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**Using turning point indicators based upon business surveys:  
the French case and beyond**

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# **The Contribution of Business Surveys to the Detection of Turning Points of the Economy<sup>1</sup>**

(very preliminary: please do not quote)

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***Abstract:***

Business surveys are the first indicators relying on microeconomic data collected at the firms level to be published. As such, they can be expected to provide reliable leading signals about the state of the economy. In France, turning point indicators based upon a Markov-switching representation of surveys balances have been developed since a decade to that aim. Available initially for the industrial sector, they have been progressively extended to other sectors (construction, wholesale trade,...) and lastly for the whole economy.

The paper shows that this methodology provides particularly good results when applied the European level when information stemming for several countries is used. In that case the signal delivered by the indicator is very clear. And the indicator has a good track record during the crisis: it indicated well in advance, in the spring of 2008, the transition from a favorable state of the economy to an unfavorable one and, conversely, have announced the end of the depressing state a little before it became visible in the “hard” data.

The results show that surveys provide a credible alternative to moving forward the publication of clearly national accounts: since moving forward national accounts increases the noise to signal ratio, the availability of precise, even if qualitative, and leading signals from surveys is clearly an advantage.

The production delay of the quarterly national accounts has accelerated in the last few years. Most European countries now produce “flash estimates” 45 days after the end of the quarter. In France, the flash estimate also comes with a full decomposition of GDP.

But, this process can only reach its limits: obviously, national accounts results for a quarter will never be produced before the end of this quarter; but even the less ambitious aim of gaining a few days from today's release date is fraught with difficulties: there are inherent lags in collecting the necessary data, in processing them and, last but not least, since data may contain error or seasonal factors can change, in checking the validity of the results. And the earlier they will be produced, the greater the proportion of forecast they will contain. In the US case for instance, the first estimate of GDP, 30 days after the considered quarter, contains forecast of the last month of data for important data such as goods trade or inventories. The transition from forecast data to observed ones often leads to substantial revisions (no less than 2.4 % at an annual rate for the fourth quarter of 2008, for instance).

In the race to obtain an early diagnostic on the course of the economy, business surveys merit therefore a careful examination. In this paper, we will insist on one tool derived from business surveys and which is not well known outside the French context: turning point indicators based upon the Markov-switching model popularized by Hamilton. We will in particular examine how they have performed in the recent crisis and show they have provided early indications (in the spring of 2008) that the European economy was entering a slowdown regime and (in the spring of 2009) that it was entering a recovery regime.

### **1. The contribution of turning points indicators taken from business surveys: lessons from the French case.**

In France business surveys have been used since a long time to help forecasting the course of the French economy. Econometric relationships (so-called “bridge models”) have been used consistently for several decades. And, since the seminal work by Gregoir and Lengart (2000) a second kind of tool has been developed and progressively extended, with the aim to provide early indicators of turning points of the economy. These indicators are based upon a Markov-switching model, as popularized by Hamilton (1989). Applied to business surveys, this methodology rests on the following hypotheses:

- the economy is assumed to be in a latent state, named  $S_t$  that can be one of the 2 following values: good and bad<sup>2</sup>;
- the probabilities of the latent state  $S_t$  ( $P(S_t = 0)$  and  $P(S_t = 1)$ ) follow a (first) order Markov chain: at date  $t$ , the probability to be in state  $i$  (bad or good) depends only on the state at date  $t-1$ ;
- each survey variable is transformed into a qualitative one (taking discrete values 1, ...,  $K$ ) and then the conditional probability for variable  $j$  to take value  $k$  given state  $i$  is constant.

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2 This framework can be extended to the case of more than 2 states

Gregoir and Lenglart also found fruitful to introduce a second latent variable  $W_t$ , independent from  $S_t$ , and depicting the strength of the signal conveyed a date  $t$  by the observed variables and which follows also a first order Markov chain.

Formally this can be stated as follows:

$$\begin{aligned} P(S_t=0/S_{t-1}, \dots, S_{t-k}, \dots) &= P(S_t=0/S_{t-1}) \\ &= \alpha_{1,1} && \text{if } S_{t-1}=0 \\ &= 1-\alpha_{1,1} && \text{if } S_{t-1}=1 \end{aligned}$$

Similarly for  $P(S_t=1/S_{t-1})$ :

$$\begin{aligned} P(S_t=1/S_{t-1}, \dots, S_{t-k}, \dots) &= P(S_t=1/S_{t-1}) \\ &= \alpha_{2,1} && \text{if } S_{t-1}=0 \\ &= 1-\alpha_{2,1} && \text{if } S_{t-1}=1 \end{aligned}$$

The same hypothesis applies to state  $W_t$ :

$$\begin{aligned} P(W_t=0/S_{t-1}, \dots, W_{t-k}, \dots) &= P(W_t=0/W_{t-1}) \\ &= \beta_{1,1} && \text{if } S_{t-1}=0 \\ &= 1-\beta_{1,1} && \text{if } S_{t-1}=1 \\ P(W_t=1/S_{t-1}, \dots, W_{t-k}, \dots) &= P(W_t=1/W_{t-1}) \\ &= \beta_{2,1} && \text{if } W_{t-1}=0 \\ &= 1-\beta_{2,1} && \text{if } W_{t-1}=1 \end{aligned}$$

Lastly, for each variable  $X_{t,k}$ :

$$\begin{aligned} P(X_{t,k}=i/S_t=j, W_t=0) &= 0.5 \\ P(X_{t,k}=i/S_t=j, W_t=1) &= \gamma_{k,i,j} \end{aligned}$$

All parameters can be estimated by the Kalman filter (see Gregoir and Lenglart, op. cit. or Tallet and Bardaji (2008) for details), which produces also 2 quantities of greatest interest:

- filtered probabilities:  $\hat{P}(S_t=i, W_t=j/I_t)$
- smoothed probabilities:  $\hat{P}(S_t=i, W_t=j/I_T)$

From these probabilities, 2 summaries, called turning point indicators, can be built:

$$TPF_t = \hat{P}(S_t=1, W_t=0/I_t) + \hat{P}(S_t=1, W_t=1/I_t) - \hat{P}(S_t=0, W_t=0/I_t) - \hat{P}(S_t=0, W_t=1/I_t)$$

and

$$TPS_t = \hat{P}(S_t=1, W_t=0/I_T) + \hat{P}(S_t=1, W_t=1/I_T) - \hat{P}(S_t=0, W_t=0/I_T) - \hat{P}(S_t=0, W_t=1/I_T)$$

Both indicators vary between -1 and 1: when the indicator is near -1, it indicates that the business surveys is in a unfavorable regime and, conversely when it is near +1, it indicates a favorable regime.

Gregoir and Lenglart implemented this model for the industrial business survey and their model has been progressively extended to some other French sectors: the wholesale sector in 2006 and the construction sector in 2008. And at the end of 2008 Insee has introduced a turning point indicator for the whole economy (see Bardaji et al. (2008)).

