CLOBRE 9.1 Nº 20

PRICE EXPECTATIONS OF FRENCH HOUSEHOLDS : A TEST ON INSEE PANEL DATA (1972–1988)

François Gardes (Université Paris I – CREDOC) Jean-Loup Madre (INRETS – CREDOC)



Centre de Recherche pour l'Étude et l'Observation des Conditions de Vie

CRÉDOC

PRICE EXPECTATIONS OF FRENCH HOUSEHOLDS : A TEST ON INSEE PANEL DATA (1972–1988)

François Gardes (Université Paris I – CREDOC)

Jean-Loup Madre (INRETS - CREDOC)

OCTOBRE 1991

1	42	,	r u	е	d u	С	h e	۷	а	۱e	r	e t
7	5	0	1	3	-		Ρ	A		R	1	S

Résumé

LES ANTICIPATIONS DES MENAGES DANS LES ENQUETES DE CONJONCTURE DE L'INSEE

Comment se forment les anticipations d'inflation?

François GARDES et Jean-Loup MADRE

A partir de réponses qualitatives à des questions sur l'inflation perçue et anticipée, observées sur 40 000 ménages interrogés par l'INSEE entre 1972 et 1988 à deux entreprises à un an d'intervalle, nous proposons quatre méthodes pour quantifier cette information, afin de modéliser les comportements d'anticipation. Nous présentons de nouvelles estimations sur la rationalité et différents modèles (adaptatif, extrapolatif, régressif). C'est la première analyse des anticipations de prix sur ces données individuelles panélisées. Les trois principaux résultats obtenus sont :

(i) les propriétés de rationalité, qui semblent vérifiées sur données agrégées, ne le sont pas sur données individuelles, ce qui révèle un important biais d'agrégation montrant la fragilité des tests macroéconomiques d'anticipations ;

(ii) les données individuelles fournissent de bonnes estimations des processus adaptatif et régressifs, ce dernier comportement étant plus marqué à certains moments (par exemple en cas de rupture d'une tendance longue); on a calculé les poids respectifs de ces deux processus pour chaque année depuis 1972;

(iii) on montre que les paramètres de ces deux modèles dépendent principalement de la variabilité de l'inflation, et moins nettement de son niveau : ces calculs confortent donc l'hypothèse d'Allais et Friedman-Schwartz (1982) plutôt que celle de Gibson (1972) et Cagan (1956).

Abstract

Household's Expectations in INSEE Conjonctural Surveys

How are determined Price Expectations?

François GARDES et Jean-Loup MADRE

From qualitative answers to questions about perception and expectation of the prices groth, collected by INSEE from 40 000 households interviewed twice between 1972 and 1988, we propose four methods to quantify this information in order to modelise expectation behoviour. New estimates of rationality properties and various models (extrapolative, adaptative, regressive) are presented. It is the first analysis of price expectations on these French individual panel data. Three main results are obtained :

(i) the rationality properties, which seem to be verified on aggregate data, are no longer verified on individual data, thus showing important agregation biases which prove the unconclusiveness of tests made with agregate expectations data;

(ii) both the adaptative and the regressive mechanisms are well estimated on individual data, the later taking importance during particular periods (for instance when a long term trend is broken), ; the relative weight of these two mechanisms can be calculated for each year from 1972 to 1988;

(iii) the estimated parameters of theses two models are shown to depend mainly on the volatility of inflation, and to a smaller degree on its level : the hypothesis made by Allais and Friedman-Schwartz (1982) is thus positively tested on these data against the hypothesis made by Gibson (1972) and Cagan (1956).

PRICE EXPECTATIONS OF FRENCH HOUSEHOLDS : A TEST ON INSEE PANEL DATA (1972–1988) '

François Gardes (Université Paris I – CREDOC)

Jean-Loup Madre (INRETS-CREDOC)

INTRODUCTION

According to Pesaran (1987), direct observations of expectations are necessary to test the theories of the formations of expectations. We use in this paper the INSEE conjoncture surveys of household behaviour, which contains questions on their expectations of future financial situation, saving intentions and inflation, as well as questions on their perception of the past values of these variables. These surveys are conducted three times a year, the autumn survey being made a new time a year later for half of the population (approximatively 2 500 households which are interviwed for two consecutive years, the sample being renewed by half each year) : thus, the expectations of an household in year (t-1) can be confronted to its perception of past evolutions of the same variable, and this allows to constitute a chained panel for a long period (1972-1988) 2.

The questions are qualitative answers presented in classes, generally three or five classes around a mean answer : this qualitative information avoids the irrelevant precision of quantitative answers, but obliges to use specific methods or to quantify the answers before treating them (see the list of questions concerning expectations in Appendix I).

¹ Research made with financial assistance of SERT (Ministry of Transport), Commissariat Général du Plan and Comité des Constructeurs Automobiles. We acknowledge the remarks and suggestions of M. GLAUDE, G. LAFAY, L. LEVY-GARBOUA, P. L'HARDY, J. MAIRESSE, B. MUNIER, I. PEAUCELLE, J.M. ROBIN, P. SEVESTRE, A. TROGNON.

² The main problem being the recognition of the same household in two successive surveys, as households are not precisely identified in the surveys for juridical reasons.

The use of surveys on a macro level ³ being not conclusive, we have tried to obtain more precise results with individual data. Answers to questions twelve to fifteen in two consecutive years allow to classify households according to the sign of transitory (not expected) income, and to analyse the consistency of expectations and the effect of this transitory income on the purchases of durable goods (see GARDES-MADRE, 1990).

In this paper, we use this same individual data (17 yearly surveys chained by pair, totalizing 40 000 households) to study the rationality of expectations (section 3), to estimate the extrapolative, adaptative and regressive mechanisms (section 4), and to analyze the differences between agregate and individual estimates and the variation of the parameters according to the level or to the volatility of inflation, testing Gibson - Cagan hypothesis against Allais - Friedman - Schwartz one (Section 5). Before, we must present the qualitative analysis of the different mechanisms before any quantification (Section 1), then the methods used to assign a quantitative value to the qualitative answers of survey (Section 2).

