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MODEL FOR THE CYCLICAL TREND IN STOCKS IN BELGIUM

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MODEL FOR THE CYCLICAL TREND IN STOCKS IN BELGIUM

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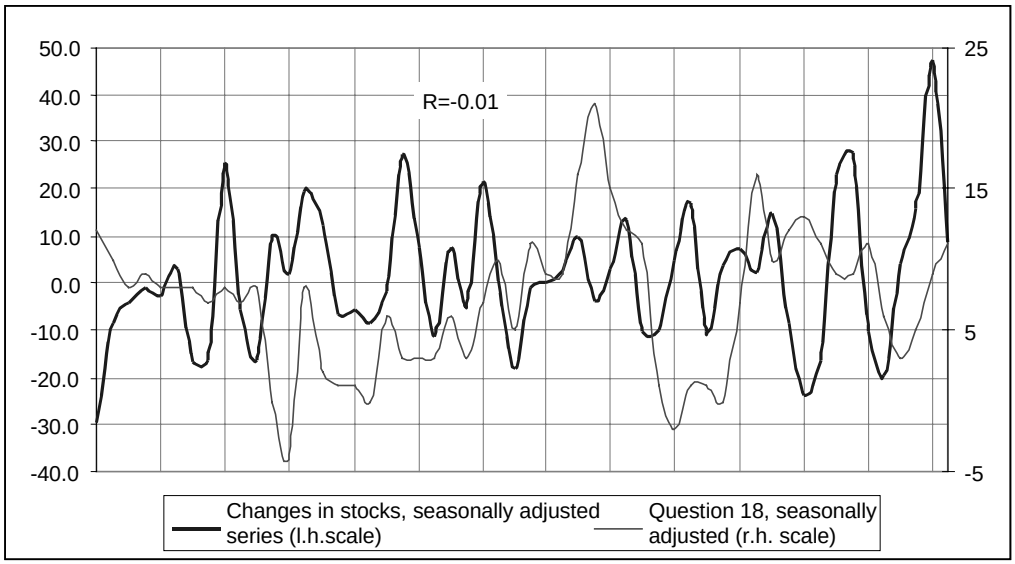
1. Changes in stocks have a significant influence on industrial output and economic growth. In the Belgian national accounts, this item is not estimated on the basis of exogenous variables but is simply taken as the difference between the aggregates obtained by the output approach and by the expenditure approach. To improve the estimate of this crucial economic variable, we should examine the possibility of validating this figure via other information sources. That is the aim of this paper.

1. Quantifying the results of the business surveys

2. Within the strict deadlines for producing the quarterly national accounts, the only information available on stocks in Belgium comes from the business surveys. This concerns a qualitative appraisal of the volume of stocks of finished products in manufacturing industry (question 18 in the survey[1]): for each of the products that he makes, the manufacturer judges the level of his stocks of finished products by comparing them with the "normal" level.

Graph 1: Apparent absence of any link between opinions on stocks and changes in stocks as estimated in the quarterly national accounts



[1] The question reads as follows:

"In your opinion, are your current stocks of this product higher than normal, normal or below normal?"

3. Our first instinct is to examine whether the answers to this question could not be used directly to estimate changes in stocks in the national accounts. This exercise is inconclusive. Graph 1 does not in fact reveal any apparent link between opinions on stocks and their levels in the national accounts.

4. There are two reasons for this problem of quantification: the difficulty lies partly in the question itself and partly in the characteristics of the national accounts.

1.1. Problem connected with the form and content of the question

5. The opinion on the level of stocks of finished products refers to a "normal" situation, which is itself subjective, varying over time and according to the economic situation. That hampers the conversion of this qualitative information into quantitative data on the trend in changes in stocks.

6. Also, the question deals only with stocks of finished products held by a producer in manufacturing industry. But changes in stocks measured by the quarterly national accounts describe changes for all stocks in the economy:

   - whoever holds them (be it the producer, another manufacturer incorporating them in his production process, or a wholesale or retail trader)

   - and whatever their origin (goods produced in Belgium or imported).

7. However, studies in other countries have shown that, even though they represent only one part, stocks of finished products fluctuate in a very similar way to overall stocks. Furthermore, it is changes in manufactured output that largely account for the economic cycle.

1.2. Problem connected with the Belgian national accounts

8. The series of changes in stocks in the quarterly national accounts are very uneven owing to its method of construction. Changes in stocks are not in fact estimated from external sources like the other national aggregates but are obtained as the difference between resources and uses.

