Analysis of the French gasoline market since the deregulation of prices

Frédéric Lantz, Chris Ioannidis

Centre Economie et Gestion

Analysis of the French gasoline market since the deregulation of prices

Frédéric LANTZ, Chris IOANNIDIS

Juillet 1992

Cahiers du CEG - n^0 12

ENSPM - Centre Economie et Gestion
228-232, avenue Napoléon Bonaparte, Boîte postale 311, 92506 RUEIL MALMAISON CEDEX.
télécopieur : 33 (1) 47 52 70 66 - téléphone : 33 (1) 47 52 64 25.

La collection "Cahiers du CEG" est un recueil des travaux réalisés au Centre d'Economie et Gestion de l'ENSPM, Institut Français du Pétrole. Elle a été mise en place pour permettre la diffusion de ces travaux, parfois sous une forme encore provisoire, afin de susciter des échanges de points de vue sur les sujets abordés.

Les opinions émises dans les textes publiés dans cette collection doivent être considérées comme propres à leurs auteurs et ne reflètent pas nécessairement le point de vue de l'IFP ou de l'ENSPM.

Pour toute information complémentaire, prière de contacter :
Saïd NACHET (*Responsable de la publication*) **tél. (1) 47 52 64 08**

"Cahiers du CEG" is a collection of researchs realized within the Center for Economics and Management of the ENSPM, Institut Français du Pétrole. The goal of such collection is to allow views exchange about the subjects treated of.

The opinions defended in the papers published are the author(s) sole responsability and don't necessarily reflect the views of the IFP or ENSPM.

For any additional information, please contact :
Saïd NACHET (*Editor*) **tel. (1) 47 52 64 08**

ANALYSIS OF THE FRENCH GASOLINE MARKET SINCE THE DEREGULATION OF PRICES

Frédéric LANTZ, Chris IOANNIDIS (*)

Abstract : in this paper, we have investigated the behaviour of gasoline prices in France over the period 1980-1990. We have established that the price liberalisation measures introduced in 1985 were successful in integrating the domestic market to the European one, but the process of integration is still in progress. The behaviour of the Tax Authorities did not inhibit price flexibility with final gasoline prices responding symmetrically to international gasoline price changes.

1. INTRODUCTION

1.1 The evolution of gasoline demand in France

Gasoline consumption has risen steadily in France since the 70's, and it is currenty standing in 1991 at 18 mT, 50 % above its level in the seventies. This growth in consumption has shown a rathet irregular pattern. Consumption grew strongly between 1970 to 1973 at an annual rate of 8.5 % p.a., but after the first oil shock its growth slowed down to 3.1 % p.a. over the remaining years. During the first half of the eighties the growth of petrol consumption did not rise above 1 % p.a., and consumption stagnation was further marked by three successive falls in consumption between 1989 and 1991.

The evolution of demand of gasoline is characterised by a period of strong growth followed by a slow-down and finally by stable consumption and such pattern classifies it as a necessity (Pasinetti, 1988). The observed reduction in demand during the last six years is correlated with a marked increase of diesel comsumption, as the stock of diesel powered cars has risen from 11 % to 16 % during this period.

The analysis of gasoline price variation which we will be developing in the following sections will therefore be integrated in the context of consumption stability during the 80's.

(*) respectively Institut Français du Pétrole and University of Cardiff

1.2 Gasoline supply conditions

The retail market for gasoline is during the past ten years has witness some dramatic changes both in the number and the character of its outlets. Th number of retail delivery points was reduced from 40400 in 1980 to 25700 in 1990 and at the same time an ever inceasing share was captured by the supermarket chains which in 1990 accounted for 40 % of total sales compared to 13 % a decade ago.

The sources of gasoline supply for the French market were liberalised in the seventies with the introduction of simplified procedures for oil contingent imports and the abandoning of the quota system in the 80's. With this change in the regulatory system, strong competitive forces emerged between the oil companies which are vertically integrated and therefore profide both both refining and distribution facilities and the specialised distributors and the supermarket chains (Bonis-Charancle, 1990).

