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Abstract

The ongoing economic stagnation and low ination rates affecting EU have refuelled the debate on the role and the limits of monetary policy in pushing the economic growth. Given the tight margins for fiscal policy for EU state members, traditional and unconventional monetary policies are becoming more looked-for to break out of this condition. However, the main issue on whether the real or nominal aspects prevails still remains. In this situation, a framework able to identify and analyse any interaction between economic and financial flows becomes crucial to detect the dynamics pushing towards expansions or contractions resulting from monetary policies. Therefore, the aim of this paper is to investigate the direct and indirect impact of monetary policies implemented by the European Central Bank on the main Italian macroeconomic variables both in aggregate and disaggregate terms. For this purpose we use Dynamic Computable General Equilibrium model calibrated on the Social Accounting Matrix integrated with financial tools.

Keywords: Financial account, Monetary policy, Social Accounting Matrix, dynamic CGE model.
JEL classification: C63, E17, E52, D57, D58.

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1. Introduction

The debate on the effectiveness of monetary policy in driving the expansion of economies has been unremitting since the nineteenth century. This discussion became even more intense because of the economic stagnation and low inflation rates affecting European Union in recent years.

In these conditions economies are clearly working under their potential (Bernanke, 2002). This pushed the attention to the monetary policy as an instrument able to trigger the level of price and turn on the economic growth through the reduction of interest rates. Indeed, according to the monetarist principles (Bordo and Rockoff, 2013; Friedman and Schwartz, 1963b,a) strong decline in money supply should lead to the sharp decline in output, while strong increase in money supply would leads to the sustained inflation. That is to say, Central Banks can manipulate the nominal supply of money with the aim of sustaining economic growth and maintaining price stability. Nevertheless, monetarists also suggests that when the economic system is affected by economic downturn and the adjustments on interest rates is unable to push the economic growth, the Central Bank should increase the nominal supply of money avoiding the credit squeeze and providing liquidity to markets and consumers (Woodford, 2012).

Actually, when these measures seems to not be sufficient to stimulate inflationary expectations and investment does not give any signal of improve, a more decisive non-standard policy monetary tool could be introduced by Central Banks such as the 'helicopter drop of money' (Friedman, 1969). However, abandoning the thigh monetary policy and expanding the nominal supply of money is a manoeuvre that cannot be pursued without considering the costs of its implementation and its impact on the public sector (or central-bank) balance sheet (Muellbauer, 2014).

To validate the monetarist thesis, the shock introduced in the economic system through an increase/contraction of fiat money base should be tested in a framework that is able to figure out the interaction between economic and financial flows (Carson, 1975; Stone, 1966). Indeed, the core interest of Central Banks is to investigate the Monetary Transmission Mechanism (MTM) that depicts how monetary policy shakes real and nominal macroeconomic aggregates. However, this process requires the sufficient knowledge on how consumers and firms reallocate their portfolio asset in response to monetary policy changes and more in general what are the distributional effects on income among Institutional Sectors after the monetary policy (Jellema et al.,

2004). Besides, these effects also depend on how the shock on nominal money supply is technically implemented.

In this perspective, the inclusion of financial tools in Computable General Equilibrium (CGE) models is receiving a consent in the economic literature. They can indeed consider the transmission effects of the instabilities in the financial markets on the real economy (Prasad et al., 2004; Goodhart et al., 2004, 2005) [2]. As a matter of fact, CGE models are widely used to analyse the policy effects and other shocks in the areas of trade, taxation, public expenditure, labour markets, environment, natural and man-made disasters, financial crises etc. (Dixon and Jorgenson, 2013). CGE modelling is primarily meant for explaining real-world policy issues and, when the financial transaction are included in this framework, it becomes one of the most practical way of quantifying the effects of fiscal and monetary policies on production, employment, income distribution and prices (Christiano et al., 2005)[3].

In this perspective, we are interested in contributing to the debate on the effectiveness of monetary policies by investigating how unconventional monetary policies implemented by the European Central Bank (ECB), such as the Quantitative Easing (ECB, 2015), would influence the Italian macroeconomic variables both in aggregate and disaggregate terms and in the medium-long term.

More precisely, we developed a disaggregate multisectoral Dynamic CGE (DCGE) model where the formalisation of Institutional Sectors' behaviour with respect to financial tools and markets is included. The DCGE is calibrated on the SAM for the Italian economy that was complemented with financial accounts to figure out the in financial interrelationships between well-defined institutional sectors (Financial and non-Financial corporations, Government, Households) within the domestic economy and vis-a-vis the rest of the world. This approach represents an advanced methodology able to emphasize the interactions among economic and financial forces primarily in a disaggregate context and then in a dynamic perspective (Ciaschini et al.,

[2]Prasad et al. (2004) explores the effects of a large and increasing private foreign capital inflow on the growth rate of developing countries. Goodhart et al. (2004, 2005) who disaggregate net investments by type of investors, banks, firms and the rest of the world have emphasized the modeling of international financial flows.

[3]DCGE models are also used to address a number of key issues that incorporate sources of business cycle fluctuations (Smets and Wouters, 2003, 2007), effects of productivity on hours worked, and sources of the 'Great Moderation'.

forthcoming). In particular, the full detailed flows described in the SAM and the flexibility of the model that is able to formalise all the relations between economic and financial flows, allow the analysis of different monetary policy measures.

More precisely, we consider two possible scenarios according to the different channel used by the ECB to expand the amount of money in the economic system. At first, we consider the unconventional manoeuvre of the ECB that directly purchases bond issued by the Italian Government in the primary market. Then, in the second policy scenario, we assume that the ECB purchases the same amount of bonds on the behalf of other investors, that is to say, on the behalf of the secondary market.

