université angers

13, allée François Mitterrand
BP 13633
49100 ANGERS Cedex 01
Tél. : +33 (0) 2 41 96 21 06

Web : http://www.univ-angers.fr/granem

Granem
Groupe de Recherche ANgevin
en Economie et Management
UMR-MA n°49

When should a French Investor use a Dollar-Cost Averaging Strategy?

Philippe Compaire
GRANEM, Université d'Angers

Bruno Séjourné
GRANEM, Université d'Angers

octobre 2011

Document de travail du GRANEM n° 2011-07-032

AGRO CAMPUS OUEST

When should a French Investor use a Dollar-Cost Averaging Strategy?

Philippe Compaire et Bruno Séjourné
Document de travail du GRANEM n° 2011-07-032
octobre 2011
Classification JEL : G11, C22

Mots-clés : marchés financiers, investissement régulier, PER.
Keywords: financial market, regular investment, price-to-earnings ratio.

Résumé : La stratégie d'investissement régulier est fréquemment proposée par les intermédiaires financiers dans le cadre de placements de long terme sur les marchés financiers. Pourtant, les arguments théoriques, issus de la finance traditionnelle, démontrent son caractère sous-optimal. Ils ont de plus été renforcés par les résultats des exercices de simulations et les calculs empiriques. L'alternative habituellement testée qu'est l'investissement initial de l'intégralité de la somme fournit de meilleurs résultats en termes de rentabilité ou de critères rentabilité-risque dans la majorité des cas. Majorité ne signifiant pas exhaustivité, nous confirmons dans le cas français qu'une performance supérieure de l'investissement régulier vis-à-vis de l'investissement unique est observée sur le seul critère de rentabilité dans un peu moins d'un tiers des cas. Nous montrons qu'une variable de PER ajusté à la Shiller (2000) permet de guider l'investisseur dans son choix entre les deux stratégies.

Abstract : Even if the dollar-cost averaging (DCA) investment strategy is believed to perform poorly when confronted with simulations, estimates and standard financial theory, this strategy has been shown to outperform a lump sum (LS) investment on the stock market in a small number of cases. We find similar results for the French market when considering an eight year investment, which is a usual minimum investment period on stock markets in order to benefit from tax incentives. The LS strategy dominates the DCA in about 70% of cases, which keeps a DCA strategy opportunity open in some financial market conditions. As far as we know, these initial conditions have never been studied. We find that both the net excess return of the LS investment over the DCA and the probability of outperforming can be predicted by the value of the cyclically adjusted price earnings ratio as defined by Shiller (2000). High price market ratio levels could then justify using a DCA strategy.

Philippe Compaire
Faculté de Droit, Economie et Gestion
Université d'Angers
philippe.compaire@univ-angers.fr

Bruno Séjourné
Faculté de Droit, Economie et Gestion
Université d'Angers
bruno.sejourne@univ-angers.fr

The authors thank the referees of the 28th GdRE International Annual Symposiom on Money Banking and Finance (Reading, June 2011), Christian Bordes, André Cartapanis, Muriel Travers-Appéré and Benoît Sévi for helpful comments, and Gemma Davies and Diana Pop for support in English writing.

When should a French Investor use a Dollar-Cost Averaging Strategy?

1. Introduction

Appearing probably during the 1940s, the principle of regular investment, usually called dollar-cost averaging (DCA) strategy, consists of splitting up investments on a risky financial market or a financial asset at regular intervals. One of the main objectives of this strategy is to avoid entering the market at the worst period, just before a dramatic price fall. This method also allows more assets to be bought when the prices are low and less when they are high, so that the average buying price is smaller than the average of the quotations. The results are often compared to those of an initial investment of the whole amount, called lump-sum (LS) investment. For example, the choice between DCA and LS investment strategies can be crucial in the case of an inheritance or lottery winnings.

Nowadays, this strategy is still recommended by most financial intermediaries and the financial press. This is because, beyond the two reasons that we have just mentioned, the DCA investment creates a good correspondence with the timing of the households' incomes and thus their financial saving. Furthermore, the simplicity of the method reduces the participation costs[1] as the choice of when to enter the market becomes unimportant.

The DCA strategy has been criticized in different ways. First, Constantinides (1979) in a standard reference' article insists on two essential theoretical arguments. The first is that an automated investment process tends to neglect all the information that can be obtained after strategy activation. Thus, at any time except the initial point in time, the structure of the portfolio does not reflect all the information available and therefore is suboptimal. Second, the use of a DCA strategy makes the financial wealth dependent on its initial structure, with the same consequences.

Most of the time simulations also lead to negative results. The seminal article of Rozeff (1994) does not only show the mean-variance superiority of a LS investment but also that the greater the investment duration, the higher the advantage. Knight and Mundell (1993) use

[1] The participation costs correspond to the time and the efforts that must be engaged to build up a portfolio (see for example Allen and Santomero, 2001).

Monte Carlo simulations types. They extract parameters from the NYSE index and use different risk aversion coefficients and investment durations. DCA strategy is shown to always give the worst results 1) in terms of utility when compared to the LS investment and 2) than a strategy which would consist in maintaining an optimal part of the financial wealth invested in the risky portfolio. A few years later, Abeysekera and Rosenbloom (2000) confirm that the DCA is more likely to underperform. This general agreement was disrupted by Brennan, Li and Torous (2005) who obtain divergent results for investments running from 1 to 6 years. They show that, with the exception of the most tolerant investors towards risk, DCA will give more satisfaction that LS since the other investors should not maintain their whole investment in the risky portfolio. Furthermore, when dealing with the acquisition of a single new equity, whether it is added to an existing market portfolio or not, a regular progressive integration gives better results. In the latter case, this could be the consequence of the sub-optimality of a single-asset portfolio.

This latter contribution is an exception: on the standard portfolio theory and expected utility frameworks, the regular investment is seen as a non-optimal strategy. However, note that the utility function of the investor has been revisited over the last few years through behavioral finance. In this way, Statman (1995) proposes a survey of various approaches of behavioral finance, particularly the prospect theory of Kahneman and Tversky (1979) and the regret theory (Bell, 1982, Loomes and Sugden, 1982) to justify the use of a DCA strategy.

Finally, statistical tests on historical market data generally confirm the inefficiency of the regular investment. Williams and Bacon (1993) find better results for LS investments compared to DCA for a one-year investment on the American market from 1926 to 1991 in about two thirds of cases. Those results are comparable with the returns on investment in government and corporate bonds (Bacon *and alii*, 1997). Concerning France, for a one-year investment on the CAC40 index, with a rate of 4% for the non risky asset, Haguet (2009) obtains roughly the same proportions of higher returns for the whole initial investment.

All of those results mainly reflect the existence of a positive risk premium on the equity market. That is why, when maintaining a fraction of his financial wealth on the non risky asset, the investor does not benefit from this premium. On the other way, the experiments also generally show that the DCA strategy is less risky than LS. However Rozeff (1994) finds that, for an identical benefit, the DCA investment is in fact more risky than the initial global

investment. In the French case (Haguet, 2009), the Sharpe ratio, which includes both risk and return criteria, is superior for the LS strategy in 56% of the cases.

Beside the main average results, most of the calculations show that the LS strategy never systematically outclasses the regular investment. This is why further research on the conditions for this domination must be carried out and such is the objective of this article. Our study deals with the French market, for which we now have enough historical data[2] to observe various market conditions (stagnation, strong bull and bear periods). Séjourné, 2006, found that the French investors have a strong home bias over the analyzed period; therefore we focus our analysis exclusively on the domestic market.