SECTION 1 : QUALITATIVE ANALYSIS OF CONTINGENCY TABLES :

In models where expectations $p^{e}(t)$ depend on past expectations $p^{e}(t-1)$ and current or past realization of the variable, $p^{p}(t)$ and $p^{p}(t-1)$, with only one lag :

 $p^{p}(t)$, $p^{p}(t-1)$, $p^{e}(t-1) \rightarrow p^{e}(t)$, it is possible to obtain bivariate relations by fixing one variable : for instance, the adaptative model : $p^{e}(t-1)$, $p^{p}(t) \rightarrow p^{e}(t)$ is obtained by fixing $p^{p}(t-1)$ at each of the six items of answers ; six bivariate relations are thus defined between $p^{e}(t-1)$ and $p^{e}(t)$ when $p^{p}(t)$ is fixed, six others between $p^{p}(t)$ and $p^{e}(t)$ when $p^{e}(t-1)$ is fixed : thus, a x^{2} test can be performed to measure the dissymetry of the contingency tables containing the frequencies of the realization of pair of answers for two variables ($p^{p}(t)$ and $p^{e}(t)$ in our example). We present in table 1 the result of the X^{2} test for the adaptative and extrapolative models for the pair of surveys of October 1987 and 1988. The X^{2} are calculated for the table corresponding to the four first modalities of answer of each variable, because the fith answer (decrease of prices) is very rare. The X^{2} for the five first answers are greater and lead to the same conclusion (see Gardes-Madre, 1991, page 24).

³ STERDYNIAK (1988), L'HARDY (1976) conclude to a weak predictive power of expectational variables (of income, prices or intentions to buy or save) on households' behaviour, on an aggregate level (See Gardes-Madre, 1991, pages 6-10, for details).

Relation tested		ADAPTATIVE MODEL				EXTRAPOLATIVE MODEL			
Answer for the 3 rd variable	p ^e	p ^e (t)/p ^p (t) p ^e (t)/p ^e (t-		c(t)/p ^e (t-1)	p ^c (t)/p ^p (t)		p ^e (t)/p ^p (t-1)		
	x ²	n	x ²	n	x ²	n	x ²	n	
1	34.7	355	43.6	438	69.2	540	33.5	472	
2	226.9	1079	73.3	1196	170.2	134	29.2	1284	
3	55.0	604	47.0	1404	133.1	1303	22.5	1521	
4	234.8	1089	99.7	860	204.7	1010	31.5	911	
5	9.0	40	4.9	15	24.6	38	3.1	15	
6	91.9	319	6. 8	15	18.7	29	10.4	73	

TABLE 1 : X^2 test for the contingency tables (surveys 1987-1988).

Remarks :

Adaptative model : p^e(t) = f[p^e(t-1), pP(t)]
 Extrapolative model : p^e(t) = g[pP(t-1), pP(t)]

When the relation between $p^{e}(t)$ and $p^{p}(t)$ is studied (for the adaptative model in the second column), the variable $p^{e}(t-1)$ is fixed at each of its six modalities (line one to six).

2) X^2 calculated for the first four modalities of the two variables compared; for five modalities, the X^2 is, in the first column: 34.7, 257.7, 84.6, 243.1, 9.0, 91.9; the only clear difference between the X^2 corresponding to 4 and 5 modalities appear in line 2, last column: $X^2 = 55.7$ instead of 29.2.

3) n = number of households of the contengency table whose X^2 is indicated (for 5 modalities - the fifth one being very rare).

4) X² limit : 16.92 at 5 % ; 21.67 at 1 %.

5) The modalities of answers are presented in Appendix I.

One can conclude from table 1:

(i) The X^2 statistics are always significative : the contingency tables are thus proved to be asymetric, and a direct observation of these tables shows that the relation existing between the two variables correspond to those which are predicted by the models (see Gardes-Madre, 1991, page 26).

(ii) The relations predicted by the adaptative model are better established than those of extrapolative model (X^2 greater of 16% for the extrapolative model): this result imports because it will be difficult to estimate the extrapolative model by the quantitative methods studied later.

(iii) The relation between past prices perceived in t and future prices expected in the same date $(p^{p}(t) \text{ and } p^{e}(t), \text{ corresponding to the adaptative and the regressive models}), is more firmly established than the relation between expectations in (t-1) and t, or between past prices perceived in (t-1) and expectations made in t : thus, there appears a strong dependency between perceptions of past inflation and expectation made in the same period (L'Hardy, 1976, observed the same fact on macro data).$

This qualitative analysis does not infirm the extrapolative and adaptative models. The quantification of the answers allows us to measure more precisely these relations.

SECTION 2 : QUANTIFICATION OF PERCEPTIONS AND EXPECTATIONS :

During the last twenty years, the inflation has been very changing in France : during a first period (1973-1983), prices have been increased by 10 % per year, with peaks at 15 % around 1974 and 1978; after a relatively short period of sharp decrease, inflation has remained around 3 % since 1985.

The modalities one to three of question five are labelled in levels for the perception of past inflation, while expectations (question 6) they are labelled in deviation to these perception of past inflation : this difference must be taken into account in the quantification.

Two types of measure have been performed.

2.1 First quantification :

The more commonly used quantification of qualitative surveys consists in the definition of fixed hierarchised weights corresponding to each item of response, for instance an arithmetical scale from +2 to -2 when there are five modalities of response. These weights are added for the whole population to obtain an aggregate index : The often used Theil index, for instance (difference between the percentage of the first and the last modalities of response), consists in the scale +1, -1 for the extreme modalities and 0 for the other ones.

A first mechanical quantification, Ia, is obtained through a scale +3 to -1 by attributing the nul weight to the modality 4 ("prices remain stationary") for question 5 on past perceived inflation, then adding 1, 0 or -1 to these perceived inflation rates according to the answer of the household to question 6 (acceleration, stability or decrease of inflation).

A second quantification, Ib, is obtained by optimizing the choice of this scale through a minimisation of the difference between the actual inflation rate and the aggregate index calculated by the weighted sum of the percentages of answers.

To realize this optimization, aggregate data (the percentage of answers) have been used for the perception of past inflation, while individual data were used for the expectations. The details of this method are presented in Appendix II.