The results of the scenarios are presented as changes from the standard path followed by the economy when the shock is not observed. That is to say, we evaluate the impact of monetary policies as a counter-factual analysis of its impact.

In the next section provides a brief description of the database, represented by the SAM for the Italian economy, and of the DFGE especially as regard the financial aspects. Section three describes the characteristics of the monetary policy programmes conducted by the ECB to expand the money supply and discusses the assumptions of the two policy scenarios simulated. Then the results are discussed and some concluding remarks are pointed out.

2. Tools for economic policy: DCGE and SAM

Measuring the disaggregate effects of a monetary policy within the economic system in a dynamic context, requires a sophisticated set of tools. They should be able to figure out the economic and monetary flows in disaggregate terms occurring in the economic system and formalise the behaviour of all agents an markets involved in the income circular flows (Ciaschini et al., 2013). The DCGE model, calibrated on the SAM for Italian economy, represents an optimal instrument to carry out the analysis of the ECB monetary policies.

2.1. The DyFiGE16 Model for Italian economy

In this study we developed *DCGE16*, a dynamic CGE characterized by two main aspects: it incorporates the multi-sectoral aspect which explicitly mentions the structural changes in intermediate consumption among the production activities of the economy (Ciaschini et al., 2011) as described by

the SAM. Similarly, it also exhibits the behavioral changes in the choice of the investment and savings by the Institutional Sectors in response to the fluctuations in the prices of financial instruments. Second, DCGE16 is a recursive dynamic CGE model on the SAM for Italian economy that includes the financial mechanism to investigate the impact of the monetary policy on macroeconomic variables such as GDP, final consumption, investments, prices and income distribution.

The DCGE16 model implies that the behaviour of agents depends on adaptive expectations. To determine prices and quantities that maximize producers' profits and consumers' utility, DCGE16 solves the Arrow and Debreu (1954) problem as an optimization problem of the consumer subject to income, technology and feasibility constraints. The evolution path is a sequence of single period static equilibria linked each other by the capital accumulation condition (Lau et al., 2002).

DCGE16 analyses an open economy with a set of m commodities, c components of value added, i Institutional Sectors and f financial instruments. It is structured in order to follow the SAM framework described in table 2 so that the behavioural equations and income constrains for agents track the income circular flow phases (Ciaschini et al., 2011). The general structure of DCGE16 is showed in table 1.

Table 1: Basic framework of Dynamic Computable General Equilibrium (DfCGE14) model

			Commodities	Industries	Value Added	Institutional Sectors		Financial liabilites
						Current Account	Capital Account	
		n.	1	2	3	4	5	6
	Commodities	1		B(x,p)		C(rd,p) G(rd,p) E(e,p)	$I^{i}(p)$	
	Industries	2	X(x,p)					
	Value Added	3		Y(x, pc)				
Institutional Sectors	Current Account	4	M(x,e)	Ta(x)	$R^{i}(y)$	$Ta^{i,j}(r,a)$ $Tr^{i,j}(r,a)$		
Institutional Sectors	Capital Account	5				$S^{i}(rd,pf)$	$CTr^{i,j}(rd,pf)$	$L^{i}(s, pf)$
	Financial assets	6					$A^{i}(s,pf)$	

The production of commodities is modelled as a set of nested Constant Elasticity of Substitution (CES) production functions to emphasize any complementarities or substitution effects among inputs - notably labour and capital. Total output by commodity ($\mathbf{X}$) results from the combination of domes-

tic (national) output($\mathbf{XN}_t$) and imports ($\mathbf{M}_t$)[4] with elasticity of substitution set equal to zero (Leontief assumption). Adding taxes on production ($\mathbf{Ta}_t$) we obtain the total supply by commodity that corresponds to the sum of intermediate demand ($\mathbf{B}_t$), final consumption expenditures by agents ($\mathbf{C}_t$ for private agents and $\mathbf{G}_t$ for Government), gross fixed capital formation ($\mathbf{I}_t$) and exports ($\mathbf{E}_t$) to grant the macroeconomic equilibrium in all commodity markets.

The domestic production ($\mathbf{XN}_t$) is generated combining intermediate goods ($\mathbf{B}_t$) and Value Added aggregate ($\mathbf{Y}_t$) using a Leontief production function. Finally, value added aggregate is obtained by combining primary factors, capital ($\mathbf{K}_t$) and labour ($\mathbf{L}_t$), using CES technology[5].

Primary factors are perfectly mobile across activities and their markets are perfectly competitive. That is to say, the model assumes market clearing wages on the labour market and market clearing rent of capital in capital market in each period. Labour and capital incomes, together with revenues from taxes on production, are allocated to i Institutional Sectors to determine their row income ($\mathbf{R}_t$). The disposable income by Institutional Sector is obtained by adding the current net transfers from the other Institutional Sectors ($\mathbf{Tr}_t$ and $\mathbf{Ta}_t$) in the secondary income distribution phase. Thus, the disposable income is allocated in two main aggregates: the final consumption ($\mathbf{C}_t$, $\mathbf{G}_t$) and saving ($\mathbf{S}_t$) using a Cobb-Douglas function. The final consumption aggregate of Households and Government is the combination (Cobb-Douglas assumption) of the final demand of commodities by each Institutional Sectors. On the other side, the saving aggregate drives the total amount of investment by commodity ($\mathbf{I}_t$) that are endogenously determined in the model. That is to say, the level of investment is largely influenced through households, firms and Government savings which depend on disposable incomes. Government savings result as the difference between total tax revenue ($\mathbf{Ta}_t$) minus the sum of final consumption expenditures by Government $\mathbf{G}_t$ and transfers to other Institutional Sectors $\mathbf{Tr}$. We consider two macro-categories of taxes: direct income taxes ($\mathbf{Ta}_t$) and a set of indirect taxes (tax on products, value-added tax and payroll taxes) that we indicate

[4]Following the Armington's hypothesis (1969), imported and domestically produced commodities are not perfect substitutes. This solves the problem that the same kind of good is found to be both exported and imported.

