Agreement and disagreement between expectations and realizations

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AGREEMENT AND DISAGREEMENT BETWEEN EXPECTATIONS AND REALIZATIONS

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Résumé

L'objet de la recherche est de mesurer l'intensité de la relation existant entre anticipations et réalisations de variables stratégiques pour l'entreprise comme la production, la demande ou les prix. L'existence d'une erreur d'anticipation révèle un désaccord que l'on rapproche de l'hypothèse d'anticipations rationnelles. Le coefficient d'accord entre des classifications suggéré par COHEN (1968) et LIGHT (1971) et calculé à partir d'une matrice de probabilités, a été généralisé pour mesurer directement le désaccord entre classifications. La comparaison des coefficients permet de se prononcer quant à la validité de l'hypothèse d'anticipations rationnelles.

L'application utilise les données issues des enquêtes de conjoncture effectuées régulièrement par l'INSEE, entre 1974 et 1986.

Mots-clefs: Anticipations rationnelles - classification - coefficient d'accord - erreur d'anticipation.

Abstract

The objective of the paper is to measure the intensity of the relation between expectations and realizations for strategic variables of firms, such as production, demand or prices. An anticipation error reveals a disagreement which can be associated with the rational expectations hypothesis. The agreement coefficient between classifications, given by COHEN (1968) and LIGHT (1971) and calculated from a probability matrix, is used to define a direct measure of the disagreement between classifications. Comparison of the coefficients is used to test the rational expectations hypothesis.

The coefficients are applied to business survey data of INSEE for France between 1974 and 1986.

Keywords : agreement coefficient - anticipation error - classification - rational expectations.

1. Introduction.

The measure of association between two kinds of variables (nominal, ordinal, categorical...) has been widely studied in the literature (for a synthesis, see LIEBETRAU 1983). Numerous applications appear in sociological or psychological experiments, or in economics. A special form of association is **the agreement existing between the classifications of n items into k categories** made by two or more individuals, introducing or not weighting coefficients. One can also be interested in conditional agreement if the classification of one individual is seen as a reference (LIGHT 1971) or if one studies two classifications made at two successive moments. A more special case appears when the two classifications are given by one person at two periods of time (for example, grades for an examination) or when the classifications concern the prediction and the realization of a particular variable. In this last situation, the agreement-disagreement idea can be associated with the concept of rational expectation ; then, an agreement between prediction and realization should reveal a rational expectation. In this paper, we envisage this case in the application.

A particularly interesting use of these techniques appears in the analysis of the behaviour of firms relative to their production, prices, demand, stocks... by using business survey data, the expectations and realizations of these variables, and the concept of "surprise variables" or "failure to fulfill a plan" used by NERLOVE (1983) ; information is generally given according to three categories : increase, no change and decrease of the considered variables. In such an economic problem, it is useful to consider the agreement between anticipations and realizations by using the GOODMAN-KRUSKAL γ coefficient (1954) which gives only a measure of the association between two variables. But it may be important too to point out the disagreement associated with these two series of classifications, specially when a large part of the firms is situated in the "no change" category (as it is frequently the case if we consider business survey data for USA, Germany or France).

For this study, we propose in Section 2 to extend the results of COHEN (1968), LIGHT (1971) and COLEMAN-LIGHT (in Liebetrau 1983) to develop a disagreement coefficient to measure directly the intensity of the differences between two classifications or two behaviours, and specially a conditional disagreement coefficient (COLEMAN, 1966) used when the two variables are not independent. So, the problem is not only to obtain a general or global disagreement measure, but to characterize each case, to compare them and eventually to compare agreement and disagreement. The different coefficients are compared in Section 3 and are applied to the expectations and the realizations of production, prices and demand for firms in France in Section 4. It is important to note here that such an analysis is more descriptive of the behaviours than explanatory.

2. The conditional coefficients.

Several situations can be considered, with the same coefficients but with different interpretations. In the most general case, one considers classifications given by two individuals A and B, and one studies the situations corresponding to the classification made by one individual given the one made by the other individual. In such a case, A and B have symmetric roles ; noting P(B/A) the probability that B makes a choice given the choice of A, it is possible to study P(B/A) and/or P(A/B), whether or not the information of the first classification is known.

If now an order is introduced between the two classifications, for example A first and B second, time is an important implicit variable, and calculations can be made in one direction only P(B/A), whether or not B knows the classification made by A.

Finally, it is possible to envisage a third situation, more particular, by considering that the two classifications are made by the same individual, at two different periods, directly successive or not. In this case too, a single calculation is feasible. An illustration of such a situation is one which considers expectations and realizations of a special variable, a situation which can eventually be linked to the concept of rational expectations.

2.1. The basic tools.

Let us consider n homogeneous items which have to be classified into k categories by 2 individuals. These items can be responses given by n firms for the k categories of values of a variable X through time (categories given in increasing or decreasing order). The different coefficients which will be developed here are based on the elements of a squared matrix associated with the classifications of the n items by the two individuals A and B.

