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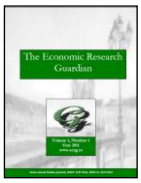

Quantitative Easing, Households' Savings and Growth: A Luxembourgish Case Study

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Abstract

The aim of the paper is to evaluate the impact of Quantitative Easing (QE) on economic growth through households' saving, in particular currency, deposits, and mutual funds. We focus on currency, deposits, and mutual funds since they represent more than 75% of the total assets of Luxembourgish households (on average more than 50% for the currency and deposits and about 25% for the mutual funds for the period 2002Q1 to 2016Q2). We try to under-line how savings' decisions are affected by unconventional monetary policies during crisis periods, economic instability and low-interest rate environment. Different scenarios are taken into account. Three trials, with one being the base-line model, are performed. The baseline is run with the pre-crisis values for all model parameters. The first scenar-io presents a crisis environment without quantitative easing policy whereas the second Scenario introduces the QE policy in a crisis environment. According to our simple theoretical model, the saving rate decreases during an eco-nomic crisis without QE framework. This result may be interpreted as a "ratchet effect", and increase globally when the QE program is applied. For the wealthier the precautionary saving rises (despite its weak yield) due to economic uncertainty whereas the poorest population dissave.

Keywords: Quantitative Easing Policy, Mutual Funds, Currency, Deposits

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1. Introduction

The links between quantitative easing (QE) policy and mutual funds, currency and deposits held by households seem to be at the first glance obvious. However, the empirical linkage is not so simple. Amongst the theoretical and empirical works, no concrete result has been highlighted.

The primary role of QE is to purchase a large scale of assets by central banks from the private sector. In theory, such policy tends to increase the liquidity of the private sector and therefore promote economic growth within a stable inflation framework. The impact on financial markets seems to be obvious. Indeed, the recent empirical literature suggests that purchases contribute to reduce yields, but the effects on the economy are very difficult to evaluate. Then to simplify, only

questions about the link between QE and households' wealth via currency and deposits and/or household mutual funds holding are analyzed.

Saving and wealth behaviors are the engine of growth. This idea is not new and plethoric theoretical and empirical studies tend to describe the effect of households' savings and households' wealth on growth). They attribute the differences in growth rates between countries to the saving behaviors since the level of investment is related to savings. According to Feldstein and Bachetta (1991), "*an increase in saving has a substantial effect on the level of investment*". In a simple manner, saving drives growth therefore it is legitimate to ask what is the appropriate monetary policy for growth to promote saving. As monetary policy impacts saving it may be interesting to evaluate its effects on growth via household saving.

The elementary monetary policy is based on the interest rate adjustment. Nevertheless, the interest rate adjustment has finally shown its limits to boost economic growth. Indeed, short term interest rates are close to zero and the growth in the major advanced countries has remained weak. To tackle this problem, central banks have adopted unconventional policies and notably quantitative easing.

The purpose of this paper is to present a small growth model, like Luxembourg, to measure how QE policies impact the recovery through households' savings. Moreover, Luxembourg is a dynamic financial place lead by the development of mutual funds markets. This latter has boosted the economic growth and has stimulated the employment market. However, during the recent years, an increase in poverty has emerged and may be concerning at term (Institut national de la statistique et des études économiques, STATEC, Rapport travail et cohésion sociale 2018). The causes of poverty are of course plural and the current monetary policy may accelerate the rhythm of the development of poverty. In addition, in a synthetic manner, the role of the monetary policy aims at guaranteeing the financial stability of the economic system and mitigates the systemic risk; in contrast, the social aspects of such policies are rare. Our analyses tend to cover this theoretical and empirical gap relative to the social impacts of monetary instruments activated to tackle the financial crisis.

The first section discusses the main theoretical and empirical QE studies. The reminder of the paper is organized as follows. Section 2 presents the assumptions of the growth model within a QE framework. Section 3 introduces some simulations to measure the impact of QE measure on the economy. Section 4 concludes.

2. Literature Survey

This section shortly presents the theoretical foundations for QE policies. Since 2000, central banks of major advanced economies have developed and applied various unconventional monetary policies to stop the slowdown of economic growth. With no possibility for lowering nominal interest rate below the zero lower bound, QE is therefore an unconventional policy solution. This kind of policy has been adopted by the US Federal Reserve from 2008 to 2014, followed by the Bank of Japan from 2013 and the European Central Bank from 2015. In the US, QE has produced visible effects. The three US versions of QE improved greatly economic growth (FED, 2015). Hence the US government exited and in 2015 the Fed raised its interest rate policy. In Japan the QE have had a strong impact on labor market but the inflation target is not reached.

