Measuring the Persistence on Consumption in Portugal

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MEASURING THE PERSISTENCE ON CONSUMPTION IN PORTUGAL

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Abstract

The paper deals with the detection and measurement of the level of persistence on aggregate private consumption in Portugal, USA, European Union and EuroZone as well as on some categories of aggregate consumption in Portugal. By the use of a non-parametric methodology applied to monthly data (1992-2007) it is concluded that aggregate consumption in Europe (both European Union and Euro Zone) is more persistent than in the USA and in Portugal. In particular, the relatively lower degree of persistence shown by the consumption in Portugal can be beneficial for the effectiveness of the countercyclical fiscal and monetary policies that are currently being implemented to overcome the current economic crisis. Our results also suggest that consumption of durables is less persistent, also being more volatile. This result is important in the explanation of the severity of the current economic crisis in Portugal.

KEYWORDS: Consumption, Persistence, Portugal

JEL CODES: C14, C22, E21

1. Introduction and motivation

One of the most important stylized facts of the short-run business cycle is the relative smooth behavior of consumption relatively to GDP. Consumption is less volatile than GDP and, in fact, it is the most stable component of aggregate demand. The life-cycle, permanent income and random walk literature explains this pattern by assuming that households try to smooth their life-time consumption path by adopting a forward looking behavior. This behaviour in conjunction with rational expectations on the part of consumers makes it possible that current consumption expenditures incorporate anticipated future levels of income. In particular, the Hall (1978)'s consumption walk theory suggests that all future incomes are correctly anticipated and incorporated into current wealth so that current consumption fully reflects this information. Since all that it is known of the future is already taken into account in the present assessment of wealth, only true surprises can alter wealth and thus consumption. Put differently, in accordance to those theories, consumption displays some degree of inertia or persistence.

However the smoothness of consumption varies significantly by type of consumption. Typically, non-durables and services tend to exhibit a smooth behaviour regardless the economic fluctuations but most of the business cycle fluctuation in consumption expenditures are due to durables.

In the current economic situation, which is characterized by some inertia of the economic aggregates at undesirable levels (for instance, low levels of growth and high levels of unemployment) the persistence that some relevant variables, namely consumption, exhibit is of obvious importance. This is so because, on the one hand, the presence of inertia can substantially change the response of households to a policy shock. This is particularly problematic for the formulation and the effectiveness of the present countercyclical policies that act through consumption. On the other hand, persistence can reduce the incidence, the length, and the severity of shocks and of changes of the economic conditions. Traditionally macroeconomic policies play the dominant role in smoothing the business cycle but the effectiveness of those policies depends upon the ability of the economic system to absorb (displacement from the baseline) the shock and to return to the baseline, in short it depends

on the economy's resilience. To the best of our knowledge, the analysis of persistence has focused on inflation and not on real variables such as consumption.

Persistence, broadly understood as a characteristic of a phenomenon that despite the actions taken in order to invert its evolution (or simple unfavorable states of nature), leads to an observation of some inertia in the evolution of that phenomenon, should be an interesting issue in Economics both from the theoretical and empirical points of view. In other words, persistence is the speed with which a variable returns to baseline (its previous level) after, say, a shock, i.e. some event (for instance, a macroeconomic policy measure) that provoked an increase (or decrease) in that variable (Marques, 2004).

There are two dimensions involved in the concept. First, the speed with which a variable respond to a shock and the speed with which it converges to its baseline. In particular, consumption persistence is associated with the speed with which consumption responds to a shock and with its convergence to its previous level. In this context, consumption is said to be (highly) persistent if, following a shock, it converges slowly to its previous level.

Plainly, the evolution of the economic variables is different under persistence and this fact cannot be ignored either from a theoretical approach or from a policy perspective. As a matter of fact, the literature on the economic importance of persistence is inexplicably scarce, taking into consideration that the first studies are from the beginnings of the 1980s and only quite recently authors showed a remarkable interest in the phenomenon. Clearly, this is in accordance to the analysis of the current situation in the world, in which the persistence of the recession is an issue to be tackled. Still, is also the almost inexplicable the lack of studies, especially through the use of appropriate techniques to detect and measure the level of persistence, aiming at testing the evidence of the phenomenon. In particular, for Portugal, to the best of our knowledge, there is no study of this nature.

The first studies that explicitly considered the importance of persistence were of macroeconomic nature. Following the seminal work of Taylor (1980), which has shown that staggered wage-setting can lead to persistence in employment after a temporary shock, the authors focused their attention in the causes of persistence in the major macroeconomic aggregates. For some time, both staggered wage-setting and staggered price-setting were

considered as being similar in the process of generation of persistent real effects of monetary shocks. For instance, Rotemberg & Woodford (1997) argue that output persistence can be due to price staggering. However some other authors, namely Huang & Liu (2002), have argued that price staggering and wage staggering models are crucially different in such a way that the staggered price mechanism is not capable of generating persistence, while the staggered wage mechanism is indeed important in generating persistence. On the other hand, in Ascari (2003) it is argued that the ability of a model to produce output persistence is not due to price or wage staggering mechanisms but, in fact, is due to the particular characteristics of the model, namely the behaviour assumed by firms and by the labour force.

Further to the analysis of the causes, the consequences of persistence were analysed by several authors. For instance, in the standard real business cycle models, it was inherent a lack of propagation of causal effects of temporary shocks, such as policy measures, to output. Not surprisingly, some criticisms were made based upon the alleged inability of standard real business cycle models to reproduce the evolution of output shown in real world conditions (see Cogley & Nason, 1995). As a response to this critique, RBC models were augmented with persistence mechanisms capable of explaining the (strong) persistence of output that could be observed in reality (see, among others, Bouakez & Kano 2006, and Maury & Tripier, 2003). In fact, this response did not close the debate, in which the possibility of monetary policy shocks affecting aggregate output is central. Indeed the persistence of shocks to aggregate output has been, still is (and most probably it will be for some time) one of the issues predominantly subject to investigation.

For the empirical evidence that monetary policy shocks can have permanent effects on aggregate output (or unemployment) there has been proposed some theoretical explanations, notably imperfect information about nominal fluctuations, namely about prices, and short-run nominal rigidities, such as sticky prices. For instance, considering nominal price stickiness and imperfect information, Kiley (2000) has shown that both factors allow nominal shocks to propagate in the cycle, but that only sticky prices propagate the real effects of nominal shocks. However, Wang & Wen (2006) argue that whether or not price rigidity is responsible for output persistence is not a theoretical question, but an empirical one.

