A SFC modeling of Moldova with remittances flows

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Very preliminary and incomplete draft

Abstract

Stock-flow consistent models (SFC) have essentially focused on developed countries and do not take into account migrants' remittances. In this article, we build a post Keynesian SFC model adapted to Moldova, one of the top recipients of remittances. Households' consumption highly depends on remittances in Moldova while these transfers also ease liquidity constraints, leading to a strong effect on economic growth. However, remittances flows are very sensitive to the economic conditions in migrants' destination countries and may create instability in times of economic or political uncertainty. This is particularly true for Moldova since the country is divided between both European and Russian interests. After including remittances in consumption behavior and lenders' risk, we run simulations to show how shocks in destination countries (*i.e.* Euro zone and Russia) impact the Moldovan economy through remittances fluctuations. We also propose two scenarios depending on the evolution of Moldova's relations with Russia and the European Union.

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Introduction

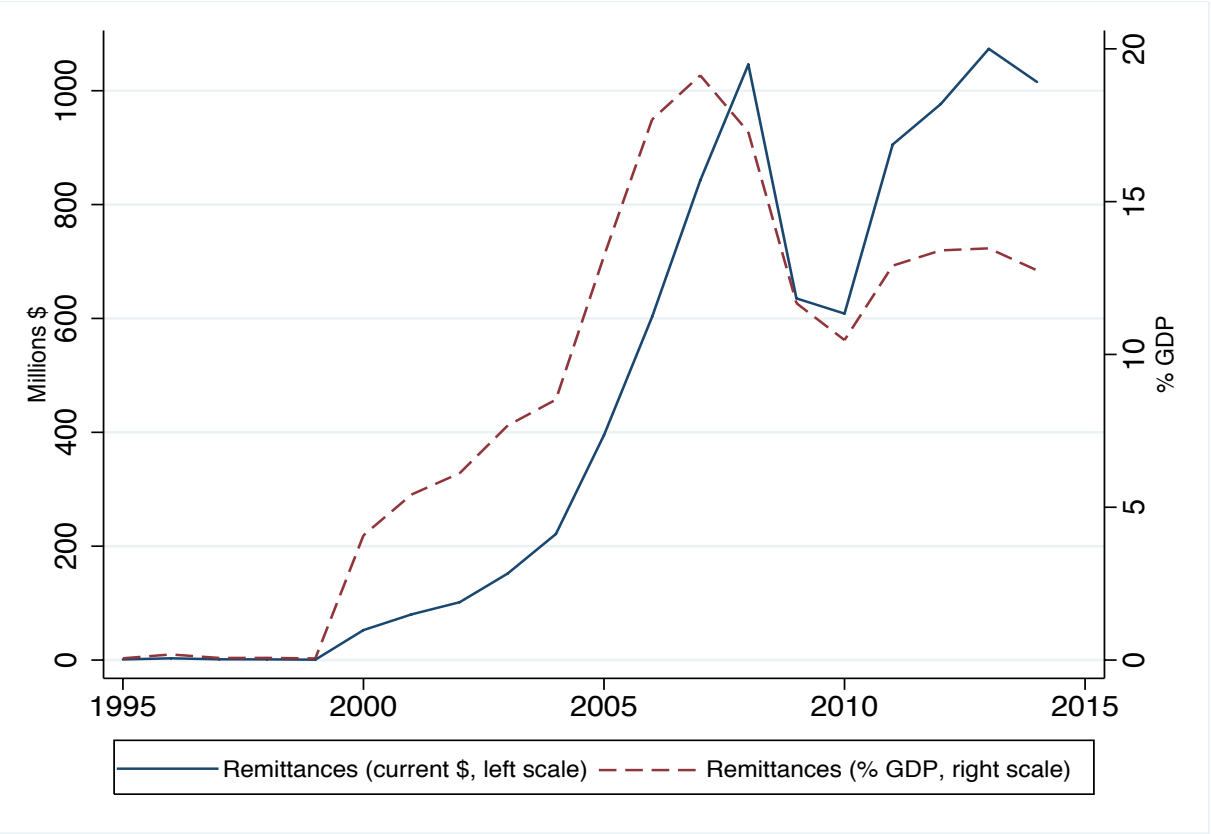
Since many years, remittances represent an important source of income for households in many developing countries. These private transfers reach more than 40 per cent of GDP in the largest recipients, generating numerous effects for households but also for the economy. Macroeconomic effects of remittances have been studied since the early 2000s, with a focus on economic growth (Chami and al., 2005 ; Catrinescu and al., 2009), financial development and investment (Giuliano and Ruiz-Arranz, 2009 ; Aggarwal and al., 2011) and more recently institutions (Ahmed, 2012 ; Berdiev and al., 2013). However, most of these articles are based on econometric analysis using panel data and provide fuzzy results. One disadvantage of econometric studies is being subjected to endogeneity problems and more precisely to reverse causality between explanatory variables and the dependent variable. Even if the most recent econometric methods allow to correct endogeneity biases, their complexity can lead to contradictory results [1]. Empirical results are therefore very contrasted, for example concerning the impact of remittances on private investment : some studies find no significant effect (Abdih and al., 2012) while others report opposite conclusions (Giuliano and Ruiz-Arranz, 2009). It is actually difficult to draw clear conclusions from econometric models since estimated coefficients estimate an "average effect" across a large number of countries.

Given these mixed results, it seems relevant to consider a methodology allowing to estimate the effect of remittances in a specific country. Stock-flow consistent models (SFC) have an interesting potential and have rarely been applied to developing countries yet, with few exceptions as Le Heron and Marouane (2017). In this latter article, the authors analyze how the recent events Tunisia faces (2008 global crisis, 2011 revolution, terrorist attacks in Tunis and Sousse in 2015) have affected the economy.

Our study is inspired by the work of Le Heron and Marouane (2017) and proposes a modeling of the Moldovan economy. The small eastern European country has an important migration rate, accounting for 25 per cent of its active population. Migrants are essentially located in Russia and European Union and send back large amounts of money to

1. Among them, the generalize method of moments (GMM) is widely used. However, David Roodman notes that : *"One disadvantage of difference and system GMM is that they are complicated and can easily generate invalid estimates. Implementing them with a Stata command stuffs them into a black box, creating the risk that users, not understanding the estimators' purpose, design, and limitations, will unwittingly misuse them."* (Roodman, 2009, p. 87).

FIGURE 1 – Remittances sent to Moldova

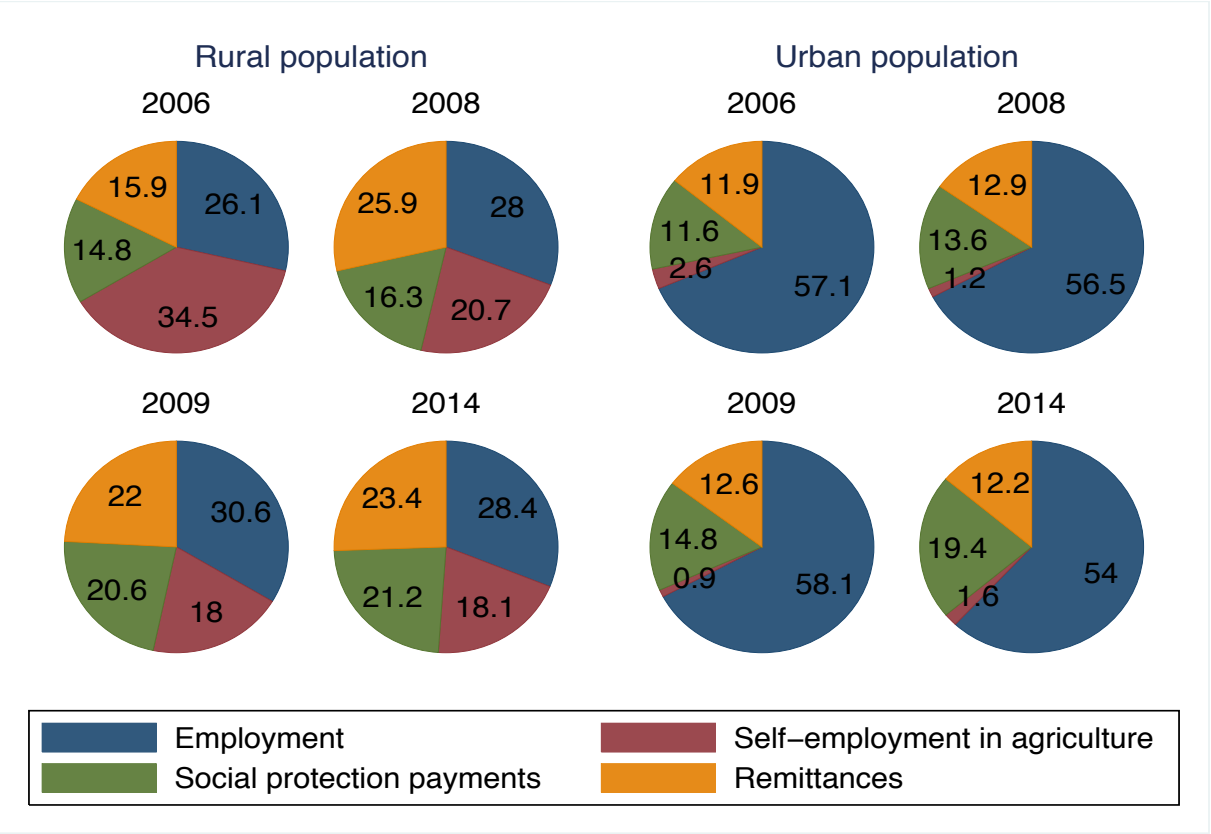


Compensation of employees are not accounted. Including them, the total of remittances reaches 25-30 per cent of GDP. Source : National Bank of Moldova.

Moldova (see Figure 1). Remittances to Moldova account for more than 10-15 per cent of GDP (25 per cent including compensation of employees *i.e.* temporary workers). To the extent that remittances represent an essential source of income and consumption for households, Moldova is considered as a "remittances-dependent" country. Figure (2) exhibits the importance of remittances for Moldovan households, particularly those living in rural areas.