When considered in more detail, we realize that the various statistical experiments reviewed above are not appropriate for dealing with the opportunities faced by the French investors[3]. Particularly, in France, DCA strategies are offered over a longer period of time within long term saving products such as life insurance contracts, employee saving schemes or personal equity plans. There is nothing uncommon about finding a regular investment strategy offered for an infinite period: the saver will invest the same amount every month (term) as long as he holds the financial product. In the latter case, it is difficult to define an investment period for our tests. One solution consists of choosing the fiscal expiration date, *i.e.* the moment after which the benefits from the financial product become tax-free. Concerning the very popular life insurance contracts and personal equity plans, this occurs after an eight year holding period. Just like in most of the experiments listed, we study the return on investment initially made on a risk free asset (the three months rate being our reference) and progressively transferred into equities on the French market every month. The result is compared to that of a LS investment.

The second section describes the DCA investment method and the choice of indexes and benchmark data. In section 3 we analyze the statistical results for these strategies. Considering the strong variation observed on the French financial market, non-systematic over-performance of one type of investment over the other is expected. In such a case, finding a decision-making variable is of the utmost importance. In Section 4, we explain our choice for the cyclically adjusted price earning ratio. The estimated results are presented in Section 5 and Section 6 concludes.

[2] since 1988 for the CAC40 index

[3] Testing the DCA strategy's interest over a relative short period of time is due to the existence of one-year investment mandates for several American funds (Milevsky and Posner, 2003).

2. The DCA investment method and the choice of data

When they want to invest in stocks, French savers are encouraged to keep their portfolio for at least eight years. This is because the two main free tax assets are life insurance products and a peculiar special equity plan (*Plan d'épargne en actions - PEA*). In both cases, taxes decrease over time and optimal fiscal management reaches the lowest level after an eight year holding period. At that time, an investor holding a life insurance contract can choose between a small taxation of 7.5% on benefits[4] (with an exemption of €4,600 per adult in the household) and an integration of the benefits into his fiscal yield. In the case of the PEA, the gains become tax-free after five years but any withdrawal will lead to closure[5]. Only after three more years can the investor benefit from the free management of his portfolio.

This fiscal treatment is the main reason for our choice of the investment period. For both products, long term DCA strategies are offered to savers. Most of the time, these strategies have no pre-defined limit, but we will consider that, since the investor is encouraged to start profiting from his investment after eight years, he may stop the process of accumulation at that time. In addition, since the investors are fiscally encouraged to maintain the dividends inside their PEA or their life-insurance contract, we will consider that the dividends are reinvested, or in other words that the gains are capitalized.

We consider an investment of €12,000. The DCA strategy consists of the regular purchase of shares for €125 every month during the eight years period. The remaining amount is invested on a risk free asset, for which the return is based on the three-month market rate. The return from this investment (r_{DCA}) is compared to that obtained with an initial investment of the whole amount on the stock market (r_{LS}). The observed variable is the net excess return of the LS investment over the DCA ($r_{LS} - r_{DCA}$).

Although the financial education of French households has been greatly improving since the mid 80's (which is partly a consequence of the privatization of banks and insurance companies), and despite the birth of the Eurozone and the opening of a liberal European financial market created new opportunities for diversification, with or without exchange rate risk[6], the portfolio of most French individual direct stockholders remains mainly characterized by an important home bias. According to the 2007 TNS Sofres survey, only 27% of these

[4] 35% before 4 years; 15% between 4 and 8 years.
[5] Before 2 years, a taxation of 22.5% will occur on the benefits for any withdrawal. This rate lowers to 18% between 2 and 5 years.
[6] See Schoenmaker and Bosch (2008) for an analysis of the consequences of the creation of a single currency on portfolio structure (all investors).

stockholders were holding equities from foreign firms. Furthermore, when looking to the invested amounts, the 2009 financial accounts from the Bank of France show a 93% investment in local listed shares! Of course, this international diversification may pass through mutual funds. This could be explained by the increasing offer of international financial products (the last step being the emergence of a multitude of exchange traded funds), and by the interest of French investors in reducing significantly their participation costs when trusting a professional manager with their funds invested abroad. However Boutillier and Séjourné (2009) show that this phenomenon is still limited: among the 24.8% of their portfolio invested in listed shares in 2003, both directly and through the different types of funds, only 20% was oriented towards foreign shares.

This information has led us to consider that the representative investment was a domestic one, *i.e.* a classical investment on the French domestic market. In line with this approach, concerning the three month rate, we use the three months French PIBOR rate until the end of 1998, and the three months Euribor rate from January 1999. The historical index for the French stock market is the CAC40, which was first published on the 31st December 1987 with an initial level of 1,000 points. This allows us to study the investments on the French market from the first opening day of January 1988 until the end of December 2008. Since we work on an eight years investment, the first result is obtained on the closing day of 1995 and our sample is comprised of 3,388 daily observations. Note also that the type of investment considered requires the analysis of the CAC40 dividends being reinvested[7].

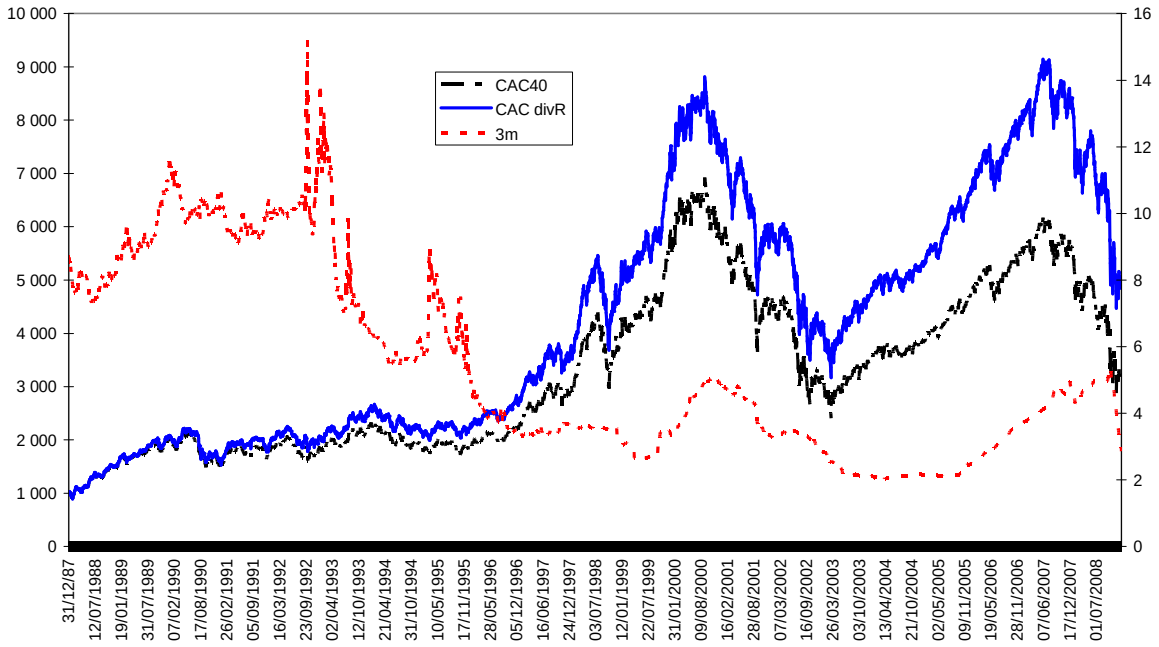
As observed on Graph 1, this large period is characterised by dramatic variations in the CAC 40. After a relatively calm period of growth until the end of 1996, just like the major indexes of the various financial places around the word, the graph shows a series of sharp peeks - for example with the bubble generated by the new technologies at the end of the nineties - and deep troughs corresponding firstly to the explosion of this previous bubble, and later to the consequences of the subprime crisis. Turning to the three month rate, we note its irregular tendency to decrease during our period of reference. This was particularly the case in the mid-nineties, just after the exchange rate crisis of 1992, when the Bank of France had to increase interest rates in order to maintain the French franc inside the European Monetary System.