[5]The elasticity of substitution is set equal to 0.5218 for all productions, according to the estimation of Van der Werf (2008).

in table 1 with the same acronyms $\mathbf{Ta}_t$.

The model is completed with the conditions on financial markets. The equilibrium of financial instruments, also called financial commodities, is determined by a vector of prices for which the total demand of each instrument ($\mathbf{A}_t$) must be equal to the total supply of financial instruments($\mathbf{SL}_t$). That is to say, the markets of financial instruments are perfectly competitive and the flows originated by changes in demand of financial instruments generate a similar change in liabilities (supply) of those instruments. Hence, the change in the value, for each agent, lent to the financial fund $\triangle\mathbf{A}_t$ and the changes in its liabilities with the financial fund $\triangle\mathbf{SL}_t$ are compatible with the savings availability and the decision with respect to the level of real investment. Accordingly, the net asset equilibrium of each agent requires that the net change in the balance of borrows and loans of each agent, has to be used to finance the difference between savings and investment.

Technically, we can say that the supply of financial instruments is determined by the combination (Leontief assumption) of Institutional sectors total liabilities (exogenously determined), and the total demand of each financial instruments is the sum by Institutional sectors, of their demand for financial instruments (endogenously determined). Similarly to the other commodities, the demand of financial instruments depends on their price and the level of savings.

Finally, DyFiGE16 is a dynamic model and, following the logic of the Ramsey model, all the Institutional Sectors are assumed to maximise the present value of their intertemporal utility function that depends on final consumption expenditure and and gross saving subject to the lifetime budget constraint (Ciaschini et al., forthcoming).

The capital accumulation condition states that the capital stock in period $t+1$ is equal to the capital stock in period t ($\mathbf{K}_t$) less depreciation ($\delta\mathbf{K_t}$) plus gross fixed capital formation in period t ($\mathbf{I}_t$)[6].

In order to solve the model for a finite number of periods, we approximate the infinite horizon equilibria with endogenous capital accumulation condition according to Lau et al. (2002). Thus in order to obtain the ter-

[6]We calculate the rate of capital depreciation that is consistent with the data in the SAM and the assumptions on the steady state interest rate γ and the steady state growth rate $\mathbf{g}$. In our model, we set the nominal interest rate $\gamma = 0.05$ and the real exogenous growth rate $\mathbf{g} = 0.024$. According to the rule for investment on a steady state, we calibrate the value of the depreciation rate δ on the SAM data

minal period equilibrium we set the terminal gross capital formation growth rate equal to the growth rate of aggregate output. Since there is a set of commodities, primary factors and institutional sectors the model produces a disaggregate set of information on prices, output and incomes.

The optimization problem for all consumers has been settled as:

$$max \sum_{t=0}^{T} \left(\frac{1}{1+\rho} \right)^t u[C_t^l] \tag{1}$$

s.t.

$$C_t^l = \xi_l \left(x[K_t^j, L_t^j, M_t^j, Ta_t^l] - B_t^j - I_t^j - E_t^j \right) \tag{2}$$

$$K_{t+1}^j = (1-\delta^j) K_t^j + I_t^j \tag{3}$$

where $t = 1, ..., T$ is the time period, ρ is the individual time-preference parameter, u is the utility function, institutional sectors are l=1,...,i, the commodities j=1,...,m, C_t^l is the consumption of each institutional sector in each period, ξ_l is the share of consumption by institutional sector.

The first order conditions deriving from this maximisation problem are:

$$P_t^j = \sum_l \xi_l \cdot (\frac{1}{1+\rho})^t \cdot \frac{\delta u(C_t^l)}{\delta C_t^l} \tag{4}$$

$$PK_t^j = (1-\delta) PK_{t+1}^j + P_t^j \cdot \frac{\delta x(K_t^j, L_t^j, M_t^j, Ta_t)}{\delta K_t^j} \tag{5}$$

$$P_t^j = PK_{t+1}^j \tag{6}$$

where P_t^j is the price of output, PK_t^j is the price of capital paid by each sector.

Than the corresponding mixed complimentary problem can be formulated as a sequence of conditions on markets, profits and budget constraints.

Market clearing conditions holds for all commodities and primary factors markets. These conditions posit that the value of excess demand is always non positive. That is to say that the total supply is equal to the total demand of each good and primary factor only for a certain positive price determined by the solution of the problem. Analytically we can write:

$$X_t^j \geq B_t^j + \sum_l C_t^l(P_t^j, RA^l) + I_t^j + E_t^j \perp P_t^j \geq 0, \qquad P_t^j (X_t^j - B_t^j - \sum_l C_t^l(P_t^j, RA^l) - I_t^j - E_t^j) = 0 \tag{7}$$

$$L_t \geq \sum_j X_t^j \frac{\delta x(RK_t, PL_t, PM_t^j, Ta_t^j)}{\delta PL_t} \perp PL_t \geq 0, \qquad PL_t(L_t - \sum_j X_t^j \frac{\delta x(RK_t, PL_t, PM_t^j, Ta_t)}{\delta PL_t}) = 0 \tag{8}$$