Following another approach, Jonsson (1997), Lockwood (1997) and Svensson (1997), analysed the consequences of output or unemployment persistence on the establishment of inflation contracts. Other interesting consequence of output persistence is that it may turn upside down the political business cycle, which, in its typical form, is associated with depressions at the beginning of the mandate followed by pre-election inflationary expansions. This consequence on the pattern of the typical political business cycle is shown to exist by Gärtner (1996) who considers a model with adaptive expectations and a linear (in output)-quadratic (in inflation) policy objective function (see also Caleiro, 2009). Furthermore, Gärtner (1999) also gives some credit to the output persistence hypothesis from an empirical point of view.

Quite recently, it was registered an increase of interest in analyzing the persistence of output, as well as of inflation, considering its relationship with other aspects such as the degree of openness of the economies (see Guender, 2006, for a recent analysis), the exchange-rate regime (for instance, Giugale & Korobow (2000) argue that the speed of recovery of real output following an interest rate shock is higher under a flexible exchange rate regime, than under a fixed exchange rate regime) or the structural change on the behaviour of consumers, firms or policy-makers. In particular, the causes, the patterns and the political implications of inflation persistence have been elected the main objective of the Inflation Persistence Network (IPN), an ECB team of economists undertaking joint research on inflation persistence in the euro area and in its member countries.

Having said that, it is important to mention, at this stage of our analysis, that the previous studies confirm the persistence of output (or unemployment) being an up-to-date relevant issue. Still, besides a lack in the methods of empirically measuring the persistence, a gap in the literature is evident. A microeconomic foundation of macroeconomic persistence, for instance in consumption, is missing, notwithstanding the existence of a well-built theoretical set of analyses based upon the hypothesis of intertemporal depedent preferences in the form of a process of habit-formation. Indeed, in a seminal work Dusenberry (1949) called the attention for the importance of past consumption on the current consumption of households. There are several ways to build intertemporal dependent preferences.

In the literature on macroeconomics (both closed and open) and finance the Ryder & Heal (1973) model for the so-called habit formation has been used to solve a number of puzzles

(namely the well known “equity premium puzzle” – Constantinidies, 1990) as it conforms well with the short run low volatility of consumption. They showed that when instantaneous well-being is determined not only by the current level of consumption (the level effect) but also by it (average) past level (the habit or persistence effect) throughout a process of "learning-by-consuming", the intertemporal dependent preferences might be a sufficient reason to cause a cyclical behavior of consumption along its time path. This hypothesis, built upon the importance of habits, has been tentatively used to explain the behaviour of the growth rate and of the savings rate during a recession (Carroll, 2000; Wendner, 2002), On the other hand, Belbute & Brito (2008) show that the presence of the inertial effect can not only lower the long run equilibrium level of natural capital and the growth rate of the economy, but also reduce the effectiveness of an environmental policy that is meant to improve environmental quality as well as sustainability.

The paper intents to measure the persistence in consumption by the use of statistical techniques, in a univariate approach, which are adequate to measure the degree of persistence over time. The paper has the following structure. Section 2 presents and justifies the methodology that will be used to measure the persistence on consumption, distinguishing the durable from the non-durable goods cases. Section 3 offers the results. Section 4 concludes.

2. The methodology to measure the persistence

As the previous section has shown, when distinguishing non-durable from durable goods, consumption in Portugal has gone through evolutions that are apparently distinct. A question that then comes up is the following: does this distinction has to do with the fact that consumption persistence is different in those two cases? We start giving an answer to this question by the use of statistical techniques, in a univariate approach, which are adequate to measure the degree of persistence over time.

Since some time ago, some authors have started to pay attention to persistence in (economic) time series as a phenomenon that reveals to be crucial to policy measures, namely at the inflation level. In fact, to the best of our knowledge, all the applications of the statistical

techniques to measure the level of persistence have considered the inflation rate case (see Hondroyiannis & Lazaretou, 2004; Levin & Piger 2002; Marques, 2004; Minford *et al.*, 2004; and Pivetta & Reis, 2004). We propose to apply those statistical techniques, developed by Andrews & Chen (1994), Dias & Marques (2005) and Marques (2004), to the different kinds of consumption in Portugal. In this sense, the novelty in the approach is supposed to be a contribution to filling the gap in the literature on consumption.

Starting with a simple definition, consumption persistence is the speed with which consumption returns to baseline (its previous level) after, say a shock, *i.e.* some event (for instance, a macroeconomic policy measure) that provoked an increase (or decrease) in consumption. This definition, in other words, implies that the degree of consumption persistence is associated with the speed with which consumption responds to a shock. When the value is high, consumption responds quickly to a shock. On the contrary, when the value is small, the speed of adjustment by consumption is low. To put it clearer, a variable is said to be the more persistent the slower it converges or returns to its previous level, after the occurrence of a shock. Persistence is, thus, inversely related with the concept of mean reversion.

Quantifying the response of consumption to a shock is indeed important not only because it may allow assessing the effectiveness of economic policy measures but also because it may, indeed, show at what time is more essential to act, through those measures, in order to overwhelm a harmful effect of a shock over consumption. By definition, quantifying the response of consumption to shocks implies evaluating the persistence of consumption.

As the estimates of persistence at time *t* will express how long we expect that a shock to consumption will take to die off (if ever), given present and *past* consumption, authors have proposed to obtain those estimates by the use of *autoregressive models*. As it is well known, a univariate AR(k) process is characterised by the following expression:

$$f_t = \mu + \sum_{j=1}^{k} \alpha_j f_{t-j} + \varepsilon_t \tag{1}$$

where f_t denotes the consumption rate at moment *t*, which is explained by a constant μ, by past values up to lag *k*, as well as by a number of other factors, whose effect is captured by the random variable ε_t. Plainly, (1) can also be written as:

$$\Delta f_t = \mu + \sum_{j=1}^{k-1} \delta_j \Delta f_{t-j} + (\rho - 1) f_{t-1} + \varepsilon_t \tag{2}$$

where

$$\rho = \sum_{j=1}^{k} \alpha_j \tag{3}$$

and

$$\delta_j = -\sum_{i=j+1}^{k} \alpha_i \ .$$

In the context of the above model (1), or (2), persistence can be defined as the speed with which consumption converges to its previous level after a shock in the disturbance term that raises consumption at moment *t* by 1%.[1]

The techniques allowing for measuring the persistence are based on the analysis of the autoregressive coefficients α_j in (1) or (2), which are subject to a statistical estimation. Plainly, the most simple case of the models (1) or (2) is the so-called AR(1) model, that is:

$$f_j = \mu + \alpha_1 f_{t-1} + \varepsilon_t \ . \tag{4}$$

Clearly, the variable ε_t in this kind of models has a particular importance given that it may be associated with policy measures leading to a shock in the consumption rates. A positive shock, at moment *t*, will significantly last for future moments the higher is the autoregressive coefficient α_1. Following this approach, Andrews & Chen (1994) proposed the sum of the autoregressive coefficients, $\rho = \sum_{j=1}^{k} \alpha_j$, as a measure of persistence.[2] The rationale for this measure comes from realizing that for $|\rho| < 1$, the cumulative effect of a shock on consumption is given by $\frac{1}{1-\rho}$.