A <u>second type of quantification</u> stays on the hypothesis of normal distributions of the responses to question 5 to 6. This method has been often used for aggregate data (for instance by de Menil, 1974; Carlson - Parkin, 1975; Prat, 1988, which presents it precisely pages 27-72) and we have adapted it to individual data : applied at a macro-level, the method affords the mean Π of individual perceptions or expectations, and its standard error $\mathbf{c}_{\mathbf{r}}$ (see Appendix II for some detail); suppose that a1 is the percentage of households having chosen the first modality for perceived past inflation, and s1 the threshold of a normal variable N(0,1) associated with the cumulate frequency $a_1/2$, we quantify this first modality by the value $\Pi P + s_1 \cdot \mathbf{c}_{\mathbf{r}}$; for the second modality, the threshold s2 is associated to the cumulate frequency $a_1 + a_2/2$ and this modality is quantify by the value $\Pi^P + s_2 \cdot \mathbf{c}_{\mathbf{r}}$. The same quantification is applied to the qualitative expectation, but the choice of a mean expected inflation gives some trouble : it seems

natural to take, for each household, the value of the modality of past perceived inflation that he has declared, for question 6 is labelled in terms of "expectation compared to what is presently happening. In this first quantification (II a), we make in fact the hypothesis that the distribution of answers to question 6 does not depend on the modality chosen in question 5, for we use to determine the threshold s_i the distribution of the whole population on question 6. This independence of the two distributions corresponding to the question on past an future inflation is not proved by an empirical test, and, moreover, it gives rise to multicolinearity problems as $p_i^{p}(t)$ and $p_i^{e}(t)$ for household i will be related : $p_i^{e}(t) = p_i^{p}(t) + s_i \cdot \sigma_{m'} e$.

A second hypothesis (quantification II b) consists to take the mean perceived past inflation $\prod P$ as the center of all expectations, and to define $p_i^e(t) = \prod P + s_i \int_{n/e}^{\infty} we lose the information on the dispersion of individual perceived past inflation, in addition to the information lost on the dispersion of individual expected inflation rates between the two thresholds of the modality of expectation chose by the household, but this second hypothesis gives rise to much better empirical results.$

Other types of quantification are presented in Gardes-Madres (1991, page 32).

SECTION 3 : TEST OF RATIONALITY :

When the perceptions and expectations are aggregated over all households⁴, unbiasedness and efficiency (against the perception of past inflation in (t-1) are positively tested, as shown by the following adjustments :

(1) (unbiasedness) $pP(t) = 1.14 + 0.91 p^{e}(t-1)$; $R^{2} = 0.71$; DW = 1.50(0.61) (5.81) (2) (efficiency) $pP(t) - p^{e}(t-1) = -0.11 p^{P}(t-1) + 1.50$; $R^{2} = 0.03$; DW = 1.46(0.70) (0.73)

(annual data : 1973-1987 ; quantification II b).

As these agregate data follow a common trend (approximatively the trend of the actual inflation rate), these tests are not very convincing.

On the contrary, the expectations seem to be biased and unefficient on individual data, as table 1 and 2 show clearly : for the second quantification (II b), the coefficient of $p^{e}(t-1)$

⁴The aggregate data are directly given by method II, as indicated in Appendix II.

lies between 0.08 and 0.45, with a constant significantly different from 0 (and a weak R^2 , around 2 %): a clear bias is shown. In equation (2), table 2, the perception of past inflation determines positively the errors of anticipation, with coefficients around + 0.2 and a mean R^2 of 3 %: a weak unefficiency appears for the past perceptions of inflation.

Thus, one can conclude that tests of rationality on aggregate data are not significant, and that tests on individual data trend to prove some irrationality of expectations.

<u>Table 1</u>: Unbiasedness : $pP(t) = a + bp^{e}(t-1)$ (quantification II b)

	R²	CTE		PF	(t-1)
1973	0.002	10.242	31.0	0.085	2.1
1974	0.008	18.327	53.5	0.114	4.7
:975	0.022	10.734	:7.7	0.230	7.9
1776	0.013	10.340	22.7	0.209	5.2
:377	0.024	8.576	23.3	0.217	7.3
:778	0.015	8.521	27.7	0.183	6.2
:979	0.015	11.080	31.3	0.204	6.1
: 780	0.012	14.540	29.4	0.212	5.6
:361	0.005	13.733	29.2	0.146	3.7
:732	0.014	9.75:	:7.5	0.224	6.3
:763	0.008	8.508	24.1	0.113	4.7
:73+	0.022	5.143	15.3	0.283	7.1
:225	0.045	:.55+	4.1	0.452	10.3
:935	0.034	-1.563	-3.9	0.355	8.8
: 767	0.073	1.140	12.7	0.264	S. 5
:703	0.024	-0.256	3.:	0.238	7.1

<u>Table 2</u>: Efficiency : $pP(t) - p^e(t-1) = a + b pP(t-1)$

(quantification II b)

		R²	a	ta	b	tb
	1973	0.045	0.781	3.3	0.251	10.3
	1974	0.012	6.857	25.2	0.137	5.9
	1975	0.015	-6.368	-13.9	0.146	6.4
	1976	0.039	-3.531	-11.4	0.215	10.8
	1977	0.012	-2.782	-7.9	0.130	5.2
	1978	0.007	-0.697	-3.0	0.080	4.2
1	1979	0.020	1.349	6.0	0.146	7.2
ł	1980	0.049	1.300	5.0	0.225	11.7
	1981	0.026	-4.027	-11.0	0.178	8.6
	1982	0.020	-5.359	-12.6	0.190	7.4
	1983	0.043	-7.358	-25.2	0.234	11.3
	1984	0.027	-2.559	-10.4	0.181	7.9
	1985	0.028	-4.750	-20.7	0.196	8.0
	1986	0.018	-4.883	-32.3	0.147	6.4
	1987	0.034	2.336	27.6	0.200	8.8
	1988	0.036	0.194	2.2	0.210	8.8
- 1						

SECTION 4 : ESTIMATION OF MODELS OF ANTICIPATIONS :

3.1. Simple models :

The extrapolative model can be estimated, on an horizon of two years, by adjusting the expected inflation $p^{e}(t)$ on perception $p^{p}(t)$ and $p^{p}(t-1)$. For the first quantifications (Ia) and (Ib), the measure of the expected inflation by adding an indicator of expectations to the perception of past inflation biases the estimation. The quantification II a (equivalent for this model to II b) allows us to observe (table 3) a positive correlation ($R^{2} = 5,6\%$), with a greater and more significant coefficient of $p^{p}(t)$ compared to $p^{p}(t-1)$ (0.11 against 0.03); it is interesting to note that the influence of these two past prices compensate one another from year to year : b = 0.85 c + 0.14; $R^{2} = 17\%$,

past inflation in t $(p^{D}(t))$ being caracterized by a greater coefficient when the inflation rate changes rapidly (1975-1978; 1981; 1983-1987) : this fact proves that the anticipation does not follow a regular extrapolative process of past perceived evolutions, but that the weight given to these evolutions depends on the continuity or the ruptures of past evolutions.

