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Autonomous demand and economic growth: some empirical evidence*

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Abstract - According to the Sraffian supermultiplier model, economic growth is driven by autonomous demand (exports, public spending and autonomous consumption). This paper tests empirically some major implications of the model. For this purpose, we calculate time-series of the autonomous components of aggregate demand and of the supermultiplier for the US, France, Germany, Italy and Spain and describe their patterns in recent decades. Changes in output and in autonomous demand are tightly correlated, both in the long and in the short-run. The supermultiplier is substantially higher and more stable in the US, while in the European countries it is lower and decreasing. Where the supermultiplier is reasonably stable - i.e., in the US since the 1960s - autonomous demand and output share a common long-run trend (i.e, they are cointegrated). The estimation of a Vector Error-Correction model (VECM) on US data suggests that autonomous demand exerts a long-run effect on GDP, but also that there is simultaneous causality between the two variables. We then estimate the multiplier of autonomous spending through a panel instrumental-variables approach, finding that a one dollar increase in autonomous demand raises output by 1.6 dollars over four years. A further implication of the model that we test against empirical evidence is that increases in autonomous demand growth tend to be followed by increases in the investment share. We find that this is the case in all five countries. An additional 1% increase in autonomous demand raises the investment share by 0.57 percentage points of GDP in the long-run.

JEL Classification: E11, E12, B51, O41

Keywords: Growth, Effective Demand, Supermultiplier

Introduction

Following the Great Recession, which exposed blatantly the flaws of mainstream neoclassical macroeconomics, there has been a surge of interest in alternative

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macroeconomic theories, mainly of Keynesian inspiration (Fig. I).

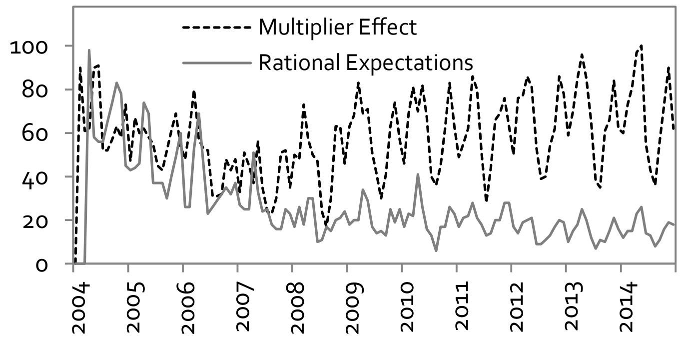


Figure I – Searches on Google for "Multiplier Effect" and "Rational Expectations" (Monthly indices; 100= peak)

Source: Authors' own elaboration on Google Trends data

Among the approaches that have attracted most attention from heterodox scholars, there is the so-called 'Sraffian Supermultiplier', a theory which highlights the role of the autonomous components of demand (exports, public spending and credit-financed consumption) as a main driver of output growth.

Since the seminal contribution of Serrano (1995), an intense theoretical debate has taken place (Trezzini, 1995; Trezzini, 1998; Park, 2000; Palumbo and Trezzini, 2003; Dejuán, 2005; Smith, 2012; Allain, 2014; Cesaratto and Mongiovi, 2015; Freitas and Serrano, 2015). The model has also been utilized as an interpretative tool to explain historical tendencies in output and demand for single countries (Medici, 2010; Amico et al., 2011; Freitas and Dweck, 2013). In the meantime, only few attempts have been done to test empirically its main predictions (e.g., Medici, 2011, which studies the case of Argentina). With the present work, we intend to perform a first systematic, multi-country empirical test of the implications of the supermultiplier model.

We first introduce and discuss the theoretical model (Section 1). Section 2 illustrates the construction of the time-series of the autonomous components of aggregate demand and of the supermultiplier, for a sample of countries which includes the US, France, Germany, Italy and Spain. Section 3 describes the recent dynamics of output, autonomous demand and of the supermultiplier in these countries. It also carries out a simple exercise of 'alternative growth accounting', calculating the contribution of each component of autonomous demand and of the supermultiplier to the growth rate of the economy. We then test empirically three main implications of supermultiplier theory:

(a) for any given value of the supermultiplier, the trend growth rate of output converges, in the long-run, to the trend growth rate of the autonomous components of aggregate demand (Section 4);

(b) positive changes in autonomous demand cause positive changes in output (Section 5);

(c) a higher growth rate of autonomous demand is associated with a higher investment share in output (Section 6).

In order to test these hypotheses, we employ cointegration analysis, IV (instrumental variables) regressions and Granger causality tests. Sources for all variables are provided in Appendix A.

As we will argue, the evidence provided in the paper appears quite favorable to the Sraffian supermultiplier model. Nonetheless, it has to be clarified that this is just a first, tentative approach to testing Serrano's model empirically. In the conclusions, some of the probable deficiencies of the analysis conducted in this work and future, possible avenues of research are sketched.

1 – Demand-led growth and the supermultiplier model

1.1 The 'Sraffian supermultiplier' model

According to the Sraffian supermultiplier model, originally presented in Serrano (1995, 1996) and further discussed and applied in Cesaratto, Serrano and Stirati (2003), output growth is shaped by the evolution of the autonomous components of demand: exports, public expenditure and credit-financed consumption. As a demand-led growth model, the Sraffian supermultiplier displays several desirable properties:

i. the extension to the long-run of the Keynesian Hypothesis, meaning that "*in the long period, in which productive capacity changes … it is an independently determined level of investment that generates the corresponding amount of savings*" (Garegnani, 1992, p. 47);
ii. an investment function based on the accelerator mechanism, without at the same time engendering Harrodian instability;
iii. the absence of any necessary relation between the rate of accumulation and normal income distribution;
iv. an equilibrium level for the degree of capacity utilization equal to the normal, cost-minimizing one;[1]

[1] It is important to recall that the Supermultiplier is not endorsed by all Sraffian scholars. This last aspect of the model, in particular, has drawn several criticisms, as summarized for example in Trezzini (1995, 1998), where it is maintained that "assuming long-run normal utilisation would therefore mean denying the

To provide a simple, baseline formalization, we can start with the output equation

$$Y_t = c(1\text{-}t)Y_t + I_t + Z_t - mY_t \tag{1}$$

Y_t, the current level of output, is equal to aggregate demand. The latter is the sum of induced consumption, investment and the autonomous components of demand (Z), minus imports. As usual in the literature, *c* is the marginal propensity to consume, *t* is the tax rate and *m* the marginal propensity to import.[2]

With the term Z we refer to the sum of "*all those expenditures that are neither financed by the contractual (wage and salary) income generated by production decisions, nor are capable of [directly] affecting the productive capacity of the capitalist sector of the economy*" (Serrano, 1995, p. 71): autonomous credit-financed households' consumption (C_0), public expenditure (G) and exports (X). Formally,

$$Z_t = C_{0t} + G_t + X_t \tag{2}$$

Differently from other heterodox contributions on growth and distribution[3], investment is treated as completely induced: productive units invest to endow themselves with the capacity necessary to produce the amount they are demanded at normal prices.[4] In its simplest version[5], this can be represented by

$$I_t = h_t Y_t \tag{3}$$

where *h* is the investment share in output (or, as Freitas and Serrano, 2013, p. 4, call it, "*the marginal propensity to invest of capitalist firms*").

To sum up, we have that the level of output is equal to the product of the autonomous

independence of investment from capacity savings" (Trezzini, 1995, p. 37) and that "the prevalence of normal utilisation depends on the compatibility between the expected trend of aggregate demand and productive capacity, (this compatibility being realized only) when aggregate demand actually grows at a warranted rate, and when such a trend is perfectly foreseen by the firms" (Trezzini, 1998, p. 57). A critique of the Supermultiplier can be found also in Barbosa-Filho (2000) and Schefold (2000). For a detailed discussion and a reply to these and other arguments, see Freitas and Serrano (2015) and Cesaratto (2015).

[2] The consumption and import functions are assumed to be linear for the sake of simplicity.

[3] See for example Marglin and Bhaduri (1990) and all the literature that takes inspiration from this seminal contribution.

[4] It emerges clearly from a vast empirical literature that output growth is the main determinant of investment, while the interest rate and the profit rate exert a much weaker influence, if any (see for example Chirinko, 1993; Lim, 2014; Sharpe and Suarez, 2014).

[5] For a more sophisticated investment function within a Supermultiplier framework, which models explicitly demand expectations, see Cesaratto, Serrano and Stirati (2003).

components of demand and the so-called Supermultiplier:[6]

$$Y_t = \frac{Z_t}{1 - c(1-t) + m - h} \tag{4}$$

Another relevant difference with other demand-led and non-neoclassical growth models[7] is that the investment share is endogenously determined, adjusted on the basis of the entrepreneurs' desire to achieve, in the long-run, the normal, cost-minimizing level of capacity utilization. In fact there is no guarantee that, in a position like the one depicted by equation (4), the existing stock of capital is utilized at its desired intensity. For this reason, firms are assumed to be continuously attempting to adjust their productive capacity, investing more when there is over-utilization and less otherwise, according to the equation[8]

$$\dot{h} = h_t \gamma (u_t - 1) \tag{5}$$

where γ is a positive reaction coefficient, u_t the actual and $u_n = 1$ the normal degree of capacity utilization. The former is defined as $\frac{Y_t}{Y_t^n}$; Y^n_t is the normal level of output entailed by the existing capital stock, that is to say the level of output obtained utilizing normally and in the cost-minimizing way the productive capacity. In general normal output will be lower than potential, full-capacity output, defined as Y^p_t.[9]

From equation (4) it is possible to derive the rate of growth of the economy, given by

$$g_t^Y = g_t^Z + \frac{\dot{h}}{s + m - h} \tag{6}$$

where we define *s*, the tax- adjusted aggregate marginal propensity to save, as *s = 1- c(1-t).* As it is possible to notice, equation (6) is defined under the implicit assumption that the parameters *c*, *t* and *m* are constant, given their exogeneity with respect to the model and the absence of plausible equations describing their time paths.

The rate of capital accumulation, from (3) is

$$g_t^K = h_t \frac{u_t}{v} - \delta \tag{7}$$

[6] For meaningful results, it is assumed that 1 – c(1-t) + m – h > 0.

[7] See Freitas and Serrano (2013) for a detailed discussion and comparison.

[8] From eqs. (3) and (5), it follows that investment dynamics depends on output growth and capacity utilization: $g^I_t = g^Y_t + \gamma(u_t - 1)$.

[9] See Steindl (1952), Kurz (1986) and Shaikh (2009) for accurate definitions of normal capacity utilization and for the provision of arguments in favor of normal output being less than full-capacity output.

where *v* is the normal capital-output ratio[10] and δ is the rate of capital depreciation.

If we introduce an explicit consideration of the dynamic behavior of capacity utilization[11]

$$\dot{u} = u_t(g^{Y}_{t} - g^{K}_{t}) \tag{8}$$

it is possible to study the dynamic system given by equations (5) and (8), whose equilibrium position ($\dot{h} = \dot{u} = 0$) is characterized by

$$g^{Y}_{t} = g^{K}_{t} = g^{Z}_{t}$$
$$u_t = 1 \text{ and } h^{eq} = v(g^{Z}_{t} + \delta).^{12} \tag{9}$$

If the rate of growth of autonomous demand is sufficiently persistent, output and productive capacity tend to the position represented by the so-called "*fully adjusted*" Supermultiplier (Cesaratto, Serrano and Stirati, 2003, p. 44), all the relevant variables evolve according to the rate of growth of the autonomous components, capacity is normally utilized and entrepreneurs adjust their investment share in order to maintain this optimal level of utilization.

As clearly pointed out by Freitas and Serrano (2013) and as it is possible to deduce from the above argument, the model described does *not* imply "*a continuous fully adjusted growth path*" (ibid., p. 22). In fact, the relevant rates of growth (rate of capital accumulation, rates of growth of output and of Z) are equal to each other only in the equilibrium path, while they are allowed to diverge during the disequilibrium adjustments. It is exactly the possibility for the rate of accumulation to be higher or lower than the rate of growth of demand and output that allows adjusting productive capacity and restoring normal utilization, in case of unexpected changes in autonomous demand or in some parameter.

While a relevant majority of post-Keynesian and neo-Kaleckian demand-led growth models tend, in general, to be investment-driven[13], in this case the long-run trend growth rate of the economy is determined by the growth path of autonomous demand. Nonetheless, a higher rate of growth of the economy still goes along with a higher investment share. This can be seen most clearly by borrowing some Harrodian concepts. From I = S and $u = u_n = 1$, defining $s_i = 1 - c(1\text{-}t) + m$, we can define the (endogenous) Supermultiplier "warranted rate" as

[10] For the sake of simplicity, it is assumed that the technical coefficient $v = \frac{K_t}{Y^n_t}$ is given and fixed, being technological progress out of the scope of the present work.
[11] From the definition of the technical coefficient *v*, it is possible to derive $g^{Y^n}_t = g^K_t$.
[12] For an explicit analysis of the dynamic stability of the model, see Freitas and Serrano (2015).
[13] See Lavoie (2006, ch. 5) for an exhaustive overview.

$$g^Z = \frac{s_i - \frac{Z}{Y}}{v} - \delta \tag{10}$$

and imagine a permanent, unexpected increase in g^Z, which causes a permanent increase in the equilibrium rate of growth of aggregate demand and output. Recalling that s_i, v and δ are exogenous, given parameters, the increase in g^Z has to be accommodated by a decrease in the ratio Z/Y and by the corresponding increase in the share of investment in output. We have assumed that induced investment has the task to adjust capacity. Hence, as a reaction to the initial over-utilization[14], prompted by the rise in the rate of growth of autonomous demand, investment will speed-up. As we can see from eq. (6), this implies that output will grow, for a certain span of time, at a rate higher than g^Z. Once $u = 1$ is reached, Y and Z will grow at the same rate, but until then Y has grown more than proportionally, due to the acceleration in investment. The rate of growth of autonomous demand is now higher, but its share in output is lower. At the same time, a new, higher "normal" investment share has prevailed (eq. 9). The difference with the other heterodox models mentioned above lies in the causality, which in the present model goes from the rate of growth of the autonomous components to the rate of growth of demand and output, with an aggregate investment function fully induced and appointed to keep pace with the evolution of aggregate demand.

1.2 Different views about the role of autonomous demand

There is however, even among non-neoclassical authors, a certain degree of controversy regarding the relation between the autonomous components of aggregate demand and output. In Park (2000), for example, a higher rate of growth of autonomous demand leads to an equilibrium path characterized by a lower rate of output growth, due to the fact that, in the author's words, "*as the larger part of aggregate demand is used for non-capacity generating purpose, ceteris paribus, the lesser part thereof will be used for accumulating productive capacity*" (Park, 2000, pp. 9-10). It is however necessary to keep in mind that this reasoning requires the assumption of continuous normal capacity utilization, which would imply that normal capacity output determines actual output. Hence, normal capacity savings would determine the rate of accumulation compatible with keeping utilization continuously normally utilized. No independent role for aggregate demand is left and more of Z causes less of I. Given that, in Park's analysis, capacity has to be utilized continuously at its target level, the rate of accumulation and the rate of output growth have to coincide all

[14] An increase in demand is accommodated, in the first place, by an increase in the rate of utilization of the existing stock of capital, because building and installing additional productive capacity is a time-demanding process.

the time and if the former slows down, the latter adjusts consequently.

On the contrary, in the Sraffian supermultiplier model, total demand is not bounded and an increase in g^Z has as a consequence an acceleration in the process of accumulation, to endow the economy with the new productive capacity, required to produce normally the increased demand. The new equilibrium path is characterized by a rate of growth equal to the higher rate of growth of the autonomous components.