In the new environment the origin of supply of gasoline in France have altered as with imports of gasoline now accounting for 19.5 % of total domestic supply compared to 3.55 % in the seventies. At the same time the share of domestic production devoted to exports has risen from 1 % to 19.2 %. The European Community countries provide 75 % of imports and recieve 39 % of French exports, which is strong prima-facia evidence of the internationalisation of the French gasoline market. This process will in turn imply that international quoted spot prices for gasoline, such as the Rotterdam spot prices, will now be the main pricing signal, in the French market.

1.3 Taxes on gasoline in France

Taxes on gasoline represent almost three quarters of the retail price, 76 % for super in 1991. The total revenue from gasoline taxes stood at FF 98bn in 1990 corresponding to 6.9 % of the French Budget.

We can distinguish three categories of taxes, a) TIPP ("Taxe Intérieure sur les Produits Pétroliers") internal tax on petroleum products, b) the taxes on gasoline collected for public organisations and c) the Value Added Tax (TVA).

In a more convenient classification we can group together the first two taxes - excice taxes - which are quoted at FF per liter and the TVA which is proportional to the unit value of the gasoline before its application. These two types of tax represent 80% and 20% respectively of the total revenue in 1990

2. GASOLINE PRICES IN FRANCE

The consumption price of gasoline was an administrated price from 1945 to the end of 1985. The decision to liberalise gasoline prices followed the decision of the European Court of Justice which ruled that the current practices were inhibiting competition between distributors. The dismantling of the price control system was thus the result of the persistence of specialised distributors and super-markets which sought the judgement of the European Court. At the same time, international oil prices fell bringing down the cost of imported oil into France.

The path towards the deregulation of the gasoline market in France has been a long one. It began with the announcement of price liberalisation from january 1980, in august 1978, which was never implemented due to the second oil price shock. In may 1982 the price controls which set minimum and maximum prices for gasoline were replaced by a fiscal formula which allowed a more rapid response of the consumption price to changes in the price of oil, and during the winter 1983-84 the dollar exchange rate used for the calculation of the price formula was capped to stop the rapid rise in the price of gasoline before taxes.

The price liberalisation of february 1985 was made effective in the context of falling oil prices and the emergence of strong competition among distributors and retailers.

3. ECONOMIC METHODOLOGY

The gasoline price liberalisation should in principle result in the closer integration of the French gasoline market with the European one. The ever closer price links between the two markets should increase the competitive pressures on the domestic refining industry as the price of imports will not only reflect the raw material price but also the processing refining and transport costs.

But although the increased internationalisation of the French retail market is bound to affect the price of gasoline before tax, it is not clear whether the final consumer gain from the change in the commercial environment, as the State can appropriate the gains by increasing taxes, thus leaving unaltered the price to the consumer.

Our first task is to establish whether the retail price of gasoline exhibits a long-run relationship with the Rotterdam spot price, once local consumption pressures are accounted for. If such relationship is found to exist then it can be adequately described by an Error Correction Mechanism (ECM), and observed departures of the local price from the internationally quoted price are purely temporary.

Unsing monthly information on the spot price of gasoline in Rotterdam, the retail price of gasoline in France before and after tax and the monthly consumption we proceed to test the hypothesis of market integration for the period 1980m1 to 1990m12.

Following Ravaillon (1986), we propose in the first instance the following simplified econometric model of price formation. We will assume that there are two types of markets, the 'dominant' market where prices are set by some auction process, and whose prices are independent of the trading process in the second type of markets the 'local' market.

Thus one can write the price formation equations in the two markets as follows :

$$P_1(t) = P(t) \qquad (1)$$

where P_1 denotes the price in the 'dominant' market, P(t) is an exogenous process :

$$P_i(t) = F_i\,(P_1(t), X_i(t)) \qquad (2)$$

where $P_i(t)$ denotes the price quoted in local market i and $X_i(t)$ is a vector of variables which captures local demand and/or supply conditions

To establish the statistical framework for the test of market integration consider the following general dynamic model :

$$P_i(t) = A(L)\, P_1(t) + B(L)\, P_i(t-1) + C(L)\, X_i(t) \qquad (3)$$

The following hypotheses can now be tested :