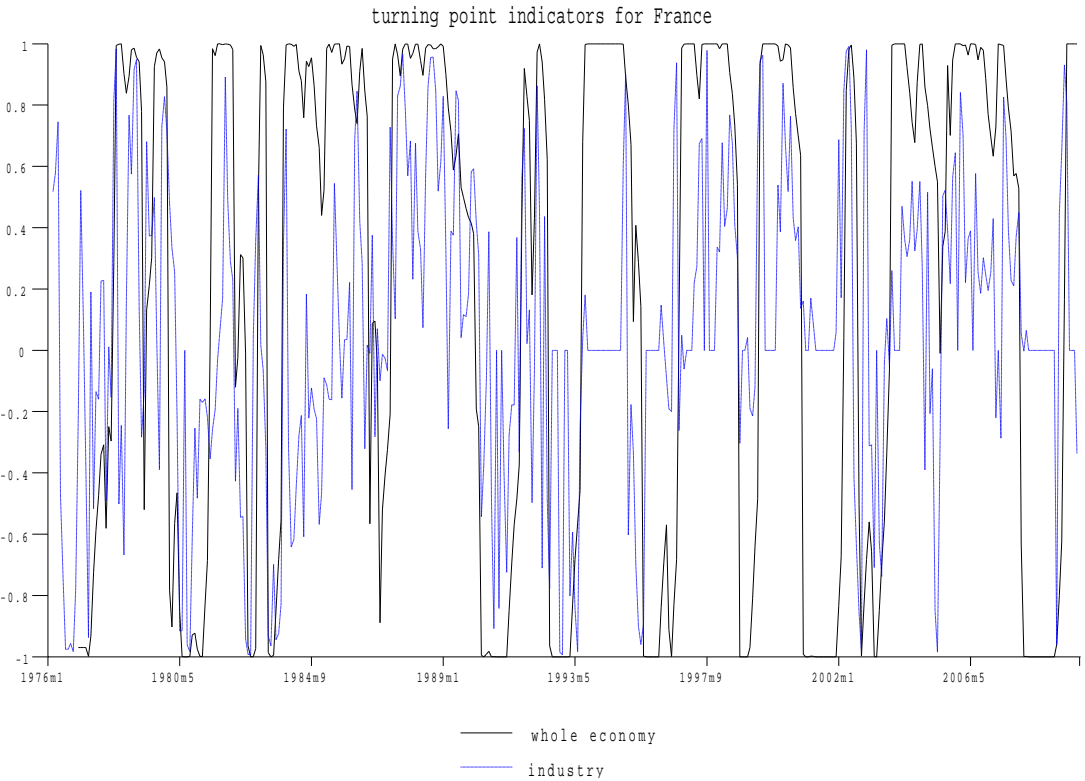
Several lessons can be drawn from Insee experience.

First, all business surveys do not allow to devise turning point indicators that are sufficiently clear to provide indications: this is the case when the surveys time span is too short or when answers are too noisy: in France, it has not been possible yet, for example, to devise a satisfactory turning point indicator for the services sector, which can be due to the fact that this survey has a monthly frequency only since a few years.

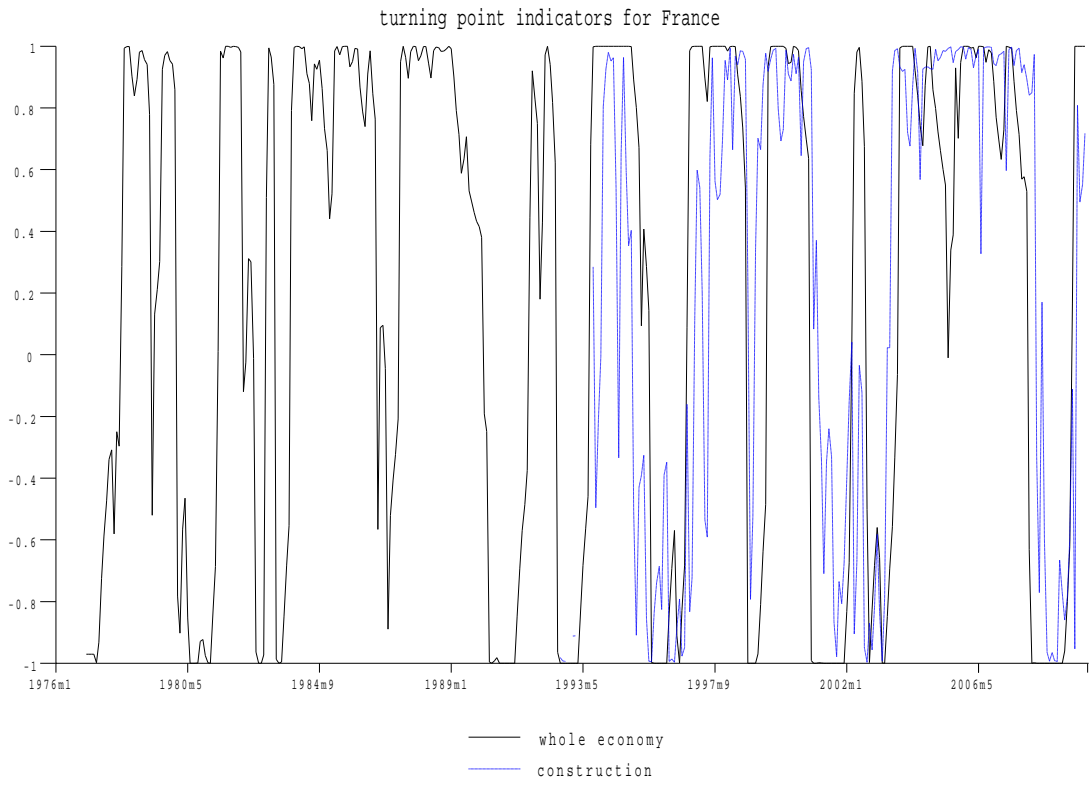
But, second, when surveys have a sufficient history and when answers are not too noisy, then it is possible to devise turning point indicators that convey relatively clear and leading indicators of the state of the economy.

Third this is all the more the case when you can mix different surveys: since these surveys have some co-movement, the signal to noise ratio increases and the turning point indicator becomes more readable. This point can be seen on figure 1: in the case of France, the industry turning point is somehow noisy, much more than the global one: the global indicator delivers more clear-cut results, being more often in the vicinity of -1 or +1. And this increase in readability does not come with a degradation with respect to the other existing indicators, in the wholesale and construction sectors (see figures 2 and 3)