An argument similar to Park's is advocated by Shaikh (2009), which develops an expressly Harrodian model in which autonomous components are introduced. An equation for the warranted rate is presented (ibid., p. 469), given by

$$g_Y = [s_i - (G_t + X_t)/Y_t]u_n/v \tag{11}$$

with G equal to government spending and X to exports. Eq. (11) is analogous, in principle, to the supermultiplier warranted rate (eq. 10), interpreting the sum of G and X as equivalent to Z. The author claims that an increase in the rate of growth of G and X will be expansionary or contractionary depending on the impact on the (G+X)/Y ratio, that is to say that the equilibrium rate of growth of output will increase only if the Z/Y ratio decreases. However Shaikh considers this case to be unlikely and maintains that, usually, the increase in Z will result in a reduction in output growth, thus qualifying government spending and exports as "*too much of a good thing*" (ibid., p. 469). This does not happen in the supermultiplier model presented above, due to the presence of margins of unutilized productive capacity. An increase in g^Z is initially accommodated by above-normal capacity utilization. The latter increases investment, whose contribution to output growth is represented by the term $\frac{\dot{h}}{s+m-h}$ in eq. (6), and for this reason Y temporarily grows more than proportionally to Z (eq. 6). The Z/Y ratio will thus have decreased, while the investment share has increased.

1.3 Empirical implications

On the basis of the discussion in 1.1, we can identify three hypotheses implied by supermultiplier theory that can be tested against empirical evidence:

H1) For any given value of the supermultiplier (SM), the trend growth rate of output converges to the trend growth rate of the autonomous components of aggregate demand (Z);

H2) Positive changes in Z cause positive changes in output;

H3) A higher growth rate of Z is associated with a higher investment share in output.

In the remainder of the paper we test these hypotheses empirically, using macroeconomic data for the US, France, Italy, Germany and Spain.

2 - Construction of the time-series of autonomous demand and the supermultiplier

2.1 Autonomous demand in the national accounts

First of all, we need to build time-series of our variables of interest, autonomous demand (Z) and the supermultiplier (SM).

We defined Z as the sum of exports, government expenditure and autonomous consumption. Estimates of exports and government expenditure[15] are routinely provided by national accounts. Indeed, in constructing a time-series of Z, the main task is that of choosing an empirical counterpart for autonomous consumption (C_0). Autonomous (as opposed to induced) consumption is defined as that part of household's consumption that is not financed out of current income. Rather, it is financed out of (endogenous) credit money or accumulated wealth.

For our purposes, it is appropriate to classify dwellings as durable consumption goods rather than investment goods, as they do not contribute to the expansion of productive capacity. We can thus identify two components of C_0: consumption spending financed by consumer credit[16] and house construction financed by residential mortgage credit. With respect to the first, it appears reasonable to assume that consumption goods are purchased as soon as credit is conceded. Cars, computers, TVs and washing machines – to mention some of the most common examples – are provided to households at the moment when the credit line is opened. So we can estimate this component of C_0 on the basis of net flows of consumer credit.[17]

Things are different in the case of residential mortgages. It would be unrealistic to assume that new houses are provided at the very moment the mortgage is approved, if only because construction takes considerable time. The flow of construction spending takes place gradually across several months (after the residential mortgage is opened or before[18]).

[15] With this term we refer to final consumption expenditure of general government and general government gross fixed capital formation.

[16] Unfortunately, there is not an obvious way of quantifying the share of consumption financed by accumulated wealth.

[17] We employ net inflows, rather than gross, because in this way we take into account the fact that when households repay a share of previously opened debts, these fixed amounts are subtracted from current consumption independently of the current level of income, so in this sense they represent 'negative' autonomous spending.

[18] Often the developer starts building the home before it is sold.

It thus appears safer to employ residential investment as our empirical measure of autonomous residential spending, under the assumption that the share of dwellings bought with cash is negligible.[19]

We will thus calculate autonomous consumption in each period, when possible, as the net flow of consumer credit (CC) plus residential construction spending (RES).

$$C_0 = CC + RES \tag{12}$$

For France, Germany and Italy, where quarterly data on consumer credit are not available for the entire sample, we exclude this component.[20] In doing this, we are reassured by the available evidence, which suggests that consumer credit, both in the US and in Europe, has been exiguous relative to residential investment and the other components of Z (see Appendix B).

2.2 The supermultiplier

Let us now turn to the task of building a proxy for the supermultiplier. Given our theoretical definitions (eq. 4), the supermultiplier (SM) depends on the tax-adjusted propensity to consume ($c[1-t]$), the propensity to import (m) and the investment share (h). We employ the share of imports in GDP as a proxy for m. Given the stylized linear consumption function, we employ 1-C/GDP (where C is total induced consumption) as a proxy for the term [1-c(1-t)]. The investment share is simply calculated as I/GDP, where I is private non-residential investment.

2.3 Sample of countries

We employ data on the US and four European countries. We try to encompass heterogeneous economic regimes and different growth strategies: the leading world economy; Germany and its export-led option; France and the economic activism of its

[19] Note that in any case, even when paid by cash, dwellings are surely not financed out of current income, so in this sense they fit our definition of autonomous spending (the median price of a new home is worth several times the median yearly income in all countries).

[20] In the case of Spain, instead, we include consumer credit in the quarterly series but not in the yearly series. We do so because in the quarterly series, which are for the period 1995:Q1-2014:Q1, consumer credit data are available almost for the entire sample, and we just have to interpolate (using BIS data on total credit, as explained in appendix A) the first two years of data. In the case of the yearly series, which cover the 1980-2013 period, we would need to interpolate more than half of the series, which would be rather incautious in our judgment.

public sector; Spain of the real estate bubble and Italy, two southern countries that after the crisis have been usually included in the Eurozone periphery (see Cesaratto and Stirati, 2011 and Stockhammer, 2013). We have built quarterly and annual time-series: 1947-2013 for the US, 1970-2013 for France, 1980-2013 for Italy and Spain, 1991-2013 for Germany. The quarterly series for the European countries are shorter than the respective yearly series: 1978:Q1-2014:Q1 for France, 1991:Q1-2014:Q1 for Germany and Italy, 1995:Q1-2014:Q1 for Spain.

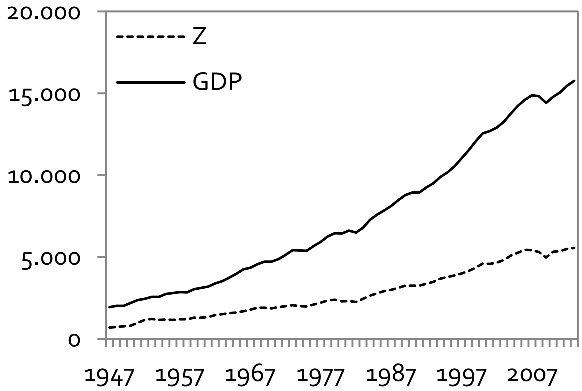
3 – The dynamics of autonomous demand and output: stylized facts

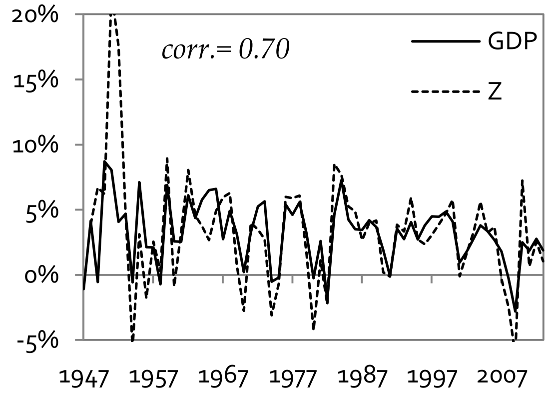
3.1 Growth in autonomous demand and output

United States - Our sample period for the US (1947-2013) starts with the 1946-1949 slump, mainly due to the withdrawal of government wartime spending and the weakness of external demand (Armstrong et al., 1991, p. 73). Recession ended in 1950, when the burst of the Korean War triggered a strong upswing led by military expenditure (ibid., pp. 106-109). Like other western economies, the US then entered a ‘Golden Age’, with GDP growing at an average annual real rate of 4.3% between 1950 and 1973. The ‘Golden Age’ was characterized by fast productivity growth, fiscal and monetary demand management policies, rising real wages, decreasing inequality and regulated financial markets. Following a ‘mini-boom’ in 1972-1973, the late Seventies and early Eighties were characterized by an evident slowdown (GDP increased by 2.3% per year between 1973 and 1983). Growth somehow rebounded since the early Eighties, before the explosion of a Great Recession in 2008-2009, followed by a relatively weak recovery (See Figure 1, panel b). The ‘Neoliberal cycle’ (Vercelli, 2015), experienced since the Eighties, displays opposite features with respect to the ‘Golden Age’, being characterized by market deregulation (especially in the financial sector), worsening income distribution and a reduction in the economic role of the State.

Western Europe – Our shorter sample periods for the European countries (1970-2013 for France, 1980-2013 for Italy and Spain, 1991-2013 for Germany) are instead almost entirely comprised in the Neoliberal Cycle. They depict, in general, a time span of similar steady and relatively moderate GDP growth, interrupted by the outburst of the Great Recession between the end of 2008 and the beginning of 2009. In the afterwards of this event, performances tend to differentiate: Germany recovers rapidly, France stagnates while Italy and Spain suffer most.

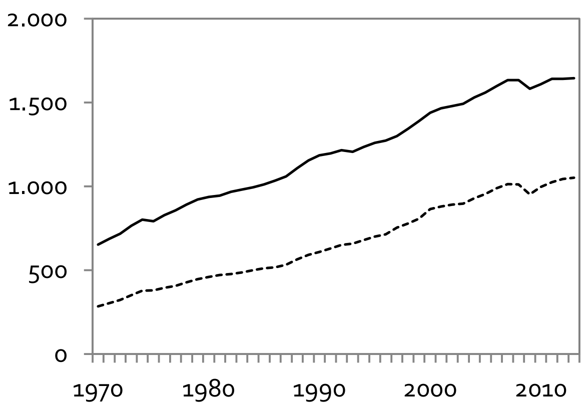
As it is possible to see in Figure 1, in all cases GDP and autonomous demand have been on a quite parallel path and their yearly rates of growth have been tightly correlated.

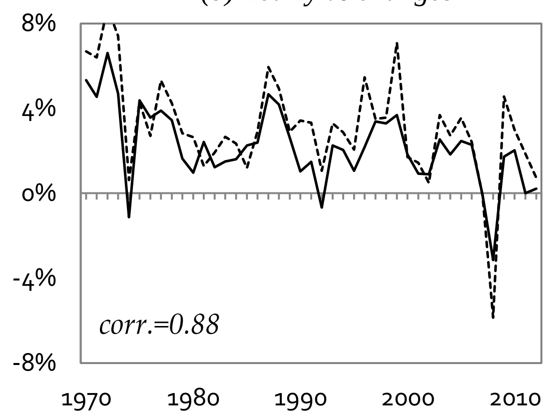




US - *(a) Billions of chained 2009 US $*

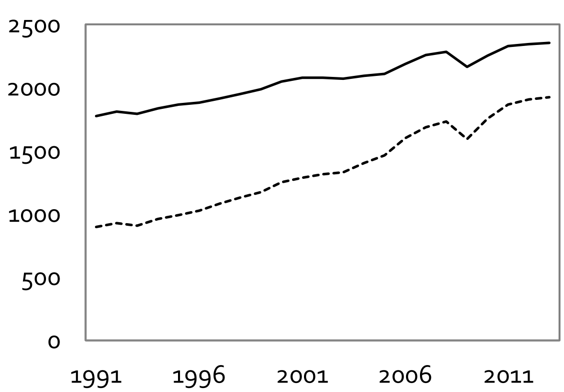
(b) Yearly % changes

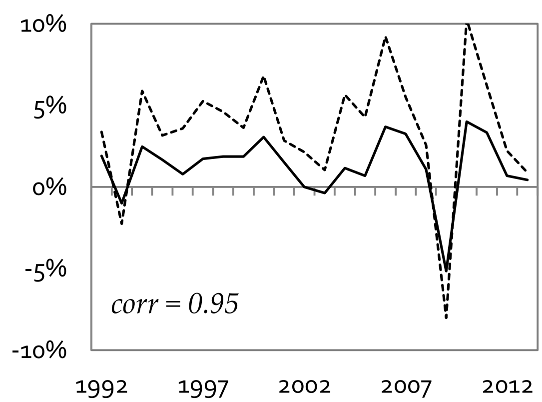




France - *(c) Billions of chained 2000 €*

(d) Yearly % changes

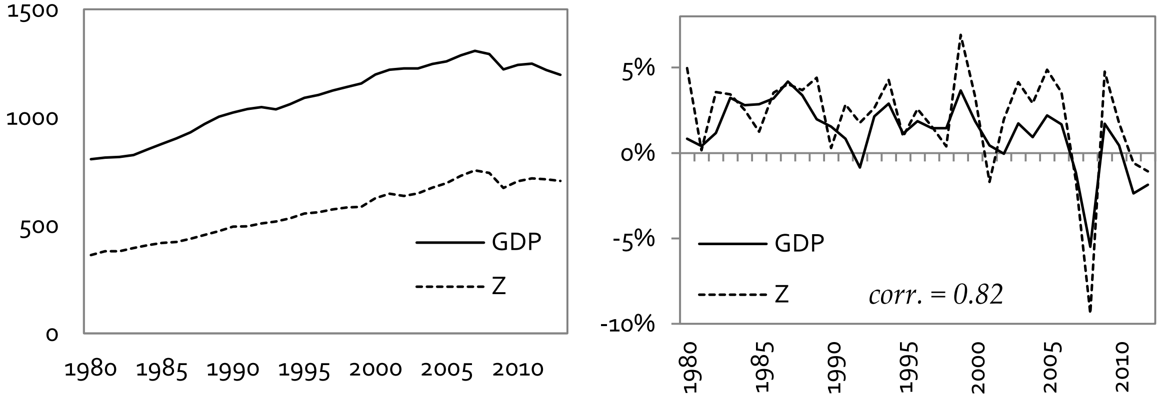




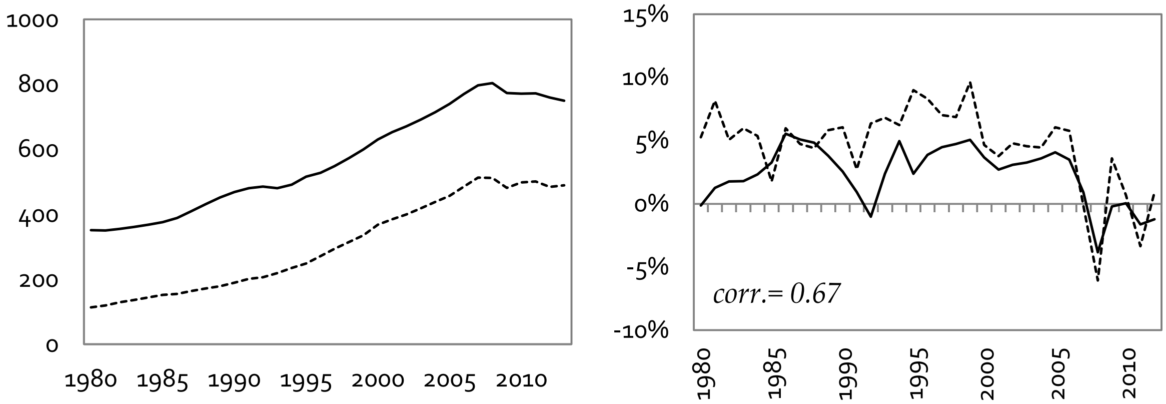
Germany - *(e) Billions of chained 2000 €*

(f) Yearly % changes

Figure 1a – Autonomous demand (Z) and Gross Domestic Product (GDP)
(US, 1947-2013; France, 1970-2013; Germany, 1991-2013)
Source: Authors' own elaboration on various sources (see appendix A)



Italy* - *(g) Billions of chained 2000 € *(h) Yearly % changes*



Spain* - *(i) Billions of chained 2000 € *(j) Yearly % changes*

Figure 1b – Autonomous demand (Z) and Gross Domestic Product (GDP)
(Italy, 1980-2013; Spain 1980-2013)
Source: Authors' own elaboration on various sources (see Appendix A)

3.2 The structure and dynamics of autonomous demand

United States - While its overall volume has grown steadily (at least until the mid-2000s), the composition of autonomous demand has changed substantially in time (Figure 2). The share of government spending in GDP and in Z has followed a decreasing pattern, almost perfectly compensated by the rising share of exports. The importance of residential investment has been broadly constant, although with a cyclical pattern, until the early 2000. It then displayed a relevant increase, reaching a peak in 2005-2006, followed by an even more dramatic reduction.