According to Benhabib et al. (2001) and Gabaix (2017), when the nominal interest rate fluctuates in the zero lower bound, the Taylor rule becomes nonlinear and two steady states or multiple equilibriums appear: an inflationary steady state and a deflationary steady state. This theoretical result matches with US and Japan economies situations (Bullard, 2010). From January 2002 to May 2010, the authors demonstrate that the Japanese economy was locked into the low interest rate steady state whereas US economy was in a situation where both inflation and interest rate were higher than 2% (the high steady state). The inflation expectations are the corner stone of any monetary policy.

Indeed, the role of inflation on growth has largely been described by the theoretical literature. The empirical analyses, precised above, based on a panel-dataset show that for industrialized economies, the optimal inflation target is about 2%.

The low inflation environment leads financial authority to develop expanded asset purchase programme on January 22, 2015. The main goal is to increase the inflation rate to a level close to 2%, but less than 2%. The initial programme includes the purchase by ECB of more than EUR1.1 trillion worth of assets in 19 months. Over time and experiences, the programme changes in size, time length and range of asset purchased. According to empirical and theoretical literatures on QE programme, there are different channels of transmission of QE to the whole economy. All these channels are largely described by the financial literature and globally these policies are successes. Nevertheless, the social consequences of the conventional and non-conventional policies are not evaluated with accuracy and this maybe raise the question of the development of the poverty since the poorest have very small savings or no savings (cash deposits) largely negatively impacted by the decrease in interest rate and they cannot be property owners given their level of income and the price of the real estate goods despite the very low interest rate (STATEC, 2018). Detailed analyses taken into account the income in terms of percentile are therefore welcome to provide more information on the social aspects of monetary policy.

3. Presentation of the model and parameterization assumptions on the data selected

3.1. Model presentation

The model is based on two-period steps. Without any loss of realism, two different consumer agents (savers and borrowers) are taken into account within a framework of overlapping generation growth model (Samuel, 1958). We exclude banking sectors in this simple model since it is not the paper priority.

All saving is supposed to be intermediated by mutual funds, currency and deposits. More precisely, during the first period (period 1), the saver (agent *s*) invests its saving in mutual fund, currency and deposits. This amount is dedicated to the financing of capital and guarantees a gross return to the savers at period 2. There is a perfect competition on this market. S_t is the total amount of savings in the economy at *t*. To simplify, number of agents and type of agents in the economy are assumed constant during the two periods.

The monetary policy is unique to avoid any complex formalization. As often assumed, the "money supply" is *exogenous* if we precise that it is set by the central bank/government and private agents within the economy will set interest rates on instruments in response to the supply of

money. This assumption has no incidence on the model since the aim is to evaluate the impact of cash injection on savings and growth without paying attention to money offer nature. The traditional equation describing the money growth rate supply is the following:

$$M_t = \mu M_{t-1} \tag{1}$$

We assume that the government/central bank maintains a constant growth rate, μ. The value of the parameter μ depends on the monetary policy. For illustration, if the policy is expansive the parameter value is greater than 1.

During monetary expansion periods, the evolution of future price is greater than the current price. Hence, price equation can be written as:

$$P_{t+1}/P_t = \mu/\theta \tag{2}$$

θ is the growth rate of saving at period 2. The impact of a QE policy is obvious. The cash injection impacts the saving behavior since the interest rate decrease. Therefore, unless the growth rates of money supply and saving are equivalent, the increase in cash injection tends to develop inflation (see equation (2)).

The dynamic budget constraint is:

$$C_1 + C_2/(1+r) \leq re_0 + \tilde{\omega} y_1 + E(y_2,\varepsilon_2)/(1+r) \tag{3}$$

It is assumed that the agents do not consume all their initial endowments and dedicate a fixed amount of their current income to transfer to the next generation ($\tilde{\omega}$). The value depends on their previous wealth and incomes. The intertemporal utility function has some features to measure the risk aversion behavior. It is an isoelastic utility function.

$$u(C_1,C_2) = (C_1^{1-\sigma} - 1)/(1-\sigma) + \gamma(C_2^{1-\sigma} - 1)/(1-\sigma) \tag{4}$$

σ is assumed to measure coefficient of the relative risk aversion (CRRA). If the CRRA is high this means that the intertemporal substitution elasticity is low therefore the agent will smooth its consumption. The CRRA is not a function of income and may be related to agent anticipation about future. If the agents are optimistic, they will consume more whereas if they are pessimistic, they will save more. During the QE period the decision to save more is not so obvious since the interest rate is very low. γ is the discount factor supposed to evaluate the agent's patience (Fisher (1930), Lawrance (1991)). γ depends, inter alia, on the agent's income level. A high income is associated with a high value of γ then the agent is assumed to be more patient.