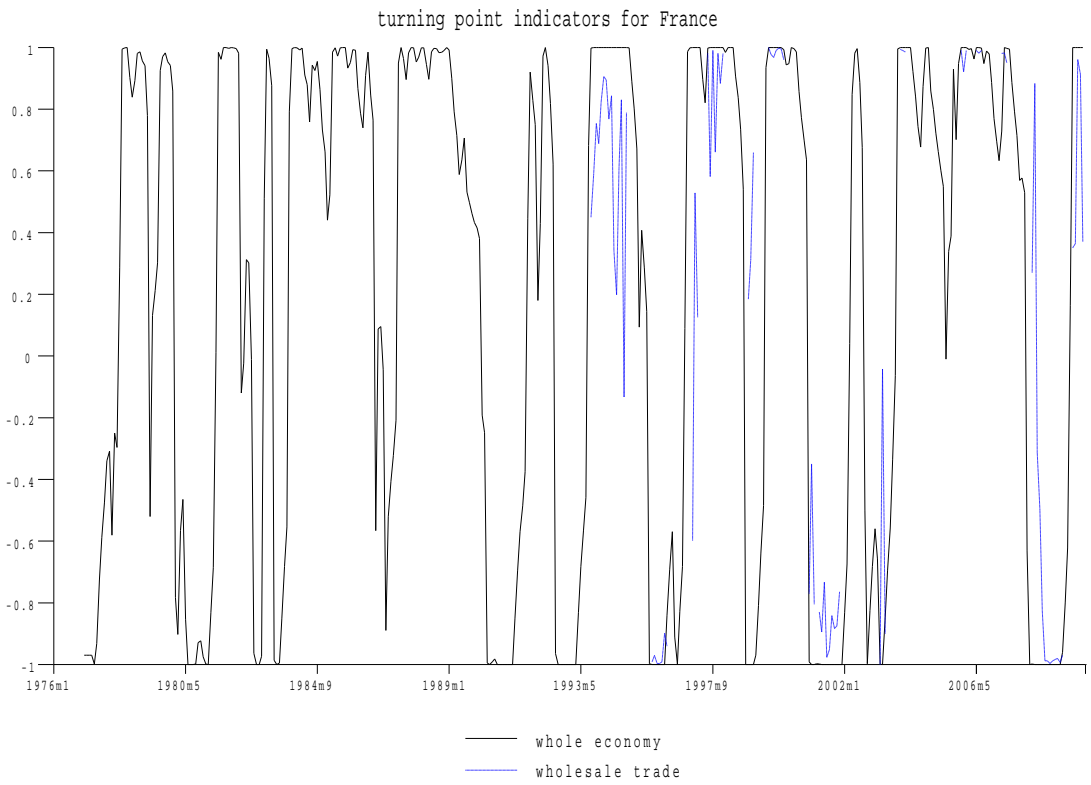
**Figure 1**



**Figure 2**



**Figure 3**

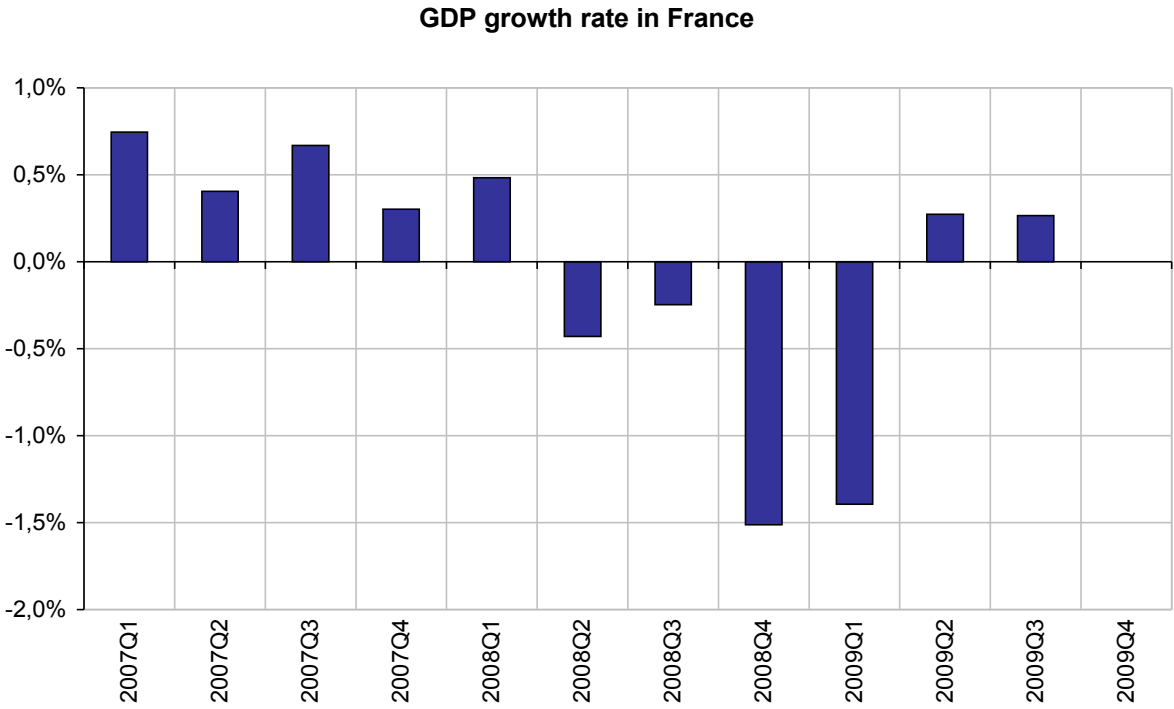




Fourth, the second latent variable helps at providing a more clear-cut indicator (see Gregoir and Lengart again).

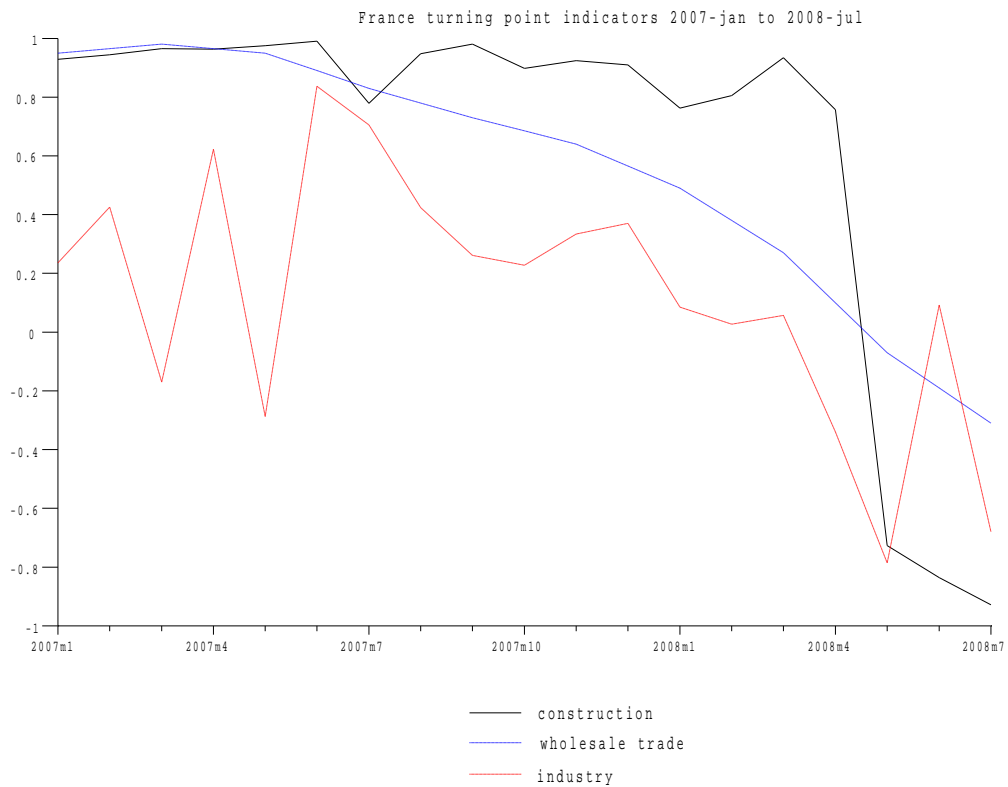
Let us now examine how these indicators have performed during the crisis. A look at GDP growth figures (see. Figure 4) shows that the recession can be considered to have begun in the second quarter of 2008 and to have ended in the second quarter of 2009: GDP growth remained significantly positive until the first quarter of 2008 and then declined until the first quarter of 2009; growth has become positive again in the second quarter of 2009.

**Figure 4**



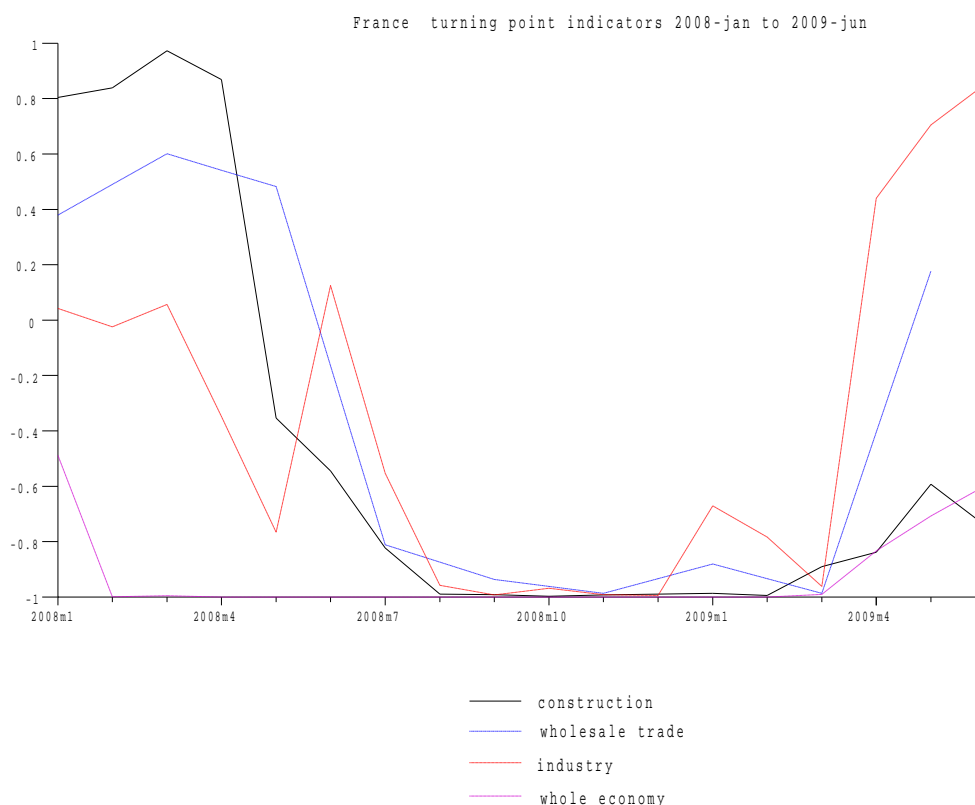
Now, how have these indicators performed during the crisis? To answer this question, I have graphed the indicators as they were published by Insee at the end of July 2008 (see figure 5): it was well before the failure of Lehman Brothers and it was before the publication by Insee of the second quarter GDP figure. Turning points indicators were then available for industry, construction and wholesale trade. All three indicators had dropped in the unfavorable regime, even if they had not reached the -1 level: they were indicating that the French economy was probably slowing down very significantly, a fact that was not obvious at that time for many analysts.