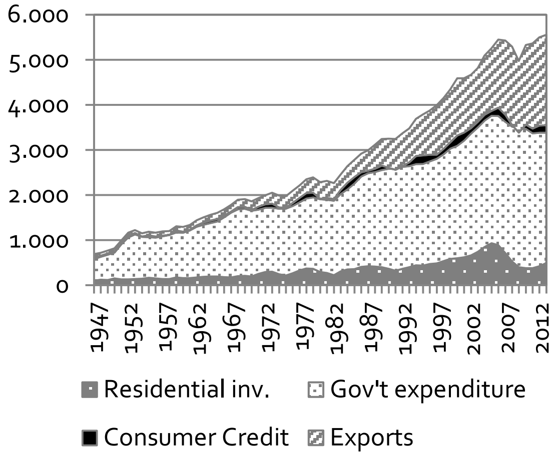
Overall, after the peak due to military spending in 1950-1953, the share of autonomous demand in GDP has displayed a decreasing trend until 1980, followed by a mild recovery (once again led by military spending) in the first half of the Eighties and by a broad stabilization. Note that net flows of consumer credit (which excludes mortgages) are modest with respect to the dynamics of autonomous demand. Even during the credit booms of the mid-Eighties and mid-2000s, their size was moderate with respect to the other components of autonomous demand.

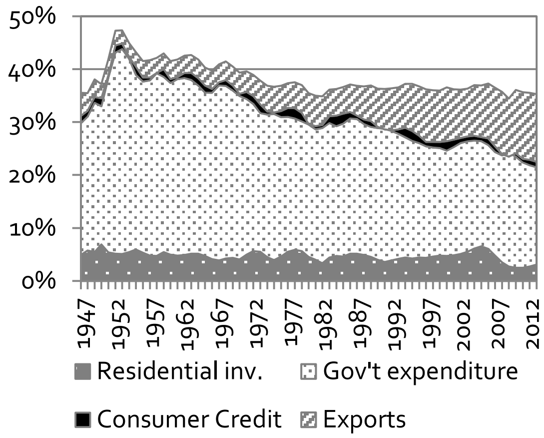
Western Europe - The overall evolution of the autonomous components of demand is characterized by an increasing trend in the Z/GDP ratio in the European countries in our sample. Export is, in general, the fastest growing component. In Germany, in particular, the share of autonomous components reaches a record amount of more than 80%, reflecting a huge increase in the openness of its economy. Also remarkable is the structural transformation that took place in Spain, after the end of Franco's dictatorship. The definitive abandonment of protectionist policies is reflected in a sharp increase in exports. There are other interesting structural differences revealed by Figure 2: in the decade before 2008-2009, residential investment has been a dynamic and important factor in explaining the Spanish performance; France has the most active public sector, in the context of a decreasing (Germany) or stagnating (Italy) weight of Government demand. In Spain, Government expenditure was growing, in absolute terms and relative to GDP, until the end of 2007, when it entered into a severe slump, due to the application of austerity measures.

The increasing trend of the Z/GDP ratio in the European countries, which is the result of GDP growing slower than autonomous demand, can be explained in terms of a decreasing supermultiplier, a factor that dampens the impact on GDP of variations in autonomous demand; of course, the discrepancy between the growth rates of Z and Y is larger where the supermultiplier has fallen more (see Figs. 3).

Having presented these series, a clarification is in order. Given the magnitudes involved, it may appear of little sense to study the relationship between the total (GDP) and a very big part of it (Z). However, it is important to note that the ratio Z/Y does not correspond to the net contribution of Z to GDP. Part of autonomous demand is devoted to foreign production, as taken into account by the presence of *m* in the denominator of the supermultiplier. Hence, the fact that the Z/Y ratio is, for example, 80%, does not mean that 80% of GDP is produced to fulfill autonomous demand.[21]

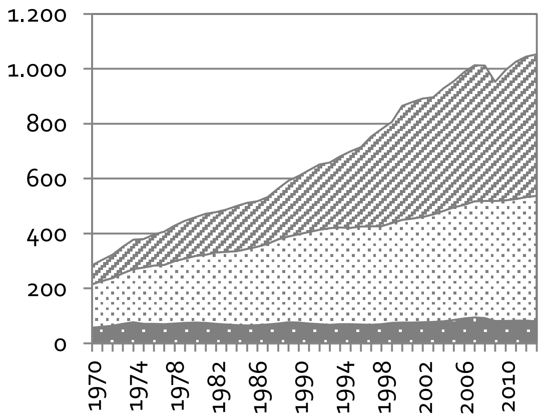
[21] From the accounting identity Y ≡ C+I+Z-M, we can see that Y+M ≡ C+I+Z, which makes clear that Z is not a net component of GDP.

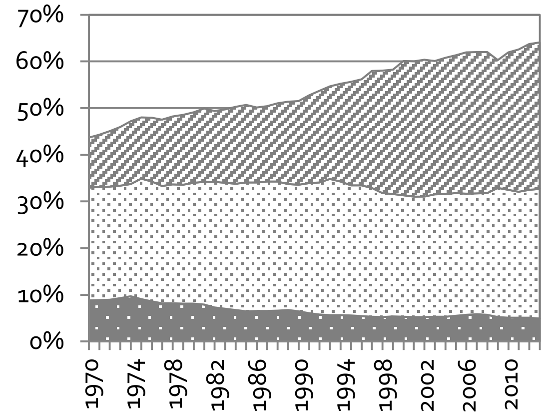




US *- (a) Billions of chained 2009 US $*

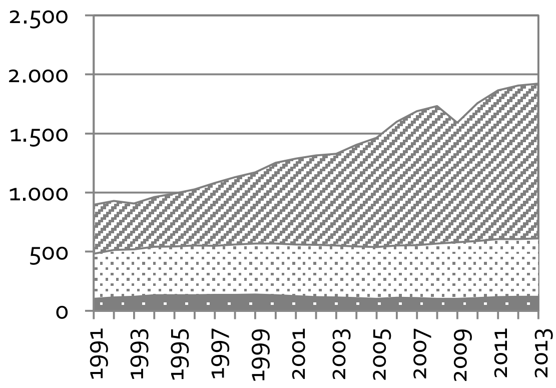
(b) As a % of GDP

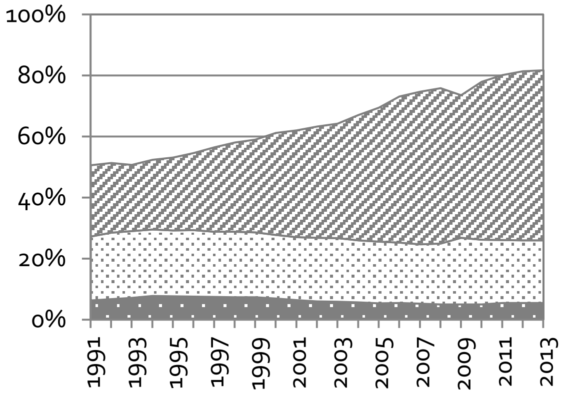




France *- (c) Billions of chained 2000 €*

(d) As a % of GDP

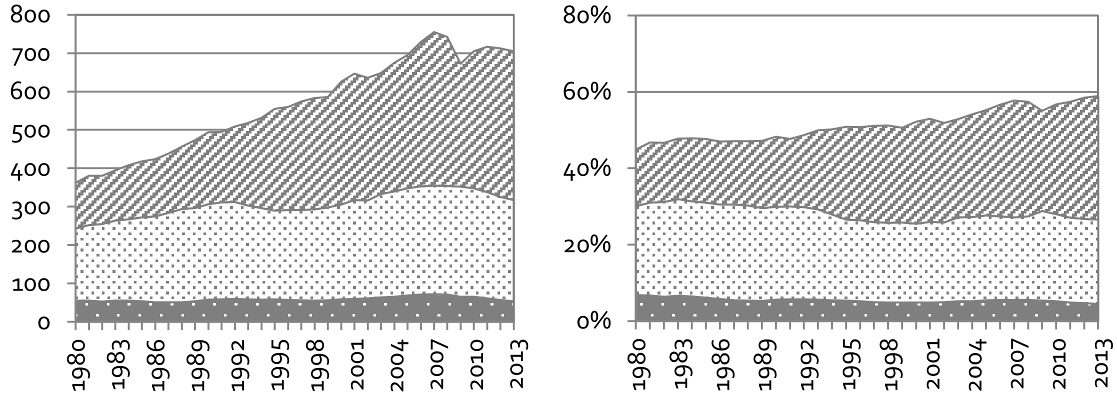




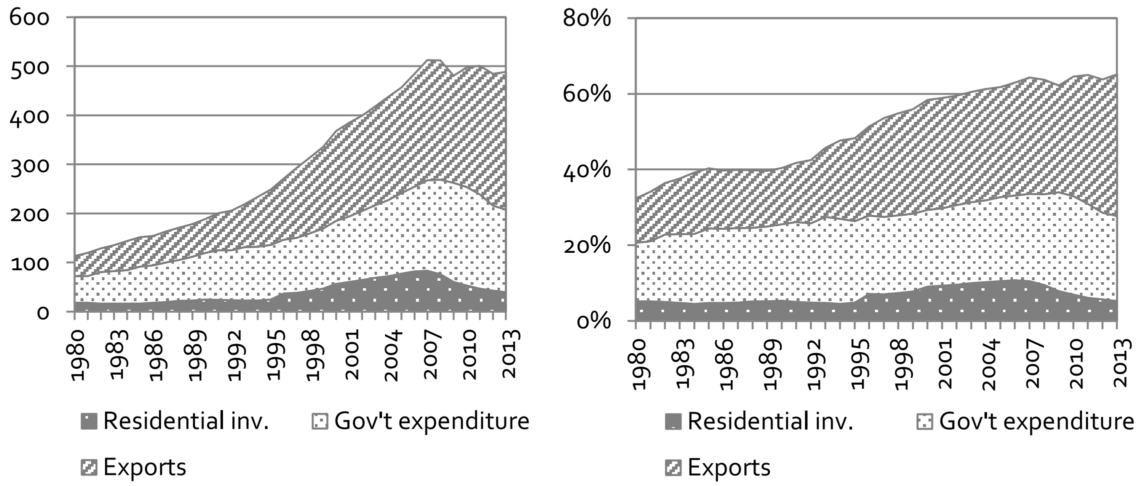
Germany *- (e) Billions of chained 2000 €*

(f) As a % of GDP

Figure 2a – Autonomous components of aggregate demand
(US, 1947-2013; France, 1970-2013; Germany, 1991-2013)



Italy - *(g) Billions of chained 2000 €* *(h) As a % of GDP*



Spain - *(i) Billions of chained 2000 €* *(j) As a % of GDP*

Figure 2b – Autonomous components of aggregate demand
(Italy, 1980-2013; Spain 1980-2013)
Source: Authors' own elaboration on various sources (see appendix A)

3.3.The supermultiplier

It is interesting to notice that, throughout the entire period in which comparable data are available, the SM has been clearly higher in the US than in the European countries[22] (Fig. 3c). This mainly reflects lower propensities to import and to save. At the

[22] The inclusion of consumer credit (CC) in the US leads to a small underestimation of the difference between the US supermultiplier and those of the European countries. Indeed, the US propensity to save – which we computed as [1 – (C – CC)/GDP], where C is total household consumption - is increased by the presence of CC and, accordingly, the SM is reduced.

beginning of our sample period, the Spanish supermultiplier was roughly in line with that of the US; nonetheless, the democratic transition was accompanied by a relevant and prolonged increase in the degree of openness of the Spanish economy. This brought Spain's supermultiplier in line with that of the other Western European countries very rapidly.

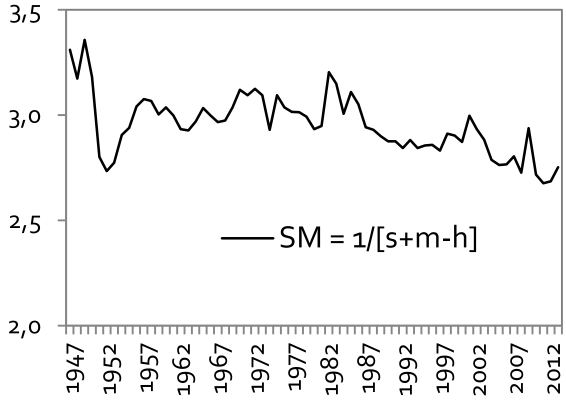
United States - The supermultiplier (SM) was at an extremely high level in 1947, due to a peak in the propensity to consume - most probably because families were eager to spend savings accumulated during the war.[23] As this effect faded away, the propensity to consume and the supermultiplier fell steeply between 1947 and 1951. Since the Sixties, the SM has remained broadly stable. After 1975, its dynamics has been the result of two opposite tendencies: a decreasing propensity to save (at least until 2007-2008) and an increasing propensity to import. The result has been overall stability, with a mildly decreasing trend in the last two decades (Figures 3a and 3c).

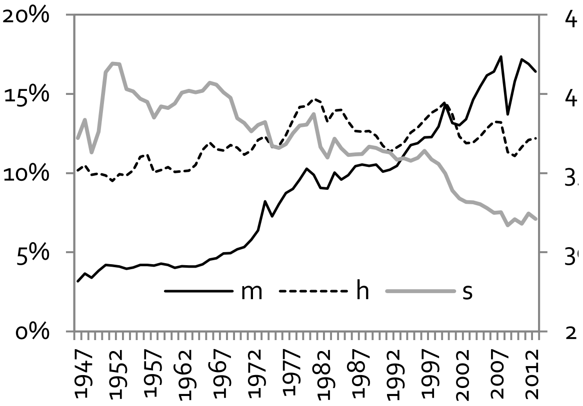
Western Europe – A generalized increase in the import share is the main explanatory factor of the decrease in the supermultiplier experienced by the four countries in the years before the outburst of the recent financial crisis.

For what concerns the German case, the reduction in the supermultiplier has been strengthened by a rising propensity to save, prompted by an improving external balance (Cesaratto, 2013). In France and Italy, the propensities to save have displayed instead a more stable long-run pattern, although with cyclical fluctuations. The same can be maintained for Spain, with the exception of the first years of the sample (1980-1984), which displayed a relevant enlargement of the fraction of income saved by households.

It is worth noting the remarkable stability of the propensities to invest, which can be interpreted as a signal of an average degree of utilization close to the normal one.