	<u> </u>	Q	ta	b	tb	C	t _c
1973	0.014	11.063	77.3	0.010	0.7	0.054	 5. :
1974	0.017	17.322	63.3	0.071	5.4	0.042	3.2
1975	0.078	±1.359	47.5	0.029	2.5	0.144	14.2
1976	0.041	9.337	41.8	0.075	5.5	0.100	7.3
1977	0.060	8.298	43.1	0.011	0.7	0.135	11.1
1978	0.060	3.821	63.3	0.047	5.3	0.107	7.7
1979	0.043	11.575	73.6	0.055	5.5	0.073	7.1
1960	0.034	15.322	35.3	0.027	3.1	0.078	7.7
1781	0,024	14.417	54.1	-0.011	-0.3	0.103	8.1
1782	0.004	13.482	46.3	0.056	3.4	0.005	0.5
1783	0.078	7.859	61.5	0.027	3.3	0.122	13.9
1734	0.113	6.535	56.0	0.039	3.8	0.145	:4.7
1765	0.103	2.783	25.1	0.031	2.5	0.150	14.4
1766	0.063	-1.509	-15.4	0.007	0.5	0.170	:4.0
1987	0.079	-0.727	-17.7	0.031	2.3	0.156	11.5
1958	0.064	-1.731	-75.0	0.043	3.1	0.130	3.3

<u>Table 3</u>: Extrapolative model : $p^{e}(t) = a + b pP(t-1) + cpP(t)$

(quantification II a)

The <u>regressive process</u> can not be estimated without the definition of the reference inflation rate, corresponding to the long run equilibrium that the agents expect to be realized in the long term. If it is supposed constant, the model can be written : $p^{e}(t)-pP(t) = \mu [\Pi - pP(t)]$. For the second quantification, the extrapolative equation corresponds to a coefficient $\mu = 0.9$ and an inflation rate $\Pi = \text{constant}/\mu$ which is not absurd. Nevertheless, a correct estimation would necessitate a better specification of the évolution of the long term inflation rate Π .

The simple adaptative model :
$$p^{e}(t) = (1-\beta)p^{e}(t-1) + \beta pP(t)$$
 (3)
= $p^{e}(t-1) + \beta EE(t)$ (4)

with an expectation error $EE(t) = pP(t) - p^{e}(t-1)$, has been estimated in the form (3) [with no constraint on the parameters], then by equation (4') $p^{e}(t) - p^{e}(t-1) = B EE(t) + \xi$, with ξ supposed to be null or not.

The first quantification (Ia) implies a mechanical effect (dpP=pP(t) - pP(t-1)) being contained in each term of the equation) which fixes B around the unity; the quantification Ib (tables 4 and 5) gives rise on the contrary to a B around 0.3, the exceptional stability of which seems also due to a mechanical effect (proved by the excessive R^2 for individual data).

<u>Table 4</u>: Adaptative model in levels (3) $p^{e}(t) = (1-\beta)p^{e}(t-1) + \beta pP(t)$ (Quantification Ib)

	$R^2(1) PF(t-1) PP(t)-PF(t-1)$							
	An	ticipatio	n Erre	ur d'Ani	ticip.			
	C	loeft. S	tud. Co	oeft. St	ud.			
1973	0.937	1.019	512.8	0.285	49.3			
1974	0.904	0.989	695.0	0.302	61.4			
1975	0.961	0.909	599.6	0.280	102.0			
1976	0.936	1.011	496.4	0.279	57.0			
1977	0.956	0.913	392.8	0.276	71.6			
1978	0.963	0.978	355.0	0.281	61.9			
197 9	0.964	1.026	429.0	0.279	54.2			
1980	0.963	0.994	494.8	0.269	59.9			
1981	0.940	0.979	496.0	0.285	64.2			
1982	0.955	0.806	309.1	0.272	94.5			
1983	0.962	1.001	344.6	0.281	65.4			
1984	0.967	0.916	267.0	0.290	68.4			
1985	0.928	0.717	178.0	0.291	78.7			
1986	0.891	0.753	123.3	0.300	64.0			
1987	0.883	0.865	134.0	0.274	55.0			
1988	0.879	0.852	120.7	0.283	53.0			

(1) R2 du modèle avec terme constant.

Sources : Enquête INSEE de Conjoncture auprès des Ménages

	R ² Constante Erreur d'Anticip.								
				PP(t)-PF(1-1)			
		C	Coeft. Si	ud. C	oeft. St	ud.			
l		•	ğ		P				
	1973	0.538	0.196	15.6	0.282	50.4			
	1974	0.573	-0.026	-2.6	0.299	60.3			
	197 5	0.763	-0.439	-48.2	0.279	90.7			
	1976	0.557	0.156	12.8	0.277	57.9			
	1977	0.673	-0.352	-27.4	0.275	64.1			
	1978	0.620	0.012	0.9	0.282	61.1			
	1979	0.570	0.254	19.2	0.277	56.4			
	1980	0.583	0.049	4.1	0.267	59.8			
	1981	0.604	-0.051	-4.2	0.284	62.6			
	1982	0.674	-0.571	-47.9	0.273	73.4			
	1983	0.620	0.137	10.8	0.280	66.7			
	1984	0.625	-0.170	-11.7	0.280	60.1			
	1985	0.583	-0.454	-34.7	0.293	54.3			
	1986	0.555	-0.167	-13.1	0.306	50.6			
	1987	0.543	-0.019	-1.7	0.270	49.4			
	1988	0.541	0.010	0.8	0.282	47.8			

Sources : Enquête INSEE de Conjoncture auprès des Ménages

The quantificatification (II a) gives also rise to a multicolinearity ; when corrected, ß appears to be around 0.8 (when the equation contains also dpP in addition to EE(t). The quantification (II b) (tables 6 and 7) gives the better results : R^2 around 18 %, and a ß varying between 0.3 and 0.5, with significant and continuous variations from one year to another (0.2 to 0.4 for equation (3), 0.2 to 0.8 for (4')) : the adjustment in level (equation (3)) verifies the additivity to one of the coefficients and shows that the inertia effect of $p^e(t-1)$ on $p^e(t)$ diminishes rapidly with the inflation rate after 1982 ; the adjustment in differences (equation (4')) shows that the influence of the expectation error EE(t) is particularly important when the inflation rate is violently changed (1974-1975, 1983, 1985-1986) and weak during the period of stability (1979-1982) : this correlation will be studied more thoroughly later.