The current literature found that remittances help to stabilize consumption and income in developing countries (Combes and Ebeke, 2011) and decrease poverty. The impact on investment is more controversial and seems to differ depending on the context. For example, Woodruff and Zenteno (2007) show that remittances promote microenterprise investments in Mexico. More generally, the literature suggests that the impact of migrants' remittances is stronger on investment when the level of financial development is low. In that case, they relax financial constraints and increase growth more significantly (Giuliano and Ruiz-Arranz, 2009).

FIGURE 2 – Households' incomes sources



Source : National Bureau of Statistics.

The aim of this paper is threefold. First, we propose a SFC modeling of the Moldovan economy within a three-countries framework, including remittances into behavioral equations. Second, we reproduce the effects of the 2008 global crisis as well as the ruble crisis (2015) in order to put forward the role of remittances on the Moldovan economy. Third, we formulate two scenarios based on the evolution of the relationships between Moldova and Russia.

1 The model

We first establish the balance sheet matrix (table 1) and the transactions matrix (table 2). We follow Godley and Lavoie (2007), Lavoie and Zhao (2010), Le Heron (2011) and Le Heron and Marouane (2017). Six sectors are considered : firms, households, government, private banks, central bank and the rest of the world [2].

2. Since Moldova has important ties with Russia and the countries of euro area, the rest of the world will be represented by these two partners.

Tableau 1 – Balance sheet matrix

	Government	Households	Firms	Private banks	Central bank	Rest of the world		$\sum$
						Russia	Euro area	
Capital			+K					+K
High powered money (HPM)				+H	-H			0
Treasury bills	- B			+ B				0
Loans			$-L_E$	$+L_E$				0
Foreign loans					$-L^{RUB}$ $-L^{EU}$	$+L^{RUB}$	$+L^{EU}$	0 0
Deposits		+D		-D				0
CB advances				-REF	+REF			0
Net wealth	-B	$+V_M$	$+V_E$	$+V_B$	+RES	$+L^{RUB}$	$+L^{EU}$	+K

Tableau 2 – Transactions matrix

	Government	Households	Firms		Private banks		Central bank		$\sum$	Rest of the world				$\sum\sum$
			Current	Capital	Current	Capital	Current	Capital		Russia		Euro area		
Consumption		- C	+ C						0					0
Public expenditure	- G	$+G_M$	$+G_E$						0					0
Investment			+ I	- I					0					0
Wages		+ W	-W						0					0
Remittances		$+REM_{EU}$ $+REM_{RU}$							0 0	$-REM_{RU}$	E_1	$-REM_{EU}$	E_2	0 0
Taxes	+T	$-T_M$	$-T_E$						0					0
Interests on Treasury bills	$-i_{cb-1}.B_{-1}$				$+i_{cb-1}.B_{-1}$				0					0
Interests on loans			$-i_{L-1}.L_{E-1}$		$+i_{L-1}.L_{E-1}$				0					0
Interests on deposits		$+i_{D-1}.D_{-1}$			$-i_{D-1}.D_{-1}$				0					0
Interests on CB adv.					$-i_{cb-1}.REF_{-1}$		$+i_{cb-1}.REF_{-1}$		0					0
Interests on foreign loans							$-\frac{i^{RU}_{L-1}.L^{RU}_{-1}}{E_1}$ $-\frac{i^{EU}_{L-1}.L^{EU}_{-1}}{E_2}$		0	$+i^{RU}_{L-1}.L^{RU}_{-1}$	E_1	$+i^{EU}_{L-1}.L^{EU}_{-1}$	E_2	0
Profits of firms		$+P^d_E$	$-P_E$	$+P^u_E$					0					0
Profits of banks		$+P^d_b$			$-P_B$	$+P^u_B$			0					0
Profit of CB	$+P^d_{cb}$						$-P_{cb}$	$+P^u_{cb}$	0					0
Δ HPM						$-\Delta H$		$+\Delta H$	0					0
Δ Treasury bills	$+\Delta B$					$-\Delta B$			0					0
Δ Loans				$+\Delta L_E$		$-\Delta L_E$			0					0
Δ Deposits		$-\Delta D$				$+\Delta D$			0					0
Δ CB adv.						$+\Delta REF$		$-\Delta REF$	0					0
Δ Foreign loans								$+\frac{\Delta L^{RU}}{E_1}$ $+\frac{\Delta L^{EU}}{E_2}$	0	$-\Delta L^{RU}$	E_1	$-\Delta L^{EU}$	E_2	0
Exports			+ X						0	$-IM_{RU/MO}$	E_1	$-IM_{EU/MO}$	E_2	0
Imports			- IM						0	$+X_{RU/MO}$	E_1	$+X_{EU/MO}$	E_2	0
$\sum$	0	0	0	0	0	0	0	0	0	0		0		0

1.1 Trade

FIGURE 3 – GDP growth rate in Moldova, Russia and euro area

Source : IMF.

Russia and the euro area represent the rest of the world. Figure 3 exhibits a strong correlation between economic growth in these three zones, especially between Moldova and Russia. The Russian crisis (1998) had a strong impact on the Moldovan economy, as well as the various fluctuations up to the end of the 2000s. However, the Moldovan economy is less and less influenced by Russia because of the diversification of its exports, in particular towards European countries.

Our model includes three zones (Moldova, Russia, euro zone) and three currencies (Moldovan leu, Russian ruble, euro). We follow Godley and Lavoie (2007) and Lavoie and Zhao (2010) to model trade flows, with some changes. Moldava's exports depend on the Russian GDP and the Euro zone GDP (y^{EU} and y^{RU}) [3]. On the other hand, we consider that exports are not affected by the exchange rate since Moldova exports agricultural or food products (like wine) essentially. Similarly, imports do not depend on the exchange rate because Moldova imports a large part of its domestic consumption (see figure 5). Hence,

3. Both GDP are expressed in logarithm. "EU " refers to euro zone and "RU " refers to Russia.

a depreciation of the local currency increases inflation rather than decreasing imports. In order to avoid any "black hole", imports from one zone represent the sum of exports of the other two zones.

Moldova's imports come from Euro zone and Russia [4] :

$$IM = (\mu_1 + \mu_2.y^{MO}) + (\mu_3 + \mu_4.y^{MO}) \tag{1}$$

Russia and Euro area both import from Moldova :

$$IM_{RU/MO} = \mu_5 + \mu_6.y^{RU} \tag{2}$$

$$IM_{EU/MO} = \mu_7 + \mu_8.y^{EU} \tag{3}$$

Moldova's exports are the sum of imports of Russia and Euro zone [5]

$$X = \frac{IM_{RU/MO}}{E_1} + \frac{IM_{EU/MO}}{E_2} \tag{4}$$

It should be noticed that trade flows between Moldova and Russia have experienced important changes since 2006. In 2006, Moldova signed agreements with the EU that have been followed by Russian bans on Moldovan products. While exports to Russia represented 40 per cent of Moldovan total exports before 2006, this share has been divided by 2 because of bans. Equations (2) and (3) are therefore calibrated with different values before and after bans.

1.2 Integrating remittances to the model

Households receive remittances (REM) depending on economic conditions in migrants' host countries work i.e. Russia and Euro zone. More precisely, remittances depend on relevant foreign GDP y^{EU} and y^{RU} and exchange rates E_1 and E_2.

4. We present the main equations in the article. The full model is available in appendix.

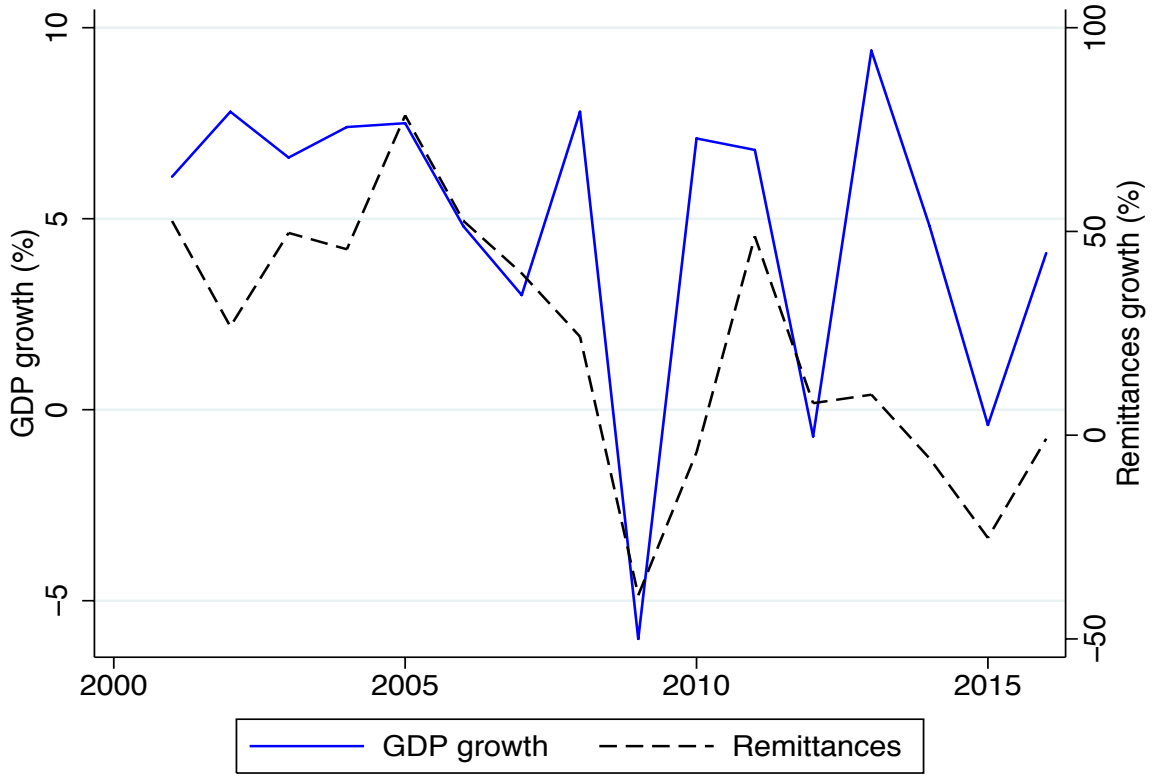
5. E_1 refers to the leu/ruble exchange rate (number of rubles per leu) while E_2 is the leu/euro exchange rate (number of euros per leu).

$$REM_{EU} = \frac{\beta_1 + \beta_2.y^{EU}}{E_2} \tag{5}$$

$$REM_{RU} = \frac{\beta_3 + \beta_4.y^{RU}}{E_1} \tag{6}$$

$$REM = REM_{EU} + REM_{RU} \tag{7}$$

FIGURE 4 – Remittances and GDP growth rate in Moldova



Sources : National Bureau of Statistics, National Bank of Moldova.