[1] Given that the persistence is a long-run effect of a shock to consumption, this concept is intimately linked to a concept usually associated to autoregressive models such as (1) or (2), *i.e.* the impulse response function of consumption, which, in fact, is not a useful measure of persistence given its infinite length.

[2] Authors have, indeed, proposed other alternative measures of persistence, such as the largest autoregressive root, the spectrum at zero frequency, or the so called half-life. For a technical appraisal of these other measures see, for instance, Marques (2004) and Dias & Marques (2004).

Unfortunately, the procedure above described is subject to a problem that is likely to occur in practice, in particular when analysing macroeconomic variables, which is the possible existence of factors leading to a non stationary behaviour of the time series as the result of, for instance, the existence of a trend in the data.[3] In fact, the existence of a unit root in the data generation process makes it impossible to accept the results from a traditional OLS estimation. This fact poses a problem from the viewpoint of measuring persistence in consumption rates, which means that we decided to follow another approach as it will be described below.

Recently, Marques (2004) has suggested a non-parametric measure of persistence, *γ*, based on the relationship between persistence and mean reversion. In particular, Marques (2004) suggested using the statistic:

$$\gamma = 1 - \frac{n}{T}, \tag{5}$$

where *n* stands for the number of times the series crosses the mean during a time interval with *T* + 1 observations[4], to measure the absence of mean reversion of a given series, given that it may be seen as the unconditional probability of that given series not crossing its mean in period *t*.

As Dias & Marques (2005) have shown, there is a one-to-one correspondence between the sum of autoregressive coefficients, ρ, given by (3) and the non-parametric measure, *γ*, given by (5), when the data is generated by an AR(1) process, but such a one-to-one correspondence ceases to exist once higher order autoregressive processes are considered. In other words, only in the particular case of a first-order autoregressive model, AR(1), either one of the two measures can be used to quantify the level of persistence, as both transmit the same result, but as soon as higher order autoregressive models are considered, *i.e.*, AR(*k*) with $k \geq 2$, the monotonic relationship between ρ and *γ* no longer exists, therefore leading to possibly crucial differences when measuring persistence in the series.

[3] For instance, after the application of augmented Dickey-Fuller tests in order to test for the stationarity of the time series for consumption, we could not reject the existence of a unit root in all of them.
[4] The ratio *n/T* gives the degree of mean reversion.

Moreover, using the alternative measure of persistence, *γ*, given by (**5**), has some important advantages (Dias & Marques, 2004).[5] Given its nature, such measure of persistence does not impose the need to assume a particular specification for the data generation process, therefore does not require a model for the series under investigation to be specified and estimated.[6] This is so given that γ is indeed extracting all the information about the persistence from the data itself. As it measures how often the series reverts to its means and (high/low) persistence exactly means that, after a shock, the series reverts to or crosses its means more (seldom/frequently), one does not need to specify a particular form for the data generation process. To put differently, the less a time series cut its mean, the greater will be the degree of persistence and thus the higher the value of γ.

3. Consumption persistence in Portugal

3.1. An international perspective

Let us begin by considering quarterly data of aggregate consumption for Portugal, USA, European Union and EuroZone, for the period of 1995 – 2008 as plotted in figure 1.

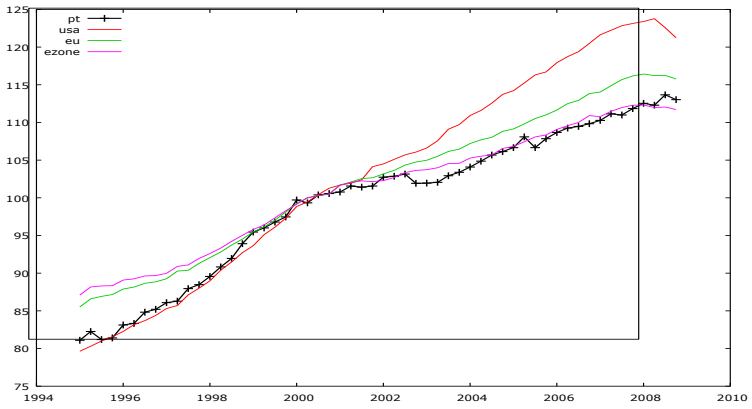

Figure 1: Total private Consumption for Portugal, USA, European Union and EuroZone.
Quarterly Volume index, OECD reference year (2000), seasonally adjusted, (1995-2008)

Given that for all trajectories the hypothesis of non-stationarity cannot be rejected (either confirmed by the ADF tests and by the slow decline of all the ACF's - see the annex A),

[5] The statistical properties of *γ* are extensively analysed in Marques (2004) and Dias & Marques (2005).
[6] In technical terms, this means that the measure is expected to be robust against potential model misspecifications and given its non-parametric nature also against outliers in the data.

therefore making it impossible to rely upon the OLS estimation of AR models, it resulted clear that, in order to measure the persistence in the consumption rates, one should rely on the use of the non-parametric measure *γ* as given by (**5**).

Clearly, in order to compute the estimative for each kind of consumption, the mean of each series has to be computed. As suggested in Marques (2004), a time varying mean is more appropriate than the simple average for all the period under investigation. In our case we followed that suggestion by using the well known Hodrick-Prescott (HP) filter in order to compute the mean.