These variations are of course of great interest to our experiment since the results are obtained in very different market conditions. On the one hand, some of them take into account the

[7] Source: Euronext

extraordinary rise of the market during the nineties and, on the other hand, our last results occur at the end of the so-called « lost decade » (2000-2009).

< *Graph 1:* Market conditions: CAC40 index and CAC40 index with dividends reinvested (left),
3 months rate (%, right)>

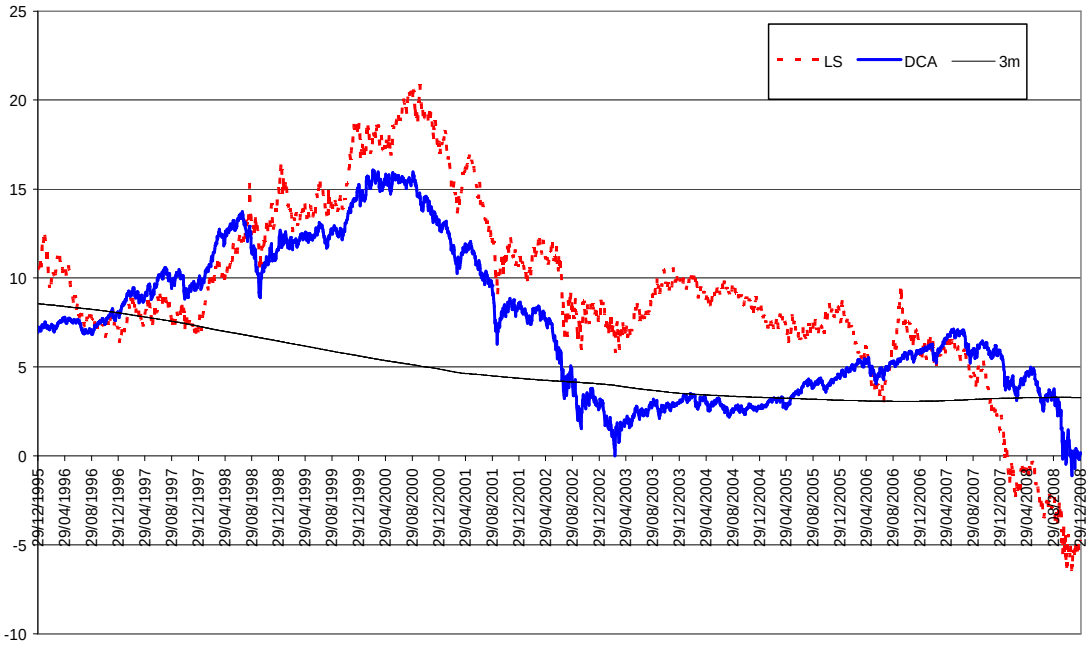


Sources: Euronext and Fininfo

3. The statistical results.

Over our sample period, the LS investment on the French market over eight years outperforms the DCA one in 69.4% of the cases (Graph 2), with a high density of excess annual return between 2% and 6% (Graph 3). Remarkably, the LS investment has produced a better result for any initial investment made between the 3rd August 1990 and the 28th April 1998. This result, which can be considered as significant over such a long period, is of the same order of magnitude as the results obtained by previous studies. Confirming that, using only the return criterion, the LS strategy leads in the majority of cases but not systematically. Nevertheless, a rate of nearly 70% is a little higher than the results mentioned above. This could be explained by our eight years period of investment. The probability of obtaining a positive risk premium may increase with a longer period.

<*Graph 2:* Comparison of the returns for DCA, LS
and three month rate investments (%)>



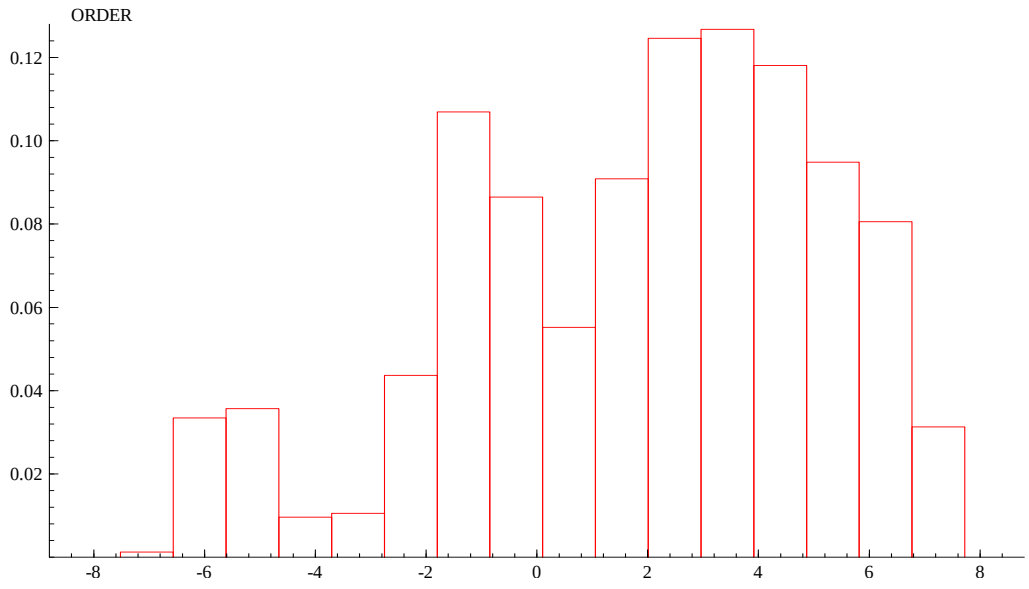
Source : authors calculations

Of course, a 70% higher return for the LS investments could also be associated with dramatic results for the remaining cases, *i.e* when the DCA strategy is dominating. Such is not the case: Graph 3 (and Appendix 1) show that the extreme points are of the same order of magnitude (between 7 and 8%), and the average of the net excess return of the LS investment (3.66%) is superior to the average of the net excess return of the DCA (2.30%).

We observe also that during three periods of time[8], the return for the DCA investment has been smaller that a simple investment at a three months rate. This could be explained 1) by the high levels of the interest rates and 2) after dramatic shortfalls of the stock market prices. But concerning the latter explanation, note that the LS investments under-perform the three months rate investment less often than the DCA (511 cases instead of 1,082 out of 3,388 observations).

[8] Investments starting in 1988 until the end of the year; then investments made between July 1994 and May 1997; and finally those beginning during the last semester of 2000.

<*Graph 3:* **Frequencies associated with (r_{LS} - r_{DCA})**>



Dealing with the average return (Table 1), we find a result of 7.31% for the DCA strategy, which is about 180 basis points below the average of the total return of the CAC40. Not surprisingly, this lower result is compensated by a smaller risk: 16.90 instead of 25.96 for the LS strategy. The DCA investment is less risky but returns are lower. Note also that both strategies are more risky and produce a better return than a simple investment on a three month money market rate over the period.

***Table 1:* Main statistical results[9]**

	Average return (%)	Average risk (variance)	Sharpe ratio	Probability of loss (%)
DCA investment	7.317	16.897	.603	.590
LS Investment	9.155	25.962	.848	6.995
3 months interest rate	4.83	3.14	-	0

The number of observation is equal to 3,388, the eight years investment results being observed from the29th of December 1995 to the 31st December 2008.