**Figure 5**



Let us now examine what the indicators were saying at the end of June: at this time, the available figures for industrial production (concerning April) were still showing a decline and the end of the recession did not seem in sight. Turning point indicators were however starting to show some improvement: this was in particular the case for the the industrial sector and the construction sector. Although the messages were not totally clear-cut, they were indicating that the worst of the recession was probably behind us.

**Figure 6**



## 2. Turning point indicators should have been very helpful to diagnose in advance a marked slowdown in the European Union

French business surveys are part of the Joint Harmonised EU Programme of Business and Consumer Surveys. The methodology used in France can therefore be expected to prove fruitful in an European context. A few caveats are in order however. First, not all business surveys that can be used in the case of France can be used in the European context: for instance, there does not exist a wholesale survey at the European level and the services survey has a much shorter history than the French one. This is the reason why Insee has built, and publishes since several years, a turning point indicator for the industrial sector of the Euro area, based upon the industrial balances of 6 countries<sup>3</sup>: Belgium, France, Germany, Italy, the Netherlands and Spain. Second, even for the industrial survey, data only start in 1985.

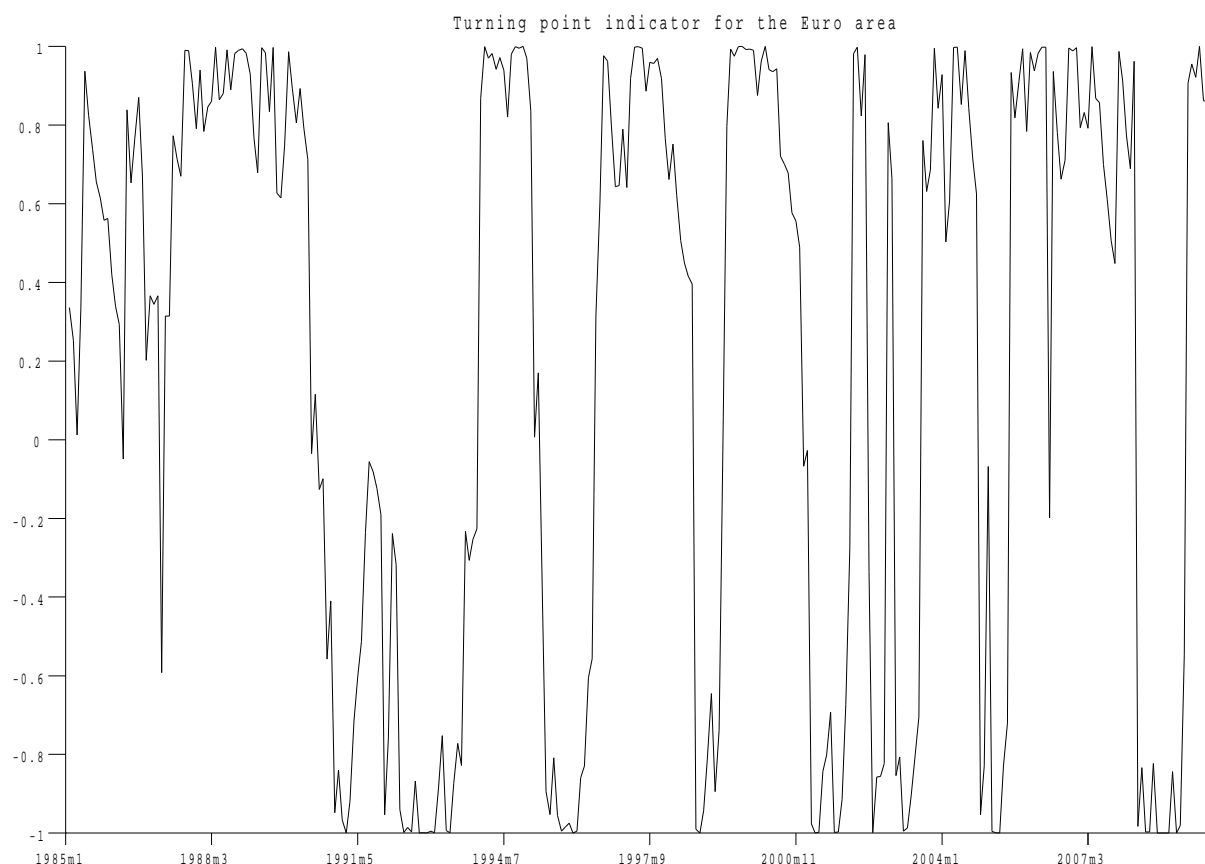
The Insee indicator as published in November 2009 is graphed on figure 6. As can be seen on this graph, the indicator has well-defined regimes and is estimated today to have been between -0.8 and -1 from April 2008 to April 2009, that is during the crisis.

<sup>3</sup> The indicator is published each month on Insee's web site at the page

[http://www.insee.fr/en/themes/theme.asp?theme=17&sous\\_theme=1](http://www.insee.fr/en/themes/theme.asp?theme=17&sous_theme=1)

It has been presented in Insee's publication « La note de conjoncture » (see Doz et al. (2000))

**Figure 6**



The indicator is based on a mix of national survey data and European ones and estimated with a Gauss program due to F. Lenglart. As such it is not easy to reproduce. I will therefore show now how an indicator very similar to the Insee's one can be built only with the data available in the European surveys and with programs available freely on the Internet, so that every one can reproduce them easily: all estimations in this part rest on the program `ms_quali`, incorporated in the free and opensource package GROCER for Scilab, available on the Internet<sup>4</sup>. I will also illustrate how one can arrive at such an indicator and present an indicator with some slight improvement with respect to the original indicator.

At first, one can estimate a turning point estimator from the balances at the EU and the euro area level: the euro area itself is of peculiar interest, because such an indicator could be useful for the European central bank in the conduct of her monetary policy.

As for all estimation presented from now, the estimation is performed as follow

- 1) data are the seasonally adjusted balances relative to the 5 following balances: Production trend observed in recent months (code 1), Assessment of order-book levels (code 2), Assessment of stocks of finished products (code 4), Production expectations for the months ahead (code 5) and Employment expectations for the months ahead (code 7)

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<sup>4</sup> All the GROCER instructions used to apply the program are available upon request and will be soon posted on Internet at the following address: <http://dubois.ensae.net/biblio.html>

2) each balance is differentiated and regressed on 5 lags of its difference, on a lag of its level and a constant; formally, the general regression is the following:

$$\Delta B_t = \sum_{i=1}^5 \beta_i \Delta B_{t-i} + \alpha B_{t-1} + \gamma + \varepsilon_t$$

The best model is then selected automatically by the pc-gets like program implemented in GRO CER (see Hendry and Krolzig (200x) for a theoretical presentation and Dubois and Michaux (2009), chapter 13, for a description of the program used here)

- 3) the resulting innovations (that is the residuals from this regression) are then shared into 2 parts (low and high) using an Epanechnikov kernel<sup>5</sup>;
- 4) the Markov-switching model with the latent variables is then estimated over the whole period

I choose thereafter to present the filtered and smoothed indicators. The filtered indicator uses the Kalman filter only in the forward dimension: as such, once the parameters are given, the indicators only uses the information available at date  $t$ . The smoothed indicator uses the Kalman filter both in the forward and backward dimension: at each date, the indicator make therefore use of the information available over the whole period.

