a sluggish wage adjustment due to staggered, Calvo-type, nominal wage contracts.

4.2. The domestic Macroeconomy in General-equilibrium

In the multi-country general-equilibrium setup, we allow for the international dimension of each economy. H is the *home* country and CO is one of the (remaining) *foreign* countries (EA, US or ROW). Imports of the representative firm x, $IM_t^C(x)$ are a CES function of baskets of imported tradable intermediate goods (illustrated here for the consumption good):

$$IM_t^C(x)=\left[\sum_{CO\neq H}\left(\nu_{IM^C}^{H,CO}\right)^{\frac{1}{\mu_{IMC}}}\left(IM_t^{C,CO}(x)\left(1-\Gamma_{IM^C}^{H,CO}\left(\frac{IM_t^{C,CO}(x)}{Q_t^C(x)}\right)\right)\right)^{\frac{\mu_{IMC}-1}{\mu_{IMC}}}\right]^{\frac{\mu_{IMC}}{\mu_{IMC}-1}} \tag{16}$$

where: $\mu_{IMC}>0$ are country H's elasticity of substitution across exporters, $IM_t^{C,CO}(x)$ are imports of firms in country H from firms in country CO, the sum ($\sum_{CO\neq H}$) refers to the foreign partners and the coefficients $v_{IM^C}^{H,CO}$ determine the composition of the import basket across countries:

$$0 \leq \nu_{IM^C}^{H,CO} \leq 1, \sum_{CO \neq H} \nu_{IM^C}^{H,CO} = 1$$

The import adjustment costs ($\Gamma_{IM^C}^{H,CO}$) are firm-specific: in line with empirical evidence regarding the *J-curve*-type effects, it is costly to change the share of the imported goods in total production. As a result, the import share in consumption is relatively unresponsive in the short-run to changes in the relative price of imported goods, while the level of imports can jump in response to changes in overall consumption demand without incurring any costs.

For final goods producers, the optimal condition is:

$$IM_t^C(x) = (1 - \nu_{TC})\nu_C \left(\frac{P_{IM^C,t}}{P_{TT^C,t}}\right)^{-\mu_{TC}} \left(\frac{P_{TT^C,t}}{P_{C,t}}\right)^{-\mu_C} Q_t^C(x) \tag{17}$$

The marginal cost of importing an additional unit of the tradable good from *foreign* economies, $P_{IMc,t}(x)$, is identically equal to the Lagrangian multiplier of the optimization problem:

$$P_{IM^C,t}(x) = \left(\sum_{CO} \nu_{IM^C}^{H,CO} \left(\frac{P_{IM,t}^{H,CO}(x)}{1 - \Gamma_{IM^C}^{H,CO} - \left(\Gamma_{IM^C}^{H,CO}\right)' IM_t^C(x)}\right)^{1-\mu_{IMC}}\right)^{\frac{1}{1-\mu_{IMC}}} \tag{18}$$

Price setting in the tradable goods sector - export markets. A central idea in the Keynesian approach to international macroeconomics is the *expenditure-switching effect* of a nominal exchange rate change. For instance, a country with a depreciated currency will see a fall in the relative price of its exports and, thus, an increase in world demand for its products. In reality, though, national markets for manufacturing goods appear to be more segmented and less susceptible to international arbitrage than the simplest assumptions of international macromodels, which implies that most of the time the *law of one price* does not hold (see, e.g., Rogoff [29]).

Therefore, in order to reconcile the model with the data, we use the *local currency pricing* hypothesis (Devereux [14] and Obstfeld [26]). This implies that exporters' prices are set in the buyer's currency and are sticky. Literature shows the potential of this approach to replicate striking international business cycle regularities, such as the high variability of real and nominal exchange rates and the comovements in international consumption levels.

The mechanism of setting prices is also based on the *Calvo*-type algorithm, with firms discriminating across countries, by invoicing and setting the price of their brand in the currency of the destination market. The maximum profits condition is denominated in a single currency (in Equation (19), everything is expressed in domestic currency):

$$E_t\left[\sum_{k=0}^{\infty}\Lambda_{I,t,t+k}\left[\sum_{CO}(\xi_X)^k\left(S_{t+k}^{H,CO}P_{X,t+k}^{CO}(h)IM_{t+k}^{CO}(h)-\right.\right.\right.$$
$$\left.\left.\left.-MC_{T,t+k}\left(IM_{t+k}^{CO}(h)+\psi_T\right)\right)\right]\right] \tag{19}$$

The optimal condition is similar to that in the Equation (12).

4.3. Monetary and Fiscal Authorities

Monetary authorities. For Romania, the US and ROW, we use symmetric Taylor-type interest rate rules, specified in terms of annual CPI inflation and quarterly output growth.

$$\begin{aligned}\left(R_t^{CO}\right)^4 = {} & \phi_R^{CO}\left(R_{t-1}^{CO}\right)^4 + \\ & +\left(1-\phi_R^{CO}\right)\left[\left(R^{CO}\right)^4+\phi_\pi^{CO}\left(\Pi_{C,t}^{CO,4}-\overline{\Pi}^{CO,4}\right)\right]+ \\ & +\phi_{\Delta Y}^{CO}\left(\Delta Y_t^{CO}-1\right)+\epsilon_{R,t}^{CO}\end{aligned} \tag{20}$$

For the EA, a similar equation holds for the single monetary authority (the European Central Bank) that targets a weighted average (according to the size of the economies) of annual CPI inflation and real quarterly output growth.

Fiscal authorities. In each country, the fiscal authority purchases G_t, a final good which is completely biased towards non-tradable intermediate goods. The fiscal authority makes transfer payments to both types of households, but in different proportions (TR_t), issues bonds to refinance its debt (B_t), earns seigniorage on outstanding money holdings (M_{t-1}) and levies taxes.

Both transfers provided by the fiscal authority and purchases of final public consumption goods, specified as fractions of steady-state nominal GDP, are assumed to be exogenous and follow AR(1) processes. Finally, lump-sum taxes, as a fraction of steady-state nominal output, are adjusted to make public debt stable according to the following rule:

$$\tau_t = \phi_{B_Y}\left(\frac{B_t}{\overline{P_Y Y}}-\overline{BY}\right) \tag{21}$$

where $\overline{BY}$ is the fiscal authority's target for the ratio of government debt to output and $\varphi_{BY}>0$ is a parameter. All distortionary tax rates are assumed to be exogenously set by the fiscal authority and constant.

4.4. Solution Techniques and Calibration of the Model

Solving rational expectations models involving large sets of equations, variables and parameters, as well as significant non-linearities, is not trivial. To that purpose, we use specific techniques to obtain the *steady-state* solution of the non-linear model[6]. In particular, we start from a numerical steady-state solution that guarantees an 'easy' solution. Next, after having an initial set of values for the endogenous variables, we gradually adjust the parameters and exogenous variables towards their desired values.

For our model, given the isomorphic theoretical structure across countries, some parameters capture the same concepts for all entities, which allows the shrinkage in the number of calibrated parameters. The strategy is to set different values only for those parameters that can be linked to specific data and features of the economies (e.g. based on *input-output* tables, balance of payments data, great ratios etc.). For the other parameters, we assume similar values across economies and we primarily resort to consensus values borrowed from literature. The calibrated parameters are listed in Tables (1) to (8) in the *Annex* and were chosen at a quarterly frequency.

The relative dimension of the economies varies from very small (Romania has a share of only 0.3% in the world GDP) to moderate (the Euro area and the U.S. hold, respectively, 21% and 27%, respectively in the world GDP) and large (the rest-of-the-world, a residual composite, accounts for 52% of the world GDP)[7].

Regarding the *utility function*, we set the discount factor β = 0.9926 for all countries, which implies an annual real interest rate of r = 3.0%. The coefficient of constant relative risk aversion, σ, is set to 1, following Gomes [18]. The inverse of the intertemporal elasticity of substitution in leisure, ζ, is set to 2, in line with Cristadoro [13] and Cönen [8]. The habit formation coefficients are estimated by Rabanal [28] to be approximately the same in both the euro area and the U.S. and are calibrated at κ = 0.7. In line with literature, the depreciation rate, δ, is set to 10% annually. The share of non-constrained households (I-type) is 25%.

In the *intermediate-good sector*, we assume a similar bias towards capital across countries: $\alpha_{RO} = \alpha_{EA} = \alpha_{US} = \alpha_{ROW} = 0.3$. The elasticity of substitution between I-type and J-type labour types is set at $\eta_{RO} = \eta_{EA} = 4.33$, as in Cristadoro [13], which implies wage

markups of around 1.3 and at $\eta_{US} = \eta_{ROW} = 7.3$, as in Gomes [18], which implies wage markups of 1.16.

In the *final-good sector*, the elasticity of substitution between domestic and imported tradable goods is set, in the production of both the consumption and the investment good, at $\mu_{TI} = 2.5$ for all countries (Gomes [18]), only slightly higher than in Benigno [7]. The elasticities of substitution between the tradable and non-tradable goods are calibrated at: $\mu^{RO}{}_C = \mu^{EA}{}_C = \mu^{US}{}_C = \mu^{ROW}{}_C = 0.5$ and at similar values for the investment good sector. However, in literature, the range of plausible options for these elasticities of substitution is rather large[8]. We assume there is less substitution between tradable and non-tradable goods (for both consumption and investment) than there is between intermediate exportables and importables (i.e. $\mu_{TC} > \mu_C$ and $\mu_{TI} > \mu_I$).

The *home-bias* in the production of consumption goods is calibrated based on the trade flows among these economies: $\nu_{TC}{}^{RO} = 0.36$, $\nu_{TC}{}^{EA} = 0.33$, $\nu_{TC}{}^{US} = 0.74$ and $\nu_{TC}{}^{ROW} = 0.46$. With the exception of the U.S. and, at the margin, of the ROW, the trade matrix[9] cannot confirm the fact that there is a *home-bias* in favour of the domestic tradable goods. For the investment good, the model generates a very low weight of domestic tradable intermediate goods, $\nu_{TI}{}^{RO} = 0.011$, whereas for the other economies, the values are: $\nu_{TC}{}^{EA} = 0.32$, $\nu_{TC}{}^{US} = 0.67$ and $\nu_{TI}{}^{ROW} = 0.37$. In order to satisfy the constraints of the international trade matrix, the calibrated values of the bias towards tradable goods (vs. non-tradable goods) are asymmetric across countries and sectors: $\nu_C{}^{RO} = 0.65$, $\nu_I{}^{RO} = 0.84$, whereas $\nu_C{}^{EA} = \nu_C{}^{US} = \nu_C{}^{ROW} = 0.35$ and $\nu_I{}^{EA} = \nu_I{}^{US} = \nu_I{}^{ROW} = 0.75$.

The bond holding cost (Benigno [5]) is relatively small (Γ_{BUS} =10 basis points spread per annum of the domestic interest rate on foreign assets over the foreign rate) and the steady-state ratio of net foreign assets to GDP is 0.

For the product market, we calibrate the elasticities of substitution as follows: for tradable goods, θ_T is set equal for all countries at 6, whereas for the non-tradable goods, we follow Gomes [18], $\theta_N^{RO} = \theta_N^{EA} = 3$, which implies a markup of 1.5 and $\theta_N^{US} = \theta_N^{ROW} = 4.6$, which implies a markup of 1.28[10].

The cost of adjusting investments, Γ_I, is usually calibrated such that the standard deviation of investments is a multiple of the standard deviation of GDP. Following Gomes [18], we use a value of $\Gamma_I = 6$ for all countries. We set adjustment costs on consumption and investment imports to $\Gamma_{IMC} = 2$ and $\Gamma_{IMI} = 1$, respectively. We determine the value of the transaction cost parameters ($\gamma_{v,1}$ and $\gamma_{v,2}$) as free parameters, starting from the steady-state values of the inverse of the money multiplier ($v_t(i)$,$v_t(j)$) and the semi-elasticity of the money demand with respect to the interest rate ($\partial M_t/\partial R_t$), respectively. The final

values are close to those in Schmitt-Grohé [19][11], indicating that money demand plays a limited role in the model.