As it is well known, the HP filter defines the trend or mean, g_t, of a time series, f_t, as the solution to the minimisation problem:

$$\min_{\{g_t\}}\left\{\sum_{t=1}^{T}(f_t-g_t)^2+\lambda\sum_{t=2}^{T-1}\left((g_{t+1}-g_t)-(g_t-g_{t-1})\right)^2\right\}$$

i.e. the HP-filter seeks to minimise the cyclical component (f_t-g_t) subject to a smoothness condition reflected in the second term. The higher the parameter λ, the smoother will be the trend and the less deviations from trend will be penalised. In the limit, as λ goes to infinity, the filter will choose $(g_{t+1}-g_t)=(g_t-g_{t-1})$, for $t=2,...,T-1$, which just amounts to a linear trend. Conversely, for $\lambda=0$, we get the original series.

Plainly, the HP-filter is a very flexible device since it allows us to approximate many commonly used filters by choosing appropriate values of λ. Given that the data is of quarterly frequency, authors have suggested using values for λ around 1600.[7] In particular, Ravn & Uhlig (2002) suggest the use of λ = 1600. Considering this value, the results are shown in Figures 2 and 3.

[7] In order to check the robustness of the results we considered some other values when computing the estimates of *γ*. In qualitative terms the results were not changed.

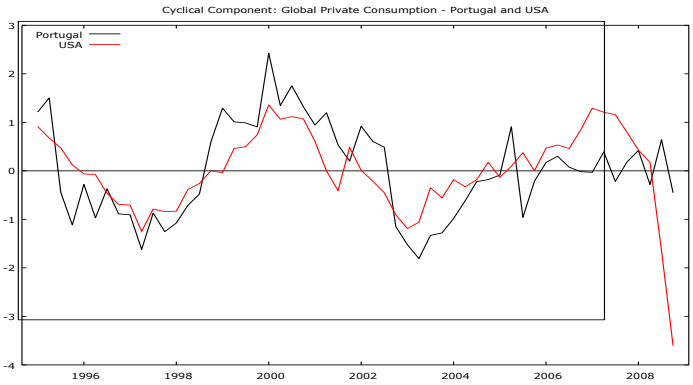

Figure 1: The cyclical component for total private consumption: Portugal and USA

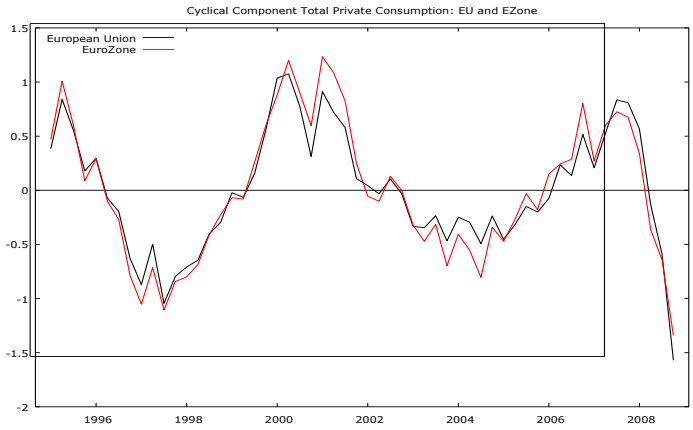

Figure 3: The cyclical component for total private consumption: Portugal and USA

For a better comparison see figure 4.

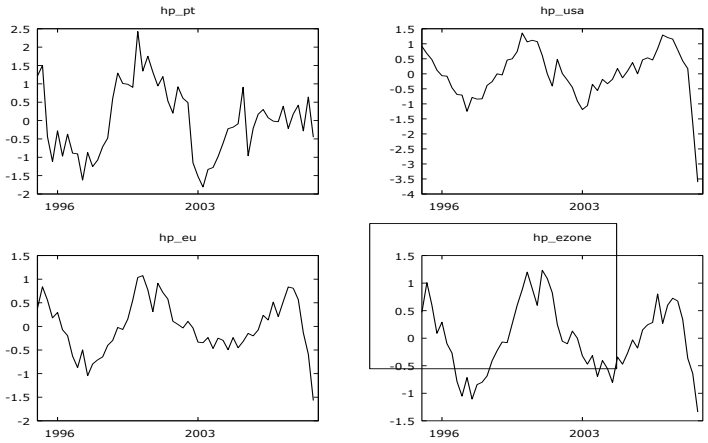

Figure 4: The cyclical component for total private consumption: Portugal and USA

Table 1 summarizes the main results for persistence. Clearly, aggregate private consumption in Portugal is less persistent (but more volatile) than in the USA, the Eurozone and the European Union meaning that after a shock, the Portuguese private consumption deviates quickly from its trend and tend to stay away from it (above or below) less time than in USA or EU/EZ. In the present context of world recession, this feature is quit relevant because in terms of economic forecasting, especially over the short run, persistence implies that one can fairly confidently predict what happens to consumption when it is below or above its trend. Being less persistent, one might expect that, in the short run, private consumption will stay above the trend less time in Portugal than in the USA , EU and EZone. The results also suggest that private consumption will stay above its trend more time in the European Union and in the Eurozone than in the USA.

Table 1 – Persistence and Volatility in Aggregate private consumption

Country	n	γ	Volatility [(1)]
Portugal	13	0,7679	0,00778
European Union	7	0,8750	0,00349
EuroZone	7	0,8750	0,00373
USA	11	0,8036	0,00520

Volatility = Standard Error ($\ln(x_t/x_{t-1})$

3.2. How persistent is consumption of durable and non-durable goods in Portugal

Let us now consider data for consumption of durables and non-durables for the period 1992-2007 (data from the Portuguese Central Bank (BP) plotted in figure 3. As expected, durables are much more volatile than non-durables (and as well as aggregate private consumption). In fact, the standard deviation of the percentage deviations in non-durables is about 19% of that for durables and only about 11% of that for the aggregate private consumption.