[9] See Appendix 1 for further statistical results.

When calculated on these average values, the Sharpe ratio of the LS investment is significantly higher than the DCA (Table 1). In other words, when taking the risk into account, a DCA investment on the French market underperforms a global initial investment.

Another interesting point is that, when analysing the results within a loss aversion behavioural frame (a characteristic of the Kahneman and Tversky's Prospect theory), note that the risk of obtaining a negative result is small when dealing with the DCA investment (Table 1). Only 20 observations had a final amount inferior to the initial investment of €12,000. This gives a probability of a 0.6% negative return, which is very much lower than the probability of losing money when making a LS investment (nearly 7%, 237 points).

4. The regression model

Since, as expected, the DCA outperforms the LS investment in terms of return in nearly one third of the cases, we try to identify initial favourable conditions for adopting this strategy. More precisely, we want to see whether some market conditions could be used as a decisional variable. Considering previous studies on the link between stock market prices and future returns, we opt for a measure of the price-to-earnings (P/E) ratio as a main explanatory variable. High levels of this ratio are a sign of the over-evaluation of the market and allow us anticipate a bearish correction towards potential equilibrium levels. Even though price-to-earnings ratios may be poor predictors for short-term stock returns (Fisher and Statman, 2000, Trevino and Robertson, 2002), various studies on American or international data have shown interesting relationships for long term investments. Campbell and Shiller (1998), Trevino and Robertson (2002), Fisher and Statman (2000), Weigand and Irons (2007) find that historically very high P/E ratios are followed by low long-term returns (between five and ten years according to the various tests) and mostly that the P/E ratio could perform well in predicting these returns[10]. Since our investment stretches over eight years, we introduce such a criterion in our empirical approach. The smaller the P/E ratio, the better the LS investment strategy should be, since investing the overall amount over a long period of time would bring more profits (dividends plus capital gains). This leads us to use a P/E ratio measure as an explanatory variable, anticipating that the higher the price of the market, the smaller the excess return (r_{LS} - r_{DCA}) should be (possibly negative).

[10] This concept of forecasting was discussed at the end of the nineties and the beginning of the century (see for example Shen, 2000), predicting a persistence of higher levels of P/E ratio, possibly associated with increasing returns. The two financial crises during the last decade prevented us from observing this.

Nevertheless, taking into account the interesting work by Campbell and Shiller (1988), showing that the traditional P/E ratio is affected by unexpected and unpredictable specific considerations, we prefer to turn to the definition of the ratio given by Shiller (2000): the cyclically adjusted price earnings ratio (CAPER). Particularly interesting for long term specifications, this definition is also constructed using real values. T being the last value of the Consumer price index, and the MBA_{10} being the moving average over ten years, we will calculate CAPER for the French market with the following formula:

$$CAPER_t = \frac{\frac{CAC40_t \times CPI_T}{CPI_t}}{MBA_{10}\left(\frac{\left(\frac{CAC40_t}{P/E_t}\right) \times CPI_T}{CPI_t}\right)}$$

As the Consumer Price Index (CPI, source: Insee) is published monthly, CAPER is first compounded on a monthly basis. Then, we employ a cubic spline method in order to determine a daily frequency of our explanatory variable. Moreover, since the use of the MBA_{10} makes us lose ten years of data, we extrapolate our explanatory variable backwards, using a VAR model with two dependent variables: the observed P/E ratio and CAPER.

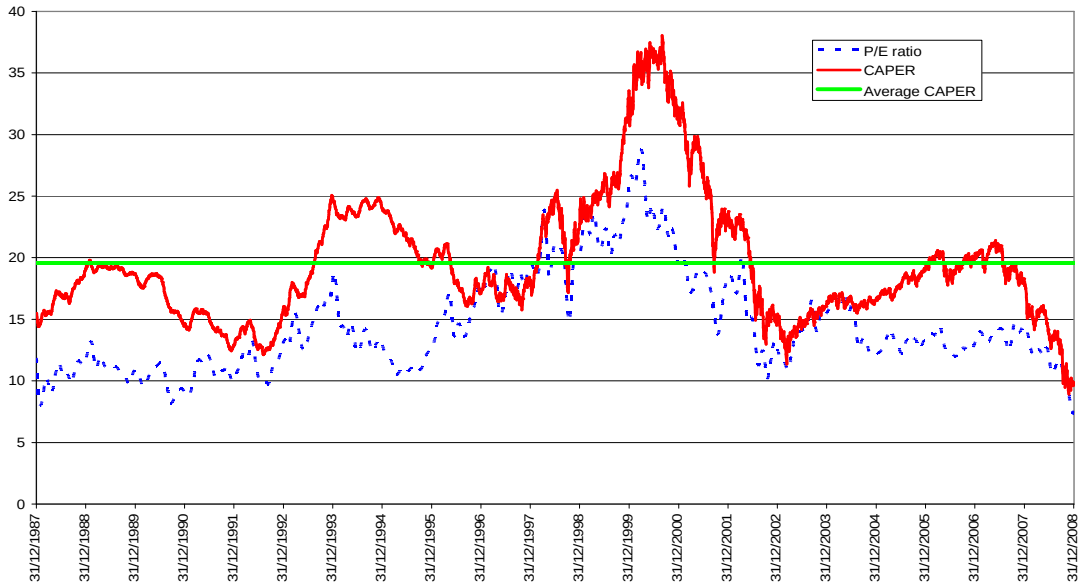
$$CAPER_t = \delta + \sum_{i=1}^{300} \mu_i CAPER_{t-i} + \sum_{i=0}^{300} \tau_i P/E_{t-i} + \varepsilon_t$$

δ, μ and τ being the regression coefficients.

When studying the overall series (the 4th January 1988 to the 31st December 2008), the average level of CAPER is 19.57%, varying between 8.91% and 38.05%. Unsurprisingly, it follows the P/E ratio series (Graph 4), but generally on a higher level[11]. This may be due to the use of a moving average for the denominator in a rising market. Then, the highest values are obtained during the first months of 2000, just before the explosion of the financial bubble, and the lowest values are observed at the end of the analysed period (2008).

[11] Mean of the P/E ratio: 16.23%.

< *Graph 4:* P/E ratio and CAPER>



Source : authors calculations (data from Insee and Datastream)

Two types of equation are being tested. Since there is no specific investment day during the month common to all financial planners, these regressions are tested on daily data. The first one, which uses the traditional time-series econometric tools, deals with the net excess return of the LS investment over the DCA (r_{LS} - r_{DCA}). The form of the equation is:

$$\left(r_{LS} - r_{DCA}\right)_t = \alpha + \beta\, LCAPER_{t-8Y} + \varepsilon_t \qquad \text{(A)}$$

with:

$LCAPER_{t\text{-}8Y}$: Log-value of the cyclically adjusted price-earnings ratio (delay of eight years);

ε_t: Random variable (normally distributed);

α and β: Regression coefficients.

The anticipated net excess return may not be the only criteria for helping savers in their investment choice. We mentioned in section 1 the existence of specific behaviours (prospect theory, regret aversion…) that could justify a complementary approach in terms of probability of loss. For example, an investor with high loss aversion, taking one of the investment techniques as a benchmark could become disappointed when observing the result of his eight years investment based on the other strategy if the benchmark outperforms his investment.