On the *fiscal* side, we use the information from *Eurostat* and *OECD* to determine the implicit tax rates. For Romania, we have the following values: the implicit tax rate on labour (τ^N = 0.302), the employers' social security contribution[12] (τ^{W_f} = 0.162), the employees' social security contribution (τ^{W_h} = 0.083), the implicit tax rate on capital (τ^K = 0.57) and consumption (τ^C = 0.177). We note that the implausible implicit tax rate on capital in Romania, well in excess of 35%, is endogenously derived by the model assuming a ratio of investments to GDP equal to 20%. In the absence of reliable data, the tax rate on dividend income, τ_D, is set to zero, an assumption that does not, however, materially influence the results of the simulations.

On the nominal side, the value of the *Calvo* parameters constraining the price-setting decisions of domestic firms that are selling in the home markets, ξ_H, is set at a rather high value for the EA (ξ_H^{EA} = ξ_N^{EA} = 0.92), in line with Cönen [8], whereas for Romania, the U.S. and ROW, we adopt a more conservative hypothesis: ξ_H = ξ_N = 0.75, which implies an average four-quarter duration of price contracts. For the foreign pricing of domestic firms, we use ξ_X = 0.75 for all countries. For wage contracts, we assume the four-quarter duration, symmetrically across the countries[13]. The indexation parameters on price and wages are equal to χ_N = χ_H = χ_X = 0.5 and, respectively, χ_I = χ_J = 0.75 in all regions.

The coefficients in the monetary policy function are standard: for Romania, the persistence coefficient is set at $\varphi_R^{RO} = 0.8$, the response to inflation at $\varphi_\pi^{RO} = 1.5$ and the sensitivity to the changes in output at $\varphi_{\Delta Y}^{RO} = 0.2$. For all other countries, the calibrated response to inflation is slighty higher (φ_π = 1.7), whereas that to output is slightly lower ($\varphi_{\Delta Y}$ = 0.1), while the persistence of the instrument is identical (φ_R = 0.87). In all countries, the inflation target is set at an annual value of Π = 2%, whereas due to factors specific to catching-up economies (e.g. the Balassa-Samuelson effect), this is set to Π = 2.5% for Romania. For fiscal rules, lump-sum taxes stabilize public debt.

4.5. The Use of the Trade Matrix for Calibration

We have used disaggregated bilateral trade data from the United Nations *Commodity Trade Statistics Database* (*Comtrade*) and, respectively, from OECD *STructural ANalysis database* (*STAN*). The *UN Comtrade* contains detailed statistics for imports and exports of *goods* reported by statistical authorities of around 200 countries or areas, thus being one of the most comprehensive trade database available, covering data starting from 1962. The *STAN* database provides statistics on international trade by service category and partner country for 34 OECD countries plus the European Union (*EU27*),

the euro area (*EA17*), the Russian Federation, Hong Kong and China. These data refer to international trade in services between residents and non-residents. Although the *STAN* database also records the *trade* in goods among countries, we have decided to use the *Comtrade* after using several control keys which indicated the latter as more accurate[14].

For trade in goods, we have used the *Broad Economic Classification* (*BEC*) methodology. In essence, the categories of *BEC* are a rearrangement and aggregation of the basic headings of the *Standard International Trade Classification* (*SITC*), reflecting the *end-uses* of the commodities covered by each basic heading. The trade flows are divided into nine categories of goods, including the three main *end-uses* capital goods, intermediate inputs and consumption, and broken down by economic activities[15].

However, regarding the *Comtrade* database , a few caveats are in order:

1. The detailed values of commodities do not necessarily sum up to the total trade value, which may be related to issues of confidentiality on behalf of the individual reporting countries; given that we use disaggregated data, we have to assign these residuals to specific categories;
2. The trade of a country group could be understated due to unavailability of some country data; countries (or areas) do not necessarily report their trade statistics for each year. This means that aggregations of data into groups of countries may involve countries with no reported data for a specific year;
3. Imports reported by one country do not coincide with exports reported by its trading partner. Differences are due to various factors including valuation (imports CIF, exports FOB), differences in inclusions/exclusions of particular commodities, timing etc.;
4. Data are made available in several commodity classifications, but not all countries necessarily report in the most recent commodity classification.

The analytical *BEC* items are grouped to end-use categories as follows:

1. *Intermediate*: food and beverages (111, 121), industrial supplies (21, 22), fuels and lubricants (31, 322), parts and components of capital goods (42), parts and components of transport equipment (53);
2. *Consumption*: food and beverages (112, 122), non-industrial transport equipment (522), non-durable consumer goods (63), semi-durable consumer goods (62), durable consumer goods for households (61);
3. *Capital*: capital goods (41), industrial transport equipment (521).

The model is built on the assumption of no imports in the intermediate good sectors, which implies that other intermediate inputs need to be consolidated with other aggregates (in our case, consumption and investment). As a result, imported intermediate inputs were reallocated to final imported consumption or final investment goods using specific assigning keys. Inevitable, this process, being based on approximations and expert judgments, is susceptible to some errors. In particular, we have distributed the intermediate goods according to the historical relative share of imports of consumption to capital goods of each country from all other trading partners. The additivity residual inherent in the aggregation of analytical categories to group totals and the import of services (*OECD STAN* database) have been split to consumption and investment using the 'equal share' rule-of-thumb.

Tables 6 and 7 present the full trade matrices. In the model, the trade links across countries are formalized at the level of imports, so we only use the *import flows* for calibration, given the implicit equality assumed in the model between the flow of imports and that of exports of trading partners.

We let the model search the values of v_{TI} and v_{TC}, based on data taken from Table 6 for the ratios IM^C/GDP and IM^I/GDP; similarly, we let the model search the values of $v_{IM^C}^{H,CO}$ and $v_{IM^I}^{H,CO}$, based on data regarding the ratios ratio $IM^{C,H/CO}/GDP^H$ and $IM^{I,H/CO}/GDP^H$. The 'fitted' values of these parameters are presented in Table 5.

4.6. Sensitivity of the Model to Shocks

In the interest of saving the space, we will assess the short-run response of the model to a standard shock, i.e. a technology shock, using perfect foresight simulations (Figures 1 to 3).

In particular, we assume a transitory, one standard deviation positive shock, with a high persistence (AR coefficient of 0.9), in the intermediate goods sector of the economy. The shock temporarily expands the production frontier of the economy[16]. In our complete markets setup, following the shock, the prices of the intermediate goods decline, following the reduction in marginal costs and taking into account the markup pricing. However, the decline in prices is only gradual, given their assumed stickiness. As a result, firms in the intermediate sector face an excess output. The less than complete reduction in the prices of tradable goods leads to a lack of aggregate demand for intermediate goods, which implies a reduction by these firms of their demand for labour (of both I and *J-type* households) and capital. The outcome is a decrease in wages and the rental rate of capital. But the fall in employment is temporary. Over time, the gradual reduction in the price of

tradables stimulates their demand which leads to an increase in employment towards the original (*steady-state*) level, with even a slight overshooting.

However, because of the economy-wide reduction in prices, real wages increase, which gradually triggers an increase in the consumption of *I-type* households, which follows the traditional hump-shaped path as a result of the habit persistence in preferences. In the case of *J-type* households, the consumption falls in the aftermath of the shock, mainly reflecting the fall in nominal wages which, in the case of *I*-type households, are compensated by the increase in dividends received from firms.

Given the reduction in the cost of capital and the increase in the production of intermediate goods, investment will also increase[17]. The fall in wages and the cost of capital, coupled with the perfect mobility of labour and capital across sectors, leads to a reduction in the marginal cost of production in the non-tradable sector.

As domestic prices go down, the real exchange rate depreciates, which implies an increase in domestic competitiveness: an expenditure-switching effect, away from foreign intermediate goods and towards domestic intermediate goods (exports increase and imports decrease). However, what we see is a deterioration of the trade balance following the shock, given that consumption and investment increase more than the total GDP in the short run. In the trade partner economies, the trade balance improves following the shock but afterwards it deteriorates as domestic products become more competitive and the expenditure-switching effects in favour of domestic tradable goods fully propagate.

The explanation lies in the impact of the nominal depreciation of the domestic currency on the domestic terms of trade[18], which undergo deterioration. However, following the depreciation of the domestic currency, the import prices will increase only gradually, given their stickiness. The same holds true for the export prices, which will decrease gradually. As these changes take time to propagate and given the slowly adjustment in the proportion of imports versus exports, in the short run, the terms of trade deterioration dominate the substitution effect in the dynamics of net exports triggered by the favourable change in domestic competitiveness.

Backus [2] talks about this apparent puzzling development in the trade balance as '*making hay where the sun shines*', attributing part of the trade deficit to an increase in domestic investment as a result of shifting resources to invest in the temporarily more productive location (in our case, Romania). However, unlike the results in Backus, neither the foreign investment nor the GDP fall following the shock, but this has definitely to do with the relative size of Romania vis-à-vis the rest of the world and the insignificant spillovers from the domestic to the foreign economies. However, the deterioration of the

terms of trade in Romania is accompanied by gains in terms of trade in other economies, which implies that there are wealth effects propagating from the domestic economy, although the magnitude of increase in consumption in the EA, US and ROW is only qualitatively significant (again, for reasons related to the small size of the domestic economy and, hence, the small spillover to the other economies)[19].

Sensitivity analysis. A key parameter in this type of models is the *elasticity of substitution between domestic foreign tradable goods* (i.e. μ_{TC} for the tradable intermediate goods used in the production of consumption goods and μ_{TI} for the tradable intermediate goods used in the production of investment goods).

The same parameters are responsible for the magnitude of changes in the exchange rate and, implicitly, for the impact on the terms of trade of the economies hit by the shocks. In particular, increasing the elasticity of substitution (e.g. from $\mu_{TC} = \mu_{TI} = 2.5$ to $\mu_{TC} = \mu_{TI} = 9.5$), we observe a more muted exchange rate reaction (and implicitly, of the terms of trade), given that, in this alternative calibration, the *expenditure-switching* effects are larger. In other words, given this calibration, relatively minor exchange rate movements are sufficient to restore the equilibrium in the current account (trade balance). What accounts for this result is the simple idea that, with greater complementarity (lower values of the elasticity of substitution), the deviation from the steady-state mix of intermediate inputs (domestic, foreign) is associated with larger changes in their relative prices.

The elasticity of substitution among tradable goods varies from 1.17, in posterior estimations in Cristadoro [13], to 2 in Benigno [5], 0.85 in Rabanal [28], 1.1 in Laxton [24] and 1.5 in Cönen [8]. Our value of 2.5 for both the consumption and investment sectors are not far away from these benchmark values.

NOTES

[1] Given the relatively small share of Romania in the world economy, we can assume that relatively small to negligible spillover effects propagated from shocks taking place in the domestic economy.

[2] The factors of production can move across sectors at no cost, but do not move across national borders.

[3] These shocks will be used to simulate a technology shock in the last part of the paper.

[4] In simulations, by changing the elasticity parameters, the model allows the simulation of the impact of structural reforms, via modifying the degree of competition in the considered market. The higher the elasticity of substitution between varieties, the lower the markup and the closer the market is to perfect competition, thus mimicking an increase in flexibility of those markets.

[5] Again, by modifying the elasticity parameters we can simulate the impact of structural reforms and modify the degree of competition in the considered market.

[6] Based on Newton-Raphson algorithms (Juillard [21]).

[7] All values calculated based on IMF's *World Economic Outlook* database, USD denominated series.

[8] For instance, empirical studies of the price elasticity of import demand, such as Hooper [20], report a median value of 0.6 for Japan, Germany and the U.K. Other studies set these elasticities at either $\mu = 1$ (e.g. Gali [17]) or $\mu = 1.5$ (e.g. Chari [12]).

[9] More details in section 4.5.

[10] Lopez-Garcia [25] calculates a price-cost margin based on balance-sheet data, showing the evolution of mean and median price-cost margins, as well as their dispersion, for the total economy and at sectoral level. Starting from an index based on figures for 2007, they show that Romania has faced marked reductions in the *markups*, while for Germany and Italy they have remained virtually unchanged.

[11] Estimated over the sample 1960-1999 for the U.S. economy.

[12] The model is calibrated using data until 2015, therefore it does not take into account the recent changes in the fiscal regulations, which are particularly large in the case of Romania.