1) If the markets are segmented, this implies $A(L) = 0$

2) For immediate integration $A(0)=1$ and $A(L)/I-B = 1$

3) For long-run integration we require $A(L)/I-B(L) = 1$

and finally for,

4) The absence of influence of local marker conditions $C(L) =0$

Recent developments in the analysis of time series have utilised the concept of cointegration to establish the validity of proposed 'equilibrium' relationships between economic time series. Economic time series where found to follow non-stationary stochastic processes such as random walk with ot without drift, rendering meaningless the concept of the mean and variance of the series, as they are both functions of time. Weakly stationarity time series on the other hand have well defined means and variances both of which are tme invariant, thus allowing for the normal statistical inference for the testing of hypotheses concerning their mean and variance. Non-stationary time series can transformed into stationary ones by appropriate differencing, and if a non stationary series must be differenced d times to become I(d). The concept of cointegration as established by Granger (1981), Granger and Engel (1987), refers to combinations of non-stationary series. If a number of series represented by the vector Z(t), are each integrated of order d, but there exist linear combinations, $u(t) = A\, Z(t)$, whose order of integration is lower than d, d-b (b>0), then the series are said to be cointegrated $Z(t)$ - CI(d,b), and the coefficients assigned to these linear combinations (A) are collectively called the cointegrating vectors (which are nomeans unique). If the series in question are of integrated of order one and they are cointegrated, thus their linear combination is stationary, then a valid ECM exists between them.

Thus if Z(t) is a K x 1 vector of series all integrated of order 1 and $u(t) = A\, Z(t)$ - I(0) then the following general error correction representation can be derived :

$$G(L)\,(1 - L)\, Z(t) = -A\, Z(t) + H(L)\, e(t) \qquad (4)$$

where G(L) is a finite order polynomial in the lag operator appropriately normalised and so is H(L), and at least one element of Z(t) is non-zero. All the elements entering (4) are weakly stationary and thus standard statistical procedures can be applied for testing, with no fear of spurious correlations due to common trends.

4. EMPIRICAL RESULTS

4.1 Price integration

All four series, three price series and the consumption series were tested for stationarity. The price series are all expressed in "real" French Franc (FF), and none of them exhibited any seasonal pattern. The series of gasoline consumption was higly seasonal, but after 12th order differencing all seasonal pattern were removed.

In the stationarity tests employed here the null hypothesis is that the series under investigation are integrated of order one, and if the null hypothsis is rejected this is taken as evidence in favour of stationarity. The following table (Table 1) summarises the evidence of out tests.

Table 1 : Tests for stationarity (with trend)

Series	DF	ADF(4)	ADF(10) (*)
ln(prt)	-2.26	-1.94	-2.31
ln(prbt)	-2.14	-1.76	-1.87
ln(prr)	-2.16	-2.17	-1.88
ln(q)	-6.27	-9.40	-4.03
(without trend)			
Δln(prt)	-8.05	-5.93	-3.17
Δln(prbt)	-7.96	-5.44	-2.87
Δln(prr)	-8.40	-5.19	-3.25

with,

prt : "real", after tax, consumption price of gasoline;
prbt : "real", before tax, consumption price of gasoline;
prr ; "real" in FF, Rotterdam spot price of gasoline;
q : gasoline consumption in mT.

Our test indicate all prices series are non-stationary whilst, the value of the test statistics indicate the rejection of the null hypothesis of non-stationarity. The first difference of the series are all stationary allowing as to conclude that all three "real" price series are integrated of order 1.

Our aim is now to establish whether the domestic prices before and after-tax are cointegrated with the internationally quoted spot gasoline prices.

(*) The 5% critical values for the DF and the ADF(4), ADF(10) tests for the number of observations used are -3.44 with a time trend and -2.88 without trend

Following Johansen (1988), we test for cointegration between the domestic prices before and after tax and the Rotterdam spot prices, all expressed in "real" FF. The following table (Table 2) summarises the test statistics for the whole period, and the two sub-period, the first spanning the 1980m1 - 1985m1 (i.e. the period before liberalisation), and the second covering the period from 1985m2 to 1990m12.