			A		
		1	j	k	
	1				$n_{1.}$
B	i		n_{ij}		$n_{i.}$
	k				$n_{k.}$
		$n_{.1}$	$n_{.j}$	$n_{.k}$	n

n_{ij} is the number of items (or frequency) classified in category j by A and in category i by B ; $n_{i.}$ and $n_{.j}$ (i = 1, ..., k ; j = 1, ..., k) are the marginal frequencies.

From this table, we can deduce a second table in terms of probability, obtained by dividing each element of the matrix by n. Some problems could arrive if one of the cells is null but such a situation is not considered here. These results are completed by the marginal probabilities $p_{i.}$ and $p_{.j}$. With the elements of the second table, two kinds of coefficients are defined to measure the conditional agreement and then the conditional disagreement between the two classifications. If the first one is associated with the diagonal elements, the second one will be studied with the off diagonal elements.

2.2. The conditional agreement coefficients.

It was proposed by COLEMAN (1966) and LIGHT (1969-1971) to study the agreement between two individuals for classification of items into a particular category i. Let us define the conditional probability

$$\theta_i = P(B_i/A_i) = \frac{P(A_i\ B_i)}{P(A_i)} = \frac{p_{ii}}{p_{\cdot i}}$$

probability that B places an item in category i, given that A placed it in category i. In the opposite case, we will have

$$P(A_i/B_i) = p_{ii}\ /\ p_{i.}$$

Under the assumption of independence of the classifications, we will have

$$\theta_i^* = \frac{p_{i.}\ p_{.i}}{p_{.i}} = p_{i.}$$

which corresponds to the marginal probability, and in the opposite case

$$\theta_i^{\prime *} = p_{.i}$$

Then, the conditional agreement of A and B will be measured by

$$K_{ii} = \frac{\theta_i - \theta_i^*}{1 - \theta_i^*} = \frac{p_{ii} - p_{i.}\ p_{.i}}{p_{.i} - p_{i.}\ p_{.i}} \qquad (1)$$

or in the opposite case

---

[1]*This coefficient is usually noted K_{pi} ; we adopt the notation K_{ii} to be in harmony with the disagreement coefficient presented in the next section.*

$$K'_{ii} = \frac{p_{ii} - p_{i.}\ p_{.i}}{p_{i.} - p_{i.}\ p_{.i}}$$

with no special relation between K_{ii} and K'_{ii}, but with a common numerator which measures the distance from the hypothesis of independence. The disagreement (associated with the fact that the p_{ij} are not null) is only indirectly taken into account through the marginal probabilities $p_{i.}$ and $p_{.i}$.

Some comments can be presented :

a) K_{ii} is calculated for each category i ; if we use a time series, it is possible to calculate such a coefficient for each period ; thus comparisons can be made over time (but not directly, see Comment d). Generally, these coefficients can be considered as independent from one period to another : there are no memory effects.

b) Each coefficient varies between a lower limit $K_{ii\ inf}$ and 1, with

$$K_{ii\ inf} = - \theta_i^* / (1 - \theta_i^*) = - p_{i.} / (1 - p_{i.})$$

The limits correspond to $\theta_i = 0$ ($p_{ii} = 0$, joint probability null) and $\theta_i = 1$. The lower boundary is always negative and associated with a perfect conditional disagreement between the classifications ; in absolute value, this limit is all the higher as the marginal probability $p_{i.}$ is high, which means that a large part of the items is classified in category i by the second person (here B). It varies between $- \infty$ for $\theta_i^* = 1$ and 0 for $\theta_i^* = 0$.

c) Statistically, the asymptotic distribution of the coefficient is normal (LIGHT, 1971), and the variance corresponding to our formulation, given by LIEBETRAU (1983), is the following

$$V(K_{ii}) = \frac{1}{n} \frac{p_{i.}\ (1 - p_{.i})}{p_{.i}\ (1 - p_{i.})}$$

For K_{ii} statistically significant, if K_{ii} is close to $K_{ii\ inf}$, it means that θ_i is close to 0 and there is a perfect conditional disagreement between the two classifications. When K_{ii} is negative, the joint probability observed is less than the joint probability under the hypothesis of independence of the classifications. K_{ii} null corresponds to the assumption of perfect independence of the classifications for category i ($p_{ii} = p_{i.}\ p_{.i}$). For K_{ii} positive, the more K_{ii} is close to 1, the more the conditional agreement between the classifications is perfect ($\theta_i = 1$ and $p_{ii} = p_{.i}$). Finally, for $K_{ii} = 1$, $p_{li} = 0$ for $l \neq i$; if A chooses i, B cannot make another choice. In case of application of this coefficient to the problem of comparison of expectations and realizations of economic variables, this last result corresponds to a perfect expectation when anticipated results are identical with the observed ones.