[13] However, the empirical evidence clearly points to the idea of state-dependent pricing of firms across the business cycle, whereas we have imposed average values for these parameters for the period 2000-2015. For instance, recent evidence indicates that producers in Spain and Italy have increased the frequency of price adjustments in the aftermath of the crisis, which is, from the perspective of the theoretical literature, somewhat counter-intuitive (for details, see Izquierdo [21]).

[14] In particular, we have analysed the disaggregated categories of goods and the additivity of the sub-categories to group totals.

[15] The subcategories of *BEC* can be aggregated to approximate the three basic *System of National Accounts* (SNA) classes of goods, thus allowing external trade statistics to be considered jointly with other sets of general economic statistics, such as national accounts and industrial statistics, for national, regional or world-level economic analysis.

[16] All variables are expressed in percentage deviation from the steady-state.

[17] In this and the next simulations, we have assumed that the capital is fully utilized ($u_t(i)$ = 1), which also implies that there are no adjustment costs associated with a time-varying capacity utilization rate ($\Gamma_u(u_t(i))$ = 0).

[18] These are defined as the domestic-currency denominated ratio of import prices and export prices: $P_{IM}^{H,CO}(h)/S^{H,CO}P_X^{H,CO}(h)$.

[19] However, if we assume the shock affecting the EA, we see some more significant positive wealth spillovers (to the U.S., RO and ROW). We stress that, in our specification, the technology processes follow simple autoregressive dynamics, without any explicit spillover coefficients. However, these spillovers between the economies simply reflect the propagation mechanisms embedded in the model, which are triggered following the shock.

ANNEX

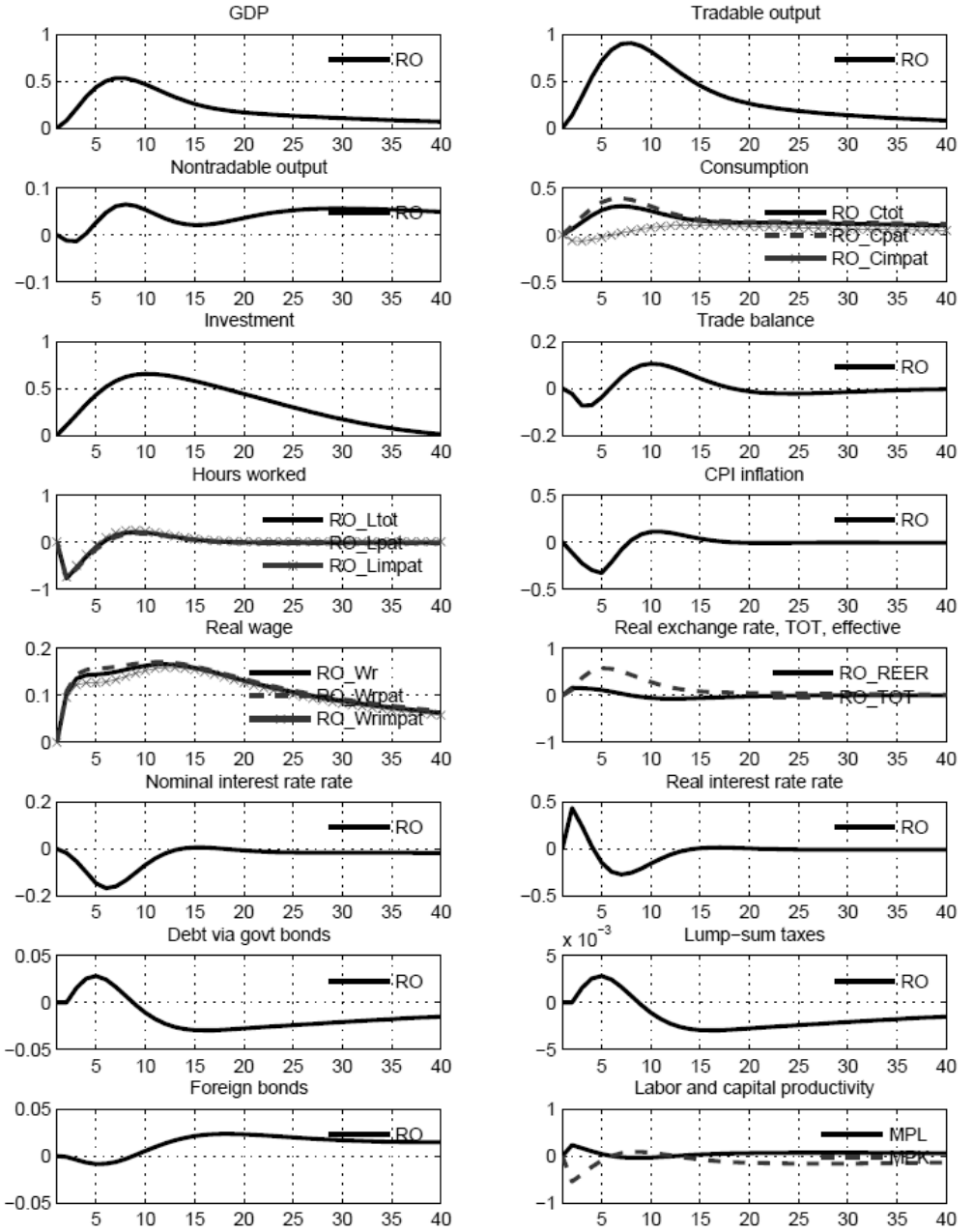

Figure 1: Effect of the Technology shock in RO on Domestic Variables

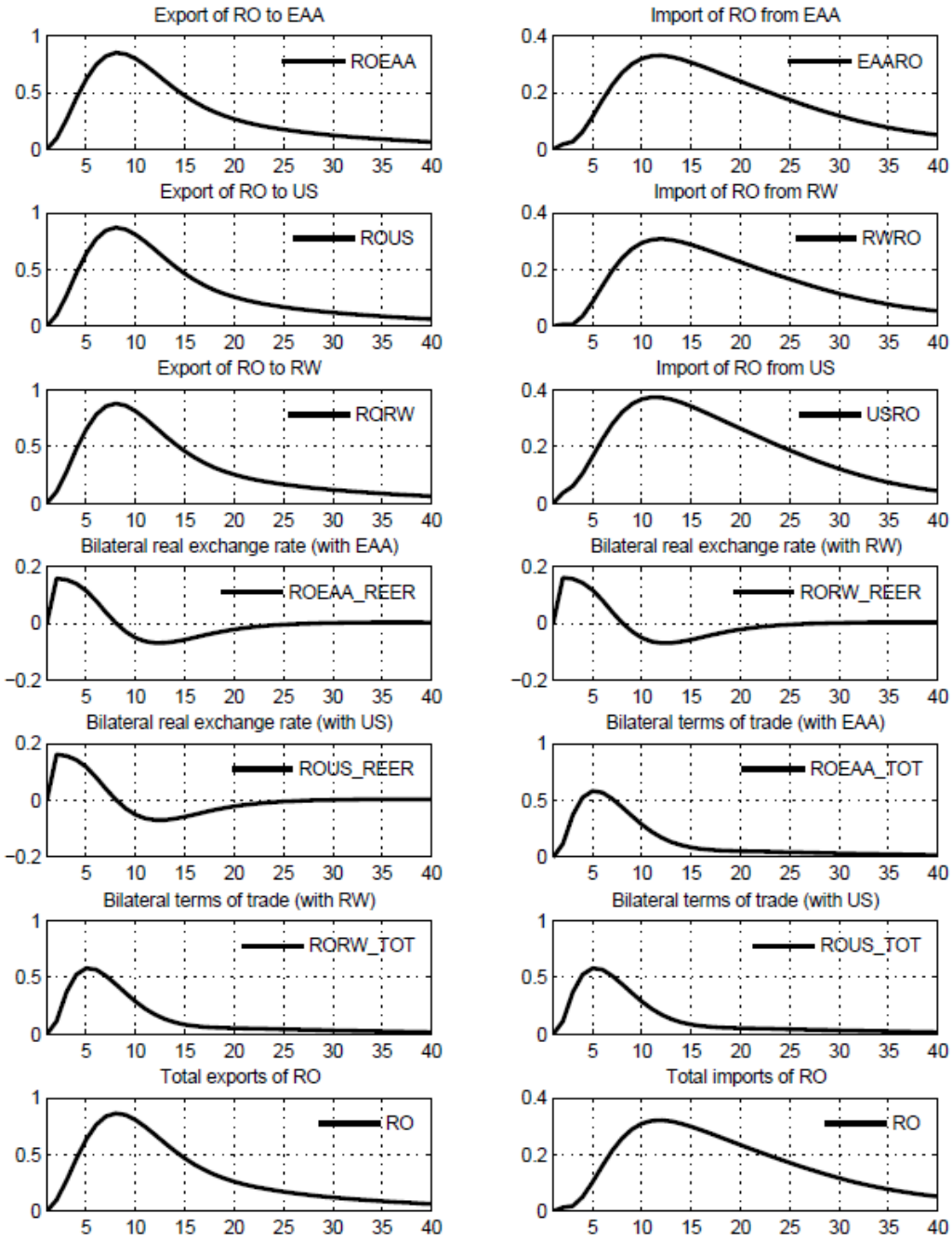

Figure 2: Effect of the technology shock in RO on trade variables

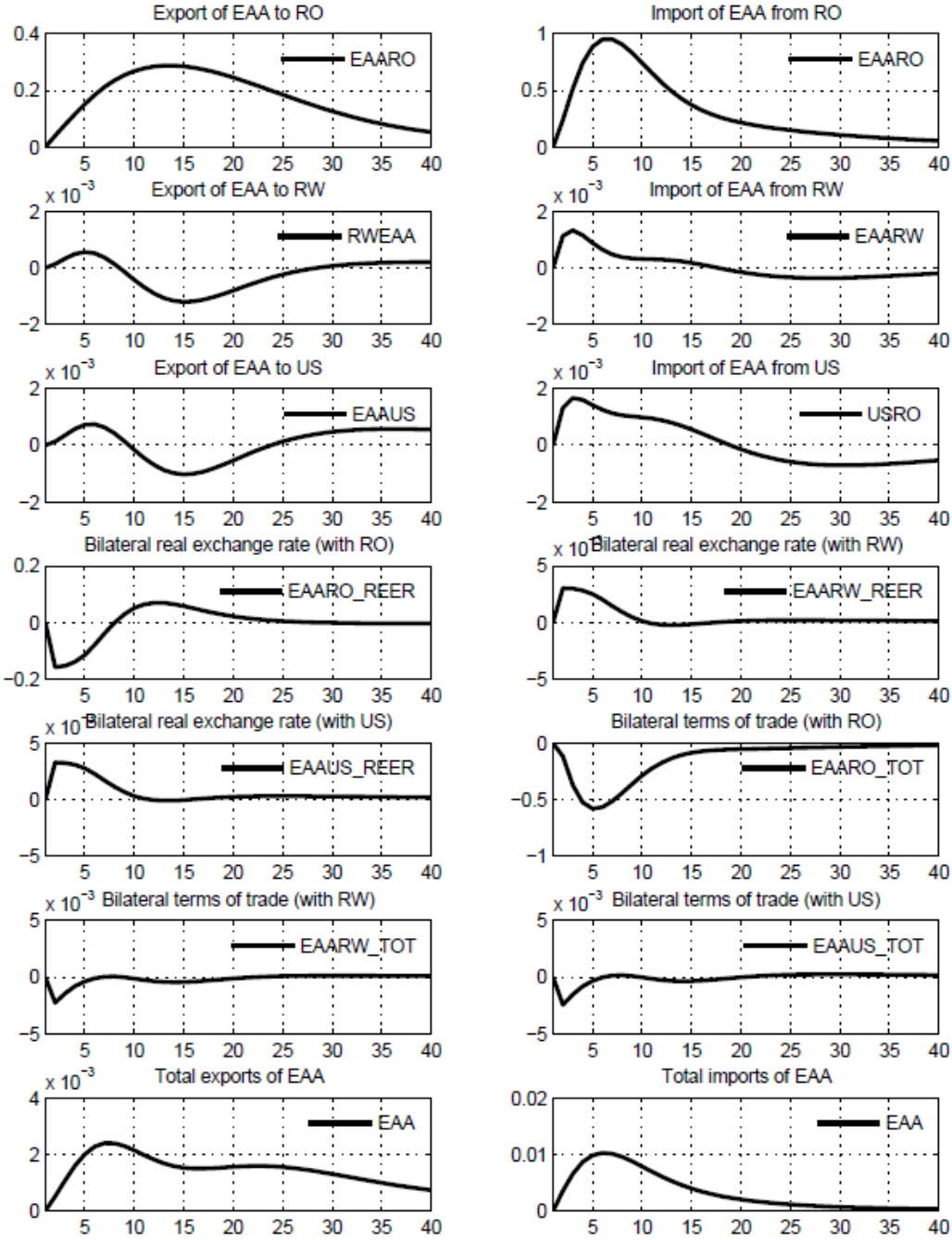

Figure 3: Effect of the technology shock in RO on EA trade variables ('spillover effects')

