Proceedings of Statistics Canada Symposium 2002
Modelling Survey Data for Economic and Social Research

THE USE OF ECONOMIC CONDITIONS SURVEYS IN ECONOMIC ANALYSIS AND MODELLING

Dominique Ladiray[1] and Gian Luigi Mazzi[2]

ABSTRACT

Economic conditions surveys – opinion surveys of business leaders and consumers – have become an indispensable tool for current economic analysis in Europe. The survey results are available a few days after the reference period, well before the main quantitative economic indicators are published. They are used today in particular to assess the state of the economy (business climate indicator), forecast turning points (turning point indicator) and make quick estimates of the major macroeconomic indicators, such as gross domestic product and the industrial production index.

KEYWORDS: economic conditions surveys, business climate indicator, turning point indicator, dynamic factor analysis, hidden Markov model.

1. INTRODUCTION

Economic conditions surveys are very brief monthly or quarterly opinion surveys of business leaders and consumers. The latter are asked what they think of the recent and future economic situation of the country, their company or their household. They are very simple qualitative surveys, and their results are published quickly, only days after the reference period, well before the main quantitative economic indicators are available. In many countries, they are widely used for short-term economic analysis since the indicators derived from them have proven to be correlated to the major macroeconomic measures. For example, Statistics Canada conducts such a survey on a quarterly basis: the Business Conditions Survey (BCS), launched in 1976. Figure 1 presents the quarterly movement of Canada's GDP and a business climate indicator derived from BCS responses; the similarity of the two curves shows that the BCS indicator could be used to provide a quick estimate of GDP.

This article is about the use of these surveys in economic analysis and modelling. Section 2 provides an overview of the harmonized system of business and consumer surveys developed by the European Commission since the 1960s. Section 3 shows how to use the survey responses and dynamic factor analysis to construct a business climate indicator that reflects the current economic situation. Section 4 deals with the forecasting of turning points. In section 5, we will see how economic conditions surveys are used to produce advance estimates of the European Industrial Production Index.

2. THE HARMONIZED EU SYSTEM OF BUSINESS AND CONSUMER SURVEYS

2.1 Economic conditions surveys

Economic conditions surveys around the world have the same characteristics: they are very brief, voluntary opinion surveys. For example, the Business Conditions Survey of business leaders conducted on a quarterly basis by Statistics Canada contains only six questions: possible impediments to production activities, inventory of finished goods, orders received, unfilled orders, expected production over the next few months, and employment prospects

[1] Statistics Canada, Ottawa, Ontario, Canada, K1A0T6, dominique.ladiray@statcan.ca
[2] Eurostat, Jean Monnet Building, rue Alcide de Gaspéri, Luxembourg, L-2920, gianluigi.mazzi@cec.eu.int

(Statistics Canada, 1994). For most questions, the respondent is asked to choose one of three options: “rising”, “about the same” or “declining” (see Figure 2).

Figure 1: Comparison of aggregated BCS results (thin line) and Canada’s quarterly GDP (thick line)