The following table summarises our results, for a chosen VAR of order 4, allowing for deterministic trends.

Table 2 : Testing for the existence of cointegrating vectors variables : {ln(prbt), ln(prr)} = Z_t

Period	H_0^1 r=0 H_1^1 r=1	H_0^2 r=0 H_1^2 r≥1
1980m5-1985m1	15.20 *	18.56 *
1985m2-1990m12	20.21 *	23.89 *
1980m5-1990m12	21.35 *	21.91 *

r = number of cointegrating vectors
* = indicates rejection of the null hypothesis at 5%

Our results provide evidence that the domestic before tax price was cointegrated with the Rotterdam price. However the rejection of the null hypothesis in the first period is rather marginal as the critical value of the statistics is 14.9 for H_0^1 and 17.9 for H_0^2 rendering the conclusion of cointegration very tenious indeed. In contrast the results for the second sub-period show that the rejection of the null hypothesis of no-cointegration is robust. For the whole sample we are able to reject the null hypothesis, due to the reference of the second period.

French gasoline prices before tax were shown to be more sensitive to internationale price movements after liberalisation, thus exerting strong pressure to domestic refining margins.

The estimated cointegrating vector for the whole period $u_t = A Z_t$, with $A=[A_{11}\ A_{12}]$ = [-1, 0.89], on which we tested the hypothesis of perfect market integration, i.e. $A_{12}=1$. The hypothesis was conclusively rejected, as the resulting X_1^2 test statistics,was 7.2.

We have repeated the cointegration tests, in order to establish whether, the final, after tax, consumption price of gasoline became more responsive to the spot prices. The results are summarised in table 3.

Table 3 (*) : Testing for the existence of cointegrating vectors variables : {ln(prt), ln(prr)} = Z_t

(*) Similar results were obtained, when quantities consumed were included in the VAR system proposed by Johansen, and the results are available on request from the authors.

Period	H_0^1 r=0 H_1^1 r=1	H_0^2 r=0 H_1^2 r≥1
1980m5-1985m1	9.55	10.78
1985m2-1990m12	13.6	19.2 *
1980m5-1990m12	13.0	14.3

r = number of cointegrating vectors
* = indicates rejection of the null hypothesis at 5%

With the exception of the second sub-period there is no cointegrating vector between after tax prices and Rotterdam spot. But in the second sub-period there is encouraging but by no means unambigious evidence that the domestic market has become better integrated into the European market. The cointegrating vector for the period was estimated $A = [A_{11}\ A_{12}] = [-1,\ 0.22]$.

The change in the commercial regime facilited the process of integration of the French gasoline market into the European, but it did not establish it immediately. We next examine the extent to which there have been shifts in the price generation process, both before and after tax, using a simple dynamic equations of the form :

$$\ln(prt)_t = a_0 + a_1 \ln(prr)_t + a_2 \ln(q12)_t + a_3 \ln(prt)_{t-1} + u_{1t} \qquad (5.1)$$

and

$$\ln(prbt)_t = b_0 + b_1 \ln(prr)_t + b_2 \ln(q12)_t + b_3 \ln(prbt)_{t-1} + u_{2t} \qquad (5.2)$$

where q12 is the seasonaly adjusted level of gasoline consumption.

We present the recursive estimates of the coefficients a_1, b_1, because their evolution provides with a useful insight into the process of adjustement to the new market conditions.

Figure 1 presents the recursive estimates of a_1 and figure 2 presents those of b_1. There is a striking similarity between the two graphs. Both show a slowupward movement from the beginning of the liberalisation period, with the trend continuing for the before tax price showing further progress in the process of integration. The coefficient a_3, b_3 decline over the period indicating that prices have become progressively less inert and more responsive to the international price developments.

Both the cointegration and the recursive estimation results point unambigiously towards greater, if not perfect, integration of the French gasoline market. Our empirical evidence suggests that the process is still underway as far as the before tax price is concerned. After tax prices have also become more responsive to gasoline price movements but their

---

Altering the sample of the second sub-period, from 1985m2-1990m12 to 1986m2-1990m12, the rejection of the null hypothesis is much stronger with the relevant test statistics obtaining values 26.8 and 32.9 respectively. This we take it as evidence at a gradual adjustment of domestic price setting to the new commercial regime.

progress has been considerably slower and whether the tax regime has inhibited the flexibility of final consumption is the next question we turn our attention to, by examining the possible symmetry of price responses.