Table 1: Households and Firms Behavior

	RO	EA	US	ROW
Households				
Discount factor (β)	0.9888	0.9926	0.9926	0.9926
Intertemporal elasticity of substitution (σ^{-1})	1.00	1.00	1.00	1.00
Inverse of the Frisch elasticity of labor (ζ)	2.00	2.00	2.00	2.00
Habit persistence (κ)	0.70	0.70	0.70	0.70
Share of J-type households (ω)	0.25	0.25	0.25	0.25
Depreciation rate (δ)	0.025	0.025	0.025	0.025
Intermediate-good firms				
Substitution btw. labor and capital (Cobb-Douglas)	1.00	1.00	1.00	1.00
Bias towards capital (α)	0.36	0.30	0.30	0.30
Substitution (I-type vs. J-type labor) (η)	4.33	4.33	4.33	4.33
Final consumption-good firms				
Substitution (domestic vs. imported trad. goods) (μ_{TC})	2.50	2.50	2.50	2.50
Bias towards domestic tradables goods (ν_{TC})	0.31	0.33	0.46	0.72
Substitution (tradables vs. nontradables) (μ_C)	0.5	0.50	0.50	0.50
Bias towards tradable goods (ν_C)	0.65	0.35	0.35	0.35
Final investment-good firms				
Substitution (domestic and imported trad. goods) (μ_{TI})	2.50	2.50	2.50	2.50
Bias towards domestic tradables goods (ν_{TI})	0.012	0.32	0.37	0.66
Substitution (tradables vs. nontradables) (μ_I)	0.5	0.50	0.50	0.50
Bias towards tradable goods (ν_I)	0.84	0.75	0.75	0.75

Source: Author's calibrated values

Table 2: Steady-State National Accounts (% of GDP)

	RO	EA	US	ROW
Domestic demand				
Private consumption	66.40	57.33	67.41	55.85
Private investment	19.90	17.97	17.03	20.4
Public consumption	21.63	23.04	19.43	20.72
Trade				
Imports (total)	41.60	21.03	15.03	10.77
Imports of consumption goods	25.19	14.71	10.92	6.23
Imports of investment goods	16.40	6.32	4.11	4.54
Net foreign assets (% of annual GDP)				
Production				
Tradables				
Nontradables				
Labor				
Share of World GDP	0.3	21	27	52

Source: Author's calculations based on Eurostat data

Table 3: Price and Wage Markups (Implied Elasticities of Substitution)

	RO	EA	US	ROW
Tradables (θ_T)	1.20	1.20	1.20	1.20
Nontradables (θ_N)	1.50	1.50	1.28	1.28
Wages (η_I, η_J)	1.30	1.30	1.16	1.16

Source: Author's calibrated values

Table 4: Real and Nominal Rigidities

	RO	EA	US	ROW
Adjustment costs				
Imports of consumption goods (Γ_{IM^C})	2.00	2.00	2.00	2.00
Imports of investment goods (Γ_{IM^I})	1.00	1.00	1.00	1.00
Capital utilization ($\gamma_{u,2}$)	2000	2000	2000	2000
Investment (Γ_I)	6.00	6.00	6.00	6.00
Transaction cost function ($\gamma_{v,1}$)	0.029	0.029	0.029	0.029
	0.15	0.15	0.15	0.15
Intermediation cost function ($\Gamma_{B^{US}}$)	0.01	0.01	0.01	0.01
Calvo parameters				
Wages - households I and J (ξ_I, ξ_J)	0.75	0.75	0.75	0.75
Prices - domestic tradables and nontradables (ξ_H, ξ_N)	0.92	0.92	0.75	0.75
Prices - exports (ξ_X)	0.75	0.75	0.75	0.75
Degree of indexation				
Wages - households I and J (χ_I, χ_J)	0.75	0.75	0.75	0.75
Prices - domestic tradables and nontradables (χ_H, χ_N)	0.50	0.50	0.50	0.50
Prices - exports (χ_X)	0.50	0.50	0.50	0.50

Source: Author's calibrated values

Table 5: International Linkages

		RO	EA	US	ROW
Consumption-good imports					
Substitution btw. consumption good imports (μ_{IMC})		2.50	2.50	2.50	2.50
Bias towards imported consumption goods from ($\nu_{IMC}^{H,CO}$)					
	RO	-	0.51	0.01	0.48
	EA	0.01	-	0.06	0.93
	US	0.00	0.16	-	0.84
	ROW	0.01	0.81	0.19	-
Investment-good imports					
Substitution btw. investment good imports (μ_{IMI})		2.50	2.50	2.50	2.50
Bias towards imported investment goods from ($\nu_{IMI}^{H,CO}$)					
	RO	-	0.55	0.01	0.43
	EA	0.01	-	0.09	0.91
	US	0.00	0.18	-	0.82
	ROW	0.01	0.7	0.29	-

Source: Author's calibrated values

Table 6: International Linkages (Trade Matrix, Imports, % of domestic GDP)

		RO	EA	US	ROW
Consumption-good imports					
Total consumption good imports		0.244	0.132	0.088	0.063
Bias towards imported consumption goods from					
	RO	-	0.123	0.0039	0.116
	EA	0.0015	-	0.012	0.117
	US	0.00005	0.014	-	0.074
	ROW	0.00036	0.044	0.0191	-
Investment-good imports					
Total investment good imports		0.16	0.10	0.07	0.05
Bias towards imported investment goods from					
	RO	-	0.089	0.00387	0.07
	EA	0.00078	-	0.015	0.085
	US	0.00004	0.0130	-	0.0608
	ROW	0.00032	0.0313	0.0244	-

Source: Author's calibrated values

Table 7: International Linkages (Trade Matrix, Exports, % of domestic GDP)

		RO	EA	US	ROW
Consumption-good exports					
Total consumption good exports		0.223	0.133	0.052	0.072
Exports of consumption goods to					
	RO	-	0.139	0.0059	0.0783
	EA	0.00139	-	0.0163	0.116
	US	0.00004	0.011	-	0.041
	ROW	0.0006	0.00449	0.0272	-
Investment-good exports					
Total investment good exports		0.104	0.0979	0.0560	0.0618
Exports of consumption goods to					
	RO	-	0.0464	0.00305	0.0548
	EA	0.0015	-	0.0152	0.0813
	US	0.00005	0.01307	-	0.05238
	ROW	0.00041	0.033	0.02834	-

Source: Author's calibrated values

Table 8: Monetary and Fiscal Policy

	RO	EA	US	ROW
Monetary authority				
Inflation target ($\overline{\Pi}^4$)	1.025	1.02	1.02	1.02
Interest rate inertia (ϕ_R)	0.80	0.87	0.87	0.87
Interest rate sensitivity to ination gap (ϕ_π)	1.50	1.70	1.70	1.70
Interest rate sensitivity to output growth ($\phi_{\Delta Y}$)	0.20	0.10	0.10	0.10
Fiscal authority				
Government debt-to-output ratio ($\overline{B_Y}$)	0.241	0.736	0.71	0.596
Sensitivity of lump-sum taxes to debt-to-output ratio (ϕ_{B_Y})	0.10	0.10	0.10	0.10
Consumption tax rate (τ^C)	0.177	0.192	-	-
Dividend tax rate (τ^D)	0.00	0.00	0.00	0.00
Capital income tax rate (τ^K)	0.57	0.16	0.17	0.16
Labor income tax rate (τ^N)	0.302	0.375	0.154	0.154
Rate of social security contribution — by firms (τ^{W_f})	0.162	0.148	0.071	0.071
Rate of social security contribution — by households (τ^{W_h})	0.083	0.0765	0.071	0.071

Source: Author's calibrated values, based on Eurostat and OECD data

Table 9: Great Ratios

	RO
Great ratios	
Private consumption	0.658
Private investment	0.214
Target public debt	0.157
Trade linkages	
Imports	0.441
Consumption of goods&services	**0.244**
from EA	0.123
from US	0.003
from RW	0.116
Investment goods&services	**0.163**
from EA	0.089
from US	0.003
from RW	0.07
Public consumption	0.166
Country size	**0.003**

Source: Author's calculations based on Eurostat, United Nations Commodity and Trade Statistics (Comtrade) and United Nations Structural Analysis (STAN) data

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Interest and Interest Rates: Macro-Economic Tools or Distorting Instruments?

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Abstract

Interest, interest rates and the policies behind these fundamental economic policy instruments are some of the most debated concepts, save for taxes and perhaps exchange rates. The objective of this paper is to present their basics and recent developments and to explore potential answers to a simple question, namely if they have to do with macro-economic realities or if they are just powerful tools used by macro-economic decision-makers, central bankers and/or, finally, by politicians for varied purposes, other than sound macro-economics. At the same time, the paper tries to identify specific features of interest policies and interest rates in countries in transition to a market economy. After years and years of central planning, these countries were abruptly confronted with the realities of the convoluted world capital markets. The adjustments required in transition have been painful and the process is not over, but the fundamental question above is, basically, the same. The intrinsic relations between the explored instruments of interest and interest rates and the others (exchange rates, deficits, savings, etc.) are deeper.

Keywords

interest, interest rates, currencies, QE, IMF, EBRD, Fed, BoE

JEL Classification:

E43, E490, E59

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1. INTEREST/INTEREST RATES: BACK TO BASICS AND MORE

1.1. Introductory Remarks and Some Definitions

The first indications about the usage of interest go back to medieval times. Some historians placed them in time in the fifteenth century or even earlier. According to some early definitions, the interest, in financial terms, is "money paid for the use of money lent"1. Similar definitions are quite common. As early as 1520s, a clear distinction started to emerge between "usury", which was a high compensation from a defaulting debtor (as a matter of fact this was illegal under Church law), and a proper interest which commenced be used. The American Heritage - New Dictionary of Cultural Literacy, Third Edition, 2002 defined interest as "the charge for borrowing money or the return for lending it", which, in a synthetic way, describes the essence of the concept. Another definition, which is very accurate from the banking point of view, is the one published by Investor Words2 which defines the interest as "the fee charged by a lender to a borrower for the use of borrowed money, usually expressed as an annual percentage of the principal". It should be noted, however, that this definition is rather related to lending transactions. Interest is very much a key instrument for saving operations as well. In this latter case, interest could be seen as the remuneration for the capital made available by a saver to an economic agent (be it a bank or an entrepreneur, via a bank). So a more complete definition of interest should consider both sides. As such interest could be defined as the fee charged by a lender to a borrower for the use of borrowed money or the remuneration paid by the banks/beneficiaries to savers for money deposited with them.

There is not much debate on the definitions of the interest/interest rate as they are practically seen as technical banking tools. However, the utilisation of these tools by the central banks and, under their guidance, by the commercial banks, funds, financial platforms and other financial and banking players has far more material consequences, as this paper tries to unveil.

As mentioned above, together with the exchange rates, interest is one of the key monetary policy instruments for developed countries, developing countries and/or emerging markets as well, including countries in transition to a market economy. Developed countries issue strategies regarding the level of interests, despite the fact that the main public concept requires that the market should determine itself the level of interest rates. For instance, in the United States, the level of interest rates is determined by the Federal Reserve System (abbreviated as the "Fed") with the full support for the development of the economy as a key declared objective. Practically, interest rates are the result of a set of indicators, amongst which the evolution of the monetary base is the main one. From a quantitative

point of view, the monetary base is measured and programmed with the support of a set of indicators mainly based on M0, M1, M2, M3 and M4. These indicators measure the level of monetary base starting with cash and coins, money at sight (M0 and M1 reflect what is called narrow money) up to long-term deposits and other forms of money measured by M3 and M4 (which are defined as measuring broad money). Fed is the American institution entitled by the law to monitor, on a daily basis, the movements of these indicators, together with the evolution of the American economy (GDP, unemployment, inflation, current account, investment, lending etc.). Based on the complex set of indicators, from time to time, Fed takes decisions regarding the level of interest rates, as it has always done during its long history, up to and including during the politically convoluted years of 2017 - 2018. The incoming change of the Chairman of the Fed in February 2018 makes the current capital markets quite uncertain and maybe even unstable or unpredictable.