All these estimations of the adaptative model (summed in table 8) indicate a coefficient β between 0.3 and 0.5, clearly less than the unity which is often obtained with aggregate data (see Gardes-Madre, 1991, pages 49-50, for a discussion of this difference).

<u>Table 5</u>: Adaptative model in difference (4') dp^e = $\beta EE(t) + \gamma$ (Ouantification Ib)

		R ²	1.B	£	ß	tA
Cable 6 : Adaptative model in levels Outputification II b) (2)	1973	0.361	1.245	172.8	0 775	~ 0
	1974	0.977	1.135	131.5	0.592	51 0
	1975	0.980	0.733	262.6	0.070	21.0
	1973	0.963	0.875	262.2	0.136	14.0
	1977	0.756	0.822	201.7	0.782	21.5
	1973	0.752	1.003	240.0	0.776	21.5
	1979	0.374	1.166	200.9	0.340	20.5
	1780	0.986	1.178	253.8	0.755	74 4
	1981	0.780	0.970	747.6	0.170	+E 4
	1982	0.750	0.577	193.4	0.105	7 4
	1983	0.753	0.725	177.9	0.245	26.0
	1964	0.953	0.371	202.5	0.247	~ ,
	1985	0.823	203.0	24 0	0.150	15 0
	1986	0.256	-0.057	-7.0	0.137	15.0
	1987	C. 174	0.410	20.5	0.117	10.0
	1288	0.173	0.527	20.1	0.157	9.7

Table 7 : Adaptative model in difference (quantification II b) (4')

	R2	8	ts	ß	tB
1973	0.113	2.714	46.0	0.207	16.7
1974	0.210	4.364	34.8	0.365	26.8
1975	0.27	-3.466	-57.6	0.321	27.6
1976	0.074	-1.638	3	0.974	16.6
1977	0.232	-1.908	-35.2	0.351	25.0
1978	0.231	0.252	6.1	0.331	24.7
:979	0.167	2.204	41.5	0.747	20.0
1930	0.125	3.107	52.2	0.207	19 1
1931	0.070	-1.274	-27.3	0.214	14.0
1782	0.037	-0.026	-11.4	0.147	10.0
1783	0.349	-3.105	-47.2	0.415	70.7
1784	0.207	-1.037	-24.4	0.274	77.9
:985	0.140	-3.770	-62.2	0.275	19.2
1786	0.154	-4.342	-57.7	0.278	19 7
1737	0.224	-0.034	-0.5	0.340	74.4
1938	0.174	-1.052	-13.3	0.7.5	21.4

Quantification	ß	R ²						
la	0.68	0.90						
Ib	0.28	0.68						
lla	0.84	0.08						
IIb*	0.28	0.18						
IIb**	0.52	-						
 En diff. première avec constante item sans constante 								

Table 8 : Different estimations of the adaptative model

4.2 Mixed models :

4.2.1. The introduction of the differential of past inflation perceived by the household (dpp) in the adaptative model :

$$dp^e = a + \beta EE(t) + \gamma dpP$$
 (table 9)

shows a regressive behaviour of expectations, as χ is clearly negative and β increases (to 0.35) compared to the simple adaptative model; moreover, β and χ seem to be negatively related, as if the regressive determinants appear when the adaptative ones lose their influence.

1	3	

	R	X	Ŀ,	6	Es	8	ty
1973	0.137	2.747	÷5.9	0.275	18.2	-0.110	-7.5
1974	0.235	5.411	40.3	0.501	32.9	-0.257	-16.9
1975	0.235	3.923	.57.4	0.435	31.6	-9.162	-14.3
1975	0.115	-1.735	-34.9	0.277	18.5	-0.122	-8.2
1977	0.284	-2.232	-37.3	0.454	27.7	-0.175	-11.3
1973	0.255	0.117	2.5	0.375	27.2	-0.104	-8.5
1979	0.171	2.278	43.0	0.332	23.2	-0.109	-8.5
1980	0.145	3.259	53.6	0.259	20.5	-0.087	-7.9
1981	0.101	-1.300	-27.4	0.238	14.9	-0.035	-2.4
1782	0.093	-1.152	-15.5	0.306	16.5	-0.231	-13.3
1983	0.422	-3.416	-57.2	0.510	44.6	-0.206	-18.6
1784	0.223	-1.121	-25.5	0.334	23.0	-0.037	-5.7
1785	0.167	-3.899	-62.0	0.311	19.0	-0.103	-7.0
1786	0.153	-4.401	-47.5	0.291	15.6	-0.021	-1.2
1987	0.236	-0.060	-0.9	0.390	23.6	-0.090	-5.4
1988	0.205	-1.174	-:3.3	0.366	20.9	-0.089	-5.1

Table 9 : Regressive determinant in the adaptative model (quantification II b).

4.2.2. It is possible to mix systematically the three processes, as recommended by Frenkel, Curtin and Prat, by adding them with weights a1, a2, $a3 = 1-a_1-a_2$ to obtain the equation :

(5) $p^e(t) - p^p(t) = (a_1 y - a_3)dpP - a_2 \mu p^p(t) + a_3 \beta[p^p(t) - p^e(t-1)] + a_2 \mu \prod$ with three models :

- extropolative (proportion a₁) : $p^{e}(t) - p^{p}(t) = \gamma dp^{p}$

- regressive (a₂): $p^{e}(t) - p^{p}(t) = \mu[\prod - p^{p}(t)]$

- adaptative (a3): (A1) $p^{e}(t) - p^{p}(t) = -dp^{p} + \beta EE(t)$ (A2) $dp^{e} = \beta EE(t)$

When estimated separately, with $p^{e}(t)$ as the explained variable, the <u>extrapolative process</u> is badly estimated (weak R², around 5 %, constraint on the parameters not verified), while the regressive process is more precisely estimated (R2 ~ 5,2 %; μ ~0.89), and especially the adaptative process appears as the best estimated, with a mean R² of 7.6 %.