Remittances are considered as exogenous to the Moldovan GDP. This assumption is both restrictive and realistic. On the one hand, migrants send money depending on their income in the foreign country but on the other hand, the transferred amounts may fluctuate according to the needs of the recipient households. In fact, our model implies that remittances are procyclical with the host countries (Russia and Euro area) and acyclical with the origin country (Moldova) but this restriction seems relevant according to the Figure 4.

A short look at the balance of payments of Moldova shows that remittances are, for

the most part, sent from Russia (roughly two third of the total), while the rest comes from Europe and Ukraine. We take into account these proportions in the model with the parameters of equations (5) and (6).

1.3 Households

The consumption function includes labor income (Y_w), financial income (Y_v) and the stock of savings (D_{-1}). Remittances (REM) are also included. To the extent that financial development is weak in Moldova, we consider that banks do not provide loans to households.

$$C = \alpha_1 Y_w^a + \alpha_2 Y_v^a + \alpha_3 D_{-1} + \alpha_4 REM \tag{8}$$

Labor income (Y_w) consists of wages (W), social benefits and government transfers (G_M). The government taxes wages and capital (T_M).

$$Y_w = W + G_M - T_M \tag{9}$$

$$W = \frac{\omega}{\sigma}.QR \tag{10}$$

ω represents the wage rate, σ is productivity and QR stands for domestic sales. Financial gains (Y_v) consist of interest earned on deposits ($i_{D-1}.D_{-1}$) and profit shares paid by banks (P_b^d) and firms (P_E^d).

$$Y_v = i_{D-1}.D_{-1} + P_b^d + P_E^d \tag{11}$$

Following Le Heron (2009), our consumption function includes error-correction behavior, as a way to introduce adaptive expectations. Households also spend a little part of their accumulated savings (D_{-1}).

$$Y_w^a = Y_{w-1} + \theta_M.(Y_{w-1} - Y_{w-1}^a) \tag{12}$$

$$Y_v^a = Y_{v-1} + \theta_M.(Y_{v-1} - Y_{v-1}^a) \tag{13}$$

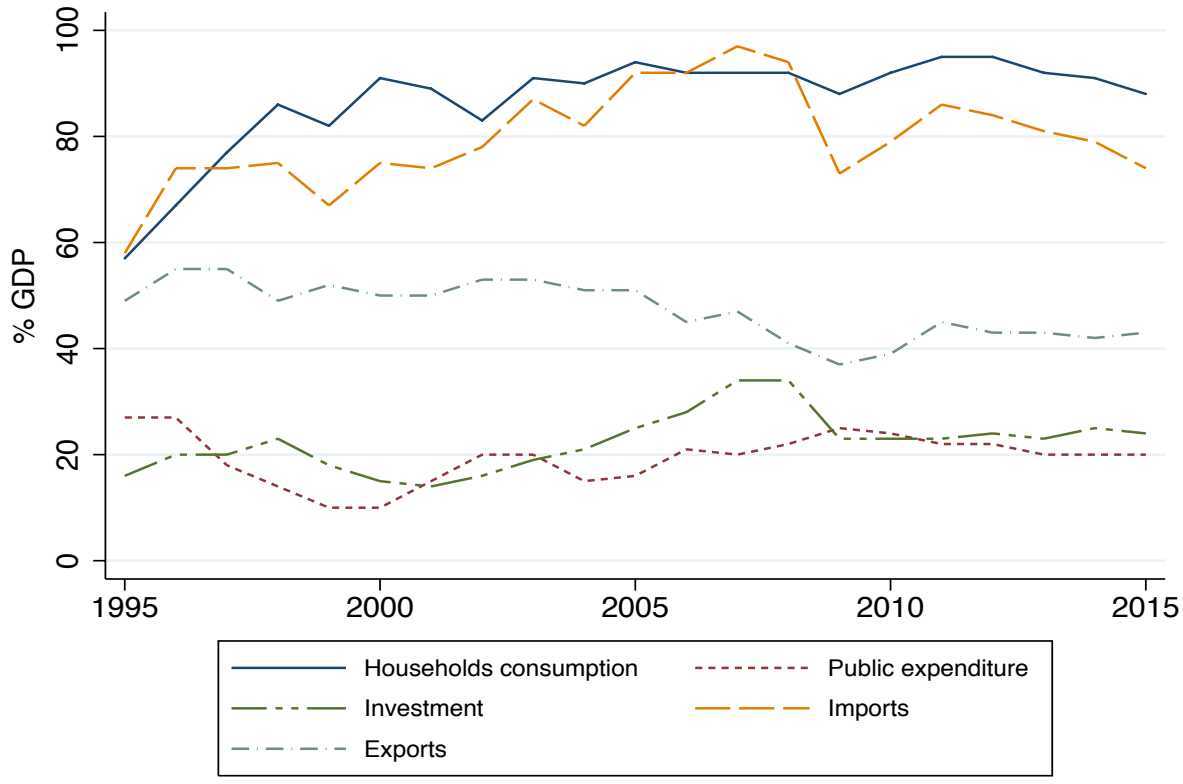
As Cuc and al. (2006) argue, remittances are mainly consumed in Moldova and weakly saved (less than 10 per cent). We thus assume that $\alpha_4 = 0.95$.

1.4 Firms

Figure 5 shows that investment is pretty weak in Moldova, while consumption is, for the most part, imported. In fact, the economy of Moldova is based on agriculture and manufacturing (e.g. clothes and footwear), but the industrial production has slightly increased since the independence (Figure 6).

In addition to their well-established impact on consumption, remittances are also recognize to support private investment in some countries. Remittances can promote investment because (1) they reduce lender-risk by increasing the borrower's wealth (2) they are a substitute for credit when the access to financial services is strongly constrained. This latter mechanism has been empirically identified, for instance by Giuliano and Ruiz-Arranz (2009). Some others articles find that remittances are used to finance small-scale productive activities, particularly in micro-enterprises. Among them, Woodruff and Zenteno (2007) show that remittances are associated with a higher capital/output ratio in Mexico.

FIGURE 5 – Main macroeconomic indicators



Source : National Bureau of Statistics.

Tableau 3 – Moldovan firms (with sizes and sectors)

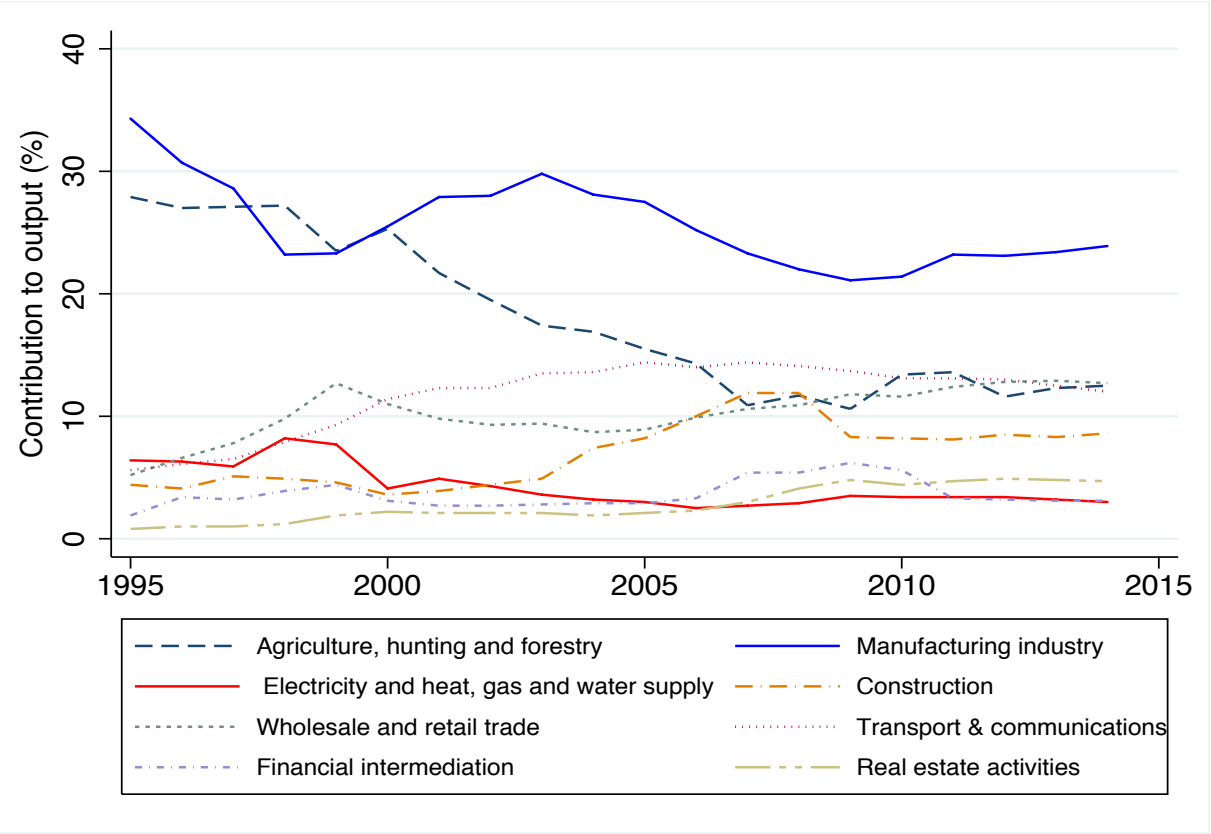
	Big	Medium	Small	Micro
Agriculture hunting, forestry, fishing, pisciculture	72	220	1054	1822
Mining and quarrying	10	12	31	64
Manufacture industry	268	235	1031	2948
Construction	116	120	800	1958
Wholesale and retail trade repairing of motor vehicles motorcycles	524	460	3531	15798
Transportation and storage	61	102	797	1730
Hotels and restaurants	14	42	342	1350
Post and telecommunications	32	41	277	1636
Financial and insurance activities	42	19	129	864
Health and social work	70	78	294	590

Source : National Bureau of Statistics.