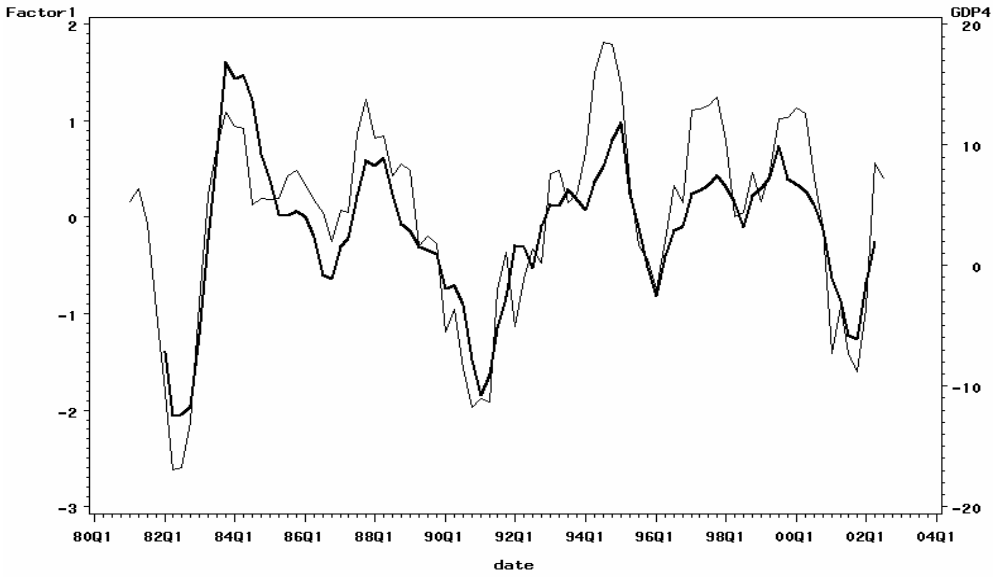
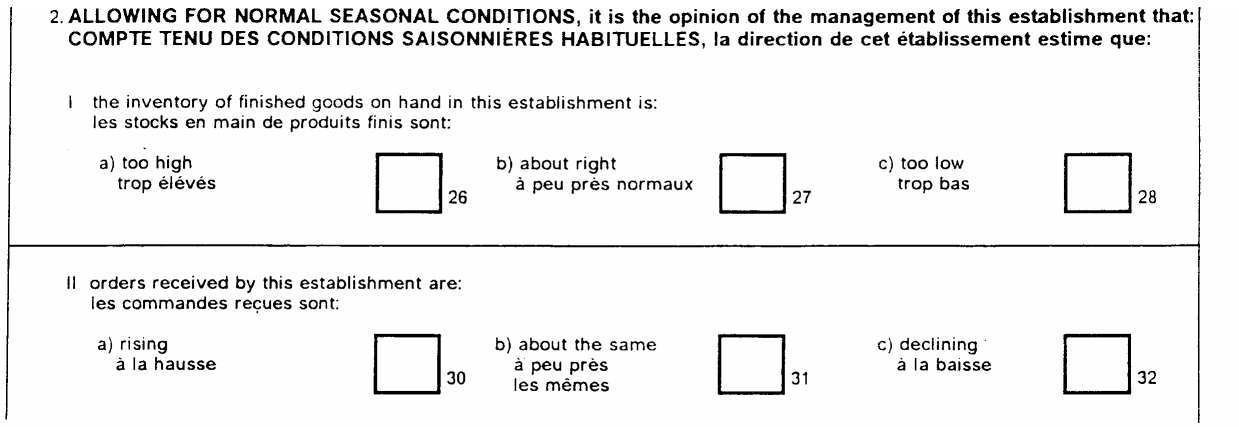


Figure 2: Excerpt from the Business Conditions Survey questionnaire (Statistics Canada)


2. **ALLOWING FOR NORMAL SEASONAL CONDITIONS, it is the opinion of the management of this establishment that:**
COMPTE TENU DES CONDITIONS SAISONNIÈRES HABITUELLES, la direction de cet établissement estime que:

I the inventory of finished goods on hand in this establishment is:
les stocks en main de produits finis sont:

a) too high / trop élevés — 26
b) about right / à peu près normaux — 27
c) too low / trop bas — 28

II orders received by this establishment are:
les commandes reçues sont:

a) rising / à la hausse — 30
b) about the same / à peu près les mêmes — 31
c) declining / à la baisse — 32

Each question is then used to produce a numerical indicator called a “balance of opinion”, which is the difference between the percentages of optimistic (“rising”) and pessimistic (“declining”) respondents. Depending on the country and the survey, the responses may or may not be weighted by size (number of employees, gross revenues, etc.) when the balances of opinion are computed.

2.2 The harmonized EU system of business and consumer surveys

The European Commission initiated the project to establish a harmonized European system of business and consumer surveys on November 15, 1961, in an effort to generalize surveys that in some cases (e.g., France, Germany) had been in place for years, so that they could be used to assess the current economic situation in the European Union. Today, the system covers most sectors of the economy: there have been monthly surveys of manufacturing since 1962, construction since 1966, consumers since 1972, retail trade since 1984 and services since

1996. An industrial investment survey has also been conducted twice a year since 1966. In addition, there is the quarterly Economic Survey International. The questionnaires and methods used are described in detail in European Commission (1997).

Harmonization of these surveys makes it easy to compare the economic cycles or "business cycles" of member countries and compute a business cycle for the European Union and the euro area. Today, the public or private organizations that conduct the surveys poll about 64,000 businesses and 24,000 consumers each month. Table 1 shows the sample sizes of the various surveys conducted in each country.

This survey system was recently extended to include EU membership candidates, and since 2002, survey results are also available for Bulgaria, Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia.