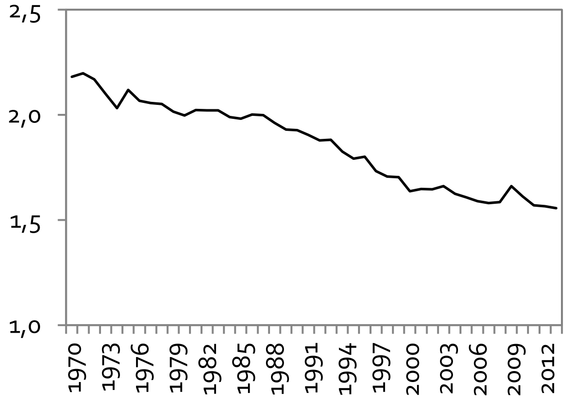
[23] In his speech on the State of the Union, delivered in Jan.1946, President Truman stated that *"On the expenditure side (...), consumers budgets, restricted during the war, have increased substantially as a result of the fact that scarce goods are beginning to appear on the market and wartime restraints are disappearing. Thus, consumers' current savings are decreasing substantially from the extraordinary high wartime rate and some wartime savings are beginning to be used for long-delayed purchases"* (Truman, 1946).

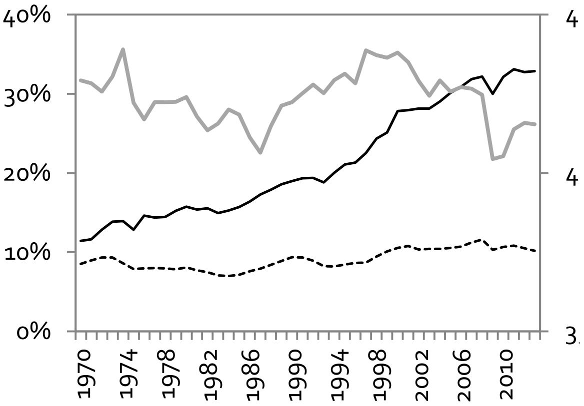




US *- (a) Supermultiplier*

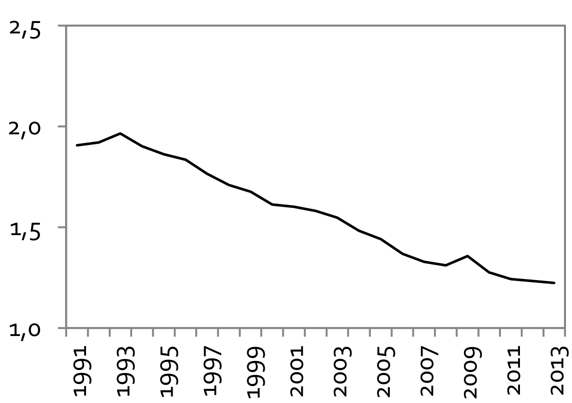
(b) Components

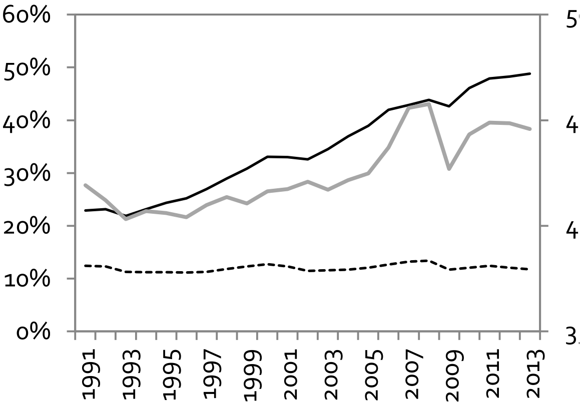




France *- (c) Supermultiplier*

(d) Components





Germany *- (e) Supermultiplier*

(f) Components

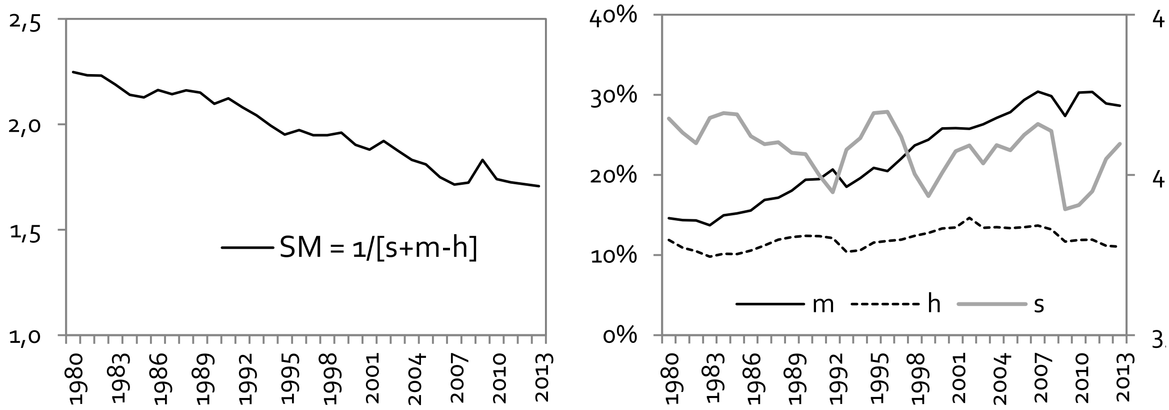
Figure 3a – Supermultiplier

(m and h on the left axis, s on the right axis; US, 1947-2013;

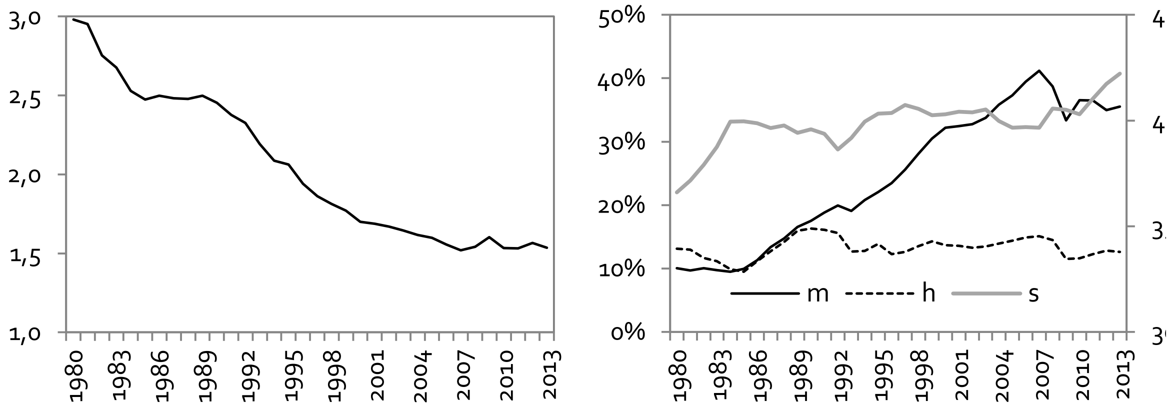
France, 1970-2013; Germany, 1991-2013)

Notes: SM = supermultiplier; m = propensity to import;

h = propensity to invest; s = propensity to save.



Italy *– (g) Supermultiplier* *(h) Components*



Spain *– (i) Supermultiplier* *(j) Components*

Figure 3b – Supermultiplier

(m and h on the left axis, s on the right axis; Italy, 1980-2013; Spain 1980-2013)

Notes: SM = supermultiplier; m = propensity to import;

h = propensity to invest; s = propensity to save;

Source: Authors' own elaboration on various sources (see appendix A)

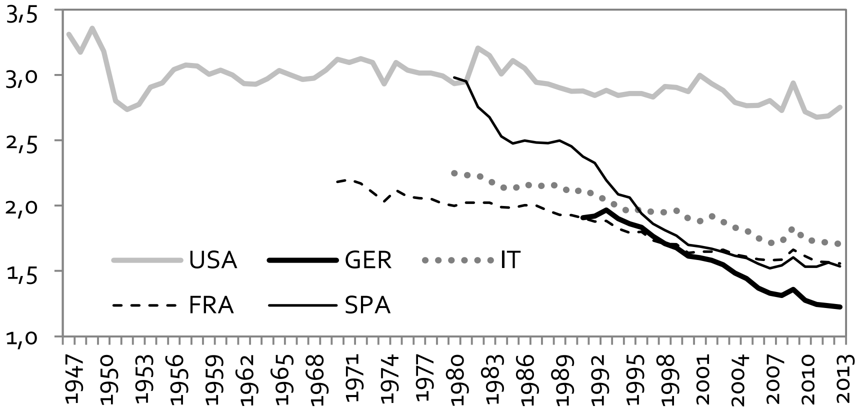


Figure 3c - Supermultiplier

Table 1 summarizes some major aspects of these historical dynamics, displaying average growth rates of output, autonomous demand and supermultiplier. Changes in Z and SM are decomposed in the contributions of each component. If we interpret this as an alternative form of 'growth accounting' – based on effective demand instead of factors' supply – we can infer from this exercise that in the US long-run changes in output are mainly accounted for by the growth of demand, while changes in the supermultiplier have been relatively less important (especially since 1960). In the European countries, instead, the strong decreasing trend in the supermultiplier has played a significant role, which results in greater discrepancies between the growth rates of autonomous demand and output.

Table 1: Average annual growth of GDP, Z and SM

			Contributions to Z growth					*Contributions to SM growth*		
	GDP	**Z**	*RES*	*CC*	*G*	*X*	**SM**	*s*	*m*	*h*
United States										
1947-1960	**3.7%**	**4.9%**	*0.5%*	*0.0%*	*4.5%*	*0.1%*	**-0.7%**	*-0.5%*	*-0.3%*	*0.0%*
1960-1978	**4.0%**	**3.4%**	*0.6%*	*0.2%*	*1.8%*	*0.6%*	**0.0%**	*0.3%*	*-0.7%*	*0.5%*
1978-1991	**2.8%**	**2.5%**	*-0.1%*	*-0.3%*	*2.0%*	*1.0%*	**-0.4%**	*0.3%*	*-0.3%*	*-0.4%*
1991-2013	**2.6%**	**2.5%**	*0.2%*	*0.0%*	*0.7%*	*1.4%*	**-0.2%**	*0.5%*	*-0.9%*	*0.1%*
France										
1970-1980	**3.7%**	**4.9%**	*0.5%*	-	*2.3%*	*2.0%*	**-0.9%**	*0.1%*	*-0.9%*	*-0.1%*
1980-1991	**2.3%**	**2.9%**	*-0.1%*	-	*1.6%*	*1.4%*	**-0.4%**	*0.0%*	*-0.6%*	*0.2%*
1991-2013	**1.5%**	**2.4%**	*0.0%*	-	*0.7%*	*1.7%*	**-1.0%**	*-0.1%*	*-1.1%*	*0.1%*
Germany										
1991-2013	**1.3%**	**3.5%**	*0.1%*	-	*0.4%*	*3.0%*	**-2.0%**	*-0.2%*	*-1.8%*	*-0.1%*
Italy										
1980-1991	**2.3%**	**2.9%**	*0.1%*	-	*1.4%*	*1.4%*	**-0.5%**	*0.4%*	*-0.9%*	*0.1%*
1991-2013	**0.6%**	**1.6%**	*0.0%*	-	*0.1%*	*1.7%*	**-1.0%**	*-0.1%*	*-0.8%*	*-0.1%*
Spain										
1980-1991	**2.9%**	**5.3%**	*0.4%*	-	*2.8%*	*2.2%*	**-2.0%**	*-0.7%*	*-1.8%*	*0.6%*
1991-2013	**2.0%**	**4.1%**	*0.3%*	-	*0.9%*	*2.9%*	**-2.0%**	*-0.2%*	*-1.5%*	*-0.3%*

Notes: contributions may not sum up precisely to the growth rate of the aggregate due to rounding and approximation.

4 – Autonomous demand and output growth: long-run relation

4.1 Economic growth and autonomous demand across countries and decades

As a first step, we look at the long-run relation between GDP and autonomous demand (Z). We compute (approximately) 10-year[24] average changes in GDP and in Z in our sample of five countries. We then regress GDP growth rates on percentage changes in Z. The relation is tight and highly significant. On average, a 1% increase in autonomous demand is associated with a 0.67% increase in GDP. Changes in Z explain 88% of variability in GDP growth (see Fig. 4).

[24] Not in all cases the changes are taken exactly over 10-year periods. More specifically, we computed average changes over the following periods: '47-'60, '60-'70, '70-'80, '80-'90, '90-'00, '00-'07, '07-'13 for the US; '80-'90,'90-'00, '00-'07, '07-'13 for Italy and Spain; '70-'80, '80-'90, '90-'00, '00-'07, '07-'13 for France; '91-'00, '00-'07, '07-'13 for Germany.

Of course, one must be cautious in interpreting this result in terms of a causal effect of Z on GDP. In fact it is not guaranteed that changes in autonomous demand are completely exogenous. There could be reverse causality (a positive effect of GDP on autonomous demand), or both changes in output and autonomous demand could be driven by some other factor. Note also that, if some component of Z is to some extent negatively influenced by GDP (as may be the case, in some instances, for government spending and/or exports), this would cause a downwards bias in the estimated effect.

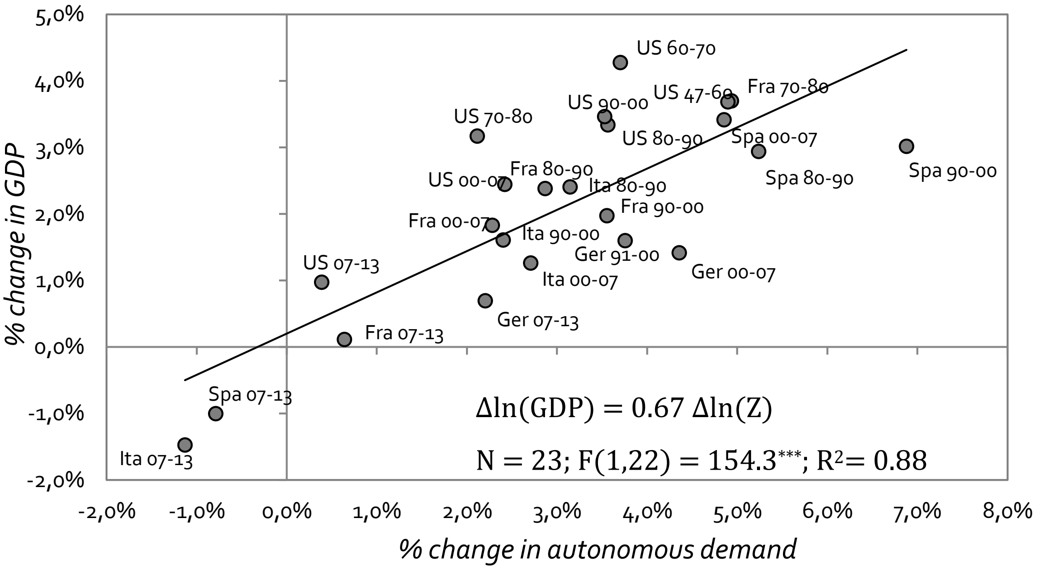


Figure 4 - Autonomous demand and GDP across countries and periods (Average annual growth rates)

Source: Authors' own elaboration on various sources (see Appendix A)

4.2 Cointegration tests

Another way to look at the long-run relation between Z and GDP is to apply cointegration analysis (Engle and Granger, 1987), to test whether the two variables share a common long-run trend (as stated by H1, in Sec. 1.3).

In order to perform this analysis, we construct the longest possible quarterly time-series, given data availability (1946:Q1-2014:Q1 for the US; 1978:Q1-2014:Q1 for France; 1991:Q1-2014:Q1 for Germany and Italy; 1995:Q1-2014:Q1 for Spain).