e) One is frequently interested in situating the more or less strong agreement between judgements or variables over time or across categories. It is not relevant to compare the absolute values directly because of the differences of the inferior limit of the variation interval. Let us illustrate this situation with an example and suppose the two following cases : $K_{11} = 0.105$ and $K_{22} = 0.120$ with the inferior limits respectively - 3.7 and - 0.9. Apparently, the agreement is more important for the second category than for the first one. To permit a more relevant comparison, it is convenient to define a normalized coefficient whose value is between 0 and 1

$$K^*_{ii} = \frac{K_{ii} + |K_{ii\ inf}|}{1 + |K_{ii\ inf}|} = p_{ii}/p_{.i} = \theta_i$$

We obtain $K^*_{11} = 0.81$ and $K^*_{22} = 0.19$, an agreement of 81 % in the first case and only 19 % in the second one, even though $K_{22} > K_{11}$ and the two absolute values are not too far apart. Then, the agreement is much more important in the first case than in the second one, which did not appear with the absolute values K_{11} and K_{22}. We have to note that for such comparisons, the θ_i's values, i.e. the conditional probabilities, are sufficient.

Naturally, $K^*_{ii} = 0$ and $K^*_{ii} = 1$ indicate respectively perfect conditional disagreement and agreement.

Another advantage of the normalized coefficients could be to allow usual operations (as addition or ratio...) or calculations of a global agreement index such as "ΣK^{*}_{ii}" which could be compared to a global disagreement index, or to compare the different coefficients directly through time.

2.3. The conditional disagreement coefficients.

We saw in the previous paragraph a measure of agreement which could be interpreted in terms of disagreement only for the extreme inferior value. However, it is possible to develop a direct measure of the disagreement, K_{ij}, calculated with the off diagonal elements of the table, with the same principle as for K_{ii}. Moreover, it is easy to distinguish in some cases negative and positive disagreements (according to the positions of i in relation to j such as i > j or j > i), which have not necessarily a symmetrical interpretation. Such a distinction is particularly adapted to the problem of expectations and realizations of economic variables. As a matter of fact, positive disagreement will be associated with the situation where the observed results of the variable are higher than it was expected. The negative disagreement will correspond to the opposite situation.

Then, we can define the conditional probability in the most general case :

$$T_{ij} = P(B_i/A_j) = P(A_j\ B_i) \ / \ P(A_j) = p_{ij} \ / \ p_{.j}$$

and

$$T'_{ij} = P(A_j/B_i) = P(B_i\ A_j) \ / \ P(B_i) = p_{ij} \ / \ p_{i.}$$

which are different from

$$T_{ji} = P(B_j/A_i) = p_{ji} \ / \ p_{.i}$$

$$T'_{ji} = P(A_i/B_j) = p_{ji} \ / \ p_{j.}$$

T_{ij} is the probability that B places an item in category i, given that A placed it in category j. In the case where we envisage expectations and realizations, this coefficient represents the probability that the realization is i, when the anticipation was j and corresponds to a wrong anticipation.

Under the assumption of independence of the classifications,

$$T^*_{ij} = p_{i.}\ p_{.j} \,/\, p_{.j} = p_{i.}$$

We obtain the same result as for θ^*_i and the conditional probability is equal to the marginal probability $p_{i.}$.

We propose then to define the **conditional disagreement coefficient** by

$$K_{ij} = \frac{T_{ij} - T^*_{ij}}{1 - T^*_{ij}} = \frac{p_{ij} - p_{i.}\ p_{.j}}{p_{.j} - p_{i.}\ p_{.j}}$$

If we need the concept of positive (negative) disagreement, a general understanding can be that the positive (negative) disagreement will correspond to K_{ij} for $i < j$ ($i > j$), choice i being better (worse) than choice j. Then, in the case of expectations, it means that a positive disagreement corresponds to a realization (B_i) more important than the corresponding expectation (A_j) or that we face a systematic underestimation of the realizations. The case of a negative disagreement corresponds to a systematic overestimation.

Comments

a) K_{ij} is calculated for each off diagonal cell of the contingency table (cells (i, j), $i \neq j$, $i = 1, k$, $j = 1, k$) and for each period if we use time series. We can generally accept that K_{ij} is independent of K_{ii} and K_{jj}, but they can depend simultaneously on exterior events.

b) Under the assumption of independence, we use the same coefficient $T^*_{ij} = \theta^*_i = p_{i.}$, the marginal probability that the item is classified in category i by B. Then, we have the same quantity for the inferior limit

$$K_{ii\ inf} = K_{ij\ inf} = - p_{i.}/(1 - p_{i.})$$

Therefore,

1 - for each i and for any j, the variation interval associated with each coefficient is identical to the variation interval of the corresponding agreement coefficient K_{ii} (but not K_{jj}) ;

2 - it is possible to compare directly for each i, the coefficients K_{ii} and K_{ij} (for any j), elements of the same row i.

c) As for the previous case, the variances of the coefficients are given by

$$V(K_{ij}) = \frac{1}{n} \frac{p_{i.}}{p_{.j}} \frac{(1 - p_{.j})}{(1 - p_{i.})}$$

d) Under the hypothesis that the coefficients are statistically valid, we can provide some interesting interpretations for different values of K_{ij}, and then in comparison to the coefficients obtained for a same period t (agreement and disagreement). This last point will be developed in the next section.