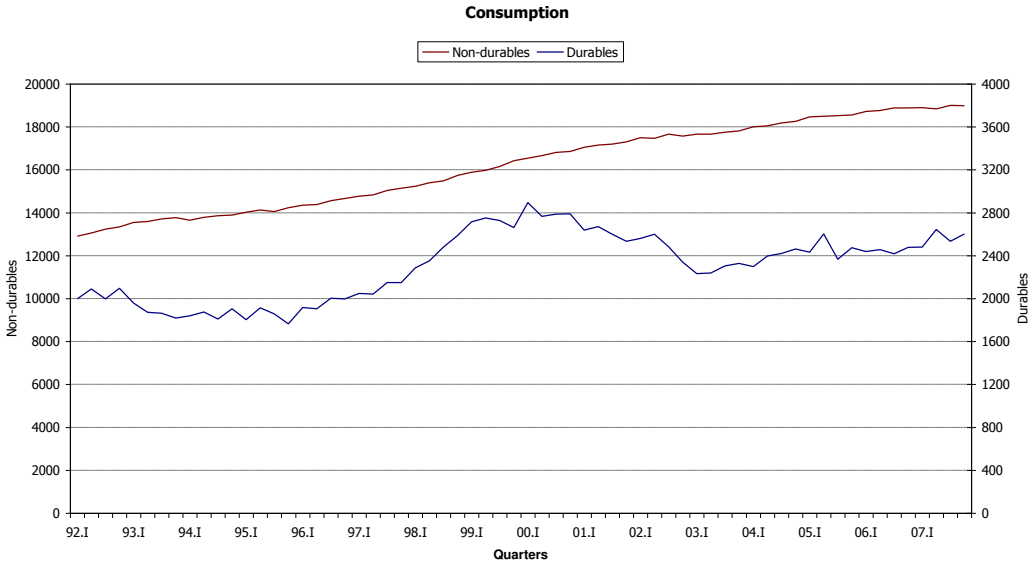

Figure 3: The data

As with the total private consumption, also with all the disaggregated consumption trajectories the hypothesis of non-stationarity cannot be rejected for both the ADF and the graphical inspection of the ACF's and PACF's tests (see the annex B). Again, under this circumstance, the measure of the persistence in the consumption rates in Portugal can be done by the use of the non-parametric measure *γ* as given by (5).

Figure 5 shows the cyclical component of durables and non-durables in order to facilitate the comparison. For the case of non-durables the cyclical component crosses the mean 10 times, which gives a measure of persistence, γ =0.84127. For the case of durables the cyclical component crosses the mean 12 times, which gives a measure of persistence, γ =0.809524.

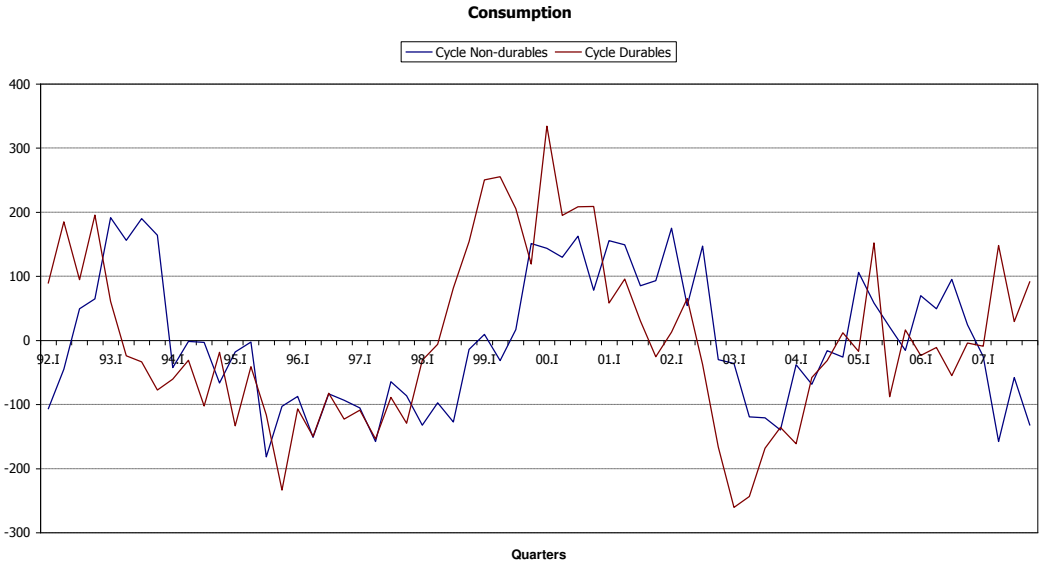

Figure 5: The cyclical component for consumption of durables and non-durables

Another source of the data makes it possible to consider consumption disaggregated into three categories: food, non-food and services and durables, for the period 1995 until 2007. Figures 6, 7 and 8 show the cyclical components of these categories.

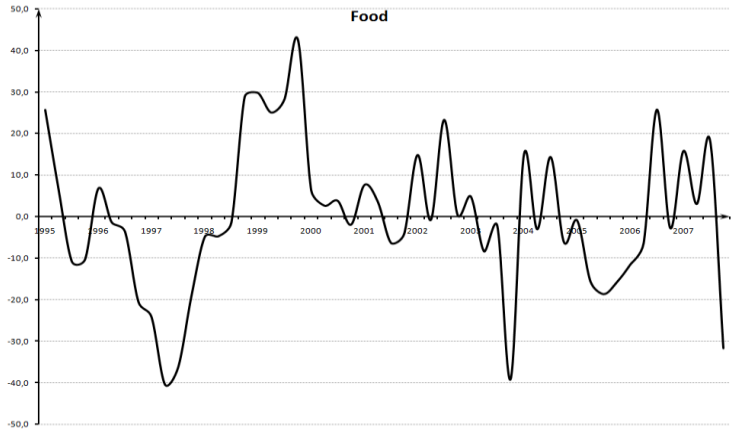

Figure 6: The cyclical component for consumption of food

For the case of food the cyclical component crosses the mean 19 times, which gives a measure of persistence, γ =0.6346.

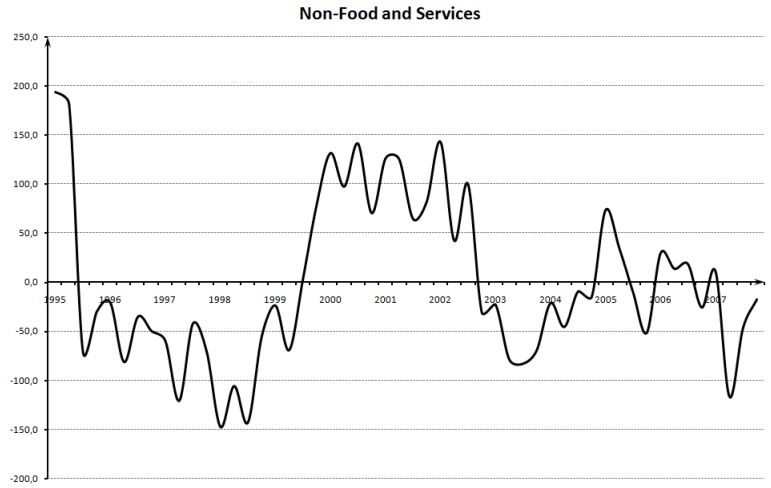

Figure 7: The cyclical component for consumption of non-food and services

For the case of non-food and services the cyclical component crosses the mean 9 times, which gives a measure of persistence, γ =0.8269.