The monthly surveys are generally carried out in first three weeks of the month, and the unprocessed results are sent to the European Commission by the end of the month. The results for Europe are published in the first few days of the following month.

Table 1: Sample sizes of business and consumer surveys in European Union member countries

Member State	Industry	Investment	Consumers	Construction	Retail trade	Services
Belgium	1950	1950	1000	1050	1450	1200
Denmark	500	800	1500	800	300	500
Germany	3770	5450	2500	1360	1020	4230
Greece	1274	1274	1500	459	741	1123
Spain	2300	2100	2000	375	535	700
France	4000	4000	2800	2500	4000	4500
Ireland	200	:	1300	M: 120 Q: 520	550	600
Italy	4100	4100	2000	500	1000	1000
Luxembourg	:	:	:	:	:	:
Netherlands	1700	2800	1500	600	400	400
Austria	M: 665 Q: 1990	1743	:	M: 160 Q: 450	3200	960
Portugal	1130	1378	1771	300	398	888
Finland	670	600	2200	80	480	80
Sweden	1107	2339	2100	122	682	1105
United Kingdom	1050	400	2000	750	280	800
EU (M)	24500	29000	24000	9200	15000	18000

M: monthly; Q: quarterly

Such surveys are also quite common around the world. CIRET, an international organization established in 1960, represents economic conditions survey experts and holds biennial conferences attended by hundreds of people. According to rather old data (1998), a total of 318 economic conditions surveys were being conducted on a regular basis in 57 countries.

3. CONSTRUCTING A BUSINESS CLIMATE INDICATOR

One of the key features of economic conditions surveys is the rapidity with which the results are available, weeks or months before the corresponding quantitative indicators. Consequently, they are used in short-term economic analysis and to assess the current economic situation. For many years, they have provided input to coincident and

leading indicators (indicators that are in phase with the economic cycle and ahead of the economic cycle, respectively).

For example, the European Commission has long published a monthly composite indicator that summarizes the general sentiment of business leaders. Known as the "industrial confidence indicator", it is computed today as the simple average of the balance of opinion on expected production, unfilled orders and inventory of finished goods (European Commission, 2001).

For the last several years, there has been ongoing research into applying modern time series analysis techniques to the problem of estimating an aggregate index. In particular, econometricians have adapted the methods of factor analysis, known to statisticians since the early years of the 20th century, for use with time series; the new method is called dynamic factor analysis (Doz and Lenglart, 1997, 1999; Altissimo et al., 2001; Forni et al., 2001; and others).

3.1 Dynamic factor analysis

The economic assumption underlying this method is that there is a "business cycle", defined in 1948 by Burns and Mitchell:

> "*Business cycles are a type of fluctuation found in aggregate economic activity of nations that organise their work mainly in business enterprises: a cycle consists of expansions occurring at about the same time in many economic activities, followed by similarly general recessions, contractions and revivals which merge into expansion phase of the next cycle; the sequence of changes is recurrent but not periodic; in duration business cycles vary from more than one year to ten or twelve years; they are not divisible into shorter cycles of similar character with amplitude approximating their own.*"

In statistical terms, this means that there are one or more unobservable factors common to a number of indicators (the indicators for the various sectors of the economy, for example) along with factors specific to each indicator.
The European Commission applied this idea to the results of the industry survey and produced a European business climate indicator (Saint-Aubin, 2001, Deroose et al., 2001). The base model is straightforward.
If

- $y_{i,t}$ represents the balance of opinion for question *i* at date *t*, with *i* ranging from 1 to *I* and *t* from 1 to *T*;
- $F_{j,t}$ represents the value of the common factor *j* at date *t*, with *j* ranging from 1 to *J*; and
- $u_{i,t}$ represent*s* the value of the specific component *i* at date *t*;

then the model can be expressed as follows:

$$\forall i \in [1;I], \forall t \in [1;T] \quad y_{it} = \lambda_{i1} F_{1t} + ... + \lambda_{iJ} F_{Jt} + u_{it}$$
$$E(u_{it}) = 0, \quad E(F_{jt} u_{it}) = 0, \quad V(F_{1t},...,F_{Jt}) = \mathrm{Id},$$
$$V(u_{1t},...,u_{It}) = Diag(\sigma_1^2,...,\sigma_I^2) = \Sigma$$

According to Doz and Lenglart (1999), estimation of this type of model can take two different paths. In addition to dynamic factor models, the standard procedures of static factor analysis can be used in this context (with a loss of efficiency) since they provide convergent estimators even in a dynamic setting.