With regard to the values, we have to note that

- $K_{ij} \rightarrow K_{ij\ inf}$ when $T_{ij} \rightarrow 0$; $T_{ij} = 0$ corresponds to $p_{ij} = 0$ and means that there is no disagreement but it does not mean that there exists a perfect conditional agreement revealed by K_{ii} or K_{jj}. This would be the case only if for a first given choice j, there were no second choices i different from j. $K_{ij} < 0$ happens when $p_{ij} < p_{i.}\ p_{.j}$, i.e., when the joint probability is inferior to the probability that the classifications are made independently.

- if $K_{ij} = 0$, it corresponds to $T_{ij} = T^*_{ij}$ and to the independence of the classifications. Decisions are taken or classifications are made as if they were independent. Finally, for $K_{ij} > 0$, the higher K_{ij} is, the higher the disagreement is between the classifications, with a perfect conditional disagreement if $K_{ij} = 1$, i.e., for $T_{ij} = 1$ or $p_{ij} = p_{.j}$.

e) As previously, we define the normalized coefficients

$$K^*_{ij} = \frac{K_{ij} + |K_{ii\ inf}|}{1 + |K_{ii\ inf}|} = p_{ij}/p_{.j} = T_{ij}$$

With these normalized coefficients, it is possible to compare the positive and negative global disagreement index and eventually display systematic opposite behaviour. However, by using a global index, we partially lose relevant information for the explanation of the behaviour.

3. Comparisons of the different coefficients.

A lot of comparisons are possible with all these coefficients and have to be defined further : they can be global or individual, through categories or time... and are particularly interesting with time series and rational expectations.

3.1. The general case.

The coefficients can constitute two new tables or matrices K and K^*, with the general terms K_{ij} and K^*_{ij}. Convenient interpretations appear if we compare the agreement and disagreement coefficients ; however, we have to distinguish the comparisons along a same row and then along a same column of these tables. A few possible suggestions are given below.

- First, let us compare K_{ii} and K_{ij} for any j, i.e., the elements of the same row i ; they correspond to the classification of the item in category i by B. As we note in Comment 2.3.-e, direct comparison is relevant given that these two coefficients have the same value interval between the lower boundary ($K_{ii\ inf}$) and 1. We obtain the following result

$$K_{ii} > K_{ij} \Leftrightarrow \frac{p_{ii}}{p_{.i}} > \frac{p_{ij}}{p_{.j}} \qquad (3\text{-}1)$$

Then, if we are considering category i chosen by B, this inequality means that the probability of having an agreement between A and B when A chooses i is higher than the probability of having a disagreement when A chooses j. This case corresponds to the fact that the conditional probability of an agreement is greater than the conditional probability of a disagreement. A more interesting interpretation will be developed with time series in the next paragraph. We can note that we obtain the same results with the normalized coefficients

$$K_{ii} > K_{ij} \iff K^{*}_{ii} > K^{*}_{ij}$$

When the classification is repeated through time, it may be relevant to study the evolution of the coefficients ; but for now the elements $K_{ii}(t)$ and $K_{ij}(t)$ have variation intervals which change through time t and it may be difficult to consider directly the variations through time.

- Now let us consider K_{jj} and K_{ij}. These coefficients correspond to the classification of the item in category j by A and belong to the same column j. Such a direct comparison has no relevant interpretation because of the differences of the limits of the coefficients, but if we envisage the normalized coefficients, we have

$$K^{*}_{jj} > K^{*}_{ij} \iff \theta_{i} > T_{ij} \iff p_{jj} > p_{ij} \qquad (3\text{-}2)$$

Given the choice of A, B's choice corresponds more to an agreement than to a disagreement. The probability of an agreement is superior to the probability of a disagreement.

Finally, we can imagine comparing the agreements for two choices ; if K_{ii} and K_{jj} are not adapted, we have to use K^{*}_{ii} and K^{*}_{jj}, i.e., θ_{i} and θ_{j}.

3.2. Case of time series and unique individual.

This is the most interesting case with the possibility of using the idea of rational expectations. In this situation, A_{j} corresponds to choice j at period t-1 (anticipated value of a variable in category j) and B_{i} to choice i at period t (realized value of the variable in category i), choices made by the same individual through time. We can then explore rationality in decision making and behaviour.