$$K_t \geq \sum_j X_t^j \frac{\delta x(RK_t, PL_t, PM_t^j, Ta_t^j)}{\delta RK_t} \perp RK_t \geq 0, \qquad RK_t(K_t - \sum_j X_t^j \frac{\delta x(RK_t, PL_t, PM_t^j, Ta_t^j)}{\delta RK_t}) = 0 \tag{9}$$

$$M_t^j \geq X_t^j \frac{\delta x(RK_t, PL_t, PM_t^j, Ta_t^j)}{\delta PM_t^j} \perp PM_t^j \geq 0, \qquad PM_t^j(K_t - X_t^j \frac{\delta x(RK_t, PL_t, PM_t^j, Ta_t^j)}{\delta PM_t^j}) = 0 \tag{10}$$

where RA^l is the consumers disposable income, RK_t is the rental of capital, PL_t is the wage and PM_t^j is the price of imported goods.

Similarly for financial commodities we have:

$$SL_t^f \geq A_t^f \perp P_t^f \geq 0, \qquad P_t^f(SL_t^f - A_t^f) = 0 \tag{11}$$

$$with A_t^f = \sum_l a_l^f(P_t^f, S_t^l) \tag{12}$$

where P^f is the price of financial output and a_l is the demand function of financial instruments by institutional sector.

The condition on profits posits that total supply in each commodity market is determined by the perfect competitive market condition, that is to say, price equals average total cost (profit are zero). In a general equilibrium model, the price that clear the market (demand equals to supply) also equals average total costs for each commodity. Analytically we have:

$$PK_t \geq RK_t + (1-\delta)PK_{t+1}, K_t \geq 0, \qquad K_t(PK_t - RK_t - (1-\delta)PK_{t+1}) = 0 \tag{13}$$

$$AC^j(RK_t, PL_t, PM_t^j, Ta_t^j) \geq P_t^j, X_t^j \geq 0, \qquad X_t^j(AC^j(RK_t, PL_t, PM_t^j, Ta_t^j) - P_t^j) = 0 \tag{14}$$

Income balance conditions derive from the budget constraint:

$$RA^l = PK_0 K_0^l + \sum_{t=0}^{T}(PL_t L_t^l + PM_t^j M_t^{lj} - Ta_t^j) - PK_{T+1}K_{T+1}^l \tag{15}$$

2.2. The SAM for Italian Economy

The SAM provides a full detailed description of the economic flows pertaining to the production process (final demand, total output and value added generation) and to the distribution process (value added, primary and secondary distribution of income) according to the income circular flow scheme (Ciaschini and Socci, 2006). The SAM for Italian economy used to calibrate

the DCGE model considers: 64 commodities and 64 activities[7], 4 components of value added[8] and 4 Institutional Sectors[9].

This can be pursued by integrating two additional accounts to the SAM: the capital account and the financial assets/liabilities account (Emini and Fofack, 2002). These financial accounts can be considered as the ultimate accounts in the full sequence of economic accounts. More specifically, net saving by Institutional Sector is a balancing item of the use of its income and net saving plus net capital transfers (receivables/payables) can be used to accumulate non-financial assets (United Nations, 2008). The resulting surplus/deficit is called the net lending/borrowing and it represents the balancing item that is carried forward as the initial flow in the financial accounts[10].

Actually, the financial flows are identified in the SAM by a set of columns and rows headed to 33 financial instruments that are exchanged between Institutional Sectors. As showed in table 2 by row we can find the financial flows of assets and by column we read the flows of financial liabilities (Waheed and Ezaki, 2008). The Institutional Sectors incur and acquire from each other the financial liabilities and assets respectively. Since a liability automatically creates a corresponding asset, they must balance in aggregate.

3. Policy implication for the Italian Economy

The DyFiGE16 model is developed with the aim of investigating the impact of different monetary policy manoeuvre within the economic system, both in aggregate and disaggregate terms, because of its flexibility that allows to operate on the specific flows of financial instruments shocked by the policy.

Dealing with the monetary policy for the Italian economy, means observing and testing the effects of the policy measures introduced by the European Central Bank (ECB) within the Euro-zone. As a regulator of monetary policy, the ECB's main responsibility is to coordinate the policy measure in order to meet the exigencies of the member States keeping under control the fluctuation of certain macroeconomic variables such as the inflation rate. In-

[7]For the Classification of commodities and Industries in the SAM see table A.11.

[8]The components of Value Added are: Compensation of Employees, Mixed income, Gross operating surplus and Other taxes less subsidies on domestic production.

[9]The Institutional Sectors are: Households, Firms, Government and Rest of the World.

[10]The data for fSAM have been collected from the Istat, from the Eurostat and from the published accounts of Bank of Italy (as regards to financial assets and liabilities).

Table 2: Basic framework of the Social Accounting Matrix (SAM)

		Commodities	Industries	Primary Factors	Institutional Sectors' Current Accounts	Institutional Sectors' Captial Accounts	Changes in Invetories	Financial accounts
	n.	1	2	3	4	5	6	7
Commodities	1	Trade and transport margins	Intermediate consumption		Final Consumption Expenditure, Exports	Gross fixed capital formation	Changes in Invetories	
Industries	2	Output						
Primary Factors	3	Taxes on products less subsidies	Value Added by component					
Institutional Sectors' Current Accounts	4	Imports		Value Added by Institutional Sector	Current taxes on income, wealth, etc and current transfers			
Institutional Sectors' Capital Accounts	5				Savings	Capital transfers		Borrowing
Changes in Inventories	6					Changes in Inventories		
Financial accounts	7					Lending		

deed, the distress for low inflation rates and the reducing level of investment drove the ECB to perform expansive monetary policies in the last months.