3.2 Some results

Estimation of this model using BCS data produces the result shown in Figure 1, in which the factor1 variable represents the primary factor common to the survey questions.

Lenglart et al. (2002) generalized this model to the five questions in the industry survey conducted in six European countries. In so doing, they were able not only to define a common factor for the euro area but also to estimate the specific factors for each country, which made it possible to detect cyclical disparities within Europe. Figure 3 shows the common factor for the euro area, estimated both dynamically and statically. Figure 4 shows the specific components and cyclical disparities for Germany and Italy. Clearly evident in the charts are the positive shock of

German reunification in the early 1990s and the two devaluations of the lira (mid-1992 and 1995), which improved the competitiveness of Italian products and resulted in an export-led recovery.

This approach is widely used today to define coincident and leading indicators of economic activity in the euro area (Altissimo et al., 2001; Forni et al., 2001; and others) and to study the convergence of economic cycles in Europe (Ladiray and Mazzi, 2001).

Figure 3: Business climate indicators in the euro area (thick line: dynamic estimate; thin line: static estimate)

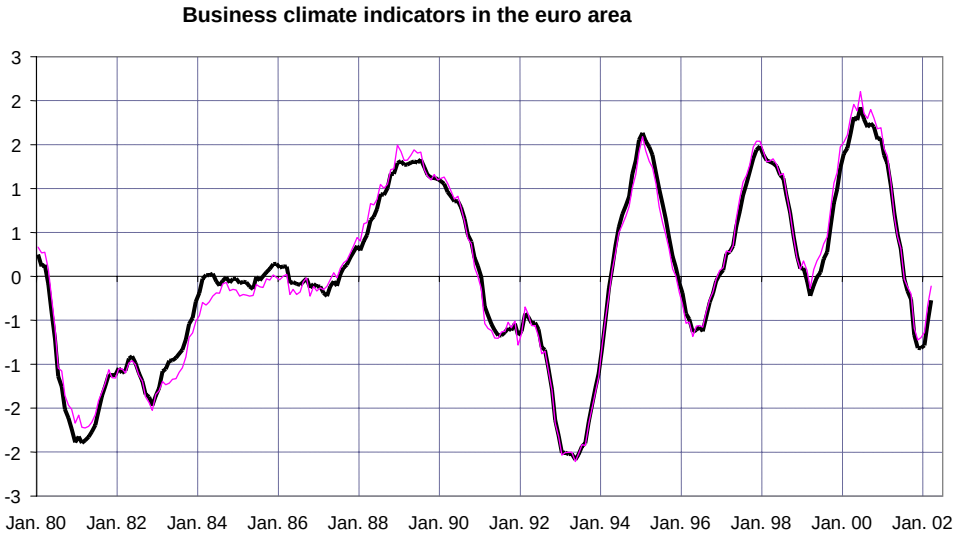
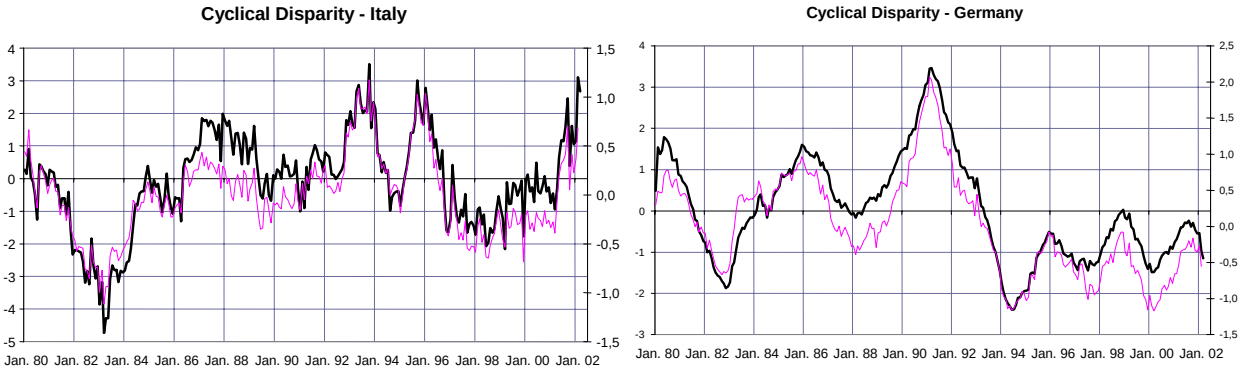