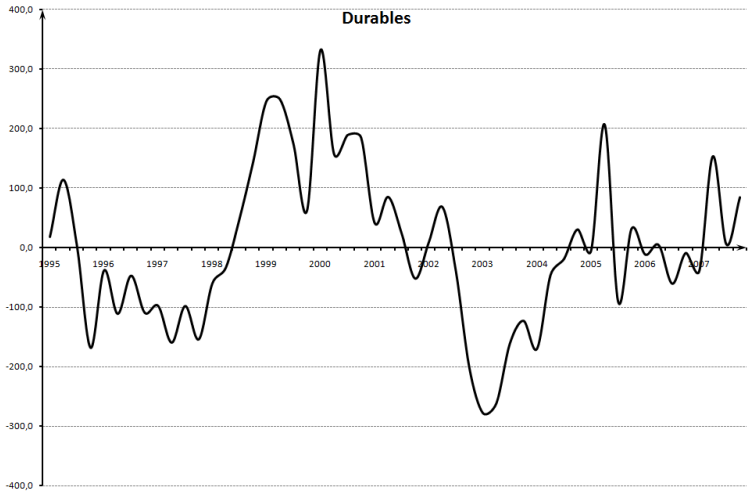

Figure 8: The cyclical component for consumption of durables

For the case of durables the cyclical component crosses the mean 14 times, which gives a measure of persistence, γ =0.7308.

To sum up, durables are more volatile and also less persistent. Note that non-durables volatility in BP data is different from the one in the INE data. Table 2 summarizes the results.

Table 2: A summary of the results

		Portuguese Central Bank (BP)			National Statistical Office (INE)		
		Volatility Index		γ	Volatility Index		γ
		V_1	V_2		V_1	V_2	
Aggregate Consumption			0,0065	0,8594		0,0107	0,8077
Non-durables	Food	0,0052	0,0065	0,8413	0,0053	0,0051	0,6346
	Non-food and services				0,0059	0,0071	0,8269
Durables		0,0404	0,0567	0,8095	0,0473	0,0549	0,7308

V_1– Standard Error $(\ln(x_t/x_{t-1}))$

V_2– Standard Error$[(x-x^*)/x^*]$ with x^* being the trend.

4. Conclusions and directions for further research

This paper has explored the issue of consumption persistence in Portugal. One important stylized facts of the short-run business cycle is the relative smooth behavior of consumption relatively to GDP. Indeed, private consumption is less volatile than GDP and, in fact, the most stable component of aggregate demand. Put differently, consumption exhibits a high degree of inertia or persistence.

Persistence is associated with the speed with which a variable responds to a *shock* and with its convergence (or its return) to its previous level. Consumption is said to be (highly) persistent if, following a shock, it converges slowly to its previous level. In other words, a high degree of persistence in consumption means that when consumption is above (or below) the trend, it tends to stay above (below) the trend for more time. This property is quite relevant for economic forecasting as it allow to confidently predict the short run behavior of consumption. However, countercyclical policies that act through the consumption may be ineffective if consumption very persistent. Households may be fearful about the future, may identify uncertainty factors that might restrain their consumption expenditures or even look current fiscal policies as equivalent to future taxes.

Our conclusions suggest that aggregate consumption in Europe (both European Union and Euro Zone) is more persistent than in the USA and in Portugal. In the particular context of the world economic crisis, our results suggest that private consumption will stay less time above the trend in Portugal than in USA and than in European Union and/or European Zone. Furthermore, the relatively lower degree of persistence shown by the consumption in Portugal

can be beneficial for the effectiveness of the countercyclical fiscal and monetary policies that are currently being implemented to overcome the current economic crisis.

When data is disaggregated between durables and non-durables, our results suggest that the consumption of durables are less persistent, being also more volatile as expected. This apparently non-intuitive result lies on the nature of the "consumption" of durables. In fact, as happens with capital goods, they yield a flow of consumption services over its lifetime (they are not consumed simultaneously with consumer spending and enjoyment). However, data includes "expenditures" on durable goods, not its services or enjoyment, whose pro-cyclically and high volatility nature is well known in the literature.

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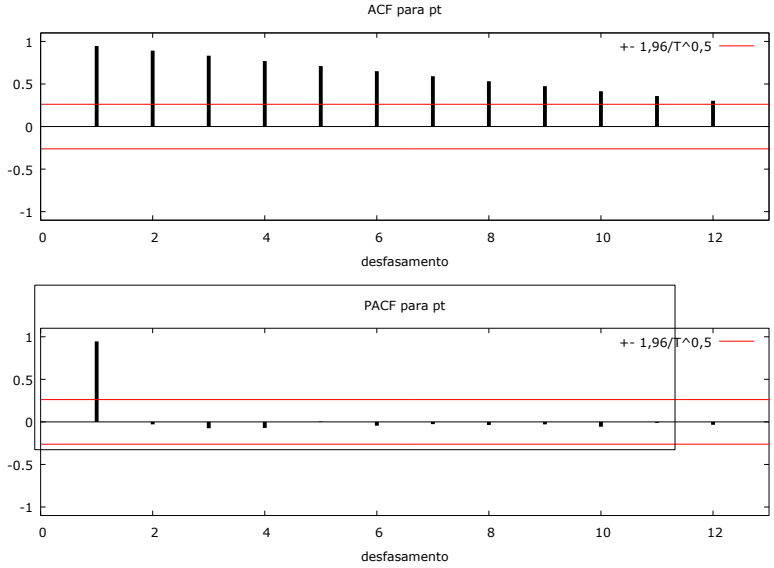
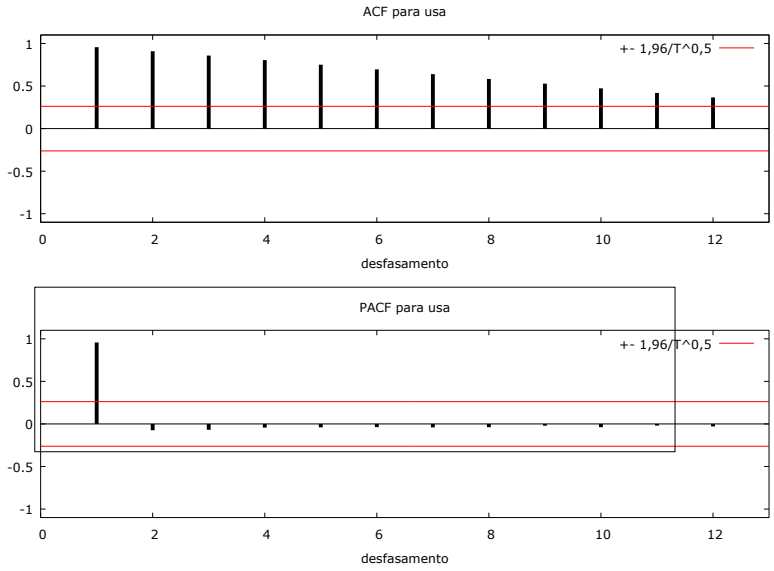
Annex A– The ACF and PACF of the series of total private consumption