Having eliminated the extrapolative process which is contrary to the regressive element found in the previous analysis (4.2.1.) and badly estimated, the mixing of regressive and adaptative models shows, for the quantification IIb, that (table 10) μ a2 is close to 1 (0.7 in mean) : thus, as the regressivity coefficient μ is less than 1,

<u>Table 10</u>: Mixed process regressive - adaptative $p^{e}(t) - p^{p}(t) = constant + a_{3}(B-1) EE(t) - \mu a_{2} p^{p}(t)$ (Quantification II b)

		02 · F		$L \sim (R, A)$		- µ a,		(a)		(67			
		K -	Us le	لي نه 1 و		- '	L	/	vi	μ	*;	μ	3
	1973	0.782	10.144	47.7	-0_140	-6.8	-0.819	-36.0	013	0.99	a34	1, 23	0.53
1	1974	0.655	16.464	52.3	-0.131	-8.0	-0.318	-40.5	0.24	4.65	0.15	1.31	0.30
	1975	0.737	9.005	28.7	-0.165	-10.5	-0.702	-40.3	0.24	2.95	0.71	2.43	0.77
	1976	0.631	6.954	19.0	-0.290	-12.1	-0.614	-23.6	0.34	6.9Z	035	1.61	0.11
	1977	0.718	6.363	29.2	-0.143	-8.4	-0.736	-37.9	0.22	3.94	6.27	0.99	0.47
	1978	0.738	7.920	41.2	-0.142	-8.7	-0.749	-40.4	6.21	6 55	5.11	1.05	C 35
	1979	0.762	10.501	48.7	-0.157	-8.9	-0.757	-37.2	3.21	5.5%	0.55	A.23	059
1	1980	0.784	12.975	\$6.0	-0.207	-11.0	-0.714	-35.5	0.25	1.62	0.60	1.19	0.66
	1981	0.673	10.509	21.9	-0.223	-9.7	-0.584	-24.6	0.28	6.91	0.32	461	0.30
ł	1982	0.694	11.514	28.2	-0.194	-7.9	-0.319	-30.6	5,23	1.0L	6.15	1.65	0.41
	1682	0.786	7.218	39.7	-0.067	-5.7	-0.305	- 58.6	0.11	0.91	1:17	4.15	0.77
	1984	0.780	5.545	30.1	-0.138	-7.4	-0.709	-36.2	0.13	6.53	c . 11	0.91	0.33
	1985	0.764	1.791	10.3	-0.127	-5.8	-0.723	-32.4	0.17	2 87	0.45	1.17	0,72
	1986	0.650	-2.291	-20.6	-0.191	-7.5	-0.638	-24.0	0.26	c.St	4.00	-	ذكى ف
İ	1997	0.683	-0.546	-11.5	-0.178	-7.5	-0.571	-32.5	0.17	0 Y2	021	ú.Sz	0.34
i	1938	0.589	-1.553	-31.2	-0.167	-3.2	-0.702	-31.1	0.24	0.95	6.13	3.32	0.23

Hypothèses : (a) β = valeur obtenue dans le tableau 18

(b) β = valeur obtenue dans l'ajustement adaptatif en différence sans constante.

the <u>regressive process appears to be influent</u> ($a_2 = 70 \%$); the coefficient B is estimated as clearly infra-unitary (if a3 is taken to be 30 %). If B = 0.28 for instance (as estimated separately in table 7), we obtain in mean $\mu = 0.95$ and $a_2 = 0.77$, $a_3 = 0.23$

The mix of these two processus is probably marked by the preponderance of one or the other in different periods, according as each household uses both processes (for instance for long term and short term expectations, as predicted by Frenkel, 1975) or as the proportion of households adopting each process varies. As an example of this phenomenon, we analyse the changes of the parameters of the adaptative process according to the level or to the volatility of inflation.

SECTION 5 : CHANGES OF THE ADAPTATIVE PROCESS ACCORDING TO THE LEVEL OR THE VARIABILITY OF INFLATION

The volatility of inflation rates has been measured by different indicators of short-term volatility (s2, CV12, CV36) or long-term variability (s5, $|d\Pi|$) summing-up into the total variability 3 indicated by the standard-error of monthly inflation rates calculated on 36 months.

For the quantification (II b), strong correlations are observed between the annual coefficients β (estimated by equation (4')) of the expectation error and these indicators, the discordances with one type of variability (for example, the peak of 1974 or its variation after 1984, not correlated to the short-term indicators, being explained by the long-term ones).

The adjustments of B, for the period 1973-1988, on the level of the annual inflation rate, Π , its differential, $d\Pi$, and the variability indicators, show that :

(i) The total variability 53 and the differential $d\Pi$ (two variables with are not correlated) explain the two third of the variations of B:

 $/3 = 93.5\sigma_3 + 35.0 \,\mathrm{d}\,\pi + 0.05$; $R^2 = 0.679$, Dw' = 1.65(2.51) (3.88) (0.56)

while the correlation of β with the level of inflation \prod is smaller :

$$A = 78.4\overline{3} + 13.4\pi + \text{constante}; R^2 = 0.376, DW = 1.32$$

(1.20) (1.19)

(the correlation with the sole 53 being already 31 %).

(ii) The influence of the total variability σ_3 preponderate (by a factor 11 to 25) on that of Π and $d\Pi$, as is shown by the betas of these variables :

béta $(\overline{\sigma_3}) = 43121 >> béta(\pi) = 1270$ béta $(\overline{\sigma_3}) = 29293 >> béta(dr) = 2652$ (iii) The decomposition of the total variability between its short and long-term components is not clear, even if these two components are positively correlated to B.

(iv) The annual differential of β is well explained by the differential and the variability of inflation :

 $dh = 35.5 d\tau + 0.3 s5 - 0.05; R^{2} = 0.44, DW = 1.77$ (2.5) (1.4) $df = 45.0 d\tau + 0.3 CV12 - 0.08; R^{2} = 0.44, DW = 1.94$ (3.0) (1.4)

The same correlations exist between the quality of estimates (R^2 and t of the estimations of equation (4')) and the variability of inflation (besides, β is correlated to the R^2 of the adaptative equation : when the adaptative behaviour is strong, its become also rapid).