Then the crucial question would not deal with return values but with the probability that one of the investments will outperform the other. The second equation will test the probability of obtaining a better return for the DCA than for the LS investment, depending upon the initial market conditions. The probit model's type is written in the following way:

$$\left(\Pr\left(r_{DCA} > r_{LS}\right)=1\right)_t = \gamma + \lambda\, LCAPER_{\,t-8Y} + \varepsilon'_t \qquad \text{(B)}$$

with γ and λ the regression coefficients, and ε'_t a random variable (normally distributed).

5. Econometric analysis

According to three different tests (Table 2), the endogenous and exogenous variables in equation (A) are I(0). Note also that the tests of seasonality[12] and the tests used to detect cycles[13] have all failed when studying the spread between the returns of both strategies. As our objective is to find values of CAPER which could help in order to choose between a DCA and a LS investment, we first test equation (A) with level data. The long term regression offers an expected result since the net excess return of an LS investment is negatively correlated with the level of CAPER (Equation 1 in Table 3). The smaller the initial price of the market, the higher the excess return of a global investment over a DCA should be on the French stock market after an eight years period. Unfortunately, even if the R-squared reaches a high value (0.97), the level of the Durbin-Watson test indicates a high correlation in the residuals. The graph (see appendix) also shows a kind of breakage in the predicted series, the first part appearing smoother than the last. This is confirmed by the Chow test, and the CUSUM test allows the detection of three breakage points (Appendix 2).

<***Table 2*: Stationarity tests**>

Test	$(r_{LS} - r_{DCA})$		LCAPER	
	Test Stat	P-value	Test Stat	P-value
Wtd.Sym	-2.72	0.18	-2.40	0.36
Dickey-Fuller	-2.73	0.22	-2.42	0.37
Phillips	-27.93	0.01	-11.88	0.32

We then turn to an error correction model (ECM) (see Equation 2 in Table 3 and Appendix 3). A satisfying R squared is obtained (0.82) and the value of the Durbin-Watson coefficient

[12] ACF tests (auto-correlation function) and PACF (partial auto-correlation) on TSP software.
[13] Spectrum analysis on SAS software.

(2.00) shows the absence of autocorrelation. The Chow test and the CUSUM one do not show anymore breakages in the estimation.

The long term equation obtained from ECM gives the following specifications:

$$\left(r_{LS} - r_{DCA}\right)_t = 39.22 - 12.61\, \mathrm{L}CAPER_{\,t-2088}$$

A negative impact of the cyclically adjusted price earning ratio is confirmed. In other words, the higher the price of the market, the less interest a LS offers over a DCA investment.

<***Table 3*: Main estimated coefficients for the various specifications[14].>**

	Expl. variable	Coef.	t-stat	R^2	D-W	Chow test
Equation 1	α	40.41	241.68	0.97	0.28	34.57
	$LCAPER_{t-2088}$	-12.86	-237.40			
Equation 2	α	1.32	2.45	0.82	2.00	5.03
	$(r_{LS}-r_{DCA})_{-1}$	-0.40	-14.47			
	$\Delta((r_{LS}-r_{DCA})_{-2}-(r_{LS}-r_{DCA})_{-4})$	0.19	6.37			
	$(r_{LS}-r_{DCA})_{-4}$	0.36	12.58			
	$\Delta LCAPER_{t-2088}$	-2.10	-2.87			
	$LCAPER_{t-2090}$	-0.42	-2.47			

Number of observation: 1304 in equation 1 and 1299 in equation 2

Turning to the probability of obtaining a better performance for the DCA investment depending upon the initial market conditions (equation B), we obtain a confirming result with a Probit estimate (Table 4)[15]. The higher the cyclically adjusted price earning ratio the greater the probability of obtaining, eight years later, a better return with a DCA than with a LS investment.

<***Table 4:* Probit estimate (Dependent variable: Proba ($r_{DCA}>r_{LS}$) = 1)>**

Parameter	St. estimate	error	t-stat	P-value	Marginal effect
γ	-90.52	8.92	-10.15	** [.000]	-4.20
$LCAPER_{t-2088}$	28.71	2.82	10.18	** [.000]	1.33

Number of observations = 1304

Number of positive obs. = 559

Scaled R-squared = 0.94

[14] See Appendix 2 (equation 1) and Appendix 3 (equation 2) for further results.

[15] A Logit estimate gives very closed results.

Log Likelihood = -109.6

Fraction of Correct Predictions = 0.96

6. Conclusion

The dollar-cost averaging strategy is still developing in the portfolio management of French investors'. Being already offered in traditional life insurance and personal equity plans, this investment rule is now available on the specific retirement savings market. The strategy is often adopted by default, since investors do not want to take the risk of entering the market at a bad moment and have no real estimates of future stocks movements. Yet it has been demonstrated that the strategy is outclassed by a lump sum investment, both on the traditional financial theory field and in cases of simulations and calculation.

We also find a dominance of the return of the lump sum investment on the French market when comparing both strategies in the case of an eight year investment, and when calculating the average Sharpe ratio. But the DCA strategy should not be completely eliminated for two reasons. Firstly, DCA investment generates a loss probability inferior to the LS. Thus, when considering the prospect theory, this strategy could possibly be of interest to investors facing loss aversion. Secondly, the DCA strategy offers a better return than the LS in about 30% of cases. This latter result drove us to find an explanatory variable for the net excess return of LS over DCA. Our estimates show that the cyclically adjusted price earnings ratio of the market can be usefully introduced to explain this spread. It is also a good explanatory variable in a Probit model: the cheaper the market, the higher the probability of observing a higher return for a lump sum investment after eight years. The ratios current level could then be calculated when investors have to make a choice between the two strategies. In fact, instead of being systematically offered to investors, the DCA strategy should be kept for high price market situations.

REFERENCES

- Abeysekera S. and Rosenbloom, E. (2000): "A Simulation Model for Deciding Between Lump-Sum and Dollar-Cost Averaging". Journal of Financial Planning, June, pp.86-96.

- Allen F. and Santomero A. (2001): “What do Financial Intermediaries do?” Journal of Banking and Finance, Vol. 25, pp. 271-294.

- Atra R. and Mann Th. (2001): “Dollar-Cost Averaging and Seasonality: Some International Evidence”. Journal of Financial Planning, July, Vol. 140 Issue 7, pp.98-103.

- Bacon P., Williams R. and Fall A. (1997): "Does Dollar-Cost Averaging Work for Bonds?" Journal of Financial Planning, June, Vol. 10 Issue 3, pp.78-80.

- Bell D. (1982): “Regret in Decision Making under Uncertainty”. Operations Research, vol.30, n°5, Sept-Oct. pp.961-981.

- Boutillier M. and Séjourné B. (2009): “L’orientation de l’épargne des ménages vers les actions”, in *Epargner à long terme et maîtriser les risques*, Conseil d’analyse économique, La Documentation française, pp.109-121.

- Brennan M., Li F. and Torous W. (2005): "Dollar-Cost Averaging”. Review of Finance Vol.9, n°4, pp.509-535.

- Campbell J. and Shiller R. (1988): “Stock Prices, earnings and Expected Dividends”. The Journal of Finance, vol.XLIII, n°3, July, pp. 661-676.

- Campbell J. and Shiller R. (1998): “Valuation Ratios and the Long-Run Stock Market Outlook”, Journal of Portfolio Management, hiver, Vol.24, pp. 11-26.

- Constantinides G. (1979): "A Note on the Suboptimality of Dollar-Cost Averaging as an Investment Policy". Journal of Financial and Quantitative Analysis, Vol. 14, Issue 2, pp.443-450.

- Fisher K. and Statman M. (2000): “Cognitive Biases in Market Forecasts”. ”. Journal of Portfolio Management, Fall, pp.72-81.

- Haguet D. (2009): "L'investissement progressif doit être démystifié". L'Agefi Actifs n°393, pp.8-9.