Several governments attempt to channel remittances towards investments in order to promote growth in remittances-receiving countries. Since 2010, the Moldovan government tries to increase the growth potential of remittances with a program called "PARE 1+1" [6]. It proposes to double each leu spent in any investment project [7]. The aim is to encourage private investment in a context of a weak financial development while reducing imports [8]. However, the PARE 1+1 program does not meet the expected success (Martinez and al., 2015). In particular, households are subjected to a limit of 200 000 lei (about 9700 euros). Only 504 projects have benefited of public support between 2010 and 2014, for a total of 184 million lei (9 million euros) (Martinez and al., 2015, p. 12). Empirically, Hristev and al. (2009) show that less than 10 per cent of remittances are invested in Moldovan

6. Project of Attracting Remittances in Economy
7. Mexico has developed similar incentives though the well-known 3X1 program.
8. Indeed, remittances increase imports rather than internal demand.

FIGURE 6 – Contribution to output, by sectors



Source : National Bureau of Statistics.

rural areas. On the other hand, remittances can promote investment by relaxing the financial constraints of borrowers (IMF, 2005). In this case, remittances are considered as a collateral because lenders are more likely to grant a loan if the borrower enjoys an exogenous income. Despite the limited success of the PARE 1+1 program we will consider - with regard to the current literature - that remittances stimulate investment slightly by decreasing the lender's risk. The important number of micro-enterprises in Moldova (table 3) confirm that remittances may contribute to finance small investment projects.

The investment function is close to Le Heron (2011) but adapted to the Moldovan context. Since financial development is low in Moldova, we consider that firms can increase their investment by self-financing or borrowing only. There is one kind of loan and no financial assets such as commercial papers or bonds on equities.

$$I \equiv \rho + IF \tag{14}$$

$$IF = P_E^u - \theta L_{E-1} \tag{15}$$

P_E^u is retained earnings and L_E firms loans. As in Le Heron (2011), we consider that firms prefer self-financing and borrow external funds if necessary. Since investment is partially financed with external funds, the demand of desired investment (I^d) is not always satisfied. A financing constraint may arise and depends on banking behavior [9].

$$I^d = gr_{Kd}.K_{-1} \tag{16}$$

$$\rho^d = I^d - IF \tag{17}$$

$$gr_{Kd} = \gamma_1 + \gamma_2 r_{cf-1} + \gamma_3 U_{-1} - \gamma_4 lev_{-1} \tag{18}$$

ρ^d is the desired amount of external funds. Desired growth of capital (gr_{Kd}) depends on an exogenous state of confidence parameter (γ_1), the rate of cash flow (r_{cf}), the capacity utilization rate (U) and leverage (lev).

$$lev = \frac{L_E}{K_{-1}} \tag{19}$$

$$r_{cf} = \frac{P_E}{K_{-1}} \tag{20}$$

$$U = \frac{Y}{Y^\star} \tag{21}$$

$$Y^\star = K_{-1}.\sigma \tag{22}$$

$Y^\star$ is the full capacity output. Firms' profits are therefore :

$$P_E \equiv C + I + G_E + X - IM - W - T_E - i_{L-1}.L_{E-1} \tag{23}$$

T_E are taxes, W wages and G_E public subsidies.

1.5 Private banks

Private banks set an interest rate on loans based on the central bank's main rate (i_{cb}), plus a mark-up (χ_1). The interest rate on deposits is lower and the profit (P_b) is partially

9. See Le Heron and Mouakil (2008) for a complete explanation of this financing constraint.

paid to households.

$$P_b = i_{cb-1}.B_{-1} + i_{L-1}.L_{E-1} - i_{cb-1}.REF_{-1} - i_{D-1}.D_{t-1} \tag{24}$$

B are treasury bills, REF is central bank refunds and i_{cb} the central bank's main rate. Banks care about remittances since they increase the creditworthiness of the borrower. Migrants' transfers are therefore an additional guarantee for the lender : if the loan goes bad, the borrower can still use remittances to repay his debt. LR represents the lender risk and depends on an exogenous state of confidence parameter ($-\phi_1$), leverage (lev) and the main central bank's interest rate (i_{cb}). To the extent that the contribution of remittances to investment seems to be low in Moldova, we assume that the effect on the lender risk is weak and related to their growth ($\frac{\Delta REM}{REM_{-1}}$).

$$\rho = \rho^d.(1 - LR) \tag{25}$$

$$LR = -\phi_1 + \phi_2 lev - \phi_3 \frac{\Delta REM}{REM_{-1}} + \phi_4 i_{cb} \tag{26}$$

$$i_L = i_{cb} + \chi_1 \tag{27}$$

$$i_D = i_{cb} - \chi_2 \tag{28}$$

1.6 The government

The government taxes wages ($\lambda_1.W_{-1}$) and deposits ($\lambda_2.D$). Firms' profits (P_E) are also taxed (λ_3) as well as domestic sales ($\lambda_4.Q_D$).

$$T_M = \lambda_1.W_{-1} + \lambda_2.D \tag{29}$$

$$T_E = \lambda_3.P_E + \lambda_4.Q_D \tag{30}$$

$$Q_D = C + I + G \tag{31}$$

The government's deficit is financed with treasury bills (ΔB). As in Le Heron and Marouane (2017), public expenditure grows at the same pace than the economy in the last period grY_{-1}^{MO} involving a slight counter-cyclical effect.

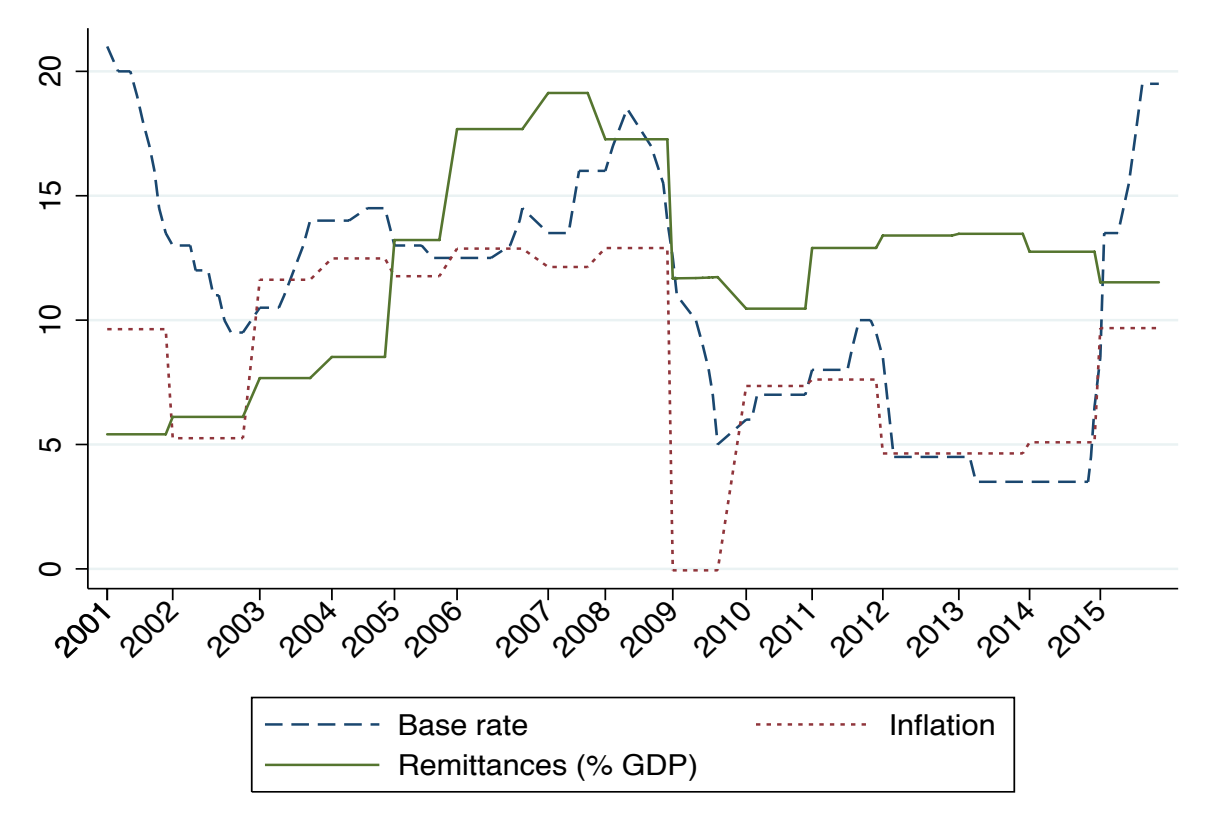
$$G = G_{-1}.(1 + grY_{-1}^{MO}) \tag{32}$$