In summary, this paper will focus on four interest rates for both developed economies and the ones in transition:

- Monetary policy interest rate, determined by the central bank for each state or union of states (Fed rate, Euribor, Libor, Robor, etc.);
- Prime rate, set by each commercial bank considering the monetary policy rate and the bank's own evaluation of the economic and financial realities;
- Saving rates, established by each bank based mainly on the prime rate and, in some circumstances, on saver's profile. The bank may pay a higher rate for a higher saved amount or for an important client. Usually the saving rate is smaller than prime; and
- Lending rates, established by each bank based mainly on the prime rate and the profile of the client (collateral assets, credit score, risks, etc.). Usually this rate is higher than prime. One of the reasons for 2008-2009 crash was the fact that some financial agents have provided, admittedly for a limited period of time, loans at rates well below the prime.

1.2. Related Basic Concepts

Both theoretical and practical terms related to interest and interest rates are in a constant evolution and they tend to adapt to changing economic landscapes. The full understanding of the interest and its related terminology would require a short research of some fundamental terms and policies behind them.[3]

Amongst the key terms related to interest there is the well-known LIBOR (London Interbank Offered Rate), which is practically a daily computed rate based on the

submissions of the key commercial banks present in the United Kingdom (UK). This is a major indicator not only for the UK, but also for international markets. The large majority of international lending transactions are made based on LIBOR. After the introduction of EUR in the Eurozone, EURIBOR, as published by the European Central Bank (ECB), started to be used in parallel with LIBOR and USD prime rate for USD. However, the LIBOR rate has been plagued by large scandals of "manipulation" in the last years. As commercial banks started to become increasingly uncomfortable with making their submissions, there are current discussions for the replacement of LIBOR with SONIA, possibly as early as 2021. SONIA (Sterling Overnight Index Average) is a newly proposed rate to replace LIBOR. The new rate will be based on transactions. It will not take into consideration "the judgement of submitters" which proved to be controversial. Despite its assumed "objectivity", market analysts still believe that even SONIA will be manipulated. In short, the LIBOR scandal is a clear illustration that, in some cases, interest rates are manipulated depending on the objectives of the participants. Even worse, sometimes the rates are (indirectly) influenced by politicians eager to win voters' support by keeping interest rates at certain level which is convenient for the largest number of utilisers (normally, the group of borrowers).

Another immediately related term is maturity (or maturities), which is the final date when a certain debt/loan should be repaid. It could be a single final date in the case of a loan agreement with a bullet repayment. More frequently, in practice, series of dates are agreed by contract when the debt/loans are to be repaid in instalments. The debt/loan becomes non-performant when the final maturity or some of the partial maturities are not observed. Non-repayment(s) of the debt or delays in repayments are material breaches of the contractual obligations by the debtor/borrower and could have many implications. Some of such implications are related to the execution of collateral, the negative impact on the credit history of the borrower up to ineligibility for future loans or, in some cases, they could lead to the bankruptcy of the non-performer/borrower. For deposits, the terms are used to clearly define the date/dates when depositors can use the money again. For some deposits, the banks allow early withdrawal, but penalty charges apply. More recently, banks have started to use the instrument of maturity/maturities as an incentive to attract deposits in a situation in which the offered interest rates are meagre.

As the world is full of risks, the banking science and practice started to look at credit risks very carefully, given the complexity of the concept utilised to measure either the possibility and/or probability of breaches of the contractual obligations, usually by the debtor. These are also closely related to the interest rate risks and measure uncontrollable changes in the market forces which have a direct impact on contractual parties' behaviour. Sometimes, the

risks for such cases could be related to the borrowers that will not be able or willing to pay the interest (and/or the principal as well) due to creditors. In other cases, the risk could be related to the mismatches between the interest rates applied on the assets side of the balance sheet as compared to the liabilities side. Both credit risks and interest rate risks could also be related to the types of interest rates (variable versus fixed rates) charged/remunerated from/to the clients. In this latter case, the risks could be on the client's side and/or on the commercial banks' or lenders' side. A material mismatch of the rates between assets and liabilities could have devastating effects on the profitability of the lenders or on the welfare of the clients. In many cases, clients bring the banks to courts for perceived cases of misconduct, misinformation or malpractices. And, in many cases, they even win!

Additional risks are related to fixed versus variable interest rates. Fixed rates are defined as an *annual* percentage of the *principal* which remains the same during the whole duration of the contract (of lending or saving), while variable one is a rate which could be (and generally is) changed unilaterally by the lender or by the deposit-taking institution. The risk of change of the interest rate during the maturity of a loan or of a deposit should be properly scrutinized by both the lenders/banks and the borrowers/savers, respectively, as the change of interest rates could increase or decrease costs at any time in the case of variable rates, with material consequences and risks for both contractual parties. Moreover, a concept which has recently stirred heated debates is that of Simple versus Compounded Interest. An interest rate applied to borrowed money or deposits is normally a simple one. In some cases of lending, banks add the paid (matured) interest to the original borrowed money and apply the rates to the increased amount. In other words, in this case, the interest is also paid on the previous interest which has been accumulated. In some jurisdictions (especially in force in Arab countries), the practice of interest on interest is prohibited for religious reasons. Banks should be very innovative in such cases, as their efforts to make money available to borrowers should be remunerated somehow.

Finally, the Interest Rate Differential is a very useful instrument when interest rates and exchange rates are compared in two different countries. Many analysts defined the case when the difference between *market interest rates* in any two countries is about the *same* as the difference between the *forward* and the spot exchange rates of their respective *currencies* as the interest rates parity (see endnote 3). When the parity holds, no arbitrage is practically possible. Moreover, given the fact that many governments manipulate interest rates (and/or exchange rates in many cases), parity situations are generally rare cases. For instance, just for highlighting some interactions, we could consider a hypothetical case. Let us assume that the Bank of England will arbitrary raise the Libor rate by 5 per cent higher

than other key central banks in the world. The main banks in UK will follow and will raise their rates and subsequently the rates for deposits and loans. At this point, many currency speculators will rush to buy the sterling, because they will obtain a high interest on it. Due to high demand, the sterling value relative to other currencies will increase significantly making the goods imported into UK very affordable. Many local UK producers will be unable to sell their products and will not be able to pay such higher interest on loans, so they will go bankrupt. Unemployment will increase and social-economic crises could be generated.

With a similar rationale, it could be shown that lowering the interest rates will help the local economy and decrease the unemployment. However, there are other limitations. The interest cannot go into too deep negative values and the unemployment cannot go below a certain value, called natural unemployment rate. In any country, there are always persons that are going into unemployment for objective reasons. At this point, more people are needed and this could be one economic justification for accepting immigrants. In practice, two (apparent) different approaches on immigration for two countries with good economic growth in the last years could have been observed. On one side, Germany who accepted some 1.5 million untested immigrants from Africa and Asia, on the other side USA trying to limit the illegal, low skills immigrants while still accepting a certain number of legal, qualified immigrants. In other situations, like in the case of Canada, the number of immigrants is established each year based on economic realities. However, the immigration process cannot go on indefinitely. You cannot transfer all qualified people from a country somewhere else without very material negative effects. In fact, one could say that the low and/or negative interest rates are bringing the economic and banking world in uncharted territory where any prediction could be negated.

2. RECENT INNOVATIONS

2.1. Interest Rates and QE

Quantitative Easing (QE as it is well-known in economic literature) was labelled by some analysts as a euphemistic term for money printing. This paper tends to agree with such a view. Others may argue that QE programs served well their original purpose, namely to restart and/or to maintain economic growth in the respective countries in dire economic circumstances. This QE practice of the central banks from the major countries - the USA, the United Kingdom, Japan and the European Union (via European Central Bank) - to buy government bonds was introduced in the aftermath of the global banking crisis of 2007-2008 (conventionally assumed to have started some 10 years ago on 9 August 2007 when

BNP Paribas announced they could not pay). This was a historical "innovation" to save the governments and commercial banks from imminent bankruptcy in the mayhem created by the crisis (incidentally started by the sub-prime mortgage covered bonds). From 2008 to 2017 a huge amount of USD 22 trillion of bonds were acquired by the central banks of the countries mentioned above, of which a sizable portion was bought by the European Central Bank (ECB) (EUR 2.3 trillion). It recently hinted to end QE program because of fears that Eurozone will soon overheat. With some delays though but as expected, Europe indicated via ECB that it will follow America's new trends for reasons mentioned already. This should have been done much earlier if a weaker EUR and other major European currencies (where the interest rates are negative)[4] were to be avoided (see also Section 4.1).

Another sizable part of this huge stimulus program was acquired by the US Federal Reserve System (the Fed) with holdings of USD 3.5 trillion[5]. The current efforts of the Fed start deleveraging its balance sheet are well noted and in the right direction. First it will not buy any new bonds and, furthermore, they will start selling small amounts of the existing stock. This will put pressure on interest rates to increase, a process which is already underway in the USA. Interest rates (the Fed funds rate), currently at 1.00 - 1.25%, were increased by the Fed on 16 December 2015 (it was unchanged since 2006!), in December 2016 and again on 14 June 2017. The last increase in the rate took place on 13 December 2017 (effective 14 December 2017) to 1.25-1.50%, with possible more increases in 2018. The current levels should be seen in the historical dimension with its all-time high on 19 December 1980 at 21.50% for the prime rate. These recent modest increases were possible in the USA in the context of a good economic growth and decreasing unemployment, but the February 2018 change of the Chairman may lead to a change in strategy.

All of the above are mere reflections of an abnormal situation in which savers are covering for the costs of the banks and the proper re-distribution function of the interest rates does not apply. In fact, one could say that these are very distorting cases with an unpredictable macro-economic impact (most of the times, a negative one).

2.2. Interest Rates and Special Banking/Non-Banking Products

Apart from the macro-economic importance, interest rates are very practical tools for banking activities. All commercial banks act under the guidance of the central banks when it comes to the general trends of interest rates, but they have enough autonomy to establish their own interest rates for both asset and liabilities of their balance sheets. As such, in most cases, these banks use the rates either to stimulate/attract deposits or to deter certain type of activities which are not very profitable for them. For instance, in countries like the United Kingdom (UK), commercial banks designed specific instruments to help their clients to

save on taxes. A large group of such instruments are called *Individual Savings Accounts (ISA)*. From this basic concept, a myriad of sub-products soon appeared in practice. Easy-access ISAs, Life ISAs (LISA), Term ISA, Junior ISA (JISA), Stocks & Shares ISA, Help to Buy ISA, Innovative Finance ISAs (a very risky product and somewhat unregulated) and many others are currently offered to a large variety of customers. However, it should be noted first that such products are for limited amounts per tax year (GBP 7,000 for the financial years since its introduction in 1999 up to 2008). This threshold has been constantly increased to GBP 20,000/tax year plus the gain (interest or investment returns in the financial year starting with 6 April 2017), but it is still seen as a rather small limit. Second, it should be noted that not all of them are very attractive, despite the fact that modest tax benefits are offered. For instance, LISA accounts offered in 2017 rates of 0.5% per annum in an economic environment in which the monthly inflation reached 3.0% (CPI, end-2017).