A complication arises, however, in performing cointegration tests on our sample period. The simple theoretical model, derived in Sec. 1.1, was built under the assumption of constancy of the marginal propensities to save and to import. Nonetheless, the supermultiplier has displayed a strong decreasing trend, in the European countries in our sample, during the whole period under observation (see Figs. 3), due to an upward trend in the propensity to save (s) and, more importantly, in the propensity to import (m). We thus need to adjust the model, relaxing the mentioned assumption, to appreciate the theoretical implications of these relevant changes. With a time-varying SM, eq. (6) becomes

$$g^Y = g^Z + g^{SM} + g^Z g^{SM} \quad (13)$$

which implies $g^Y - g^Z = g^{SM} + g^Z g^{SM}$, where g^{SM} is the rate of growth of the supermultiplier. This makes clear that, according to the theory, Y and Z are cointegrated (i.e., $g^Y = g^Z$) only when $g^{SM} = 0$ and that the discrepancy between the trend growth rates of Y and Z is a positive function of the change in SM.[25]

In other words, output and autonomous demand move in step as long as the supermultiplier is constant. Otherwise, the impact of variations in Z is amplified or dampened by the change in SM.

Visual inspection of Fig. 1 strongly suggest that both GDP and Z are I(1) processes (i.e., they are non-stationary in levels but stationary in first-differences). This is confirmed by ADF unit-root tests (Dickey and Fuller, 1979). On the basis of the above discussion, we expect GDP to be cointegrated with Z for countries and periods in which the supermultiplier (SM) is stable enough.

To test for cointegration, we perform a Johansen cointegration test (Johansen, 1988 and 1991), based on a model with a constant trend and two lags[26], on the natural logarithms of Z and GDP. The null hypothesis of no cointegration is rejected at the 95% confidence level only for the US, while it cannot be rejected at any conventional level for the four European countries. This appears compatible with the predictions of supermultiplier theory. As shown in Figures 3, the supermultiplier was indeed broadly stable in the US (except for some fluctuations in the very beginning of the sample), while it had a neat and strong decreasing trend in the four European countries.

Table 2: Johansen test, trace statistics for the null of no cointegration between Z and GDP

	USA	Germany	France	Italy	Spain
H_0: rank = 0	***18.7*****	*9.9*	*6.7*	*6.0*	*12.3*
N	*267* 1947:Q3 –2014:Q1	*91* 1991:Q3 – 2014:Q1	*143* 1978:Q3 – 2014:Q1	*91* 1991:Q3 – 2014:Q1	*75* 1995:Q1 – 2014:Q1

*Notes: 2 lags of each variable and an unrestricted constant included in the underlying VAR model; *, ** and *** denote rejection of the null hypothesis of no cointegration at the 0.10, 0.05 and 0.01 significance levels respectively.*

[25] Of course, we are ruling out the case in which $g^Z \leq -1$, which makes little economic sense.

[26] Inclusion of a constant trend is suggested by visual inspection of the data. In order to select the lag order, we estimated a VAR in levels including Z and GDP and computed several standard information criteria. Schwarz's Bayesian information criterion (BIC), Akaike's information criterion (AIC) and Hannan-Quinn information criterion (HQIC) all point to the inclusion of two lags. As shown by Nielsen (2001), these tests are valid even in the presence of I(1) variables. As a robustness test, we run the Johansen test with any possible number of lags between 1 and 16. In all cases results are unchanged: the null is rejected for the US but not for European countries.

In order to get a taste of the stability of the cointegration relation found in US data, we plot the residuals from a regression of GDP on Z (Figure 5). The result is not exactly what we would expect from a stable cointegration relation: it appears clear that the relation between Z and GDP underwent a major change in the very first years of the sample. In particular, if we accept provisionally the hypothesis that the cointegration relation is due to a long-run causal effect of Z on Y, the pattern of residuals would suggest that the elasticity of Y with respect to Z was much higher in the 1947-1950 period, and then decreased substantially. According to theory, this should be the result of the initial reduction in the supermultiplier.

Summing up, in our sample we have a situation which approximates reasonably well the case of $g^{SM} = 0$ only in the US in the period after the Fifties. Consistently with theory, only in this case we find a stable long-run relation between Z and GDP. In the European countries, in which SM displays a clear decreasing trend, GDP growth has lagged behind the growth of Z.

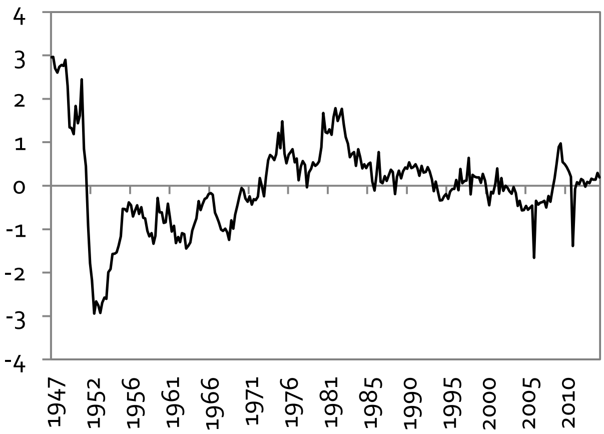


Figure 5 – Standardized residuals from a regression of ln(GDP) on ln(Z) (US, quarterly data, 1947:Q1 – 2014:Q1)

It would be useful to test more formally whether the discrepancies between the long-run trends of Z and GDP, in the European countries, are actually explained by the declining trend of the SM. The most natural way to do this would be to include SM in the cointegration equation and check whether this yields a stable long-run relation or, alternatively, to correct Z by multiplying it for SM. The problem with these solutions is that they would produce a stable cointegration relation *by definition*. In our data $Y_t \equiv Z_t{*}SM_t$ holds by construction, due to the fact that we calculated the SM components as ex-post ratios of consumption, investment and imports to GDP.[27] Of course, when we introduce SM in the cointegration equation in the two ways just mentioned, we obtain a stable cointegration relation in all countries, but the result has no explanatory meaning.

[27] Changes in inventories, which we did not include in the analysis, and possibly a statistical discrepancy between expenditure side and output side measurement of GDP, prevent our measure of Z*SM to be exactly equal to GDP.

One could try to build some proxy for the supermultiplier in order to break the accounting identity (for example employing the household saving rate, corrected for an average taxation rate, instead of the actual overall marginal propensity to save). But the dilemma would not be solved at all: a good proxy for SM is closely correlated with actual SM, so our estimated cointegration relation would remain very close to an accounting identity.

We thus exploit the period of stability of the supermultiplier, in the US since the Sixties - which results in cointegration between output and autonomous demand - to study the properties of the cointegration system. In particular, the estimation of a Vector Error-Correction model (VECM) allows us to assess the direction of short and long-run causality.

4.3 Short-run impacts, long-run impacts and direction of causality: an error-correction model for the US economy

In order to assess short and long-run relations and try to identify the direction of causality, we estimate the parameters of a bivariate Vector Error-Correction model (VECM), using US quarterly data on Z and on GDP for the period 1960:Q1-2014:Q1.[28] We include a constant trend and a two-lags order structure. Assuming a long-run equilibrium relation of the type[29]

$$GDP_t = c + \theta\, Z_t \tag{14a}$$

we model the short-run adjustment process through the following VECM:

$$\Delta GDP_t = \alpha_0 + \alpha_1(GDP_{t-1} - \theta\, Z_{t-1} - c + \mu) + \alpha_2\, \Delta GDP_{t-1} + \alpha_3\, \Delta Z_{t-1} + e_{1t} \tag{14b}$$

$$\Delta Z_t = \gamma_0 + \gamma_1(GDP_{t-1} - \theta\, Z_{t-1} - c + \mu) + \gamma_2\, \Delta Z_{t-1} + \gamma_3\, \Delta GDP_{t-1} + e_{2t} \tag{14c}$$

where Z is the log of real autonomous demand and GDP is the log of real GDP. Supermultiplier theory implies that, *given the stability of the SM*, we should have the following:

a) $\varepsilon_t = GDP_t - \theta\, Z_t - c$ is a stationary series
b) $\theta = 1$
c) $\alpha_1 < 0$
d) $\gamma_1 = 0$
e) $\alpha_3 > 0$

[28] As discussed in the previous subsection, we restrict the analysis to the period during which the supermultiplier was broadly stable (see Fig. 3a, panel a).
[29] One obtains eq. (14a) by normalizing the cointegrating vector w.r.t. GDP_t.

Condition (a) ensures that autonomous demand and output share a common long-run trend. We have already verified that through the Johansen cointegration test. Condition (b) means that Z and GDP move in step in the long-run. The most important restrictions are (c) and (d): taken together, they imply that long-run causality goes from Z to GDP and not vice-versa. Finally, (e) means that autonomous demand has a positive short-run multiplier effect.

Results are presented in Table 3, columns (1). The estimated long-run coefficient θ is very close to one (1.04). The error-correction term in the equation explaining ΔGDP (α_1) is negative and significant at the 95% confidence level, but also the adjustment term explaining ΔZ (γ_1) is significant, even if only at the 90% confidence level. For what concerns short-period coefficients, ΔZ_{t-1} has a positive but low effect on ΔGDP, while the impact of lagged output changes on ΔZ appears higher.

Consumer credit is likely to be the element which is most influenced by the economic cycle (see discussion below). We thus try to re-estimate our VECM, after subtracting this component from Z. Results – reported in table 3, columns 2 – are more in line with the predictions of supermultiplier theory. α_1 is negative and significant, while γ_1 is not significantly different from zero: when GDP and Z are in disequilibrium, it is GDP that adjusts to the equilibrium relation. This result - coupled with the fact that R^2 is much higher for eq. 14b than for 14c - is supportive of the hypothesis that autonomous demand drives output in the long-run. The short-run impact of Z on output becomes higher, while the elasticity of autonomous demand to short-run changes in output strongly decreases, from 0.7 to 0.3. In any case, also after excluding consumer credit from Z, the short-run effect of output changes on autonomous demand remains significant, suggesting that also the other components of Z are somehow influenced by GDP growth.

We can appreciate the dynamics of the estimated model by calculating orthogonalized impulse-response functions (IRFs).[30] A positive shock to autonomous demand has a permanent but low effect on output (left panel). At the same time, an increase in output has a positive and persistent, but even lower, effect on autonomous demand (Figure 6, panels a and b).

Unsurprisingly, the picture changes after excluding consumer credit from Z (Figure 6, panels c and d). The main difference is that the impact of output on Z becomes much smaller and tends to fade away with time.

[30] In order to obtain the OIRF we had to impose an identification restriction to the underlying structural model. We choose to employ a Cholesky decomposition, assuming that Z is 'causally prior' to GDP. That means that GDP growth can be affected by contemporaneous and lagged autonomous changes in Z, while Z can be affected by lagged autonomous changes in GDP, but not by contemporaneous ones. This restriction appears the most sensible one: changes in Z are bound to have a contemporaneous effect on output growth, since Z shares some components with GDP. To the contrary, Z is composed by autonomous variables that are discretionally determined by individuals and institutions. When choices influencing Z are made (government budget choices, house purchases, foreign citizens' spending, etc.) the individuals and institutions involved can possibly observe estimates of growth in the preceding quarters, but they cannot observe unexpected changes in GDP that will happen in the same quarter.

Table 3: Cointegration analysis, relation between Z and GDP
Estimation of the VECM in equations 14a – 14c (US, 1960:Q1-2014:Q1)

Long-run cointegrating eq.			Short-run eq. for ΔGDP_t			Short-run eq. for ΔZ_t		
	(1)Incl.CC	*(2)Excl.CC*		*(1)Incl.CC*	*(2)Excl.CC*		*(1)Incl.CC*	*(2)Excl.CC*
c	0.75	1.8	α_0	$\mathbf{5.5 \cdot 10^{-3***}}$	$-6.5 \cdot 10^{-4}$	γ_0	$2.9 \cdot 10^{-3}$	$2.0 \cdot 10^{-3}$
	-	-		(7.5)	(-0.29)		(1.63)	(0.69)
ϑ	**1.04*****	**0.93*****	α_1	**-0.03****	**-0.02*****	γ_1	**0.05***	$-5.5 \cdot 10^{-3}$
	(43.2)	(13.8)		(-2.21)	(-2.56)		(1.68)	(-0.65)
			α_2	**0.21*****	**0.18****	γ_2	**-0.24*****	0.11
				(2.80)	(2.24)		(-3.13)	(1.40)
			α_3	**0.07****	**0.17*****	γ_3	**0.71*****	**0.27*****
				(2.34)	(2.68)		(3.91)	(2.67)
			R^2	0.53	0.54	R^2	0.18	0.36

*Notes: All variables taken in natural logarithms; t statistics in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$;*

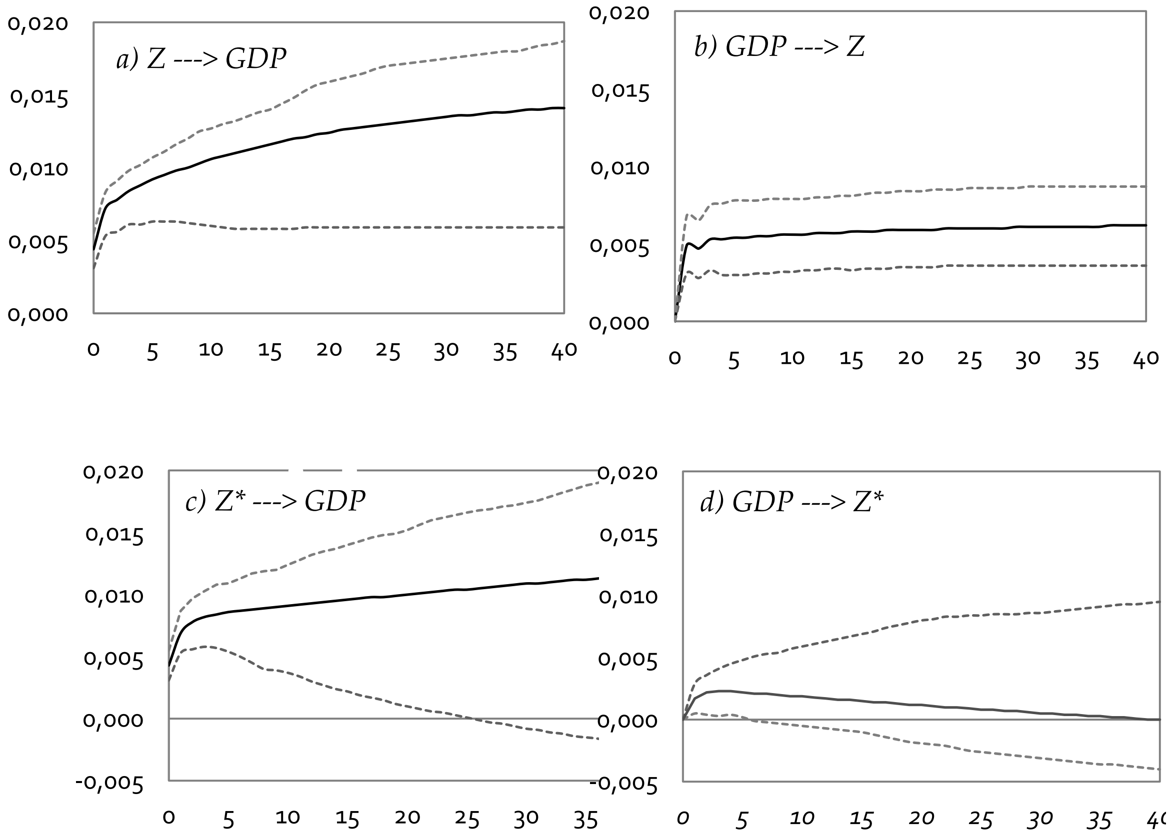


Figure 6 – Orthogonalized impulse response functions (OIRFs) and bootstrapped 90% confidence intervals (US, quarterly data, 1960:Q1 - 2014:Q1; Z=Z-CC)*

It emerges clearly from these results the presence of a mutual influence between autonomous demand and output. In spite of having classified Z as the autonomous components of demand, by definition independent from actual or expected real income, the empirical evidence shows that causality runs not only from Z to Y, as expected, but also from Y to Z.