One can conclude that the annual estimations of the adaptative model, which are totally independent for the different years, indicate :

that <u>the adaptative behaviour becomes more marked as the risk of the anticipation error</u> increases (increased volatility or annual change of the inflation rate);
<u>a much weaker relationship with the level of inflation contrary to what Cagan (1956)</u>

and Gibson (1972) have predicted: $\beta(t) = 44.4 \pi(t) - 33.2 \pi(t-1) + 0.18$; $R^2 = 0.59$, DW = 1.67. (4.3) (3.0) (3.0)

Thus, these empirical results are rather a proof of the thesis proposed by Allais, Friedman - Schwartz (1982, page 358) and Turnovsky (1969) of a <u>dependency of the</u> <u>anticipation processes on the variability of the phenomenon anticipated</u>. Besides, the variation of the coefficients of the adaptative model shows that its estimation on time series on a long period is biased by the hypothesis of the constancy of its parameters.

CONCLUSION

The analysis of INSEE panel data takes its interest on the presence of perceptions of past inflation as well as expectation of future inflation, and on the possibility to estimate expectation processes year per year, thus allowing to study the evolution of these processes and the causality of its evolution, and to test hypothesis made by Cagan, Gibson, Allais, Friedman Schwartz and Turnovsky.

New methods to quantify the quantitative data has been proposed, and it has been shown that traditional methods, imposing an a-priori scale for the hierarchised answers, give biased results.

Besides, on these individual data, the test of rationality and the estimates of inflation processes has been revealed as very different from the results obtained on aggregate data. The research will be continued to analyse the variation of the rationality properties and the expectations processes with the socio-economic characteristics of the households (some results already obtained are convergent with those published by Jonuung, 1980 (and Jonuung-Laidler, 1982), and to estimate on individual data the influence of anticipated and non-anticipated inflation on the households' saving and consumption behaviour.

<u>APPENDIX I</u> : Presentation of the Survey

The French INSEE survey "Enquêtes de conjoncture auprès des ménages" (part of the European surveys) is made three times a year (october, January, May) on 6 000 to 8 000 households ; the October survey is renewed by half each year, so that about 2 500 households are interviewed in two consecutive years. Besides questions on socio-economic caracteristics of the households, its equipment in durables, various expenses (holidays, purchase of cars and durables, ...), it contains questions on the perception and anticipation of macro economic conditions (conjoncture, unemployment, inflation) and of the past and the future economic situation of the household.

6) General Questions :

1. Do you think that, for the last year, the level of being ("niveau de vie") of French people has :

- 1. been clearly improved ;
- 2. been a little improved ;
- 3. remained stationery ;
- 4. a little decreased ;
- 5. clearly decreased;
- 6. do not know.

2. Do you think that, for the year to come, the level of being of French people will :

- 1. been clearly improved;
- 2. been a little improved ;
- 3. remained stationery ;
- 4. a little decreased ;
- 5. clearly decreased;
- 6. do not know.

3. According to what you see around yourself, do you think that the situation in the labor market has during the previous months :

- 1. been clearly improved;
- 2. been a little improved ;
- 3. remained stationery ;
- 4. a little decreased ;
- 5. clearly decreased;
- 6. do not know.

4. Do you think that, for the months to come, the number of unemployed will :

- I. been clearly improved;
- 2. been a little improved ;
- 3. remained stationery;
- 4. a little decreased ;
- 5. clearly decreased;
- 6. do not know.
- 5. Do you feel that, since six months, the prices have :
 - 1. much increased;
 - 2. meanly increased;
 - 3. A little increased ;
 - 4. hardly varied;
 - 5. slightly decreased ;
 - 6. do not know.

6. Compared to the present situation, do you think that for the next six months :

- 1. there will be a greater price increase;
- 2. an equivalent price increase ;
- 3. a smaller price increase;
- 4. prices will remain stationary;
- 5. prices will slightly decrease ;
- 6. do not know.

The questions 7 to 17 concern the intentions to buy durable goods (especially cars); the perception of the past financial situation and the anticipation of the future one; the intention to save and the type of saving wanted. These questions are analysed in Gardes-Madre (1989; Sept. 1990; January 1991) to test the consistency of households' expectations and the nullity of the transitory income elasticity of consumptions and savings.

APPENDIX II: QUANTIFICATION METHODS

1. Quantification Ib:

The quantification of the perception of past inflation has been performed on two distinct periods from : November 1974 to november 1983, from May 1984 to May 1989, the inflation rate being around 9 % during the first period and 3% during the second. The weights are determined by the adjustments of the semestrial serie of the actual inflation rate (p) on the percentages of each item of response : the first three give significant coefficients, but the weight attributed to the third modality ("little increase") is too close to 0 to be kept (the two other modalities are to rare to be considered) :

(a) <u>November 1974-November 1983</u> : $p = 3.0 I_2 + 7.8 I_1 + 0.38 u(t-1)$; $R^2 = 0.52 5$ (1.7) (9.1) (1.6) DW = 2.24

(b) May 1984-May 1989 : $p = 1.8 I_2 + 6.7 I_1$; $R^2 = 0.898$; DW = 1.98 (2.3) (6.4)

The weights are well hierarchised, but very different from the a-priori weights +2, +1, 0, -1, -2 which are commonly used, as in Ia.

The adjustments are not too different between the two periods, but we prefered to use seperate regressions because this method affords a better explanation of the period of desinflation (1983-1985).

In a second, the anticipation are quantified by minimizing on the whole panel (40 000 households) the distance between the individual expectations made in (t-1) and the perceived past inflation declared in t, pP(t): this method consists in the minimization of the bias on the whole period, without imposing the absence of bias each year; dummies has been introduced to take into account the variation of the inflation rate during the period, but the other coefficients have been shown not to vary much:

 $pP(t) = Constant + 0.268 \ pP(t-1) + 0.66 \ E_1 + 0.48 \ E_2 + 0.17 \ E_3$ (55.6) (12.4) (11.5) (3.6) $R^2 = 0.796$

 $⁵_{u(t-1)}$, the past residual, being taken into account to remove the first-order autocorrelation.

where pP(t) and pP(t-1) are perceived inflation rates quantified previously (each household having the perceived inflation indicated by equations (a) and (b), for instance 3.0 for the first period and the households who chose the second response, if u(t-1) is nul); E1, E2, E3 are dummies indicating the answers 1, 2, 3 to question 6, the fourth modality ("prices will remain stationary") being omited from the adjustment for multicolinearity reasons (the fifth modality is quite absent) and replaced a-priori by a 0. We note that the hierarchy of the coefficients is satistied.