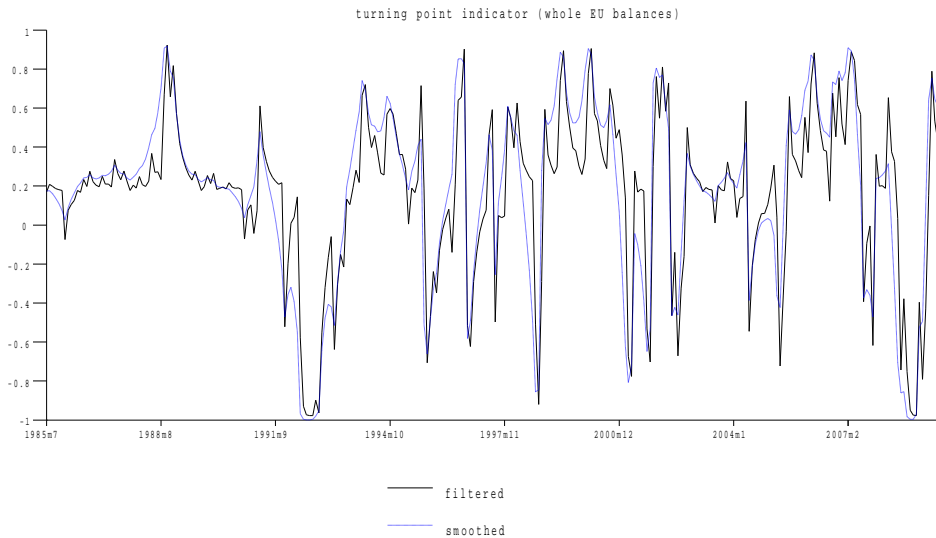
Both indicators have their advantages and drawbacks. The filtered one looks more like what should have been obtained in real time, since it does not make use of the data available in the future; to judge the quality of the signal delivered at date  $t$ , it is therefore preferable to use the filtered indicator. But the smoothed indicator provides better indications of what happened in the past: so, when a turning point has been reached in the recent past, the filtered indicator will provide a better signal and this should be taken into account. Pu differently, if you want to assess whether a turning point *is currently occurring*, then is a better to compare the last point to the whole curve to asses the real time capacity of the indicator of detecting turning points; but, if you want to asses whether a turning point *has occurred*, then it is better to use the smoothed indicator.

Results, reported in graphs 5 and 6 show disappointing results regarding the whole European Union, but better ones with respect to the euro area: in this case, the indicator provides relatively clear-cut regimes and these regimes broadly match what we know about the economic cycle during the years 1985 to 2007 (we leave the period of the financial crisis for later): the boom at the end of the eighties; the slump that followed the first Gulf war; the brief recovery in 1994; the temporary slowdown in 1995-1996; the boom at the end of the nineties until the end of 2000; the slowdown in 2001; the false recovery of 2002; the relatively high growth regime until 2007.

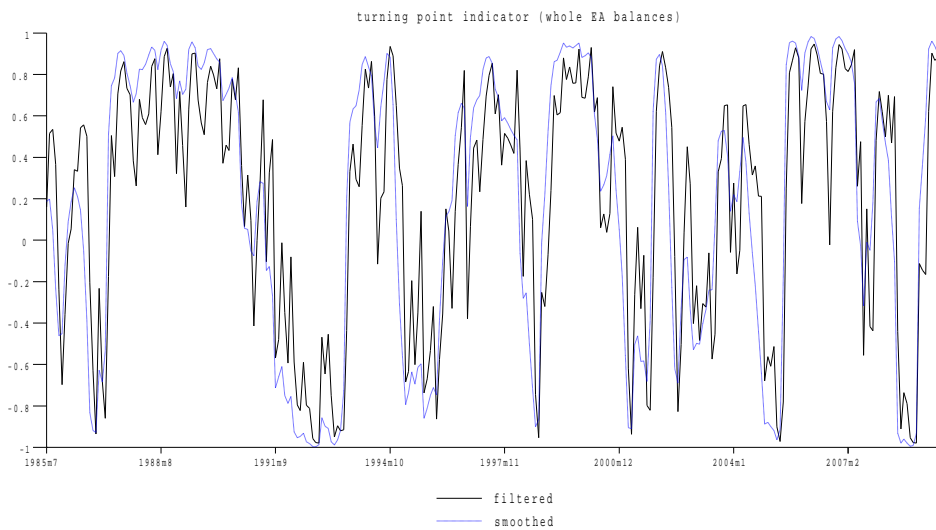
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5 This is the option 'KERN' in GRO CER program ms\_quali

**Figure 7**



**Figure 8**

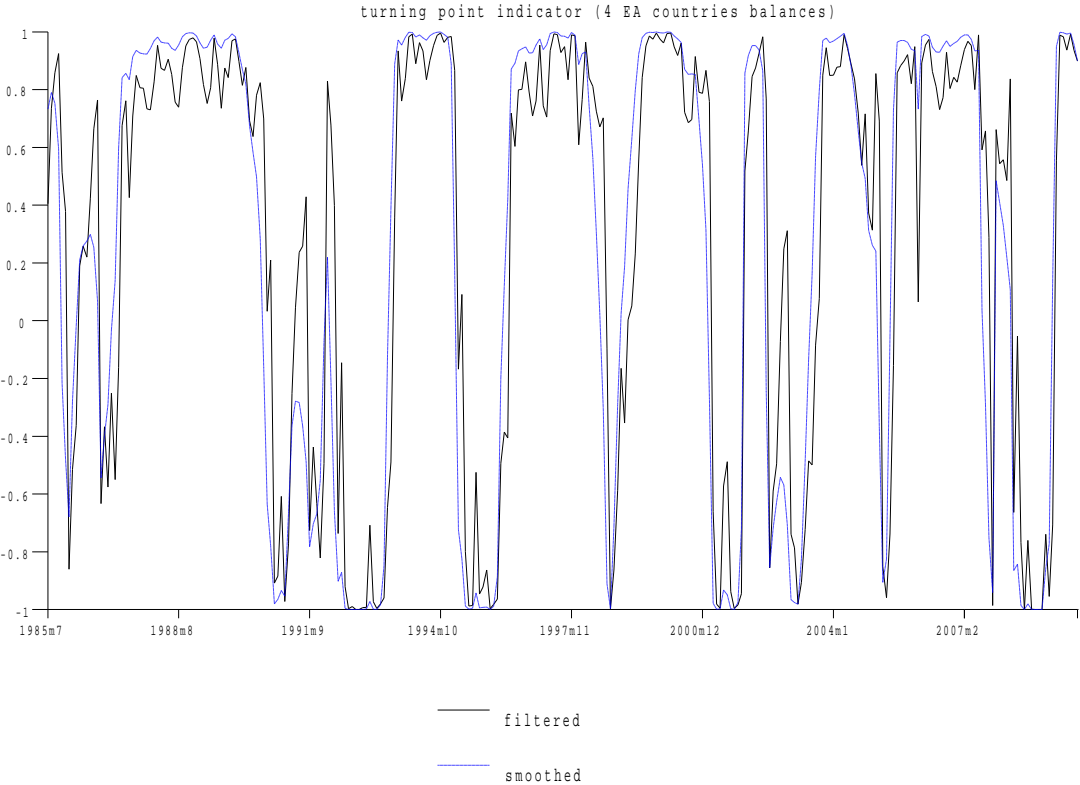


The indicator remains however noisy. As the French case indicates, it can be fruitful to use more information than the ones embodied in the 5 balances used to estimate the indicator. One way would be to add balances taken from other surveys, but as already indicated, such information is rather scarce<sup>6</sup>. Another road must therefore be followed, which consists in using the country dimension of the European surveys. More precisely, I have estimated indicators for the 6 main countries in the Euro area -Belgium, France, Germany, Italy, Netherlands and Spain- (see annex 1 for the corresponding results) and selected the 4 countries which provided sufficiently satisfactory results: Belgium, France, Germany and

<sup>6</sup> The households survey covers also a long period, but it is impacted by many non economic factors, which inclines to doubt that it can provide additional useful information to the industrial survey.