$$\Delta B = DG \tag{33}$$

$$DG \equiv G + (i_{cb-1}.B_{-1}) - T - P_{cb}^{d} \tag{34}$$

1.7 The central bank

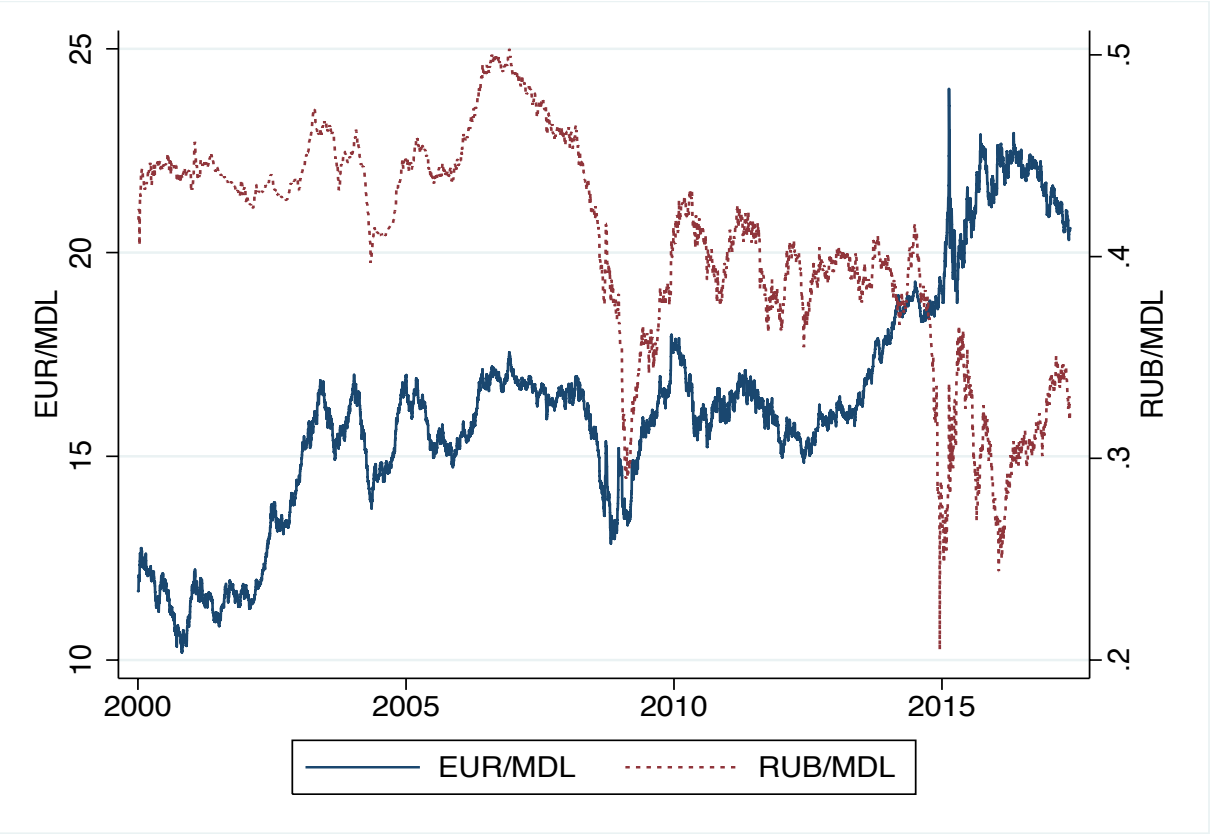
FIGURE 7 – Base rate, inflation and remittances



Source : National Bank of Moldova.

The first objective of the Moldovan central bank is targeting inflation at a rate of 5% (± 1.5%). There is no exchange rate target officially but it seems obvious that currency fluctuations are a matter of concern for the central bank. To the extent that a large part of consumption goods is imported in Moldova, inflation is highly dependent of exchange rate fluctuations. Hence, the central bank make sure to keep the leu between an "acceptable band" in order to stabilize prices, as shown by figure 8

FIGURE 8 – Leu/ruble exchange rate vs leu/euro exchange rate



Source : National Bank of Moldova. EUR/MDL is the number of lei per euro, RUB/MDL is the number of lei per ruble

Remittances can affect monetary policy in two ways. First, it is recognized that an exogenous income favors inflation due to the increasing demand in domestic markets (Narayan and al., 2011). Remittances are also likely to create an appreciation of the local currency while reducing exports in the receiving country, a phenomenon known as the "Dutch disease" (Acosta and al., 2009 ; Bayangos and Jansen, 2011). However, remittances are obviously not correlated to inflation in Moldova, while exports have been stable since 2000's. For these reasons, we consider that remittances do not affect the monetary policy. However, they represent an essential source of foreign currency and help the central bank keeping the exchange rate to a suitable value.

The profit of the central bank (P_{cb}) depends on the interests paid by privates banks ($i_{cb-1}.REF_{t-1}$), minus interests paid on European and Russian loans $\left[i^{EU}_{L-1}.\frac{L^{EUR}_{-1}}{E_2}+i^{RU}_{L-1}.\frac{L^{RU}_{-1}}{E_1}\right]$.

$$H = \eta.D \tag{35}$$

$$P_{cb} = i_{cb-1}.REF_{t-1} - \left[i^{EU}_{L-1}.\frac{L^{EUR}_{-1}}{E_2} + i^{RU}_{L-1}.\frac{L^{RU}_{-1}}{E_1} \right] \tag{36}$$

The interest rate i_{cb} is exogenous, as well as the monetary policy [10]. However, we take into account exchange rate fluctuations in our simulations using the observed values of the exchange rate (see next section).

10. We are currently working on a Taylor rule including a target for both inflation and the exchange rate. The results are not presented in this early version of the paper.

2 Some experiments simulating the fluctuations of remittances

2.1 The global financial crisis (2008-2009) and the Russian currency crisis (2014-2015)

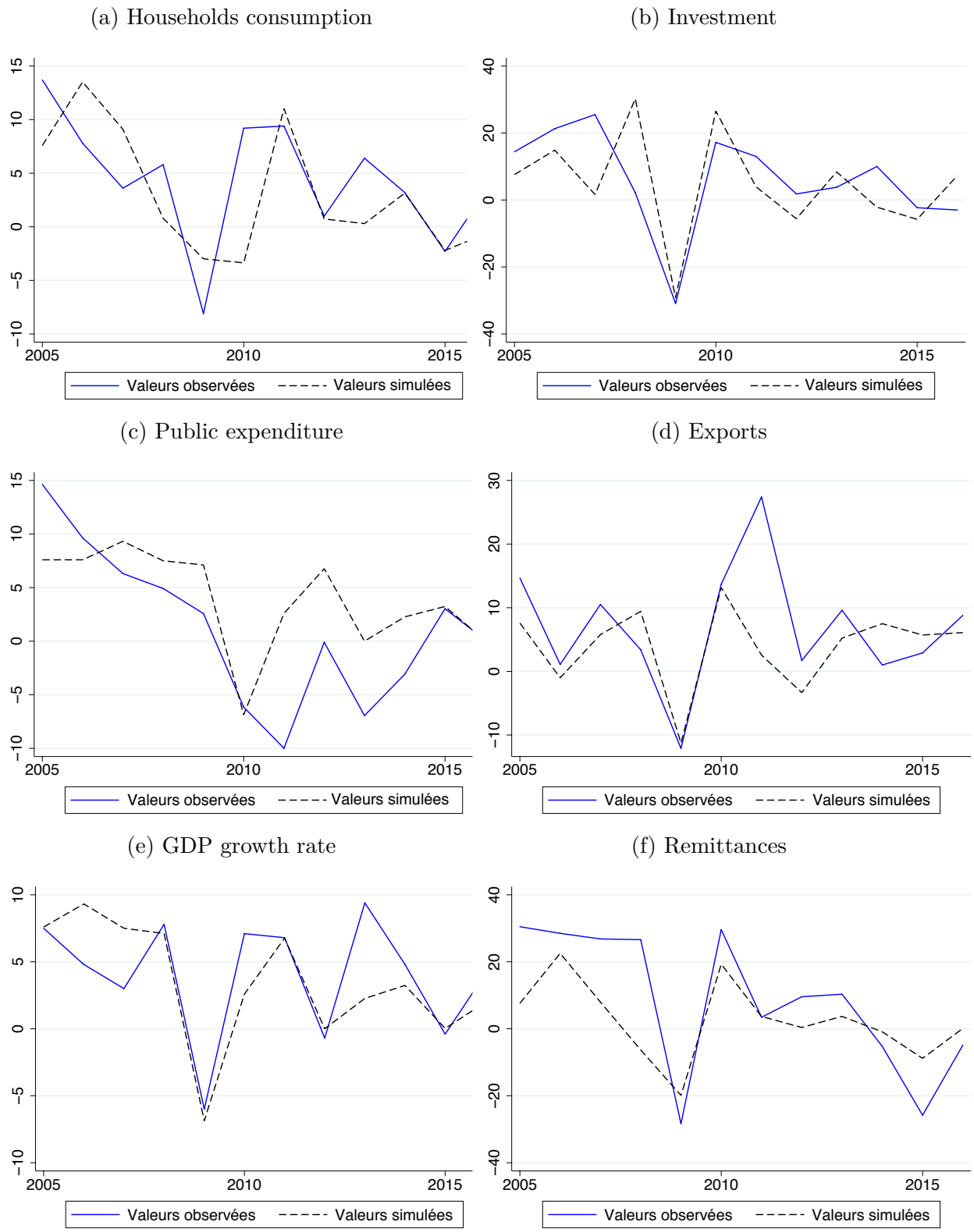
The global crisis of 2008-2009 has sharply affected the Moldovan economy through the decline in exports and remittances. Figure 1 shows that remittances declined by around 40 per cent in 2009 with major consequences at both micro and macro level. We reproduce the effects of the crisis using the empirical values of Russian and Euro zone respective GDPs. We also replace E_1 and E_2 by the empirical values of exchanges rates in order to take into account monetary fluctuations. By including currencies fluctuations, we are able to estimate the effect of the Ruble crisis (2014-2015). Insofar as remittances are sent in foreign currencies, a sudden drop of the ruble depreciates the real value of foreign income received by Moldovan households.

This first simulation aims to estimate the extent to which the Moldovan economy depends on external factors. This question is particularly relevant because Moldova's exports are mainly addressed to the countries where Moldovan migrants are working. Hence, a recession in Russia or in Euro zone implies a simultaneous drop in remittances and in external demand (*i.e.* exports) for Moldova. In fact, remittances and external demand both depend on Russian and European economic conditions. This could explain why the Moldovan GDP is very unstable, as shown by Figure 4.

The results of these experiments are shown in figure 9. As said before, we have used the empirical values of the Russian and the European respective GDPs and exchange rates to run the simulation. We also decrease the state of confidence ϕ_1 in 2009 while the other parameters remain constant. The simulated variables follow the empirical values pretty well, with some important deviations though. For instance, the estimated growth rate does not capture the sudden recovery of the Moldovan economy in 2013. These differences come from the discretionary fiscal policy that our model cannot take into account.

The simulated variable for remittances follows roughly the same trend than the empirical values, meaning that our modeling is quite consistent. This confirms that transfers highly

FIGURE 9 – Main trends in the Moldovan economy, observed vs simulated values



Period-to-period growth. Blue solid lines represent observed values, dashed lines are simulated values.

depend on the situation of the host countries and also on the exchange rate, in accordance with the specification of equations (5-6). These early results suggest that Moldova's economy is highly related to external factors and more precisely to Russian and European economic conditions. By changing the values of EU and Russian GDP as well as exchange

rates, our model catches the main trends of the Moldovan economy. In particular, a sudden drop of remittances dramatically decreases internal demand, while exports decline simultaneously. Because remittances sent to Moldova depend on economic conditions in migrants' host countries, they contribute to transmit external shocks to the domestic economy. To the extent that host countries (Russia, EU) are also the main destinations of Moldova's exports, a decline in external demand is magnified by simultaneous fluctuations of remittances.