This behaviour has attracted comments and remarks which posit a set of prospects and challenges in following the policy of 'Public Sector Purchasing Program' (PSPP)(ECB, 2015).

Several studies discuss the pros and cons of ECB's stance government debit and some severe criticisms have been received from all around (De Grauwe, 2012, 2013; Ferry, 2013; Lane, 2012). These criticisms belong both to the legal grounds and to the fiscal implications. ECB cannot buy debt instruments directly from the member states according to the article 21 of the 'Protocol on the Statute of the European System of Central Banks and the European Central Bank'. However, article 18 of the same statute clearly states that 'the ECB and the national central banks may operate in financial markets by buying and selling (...) and by lending or borrowing claims and marketable instruments'. Of course it is understood that, on the one hand, the Statute forbids ECB from direct purchasing of government bonds but, on the other, it permits to purchase them in the secondary market.

It is also imperative to mention some other criticisms associated with fiscal consequence of the purchasing program, which states that if governments fail to service their debts, the ECB will make losses which will have to be borne by taxpayers. Therefore, by purchasing bonds issued by national Governments, the ECB is committing future taxpayers which posits

the operations that mix monetary and fiscal policies (Goodfriend, 2011).

In this context, this analysis aims at investigating and addressing the impact of ECB's proposed decision of purchasing the Italian Government bonds on the economic system. We devise two policy scenarios:

1. we assume that ECB purchases marketable debt instruments (bonds) issued by the central Government directly from the Government, thus providing liquidity by the same amount. In DyFiGE16 we simulate a change in the composition of Institutional Sectors portfolio, so that the amount of bonds owned by Rest of the World increases likewise the currency owned by the Government. The volume of the manoeuvre is 10 billion Euro and is assumed to be permanent.
2. we assume that ECB purchases bonds issued by central Government on the secondary market, thus bonds owned by Households, Financial and non-Financial Firms. In DyFiGE16 we change the composition of Institutional Sectors' portfolio accordingly and consider an increase of the same amount in liquidity for the system. The volume of the manoeuvre is still 10 billion Euro and is assumed to be permanent.

Since the channel through which the monetary policy is introduced differs, the outcome of the two monetary policy scenarios might be quite different, because they activate different forces interacting in the system. The effects of both the policies are measured in terms of GDP, value added by commodity, financial assets and price changes along the time with respect to the baseline equilibrium (or *benchmark* equilibrium). The distance in every period between the baseline trend path and the path generated after the simulations represents the impacts of the policy on the main macroeconomic variables in each period.

3.1. Policy Scenario 1: ECB purchases bond issued by national Government

In the first scenario we simulate an increase in money supply operated by the ECB on the Italian economy through the purchase of bonds issued by Government for 10 Billion. This results in an injection of an equal amount of currency in the economic system.

The impact on macroeconomic aggregates is showed in table 3 as percentage change with respect to the baseline trend in a 5 years period, from 2017 to 2021.

The increase in money supply generates an increase in real GDP by 0.36% in 2017. This positive effect is confirmed also in subsequent periods but it

Table 3: Percentage change in main Macroeconomic aggregates from 2016 to 2020

	2017	2018	2019	2020	2021
GDP	0.36	0.27	0.18	0.09	0.00
Inflation rate	0.12	0.18	0.23	0.26	0.27
Consumption	0.37	0.37	0.38	0.38	0.39
Public Expenditure	-0.83	-0.83	-0.83	-0.82	-0.82
Investments	1.25	0.55	-0.15	-0.87	-1.66
Exports	0.61	0.62	0.64	0.66	0.68
Imports	0.01	0.01	0.02	0.02	0.02

tends to fade and eventually disappear in 2021. The positive effect on real GDP is mainly driven by the positive impact on real Consumption that is higher than the baseline by 0.37% in 2017 with a rising trend. Investments contribute to the positive performance of real GDP in the first years, as well as exports.

Table 4: Percentage change in Value added by commodity from benchmark - best performances

		2017	2018	2019	2020	2021
55	Public administration and defence services; compulsory social security services	3.03	2.26	1.47	0.64	-0.23
31	Land transport services and transport services via pipelines	2.73	5.03	7.35	9.64	11.88
32	Water transport services	2.07	3.15	4.24	5.33	6.39
28	Wholesale and retail trade and repair services of motor vehicles and motorcycles	1.12	1.92	2.75	3.58	4.40
57	Human health services	1.11	0.97	0.82	0.66	0.50
45	Imputed rents of owner-occupied dwellings	0.96	0.92	0.89	0.87	0.85
58	Social work services	0.94	0.88	0.82	0.75	0.68
12	Basic pharmaceutical products and pharmaceutical preparations	0.93	0.75	0.57	0.38	0.19
56	Education services	0.89	0.79	0.68	0.58	0.46
63	Other personal services	0.85	0.87	0.89	0.91	0.93
60	Sporting services and amusement and recreation services	0.76	0.83	0.92	1.00	1.08
6	Textiles, wearing apparel and leather products	0.74	0.57	0.39	0.21	0.03
10	Coke and refined petroleum products	0.69	0.63	0.55	0.46	0.35
1	Products of agriculture, hunting and related services	0.68	0.57	0.46	0.35	0.23
64	Services of households as employers; undifferentiated goods and services produced by households for own use	0.67	0.70	0.73	0.77	0.80
	.....					