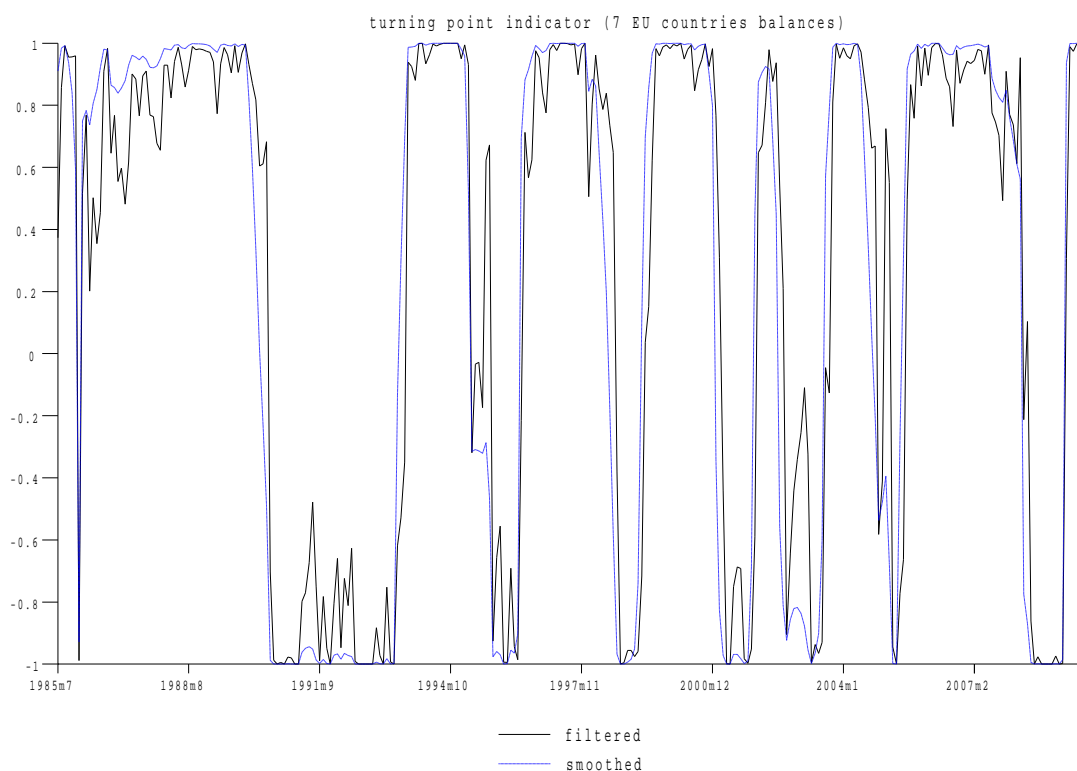
Spain. I have then estimated the model with the same 5 balances as before for the 4 countries: instead of the 5 initial variables, there are now 20 ones. The results are plotted on figure 9. The comparison with figure 8 shows that a significant part of the noise has been removed and that the regimes appear more clearly than before. And now the indicator looks very much like the Insee's original one.

**Figure 9**



There is one thing that can be done to improve the quality of the signal: add balances from some non euro area countries. I have considered 3 countries: the United Kingdom and Sweden because they are the 2 UE biggest countries outside the Euro area and Denmark, because it is an economy linked to the Euro area and has series starting in 1985. When these 3 countries are added to the previous countries, the quality of the signal is indeed slightly improved. In particular it exhibits many less spikes, especially if you look at the smoothed indicator.

**Figure 10**



Now, how have these indicators performed during the crisis? To answer this question, I do not use the previous results, but turn to a quasi-real time experiment. Namely I reestimate the indicators using data ending respectively in July 2008 and June 2009. The first date is almost one month and a half before the Lehman Brothers failure and it corresponds to the last survey published before the quarterly national accounts for the second quarter of 2008. The second date is the last one before the publication of the may industrial production, which began to mark a visible improvement in the economic situation. The experiment can be considered as a quasi-real time experiment since answers to the business surveys are never revised one more than month after the first release. True, the seasonal adjustment can make a difference over a much longer period of time, but the addition of less than two years should not make a big difference. And I use a true real time indicator, that is the indicator originally published by Insee, available however only in filtered form.

## **2.2 In July 2008 turning point indicators were pointing to a significant slowdown.**

Two models have been here estimated again, over the period from July 1985 until July 2008: the model with the Euro area balances, the model with the balances for the 4 selected Euro area countries three non Euro European countries (Denmark, Sweden and United Kingdom). Figure 8 reports the resulting filtered indicators, along with the indicator published at the beginning of August 2008 and figure 9 the smoothed ones, all indicators zoomed over the period going from the start of 2007 until July 2008.

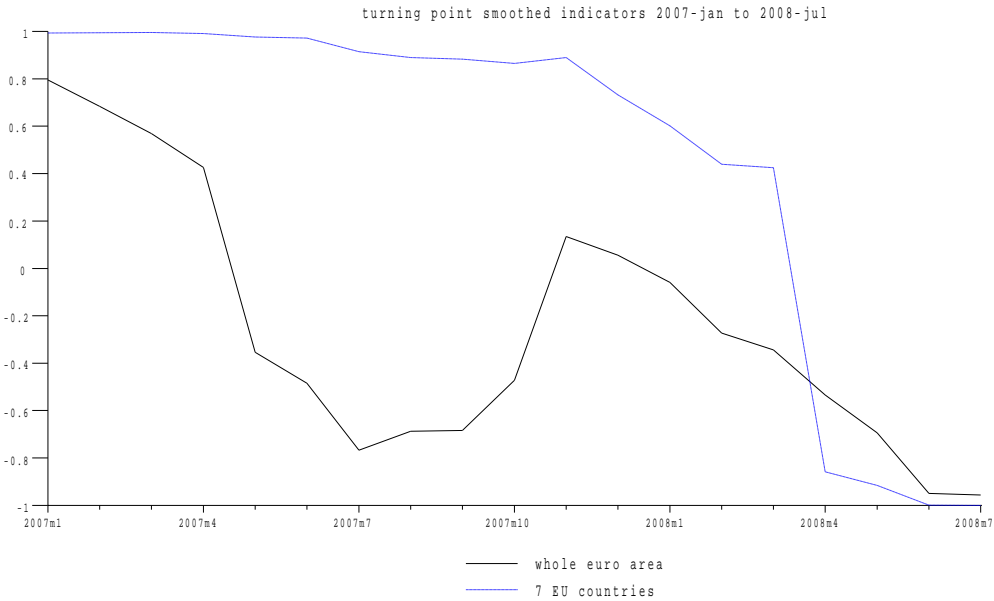


Three interesting results emerge. First, as already seen, the indicator using only the data aggregated over the whole euro area do not give clear-cut results, but the 2 others transit very quickly from the favorable state to the unfavorable one. In July, the change in regime can be considered as established according to these indicators. Second, this is unsurprisingly more visible still on the smoothed indicators calculated with 7 countries. And third, on that occasion the original Insee indicator performs somehow bit better.