2.2 Simulating an economic shock in Russia

We now focus on Russia specifically since this country hosts the largest share of Moldovan migrants (about 40 per cent of the total). In order to show how the Russian economy affects Moldova through remittances, we simulate a recession from the steady state. Based on empirical facts, we assume that Russia experiences a negative growth of -7.8% during one period (like in 2009) then recovers the next year. This allows to estimate how the Russian economic cycle affects remittances while currency and European GDP remain constant.

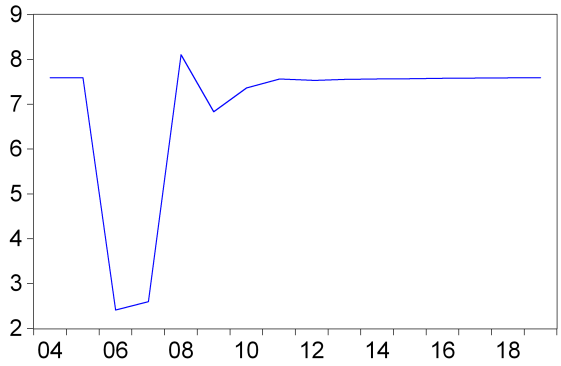
Figure 10 shows that remittances are modestly affected, at around 5.5 per cent. This trend is much lower than the previous value and means that remittances are affected by other factors. The Moldovan GDP growth rate is temporarily reduced, but returns quickly to its initial level. The variables depending on remittances, namely consumption and investment, are temporarily but sharply impacted. In fact, this simulation shows that a temporary economic shock in Russia affects the Moldovan economy but only in the short term. Even if the GDP growth rate is reduced, it remains positive and recovers very quickly. These important differences with the previous results suggest that the declines in remittances observed in 2009 and 2015 are probably due to monetary fluctuations.

2.3 Simulating a currency crisis in Russia

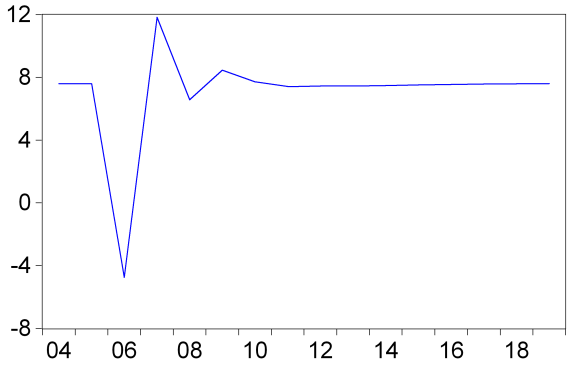
In order to estimate the impacts of currency fluctuations, we simulate a depreciation of the ruble. During the 2009 crisis, the ruble depreciated by more than 30 per cent (figure 8), we thus use a similar depreciation rate to run our simulations. This time, the Russian GDP growth rate remains constant, which makes it possible to differentiate between economic and monetary effects. Figure 11 shows that a ruble depreciation has significant

FIGURE 10 – Impacts of an economic shock in Russia on the Moldovan economy

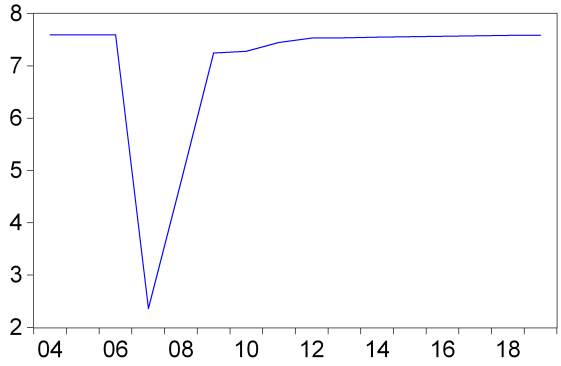
(a) Households consumption



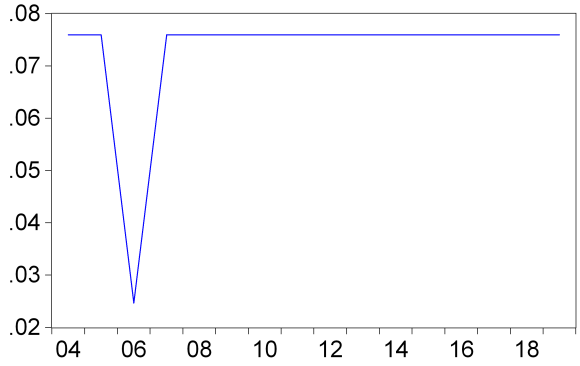
(b) Investment



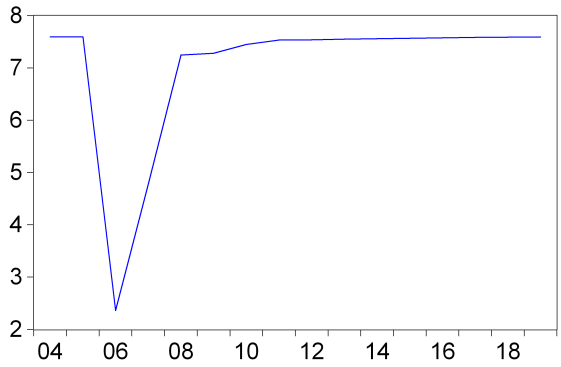
(c) Public expenditure



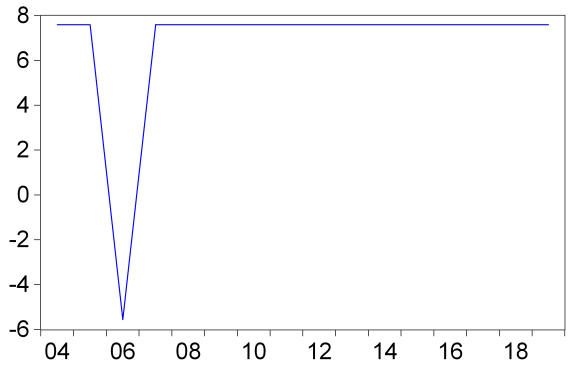
(d) Exports



(e) GDP growth rate



(f) Remittances



Period-to-period growth (%).

effects on remittances. They are reduced by about 10 per cent, twice more compared with the previous simulation. Similarly, the other variables are more strongly affected, especially investment. It should be noticed that all variables increase sharply after the shock because the value of the ruble is assumed to recover two years after the initial shock. In practice, depreciation is often a brutal phenomenon while an appreciation is generally more progressive. This explains why our variables look somewhat volatile. These early estimates should be interpreted carefully because inflation is not yet included in the model.

Indeed, ruble depreciation should be associated with rising inflation in Russia and this rise in prices probably limits the effect on remittances by increasing migrants' nominal wages. As a result, our simulation may bias upward the effect of the currency crisis since inflation is supposed to offset the impact of a currency depreciation.

However, we can say that Moldova is vulnerable to remittances fluctuations which are themselves due to monetary issues. Using the growth rates of Russia and the fluctuations of the ruble, we find an unstable currency is indeed the main source of volatility. A closer look at the empirical data confirms our point. If we look at the 2008 crisis versus the 2015 crisis, we can see that the fall of remittances is pretty similar in the two cases as well as the ruble depreciation rate. However, the Russian recession is three more time important in 2009 than in 2015. Remittances seem therefore more sensitive to the ruble fluctuations than to the Russian GDP growth rate.

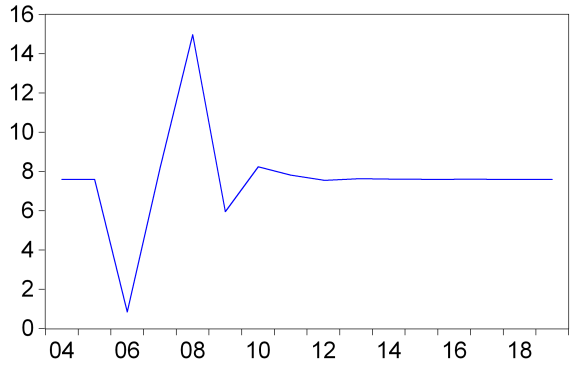
2.4 Simulating a permanent shock in remittances

This last series of simulations examine the consequences of a permanent decline in remittances that is not related to economic factors. As we suggested at the beginning of this paper, Moldova is currently divided between European and Russian interests. On the one hand, European integration represents an opportunity to increase exports towards Euroland but one the other hand it exposes the Moldovan government to Russian sanctions. Indeed, the Russian government has always applied punitive sanctions when Moldova signed agreements with the EU (like in 2006 and more recently in 2014). The issue of European integration is particularly relevant since Moldovan have elected a pro-Russian president in 2016 (Igor Dodon) while the prime minister is clearly pro-European. If Moldova joins the EU, it is clear that Russia is not going to remain inactive. Since Moldova is not dependent to Russia's imports anymore, the punitive sanctions could target migrants' transfers rather than exports. For instance, Russia refused any visa application during the conflict with Georgia (2006) and limited money transfers to this country.