The model solutions are obtained thanks to the method of *Lagrange* multipliers applied to an optimizing program.

$$C_1^{eq} = [re_0 + \tilde{\omega} y_1 + E(y_2,\varepsilon_2)/(1+r)]/[1 + \gamma^{1/\sigma}(1+r)^{(1-\sigma)/\sigma}] \tag{5}$$

$$C_2^{eq} = [re_0 + \tilde{\omega} y_1 + E(y_2,\varepsilon_2)/(1+r)]/[1 + \gamma^{1/\sigma}(1+r)^{(1-\sigma)/\sigma}] * \gamma(1+r)^{1/\sigma} \tag{6}$$

$$S_1^{eq} = y_1 - [re_0 + \tilde{\omega} y_1 + E(y_2,\varepsilon_2)/(1+r)]/[1 + \gamma^{1/\sigma}(1+r)^{(1-\sigma)/\sigma}] \tag{7}$$

According to the equation (5), there is a negative link between σ and C_1^{eq} since γ is less than 1. Wealth (current or expected) is the engine of consumption. Indeed, an increase of y_1 and/or

$E(y_2,\varepsilon_2)$ boosts the current consumption according to equation (5). Besides, the interest rate has a negative impact on consumption. An increase of interest rate decreases consumption. Nevertheless, the impact of an increase of wealth is positive. This result occurs in the equation (6). The link between σ and C_2^{eq} is positive. An increase of the interest rate raises the consumption in period 2.

Equation (7) provides interesting insights. Indeed, and in line with Keynesian and post-Keynesian savings theories, the current income is positively linked to savings. Nevertheless, expected income and saving are negatively correlated. This is a simple principle: the expected income is based on anticipations more precisely to confidence indicator. If agents forecast any economic recovery, they will save less. The role of expectations is essential to analyze QE impacts on the economy.

3.2. Parameter selections

Different scenarios are described in this section. For the baseline pre-crisis, we used values before 2008Q3. Three other scenarios are compared to the baseline case. Three parameters are supposed to evaluate according to the economic environment. The money supply growth rate, the interest rates and the confidence indicator can take different values according to the scenarios defined. In scenario 1, it is assumed that there is no crisis but a QE policy is applied. In scenario 2 there is a crisis and no QE is applied. In scenario 3 there is a crisis and a QE policy.

For CRRA, different values are proposed from 2 to 10. A low (high) value is often associated to a period where there is no crisis (crisis). Moreover, the confidence indicator may measure the household anticipation about their future income. The following tables present the main scenarios and the related parameterizations.

The expected income depends on the economic climate and the expected value of income at $t=2$. For the climate variable, different approaches may be explored. Our approach is based on the monitoring of several time series. The consumer survey, more precisely the job loss question and the search-outcome question are useful to evaluate the agent's expectations (Manski and Straub, 2000; Manski, 2017). Nevertheless, the use of this variable requires the monitoring of other macroeconomic variables such as the unemployment and bank non-performing loans rates. A part of the evolution of the future income is random. At $t=2$, the income may be the same or lower in the case that the agent loses his job. If ε_2 increases, the variance of the expected income increases. The economic literature often strengthens the link between GDP, the unemployment rate, unemployment expectation and the non-performing loans. A small number of macroeconomic variables are qualitative predictors for non-performing loan ratio in the US. Similarly, Hoggarth et al. (2005) provide evidence of a clear link between the state of the UK business cycle and banks' nonperforming loans. The idea lies in the role of banking activity in financing the real economy. Therefore, the bank loans are a relevant source of financing for the non-financial sector, central banks and supervisory authorities should monitor the uncertainty degree on the main economic aggregates evolution in order to reinforce macroeconomic and financial stability.

The higher is the unemployment rate, the higher is the non-performing loans rate. For Luxembourg, the rule is verified until 2008. Moreover, the highest non-performing loans[1] rate (0.6%) coincided with the highest unemployment (5.1%) in 2009. For the same period, we observe abrupt GDP decrease and a peak in the evolution of the job loss and the search-outcome answers trajectory, which comfort the idea that the agent's anticipations are based on the unemployment rate. The nonperforming loans rate is assumed to be a good proxy to evaluate the banking and financial stability or instability. They are introduced in stress testing credit risk model and are reported as part of the "financial soundness indicators"[2]. For ε_2=0.6%, it is assumed that the economic uncertainty is high and for ε_2=0.1% it is a period where the uncertainty is low.