4.2 Symmetry of price reactions

The fall of the real price of gasoline from its collapse between the summer of 1985 and the spring of 1986, has generated a number of questions concerning the symmetry of price reactions at the different stages of commercialisation ans the response of consumers facing such symmetrics (Wirl, 1991).

Following Karrenbrock (1991), we will test the symmetrics of prices reactions of domestic prices, before taxes, to impulses from the Rotterdam spot market, and subsequently the response of after tax prices to changes in the before tax prices.

Thus, we will be able to determine whether the authorities from the fall in gasoline prices.

For the analysis we will study simply the reactions of D(prbt) to D(prr) in the context of the following model :

$$\Delta(prbt)_t = c_1 \Delta^+(prr)_t + c_2 \Delta^-(prr)_t + c_3 + u_{3t} \qquad (6)$$

where Δ^+ denotes positive changes (otherwise assumes the value 0) and Δ^- denotes negative changes. Using equation (6), testing for symmetry is equivalent to testing the validity of the hypothesis $c_1 = c_2$. The following table (table 4) summarises our results for the second sub-period 1985m2-1990m12.

Table 4 : Testing for symmetric price responses variables D(prbt), D(prr)

Model	$\Delta^+(prr)_t$	$\Delta^-(prr)_t$	$\Delta^+(prr)_{t-1}$	$\Delta^-(prr)_{t-1}$	RSS
Unconstr.	0.1542 (1.85)	0.1972 (1.98)	0.6522 (7.75)	0.502 (4.93)	0.237
Constr.	0.1617 (3.15)		0.5869 (11.2)		0.241

(both intercepts were insignificant)
() : Student

The F-test for the equality of coefficients cannot reject the null hypothesis of $c_1 = c_2$. So, we conclude that domestic prices before tax reacted symmetricaly to international conditions.

To analyse the influence of taxes on the behaviour of gasoline prices for the entire period we use the model :

$$\Delta(prt)_t = d_1 \Delta^+(prbt)_t + d_2 \Delta^-(prbt)_t + d_3 + u_{4t} \qquad (7)$$

Using the same rationale we test for symmetric price responses by testing the restriction $d_1 = d_2$ and we have also tested for the temporal stability of the coefficients, from 1985, to establish if there is a change in the behaviour of the tax authorities after the price liberalisation. Table 5 contains our results

Table 5 : Testing for symmetric price responses variables Δ(prt), Δ(prbt)

Model	$\Delta^+(prbt)_t$	$\Delta^-(prbt)_t$	RSS
Unconstrainted 1980m2-1990m12	1.110 (19.8)	1.242 (21.7)	0.1559
Constrainted 1980m2-1990m12	1.175 (33.6)		0.1586
Unconstrainted 1985m2-1990m12	1.132 (17.9)	1.216 (18.5)	0.0890
Constrainted 1980m2-1990m12	1.173 (30.8)		0.0898

() : Student

Again as in the previous case we were unable to reject the null hypothesis of symmetric price responses. From the results of table 5, we conclude that the authorities have not gained from the price variations as the coefficient of the constrained model is not significantly different from 1.18 (i.e. 1 + rate of tax on added value).

However, both a stepwise chow test and a cusum test reveale a structiral change from july 1985 which is the last period of real gasoline retail price increase.

5. CONCLUSIONS

The consumption price of gasoline has seen a substantial fall over the last five years. The measure taken by the government to introduce competitive pressures into the domestic

market have been successful. The traditional domestic suppliers have found that new specialised distributors could import and distribute to the French market at internationally quoted prices using an already established distribution network. The behaviour of excise duties did not inhibit the final consumption prices from adjusting to its international level of inflation and exchange rate movements have being taken into account.