The meaning of Relation *3-1* can be provided by noting that it corresponds to comparisons of elements of a same row i, i.e., elements connected with the particular realization i of the variable. K_{ii} is associated with an agreement or with the observation of **a correct anticipation** ; K_{ij} is linked to a disagreement or to the observation of a wrong anticipation and an anticipation error, positive (for $i > j$) or negative (for $i < j$). Then we have, in terms of conditional probability, the fact that making a correct prevision is systematically greater than making a wrong one. If we are in category i at period t, the probability to have been right when we were in i is higher than to have been wrong when we were in j.

If now we consider K_{jj} and K_{ij}, elements of the same column j corresponding to the case of an anticipation of the variable belonging to the category j, we will have to compare what is the result of the realizations. By using the normalized coefficients,

$$K^*_{jj} > K^*_{ij} \iff p_{jj} > p_{ij} \quad \text{any } i \text{ or } p_{jj} > \operatorname*{Max}_{i \neq j} p_{ij}$$

We obtain here the necessary and sufficient condition **for a rational expectation hypothesis** to be satisfied, established by GOURIEROUX and PRADEL (1986 - p. 276) for qualitative expectations. Then, we can distinguish two concepts of correct expectation (a posteriori observation) and rational expectation (a priori hypothesis which can be tested).

Finally, it is possible to envisage some global indexes for an agreement with

$$Ia = \sum_{i=1}^{k} K^*_{ii} = \sum_{i=1}^{k} \theta_i$$

or for a disagreement, eventually positive and negative with

$$Id = \sum_{i=1}^{k} \sum_{\substack{j=1 \\ i \neq j}}^{k} K^{*}_{ij}$$

$$Idp = \sum_{i=1}^{k} \sum_{j<1}^{k} K^{*}_{ij}$$

$$Idn = \sum_{i=1}^{k} \sum_{j>i}^{k} K^{*}_{ij}$$

The two last cases give information on a global underevaluation or overevaluation of the realizations.

4. Application.

The coefficients presented in the preceding sections are used to explore the behaviour of individual firms through the Business Survey Data of INSEE (Institut National de la Statistique et des Etudes Economiques) for France, from June 1974 to October 1986. The quaterly data concern production, prices and demand of about 1150 to 2340 representative firms. For these variables, firms give qualitative information through the direction of a variation of each variable into 3 categories : increase (+ or 1), no change (= or 2), decrease (- or 3). Therefore, the initial information we have is only a qualitative variable (associated to the latent quantitative variable) which can take 3 different values corresponding to the above given 3 categories.

For each variable X, let us define ${}_{t}X^{*}_{t-1}$, the anticipation of X made at period t - 1 for period t (previous anticipation), and X_t the realization of X observed at period t (current realization). For each variable X and each period t, the observed number of firms associated with these situations is given by a contingency table such as the following one

$${}_{t}X^{*}_{t-1}$$

		+	=	-	
X_t	+	n_{11}	n_{12}	n_{13}	$n_{1.}$
	=	n_{21}	n_{22}	n_{23}	$n_{2.}$
	-	n_{31}	n_{32}	n_{33}	$n_{3.}$
		$n_{.1}$	$n_{.2}$	$n_{.3}$	n_t

Table 4.1 - Contingency Table

where n_t is the number of firms for which we dispose of two corresponding sets of information. The probabilities $p_{ij} = n_{ij}/n$ are deduced for each period t. In this application, it is highly unlikely that some p_{ij} are zero and we do not consider this eventuality.

4.1. General statements.

For each category i, for each variable and for each period, let us define the anticipation error (in terms of marginal probability)

$$e_i = p_{i.} - p_{.i}$$

During the observation period, we have the following general results for the three categories

X \ i	increase	no change	decrease
production	+	-	+
demand	+	-	+
prices	-	+	+

Table 4.2 - Signs of the anticipation errors

The anticipated probability of realizing an increase or a decrease of the production or of the demand undervalues the possibilities of the firms. On the contrary, the probability of not changing production and demand is overvalued. These misevaluations are systematic for prices too, and two types of coefficients can be established :

- if there is a good association between the series : it is the γ coefficient of Goodmann-Kruskal (1954) ;

- if there is agreement or disagreement between the classifications with the K coefficients defined in the previous section.

The γ coefficients of Goodman-Kruskal are calculated for each observation from 1974 to 1986 ; they are significantly different from zero with the values :

$0.41 < \gamma < 0.67$ for production

$0.34 < \gamma < 0.67$ for demand

$0.50 < \gamma < 0.83$ for prices

This means a good association between the anticipated and realized series, the best being for prices ; an exception appears for prices in October 82 with $\gamma = 0.212$; it corresponds to the change in the economic policy in June 82 with the devaluation, inflation curbing program and in particular the price freeze policy between the 12th of June and the 31st of October. A large part of the firms which were preparing an increase of their prices could not implement it. Generally, they did not, or could not, correctly anticipate the behaviour of the government.