2. Quantification II:

Under the hypothesis of a normal distribution of answers one, can associate the threshold s1 to the proportion a1 of households having chosen the first modality :

Proba $[\Pi > s_1] = a_1$; a second threshold s₂ is associated to the population having chosen modalities 3, 4 and 5, taking $s_1 = \Pi^n + \delta$ and $s_2 = \Pi^n - \delta$, with Π^n a mean inflation rate observed in the past, for the last n years (n = 1, 3, 5 in our estimations), and δ a perception threshold fixed at 2 %.

Taking Z₁ and Z₂ as the thresholds of a normal reduced distribution corresponding to s₁ and s₂, the thresholds of the distribution $N(\Pi, \mathfrak{S}_{\mathfrak{R}})$ of perception of past inflation or expectations, one obtains :

 $\Pi^{p} = \Pi^{n} + 2 \left[Z_{1} + Z_{2} / Z_{1} - Z_{2} \right] \text{and} \ \mathfrak{s}_{\pi} = 2 \ S \ / (Z_{1} - Z_{2}).$

APPENDIX III: Indicators of inflation volatility.

Short-term volatility has been measured by :

- CV12 = ratio of standart error on mean of the monthly inflation rates, calculated over 12 months;

- CV 36 = the same ratio calculated on 36 months;

 $-s_2 = ratio of the absolute difference on the mean of the monthly inflation rates.$

Long-term volatility is measured by :

 $-s_5$ = ratio of the absolute difference between the annual inflation rate and its mean on the three last years, calculated over five years;

- $|d\Pi|$ = the absolute difference between two consecutive annual rates.

These two types of variability sum up into $\mathbf{5}_3$, the standart error of monthly rates, calculated on 36 months.

The correlations between these indicators is shown on the graph.



 $R(Id\pi 1, J2) = -0.21$ R(J5, CV12) = 0.35

REFERENCES

CAGAN, P., 1956, The monetary dynamics of hyper inflation, in studies in the quantity theory of money, M. Friedman, ed., Chicago U.P.

CARLSON, J.A., 1977, A study of price forecasts, Annals of Economic and social measurement. January.

CHARPIN, F., 1988, Analyse rétrospective de l'enquête de conjoncture auprès des ménages, Observations et Diagnostics économiques, n° 23, avril.

FANSTEN, M., 1976, Introduction à une théorie mathématique de l'opinion, Annales de l'INSEE, n° 21, janvier-mars.

FRENKEL, J. A., 1975, Inflation and the formation of expectations, Journal of Monetary Economics, vol. 1, 403-21.

FRIEDMAN, M, SCHWARTZ, A, 1982, Monetary Trends in the United States and United Kingdom, University of Chicago Press.

GARDES, F., 1990a, Une procédure de révélation des anticipations de revenu et de prix, Cahier du GRID, mai.

GARDES, F., 1990b, Income and price expectations in the irish and French consumption and saving functions, Kilkenny, 18 mai, Annual meeting of the Irish Economic Association, *Cahiers du GRID*, mai.

GARDES, F., MADRE J.L., 1989, <u>Achats d'automobiles et anticipations des ménages</u>, rapport CREDOC.

GARDES, F., MADRE J.L., 1989, Achats d'automobiles et anticipations des ménages, 6ème journées de Microéconomies Appliquées, Orléans, mai

GARDES, F. MADRE J.L., 1990d, Modèles d'anticipation des prix : comparaison des estimations sur données macroéconomiques et microéconomiques en France, 7ème Journées de Microéconomie Appliquée, Montréal, mai.

GARDES, F. MADRE J.L., 1990b, Les anticipations de revenu et de prix dans les enquêtes INSEE de conjoncture auprès des ménages, Troisième colloque international sur les données de panel, ENSAE, 12 juin.

GARDES, F. MADRE J.L., 1990, Consumption and transitory income ; an estimation on a panel of French data, *Economics Letters*, september.

GIBSON, W., 1972. Interest rates and inflationary expectations : new evidence, American Economic Review, december.

GLAUDE, M., 1981, La réalisation des intentions d'achat, Economie et Statistique, janvier.

L'HARDY, P., 1976, Les attitudes des ménages : leur signification, Economie et Statistique, janvier.

PESARAN, M.H., 1987, The limits to rational expectations, Blackwell.

PRAT, G., 1988, <u>Analyse des anticipations d'inflation des ménages : France et Etats-Unis</u>, *Economica*.

STERDYNIAK, H., 1988, Opinions, anticipations et consommation des ménages, Observations et diagnostics économiques, n° 23, avril.

TURNOVSKY, S.J., 1969, A Bayesian approach to the theory of expectations, Journal of Economic Theory, vol. 1, pp. 220-227.

CAHIER RËCHERCHE

Récemment parus :

Penser l'insertion - Méthodes et critères : Contribution à une analyse des critères de l'insertion dans les réseaux de prise en charge des jeunes en difficulté, par Michel Legros, N° 14, Avril 1991.

L'analyse propositionnelle du discours, par Michel Messu, N° 15, Mai 1991.

Classification dichotomique descendante par Sébastien Lion, N° 16, Mai 1991.

Pratiques exemplaires ou exemples de pratiques : l'évaluation dans le secteur social aux Etats-Unis - Analyse de monographies présentées dans "Evaluation Review" et dans "Evaluation and the health professions", par Patricia Croutte, Michel Legros, N° 17, Juillet 1991.

Etude de l'opinion et enquêtes de référence : Aspects théoriques, méthodologiques et informatiques (Soutenance : Avril 1988), par Anastassios Iliakopoulos, N° 18, Septembre 1991.

Entre école et emploi : les transitions incertaines, par Denise Bauer, Patrick Dubéchot, Michel Legros, N° 19, Septembre 1991.

Président : Bernard SCHAEFER Directeur : Robert ROCHEFORT 142, rue du Chevaleret, 75013 PARIS - Tél. : (1) 40.77.85.00

CRÉDOC

Centre de recherche pour l'Étude et l'Observation des Conditions de Vie