It has to be specified that, in the Sraffian-Keynesian growth model that we summarized in Sec.1, the fact that Z is autonomous means that it is not determined by output through a necessary functional relation. Even so, Z does not fall from the sky: it is socially and historically determined; among the various social and economic factors that influence autonomous spending, economic growth certainly plays a major role. We can indeed imagine several plausible explanations for this mutual influence.

There are solid theoretical reasons to explain a strong endogeneity of consumer credit. The evolution of output is likely to influence both demand and supply for credit, given that appetite for risk is pro-cyclical (Minsky, 1982).

As we have shown, when consumer credit is excluded from autonomous demand the endogeneity of Z is significantly reduced but certainly not eliminated. Also the other components of autonomous demand, in other words, are sensitive to output growth. For what concerns exports, it can be argued that output growth increases a country's productivity – a fact known as Verdoorn's law (Verdoorn, 1949) - enhancing in this way external competitiveness and thus stimulating exports (Dixon and Thirlwall, 1975). Moreover income growth in the US, one of the main engines of worldwide demand, may have positive spillovers on trade partners, boosting their income and their demand for imports from the US. Regarding the behavior of public expenditures, various authors have noticed their endogeneity with respect to macroeconomic conditions (see for example Kelton, 2015). The direction of this effect is somehow ambiguous: fiscal policy is potentially stabilizing (Krugman, 2009; Kelton, 2015), but in several cases it has been found to be procyclical (Sorensen et al., 2001; Frankel, 2012). What matters for our analysis, in any case, is that public spending is certainly influenced by output growth. This does not imply that fiscal policy is not discretionary, even when governments follow peculiar fiscal rules (themselves completely discretionary too), but means that the path of public expenditure, even if autonomous, is not abstract from reality and necessarily responds to the economic and political context and objectives of a country. A last possible channel of influence has to do with the specific proxy we used for one of the components of autonomous consumption, namely residential investment, which tends to be positively affected by GDP growth (Arestis and González-Martínez, 2014).

Notwithstanding these feedback effects, it is worth remarking that, when consumer credit is excluded from autonomous demand, our tests indicate that long-run causality goes univocally from autonomous demand to output.

A further remark is also in order. While all our results point to a long-run causal effect of Z on GDP, the orthogonalized impulse responses (depicted in Fig.5) imply a rather low short-run multiplier[31]. The resulting 4-years cumulative multiplier[32], for example, is just around 0.45, significantly lower, for instance, than what generally found by the existing literature on fiscal multipliers.[33] Informed by the latter, we think that our low short-run multipliers are probably due to the extreme difficulty of identifying truly exogenous demand shocks from our extremely simple two-way VECM model. Estimating with more precision the short-run multiplier effect of Z – exploiting also the information contained in the time-series for the European countries - is the scope of the next Section.

5 – The multiplier of autonomous demand

The most straightforward way to assess the short-run effect of autonomous demand on output would be to estimate an equation of the type

$$\Delta GDP_{c,t} = \mu_c + \sum\nolimits^{m}_{i=1}\alpha_i \, \Delta GDP_{c,t-i} + \sum\nolimits^{n}_{j=0}\beta_j \, \Delta Z_{c,t-j} + \varepsilon_{c,t} \tag{15}$$

where c indicates the country and μ_c are country-specific fixed effects.[34]

However, the β_s estimated from this specification would suffer from endogeneity. Indeed, when studying the US case, we found strong mutual causality in the short-run between Z and GDP. Moreover, it is widely acknowledged in the empirical literature on fiscal multipliers (see for example Ramey, 2011; Nakamura and Steinsson, 2014) that Government spending, a major component of autonomous demand, tends to react to the economic cycle.

To tackle endogeneity, we estimate eq. (15) through two-stages least squares (TSLS). We include observations from all five countries in our sample using annual data[35] and set m = n = 2.[36] As instrumental variables for Z we employ military expenditure, US economic growth (for European countries) and an index[37] which

[31] Our OIRFs can be interpreted as elasticities (given that we take variables in natural logarithms), so the multiplier at a given time horizon is simply the IR divided by the ratio Z/Y.

[32] See Spilimbergo et al. (2009) for precise definitions of multipliers and cumulative multipliers.

[33] See for example the review in De Long and Summers (2012, pp. 244-246).

[34] As well-known, the inclusion of both country fixed effects and autoregressive dynamics generates a bias (Nickell 1981). However this bias is of order 1/T, so it is negligible in panels with large T. In general the literature tends to favor the use of FE estimators in panels with small N and large T (see e.g. Kennedy, 2013, p.291). In our case, N is small and T is relatively large (on average we have 32 observations per country). In any case, the resulting distortion is a downwards bias, so it renders our estimates of the multiplier of Z more conservative. Furthermore, we will show below that employing the TSLS pooled estimator (which is biased upwards) and the Arellano-Bond GMM estimator (which is unbiased but less efficient with large T) does not alter results relevantly.

[35] Most of the instruments that we employ are available only at yearly frequencies.

[36] We choose the lag-length on the basis of conventional information criteria, inspection of correlation and autocorrelation functions and statistical significance.

[37] In particular we used a component of the KOF Index of Globalization (Dreher, Gaston and Martens, 2008). See Appendix A.

measures trade restrictions imposed by Mexico and Canada (for the US).[38] These are important determinants of exports and government spending (the two major components of Z), which are plausibly exogenous with respect to a country's economic cycle.

Military expenditure is widely used as an instrument for G in the empirical literature (e.g., Nakamura and Steinsson, 2014), since it is largely unrelated to short-run output fluctuations. US growth is surely an important exogenous determinant of demand for European exports, under the plausible identifying assumption that, in the short-term, the dynamics of US output is not determined by the growth rate of European economies. Conversely, we do not employ European growth as an instrument for US autonomous demand because the US economy is likely to exert a considerable influence on it (so the instrument would not be exogenous). Instead, we employ an index of trade restrictions imposed by Mexico and Canada, by far the two most important destinations of US exports.

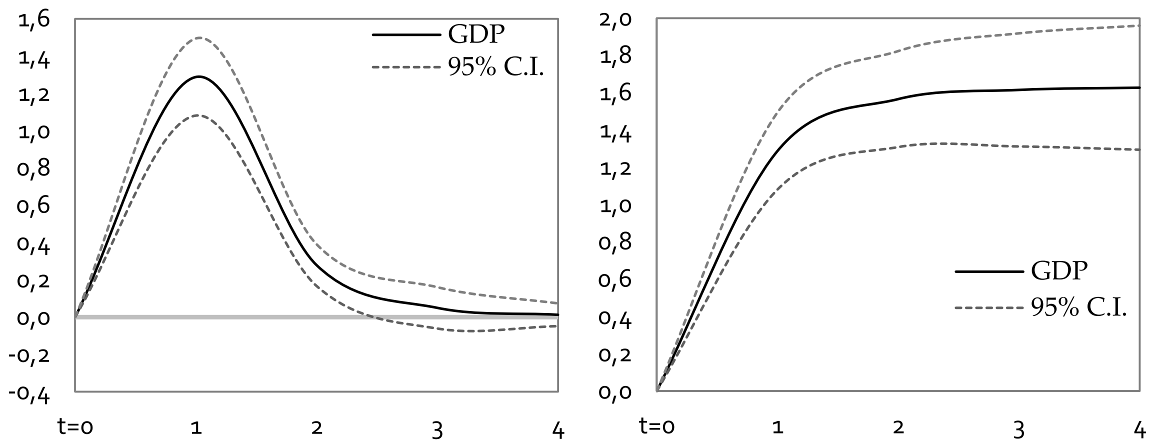
The first stage of the estimation indicates that our instruments are relevant. The F-statistic on the excluded instruments and the Anderson canonical correlation test are highly significant (with $p < 0.00001$ in both cases) and the partial R^2 of the first-stage regression is 22%. Sargan (1958) and Basmann (1960) tests of overidentifying restrictions suggest that the instruments are also valid (i.e. exogenous).

We find α_1 and β_0 to be statistically significant at the 1% confidence level, while α_2, β_1 and β_2 are not significantly different from zero at any conventional level. Country-specific effects are jointly significant. We employ estimation results to track the short-run effect of a unit increase in Z (i.e. the multiplier of Z). The impact multiplier is 1.3. The cumulative 4-year multiplier is 1.6. In other words, a one-Dollar (or Euro) increase in autonomous demand raises output by 1.3 dollars over the first year and by 1.6 dollars over four years[39] (Figure 8).

As robustness tests, we re-estimate eq. (15) using a pooled TSLS estimator (which excludes fixed-effects), difference-GMM and system-GMM. Results remain qualitatively analogous to those produced by the within-groups estimator: when using the pooled TSLS, the impact multiplier decreases to 1.1 but the 4-years cumulated multiplier rises to 1.7; when using difference-GMM the impact multiplier is 1.1 and the 4-years cumulated multiplier 1.2; when using system-GMM the impact multiplier is 1.1 and the 4-years cumulated multiplier 1.7.

[38] We have considered also several other possible instruments, like for example population growth, economic costs of natural disasters, households' debt stock and the IMF narrative index of deficit-driven fiscal consolidations (Guajardo, Leigh and Pescatori, 2011) but they resulted endogenous and/or not-relevant.

[39] Impulse responses (IRs), calculated from the estimated model, can be interpreted as elasticities (given that we take variables in natural logarithms), so the multiplier at a given time horizon is simply the IR divided by the ratio Z/Y. For the definitions of n-year multiplier and cumulative multiplier see Spilimbergo et al. (2009).



(a) Effect of a unit increase in Z

(b) Cumulative effect of a unit increase in Z

Figure 8 – Short-run multiplier of Z (TSLS estimation, yearly data, all five countries)

6 – Autonomous demand and the investment share

Let us now assess whether increases in the rate of growth of autonomous demand tend to cause increases in the investment share (hypothesis H3, as stated in Sec. 1.3), as supermultiplier theory would predict. Figure 9 displays the relation between lagged changes in Z and changes in the investment share in our sample of countries, highlighting a positive relation, which suggests that indeed the rate of change of I/Y is positive function of g^Z.

In order to test H3 more formally, we perform Granger causality tests.[40] For each country, we employ Ordinary Least Squares (OLS) to estimate the parameters of the following equations

$$\Delta I_t = \alpha_0 + \sum\nolimits^{n}_{i=1}\alpha_i\,(\Delta I)_{t-i} + \sum\nolimits^{n}_{j=1}\beta_j\,(\Delta Z)_{t-j} + \varepsilon_{It} \tag{16a}$$

$$\Delta Z_t = \gamma_0 + \sum\nolimits^{n}_{i=1}\gamma_i\,(\Delta Z)_{t-i} + \sum\nolimits^{n}_{j=1}\delta_j\,(\Delta I)_{t-j} + \varepsilon_{zt} \tag{16b}$$

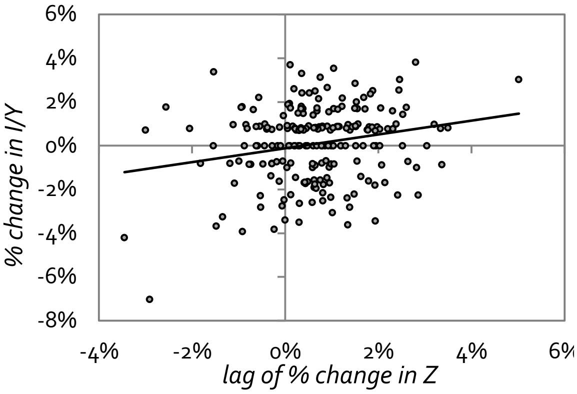
where I is the log of the investment share (I/GDP*100) and Z is the log of autonomous demand, with the order of lags (n = 2) selected by the usual criteria. We can then calculate F-statistics testing the null hypotheses of non Granger-causality, which are respectively

[40] A Granger causality test is useful in identifying lead-and-lag relationships between time-series. The variable X causes the variable Y, in the sense of Granger, if past values of X contain useful information to predict the present value of Y. Formally, X Granger-causes Y if E(yt|yt-1, yt-2, …, xt-1, xt-2, …)≠ E(yt|yt-1, yt-2, …).

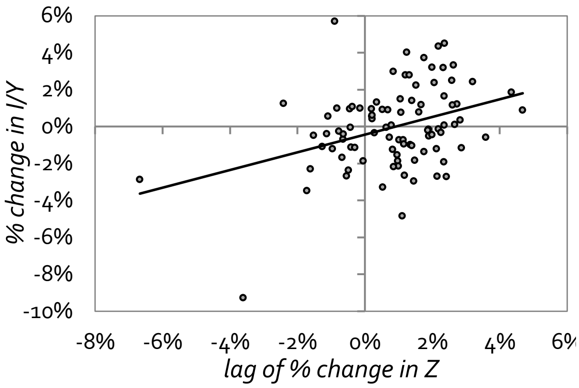
H_0: $\beta_1 = \beta_2 = 0$ and H_0: $\delta_1 = \delta_2 = 0$

Results (Table 4) confirm the indications of Figs. 9. A speeding up in the growth of Z do tend to be followed by acceleration in the dynamic of the investment share, as predicted by supermultiplier theory. First-lagged autonomous demand is positively and significantly related to the investment share in all five countries, while the second lag is negative but much lower in absolute value. The null that Z does not Granger-cause I is rejected for all European countries at the 95% confidence level, while for the US it is rejected when the sample is restricted to the after-1960 period (in the whole sample the p-value is 0.15).