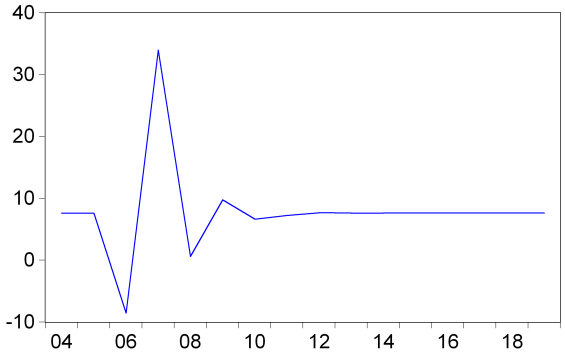
We consider a scenario where Moldova increases its integration to European markets, while Russia applies punitive sanctions simultaneously. We simulate an exogenous drop in remittances sent from Russia, which is not related to economic conditions. At the same time, we consider that Moldovan citizens circulation conditions are made more flexible in

FIGURE 11 – Impacts of a ruble crisis on the Moldovan economy

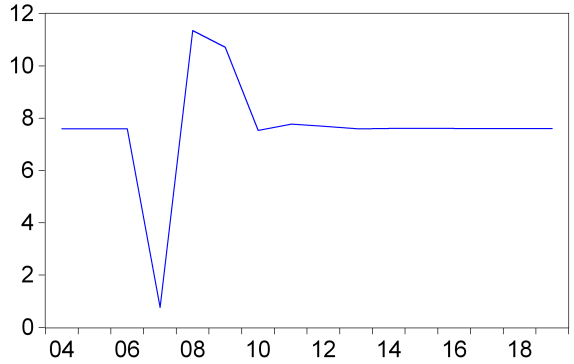
(a) Households consumption



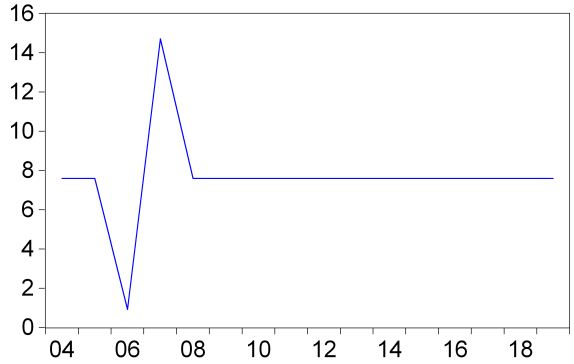
(b) Investment



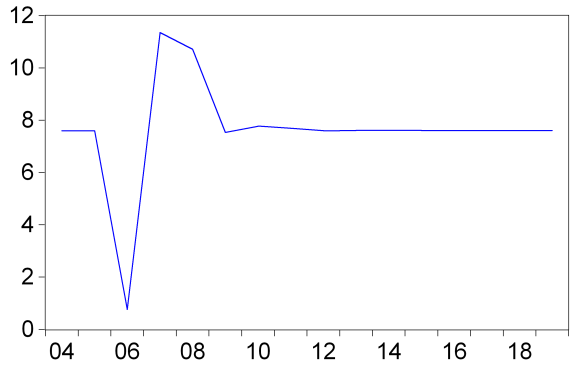
(c) Public expenditure



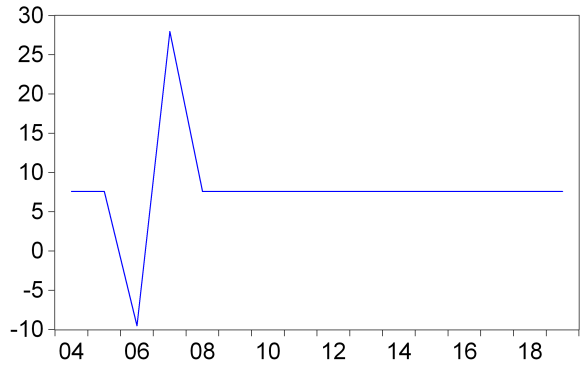
(d) Exports



(e) GDP growth rate



(f) Remittances



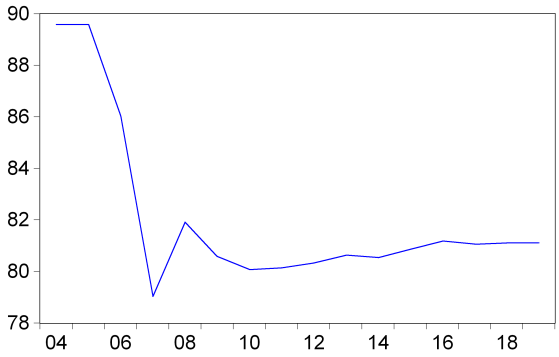
Period-to-period growth.

Europe, which increases remittances sent from this area. In our scenario, remittances sent from Russia decline sharply at first, while European transfers increase more gradually to account for the fact that migrants can not move immediately. A large part of the Moldovan population is indeed Russian-speaking : therefore, European integration does not mean that all migrants will move massively towards European countries. We do the same thing for exports because European standards require the quality of Moldovan products to be increased (Cenusa and al., 2014). In other words, losses on remittances and

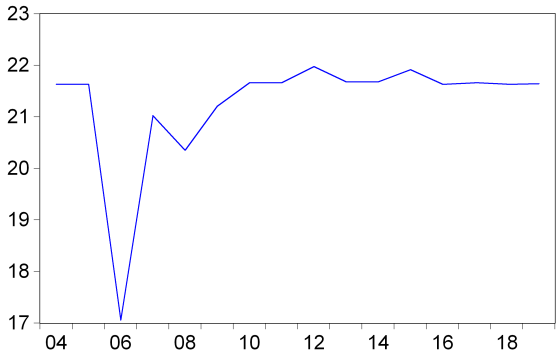
on exports to Russia are not immediately offset by more flexible access to the European markets. Since Moldova is a remittances-dependent country, it seems relevant to examine the consequences of a decline in remittances, whatever the causes [11].

FIGURE 12 – Impacts of a permanent shock on remittances

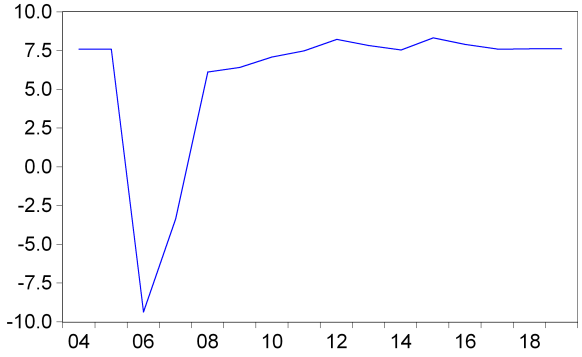
(a) Households consumption



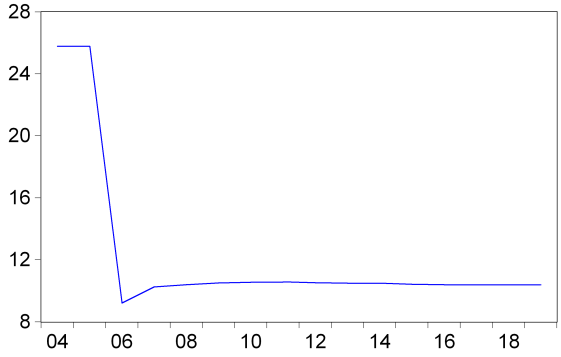
(b) Investment



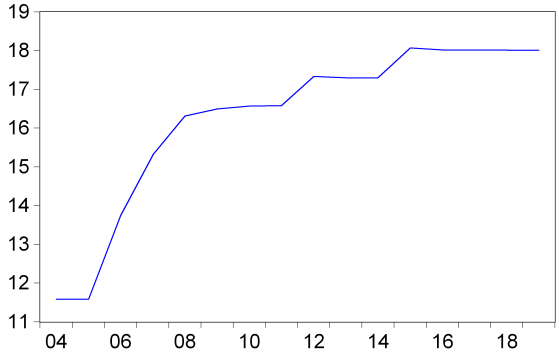
(c) GDP growth rate



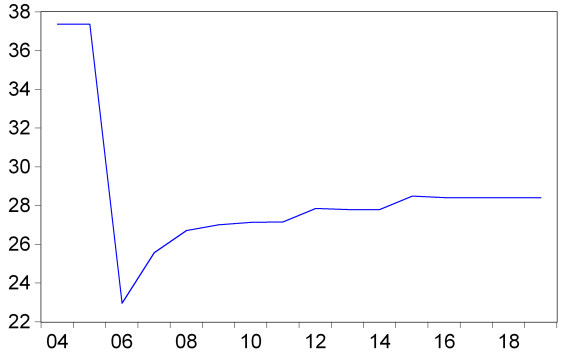
(d) Remittances (sent from Russia)



(e) Remittances (sent from euro area)



(f) Remittances (total)



% of GDP (except GDP growth rate).

The results are reported in Figure 12. The decline in remittances and exports to Russia begins in period 5. At the same time, exports to Europe are gradually increasing from period 6 onwards, as are remittances from period 7. We consider Russian and European

11. In other words, the shock may be interpreted, more generally, as an "exogenous shock".

GDP growth rates to be identical and constant in order to make sure our shock is exogenous. The graphs show that consumption is strongly affected by the fall in remittances. Even if remittances sent from Europe are gradually increasing, consumption remains at a low level compared with initial values. However, the GDP growth rate recovers pretty quickly as well as investment.

An exogenous drop in remittances has important short-term impacts on growth and persistent effects on the level of consumption. This result confirms that households are highly exposed to external factors and that remittances, rather than stabilizing their consumption, can increase volatility. In opposite with current literature, our simulations suggest that remittances increase the vulnerability of households because they represent a important part of their income. In the case of Moldova, the country concentrates risks rather than diversifies them (as remittances are supposed to do).

Concluding remarks

This article proposes a SFC modeling of Moldova. This is the first model accounting for remittances, allowing to complete the current literature with an innovative approach. Our results show that Moldova is strongly dependent on external factors because its GDP fluctuates according to economic conditions in Russia and Euro zone. This procyclical behavior is partly due to remittances which finance a large part of internal demand and make Moldova exposed to external fluctuations. The simulations suggest that remittances spread external shocks to the domestic economy, for instance in event of a ruble depreciation. By suddenly decreasing remittances, a drop of Russia's currency reduces households consumption in Moldova as well as imports.

We also propose a scenario in which Moldova increases its European integration while Russia respond with sanctions on exports and migrants visas. Even if the access to European markets improves Moldova's exports, the drop of remittances sent from Russia has persistent effects on households consumption. Several improvements of the model are discussed, such as including inflation and monetary policy with an augmented Taylor rule taking into account exchange rate targeting.