- Kahneman D. and Tversky A. (1979): "Prospect Theory: An Analysis of Decision Making Under Risk ". Econometrica, n°47, pp.263-291.

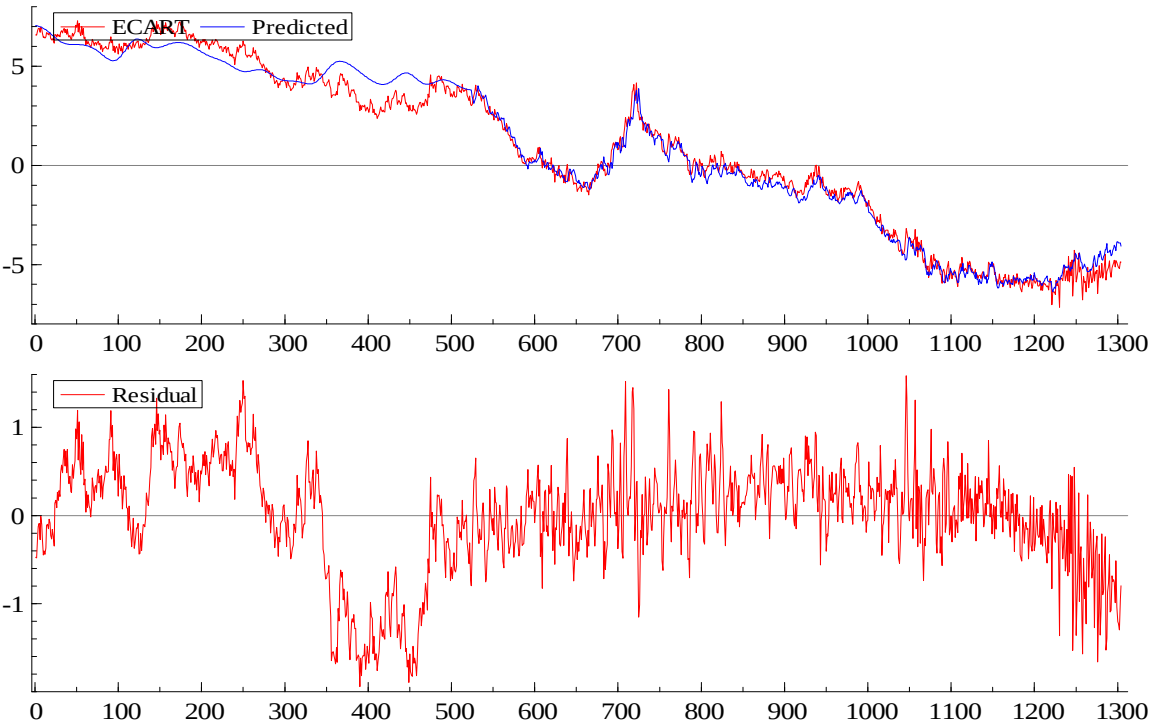
- Knight J. and Mandell L. (1993): "Nobody Gains from Dollar Cost Averaging: Analytical, Numerical and Empirical Results". Financial Services Review, 2(1), pp.51-61.

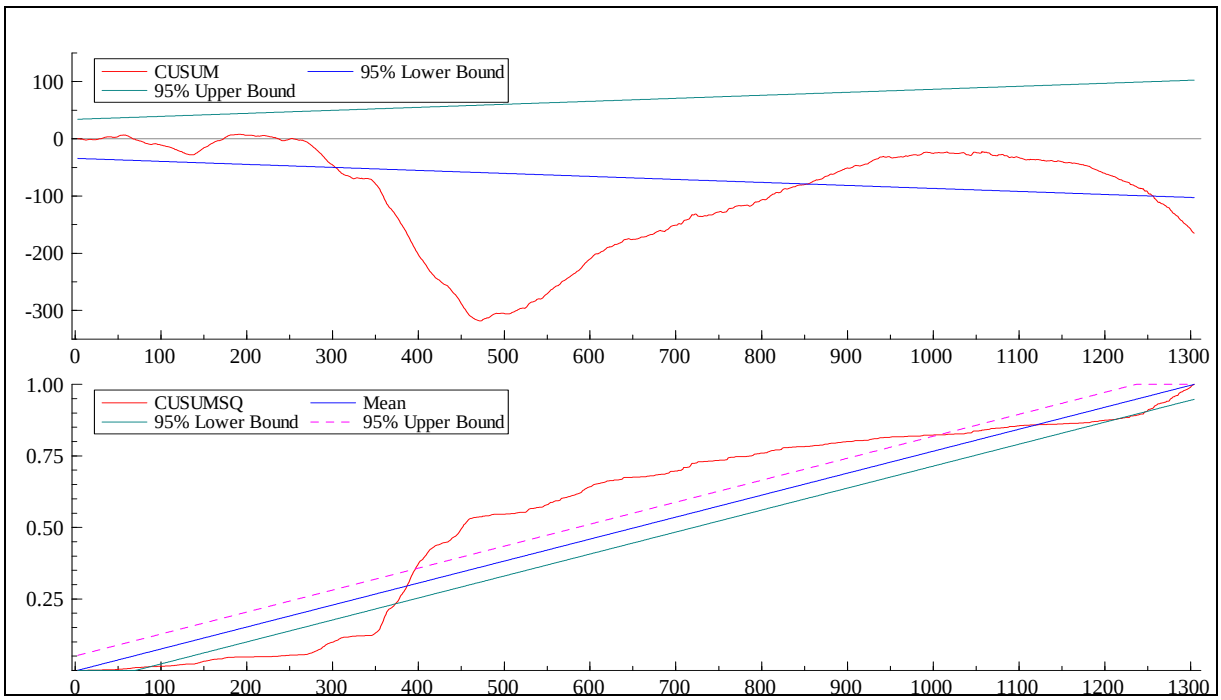
- Loomes G. and Sugden R. (1982): “Regret Theory: an Alternative Theory of Rational Choice under Uncertainty”. Economic Journal, Vol.92, Dec., pp.805-824.
- Milevsky M. and Posner S. (2003): "A Continuous-Time Reexamination of Dollar-Cost Averaging". International Journal of Theoretical and Applied Finance, Vol. 6, n°2, pp.173-194.
- Rozeff M. (1994): "Lump-Sum Investing versus Dollar-Averaging". Journal of Portfolio Management, Winter, Vol. 20, n°2, pp. 45-50.
- Schoenmaker D. and Bosch T. (2008): “Is the Home Bias in Equities and Bonds Declining in Europe?” Investment Management and Financial Innovations, Vol. 5, pp. 90-102.
- Shen P. (2000): “The P/E Ratio and Stock Market Performance”. Economic Review, Vol. IV, Fourth quarter, pp. 23-36.
- Shiller R. (2000): *Irrational Exuberance*. Princeton University Press.
- Statman M. (1995): "A Behavioral Framework for Dollar-Cost Averaging". Journal of Portfolio Management, Fall, Vol. 22, n°1, pp. 70-78.
- Séjourné B. (2006): “Why Is the Behaviour of French Savers so inconsistent with Standard Portfolio Theory?” Financial Market Authority working papers, n°1, Sept., pp.1-38.
- Trevino R. and Robertson F. (2002): “P/E ratios and Stock Market Returns”. Journal of Financial Planning, Feb., pp. 76-84.
- Weygand R. and Irons R. (2007): “The Market P/E Ratio, Earnings Trends, and Stock Return Forecasts”. Journal of Portfolio Management, Summer, pp. 87-101.
- Williams R. and Bacon P. (1993): "Lump Sum beats Dollar-Cost Averaging". Journal of Financial Planning, April, pp.64-67.