This is on the liabilities side of the balance sheets of the commercial banks, but they also have special products for the assets side. Help to Buy ISAs is a product in which the first-time buyer saves for a mortgage deposit. An up to 2.27% tax-free interest is offered as an attractive interest rate and then the British Government adds 25% free cash (although the subsidy is also limited/capped). Sometimes, the mass media from the UK has derided such saving products as the customers are simply reluctant to deposit money in accounts which do not cover at least inflation. Basically, those who decide to use such products lose money in real terms! Keeping money deposited in banks must then be based on different rationales, such as the guarantee of deposits offered in all advanced countries by the respective state, including the European Union (up to EUR 100,000 or GBP 85,000/per savers/per account). Tax avoidance (see USA case where the interest paid on mortgages are deducted from taxable income) or tax optimisation could be another reason used by the banks to attract deposits. Despite such serious considerations, the distorting role of the interest rates, acting as a penalty for savers due to their extreme low levels, is evident however in the case of these (and other) special banking products. Other investors elected to place their funds to buy shares issued by large companies, exposing themselves to higher risks (see the cases of Air Canada, Nortel, General Motors and others.) Another option, maybe with a lower risk, could be investment in high value bonds or treasury bills. Moreover, the return on pension funds are very modest these days which gives a very negative social connotation to interest rates. All these unhealthy developments are directly linked to the current low level of interest rates (in some cases even negative ones, which are yet another financial anomaly).

2.3. Cryptocurrencies and Interest Rates

One other collateral result of this distortion mentioned above is that many peoples turn to other "innovative" schemes/platforms to place their money/savings. One such scheme is the so-called "cryptocurrencies" which so far has accumulated assets of billions of USD. The international markets started to be aware/concerned of this tendency, as currently some 1,000 such cryptocurrencies are in use. Of this large group, the most used and known are "bitcoin", "ethereum", "ripple" and "bitcoin cash" (which are basically a string of computer codes and which started to be used for payments outside the monetary base of any country). These instruments using blockchain technology are not regulated by the central banks or indeed by any other financial authorities ("stateless instruments"), although strong voices are being heard (see the declarations made by the Governor of Bank of England in December 2017, for instance) that they should be. There are speculations that the cryptocurrencies are used for money laundering and other criminal activities as the issuer and the utilisers are anonymous. Moreover, bitcoin was in a very "bubbling" mode during 2017. Its "price" increased from USD 700 at the beginning of the last year to (sometimes) up to the peak of USD 19,666 registered on 17 December 2017. It subsequently decreased to around USD 11,000 and again increasing to around USD 15,000 following severe warnings from regulators (such as China and South Korea) that such levels may not be sustainable and measures will be soon introduced. This is highly speculative and it is very likely that this asset will eventually deflate. While the relation may not be immediately obvious, the large amounts of money accumulated into cryptocurrencies have, inter alia, something to do with the interest rates. The fact that the rates are currently so low could be a stimulating factor to place the money into cryptocurrencies where the investors hop that the "capital gains" will be much higher. If a simple judgement is made regarding the price of the bitcoin, such a hope seems to be a correct one. However, the risks of this unregulated segment of the markets are much higher and much more probable. The request from many central banks to regulate it are correct, albeit long overdue.

3. INTEREST VERSUS INFLATION. THE CASE OF UK

3.1. Historical Dimension - Some Twenty Years Ago

The study of the interest rates' history is worthwhile as valuable lessons could be drawn for the past and present policies. This is more so in developed market economies where the dominance of the market forces is at play. It is quite clear that the level of the interest rates was and, most likely, will continue to be mainly determined by the underlying economics. A snapshot of the level of the interest rates prevailing in the markets by mid-'90s is

presented below. Needless to say that, meanwhile, the Deutsche Mark and the French Franc disappeared (confined to the history books) and were replaced by the EUR in 1997.

Table 1: Interest Rates Evolution on 3-Month Deposits and on Long Term Bonds (%) (January - September 1996)

Currency	Deposits			Bonds		
	1996 (Sept.)	1996 (max)	1996 (min)	1996 (Sept.)	1996 (max)	1996 (min)
Deutsche Mark	2.08	3.75	2.97	6.08	6.66	5.78
French Franc	3.48	5.00	3.46	6.11	6.76	6.06
Japanese Yen	0.46	0.84	0.38	2.87	3.38	2.83
GBP	5.82	6.50	5.69	7.67	8.24	7.25
USD	5.55	5.59	5.13	6.66	7.05	5.52

Source: EBRD Transition Reports (various editions) and The Sunday Times - 29 September 1996

However, it is also true to say that the political and social factors do play an important role in the setting of rates as well. The case of the United Kingdom is illustrative and a closer look at it is warranted. In this strong economy, there was a serious dispute between the Treasury Department and the Bank of England with regard to the level of the interest rate. This dispute was a conclusive example showing that this instrument of monetary policy is a sensitive but, at the same time, powerful "gun" which a certain government or a party can use to fulfil its promised monetary goals. The then Governor of the Bank of England (Mr. Eddie George) was, during the mid-'90s, in a permanent dispute with the Chancellor (Minister of Finance or Treasury Secretary, Mr. K. Clarke) on the level of the interest rates. For instance, in December 1996, Governor E. George publicly stated that there was no need for "a dramatic increase in the interest rate". However, the opinion of the then Chancellor and his advisors' did not coincide. The latter mentioned that keeping the interest rates at very low levels could have pushed the UK into "deflation". Many meetings followed between the Governor and the Chancellor and the end-result was that the interest rate for the Pound was increased by 0.25%. The main commercial banks in the country such as National Westminster Bank (NatWest, currently owned by the Royal Bank of Scotland) and the key building societies such as Halifax, Woolwich and others have also reacted. The interest rates for mortgage loans were raised either immediately for the already existing clients or as of 1 January 1997 for future clients. The fear that UK could have slid into deflation kept the British authorities "awake in the middle of the night". A successful attempt to solve this crisis was the introduction of a new change by the then new Labour Government in May 1997. It consisted in transferring the role of setting the interest rates to a Monetary Policy

Committee (MPC) of 9 persons (rate-setters), chaired by the Governor of the Bank of England. However, one thing should be noted, namely that four of the members of the Committee (the "wise men committee") are nominated by the Treasury Department. To be fair, it should be noted that Great Britain was not the only case in those years. Japan was another similar case.

Back in those years and as of today as well, the manipulation of the rates was, inter alia, a way of ensuring an electoral gain. This was (and still is) possible especially in those countries where the number of borrowers is very high and where the normal instalments to repay such loans could represent up to one third or to one half of the family's disposable income. This was the case of the United Kingdom, in 1996-1997, where the Tory Government manipulated interest rates to gain the votes of millions of mortgage borrowers. Despite the then Chancellor K. Clarke's public declarations according to which the UK's interests would prevail, in reality, the rates were visibly manipulated to gain votes. The United States is another case in point. Interest rates were kept on hold by the Fed during the general elections which ended up with President W. Clinton being re-elected. Unfortunately, the situation did not change dramatically 20 years on, neither in these particular cases, nor in other developed or in transition countries.

3.2. Recent Developments

As some disappointed analysts would put it, interest rates in the United Kingdom have "squatted" at the historic low level of 0.25%, a level which was introduced on 4 August 2016 (after the fateful Brexit referendum in June). The very low level of 0.5%, as compared to inflation, has been kept as such during the last 9 years (since 5 March 2009 when the interest rate set by the Bank of England was decreased to 0.5%) in order to stimulate economic growth. In 2016, the immediate objective after the referendum was a little bit different, namely to smooth the UK's "divorce" from the European Union. While economic growth gained a small momentum in the second part of 2016, the forecast for GDP increase for 2017 was reduced by both the IMF and the Bank of England itself in August 2017 to 1.7% (as compared to 1.9% the previous target). According to any economic theory, the level of the interest rates should be above inflation in order to ensure that the capital is properly remunerated in real terms. However, this is not the current case in UK (or in some other countries as well). The following two graphs (Graphs 1 and 2) clearly demonstrate that the fundamental correlation between interest rates and inflation was broken[6]. This correlation was sacrificed on the "altar" of the economic growth and of the interest of millions of borrowers. Sooner or later this policy will have to be abandoned if the crash of 2008 is to be avoided.

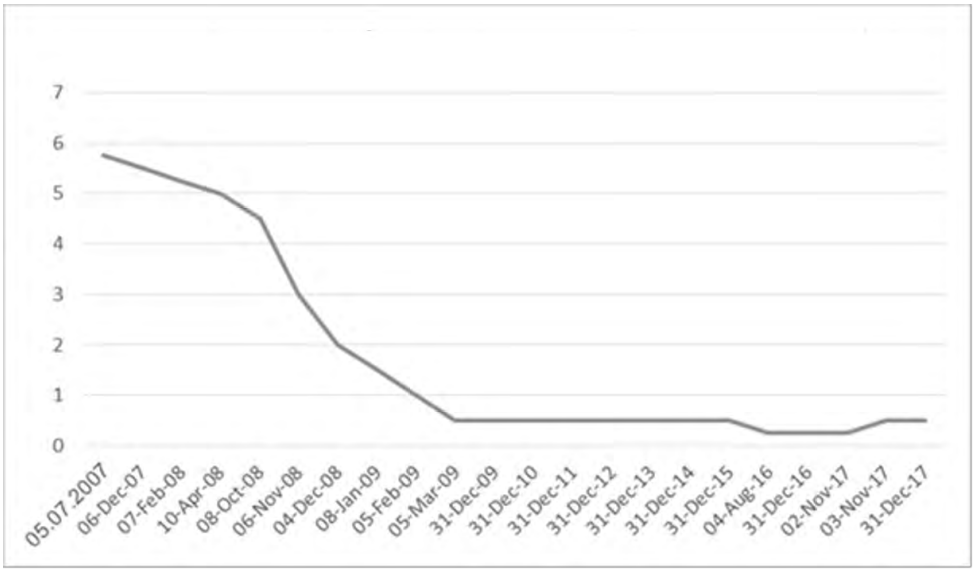

Figure 1: Bank of England – Historical Low Prime Rate (%)

Source: Based on data published by the Bank of England, end- 2017

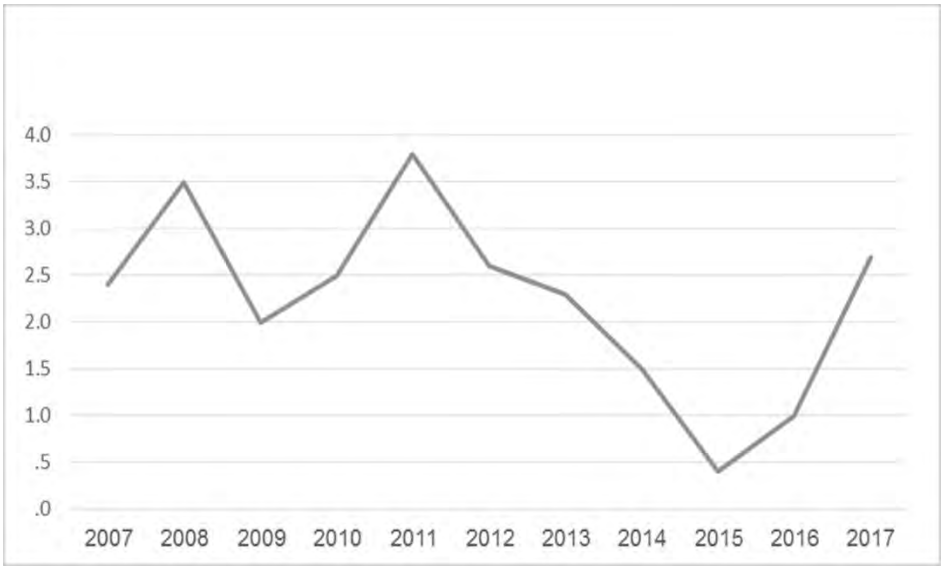

Figure 2: UK – 10 Years of Fluctuating Inflation (CPIH, %)

Source: Based on data published by UK - Office for National Statistics, 16 January 2018

The British target for inflation was to be kept at maximum 2% per annum, but the 2017 case shows that this scenario was out of control. After the June 2016 referendum, inflation has been in much higher territories and a key reason is the actual depreciation of the Pound as compared to the USD and EUR (some analyses place this depreciation at up to 30%, which is a material development). Both the Consumer Price Index (CPI) and the Retail Price Index (RPI) started to be out of control as the increased prices for imported goods reached the consumers. The other important factor was the Quantitative Easing (see Section 2.1). Labour productivity is yet another one, as the British level of this indicator is lower compared to its European and US competitors. Of course, there are also external factors, such as the price of crude oil (at around 64 USD/barrel, Brent, FOB, December 2017), which determine the level of liquidity in key oil exporting countries and which in turn has a direct impact on the level of international interest rates. At the same time, psychological factors such as panic, uncertain political, economic and business environment (such as Brexit), trust of the population in its own currency (see the case of many Eastern European countries where a large part of the population's savings is mainly in EUR or USD), fashion, trends and others could impact, both positively and negatively, on inflation and indirectly on interest rates. Finally, there is an intense debate in UK on how price indexes are computed and what type of baskets of goods are used to monitor the level of inflation which is to be compared with the actual level of the interest rate.