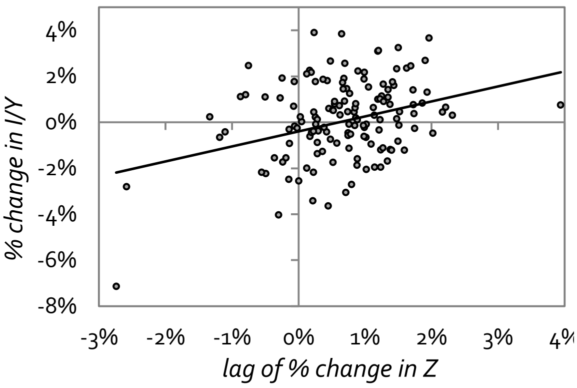
Is there some feedback effect of the investment share on autonomous demand? We would expect so, given that investment exerts a multiplier effect on output, and in turn the latter has been found in previous tests to positively affect autonomous demand. However the investment share Granger-causes autonomous demand with a positive (but rather low) coefficient in the cases of France and Italy but not in the other countries (also in the case of the US in the whole sample I appears to Granger-cause Z, however the estimated coefficient is *negative).*



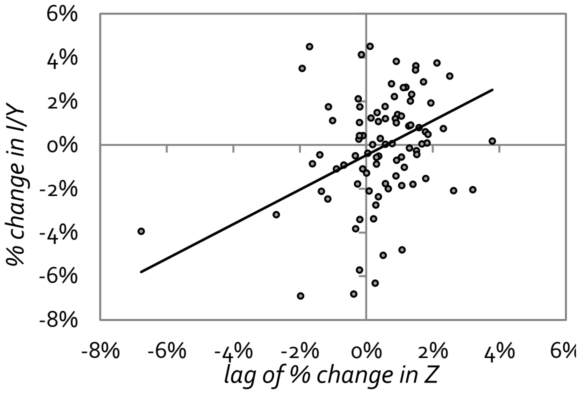
(a) US (1947:Q3 -2014:Q1)



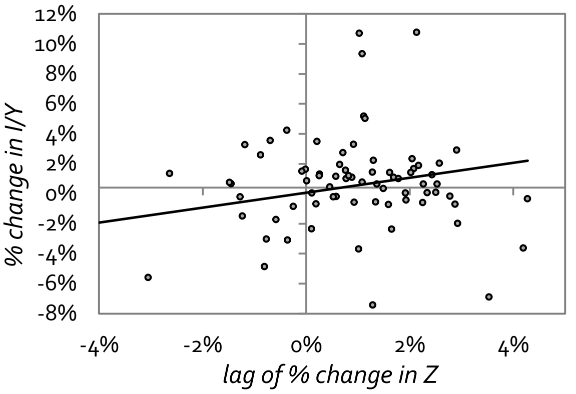
(b) Germany (1991:Q3 -2014:Q1)



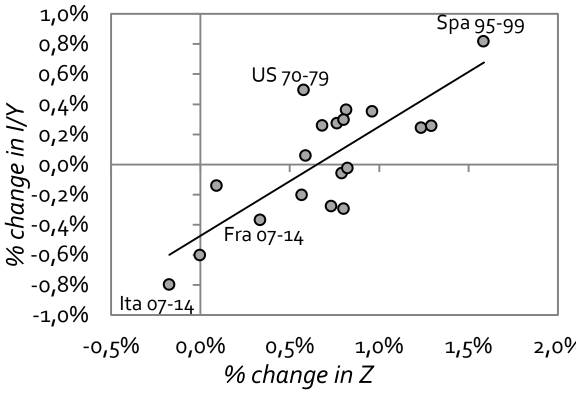
(c) France (1978:Q3 – 2014:Q1)



(d) Italy (1991:Q3 -2014:Q1)



(e) Spain (1995:Q3 – 2014:Q1)



(f) Across countries and periods[41]

Figure 9 – Relation between the investment share and lagged autonomous demand (quarterly % changes)

[41] We computed average changes over the following periods: '60-'69, '70-'79, '80-'89, '90-'99. '00-'06, '07-'14 for the US; '91-'99, '00-'06, '07-'14 for Germany, Italy and Spain ('95-'99 for Spain); '78-'89, '90-'99, '00-'06, '07-'14 for France;

Table 4: Granger causality test between autonomous demand and the investment share (eq. 16a – 16b)

		US	US^{o}	Germany	France	Italy	Spain
(eq. s1)		*Dependent variable: change in investment share (ΔI)*					
α_0	*const.*	$-1\cdot10^{-3}$	**$-2\cdot10^{-3*}$**	**$-8\cdot10^{-3***}$**	**$-5\cdot10^{-3*}$**	**-0.01^{*}**	$-8\cdot10^{-3}$
		(-0.71)	(-1.97)	(-3.01)	(-1.85)	(-1.97)	(-1.65)
α_1	ΔI_{t-1}	**0.37^{***}**	**0.55^{***}**	-0.16	0.16	**-0.26^{*}**	-0.18
		(5.02)	(7.80)	(-0.94)	(1.41)	(-1.73)	(-1.04)
α_2	ΔI_{t-2}	**-0.14^{**}**	**-0.30^{***}**	-0.10	-0.09	0.09	0.02
		(-2.20)	(-4.69)	(-0.95)	(-1.06)	(0.87)	(0.19)
β_1	ΔZ_{t-1}	**0.19^{*}**	**0.42^{***}**	**0.89^{***}**	**0.75^{***}**	**1.21^{***}**	**1.01^{***}**
		(1.93)	(3.74)	(4.30)	(2.66)	(3.73)	(2.92)
β_2	ΔZ_{t-2}	-0.06	-0.13	**-0.28***	-0.18	**-0.50^{*}**	**-0.50^{*}**
		(-0.73)	-1.45	(-1.86)	(-0.77)	(-1.74)	(-1.77)
$F_{2,85}$ (H_0: β_1= β_2=0)		1.93	**7.85*** **	**10.7^{***}**	**4.05^{**}**	**7.08*** **	**4.26** **
R^2		0.11	0.28	0.25	0.08	0.16	0.12
Adj.R^2		0.09	0.27	0.21	0.05	0.12	0.07
(eq. s2)		*Dependent variable: change in autonomous demand (ΔZ)*					
γ_0	*const.*	**$4\cdot10^{-3***}$**	**$05\cdot10^{-3***}$**	**$6\cdot10^{-3**}$**	**$5\cdot10^{-3***}$**	**$3\cdot10^{-3**}$**	**0.01^{***}**
		(4.30)	(5.40)	(2.61)	(4.60)	(2.15)	(2.89)
γ_1	ΔZ_{t-1}	**0.47^{***}**	**0.22^{**}**	**0.30***	**0.34^{***}**	**0.293^{**}**	**0.27^{*}**
		(6.90)	(2.43)	(1.86)	(3.34)	(2.34)	(1.73)
γ_2	ΔZ_{t-2}	**-0.13^{**}**	-0.05	-0.03	-0.14	$2\cdot10^{-3}$	$4\cdot10^{-3}$
		(-2.12)	(-0.70)	(-0.25)	(-1.60)	(0.02)	(0.03)
δ_1	ΔI_{t-1}	**-0.12^{**}**	-0.09	$4\cdot10^{-3}$	**0.10^{**}**	**0.15^{**}**	0.04
		(-2.37)	(-1.53)	(0.03)	(2.56)	(2.57)	(0.55)
δ_2	ΔI_{t-2}	0.04	0.07	-0.04	-0.04	-0.01	-0.02
		(0.86)	(1.38)	(-0.39)	(-1.17)	(-0.34)	(-0.32)
$F_{2,85}$ (H_0: δ_1= δ_2=0)		**3.07** **	1.39	0.15	**3.53** **	**5.43*** **	0.16
R^2		0.18	0.05	0.08	0.14	0.18	0.09
Adj.R^2		0.17	0.03	0.04	0.11	0.15	0.03
N		266	217	90	142	90	74
		1947:Q1– 2014:Q1	1960:Q1- 2014:Q1	1991:Q3 – 2014:Q1	1978:Q3 – 2014:Q1	1991:Q3 – 2014:Q1	1995:Q3 – 2014:Q1

*Notes: All variables taken in natural logarithms. ; t statistics in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$;*

Of course, Granger causality does not necessarily entail true causality. More specifically, the fact that changes in autonomous demand tend to lead changes in the investment share does not necessarily imply that Z causes I/Y. A plausible alternative explanation would be that changes in Z and I/Y are both caused by changes in income, but Z reacts faster than I/Y. We can call this the ‘income-first’ hypothesis.

Note that we cannot test the ‘income first’ hypothesis against the ‘supermultiplier’ hypothesis, just by adding income growth as a control variable in eqs. 16. As explained in Section 1, supermultiplier theory predicts that changes in Z cause changes in GDP, which in turn cause changes in the investment share. Hence, both the alternative explanation and supermultiplier theory imply that Granger-causality between autonomous demand and the investment share would disappear when controlling for Y, rendering such test powerless in discriminating between the two hypotheses.

What differentiates supermultiplier theory from the ‘income first hypothesis’ is that changes in GDP, *induced by changes in Z*, are able to trigger an accelerator effect strong enough to make I increase faster than Y. A natural way to test this is to use instrumental variables, to identify exogenous shocks in autonomous demand and check whether these shocks are accompanied by changes in the investment share. We have already identified instrumental variables for Z in Section 5 and checked the relevance of the first-stage. Given that our instruments are available only at yearly frequencies – which substantially reduces the number of observations, but in our case also enlarges the time-period analyzed for the European countries – we employ IV panel estimators to estimate the following equation:

$$I_{c,t} = \mu_c + \sum\nolimits^{m}_{i=1}\alpha_i \, I_{c,t-i} + \sum\nolimits^{n}_{j=0}\beta_j \, \Delta Z_{c,t-j} + \varepsilon_{c,t} \qquad (17)$$

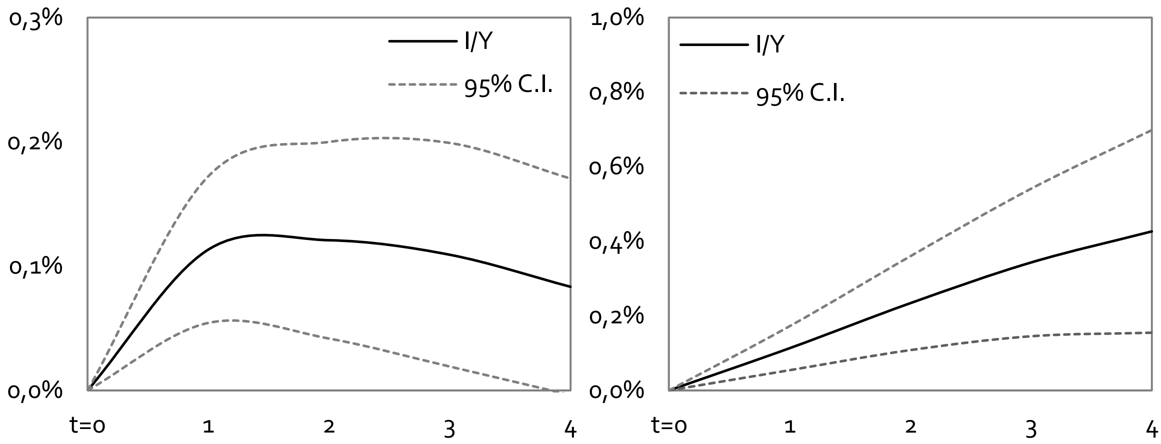
where I is the investment share[42] and Z is the natural log of autonomous demand. Again, we set m = n = 2, as suggested by both AIC and BIC information criteria. As in the previous section, a fixed-effect estimator is our preferred choice, but we estimate also pooled TSLS, difference-GMM and system-GMM to check for robustness.

Estimated coefficients for β_0 and α_1 are positive and significant, while α_2 is negative and significant; β_1 and β_2 are not significantly different from zero – as expected given that we are using yearly data and that Granger-causality tests, performed in the previous section, found the effect of Z on I/Y to last around two quarters. Results imply that, in the long-run, an additional 1% increase in autonomous demand raises the investment share by 0.57 percentage points of GDP.[43] The impulse response function is depicted in Figure 10, over a time-horizon of 4 years.

Results are robust to the use of different estimators instead of fixed-effects. The estimated long-run effect of Z growth on I/Y is 1.13% of GDP with pooled TSLS, 0.28% with difference-GMM and 0.87% with system-GMM. In all cases, the positive effect of Z growth on I/Y is statistically significant at the 0.05 confidence level.

[42] While, in eq. 16, I_t represents the natural log of the investment share, here it represents the investment share (I/Y*100).

[43] We calculate the long-run effect of Z on I/Y as $(\beta_0 + \beta_1 + \beta_2)/(\alpha_1 + \alpha_2)$.



(a) Effect of an additional 1% increase in Z

(b) Cumulative effect of an additional 1% increase in Z

Figure 10 – Estimated effect of an additional 1% increase in Z on the investment share (% of GDP; TSLS estimation, yearly data, all five countries)

Conclusions

As we have tried to synthetically convey in Section 1, the Sraffian supermultiplier model represents an interesting, recent attempt to develop and formalize a realistic, if schematic and necessarily partial, approach to economic growth. As Serrano puts it, the model is a contribution

> to a line of research started by Garegnani (1962) concerning the development of an alternative long-period theory of output and accumulation characterized by two main features: (i) the validity of the Keynesian-Kaleckian principle of effective demand in the long-run, that is, in situations which take explicitly account of the capacity generating effects of investment expenditures; (ii) the full compatibility of the analysis with the Classical Surplus approach to the theory of value and distribution, revived by Sraffa (1960).
>
> (Serrano, 1995, p. 1)

With the present paper, we have attempted a first empirical test of the model. We have calculated time-series of the autonomous components of aggregate demand and of the supermultiplier for the US, France, Germany, Italy and Spain and described their patterns in recent decades: the whole after-WWII period for the US; 1970-2013 for France; 1980-2013 for Italy and Spain; 1991-2013 for Germany. We have then performed econometric tests of some major implications of supermultiplier theory.

Our qualitative analysis has highlighted that growth rates of autonomous demand and output are tightly correlated, both in the short and in the long-run. Furthermore, the supermultiplier has been much higher in the US than in the other countries, in the whole observable period. In the four European countries, a rise in the import share, probably fueled by the process of European integration, has caused a continuous decline in the supermultiplier in our sample period. To the contrary, the supermultiplier has been broadly stable in the US since the Sixties, as a result of a decreasing propensity to save, which has compensated an increasing propensity to import.

For this reason, the US represent a suitable scenario for a cointegration analysis, in order to study the long and short-run relations between autonomous demand and output, in the presence of a generally stable supermultiplier. In this case, standard cointegration tests indicate that Z and GDP have shared a common long-run trend during the period under analysis. However, the cointegrating relation between Z and output appears to have been very unstable in the early post-WWII period. This instability seems to be ascribable to sharp changes in the propensity to save, which may be linked, at least partly, to the legacies of the wartime economy. In the 1960-2013 period, the relation seems more stable, and we have focused on that period in our analysis of causal effects.

From the estimation of a Vector Error-Correction model (VECM), we have found evidence of both short and long-run simultaneous causality between autonomous demand and output. The two variables appear to simultaneously determine each other. However, when we have tried excluding consumer credit from Z, we have found long-run causality going univocally from autonomous demand to output; short-run simultaneous causality, instead, remains. We have argued that this mutual influence between Z and GDP is not incompatible with the theory and we have proposed an explanation based on the idea that autonomous demand is socially and historically determined (an idea that proponents of the theory would not disagree with, we think).

We have not found cointegration between output and autonomous demand in the four European countries under analysis. As we have showed formally, this can be explained by the theory, given the strongly decreasing trend of the supermultiplier these countries have experimented.

To tackle endogeneity problems, we performed a TSLS panel estimation of the short-run effect of Z on output, employing annual data. In our baseline fixed-effects specification, we have found an impact- multiplier of 1.3 and a 4-years cumulative multiplier of 1.6. As instruments for Z, we utilized military spending, US growth (for the European countries) and an index of trade restrictions imposed by Canada and Mexico (for the US).

A further implication of the model that we tested against empirical evidence is that accelerations in autonomous demand growth tend to be followed by increases in the investment share. Through Granger-causality tests and Instrumental Variables regressions, we have found that this is the case in all five countries. On average, an additional percentage increase in autonomous demand growth raises the investment share by 0.57 percentage points of GDP in the long-run.

We invite to take our results with caution – this is just a first tentative approach to testing Serrano's model empirically; it will be necessary to include other countries in the assessment and to try more ingenious ways to deal with endogeneity, when testing for causality. Nevertheless, it seems fair to state that the evidence provided in this paper is rather favorable to the Sraffian supermultiplier model - consistently with the findings presented by Medici (2011) on Argentina's economy. At the same time, our results suggest that the role of consumer credit in the model may need some rethinking. This component would appear not to be autonomous in the short nor in the long-run.

Empirical tests in macroeconomics are admittedly imperfect and arguably reprehensible; variables are imprecisely measured, endogeneity is pervasive and the treatment is all but randomly assigned. At the same time, we are convinced that it is essential to assess whether there is evidence in the data of the kind of relations between economic variables that the theory predicts. We thus hope that the exercises performed in this paper can give a useful contribution, for how imperfect and limited in scope, to the line of research indicated by Garegnani and continued by Serrano and other authors.

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Appendix A – Dataset and sources

The dataset employed and the STATA do-file from which results can be reproduced are available at http://www.reconomics.it/ricerca/girardi_pariboni_autonomous_demand/ Hereafter is the list of all sources.