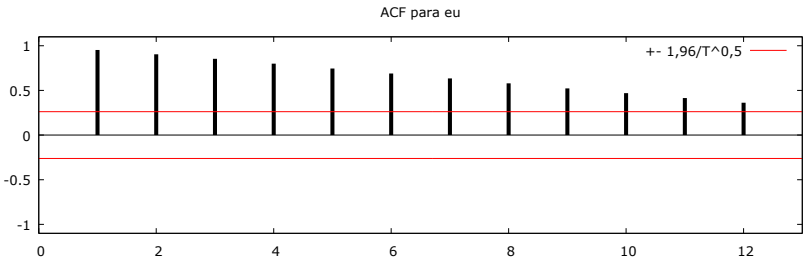
a) Portugal

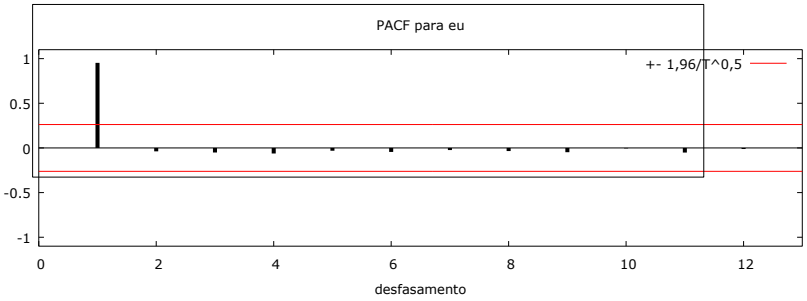


b) USA

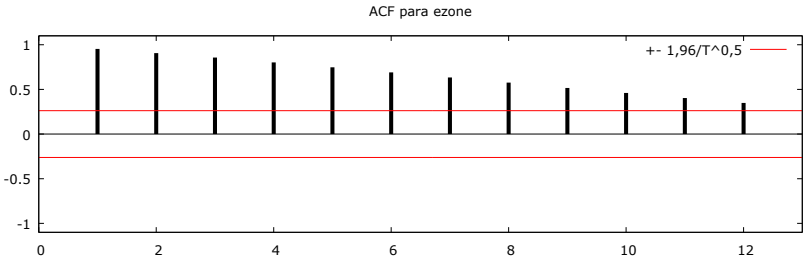


c) European Union


ACF para eu
+- 1,96/T^0,5
1
0.5
0
-0.5
-1
0
2
4
6
8
10
12
desfasamento


PACF para eu
+- 1,96/T^0,5
1
0.5
0
-0.5
-1
0
2
4
6
8
10
12
desfasamento

d) EuroZone


ACF para ezone
+- 1,96/T^0,5
1
0.5
0
-0.5
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2
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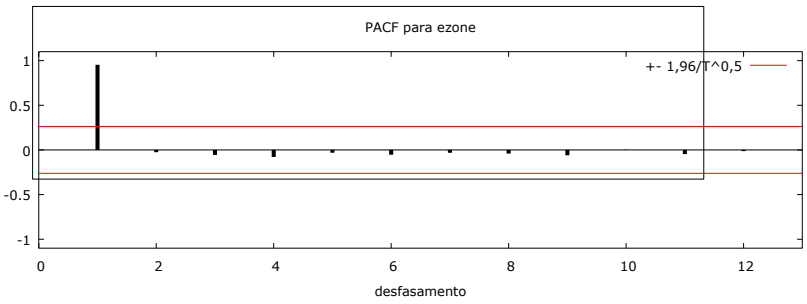
desfasamento


PACF para ezone
+- 1,96/T^0,5
1
0.5
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desfasamento