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Appendix

Appendix 1 : The full model

$Y = C + I + G + X - IM$	National income
$gr_Y^{MO} = \dfrac{\Delta Y}{Y_{-1}}$	National income growth rate
$T \equiv T_M + T_E$	Taxes
$T_M = \lambda_1 W_{-1} + \lambda_2 D$	Taxes (households)
$T_E = \lambda_3 P_E + \lambda_4 Q_D$	Taxes (firms)
$Q = C + I + G + X$	Sales
$Q_D = C + I + G$	Domestic sales
$\Delta B = DG$	ΔTreasury bills
$DG \equiv G + (i_{cb-1}.B_{-1}) - T - P_{cb}^d$	Public deficit
$G = G_{-1}.(1 + grY_{-1}^{MO})$	Public expenditure
$G_E \equiv G - G_M$	Public transfers (firms)
$G_M = z.G_{-1}$	Public transfers (households)
$I^d = gr_{Kd}.K_{-1}$	Demand of investment
$K = K_{-1} + I$	Capital
$IF = P_E^u - \theta L_{E-1}$	Self financing
$I \equiv IF + \rho$	Investment
$\rho^d = I^d - IF$	Desired external funds
$gr_{Kd} = \gamma_1 + \gamma_2 r_{cf-1} + \gamma_3 U_{-1} - \gamma_4 lev$	Desired growth in capital
$r_{cf} = \dfrac{P_E}{K_{-1}}$	Cash flow ratio
$U = \dfrac{Y}{Y^\star}$	Capacity utilization rate
$Y^\star = K_{-1}.\sigma$	Output of full capacity
$W = \dfrac{w}{\sigma_2}.Q$	Wages
$P_E \equiv C + I + G_E + X - IM - W - T_E - i_{L-1}.L_{E-1}$	Firms profits
$P_E^d = \kappa_1.P_E$	Distributed profits
$P_E^u = P_E - P_E^d$	Non distributed profits

$$Y_w^a = Y_{w-1} + \theta_M.(Y_{w-1} - Y_{w-1}^a)$$ Expected disposable wage income

$$Y_v^a = Y_{v-1} + \theta_M.(Y_{v-1} - Y_{v-1}^a)$$ Expected disposable financial income

$$Y_w = W - T_M + G_M$$ Disposable wage income

$$Y_v = i_{D-1}.D_{-1} + P_b^d + P_E^d$$ Disposable financial income

$$Y_M = Y_w + Y_v + REM$$ Disposable income of households

$$C = \alpha_1 Y_w^a + \alpha_2 Y_v^a + \alpha_3 D_{-1} + \alpha_4 REM$$ Households consumption

$$REM = \frac{\beta_1 + \beta_2.y^{EU}}{E_2} + \frac{\beta_3 + \beta_4.y^{RU}}{E_1}$$ Remittances

$$\Delta D \equiv Y_M - C$$ ΔDeposits

$$\Delta L_E \equiv I - P_E^u$$ ΔLoans

$$\rho = \rho^d.(1 - LR)$$ External funds

$$LR = -\phi_1 + \phi_2 lev - \phi_3 \frac{\Delta REM}{REM_{-1}} + \phi_4 i_{cb}$$ Lender's risk

$$lev = \frac{L_E}{K_{-1}}$$ Leverage ratio

$$X_{MO/RU} = \frac{IM_{RU/MO}}{E_1}$$ Moldova's exports to Russia

$$X_{MO/EU} = \frac{IM_{EU/MO}}{E_2}$$ Moldova's exports to Euro area

$$IM_{MO/RU} = \mu_1 + \mu_2.y^{MO}$$ Moldova's imports from Russia

$$IM_{MO/EU} = \mu_3 + \mu_4.y^{MO}$$ Moldova's imports from Euro area

$$IM_{RU/MO} = \mu_5 + \mu_6.y^{RU}$$ Russia's imports from Moldova

$$IM_{EU/MO} = \mu_7 + \mu_8.y^{EU}$$ EU's imports from Moldova

$$\Delta L^{EU} \equiv E_2.IM_{MO/EU} - E_2.X_{MO/EU} + i_{L-1}^{EU}.L_{-1}^{EU} - E_2.REM_{EU}$$ Loans (euros)

$$\Delta L^{RU} \equiv E_1.IM_{MO/RU} - E_1.X_{MO/RU} + i_{L-1}^{RU}.L_{-1}^{RU} - E_1.REM_{RU}$$ Loans (rubles)

$$i_L = i_{cb} + \chi_1$$ Interest rate on loans

$$i_D = i_{cb} - \chi_2$$ Interest rate on deposits

$$P_b \equiv i_{cb-1}.B_{-1} + i_{L-1}.L_{E-1} - i_{cb-1}.REF_{-1} - i_{D-1}.D_{t-1}$$ Profits of banks

$$P_b^d = \kappa_2.P_b$$ Distributed profits of banks

$$P_b^u = P_b - P_b^d$$ Non distributed profits of banks

$$H = \eta D \qquad \text{High powered money}$$

$$P_{cb} \equiv i_{cb-1}.REF_{-1} - \left[i^{EU}_{L-1}.\frac{L^{EUR}_{-1}}{E_2} + i^{RU}_{L-1}.\frac{L^{RU}_{-1}}{E_1} \right] \qquad \text{Profits of the central bank}$$

$$P^{d}_{cb} = P_{cb}.\zeta \qquad \text{Distributed profits of the central bank}$$

$$P^{u}_{cb} \equiv P_{cb} - P^{d}_{cb} \qquad \text{Non distributed profits of the central bank}$$

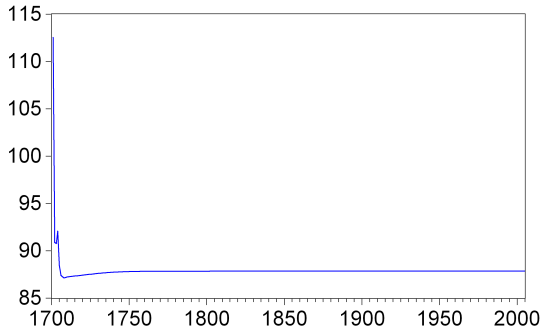
$$\Delta REF \equiv \Delta H + \Delta B + \Delta L_E - P^{u}_{cb} - \Delta D \qquad \text{CB refunds}$$

$$H_{th} \equiv H_{th-1} + \Delta REF - \frac{\Delta L^{EU}}{E_2} - \frac{\Delta L^{RU}}{E_1} - P^{u}_{cb} \qquad \text{Missing equation}$$

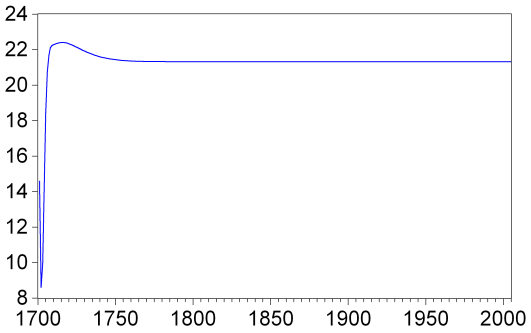
Appendix 2 : The steady state

FIGURE 13 – Steady state

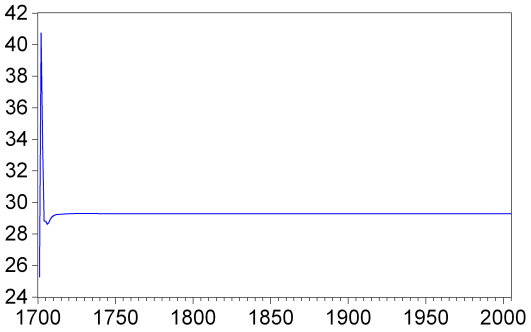
(a) Households consumption



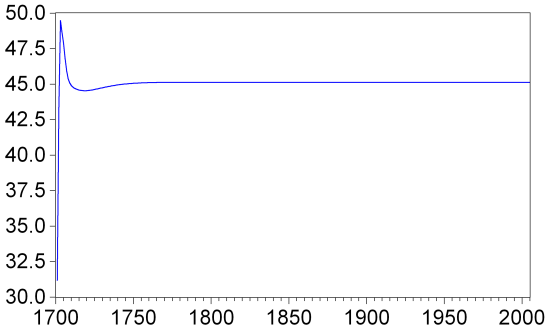
(b) Investment



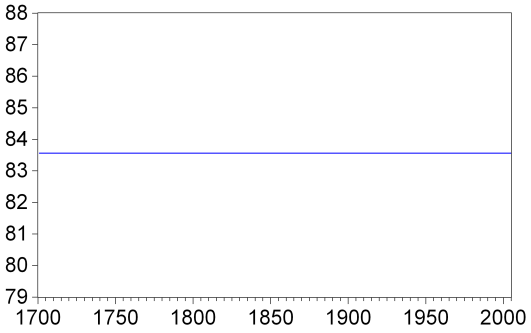
(c) Public expenditure



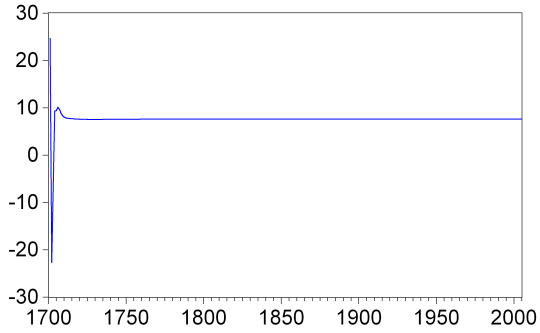
(d) Exports



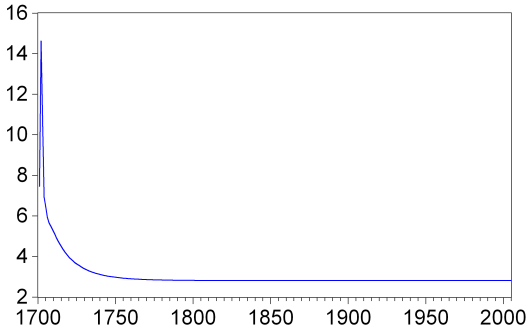
(e) Imports



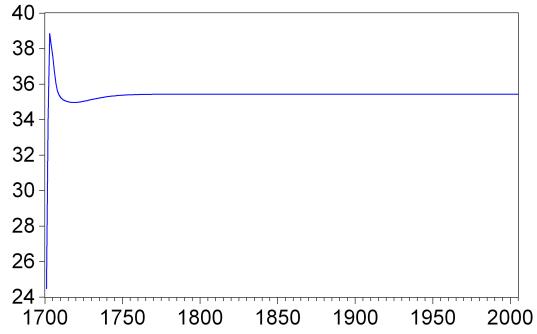
(f) GDP growth rate



(g) Government's deficit



(h) Remittances



% GDP, except GDP growth rate.