2. Link between changes in stocks and the economic cycle: identifying a stock formation model

9. Although it is difficult to use the results of the business surveys as an instrument for directly measuring changes in stocks, they can nevertheless help to update the link between changes in stocks and economic activity. Finding the model for the prevailing stock behaviour pattern in Belgium in itself provides us with a primary tool for validating the results obtained as a balancing figure in the national accounts, but above all it is the first step towards a genuine method of modelling stocks.

2.1. The two main macroeconomic models on stock formation

10. The macroeconomic models which provide an insight into stock formation behaviour are based on the reasons for building stocks found at microeconomic level. Four reasons have been identified:

- stocks may be held to eliminate or limit the marginal costs of production over time; in that case, stocks are used for maintaining steady output, serving as an adjustment variable to smooth out temporary fluctuations in sales;

- the second reason for holding stocks is based on the assumption that the enterprise can produce more efficiently under certain conditions or at certain times; it is therefore in the interests of the enterprise to take advantage of these situations favourable to productivity to produce more than necessary and build up stocks;

- the third reason for holding stocks is based on enterprises' aversion to the risk of failing to satisfy unexpectedly strong demand: building adequate stocks provides protection against goods being out of stock if demand exceeds output;

- the last reason for holding stocks is based on speculation: sometimes the enterprise may believe that it is more advantageous to stock-pile its production rather than sell it, if selling prices are expected to rise in the future.

11. There are two main macroeconomic models based on these reasons for holding stocks:

- the steady output model, based on the first reason for holding stocks: in this model, a strategy of minimising costs over time leads the enterprise to keep output steady relative to trends in sales; stocks therefore act as a buffer and follow a counter-cyclical trend;

- the stock accelerator model, based on the third reason for holding stocks: this model assumes that the enterprise holds a stock of finished products in proportion to its output level; when the economy is expanding, output is high and enterprises want to hold more stocks; conversely, when output falls, they run down their stocks proportionately; stocks therefore follow a pro-cyclical trend.

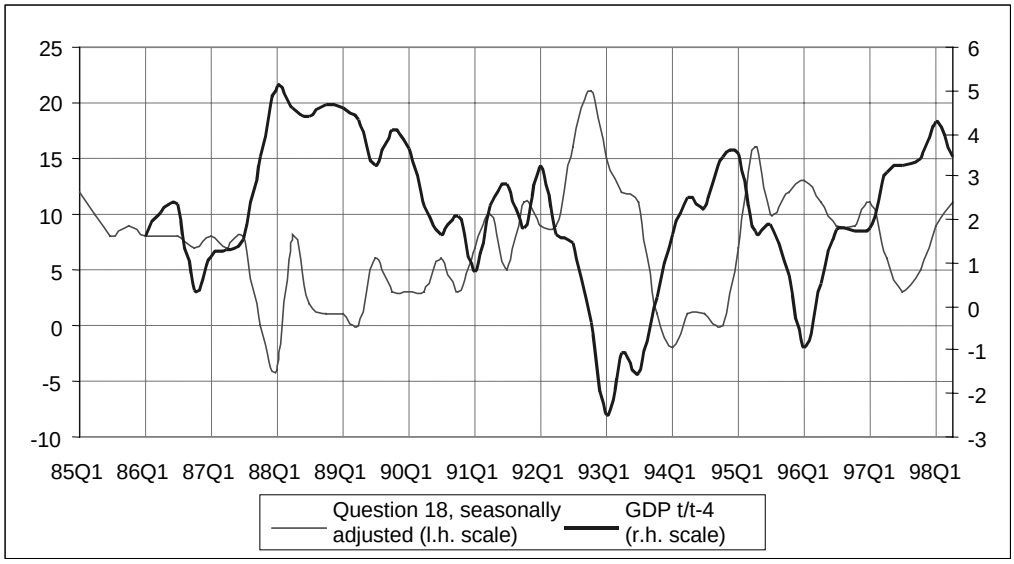
2.2. Identification of an annual stock-holding model

12. Three sources of information are used to try to identify the stock-holding model which prevails in Belgium: the business surveys, the national accounts and the annual accounts of enterprises. The results obtained from these three sources tally.

2.2.1. Identification on the basis of the results of the business surveys

13. A simple graphic analysis sheds light on the link between the qualitative appraisal of stocks in the business surveys and economic activity. Graph 2 reveals a very close link between the behaviour of stocks (described by the statistics obtained from the answers to question 18 in the business surveys) and the trend in economic activity (measured by the trend in GDP). When the economy is doing well, stocks are judged to be below normal, and vice versa.