Before presenting more general results, it is important to consider some facts of the most important changes in the French economic policy which surprised the firms (perhaps a necessary condition for efficiency ?) and which influenced on some of the variables. These measures are :

- fiscal incentives for investments at the end of 1975 and the slow economic recovery in Spring, with effects on production and demand realized in June, effects which were not expected by the firms in March 1976 ;

- program for stimulation of consumption in June and July 1981 with effects on demand in October 1981 ;

- price freeze policy between June and October 1982 with effects on prices in October 1982.

The corresponding values for K are extremal and reveal the rapidity of the effects of the economic policy or the efficiency of these policies in the short or very short term. Some kind of energetic measures can be poorly anticipated (price freezes), others can be more or less quickly integrated into the behavior of the firms such as pump priming or restraining demand, with effects later on production, correctly anticipated. To avoid spurious interpretations of the results obtained in our application, the values associated with the special periods are not taken into account in the presentation of Paragraph 4.3. However, the interest of such exceptional situations is important for further interpretations, the corresponding results are presented in the following paragraph.

4.2. Two detailed examples.

For appreciating the interest of the coefficients and sometimes the limits of their interpretations, we will study two extremal situations corresponding to a high association and a global agreement for prices in June 1980 for 1765 firms with γ = 0.833 and then a weak association and a global disagreement for prices in October 1982 for 1503 firms with γ = 0.212.

The frequencies (first line) and the proportions (second line) are given in Table 4.3 according to the notations of Table 4.1

1980

	+	=	-
+	721 0.408	103 0.058	7 0.004
=	268 0.152	619 0.351	7 0.004
-	14 0.008	14 0.008	12 0.007

1982

+	=	-
108 0.072	35 0.023	1 0.001
675 0.449	474 0.315	22 0.015
104 0.069	73 0.049	11 0.007

Table 4.3 - Frequencies and proportions of firms in each situation

For the K coefficients, the K_{inf} (second line) and the normalized coefficients (third line), we obtain the following results :

1980		+	=	-
	+	0.469 **- 0.890** (0.719)	- 0.625 **- 0.890** (0.139)	- 0.381 **- 0.890** (0.269)
	=	- 0.485 **- 1.026** (0.267)	0.678 **- 1.026** (0.841)	- 0.481 **- 1.026** (0.269)
	-	- 0.009 **- 0.023** (0.014)	- 0.004 **- 0.023** (0.019)	0.449 **- 0.023** (0.462)

1982	+	=	-
	0.029 **- 0.106** (0.121)	- 0.039 **- 0.106** (0.060)	0.073 **- 0.106** (0.029)
	- 0.082 **- 3.527** (0.761)	0.160 **- 3.527** (0.814)	- 0.598 **- 3.527** (0.647)
	- 0.009 **- 0.143** (0.117)	0.000 **- 0.143** (0.125)	0.227 **- 0.143** (0.324)

Table 4.4 - Coefficients, inferior limit and normalized coefficients

We observe without ambiguity that the diagonal coefficients are positive and clearly higher in the case of a global agreement (1980) than in the opposite case (1982). For the off diagonal elements, the coefficients are highly negative in the case of global agreement and near zero in case of disagreement. Moreover, in case of a global agreement, the diagonal elements are higher than the off diagonal ones, for K as for K^*. With such a result, and with values which are presented below, we suggest that in this application, empirically, it is unlikely that the K_{ij} can be positive with a relatively high positive value (it would correspond to a concentration of the responses for an incorrect expectation). It is doubtless more reasonable to assume, for the K_{ij} that :

- a global disagreement is revealed by null or weakly positive coefficients, for K_{ii} as for K_{ij} ;
- several simultaneously negative coefficients for K_{ij} are frequently associated with the lack of disagreement or eventually a weak one ;
- the theoretically defined independence (with $K_{ij} = 0$ and $p_{ij} = p_{i.}\ p_{.j}$) is here already the indication of a global disagreement.

More generally, we guess that if the number of categories is increasing, the interpretations are more difficult and less clear.

4.3. *The K-coefficients.*

Generally, we obtain satisfying results for agreement and disagreement coefficients : always statistically significant and reasonably clustered, positive for K_{ii}, negative for K_{ij}.

4.3.1. Coefficients for agreement. Along the period, we obtain for K_{ii} and $K_{ii\ inf}$, the following extremal values, corresponding to a correct expectation.