For the future income evaluation, we will take into account the economic uncertainty and the calculation of the unemployment benefit (*UB*). In Luxembourg, the unemployed receives unemployment benefit during one year. The allowance cannot exceed 2.5 times higher than the minimum income guarantees and represents 80% of the previous income.

$$E(y_2,\varepsilon_2) = (1-\varepsilon_2)\, y_1 + \varepsilon_2 UB_2 \tag{8}$$

To deal with the saving behavior, the yield of the mutual funds and the bank deposit rate are taken into account. As already underlined by the empirical literature, the nonconventional measures impact the short-term interest rate via liquidity effects in the money market. More precisely they may enlarge the spread between the MRO (Main Refinancing Operations) rate and EONIA. Besides, the nonconventional measures modify the slope of the money market yield curve. For the money market fund yield, we have chosen the usual variable to approximate it. As ECB, we use the difference between EIONA and the 3-month-Euribor to calculate the yield of money market fund (Lenza, Pill and Reichlin, 2010; Reichlin, Lucrezia, Turner, and Woodford, 2013). Hence, this latter is very sensitive to interest rate changes. Indeed, mutual fund values and yields decline as interest rates rise. In 2011, the money market yields reached its highest historical level (0.62%)[3]. In January 2015, the European Central Bank announced the launched of QE program, while the threat of deflation is becoming more and more precise. The share purchase program begins on 9 March 2015, for an amount of 60 billion Euros per month and for an expected duration of 18 months (until September 2016). In 2015, the money market fund yield reached 0.19%.

As the saving portfolio of Luxembourgish household is composed of more than 50% of deposits and more than 20% of mutual funds, a weighted average of interests is used for our model. The interest rates were about on average 3.54% before 2008 and 0.79% for the post-QE period (in 2015).

Table 1 - Common economic parameters

Parameters	Baseline model	Scenario 1	Scenario 2
σ	2	10	10
ε_2	0.1	0.67	0.67
r	2.25	0.55	2.25

Source: Kaplow (2003), ECB-SDW and BCL, ε_2 and r are listed in %

[1] This variable is delicate to estimate for several reasons. For instance, there is no consensus on the definition and the quality of the reporting is not always guaranteed. The sources are the STATEC (GDP and unemployment rate) and the OECD websites (non-performance loans).

[2] fsi.imf.org

[3] Sources for the interest rates are the European Central Bank database.

QE may also exacerbate the skewing of the income and wealth distribution as it increases the prices of assets mostly held by wealthy households (Domanski, Scatigna and Zabai, 2016; Huub Meijers and Muysken, 2016). It is for that reason the model takes into account heterogeneous agents. Hence, different types of agents based on percentile are defined. The classification depends on the income and the wealth of the agents. Three groups *(j*=1,2,3*)* are introduced (low income (p5%), medium income (median) and high-income groups (p95%). We have the same classification for wealth assumed to measure the initial endowments. The Household Financial Consumption and Saving, HFCS (2014)[4] results are used to categorize the agent's income and initial endowments assumed to measure wealth.

Table 2 - Specific economic parameters

Type of agents	Low Group (*j*=1)	Medium Group (*j*=3)	High Group (*j*=3)
Initial endowments	115	437 510	2 428 473
Income	12 983	50 000	147 831
Discount preference[5]	0.950	0.965	0.980

Sources: HFCS (2014) and Zhang (1997).
Notes: income and initial endowments values are listed in Euros amounts. No unit for Discount preference.

4. QE policy impacts simulations

For each scenario, we change the parameters values to describe crisis or non-crisis environments as exposed in the previous sections. To avoid any speculations on the channels transmission given the simplicity of the model, only results related to savings are exposed and briefly explained.

4.1. Baseline model

The baseline model describes an economy without crisis. Therefore, the parameters are those prevailing before 2008. The inter-temporal model is run with the pre-crisis parameters. The following table summarizes the values.

The inter-temporal saving is estimated thanks non-crisis parameters. We assume that the interest rate was about 2.25% during the "tranquil" period (before 2008). The value of σ is the lowest since it characterizes a normal climate. The economic climate is around 0.1% which may be interpreted as a non-crisis period.