3.3. Re-Distribution Effect. Impact on Real Sector

A low interest rate has positive effects in market economies, but it can also have an unwanted negative impact. There is no doubt that a low interest rate helps businesses (small and medium-sized enterprises (SMEs)[7] and large companies alike) as they have to pay less for the utilisation of credit or for borrowing money from the market. In a banking environment where the cost of credit is very low, companies are supposed to have easy access to loans, as well. This, of course, could help the economic growth of the respective countries, which is of a paramount importance for any economy. More so, the economic growth and the additional jobs implied by this are well publicised and strongly promised (in all manifestos of almost each and every party) by the politicians during the local and general elections. The positive impact on the real sector is evident and well exploited by politicians when requesting the votes of the voters.

However, a low interest rate means that the "non-performing economic agents" manage to remain in business longer then they could have otherwise (with interest rates established at appropriate levels). In fact, low interest rates help "zombie" companies[8] to survive, but the consequence is that the capital is not properly allocated in the economy and, more

importantly, productivity in the respective country will lag behind. This is a discussion which stirs serious disputes among economists and politicians, especially during the pre-election campaigns. The case of snap general elections in UK held on 8 June 2017 is just one example[9]. A survey undertaken by BDRC Continental in April 2017 showed that, because of the very low interest rates (at 0.25% base rate at the time of the survey and at 0.5% by the end-2017) held by the Bank of England at these historical low levels during the last 9 years, many companies managed to avoid the rescheduling of their debt. In addition, more such companies were able to pay their debt when due, a fact which was clearly related to the historical low level of interest rates. The USA is yet another important case of very low interest rates until recently (especially during the 2016 presidential elections), but much more cases could be identified in transition economies. As a more worrisome conclusion, one could state that by keeping interest rates at artificially low levels (or high, for the sake of the argument), the economy of the respective country will eventually suffer due to a lack of a "proper metre" to measure its efficiency. Distorted labour productivity, low(er) levels of savings and investments are just signals of such a distressing situation.

3.4. Macro-economic Tools or Distorting Instruments?

The new forecast updated by the IMF[10] in July 2017 predicted that the global GDP would increase by 3.5% in 2017 and 3.6% in 2018 (as compared to 3.2% in 2016). Out of these optimistic projections, the USA would perform at 2.0% in 2017 and 1.9% in 2018 as compared to 1.7% in 2016. This gave the Fed space for manoeuvre for at least one more increase in the rates, which actually happened on 13 December 2017. Many analysts considered this normalization in the level of interest rates and the adjustments of the central banks' balance sheets (see Section 2.1) as steps into the right direction. They have argues that this new trend should be followed by other economies as well. However, the normalization exercise has also its critics. Many argued that the increase of interest rate by the Fed will also have an unwanted collateral result, namely the reduction of the funds following to emerging markets and to countries in transition (as money will be more expensive and more scarce). As this is a valid concern, a fine balance should be achieved. A gradual normalization could be the solution or at least a part of it.

Meanwhile the new projections for the EU area are only marginally better than the 2016 actual rates. Germany would keep its economic growth at around 1.8% per annum (as Spain would do also at around 3.2%), while France and Italy are predicted to register substantial improvements in this field. On the other side, the United Kingdom lost the momentum (1.8% in 2016 versus new projections at 1.7% for 2017 and 1.5% for 2018). This is only a part of the explanation why the interest rates in UK are kept at historical low levels (see

Graph 1). However, the case of UK is even more complicated and convoluted in the aftermath of the Brexit decision in June 2016 and of a new threat of a second independence referendum ("indyref2") in Scotland in 2019. The immediate effect was a sharp depreciation of the Pound, which had started to filter in the higher inflation in the country (see Graph 2). While supporting the modest economic increase, the historically low level of interest rates is clearly distorting the distribution of the national wealth and the saving and investment processes. The fate of the savers (amongst which the pension funds and the large number of individual pensioners) was not of the highest priority for the current decision makers. Same holds true for the EUR area. This could have a negative economic impact (as the savings of the population will continue to decrease) but, more importantly, a social impact difficult to quantify. The long-suffering savers will still have to wait, while a negligible interest is paid to them on their deposits.

The interest and interest rate are two fundamental parameters of the macro-economic policies of any country, but their utilisation is more intense or more effective in the developed markets. As such they could be easily labelled as macro-economic tools, as they are instrumental for the key decision makers (central banks, strategists, parliaments, politicians, commercial banks etc.). Controlling inflation is a key objective of both major international financial institutions (IFIs), such as the International Monetary Fund (IMF), and the countries themselves. Prima facie, it seems that inflation could be primarily influenced ("controlled" is maybe too much to admit, but it is not far from the truth) by changing the interest rates, starting with the prime rates or refinancing rates, which are normally amongst the attributions of the central banks. However, it is safe to state that, in many cases, central banks do not have in mind only the needs of the economy at the specific time of decisions. For instance, during general elections periods, the rates are set in a specific way so that the voters, or at least the largest part of them, would not be upset. Central banks are usually mindful of the implications of increasing interest rates on borrowers, as well as on savers. As such, in some cases, the interest of the borrowers prevails as compared to the weary savers when interest rates are kept very low. Recent examples of policies on how such interest rates are "conducted" (not to use the term "manipulated") could be easily found both in developed markets (USA, United Kingdom, Japan etc.) and in emerging markets or transition countries (the Russian Federation, Romania, Moldova, Serbia, Former Yugoslav Republic of Macedonia etc.) as described below.

4. INTEREST RATES DURING THE TRANSITION TO A MARKET ECONOMY

For the group of countries in transition to a market economy (former socialist countries and the newly born countries from the ashes of the former Soviet Union in 1991) there is a historical prospect, first and foremost. The features and dimension of this concept of interest rates was very important during the days in which central planned economies, currently countries in transition, struggled to find an acceptable definition for a concept which, in essence, is an instrument of re-distribution of a part of GDP and, finally, of the net wealth of any society. This paper analyses the evolution of the interest rates in transition of this group of countries from rigidly planned to market economies simply to benefit from history lessons. Over many years of socialism in the former Soviet Union and in Central and Eastern Europe, there were many attempts to define the interest/interest rate concepts. A definition which passed the test of time was the one proposed by C. Kirițescu in 1982[11]. In short, Kirițescu defined the interest as a part of the net value created by the society and, in monetary terms, as a sum of money which the debtor pays to the creditor for the money lent to it. It was quite clear, in those days, that the concept of cost of capital was not well regarded in academic circles due to its ideological connotation. As a matter of fact, in accounting terms, the interest paid to/remunerated by the banks (the only socialist economic agents allowed to charge interest on loans and/or to grant interest on incipient savings accounts held by individuals and economic and social entities) was treated as an expense or as a form of income, respectively. The net income or the profit, which, in those days, was part of the formation of the national income (roughly similar to GDP) was computed after the paid and/or received interest was taken into account. This approach is, of course, now confined to history books. New trends have taken its place during the almost three decades of transition, as presented in more details below.

4.1. How It All Started in the Early '90s - Interest During Transition

Generally speaking, the central banks of many countries, and even more so, the central banks of the transition countries have a few instruments at their disposal, through which they can influence the destinies of their currencies. They are much more vulnerable and at the mercy of the international capital markets. Amongst these instruments, setting the interest rates is a pure attribution of central banks, apart from controlling the quantity of money in circulation, regulating the minimum reserves requirements for the commercial banks, deciding on the issuing of bonds and their key terms and conditions, and other monetary instruments. In many jurisdictions, the central banks of the transition countries are also responsible for managing the level of foreign debts, as an over-indebted country

will end up with sharp adjustments of its currency exchange rate. The temptation to use the interest rates for the same purpose is high, but the results are not always the expected ones.

In transition economies, the "interest rate" instrument started to be effectively utilized at the beginning of the '90s, after years and years in which the rates clearly played just a passive role in the stimulation of production and trade (in those years, the rates were administratively set with no relation to the markets, of course). Moreover, back in the early days of transition, the dynamics of the interest rates were very "erratic", to say the least. In a macro-economic environment in which the GDP sharply declined, investments were sparse, no solid savings were achieved and the national currencies suffered huge depreciations, the refinancing rates had no alternatives, but to reach, in some cases, impressive/historical levels, as presented below.

Table 2: Interest Rates Evolution in some Transition Countries, 1994 - Sept. 1996 (%)

Years/ Currency	1994	1995	1996		
			3 months	6 months	One year
Bulgarian Leva	Not available	Not available	58.08	60.66	65.60
Czech Crown	9.10	10.9	12.35	12.40	12.42
Hungarian Forint	31.30	30.00	23.00	23.37	23.50
Russian Ruble	180.00	160.00	55.00	Not available	Not available
Romanian Leu	62.4	41.50	45.00	44.00	42.00

Source: EBRD data (compiled based on central banks figures)

If interest rates are seen as "the price of money", then it should be clearly stated that rates should be positive in real terms, namely that they should be sufficiently high to cover the level of inflation in the respective country. Otherwise, any currency loses its purchasing power, the trust and backing of the population. Many times, interest rates are established with the evolution of the currency in mind, but there are clear cases in which the political factor interfered, especially during the general elections periods. The case of Romania is also illustrative from this point of view. During the early '90s, interest rates were established at high levels (end-year lending rates per annum: 86.4% in 1993, decreasing, but still very high, at over 55% in 1997) in order to alleviate the high depreciating pressure on the Leu and to cover the hyper-inflation of those days. Those were the years when ROBOR (the daily average of interests quoted by the Romanian commercial banks) reached its historical maximum at 226% on 6 March 1997. It was an extreme high, although not many peoples were very concerned. Its utilisation was rather limited to transactions undertaken by a limited number of companies.

The situation could not be any different nowadays, as presented in Table 3 below. With the notable exceptions of Ukraine, Belarus, the Russian Federation and the Republic of Moldova, the current level of interest rates are up to 4%, which is where the rates should normally be. In Romania, ROBOR itself was at a very low level of 2.35%% in December 2017 (12 months, per annum) as compared with the level registered 20 years ago (admittedly increasing from 0.87% as of the start of this year, which stirred some panic in the Romanian society). For comparison reasons, the same Table 3 presents the case of Euro area, Sweden, Denmark and Switzerland, all developed countries, where the rates set by the central banks are negative. If maintained in the long term, they will have damaging repercussions.

Table 3: Interest Rates in Selected Transition Countries, 2017 (%)

Country	Current Level	As of	Previous	Highest	Lowest
Ukraine	14.50	Dec/17	13.5	300	6.5
Belarus	11.00	Oct/17	11.5	480	10
Russia	7.75	Dec/17	8.25	17	5
Moldova	6.50	Nov/17	7	21	3.5
Bosnia and Herzegovina	4.24	Oct/17	4.13	94.09	4.13
Serbia	3.50	Dec/17	3.5	18	3.5
Macedonia	3.25	Oct/17	3.25	15.21	3.21
Croatia	2.50	Oct/17	2.5	4291	2.5
Romania	2.00	Dec/17	1.75	12.5	1.75
Poland	1.50	Dec/17	1.5	24	1.5
Albania	1.25	Dec/17	1.25	8.5	1.25
Hungary	0.90	Dec/17	0.9	28	0.9
Czech Republic	0.50	Dec/17	0.5	39	0.05
Bulgaria	0.00	Dec/17	0	5.77	0
Estonia	0.00	Dec/17	0	4.75	0
Latvia	0.00	Dec/17	0	4.75	0
Lithuania	0.00	Dec/17	0	4.75	0
Slovakia	0.00	Dec/17	0	4.75	0
Slovenia	0.00	Dec/17	0	4.75	0
For Information					
Euro Area	*0.00*	*Dec/17*	*0*	*4.75*	*0*
Sweden	*-0.50*	*Dec/17*	*-0.5*	*8.91*	*-0.5*
Denmark	*-0.65*	*Oct/17*	*-0.65*	*15*	*-0.75*
Switzerland	*-0.75*	*Dec/17*	*-0.75*	*3.5*	*-0.75*

Sources: Central Banks and Trading Economics website (http://tradingeconomics.com accessed on 26 December 2017). The levels are the latest available as of December 2017. The Highest/Lowest Levels have been recorded during the last 10 years.