	K_{ii}		$K_{ii\ inf}$		K^{*}_{ii}	
Production						
(1,1)	0.267	0.476	- 0.442	- 0.158	0.385	0.607
(2,2)	0.158	0.320	- 1.325	- 0.724	0.538	0.687
(3,3)	0.262	0.487	- 0.755	- 0.166	0.368	0.692
Prices						
(1,1)	0.260	0.520	- 1.750	- 0.231	0.475	0.797
(2,2)	0.251	0.678	- 2.739	- 0.433	0.484	0.874
(3,3)	0.117	0.601	- 0.158	- 0.007	0.125	0.672
Demand						
(1,1)	0.180	0.397	- 0.471	- 0.125	0.311	0.561
(2.2)	0.086	0.224	- 0.950	- 0.437	0.414	0.584
(3.3)	0.242	0.486	- 1.367	- 0.261	0.406	0.765

Table 4.5 - Agreement coefficients

We see that all the K_{ii} are positive and most often far from the inferior limit. It means a good conditional agreement between the two classifications, for each category, for each variable and for each period, but there is never a really perfect conditional agreement (K_{ii} near 1). It is generally for prices that we have the highest coefficients and agreement.

However we can point out that :
- for production, the values are relatively concentrated, for all the categories, and far from the inferior limit;
- for demand, the values are concentrated too, but displaced toward zero, revealing a weaker agreement than previously and there may be a stronger independence between the classifications ; it seems that firms do not always have the possibility of acting on their demand for the

short term in order to adjust realized level to anticipated one or that they estimate wrongly their future demand ;
- for prices, the values for categories (+) and (=) are more scattered than previously, and the maximum values are nearer 1. It is in these cases that we obtain the strongest agreement (maybe because it is particularly easy to act on prices). For the last situation (-), we ascertain that some coefficients are nearer zero, corresponding theoretically to an independence of the classifications or a partial disagreement, for this special case.

Globally, the behaviours are very similar (except for the decrease of the prices) denoting a real conditional agreement between expectations and realizations. Moreover, an important point to note is that the category "no change" does not have a systematically special behaviour.

For information, let us consider the results for two particular periods and the differences in behaviour through K_{ii}, $K_{ii\ inf}$ and K^*_{ii}; the first one corresponds to an agreement for demand in October 1981, the second one to a disagreement for prices in October 1982 (cf Table 4.4).

	K_{11}	K_{22}	K_{33}
Demand	0.362	0.398*	0.146*
October 1981	**- 1.892**	**- 0.498**	**- 0.014**
	(0.780*)	(0.598*)	(0.158*)
Prices	0.029*	0.160*	0.227
October 1982	**- 0.106**	**- 3.527**	**- 0.143**
	(0.121*)	(0.814)	(0.324)

* extremal values, outside the interval given in Table 4.5

Table 4.6 - Agreement coefficients for extremal situations

For demand, in October 1981, values are extremal (superior for K_{22}, inferior for K_{33}) and show a relatively important agreement, i.e. a correct expectation ; such an exceptional result corresponds to a great change in the economic policy (here reflation policy) very well anticipated with very short term effects. On the contrary, for prices in

October 1982, the outside values reveal rather a disagreement between expectations and realizations except for the position "no change" ; the economic policy surprised the firms which were constrained by the decisions to freeze the prices during 4 months. The firms which expected to increase their prices (59 % of them) could not do it ; this situation mainly influenced the high level of disagreement. However, we can point out that these coefficients never indicate a real extremal disagreement between the classifications as they are theoretically defined with K_{ii} negative (cf 4.2.).

Such affirmations show that when economic policy measures are announced, responses of the firms vary

- in accordance with the economic variable or with the nature of the measure, direct for prices (freeze) or demand (stimulation or restraint), indirect for production (through demand or investment) ;
- in accordance with possibilities and rapidity of reaction, easier for prices than for production or demand in the very short term (some weeks or one month) and reasonably possible in the short term (3 or 6 months) for demand and production.

Thus, the form of the response is not systematic, but frequently appropriate for the considered variable and the specific decision. In case of no special measures, conditional agreement is real.

4.3.2. Coefficients for positive disagreement. They correspond to cells (1,2), (2,3), (1,3).

	K_{ij}		$K_{ij\ inf}$		K^*_{ij}	
Production						
(1,2)	- 0.115	0.012	- 0.442	- 0.158	0.108	0.251
(2.3)	- 0.448	- 0.179	- 1.325	- 0.724	0.255	0.492
(1,3)	- 0.278	- 0.101	- 0.442	- 0.158	0.037	0.144
Prices						
(1,2)	- 0.823	- 0.134	- 1.750	- 0.231	0.067	0.385
(2,3)	- 1.570	0.147	- 2.739	- 0.433	0.200	0.615
(1,3)	- 1.045	0.134	- 1.750	- 0.231	0.016	0.650
Demand						
(1,2)	- 0.088	0.019	- 0.471	- 0.125	0.089	0.298
(2,3)	- 0.337	- 0.130	- 0.950	- 0.437	0.183	0.398
(1,3)	- 0.240	- 0.074	- 0.471	- 0.125	0.039	0.204

Table 4.7 - Positive disagreement coefficients

The values are generally negative revealing a specially weak disagreement, and they are particularly scattered for prices.