**Figure 8**



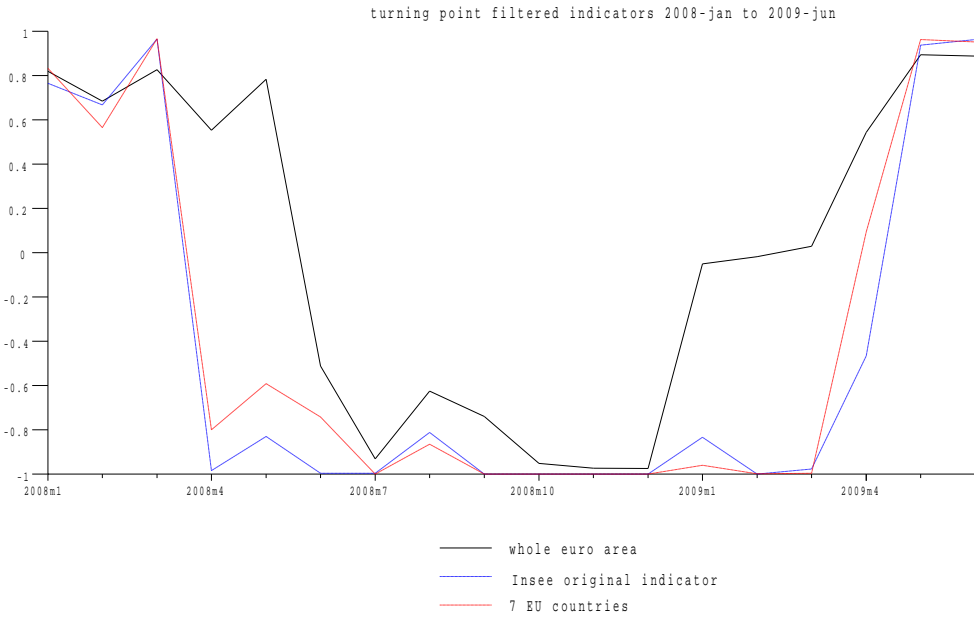
**Figure 9**



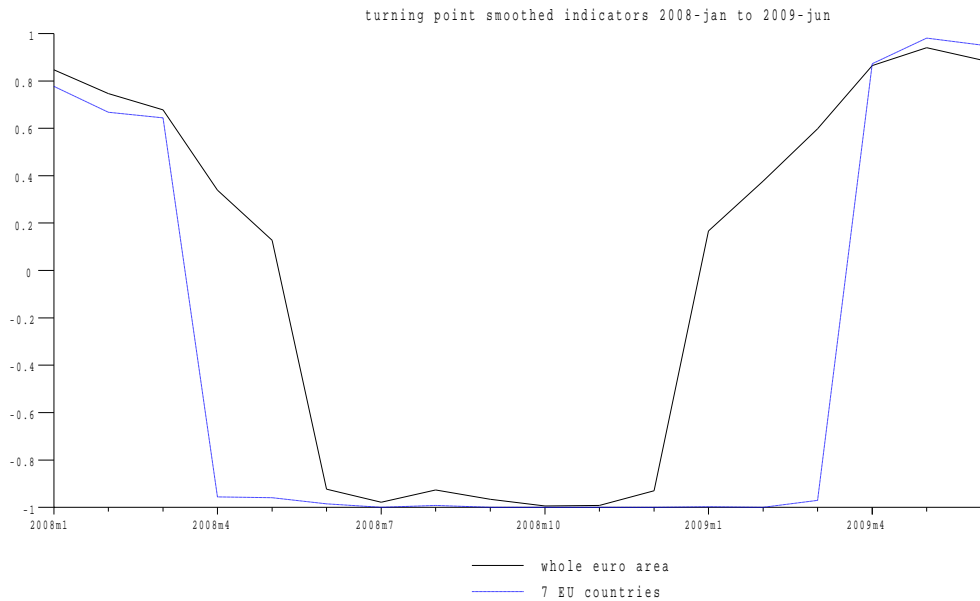
**2.2 In June 2009 turning point indicators were pointing to a recovery.**

We now examine what the indicators were saying in June 2009. At this time the uncertainty over the arrival of a recovery was still great and industrial production indexes were still decreasing at a rapid pace. The turning point indicators were as for them already in a favorable regime since 2 months (if you look at filtered indicators) or 3 months (if you look at smoothed one), with the whole Euro area a little bit advanced with respect to the other ones.

**Figure 10**



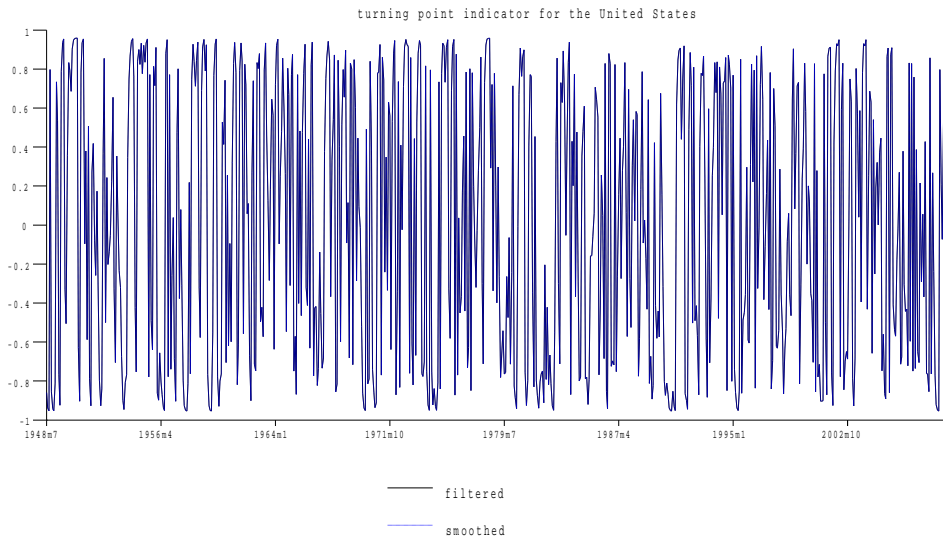
**Figure 11**



### 3. And what about the United States surveys?

Since the United States remains by a great margin the most important economy in the World, one can hope that adding balances taken from American surveys should still improve the readability of turning points indicators. It happens however that the manufacturing ISM, which is a priori comparable to the European Commission survey, does not lead to a satisfactory turning point indicator (see figure 12). Although disappointing, this is not totally surprising: in another context, Sédillot and Pain (2003) have found that business surveys were much not very useful to forecast GDP in the United States. And when US business survey balances are added to their European counterparts, then this is the noise in the first ones that dominates.

Figure 12



#### 4. Conclusion

The capacity of business surveys to provide early information of an incoming turning point of the economy have until now been underestimated. This paper shows that they can provide such useful indications, especially in the European context. In particular, they should have given a clear signal that the European economy has entered in a slowdown in July 2008. Yet, the extracted signal is only qualitative and it did not forecast the depth of the recession, but, at a time when central banks were rather focused on the inflation risk caused by the spike in energy prices, such indication could have inclined them to weigh more heavily the risk of bad output prospects. Similarly, it should have indicated in June 2009, although with less strength, that a recovery was underway.

This paper has not explored all the possibilities offered by business surveys. Improvements to the results provided here can with almost certainty be made. The technology, embodied in the free, opensource package GROCER available on the Internet is available for every one interested in the subject!