Figure 4: Cyclical disparities in Italy and Germany (thick line: country-specific component; thin line: disparity between the country's economic climate and the euro area's economic climate)



4. CONSTRUCTING A TURNING POINT INDICATOR

Business climate indicators are particularly useful for summarizing and assessing a country's economic situation, but they can also be difficult to interpret at times. If our indicator is up 1.2% from last month after declining in the previous few months, is it actually signalling a change in the economic cycle? In fact, these indicators cannot provide a qualitative signal pointing to a reversal in cycle direction. They need to be combined with an indicator capable of characterizing the current phase of the cycle and identifying turning points. Econometricians have therefore endeavoured to construct probabilistic indicators of turning points for the euro area that would provide a clear qualitative signal: the probability that economic conditions are good or bad.

The models used (Gregoir and Lenglart, 2000; Deroose et al., 2001; Baron et al., 2002) depend on the existence of a latent variable reflecting the state of the economy (for example, either good, stable or poor). They are also based on the assumption that the survey responses provide information about the current state of the economy.

4.1 Development of a Markov model

Let us examine briefly the approach taken by Baron et al. (2002). First, the information in the responses to the economic conditions surveys is coded so that it provides a positive, stable or negative indication. It is then postulated that there is a qualitative variable that summarizes the common information. That variable, described as hidden because it is not observed directly, can take one of three distinct values (1, 2 or 3) depending on the state of the economy (unfavourable, neutral or favourable), just like the coded variables. The variable's dynamic behaviour – its transitions from one state to another over time – is controlled by a first-order stationary Markov chain. This Markov property makes it possible to model the temporal dependence of the cyclical phases in a probabilistic way: if the economy is in a particular state at a given time, the hidden variable is more likely to remain in that state in the next period than to shift to another state. In other words, knowing past economic conditions helps us determine the nature of the current situation only if we know the immediately preceding state of the economy. If we let S_t be the Markov chain and p_{ij} be the probability of transition from state i to state j, the property can be expressed as follows:

$$P\left(S_t = j \,|\, S_{t-1} = i, S_{t-2} = k \ldots\right) = P\left(S_t = j \,|\, S_{t-1} = i\right) = p_{ij} \quad \forall\, i, j \in \{1,2,3\}, \text{ where } \sum_{j=1}^{3} p_{ij} = 1 \quad \forall\, i = 1,2,3$$

The chain's transition matrix is given by $P = \begin{pmatrix} p_{11} & p_{21} & p_{31} \\ p_{12} & p_{22} & p_{32} \\ p_{13} & p_{23} & p_{33} \end{pmatrix}$

While the values taken by S_t are not observed directly, it is nevertheless possible to determine the nature of the current economic phase from the set of economic signals represented by the vector of variables coded from the five balances of opinion $X_t = \begin{pmatrix} X_t^1 & X_t^2 & X_t^3 & X_t^4 & X_t^5 \end{pmatrix}'$. That is, the signals are conditional on the state of the economy. In other words, positive variations in the balances of opinion are more likely to be observed in periods of favourable activity, and negative variations are more likely in periods of unfavourable activity. This leads us to define the conditional probabilities of observing a class of variation in balances of opinion (significantly negative, zero or positive) based on the state of the economy (unfavourable, neutral or favourable):

$$\pi_j^i(k) = P\left(X_t^i = x_t^i \,\middle|\, S_t = j\right) \quad \forall\; x_t^i,\, j \in \{1,2,3\}, \forall\, i \in \{1,2,3,4,5\}$$

These probabilities are constant over time and satisfy the relation

$$\sum_{k=1}^{3} \pi_j^i\left(x_t^i\right) = 1 \;\; \forall \;\; i \in \{1,2,3,4,5\}, \forall \;\; j \in \{1,2,3\}.$$

By assigning zero probability to the transition from one polar state to another (p_{13} and p_{31}), which ensures that the hidden variable must pass through the neutral state in order to move from a peak to a trough, or vice versa, we reduce the number of Markov transition probabilities to be estimated to four. With the 30 conditional probabilities to be estimated following likelihood maximization, the total number of parameters in the model – conditional probabilities and transition probabilities – is 34.