Appendix 1: Statistical Results (Table 1).

	(r_{LS})	(r_{DCA})	(r_{3m})	(r_{LS} - r_{DCA})
Observations	3388	3388	3388	3388
Mean	9,155141	7,316843	3,423727	1,838299
Confidence -95,000%	8,983508	7,178380	3,393485	1,726388
Confidence +95,000%	9,326775	7,455306	3,453970	1,950210
Median	8,585588	6,910662	3,441400	2,453361
Minimum	-6,52339	-1,11020	1,95700	-7,15116
Maximum	20,88663	16,07169	5,39000	7,82926
1rst Quartile	7,065315	3,535954	2,663000	-0,626244
3rdQuartile	11,88342	10,66345	4,04450	4,41673
Centile 10,000	4,11046	2,68267	2,13500	-2,26460
Centile 90,000	16,60129	13,05517	4,75600	5,90742
Range	27,41002	17,18189	3,43300	14,98041
Inter-quartile Intervals	4,818105	7,127495	1,381500	5,042973
Variance	25,96222	16,89686	0,80608	11,03781
Standard deviation	5,095313	4,110580	0,897817	3,322319
Kurtosis	-0,284564	0,382314	0,079693	-0,565452
Kurtosis standard dev.	0,042064	0,042064	0,042064	0,042064
Skewness	0,732029	-0,969555	-0,965968	-0,355538
Skewness standard dev.	0,084103	0,084103	0,084103	0,084103