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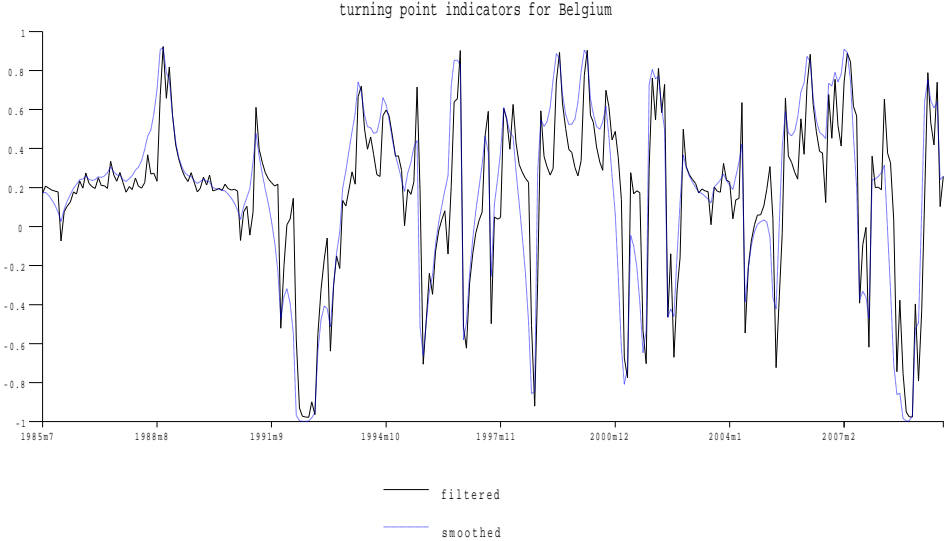
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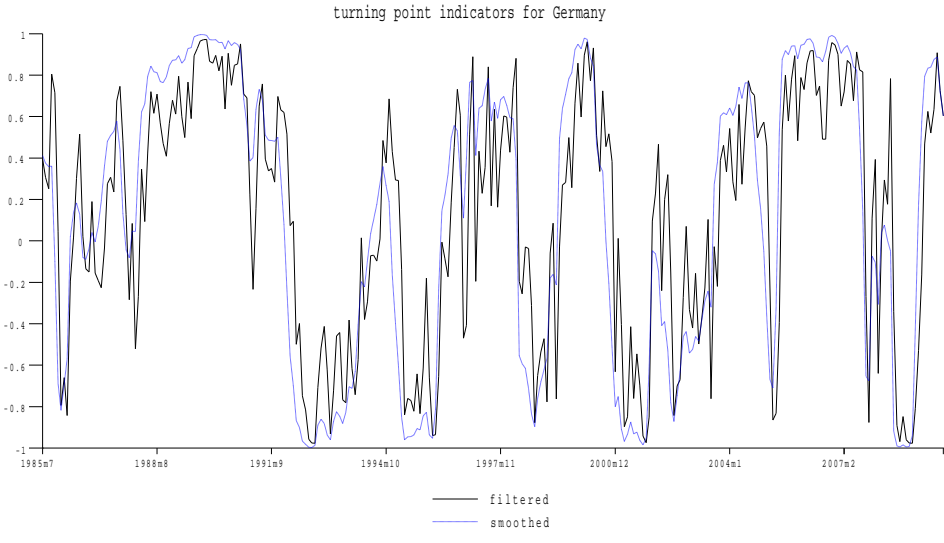
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**Annex 1: results from individual countries**

**Figure A1: Belgium**



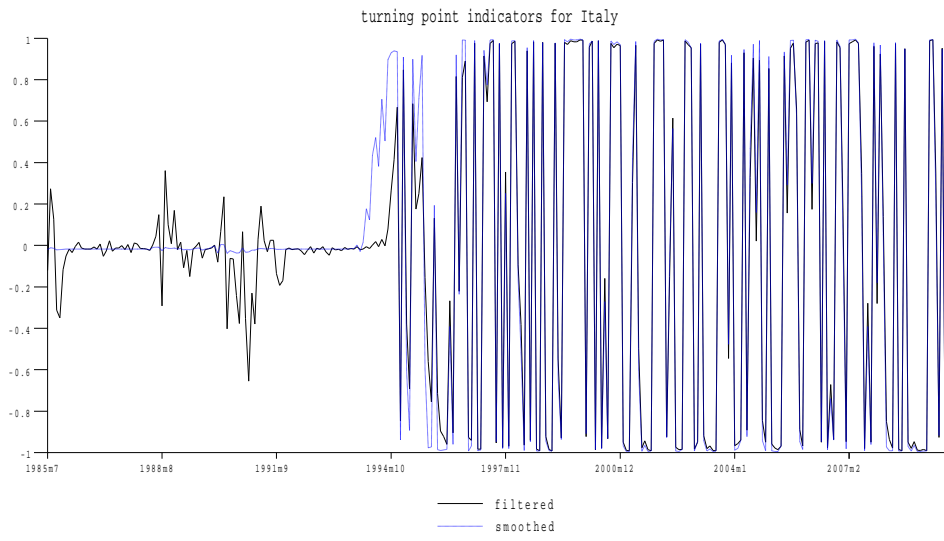
**Figure A2: Germany**



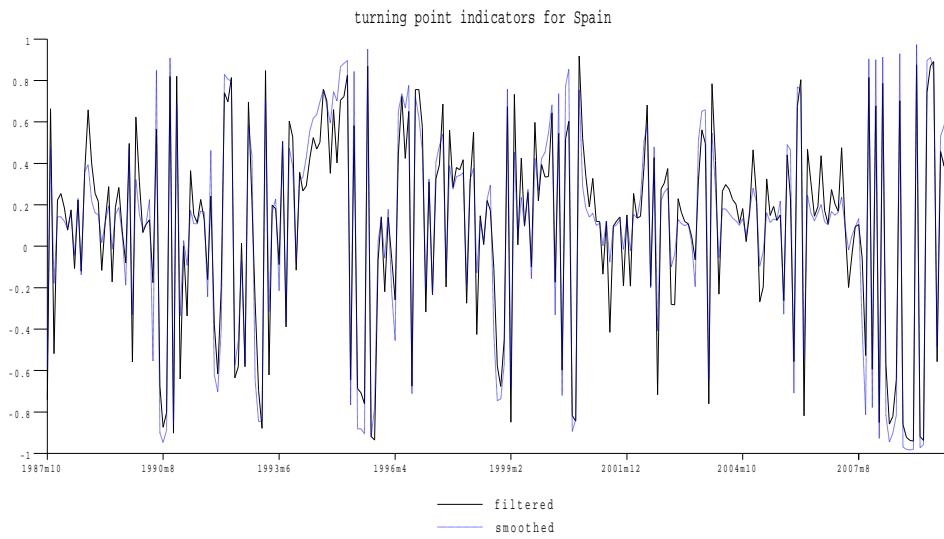
**Figure A3: Italy**



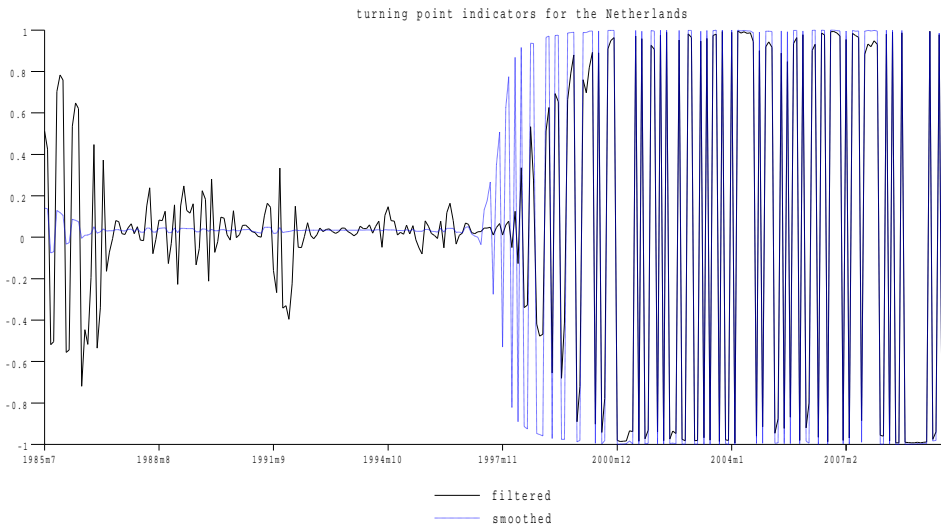




**Figure A4: Spain**



**Figure A5: Netherlands**



**Figure A6: United Kingdom**