As for the inflation rate, the expansion in nominal money supply generates an increase in global prices as expected in whole spam of time. It is 0.12% in 2017 and slightly increases in subsequent periods. In broad terms, we could

say that this impact is quite low since it does not reaches the 0.3% in whole span of time even though the monetary policy is permanent. This finding is interesting if we consider the existing studies arguing that the increase in money supply leads to the sustained increase of commodity prices (Bordo and Rockoff, 2013; Friedman and Schwartz, 1963b,a). Moreover, our findings do confirm that the expansionary monetary policy in the Italian economy has a slight impact on the commodities' price.

Table 5: Change in financial instrument demand from benchmark - best performances

		2017	2018	2019	2020	2021
8	Short-term securities, with general government	25.60	22.39	19.30	16.40	13.72
15	Bonds, issued by other residents	9.68	9.05	8.31	7.48	6.61
27	Shares and other equity, issued by rest of the world	8.78	9.51	9.76	9.60	9.10
16	Bonds, issued by rest of the world	7.31	6.95	6.47	5.90	5.27
29	Mutual fund shares, issued by rest of the world	6.89	6.23	5.55	4.87	4.20
4	Currency and transferable deposits, with rest of the world	6.89	6.22	5.53	4.85	4.18
10	Short-term securities, with rest of the world	6.89	6.22	5.53	4.85	4.18
7	Other deposits, with rest of the world	6.89	6.22	5.53	4.85	4.18
20	short-term loans, of other residents	6.53	5.91	5.27	4.62	3.99
19	short-term loans, of other financial corporations	5.94	5.37	4.79	4.21	3.64
31	prepayment and other claims	5.39	4.89	4.37	3.85	3.34
11	Bonds, issued by MFIs	2.44	2.61	2.66	2.61	2.47
2	Currency and transferable deposits, with MFIs	2.14	2.03	1.88	1.72	1.54
18	short-term loans, of MFIs	2.11	1.97	1.81	1.64	1.46
1	Monetary gold and SDRs	6.81	6.09	5.36	4.66	3.98
	.....					

However, since we developed a multisectoral dynamic model, we can also observe the disaggregate effects of this manoeuvre. In this respect table 4 shows the contribution of each commodity to the global performance on the GDP. It reports the percentage change in value added by commodity from the benchmark level for the top 15 commodities, the first being the highest. It helps to identify which commodity reacts more/less to the policy and which component of value added is prone more to the policy impacts.

The largest increases are registered for '55.Public Administration and defence services; compulsory social security services', '31. Land transport services and transport services via pipelines', '32.Water transport services', '28.Wholesale and retail trade', '29.Wholesale trade services', '57.Human and health services'. Apart from the commodities that are typically demanded by Public Administration (55. and 57.), the other commodities are mostly affected by the trade and transport margins.

Looking at the effects of the monetary policy on the financial side, we observe from table 5 the changes in the amount of financial instruments traded within the economy (only the top 15 are showed). The volume of '8.Short term security', '15.Bond issued by other residents', '27.Shares and other equity, issued by rest of the world' and '16.Bonds issued by rest of the world' and '33. Other financial instruments' are the most affected by the monetary policy. More in general, we can observe that the demand of financial instruments that constitute an alternative to Bond issued by the national Government, raise. This is the indirect effect of the monetary policy manoeuvre: the purchase of national bonds by the ECB generates an increase in their price, with consequences on their rates,thus stimulating the substitution of bonds with other financial instruments.

3.2. Policy Scenario 2: ECB purchases national Bonds from other Institutional Sectors

Similarly to the strategy recently used by ECB to increase the nominal supply of money, in this second scenario we assume that ECB purchases bond on the secondary market from investors (Households, Financial and Non Financial Firms), rather than from issuing Government itself, for 10 billion of euro.

The rational for this second scenario is mostly related to the feasibility of the policy that is more cohesive with the decisions made by ECB. On the other hand, we aim at investigating how a different channel of liquidity injection can differently affect the economy. Indeed this determines a change in expendable funds held especially by private Institutional Sectors.

Table 6: Percentage change in main Macroeconomic aggregates from 2016 to 2020

	2017	2018	2019	2020	2021
GDP	0.57	0.44	0.30	0.15	0.00
Inflation	0.24	0.38	0.47	0.53	0.56
Consumption	0.37	0.37	0.38	0.38	0.39
Public Expenditure	-0.83	-0.83	-0.83	-0.82	-0.82
Investments	2.90	1.78	0.68	-0.45	-1.65
Exports	0.61	0.62	0.64	0.66	0.68
Imports	0.01	0.01	0.02	0.02	0.02

Similarly to the first scenario, the manoeuvre generates an increase in real GDP with respect to the benchmark especially in the immediate. In

2017 it raises by 0.57% and in the following years the change reduces until it disappears. In 2021 the real GDP approximates the benchmark trend. Even though these results are consistent with findings in policy scenario 1, the difference between the absolute value is quite significant. This effect is mainly driven by the substantial effect on investment (+2.9% in 2017) deriving from the purchase of bonds in the secondary market and the increase in liquidity on private institutional sectors (Households, Financial and non-Financial Firms).

All the other variables are quite in line with the results observed in previous scenario.