REFERENCES

Bonis-Charancle F. (1990) : Demand and marketing of petroleum products, in *Petroleum Economics (J. Masseron Editor)*, Technip, Paris, 519 p.

Granger C. (1981) : Some properties of time series data and their use in econometric model specification, *Journal of Econometrics*, vol. 16, pp. 21-130

Engle R. & Granger C. (1987) : Cointegration and error-correction : representation, estimation and testing, *Econometrica*, 55, pp. 251-276

Johansen S. (1988) : Statistical analysis of cointegrating vectors, *Journal of Economic Dynamics and Control*, 12, pp. 231-255

Karrenbrock J. (1991) : The behavior of retail gasoline prices : symmetric or not ?, *Federal Reserve Bank of St Louis*, July-August 1991, pp. 19-29

Pasinetti L. (1988) : La théorie de la croissance et son avenir, *Revue Européenne des Sciences Sociales*, Vol. 26, n°81

Ravaillon (1986) : Testing market integration, *American Journal of Agricultural Economics*

Wirl F. (1991) : Energy demand and consumer price expectations, *Resources and Energy* 13, pp. 241-262

Figure 1 : coefficient a_1 of model (5.1) and its 2 s.e. band based on recursive OLS

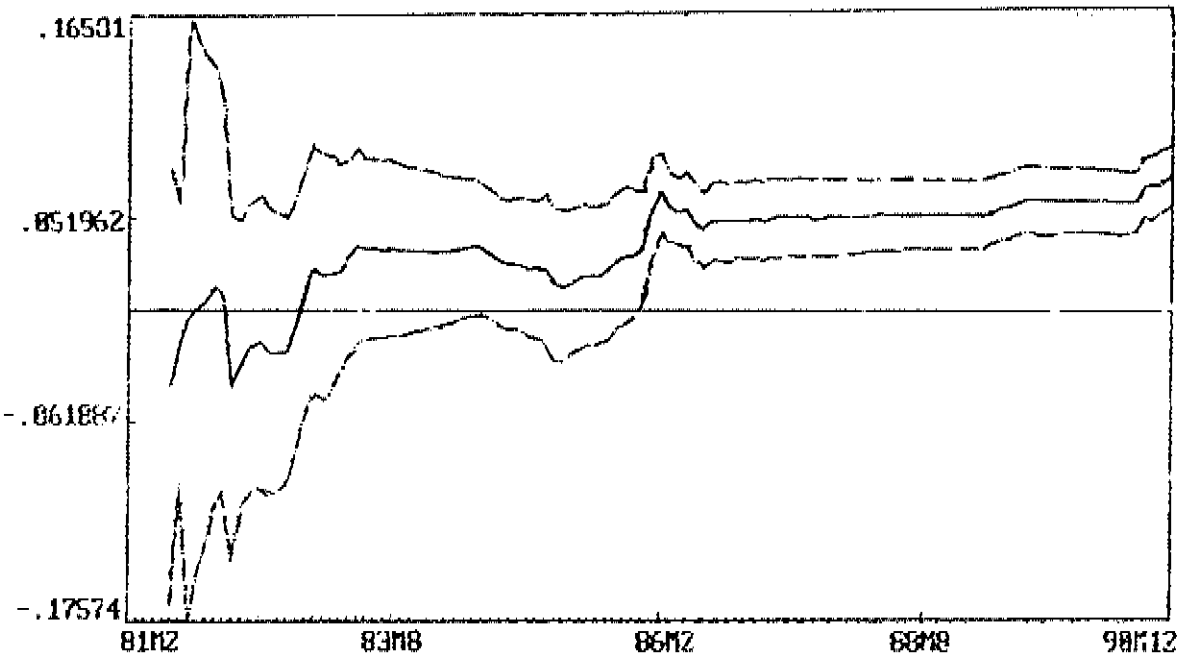
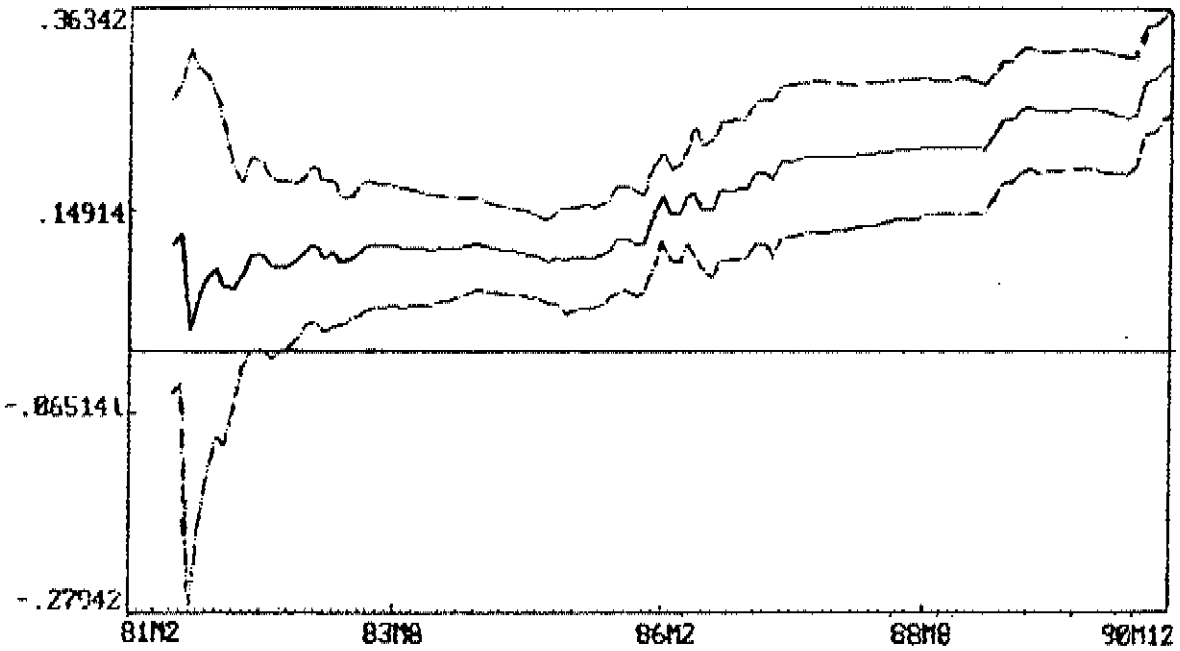