Graph 2: Link between the trend in GDP and the assessment of stocks of finished products by manufacturers



14. Graph 2 therefore suggests that Belgian stocks move according to the accelerator model, which assumes that stocks of finished products tend to adjust to anticipated demand. If a fall in demand observed when the economic climate is deteriorating shows stocks to be higher than normal, it is because the level of stocks considered "normal" has declined in line with the observed fall in demand. Conversely, rising demand is reflected in a subjective lowering of stocks, since the desired stock level has increased.

2.2.2. Identification on the basis of the national accounts

15. It is also possible to identify the stock-holding model prevailing in Belgium on the basis of the national accounts themselves. To do this, we used a linear regression on annual data to try to determine the statistical link between the rate of growth of GDP and the change in stocks (as a percentage of GDP). If Belgium has a stock formation pattern that conforms to the stock accelerator model, we would see a positive regression coefficient (significantly different from zero); a negative coefficient would indicate a steady output model.

16. The results of the regression are set out in table 1.

Table 1: Technical characteristics of the linear regression of changes in stocks on the trend in GDP (period 1981-1997)

Regressor	Coefficient	Standard error	Student's distribution
Constant	- 0.18	0.12	- 1.48
GDP growth rates	0.11	0.05	2.11

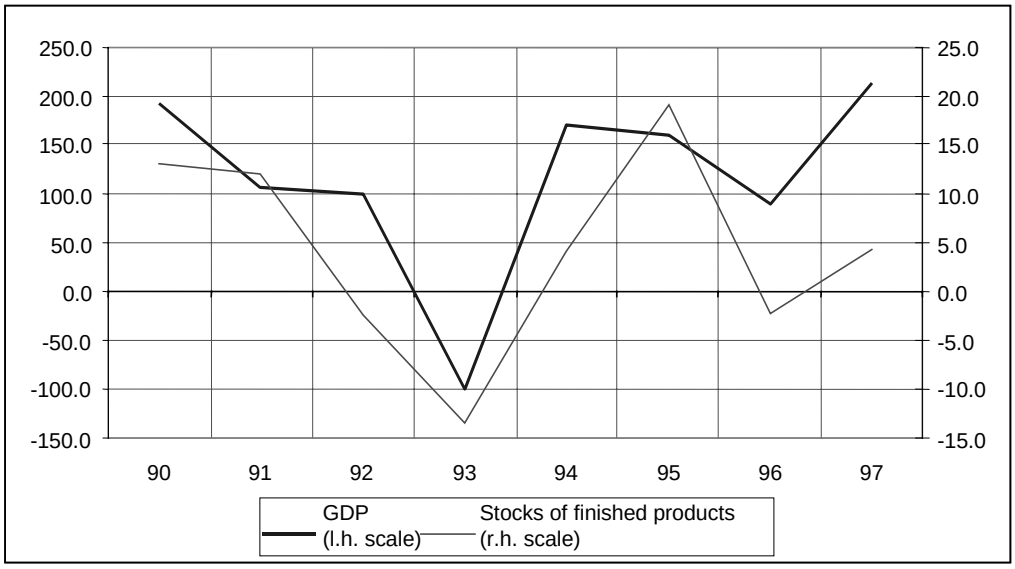
Number of observations: 17
R^2 adjusted: 0.18
Durbin-Watson: 2.17

17. With a significantly positive coefficient, the results of this regression also imply that, on annual data, it is the accelerator stock model that prevails in Belgium. Moreover, the same analysis conducted for other OECD[2] countries leads us to the same conclusion in the majority of cases, with entirely comparable regression coefficients.

2.2.3. On the basis of the annual accounts of enterprises

18. In annual terms, the change in stocks may also be measured on the basis of the annual accounts of enterprises recorded at the Central Balance Sheet Office[3]. Graph 3 shows that this third statistical source provides further confirmation of the accelerator behaviour of stocks.

Graph 3: Link between the trend in GDP and stocks of finished products noted in the annual accounts of enterprises



19. This three-part exercise leads us to conclude, with little risk of error, that in annual terms Belgian stocks follow a pro-cyclical trend, i.e. they reinforce the economic cycle. This information is itself one of the initial factors needed for assessing the changes in stocks shown as a balancing item in the national accounts.

3. Modelling changes in stocks in the quarterly accounts

20. This clear link established in annual terms between the trend in economic activity and changes in stocks encourages us to go further in modelling stock formation behaviour at quarterly level.

21. We focused on modelling changes in stocks rather than stock levels. The equation used was specified on the basis of the theoretical reasons for stock formation described earlier. The estimate

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2 Bouthevillain C. and Eyssartier D., The role of changes in stocks in the cycles of activity of the leading industrial countries, Review of the French Economic Observatory (OFCE), No. 62, July 1997.