Annex B – The ACF and PACF of the series of disaggregated private consumption

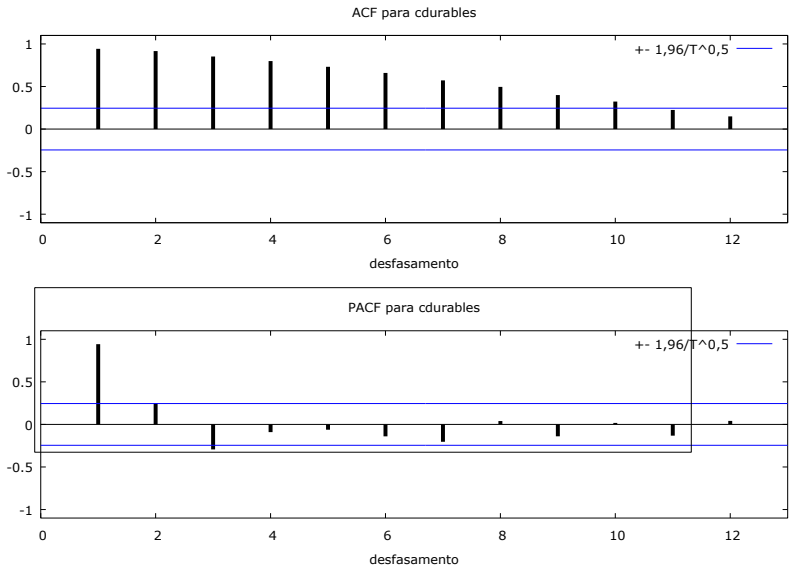

Figure 2: Durables

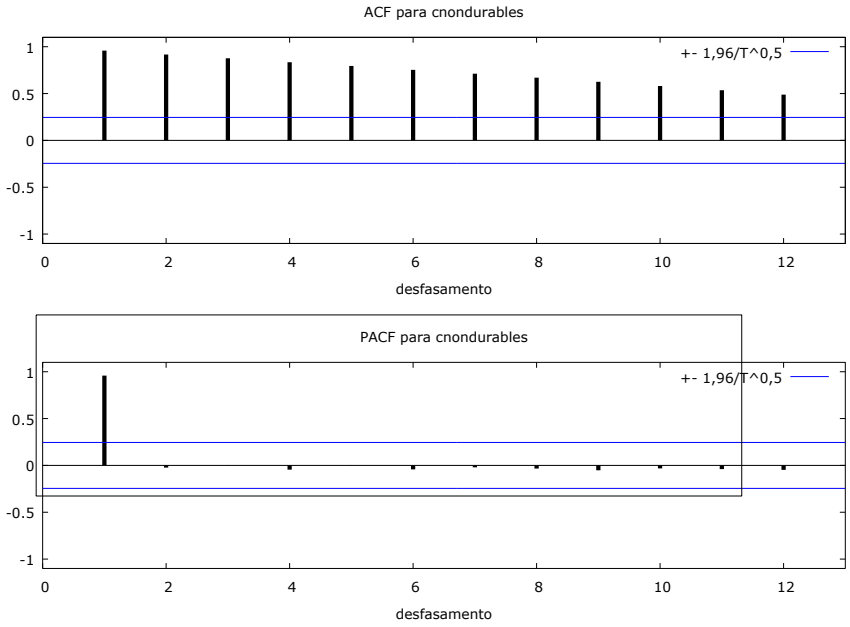

Figure 3: Non durables

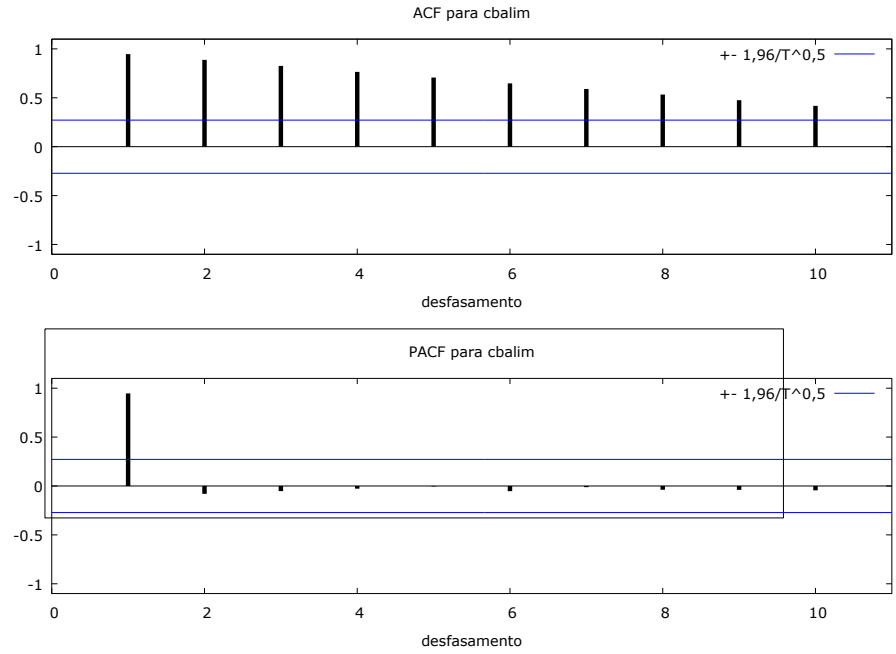

Figure 4: Food

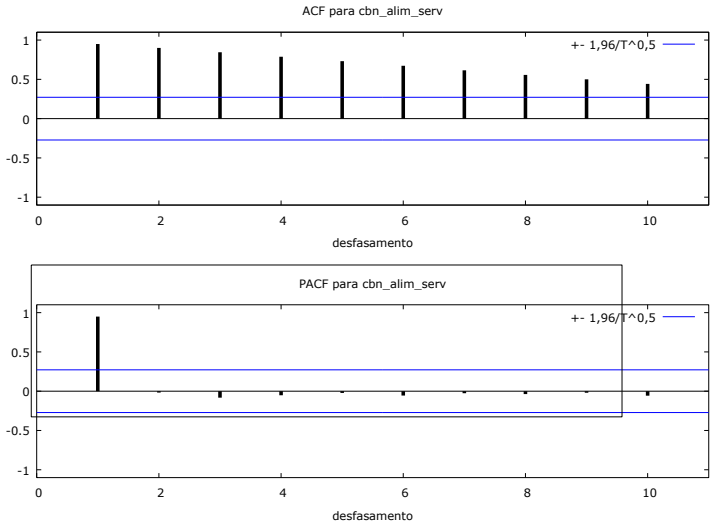

Figure 5: Non food and services

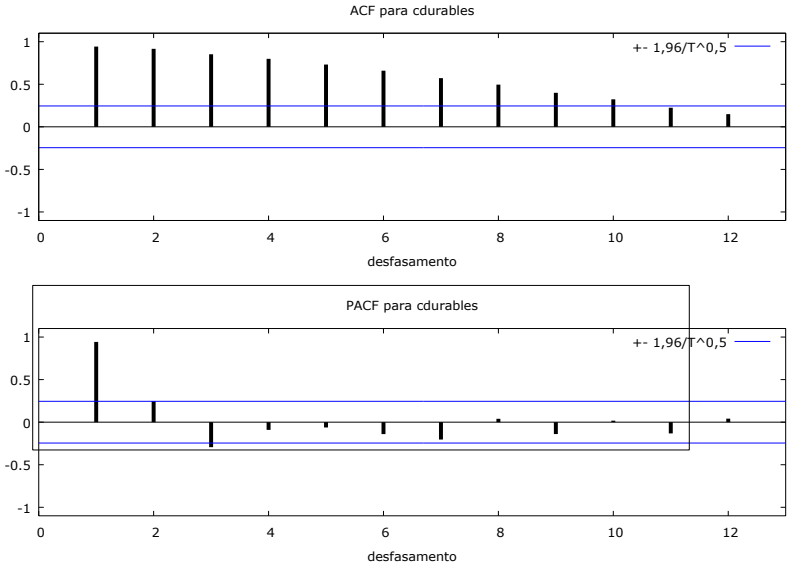

Figure 6: Durables