Table 7: Percentage change in Value added by commodity from benchmark - best performance

	2017	2018	2019	2020	2021
31 Land transport services and transport services via pipelines	5.71	10.50	15.36	20.18	24.88
32 Water transport services	3.85	5.99	8.15	10.31	12.43
28 Wholesale and retail trade and repair services of motor vehicles and motorcycles	2.80	4.47	6.19	7.92	9.65
45 Imputed rents of owner-occupied dwellings	2.35	2.28	2.21	2.16	2.12
63 Other personal services	2.26	2.30	2.35	2.41	2.47
64 Services of households as employers; undifferentiated goods and services produced by households for own use	2.11	2.19	2.28	2.38	2.49
58 Social work services	1.86	1.74	1.61	1.48	1.34
60 Sporting services and amusement and recreation services	1.85	2.02	2.19	2.37	2.55
36 Accommodation and food services	1.81	1.80	1.80	1.80	1.81
1 Products of agriculture, hunting and related services	1.71	1.51	1.30	1.08	0.86
3 Fish and other fishing products; aquaculture products; support services to fishing	1.66	1.38	1.08	0.76	0.45
5 Food products, beverages and tobacco products	1.65	1.31	0.94	0.57	0.19
6 Textiles, wearing apparel and leather products	1.58	1.26	0.92	0.57	0.23
25 Natural water; water treatment and supply services	1.56	1.41	1.25	1.10	0.96
12 Basic pharmaceutical products and pharmaceutical preparations	1.50	1.19	0.86	0.52	0.18
.....					

The disaggregate effects of the monetary policy on real GDP can be observed in table 7. It shows the best performances in terms of value added percentage change by each production process. There are commodities that are able to drive the economy more than others like: '31.Land transport services and transport services via pipelines', '32.Water transport services', '28.Wholesale and retail trade', '45.Inputed rents of owner-occupied dwellings' and '63.Other personal services'. These production differs from

those stimulated in previous scenario where public administration and health received a strong impulse.

Table 8: Change in financial instrument demand from benchmark - best performances

		2017	2018	2019	2020	2021
8	Short-term securities, with general government	27.04	24.19	21.33	18.53	15.84
15	Bonds, issued by other residents	9.56	8.70	7.81	6.90	6.00
23	Medium and long-term loans, other financial corporations	3.45	3.25	3.01	2.75	2.47
2	Currency and transferable deposits, with MFIs	2.39	2.30	2.17	2.01	1.84
11	Bonds, issued by MFIs	2.11	2.06	1.97	1.86	1.72
28	Mutual fund shares, issued by residents	1.16	1.21	1.23	1.21	1.17
22	Medium and long-term loans, of MFIs	0.65	0.75	0.83	0.86	0.87
9	Short-term securities, with other residents	0.55	0.67	0.75	0.80	0.81
30	Net equity of households	0.34	0.48	0.59	0.66	0.69
18	short-term loans, of MFIs	-0.05	0.13	0.28	0.39	0.47
32	Trade credits	-0.42	-0.20	-0.01	0.14	0.25
3	Currency and transferable deposits, with other residents	-1.61	-1.22	-0.87	-0.57	-0.33
31	prepayment and other claims	-1.75	-1.38	-1.04	-0.74	-0.49
19	short-term loans, of other financial corporations	-1.78	-1.40	-1.06	-0.76	-0.51
20	short-term loans, of other residents	-2.03	-1.63	-1.26	-0.93	-0.65
	.....					

As regard to the impact on financial markets, the purchase of Bonds on the secondary market by ECB mostly stimulates the demand of '8.Short term security', '15.Bond issued by other residents', '23.Medium and long-term loans', '2.Currency and transferable deposits' and '11.Bond issued by MFI's'. The other financial instruments register a slight increase and in many cases it is observable a reduction in their demand. This different composition of the effects, that include a many negative changes, are likely related to the different composition of private Institutional Sector portfolio. The increase in the demand of bonds issued by central Government by the Rest of World, eventually activate substitution effects on the other financial instruments.

4. Conclusion

Whatever the origins of downturns and expansions of economies, it is imperative for the policy maker to investigate what are the interactions between economic and financial flows in order to understand how to take advantage of them in achieving his objectives. The monetary policy can be considered an incisive instrument to stimulate the economic growth especially when it aims to increase the nominal money supply and reduce the interest rate.

However, if we consider the State members of the Euro area, they are no more entitled to use the instruments of monetary policy. They can only activate fiscal policies to support monetary policy when it stimulates the growth or counterbalance the monetary policy when it slows down the economic development. For these economic systems, the coordination among the national policy and the European Central Bank action is essential.

In this scenario, the DCGE model calibrated on the SAM and integrated with the behaviour of Institutional Sectors regarding financial markets and tools, represents the proper instrument detect the direct and indirect effects of shocks occurred both on economic and financial sphere.

For this purpose, we have developed the SAM for the Italian economy, which serves as the dataset showing the inter-relationship of economic and financial flows. Then we calibrated the financial DCGE model to investigate the impact of monetary policy scenarios on macroeconomic aggregates.

More precisely, we considers two policy scenarios where the nominal money supply is permanently increased through the purchase of government bonds for 10 billions of Euro in each period. This manoeuvre can be assimilated to the PSPP program developed by ECB in the Quantitative easing monetary policy. However, we assume two different channel through which the liquidity is injected in the system: in the first scenario, the ECB purchases bonds directly in the primary market even though this is strictly prohibited by the Statute. In the second scenario, ECB purchases bonds in the secondary market, from private investors (Households, financial and non-financial firms).

As regard to the legacy of the manoeuvres, we assumed that the ECB is able to purchase the Bond issued by central Government both in the primary and secondary stock exchange market to inject money in the system. We decided to explore this field because of the last changes in ECB behaviour after the financial crises experienced by the systems. Indeed, recently there is the belief that more unconventional monetary policies could be introduced in the close future such as the 'helicopter drop of money'.