Table 3 - Scenarios results for the baseline model

Groups	*j*=1	*j*=2	*j*=3
y_1	12 983	50 000	147 831
S_1^{eq}	0.004	0.356	0.313

Note: Incomes are listed in Euros amounts. S_{1j}^{eq} , saving propensities are listed in %.

The aggregate saving propensity (S_1^{eq}) is about 0.304 for the baseline model. We focus on the saving behavior to evaluate the impact of QE policy assumed to boost the growth via saving channel.

[4] For more information, Household Finance and Consumption Survey (HFCS) (europa.eu)
[5] For the value, see Zhang (1997).

4.2. Crisis and no QE scenario

This case assumes that there is a crisis and no nonconventional monetary policy is implemented. As the economic environment is uncertain, the values for agents' CRRA and economic climate indicator are high. This case aims at isolating the effects of financial crisis on savings and growth since the central bank does not intervene.

We run the model with the crisis/no QE model and get the results reported in the table 5.

Table 4 - Scenarios results for Crisis/no QE model

Groups	j=1	j=2	j=3
y_1	12 983	50 000	147 831
S_1^{eq}	0.004	0.346	0.288
SP growth rate	0	-2.97	-7.90

Note: Incomes are listed in Euro's amount and saving propensity (SP) growth rates are listed in %.

The propensity of saving (*SP*) is about 0.284, a decrease in saving of -6.51 in percentage point compared to the baseline model. In this case, agents (medium and high groups) reduce their savings to keep likely the same level of consumption ("ratchet effect").

4.3. Crisis with QE scenario

This last scenario combines the features of the first and the second scenarios. We assume that the interest rate tends to 0.6% since the QE policy is implemented. In this case, we are able to evaluate the impact of ECB intervention policy on saving and consumption.

Table 5 - Scenarios results for the crisis/QE model

Groups	j=1	j=2	j=3
y_1	12 983	50 000	147 831
S_1^{eq}	-2,43E-05	0.424	0.428
SP growth rate	-155.58	19.15	36.72

Note: Incomes are listed in Euros amounts. SP growth rates are listed in %.

The aggregate propensity of saving is about 0.401, a rise in saving of 31.73 in percentage point compared to the baseline model. Given the crisis environment the household assumed that their income will likely reduce and consequently they increase their precautionary saving to smooth their future consumption except for the poorest who are compelled to dissave. We notice that the high group save more than the other groups and than the baseline model (+66.16 in percentage point). Given their income, they have a more flexible capacity to save. As the interest rate is low the wealthier group tends to increase their saving to perhaps compensate the loss of deposits yields. In this case the QE policy may not reach its goal to boost economic growth via consumption.

5. Conclusion

The current financial literature has mainly underlined the positives consequences of the monetary policy (Borio, 2015). Nevertheless, the social aspect is neglected and this point should be

underlined since the economic growth takes into account social progresses. Our works tend to expose how the monetary policy may threat the social stability in some European countries, particularly in Luxembourg assumed to be an excellent growth model. To conclude, the simple growth model shows that households have been significant losers from "cheap money". It may be surprising since one motive for quantitative easing was to ease the pain and financial stress for households who have borrowed far more than was prudent in the boom years. But this kind of results are in line with the effect of QE on interest rates. This latter remunerates the non-risky savings. Remind that the model takes into account only financial assets such as mutual funds, currency and deposits since they represent more than 75% of financial assets. And on this basis, households in Luxembourg are net savers, rather than net borrowers. Therefore, when interest rates fall to exceptionally low levels, in the round the households are those who did not take advantage of this kind of policy, in particularly for the poorest. In other words, quantitative easing erodes savings values of those who had been putting money aside for decades for precautionary reasons.

The main lessons are when the environment is uncertain, aggregate saving increases and it dampens economic growth. Hence the aim of the government is to restore agent's confidence to increase the consumption and boost the economic growth.

The model selected was deliberated simple to provide some intuitive results of the QE policy impacts on saving. But it has the merit of forcing a debate on the impacts of QE on non-risky assets within an uncertainty environment. To be more in tune with the issues on the ground, a micro-database is necessary to be able to provide an extensive study on this topic. We regret that we could not have a detailed database on the agent's financial assets breakdown by wealth to demonstrate that the wealthier agents are perhaps the great winners of the QE policy. Indeed, according Bank of England, "By pushing up a range of asset prices, asset purchases have boosted the value of households' financial wealth held outside pension funds, but holdings are heavily skewed with the top 5% of households holding 40% of these assets" (Source: The Distributional Effects of Asset Purchases Bank of England, 12 July 2012).

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