Since the Markov variable is assumed to represent all the common information in the coded variables, the independence of those variables from one another is conditional on S_t :

$$P\left(X_t = x_t \,|\, S_t = j\right) = \prod_{i=1}^{5} P\left(X_t^i = x_t^i \,\middle|\, S_t = j\right)$$

If we let I_t be the set of all available information up to date *t*, $I_t = \{x_t, x_{t-1}, x_{t-2}, \cdots, x_1\}$, the model's likelihood can be expressed in terms of the Bayesian formula

$$P(X_T = x_T, X_{T-1} = x_{T-1}, \cdots, X_1 = x_1) = \prod_{t=2}^{T} P(X_t = x_t \mid I_{t-1}).\, P(X_1 = x_1)$$

Since we do not observe the occurrences of S_t but only those of X_t, the likelihood must be computed indirectly, through a so-called recursive filtering algorithm (see Baron et al., 2002). The model's parameters (the conditional and transition probabilities) are obtained by maximizing the likelihood calculated by the filtering algorithm.

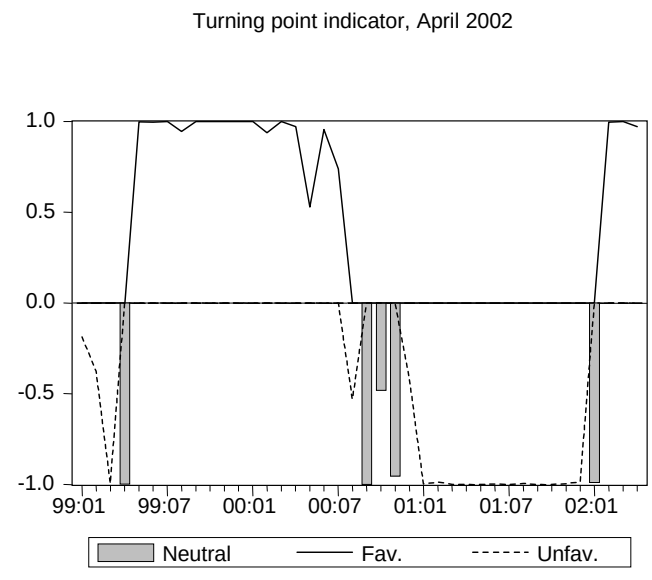
If we let p_1, p_2 and p_3 be the probabilities that the hidden variable (the state of the economy) is in an unfavourable, neutral and favourable state respectively ($p_1 + p_2 + p_3 = 1$), the three-state turning point indicator can be written as follows:

$$\begin{cases} If \quad p_1 \geq 0.5, \; then \quad I = p_2 - p_1 \\ If \quad p_2 \geq 0.5, \; then \quad I = \dfrac{p_3 - p_1}{p_3 + p_1} \\ If \quad p_3 \geq 0.5, \; then \quad I = p_3 - p_2 \end{cases}$$

4.2 Application to France's economic situation

If we input French data into the above turning point indicator, we obtain the chart shown in Figure 5. The indicator was in the neutral state in January 2002; it shifted into the favourable state in February and remained there until May. Industrial production grew in the first quarter of 2002 (+0.5%, after falling 1.8% in the fourth quarter of 2001) as a result of an upswing in world trade.

Figure 5: A turning point indicator for the French economy, based on a hidden Markov model



Date	p_1	p_2	p_3	ΔIPI
Jan. 01	**1.00**	0.00	0.00	
Feb. 01	**0.99**	0.01	0.00	
Mar. 01	**1.00**	0.00	0.00	-0.47%
Apr. 01	**1.00**	0.00	0.00	
May 01	**1.00**	0.00	0.00	
Jun. 01	**1.00**	0.00	0.00	-1.16%
Jul. 01	**1.00**	0.00	0.00	
Aug. 01	**1.00**	0.00	0.00	
Sep. 01	**1.00**	0.00	0.00	-0.40%
Oct. 01	**1.00**	0.00	0.00	
Nov. 01	**1.00**	0.00	0.00	
Dec. 01	**0.99**	0.01	0.00	-1.76%
Jan. 02	0.05	**0.95**	0.00	
Feb. 02	0.00	0.00	**1.00**	
Mar. 02	0.00	0.00	**1.00**	+0.47%
Apr. 02	0.00	0.01	**0.99**	
May 02	0.00	0.00	**1.00**	

4. QUICK ESTIMATES

In general, macroeconomic indicators for Europe are produced by aggregating national indicators. Unfortunately, the national statistical systems work at different speeds, and indicators tend to reach the European level at different times. An EU regulation requires Member States to provide their industrial production indexes (IPIs) to Eurostat no later than 45 days after the end of the reference month. Figure 6 shows the amount of time taken by the various

countries to produce their IPIs. The Member States have made considerable progress, and most are able to meet the 45-day deadline. Yet it seems impossible, at least in the near term, to shorten this period to make it compatible with monetary policy requirements for the euro area. While the United States publishes its IPI 25 days after the end of the reference month, Finland is the only European country that seems able to produce its IPI in the month following the reference month.