Figure 2 : coefficient b_1 of model (5.2) and its 2 s.e. band based on recursive OLS



Déjà parus

- CEG-1. D. PERRUCHET et J.-P. CUEILLE,
  Compagnies pétrolières internationales : intégration verticale et niveau de risque.
  Novembre 1990.

- CEG-2. C. BARRET et P. CHOLLET,
  Canadian gas exports : modeling a market in disequilibrium.
  Juin 1990.

- CEG-3. J.-P. FAVENNEC et V. PREVOT,
  Raffinage et environnement.
  Janvier 1991.

- CEG-4. D. BABUSIAUX,
  Note sur le choix des investissements en présence de rationnement du capital.
  Janvier 1990.

- CEG-5. J.-L. KARNIK,
  Les résultats financiers des sociétés de raffinage distribution en France 1978-1989.
  Mars 1991.

- CEG-6. I. CADORET et P. RENOU,
  Elasticités et substitutions énergétiques : difficultés méthodologiques.
  Avril 1991.

- CEG-7. I. CADORET et J.-L. KARNIK,
  Modélisation de la demande de gaz naturel dans le secteur domestique : France, Italie, Royaume-Uni 1978-1989.
  Juillet 1991.

- CEG-8. J.-M. BREUIL,
  Emissions de SO2 dans l'industrie française : une approche technico-économique.
  Septembre 1991.

- CEG-9. A. FAUVEAU, P. CHOLLET, F. LANTZ,
  Changements structurels dans un modèle économètrique de demande de carburant.
  Octobre 1991.

- CEG-10. P. RENOU,
  Modélisation des substitutions énergétiques dans les pays de l'OCDE.
  Décembre 1991.

- CEG-11. E. DELAFOSSE,
  Marchés gaziers du Sud-Est asiatique : évolutions et enseignements.
  Juin 1992.