In Romania's case, the interest rate of the monetary policy is currently at a low level of 2.00% per annum, in accordance with the data published by the NBR[12]. Such a low level could have a positive impact on the lending to the real sector of the economy, but, at the same time, there has been a perverse negative impact like in the case of developed markets. The extremely low level of refinancing rates (supporting the concept of "cheap money") is good for stimulating production, services, trade etc., but it has a very negative impact on deposits, especially on the population's deposits and its saving attitude. Of course, there is no reason to save in a depreciating currency which, first of all, does not even produce any meaningful interests. Moreover, the trust of the population in the currency diminishes as the real purchasing power of the respective currencies (including strong currencies such as USD, EUR, GBP and others) declines, especially if looked at it in real terms. The situation of the Romanian Leu and its refinancing rate is very similar from this point of view.

From a theoretical point of view, it should be noted that a strong currency should be supported by a strong economy. The opinion expressed by a British analyst, W. Rees-Mogg, in one of his articles written back in 1996, namely that the single currency of the European Union (the EUR introduced in 1997) should be supported by the economic and financial power of the states accepting it as their currency, was totally valid. Moreover, the cultural attitude of the respective nations would have a significant importance, noted W. Rees-Mogg[13]. Similar concepts were published by A. Kaletsky and this paper fully endorses these opinions as true as far as the group of the transition countries is concerned.

4.2. Interest Rates and Businesses

Like in developed countries, the level of the interest rates in transition countries has a special importance. It goes without saying that low interest rates are favourable to businesses in all sectors of economy. The alternative case is that high(er) interest rates will hit the economic growth, employment and, finally, the banks themselves as the level of non-performing loans is directly related to the level of interest rates. What is specific to transition countries though is that the low level of interest rates is also related to access to credit by small and medium-sized enterprises (SMEs), which in many cases are seen as the "engine" of the private sector and, finally, of the whole economy. Many such SMEs are start-ups and, obviously, they lack the capital required by lenders in order to grant them credits. In those cases when the SMEs are better established, lower interest rates would allow a higher access to loans as the monthly instalments for repayment will be affordable in terms of their cash-flow. All things being equal, the by-products of such a monetary policy with low interest rates is that the currency of the respective country will become weaker and that inflation will rise faster (as the money is cheap) than in an environment with normal

interest rates. If inflation is high and increasing, then the rates should go up as well, otherwise economy will heat up. The spiral of "inflation-interest rate" will be present in economy sooner or later and then another macro-economic tool will be impacted on, namely the exchange rate of currency[14].

The case of the 1992 - 1994 period when the level of refinancing rates reached the astonishing level of 377% (in March 1994 in the Republic of Moldova) and 180% in the Russian Federation, to invoke just a few examples, should never be contemplated once again, as its impact on the GDP and other macro-economic equilibria (starting with the fast depreciation of the currency) was a disastrous one. Yet, the fate of the savers and of the investment process was not to be a high priority in such a banking environment. It is a fact that, in the '90s, whoever wanted to save literally lost their money. Many savers in transition economies took refuge in USD or EUR or, in the case of more affluent individuals, even in gold. Needless to say, in those days, investments in transition countries were modest, to say the least. From this point of view, the positive impact of the low interest rates should be off-set with the severe consequences on individual savers and institutional investors. Hence, the interest rates' role of an efficient macro-economic tool during transition is easily questionable. The manipulation of interest rates during elections time (there are so many, including nowadays) only made the matter worse.

4.3. Interest Rates and Mortgages in Transition

Mortgages are key banking products of the largest utilization in any country. One fundamental parameter of any mortgage transaction is the interest rate which would apply during the long life of the loan. As such, interest rates started to play a material role in developing various mortgages products. Over the last 15-20 years of transition to market economies, mortgages have started to also play significant roles in the day-to-day life of millions and millions of citizens. In accordance with their roles and charters, many International Financial Institutions (IFIs) such as the European Bank for Reconstruction and Development (EBRD), European Investment Bank (EIB), International Financial Corporation (IFC), Black Sea Trade and Development Bank (BSTDB), KfW (Germany) and FMO (the Netherlands) (to name just a few) started to promote mortgage lending. This was done in a responsible way at any time and more so after the global banking crisis of 2007-2008. For instance, the EBRD launched, in May 2004, in Split (Croatia) an innovative guidance called List of the Minimum Standards and Suggested Best Practices for Financial Institutions, which basically introduced the first standards for mortgage products in almost all the transition countries contracting mortgage loans from this IFI. The document was revised after 2008 and once more in 2016[15]. It was originally designed for both commercial

and residential mortgages. The 2016 edition caters for residential mortgages only. In addition, the EBRD also issued a Mortgage Manual, which was also revised after the 2008 crisis and in 2016. The guidance provided all along by these two documents was that the Loan-to-Value (LTV) and the interest rates practiced by the commercial banks and other mortgage lenders should be responsibly designed to avoid the "mortgage lending bubble" such as the one existing before the 2007 - 2008 crisis. An affordability test is highly recommended[16]. For LTV, the normal recommendation is that it should be of maximum 75-80%, apart from special cases/categories of sub-borrowers such as the young ones. In addition to LTV, one other key ratio utilized by the banks and other mortgage lenders in extending loans is Debt-to-Income (DTI).

Moreover, the interest rates are of special importance for this type of lending as the relationship between the lenders and the borrowers is, in most cases, for many years if not for life. Like in the case of USA, the Governments may consider to deduct, partially or in full, interest paid on mortgages from taxes due by the mortgage borrowers. Meanwhile, for the time being, when setting the prime rates, the central banks have mainly in mind, many times, the important objective to grant reasonable protection to mortgage borrowers. All good, except that in this major banking decision (to set the prime rates), the interests of the savers are almost disregarded, as the number of the borrowers is much larger than that of the savers and in any general elections every vote counts. This was, of course, more valid before the general elections (see the case of Romania-2016, Serbia-2017 and other EU members which are not part of Eurozone). In such circumstances, the distorting final result of such policies is also evident. The lessons of the 2007-2008 sub-prime mortgage crisis should not be forgotten, otherwise the severe consequences will have to be faced again. Also, the lessons of the Greek debt crisis should be well appraised by transition countries, especially by those with a high level of accumulated foreign debts.

5. CONCLUSIONS

It will be quite risky to draw a simple conclusion to this paper and/or to give a yes/no answer to the question in the title. What could be clearly said is that the "interest" and the normal "interest rate" are key macro-economic tools with verified effective functions for hundreds of years. The interest has played and will continue to play a major role in any society for the foreseeable future, as a redistribution of the net income and of the accumulated wealth between different parts of the society or different participants in the creation of such net income will have to be maintained. If the two instruments are used based on a strict economic motivation, their roles will have a positive influence. The macro-

economic reality of the last 25-30 years shows, however, that sometimes a very different approach is decided. The central banks and, under their guidance, the commercial banks and other lenders or financial institutions in developed countries, emerging markets and countries in transition as well are independent from the political factors, but their independence has been questioned many times. Interest rates were especially set (not to use the more appropriate word "manipulated") many times with the general elections' agenda in mind. The setters of the rates weigh the interests of the large number of (individual) borrowers with a higher priority versus the interests of the savers. This attitude could have disastrous economic consequences as it did before the 2007-2008 crisis. The building up of an enormous amount of debts (such as mortgages, credit cards, personal loans, loans for cars etc.) is again a new feature of the markets in many major countries, such as the United States, the United Kingdom, Greece, Spain, Italy and in many countries in transition too (Romania, Serbia, the Republic of Moldova, Poland, the Russian Federation, Ukraine and others, not to mention most of the African countries).

There is no doubt that the role of credit has been positive in recent times in helping economic growth, but the over-stimulation of consumption/indebtedness damages the status of the savers and of the investment processes, via very low interest rates (kept at such artificial low levels or even in negative territories for very long periods of time). This is a dangerous game played by politicians, especially before elections, as in the case of the 2016 US elections. Many other examples could be given. Such situations could have very distorting macro-economic consequences, with macro-economic disequilibria on the shoulders of future generations, not only in the concerned countries, but in some cases with a far reaching global wide-spread. A more balanced approach is imperiously required before it is not too late. The reasons for "emergency" low levels of interest rates expired long ago. The key objective of financial stability is in peril if the deleterious low or even negative rates continue. Actions to change this dramatic situation, mainly taken by central banks and commercial banks, are needed now.

NOTES

[1] See Online Etymology Dictionary, © 2010 Douglas Harper

[2] See Investor Words site (http://www.investorwords.com), consulted on 21 July 2017

[3] Source: See IMF documentation, EBRD - Transitions Reports (various editions); IMF - IFS Yearbooks (various editions up to 2016), Financial Times Lexicon, Investors Words and United Kingdom and local publications available as of end-2017.

[4] Negative Interest Rate - A very unusual situation in which, instead of granting an interest, a fee is charged for deposits taken by the banks. This is a sign of hyper-liquidity in the markets and a clear lack of placement for money deposited by savers. In practice, this is a situation in which even the key interest rates such as EURIBOR or US Libor are very low, at zero or even negative.

[5] Aldrick, P., Waving goodbye to QE means the only way is up for cost of borrowing, The Times - 18 July 2017, page 47

[6] See also endnote 14 on the correlation between interest rates, inflation and exchanges rates and the statistical methods of testing such correlation.

[7] SME - In accordance with the definition published by the EU (in force since 1 January 2005), a small and medium-sized enterprise (SME) is an independent firm with less than 250 employees. A small firm will employ up to 50 employees and a micro-enterprise up to 10 workers. By financial assets, the following thresholds are used to define SMEs: the turnover of an SME with 50-249 employees should not be higher than EUR 50 million, EUR 10 million for a small company and EUR 2 million for micro ones. At the same time, the balance sheets for medium, small and micro enterprises should not exceed EUR 43 million, EUR 10 million and EUR 2 million, respectively.

[8] "Zombie" Companies - a jargon used to define companies that are not viable, but which would still stay in business with the help of subsidies or other facilities (without economic justification).

[9] See Aldrick, P. - Interest rate rise could ruin 80,000 businesses, The Times - 5 June 2017, page 39

[10] See Obstfeld, M. - A Firming Recovery, IMF Blog accessed on 25 July 2017

[11] Kiriţescu, C., Moneda, Mică Enciclopedie, Editura ştiinţifică şi enciclopedică, Bucureşti, 1982 (Romanian language)

[12] Currently, the interest rate of monetary policy is at 2.00% per annum (increased from 1.75%), according to the data published by the National Bank of Romania (see Communique following the Council of Administration meeting on 8 December 2017). On 3 October 2017, NBR decided to restrict the fluctuations of the interests around the rate of monetary policy at +/- 1.25% from +/- 1.50%. The situation could not be any different as compared to mid-'90s, both for Romania and for many other countries in transition.

[13] W. Rees-Mogg - An impoverished currency in The Times - 10 October 1996, page 20

[14] In statistical terms, a correlation between interest rates, inflation and exchange rate evolution could be tested using simple or multiple regression functions such as: f(x) = a + bx; or f(x,m) = a + bx + cm; in which a, b and c are the partial coefficients of the regression function and m, x and y are the annual changes of the key variables tested. To make sure that there is a direct correlation between the tested variables, a "determination coefficient" should be computed. This needs to be closer to 1 to show a strong correlation. However, in a situation in which, for many years, the interest rates are artificially kept at very low levels by the central banks, the utilisation of the statistical methods to test the direct correlation (which theoretically is there) is doomed to fail.

[15] EBRD - List of the Minimum Standards for Residential Mortgage Activities - Third Edition, 2016

[16] The Affordability Test is a computation made for each individual borrower(s) to determine if the respective person(s) is able to repay the debt contemplated to be contracted. This test is normally undertaken by the banks and other lenders for mortgage activities and takes into account the total income of the borrower(s) minus the outgoings (expenses required for a normal living) and the repayments of the future loan. For mortgage lending, the recommended additional ratio (in addition to Loan-to-Value ratio) is Debt-to-Income which should not be higher than 50%.

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