A1. United States

GDP - US Bureau of Economic Analysis, *Real Gross Domestic Product, 3 Decimal* [GDPC96], retrieved from FRED, Federal Reserve Bank of St. Louis https://research.stlouisfed.org/fred2/series/GDPC96/
US Bureau of Economic Analysis, *Gross Domestic Product* [GDP], retrieved from FRED, Federal Reserve Bank of St. Louis
https://research.stlouisfed.org/fred2/series/GDP

Exports (X) – US Bureau of Economic Analysis, *Real Exports of Goods & Services, 3 Decimal* [EXPGSC96], retrieved from FRED, Federal Reserve Bank of St. Louis https://research.stlouisfed.org/fred2/series/EXPGSC96/

Government spending (G) - US Bureau of Economic Analysis, *Real Government Consumption Expenditures & Gross Investment* [GCEC96], retrieved from FRED, Federal Reserve Bank of St. Louis https://research.stlouisfed.org/fred2/series/GCEC96/.

Residential Investment (RES) - US Bureau of Economic Analysis, *Shares of gross domestic product: Gross private domestic investment: Fixed investment: Residential* [A011RE1Q156NBEA], retrieved from FRED, Federal Reserve Bank of St. Louis https://research.stlouisfed.org/fred2/series/A011RE1Q156NBEA/

Consumer credit (CC) - Board of Governors of the Federal Reserve System (US), *Total Consumer Credit Owned and Securitized, Outstanding* [TOTALSL], retrieved from FRED, Federal Reserve Bank of St. Louis https://research.stlouisfed.org/fred2/series/TOTALSL/

Private non-residential investment (I) - US Bureau of Economic Analysis, *Shares of gross domestic product: Gross private domestic investment: Fixed investment: Nonresidential* [A008RE1Q156NBEA], retrieved from FRED, Federal Reserve Bank of St. Louis https://research.stlouisfed.org/fred2/series/A008RE1Q156NBEA/

Consumption (C) - US Bureau of Economic Analysis, *Real Personal Consumption Expenditures* [PCECC96], retrieved from FRED, Federal Reserve Bank of St. Louis https://research.stlouisfed.org/fred2/series/PCECC96/

Imports (M) - US Bureau of Economic Analysis, *Imports of Goods & Services* [IMPGS], retrieved from FRED, Federal Reserve Bank of St. Louis https://research.stlouisfed.org/fred2/series/IMPGS/

Military spending – SIPRI military expenditure database http://www.sipri.org/research/armaments/milex/milex_database

Index of trade restrictions (Mexico and Canada) – KOF index of globalization 2014, component aii. http://globalization.kof.ethz.ch/

A2. European countries

GDP – Eurostat Quarterly National Accounts (ESA95), *Gross Domestic Product at market prices*, retrieved from Eurostat http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=namq_gdp_k&lang=en
Eurostat Annual National Accounts (ESA95), *Gross Domestic Product at market prices*, retrieved from Eurostat
http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_gdp_c&lang=en

Exports (X) - Eurostat Quarterly National Accounts (ESA95), *Exports of goods and services*, retrieved from Eurostat http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=namq_gdp_k&lang=en
Eurostat Annual National Accounts (ESA95), *Exports of goods and services*, retrieved from Eurostat
http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_gdp_c&lang=en

Government spending (G) – Eurostat Quarterly National Accounts (ESA95), *Final Consumption Expenditure of General Government*; Eurostat Quarterly Government Finance Statistics (ESA95), *General Government Gross Fixed Capital Formation*, retrieved from Eurostat
http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=namq_gdp_k&lang=en
http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=gov_10q_ggnfa&lang=en
Eurostat Annual National Accounts (ESA95), *Final Consumption Expenditure of General Government*; Eurostat Annual Government Finance Statistics (ESA95), *General Government Gross Fixed Capital Formation*, retrieved from Eurostat
http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_gdp_c&lang=en
http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=gov_a_main&lang=en
IFPRI Public Expenditure Database, *Percentage of total Public Expenditure in Total GDP*, retrieved from International Food Policy Research Institute
http://www.ifpri.org/publication/public-expenditure-database
OECD, National Accounts at a glance 2014, *Gross Fixed Capital Formation, General Government, Percentage of total GFCF*, retrieved from OECD
http://stats.oecd.org/viewhtml.aspx?datasetcode=NAAG_2014&lang=en

Residential investment (RES) – Gross Fixed Capital Formation by asset type (ESA95), *Gross Fixed Capital Formation: Dwellings*, retrieved from Eurostat
http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=namq_pi6_k&lang=en
Gross Fixed Capital Formation by asset type (ESA95), *Gross Fixed Capital Formation: Dwellings*, retrieved from Eurostat
http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_pi6_k&lang=en
OECD, Gross Domestic Product, SNA 1993, *Gross Fixed Capital Formation: Housing*, retrieved from OECD

http://stats.oecd.org/viewhtml.aspx?datasetcode=SNA_TABLE1_SNA93&lang=en
Consumer credit (CC) - OECD, OECD.StatExtracts, Finance, Households' financial and non-financial assets and liabilities, *Consumer credit - up to 1 year* and *Consumer credit - more than 1 year*, retrieved from OECD
http://stats.oecd.org/Index.aspx?DataSetCode=TIS
Bank for International Settlements - Long series on credit to the private non-financial sector, retrieved from BIS
http://www.bis.org/statistics/credtopriv.htm.
Private non-residential investment (I) – We define Private non-residential investment as: Gross Fixed Capital Formation minus General Government Gross Fixed Capital Formation minus Residential Investment[44]
Eurostat Quarterly National Accounts (ESA95), *Gross Fixed Capital Formation*; Eurostat Quarterly Government Finance Statistics (ESA95), *General Government Gross Fixed Capital Formation*; Gross Fixed Capital Formation by asset type (ESA95), *Gross Fixed Capital Formation: Dwellings*, retrieved from Eurostat
http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=namq_gdp_k&lang=en
http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=gov_10q_ggnfa&lang=en
http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=namq_pi6_k&lang=en
Eurostat Annual National Accounts (ESA95), *Gross Fixed Capital Formation*; Eurostat Annual Government Finance Statistics (ESA95), *General Government Gross Fixed Capital Formation*; Gross Fixed Capital Formation by asset type (ESA95), *Gross Fixed Capital Formation: Dwellings*, retrieved from Eurostat
http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_gdp_c&lang=en
http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=gov_a_main&lang=en
http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_pi6_k&lang=en
IFPRI Public Expenditure Database, *Percentage of Total Public Expenditure in Total GDP*, retrieved from International Food Policy Research Institute
http://www.ifpri.org/publication/public-expenditure-database
OECD, National Accounts at a glance 2014, *Gross Fixed Capital Formation*, *General Government*, *Percentage of total GFCF*, retrieved from OECD
http://stats.oecd.org/viewhtml.aspx?datasetcode=NAAG_2014&lang=en
OECD, Gross Domestic Product, SNA 1993, *Gross Fixed Capital Formation: Housing*, retrieved from OECD
http://stats.oecd.org/viewhtml.aspx?datasetcode=SNA_TABLE1_SNA93&lang=en
Consumption (C) – Eurostat Quarterly National Accounts (ESA95), *Households and NPISH final consumption expenditure*, retrieved from Eurostat
http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=namq_gdp_k&lang=en
Eurostat Annual National Accounts (ESA95), *Households and NPISH final consumption expenditure*, retrieved from Eurostat
http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_gdp_c&lang=en

Imports (M) – Eurostat Quarterly National Accounts (ESA95)**,** *Imports of goods and services***,** retrieved from Eurostat
http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=namq_gdp_k&lang=en

[44] In this way, we subtract twice, from total Gross Fixed Capital Formation, General Government residential investment. In the absence of comprehensive time-series on this variable, we use our definition as a reasonable approximation of private non-residential investment, on the basis of the assumption that the share of public housing investment is very small relative to total investment.

Eurostat Annual National Accounts (ESA95), *Imports of goods and services*, retrieved from Eurostat
http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_gdp_c&lang=en
Military spending – SIPRI military expenditure database http://www.sipri.org/research/armaments/milex/milex_database

Series in nominal terms were deflated by applying the appropriate deflator. Military spending was calculated by taking the time-series of military spending as a % of GDP from the SIPRI database, and then multiplying that share for the Eurostat real GDP series.

In the case of France's yearly data, the Eurostat National Account series for *Gross Fixed Capital Formation: Dwellings* and for *General Government Gross Fixed Capital Formation*, which start in 1978, have been chained backwards using, respectively, the growth rate of *Gross Fixed Capital Formation: Housing* and of *General Government Gross Fixed Capital Formation*, from OECD Stats.

In the case of Italy's yearly data, Eurostat National Account series, which start in 1990, have been chained backwards using growth rates of corresponding variables from OECD Stats.

In the case of Spain's yearly data, the Eurostat National Account series for *General Government Gross Fixed Capital Formation* starts in 1995. For this reason, we have chained, backward from this year, the series for Government Expenditure (*General Government final consumption* plus *General Government Gross Fixed Capital Formation*), constructed upon Eurostat data. We have used, for this purpose, the growth rate of *Total Public Expenditure* from the IFPRI Public Expenditure Database. After doing that, we subtracted from our new series of Government Expenditure the values of *General Government final consumption* and we obtained the series of *General Government Gross Fixed Capital Formation* for the 1980-1995 period.

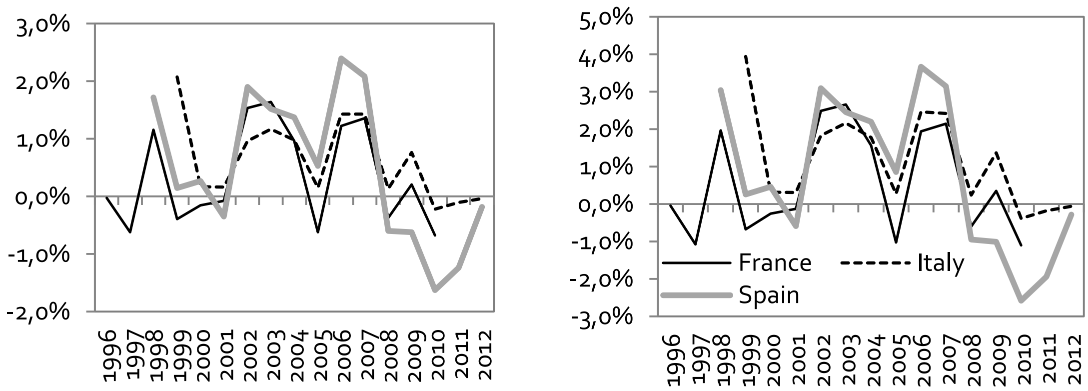
All the backwards interpolations were performed after having verified that the rates of growth of the relative magnitudes, derived from different sources, were highly correlated in the periods covered by both sources.

In constructing the quarterly series, those portions of the series that were available only at yearly frequencies (*Government GFCF* for Italy 1991-1998; Germany 1991-1994; France 1978-1990) were interpolated by assuming that the expenditure was split equally between quarters. Those quarterly series that were not seasonally adjusted (*Government GFCF* for Italy 1999-2014; Germany 1995-2014; Spain 1995-2014) were corrected by applying seasonal dummies. The part of the Consumer Credit series for Spain not covered by OECD data was interpolated by applying the rate of growth of the stock of total credit to households and NPISH provided by the BIS, after having verified that this rate and the rate of growth of the stock of consumer credit (OECD data) are highly correlated in the period covered by both sources. All series were downloaded between July and September 2014.

Appendix B – The relative weight of consumer credit flows

As explained in Section 2.1, consumer credit was excluded from the calculation of autonomous demand (Z) for three of our four European countries, due to the unavailability of comprehensive time-series. We have seen that in the US, for which it was included in the computation of Z, consumer credit (which excludes loans for house purchases) accounts for an exiguous share of Z (Figure 2a, panel a). In this appendix we show, on the basis of the available information, that the same applies to Spain, where consumer credit was included in the quarterly series but not in the yearly series displayed in Sec. 3 (see note 21), and to France and Italy. Data on consumer credit in Germany are not available; however it appears safe to assume that flows of consumer loans in Germany have not been higher, in relative terms, than in the other three European countries.

Let us examine the yearly series made available by the OECD, which start in the late Nineties (1996 for France, 1998 for Spain and 1999 for Italy).[45] On average over that period, the absolute value of the yearly net flow of consumer credit[46] (CC) accounts for 0.7% of GDP in Italy and France and 1.2% of GDP in Spain. As a share of Z, again taking absolute values, CC averaged 1.2% in France, 1.3% in Italy and 1.8% in Spain.



(a) as a % of GDP

(b) as a % of Z

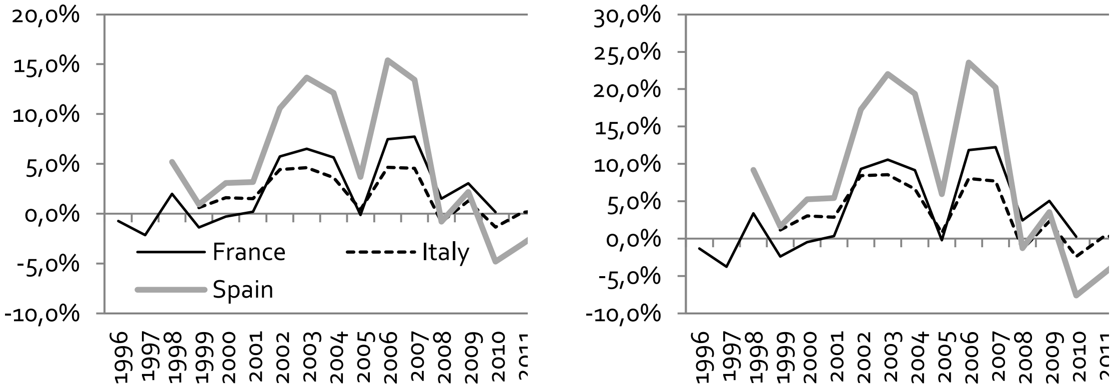
Figure A1 – Net flows of consumer credit (CC)
Note: Calculated as the yearly change in the stock of consumer loans outstanding.
Source: Authors' own elaboration on OECD and Eurostat data.

45 We include Spain in the figure for the sake of comparison, even if for this country the consumer credit component has been comprised in the empirical analysis.

46 In particular, to calculate the net flow of new consumer credit, we have taken first differences of the end-of-year stock of consumer credit (i.e., the sum of 'consumer credit, up to one year' plus 'consumer credit, more than one year' in the OECD database). The net flow of new consumer credit can thus be negative, as happens in years in which the stock of debt diminishes (meaning that the amount of money used by families to repay past debts has surpassed the amount of new consumer credit conceded).

House mortgage loans appear more relevant. On average over the available series, net flows of loans for house purchases amounted (in absolute value) to 6.2% of GDP and 9.9% of Z in Spain; 3.6% of GDP and 5.5% of Z in Germany; 3.0% of GDP and 4.8% of Z in France; 2.1% of GDP and 3.9% of Z in Italy. If we calculate overall households' autonomous spending as the sum of the net flows of consumer loans and loans for house purchases, we see that house mortgages accounted for 70% of the total in France, 73% in Italy and 82% in Spain.

In conclusion, while households' debt as a stock may have reached considerable levels, possibly relevant for financial stability, the yearly net flows of consumer credit – which are what matters for our analysis of the impact of autonomous spending on GDP growth – have been very small with respect to overall autonomous demand. To the contrary, borrowing for house purchases (which we included in the calculation of Z, using residential investment as a proxy) financed the vast majority of households' autonomous spending.



(a) As a % of GDP *(b) as a % of Z*

Figure A2 – Net flows of loans for home purchases
Note: Calculated as the yearly change in the stock of loans for home purchases outstanding.
Source: Authors' own elaboration on OECD and Eurostat data.

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