Four situations are noteworthy :

- cell (1,2) for demand with all the values near zero, corresponding to a disagreement, and an unexpected increase. Either the firms are pessimistic, or they develop specific actions to increase the demand for their products, and succeed quickly ;
- the situation is similar for production ;
- cell (2,3) and (1,3) for prices with some positive values but essentially highly negative ones. Such a wide range of the coefficients corresponds to a wide variety of situations of increasing prices, some with high agreement, others with a non-negligeable disagreement, specially for cell (2,3). It is in these last cases that we observe situations with the most important disagreement and erroneous expectations.

To complete this information, we can compare the normalized coefficients. We observe clear results only for production with $K_{23} < K_{12}$ but $K^*_{12} < K^*_{23}$ through time. Thus, in case of positive disagreement (realizations are higher than expectations), the disagreement is stronger when firms expected a decrease (23) than when they expected no variations (12). Such results may reveal a specially pessimistic behaviour or erroneous expectations which vary in accordance with the kind of expectations : decrease or no change.

4.3.3. Coefficients for negative disagreement. They correspond to cells (2,1), (3,2) and (3,1).

	K_{ij}		$K_{ij\ inf}$		K^{*}_{ij}	
Production						
(2,1)	- 0.522	- 0.076	- 1.325	- 0.724	0.311	0.474
(3,2)	- 0.265	- 0.028	- 0.755	- 0.166	0.101	0.343
(3,1)	- 0.490	- 0.062	- 0.755	- 0.166	0.062	0.264
Prices						
(2,1)	- 0.894	- 0.092	- 2.739	- 0.433	0.200	0.500
(3,2)	- 0.035	0.028	- 0.158	- 0.007	0.006	0.146
(3,1)	- 0.095	0.000	- 0.158	- 0.007	0.002	0.053
Demand						
(2,1)	- 0.298	0.032	- 0.950	- 0.437	0.296	0.431
(3,2)	- 0.274	- 0.025	- 1.367	- 0.261	0.150	0.493
(3,1)	- 0.559	- 0.067	- 1.367	- 0.261	0.091	0.348

Table 4.8 - Negative disagreement coefficients.

Here too, the coefficients are generally negative, but they can be near zero more frequently than in the previous cases. Then, we face the most numerous situations of disagreements which are associated with results inferior to their expected values.

The most specific result concerns prices, with cell (3,2) and coefficients extremely near zero, revealing a general disagreement and a wrong expectation. It is however very difficult to have an idea of the part played in these behaviours by inflation whose rate varied greatly during the period. Such a situation has to be analysed.

4.3.4. General comparisons. Now, if we envisage general comparisons, along the rows or along the columns, we have to note that $K_{ii} > K_{ij}$ and $K_{ii} > K_{ji}$ with K_{ii} positive and K_{ij} or K_{ji} negative. Such a result reveals in the first case that the conditional probability for making a correct prevision is systematically greater than making a wrong one (or that expectations are generally right).

We have to note too that if coefficients for positive and negative disagreements are not extremely different, (except for prices and cells (2,3) - (1,3) then (3,2) - (3,1)), the results are more varied for the

K^*. The disagreement is specially high when prices are undervalued (positive anticipation error) and when demand is overvalued.

For the normalized coefficients, we note that $K^*_{ii} > K^*_{ji}$ in only 10 cases on 18, and that agreement is stronger than disagreement. It means too that in these situations the necessary and sufficient conditions for existence of rational expectation are verified (cf GOURIEROUX-PRADEL, 1986).

5. Conclusions

By enlarging usual results on agreement between classifications to the study of disagreement, we propose coefficients which allow the determination of the existence of a disagreement between such classifications.

The application to situations of firms when they have to expect prices, demand and production allow us to point out some results :

- the existence of systematic differences between expectations and realizations corresponds to disagreement coefficients which are weakly positive and empirically interpreted as a global disagreement ; but generally, agreement is much stronger than disagreement ;
- it is for prices that agreement is the strongest and disagreement the least important ; opposite results are observed for demand. One reason may be that if in the short term, the most convenient intervention by the firms concerns prices, specially in the case of constraints imposed by the government (June-October 1982), an action on demand requires more time (e.g., through an advertising campaign or increase of incomes). The same kind of observations is available for production ;
- it can be noted that disagreements appear more frequently when realizations are inferior to expectations, i.e., when there was overevaluation of the real possibilities of the firms. Moreover, particular situations or results are not observed if the classification "no change" is concerned ;
- finally, we point out that expectations are generally correct (a posteriori observation) and that the rational expectations hypothesis (a

priori hypothesis) is systematically verified in a large part of the situations.

Some extensions of these results can be suggested with comparisons of the K coefficients with macroeconomic variables or indexes such as GNP, income, investment... But special attention has to be given to inflation which can influence the behaviour of firms when they expect prices to increase.

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