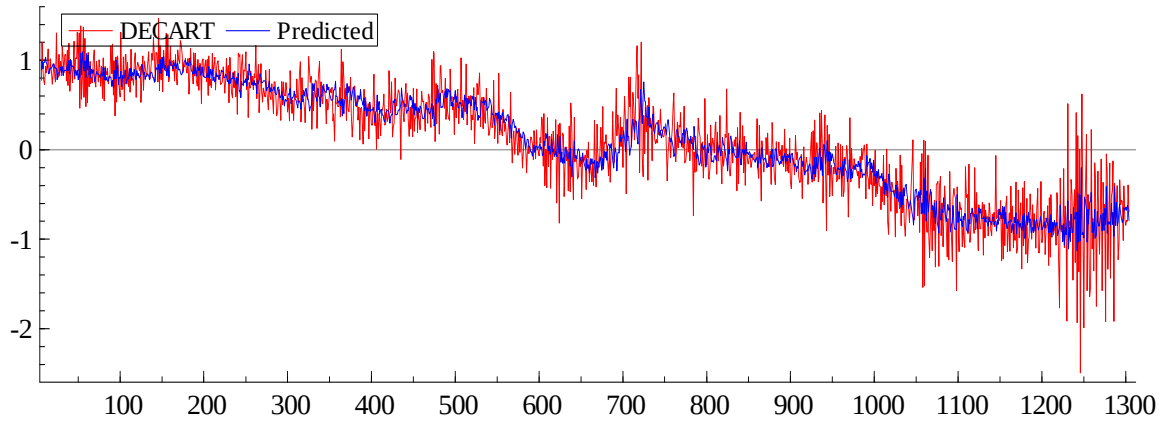
Appendix 2: Equation 1 in Table 3

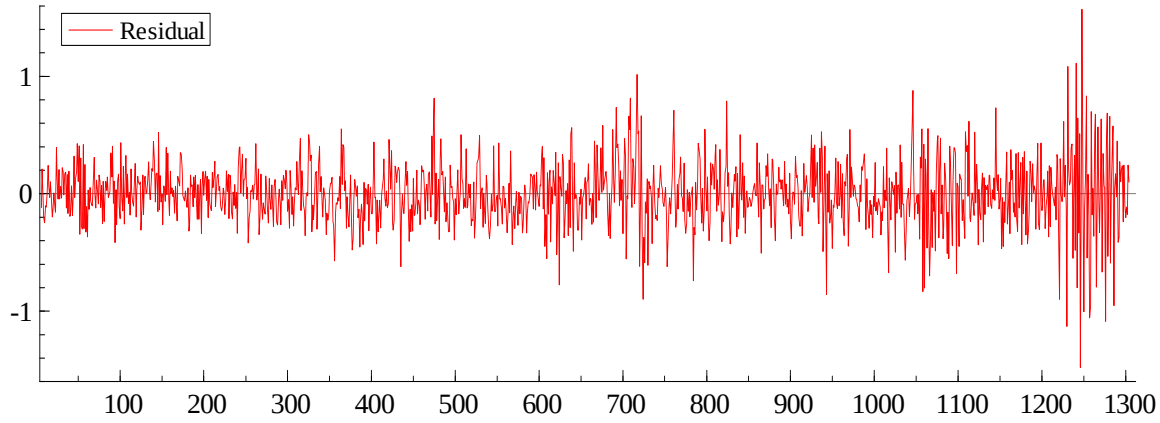


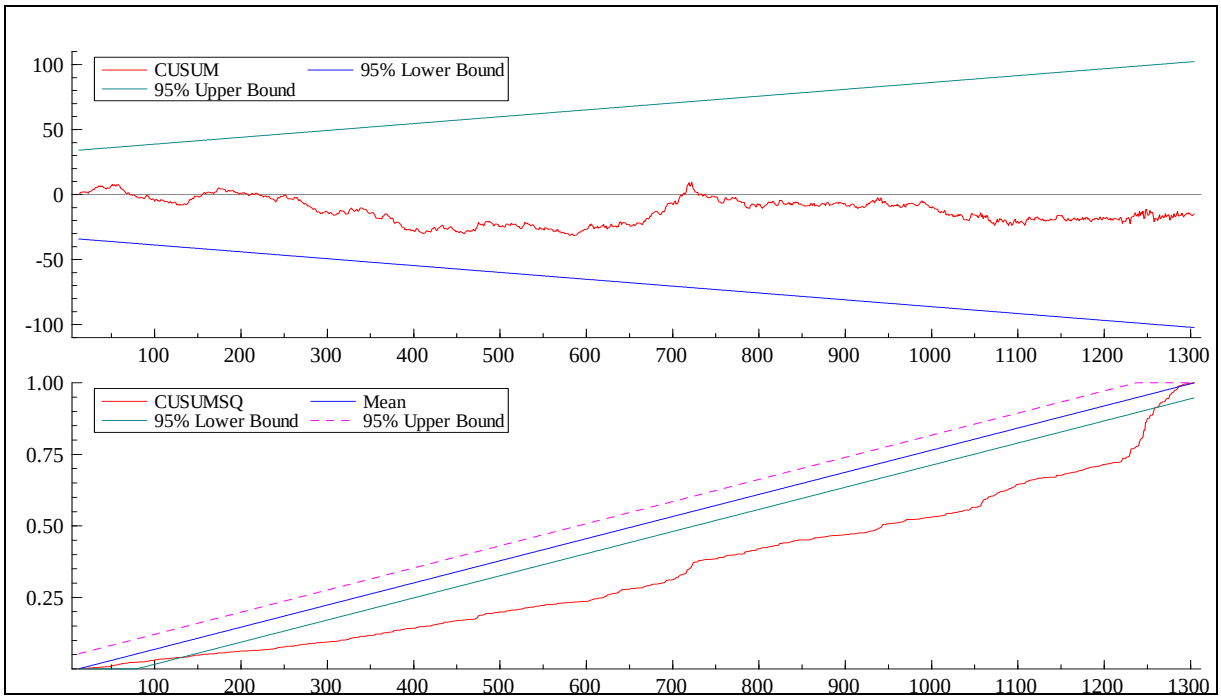


Appendix 3: Equation 2 in Table 3

Mean of dep. var.	.120118	
Std. dev. of dep. var.	.644742	
Sum of squared residuals	96.5063	
Variance of residuals	.074638	
Std. error of regression	.273199	
	Test value	P-value
R-squared	.821141	
Adjusted R-squared	.820450	
LM het. test	5.00267	* [.025]
Durbin-Watson	2.00138	[<.587]
Breusch/Godfrey LM: AR/MA1	.017856	[.894]
Breusch/Godfrey LM: AR/MA2	3.42561	[.180]
Ljung-Box Q-statistic1	.865657E-03	[.977]
Ljung-Box Q-statistic2	.488623	[.783]
ARCH test	41.2258	** [.000]
CuSum test	.516211	[.602]
CuSumSq test	.243178	** [.000]
Chow test	5.03993	** [.000]
Chow het. rob. test	5.91438	** [.000]
LR het. test (w/ Chow)	153.303	** [.000]
White het. test	187.026	** [.000]
Breusch-Pagan het. test	61.9047	** [.000]
Jarque-Bera test	432.817	** [.000]
Shapiro-Wilk test	.971646	** [.000]
Ramsey's RESET2	.840642	[.359]
F (zero slopes)	1187.24	** [.000]
Schwarz B.I.C.	176.177	
Akaike Information Crit.	160.669	
Log likelihood	-154.669	


DECART
Predicted
1
0
-1
-2
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300


Residual
1
0
-1
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300


CUSUM
95% Lower Bound
95% Upper Bound
100
50
0
-50
-100
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
CUSUMSQ
Mean
95% Lower Bound
95% Upper Bound
1.00
0.75
0.50
0.25

Les autres documents de travail du GRANEM accessibles sur le site Web du laboratoire à l'adresse suivante : (http://ead.univ-angers.fr/~granem08/spip.php?rubrique36) :

Numéro	Titre	Auteur(s)	Discipline	Date
2008-01-001	The Cognitive consistency, the endowment effect and the preference reversal phenomenon	Serge Blondel, Louis Lévy-Garboua	Théorie du Risque	octobre 2008
2008-02-002	Volatility transmission and volatility impulse response functions in European electricity forward markets	Yannick Le Pen, Benoît Sévi	Econométrie Appliquée	octobre 2008
2008-03-003	Anomalies et paradoxes dans le cas des choix alimentaires : et si les carottes n'étaient pas oranges ?	Serge Blondel, Christophe Daniel, Mahsa Javaheri	Economie Expérimentale	octobre 2008
2008-04-004	The effects of spatial spillovers on the provision of urban environmental amenities	Johanna Choumert, Walid Oueslati, Julien Salanié	Economie du Paysage	octobre 2008
2008-05-005	Why do rational people vote in large elections with costs to vote?	Serge Blondel, Louis Lévy-Garboua	Théorie du Risque	novembre 2008
2008-06-006	Salaires, conditions et satisfaction au travail	Christophe Daniel	Economie du Travail	novembre 2008
2008-07-007	Construction communicationnelle du stock de connaissances de la compétence collective – Contribution à partir d'une conversation.	Nicolas Arnaud	Gestion des Ressources Humaines	décembre 2008
2008-08-008	On the non-convergence of energy intensities: evidence from a pair-wise econometric approach	Yannick Le Pen, Benoît Sévi	Econométrie Appliquée	décembre 2008
2008-09-009	Production of Business Ethics	Guido Hülsmann	Economie Politique	décembre 2008
2008-10-010	Time preference and investment expenditure	Guido Hülsmann	Economie Politique	décembre 2008
2008-11-011	Le marché de la photographie contemporaine est-il soluble dans celui de l'art contemporain ?	Dominique Sagot-Duvauroux	Economie de la Culture	décembre 2008
2008-12-012	The newsvendor problem under multiplicative background risk	Benoît Sévi	Microéconomie de l'Incertain	décembre 2008
2009-01-013	Complémentarité de la collaboration électronique et de l'investissement relationnel : étude de cas exploratoire d'un SIIO dans le secteur du meuble	Redouane Elamrani, Nicolas Arnaud	Organisation	avril 2009
2009-02-014	On the realized volatility of the ECX CO_2 emissions 2008 futures contract: distribution, dynamics and forecasting	Julien Chevallier, Benoît Sévi	Finance	mai 2009
2009-03-015	The communicational making of a relation-specific skill: contributions based on the analysis of a conversation to strategy-as-practice and resource-based view perspectives	Nicolas Arnaud	Stratégie	juin 2009
2009-04-016	Le droit d'auteur, incitation à la création ou frein à la diffusion ? Une analyse empirique du cas de la création télévisuelle	Françoise Benhamou, Stéphanie Peltier	Economie de la Culture	septembre 2009
2009-05-017	Diversity analysis in cultural economics: theoretical and empirical considerations	Françoise Benhamou, Renato G. Flôres Jr., Stéphanie Peltier	Economie de la Culture	septembre 2009
2009-06-18	L'épargne retraite en entreprise : un état des lieux au regard de l'expérience américaine	Fabrice Pansard, Bruno Séjourné	Finance	septembre 2009
2009-07-19	Options introduction and volatility in the EU ETS	Julien Chevallier, Yannick Le Pen, Benoît Sévi	Econométrie Appliquée	septembre 2009
2009-08-20	Modeling strategic interactions between firms and local authorities – The case of a biotechnology cluster	Alain Berro, Isabelle Leroux	Economie des réseaux	septembre 2009
2009-09-21	The strategy adopted by non-profit care services organizations in dealing with the new French regulatory system: strategic coalitions and reterritorialisation of activities	Isabelle Leroux, Laurent Pujol, Eric Rigamonti	Economie Sociale	novembre 2009
2009-10-22	Une nouvelle lecture du territoire par la limite	Jean-Claude Taddei	Territoire	novembre 2009
2010-01-23	Adoption of new identity-based services: Proposition of a conceptual model based on TAM, DOI and perceived risks	Caroline Lancelot Miltgen	e-marketing	juillet 2010
2010-02-24	Young Europeans' motivations, perceived risks and requirements regarding electronic identification : Some comparative results from focus groups in four EU27 countries	Caroline Lancelot Miltgen	e-marketing	décembre 2010
2010-03-25	Analyse du risque de non-exécution des ordres à la bourse de Paris	Angélique Aubier Piron	Finance	décembre 2010
2011-01-26	Who cares? Europeans' attitudes towards the disclosure of personal identity data	Caroline Lancelot Miltgen, Margherita Bacigalupo, Wainer Lusoli	Systèmes d'information et e-marketing	janvier 2011
2011-02-27	Le rôle des Business Angels dans le financement de l'innovation radicale.	Catherine Deffains-Crapsky	Finance entrepreneuriale	avril 2011
2011-03-28	The EU Financial Reform facing the Global Context	Dominique Perrut	Economie financière	mai 2011
2011-04-29	A simple test of the sustainable development hypothesis	Serge Blondel	Economie expérimentale	septembre 2011
2011-05-30	Evaluation d'un nouveau produit alimentaire : le rôle de la congruence et du packaging	Gaëlle Pantin-Sohier et Caroline Lancelot Miltgen	Comportement du consommateur	octobre 2011
2011-06-31	Une mesure de risque extrême agrégée : risque de marché et risque de liquidité	Angélique Aubier-Piron	Finance	octobre 2011
2011-07-32	When should a French Investor use a Dollar-Cost Averaging Strategy?	Philippe Compaire et Bruno Séjourné	Finance	octobre 2011