Economic conditions surveys can be used to construct a quick estimate of the IPI for the euro area. Many different models have been developed and are currently used by economic forecasting organizations and the economic analysis departments of major banks. These models can be categorized as follows:

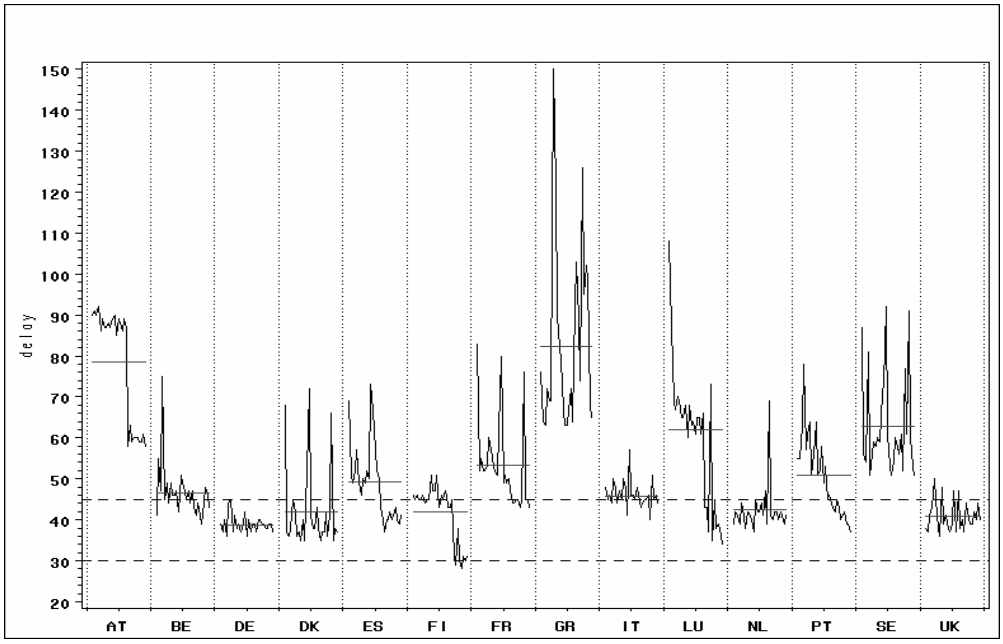
- those which provide a direct estimate of the IPI for the euro area based on its past values and the aggregated results of European business and consumer surveys;
- those which estimate the IPI for the euro area on the basis of its past values and the results of business and consumer surveys in the euro area's principal countries;
- those which first estimate the national IPIs on the basis of their past values and national business and consumer surveys, and then aggregate those estimates.

Ladiray and O'Brien (2002) have studied a number of these models, including those which use partial national information when available. To estimate the IPI for the euro area in the days following the reference period, they propose the following model:

$$IPI_t = a + 0.05IPI_{t-1} + 0.16IPI_{t-2} + 0.41PT_t - 0.08OB_{t-3} + 0.22PE_{t-1} + \varepsilon_t$$

where PT, OB and PE are the balances of opinion on past production, unfilled orders and expected production respectively.

Figure 6: Length of time taken to produce the industrial production index, by country



5. CONCLUSION

Economic conditions surveys provide fast, reliable information that helps to refine assessments of the current economic situation. They are being used in sophisticated econometric models and are giving rise to new short-term indicators. These business climate and turning point indicators are published on a regular basis and are used to describe the economic situation in the euro area and in EU Member States. There have been many studies on the use of economic conditions surveys to provide quick estimates of the main European macroeconomic indicators. The existence of a harmonized EU system of business and consumer surveys clearly simplifies comparisons of very different economies. In view of the likely expansion of the European Union, economic conditions surveys are certain to play an increasingly important role in the short-term analysis of Europe's economy.

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