The results of the simulations carried out seems to confirm the economic literature position. Indeed, the expansionary monetary policies generate an increase in real GDP especially in the immediate, but this effect seems to disappear in time. However, when the purchase is in the secondary market, the impact is higher because of the positive effect on investment. The inflation rate increases constantly along the time period observed but it is quite stable and never exceeds 0.3% in both scenarios.

In disaggregate terms, the impact on the demand of financial instruments and commodities production is quite different. That is to say, alternative tools of monetary policy activate different transmission mechanisms.

On the other hand, this analysis addresses the criticisms on ECB's policy to purchase bonds of debt-ridden countries such as Italy. A wide strand of literature has been devoted on the discussion of ECB's stance on government bond buying policy. However, our attempt develops along those lines of discussion and tries to quantify the impact of purchasing Italian bonds on behalf of ECB but in a multiperiod context and in a setup where commodity outputs, industry activities, factor incomes, industry employment and financial engagements are also taken into consideration.

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Appendix A. Tables

Table A.9: Legend of variables for CGE model

Variable description	
t	time periods
T	terminal period
	individual time-preference parameter
u	utility
C_t	consumption in period t
S_t	savings in period t
x	production function,
X_t	total output by commodity in period t
K_t	capital in period t
L_t	labour in period t
M_t	imports in period t
Ta_t	all taxes payed by sectors in period t
I_t	investment in period t
E_t	exports in period t
	capital depreciation rate
	interest rate
P_t	price of output in period t
Pf_t	price of financial output in period t
L_t	liabilities (supply of financial instruments in period t)
AC	average cost function
d	demand function
a	demand function for financial instruments
PK_t	price of capital in period t
RK_t	rental of capital in period t
PL_t	wage in period t
PM_t	price of imports in period t
RA	consumers disposable income

Table A.10: Classification of Financial Instruments

Sr.	Financial Instruments
1	Monetary gold and SDRs
2	Currency and transferable deposits, with MFIs
3	Currency and transferable deposits, with other residents
4	Currency and transferable deposits, with rest of the world
5	Other deposits, with MFIs
6	Other deposits, with other residents
7	Other deposits, with rest of the world
8	Short-term securities, with general government
9	Short-term securities, with other residents
10	Short-term securities, with rest of the world
11	Bonds, issued by MFIs
12	Bonds, issued by central government: CCTs
13	Bonds, issued by central government: other
14	Bonds, issued by local government
15	Bonds, issued by other residents
16	Bonds, issued by rest of the world
17	Derivatives
18	Short-term loans, of MFIs
19	Short-term loans, of other financial corporations
20	Short-term loans, of other residents
21	Short-term loans, of rest of the world
22	Medium and long-term loans, of MFIs
23	Medium and long-term loans, other financial corporations
24	Medium and long-term loans, general government
25	Medium and long-term loans, rest of the world
26	Shares and other equity, issued by residents
27	Shares and other equity, issued by rest of the world
28	Mutual fund shares, issued by residents
29	Mutual fund shares, issued by rest of the world
30	Net equity of households
31	Prepayment and other claims
32	Trade credits
33	Other

Table A.11: Classification of commodities and Industries in the SAM

Sr.	Commodities and Industries
1	Agriculture and hunting etc.
2	Forestry and logging etc.
3	Fisheries
4	Mining and quarrying
5	Food beverages and tobacco
6	Textiles
7	Wood other than furniture
8	Paper
9	Printing and recording
10	Coke and refined petroleum
11	Chemicals
12	Pharmaceutical
13	Rubber and plastics
14	Other non-metallic minerals
15	Basic metals
16	Fabricated metals
17	Computer, electronic and optical
18	Electrical equipment
19	Machinery and equipment
20	Motor vehicles, trailers and semi-trailers
21	Other transport equipment
22	Furniture
23	Repair and installation
24	Electricity, gas, steam and air-conditioning
25	Natural water and water treatment
26	Sewerage and materials recovery
27	Constructions
28	Wholesale and retail trade and repair services of motor vehicles and motorcycles
29	Wholesale trade services, except of motor vehicles and motorcycles
30	Retail trade services, except of motor vehicles and motorcycles
31	Land transport services and transport services via pipelines
32	Water transport services
33	Air transport services
34	Warehousing and support services for transportation
35	Postal and courier services
36	Accommodation and food services
37	Publishing services
38	Motion picture, video and television programme production services, sound recording and music publishing; programming and broadcasting services
39	Telecommunications services
40	Computer programming, consultancy and related services; information services
41	Financial services, except insurance and pension funding
42	Insurance, reinsurance and pension funding services, except compulsory social security
43	Services auxiliary to financial services and insurance services
44	Real estate services (excluding imputed rent)
45	Imputed rents of owner-occupied dwellings
46	Legal and accounting services; services of head offices; management consulting services
47	Architectural and engineering services; technical testing and analysis services
48	Scientific research and development services
49	Advertising and market research services
50	Other professional, scientific and technical services; veterinary services
51	Rental and leasing services
52	Employment services
53	Travel agency, tour operator and other reservation services and related services
54	Security and investigation services; services to buildings and landscape; office administrative, office support and other business support services
55	Public administration and defence services; compulsory social security services
56	Education services
57	Human health services
58	Social work services
59	Creative, arts and entertainment services; library, archive, museum and other cultural services; gambling and betting services
60	Sporting services and amusement and recreation services
61	Services furnished by membership organisations
62	Repair services of computers and personal and household goods
63	Other personal services
64	Services of households as employers; undifferentiated goods and services produced by households for own use