3 We confined our analysis to stocks of finished products as recorded in account 33 of the enterprise accounts. These stocks were aggregated for all enterprises in manufacturing industry submitting a complete presentation.

was primarily obtained by taking account of the anticipated and unanticipated movement in demand excluding stocks. We ascertain anticipations via adjustment mechanisms and therefore assume that the anticipations are based solely on past and current trends in demand. In consequence, the determinants adopted are past changes in stocks (VS) and current and past changes in demand excluding stocks (VDhs).

22. $VS = a + b\ VS_{-1} + c\ VDhs + d\ VDhs_{-1} + e\ VDhs_{-2} + fVDhs_{-3} + g\ VDhs_{-4}$

23. This equation is estimated on a quarterly basis by the ordinary least squares method. The results are set out in table 2.

Table 2: Technical characteristics of the quarterly modelling of changes in stocks (period 1986 - 1998)

Regressor	Coefficient	Standard error	Student's distribution
Constant	2.18	2.19	1.00
VS_{-1}	0.36	0.17	2.08
VDhs	- 0.45	0.08	- 5.36
$VDhs_{-1}$	- 0.13	0.09	- 1.47
$VDhs_{-2}$	0.20	0.07	2.62
$VDhs_{-3}$	0.15	0.07	2.23
$VDhs_{-4}$	0.17	0.07	2.25

Number of observations: 49
R^2 adjusted: 0.61
LM^4: 8.26 (χ_2 with 5 df = 0.142)

24. These results, estimated on a quarterly basis, shed new light on the stock behaviour prevailing in Belgium by identifying two stock-formation strategies which differ according to time-scales. The disaggregation into quarters revealed that stocks are used to maintain steady output in view of demand in the current and preceding quarters. This role may be interpreted as enterprises' response to unanticipated demand or as inertia in the production process, which takes time to adapt to demand. On the other hand, stocks adapt by acting as an accelerator in the light of earlier demand (dating from two or more quarters ago): this indicates how sales are expected to move, and therefore confirms the finding based on the annual figures[5].

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4 The Durbin-Watson's one-lag autocorrelation *d* test is inapplicable when the lagged dependent variable is used as a regressor. The LM (*Lagrange Multiplier*) test proposed by Breusch and Godfrey is a global test of autocorrelation (H_0: all $\rho_k = 0$); see Gujarati, D. N., *Basic Econometrics*, McGraw-Hill Intl Editions, NewYork 1995, 3rd edition, pp. 420-425. In the case that we are concerned with, one can not reject the hypothesis of the absence of autocorrelation.

5 Only an accelerator effect appears in the annual analysis made previously. This may be because, in the case of annual data, part of the effects of any role which stocks have in maintaining steady output is picked up by the accelerator and it is therefore difficult to separate the part attributable to the steady output strategy from that conforming to the accelerator concept.

4. Method of estimating changes in stocks in the quarterly accounts

25. The technical characteristics of this regression are satisfactory: the statistical adjustment is good (over 60% of the variance is explained) and, apart from the intercept and demand in the previous quarter[6], all the variables have a significant influence. However, the predictive quality of this equation is insufficient for it to be taken on its own as a tool for forecasting changes in stocks in the quarterly accounts.

26. The method of estimating changes in stocks in the quarterly accounts must therefore be multi-modal and combine the use of all available information sources, namely:

- the balancing item necessary for reconciling the production and expenditure approaches in the quarterly national accounts;
- the results of the business survey on manufacturers' assessment of stocks;
- the results of the model based on past stocks and current and past demand.

27. Properly combined, this set of tools should make major improvements to the information supplied on stocks by the quarterly accounts.

5. Conclusion

28. The purpose of this paper was to compare all information available in the short term on changes in stocks and to analyse it in the light of macroeconomic theory on the subject. The ultimate aim was to improve the estimates of the quarterly national accounts.

29. The theory considers two apparently conflicting types of macroeconomic behaviour patterns which stocks may adopt: maintaining steady output, which justifies a counter-cyclical trend, and the stock accelerator, which explains a pro-cyclical trend. Our empirical study using the data from the Belgian quarterly national accounts reconciles these two approaches: using an elementary model of the behaviour of stock formation based on quarterly data, we find that stocks keep output steady in the very short term and subsequently adopt accelerator behaviour. The latter predominates if annual data are used.

30. In conjunction with the replies to the question concerning the assessment of stocks in the business surveys, which - as we have seen - confirm the accelerator model, this method of modelling changes in stocks should prove to be a satisfactory tool for validating the quarterly balances between resources and uses, which are the first estimate of changes in stocks in the Belgian national accounts.

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6 The non-significant influence of the previous quarter's demand is probably due to the transition taking place during that quarter between the steady output strategy and the accelerator behaviour.