The inventory to sales ratio in manufacturing; a real leading business cycle indicator

Floris van Ruth and Marcel van Velzen

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Explanation of symbols

.	= data not available
*	= provisional figure
**	= revised provisional figure
x	= publication prohibited (confidential figure)
–	= nil or less than half of unit concerned
–	= (between two figures) inclusive
0 (0,0)	= less than half of unit concerned
blank	= not applicable
2010–2011	= 2010 to 2011 inclusive
2010/2011	= average of 2010 up to and including 2011
2010/'11	= crop year, financial year, school year etc. beginning in 2010 and ending in 2011
2008/'09–2010/'11	= crop year, financial year, etc. 2008/'09 to 2010/'11 inclusive

Due to rounding, some totals may not correspond with the sum of the separate figures.

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The inventory to sales ratio in manufacturing; a real leading business cycle indicator

Floris van Ruth and Marcel van Velzen

Summary: This paper presents a method for computing an inventory to sales ratio for the Dutch manufacturing industry. The resulting ratio shows a very good match with the assessment of the stock of finished goods from the manufacturing industry survey. The cycle of the inventory to sales ratio also has a strong connection with the Dutch business cycle, and even more interesting leads it by about six months. It is therefore a rare example of a leading business cycle indicator based on real indicators. It is also countercyclical, with inventories declining relative to sales in the upswing of the business cycle and increasing in the downswing. Analysis shows this to be due to the relatively weak development of inventories, as these do tend to grow and decline in step with turnover. This in turn suggests that the stocks of finished goods in manufacturing are managed to meet expected demand. Overall, the results indicate that the inventory to sales ratio is both a credible and useful business cycle indicator.

Keywords: Business cycle, leading indicators, inventory, inventory to sales ratio

1. Introduction

Inventories, or stocks, have long been known to be strongly related to business cycle movements [Bils and Kahn(2000), Khan(2003), Khan and Thomas(2007), Tsoukalas (2005)]. Some theories of the business cycle place the origin of the business cycle itself in inventory adjustments. Other approaches depart from the reverse assumption, that inventory levels change due to business cycle fluctuations and the accompanying fluctuations in demand [Bils and Kahn(2000), Khan(2003), Khan and Thomas(2007), Tsoukalas (2005)]. We do not intend to go into the issue of causation, but merely study whether inventories can be a useful business cycle indicator. In the UK and United States, inventories tend to move procyclically [Bils and Kahn(2000), Khan(2003), Khan and Thomas(2007), Tsoukalas (2005)], i.e. in concert with the business cycle. The same goes in The Netherlands, though the cycle of inventories lags the Dutch business cycle by about six months. It should be noted here that the type of inventory used in this study is the stock of *finished* goods in the manufacturing industry. This is an important fact, as there are three different types of inventory, and each type has potentially a different relation to the business cycle. Apart from stocks of finished goods, there are stocks of inputs goods. These consist of raw materials and intermediate fabricates that firms need to produce their own products. It is clear that this type of inventory will only be present in manufacturing and construction. Evidence from the UK indicates that stocks of raw materials and intermediate goods are actually much more important (83% of value) and volatile than stocks of finished goods [Tsoukalas (2005)]. The third type of inventory can be found in wholesale and retail companies, who buy finished goods and distribute these to respectively retailers and final consumers. Data for the US Census bureau indicate that levels of inventories held by manufacturing, wholesale and retail are roughly equal in size.

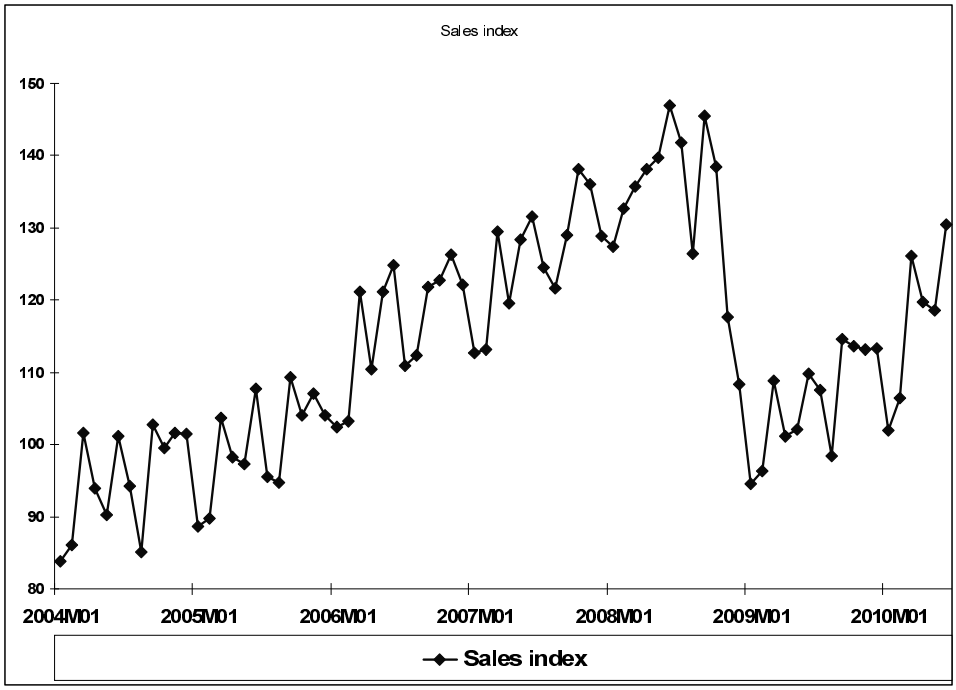
As a lagging indicator, inventories are less interesting. Instead, this study focuses on a different variant: the ratio of inventory to sales. In the United States several variants of inventory to sales ratios are widely watched business cycle indicators. The ratio is deemed to be more interesting, as it is assumed that firms target their inventory levels in relation to (expected) sales. And as this study will show, for the Netherlands it makes a more relevant business cycle indicator. This paper presents a method to construct a ratio of inventory to sales for the Netherlands, based on the manufacturing industries indices of the stock of finished goods and of sales. Following this, several quantitative analyses will be performed to test the credibility and usefulness of the computed ratio of inventory to sales (ISR). This will be done by studying the relationship of the ISR to the assessment of stocks from the manufacturing industry survey, and to the Dutch business cycle.

2. Data and methodology

The inventory-to-sales ratio for the manufacturing industry is obtained by dividing the inventory-index of finished goods by the sales index (multiplying the result by 100). Both indices are obtained from a monthly survey in the manufacturing industry. The sales index refers to the value of shipments by manufacturers. The inventory-index pertains to the value of the stocks of finished goods for the manufacturing industry at the end of the month. The index of inventory and the sales index are both normalized to 2005=100 and therefore the inventory-to-sales ratio is also automatically normalized to 2005=100. Since both indices are value based (quantity times price) the correction of the inventory-to-sales ratio for price effects is assumed to result from the division of the two indices, whereby an inventory-to-sales volume ratio is obtained.

The sales index has a clear seasonal pattern, as can be seen from figure 2.1.

Graph 2.1 ; The unadjusted sales index from January 2004 to June 2010.

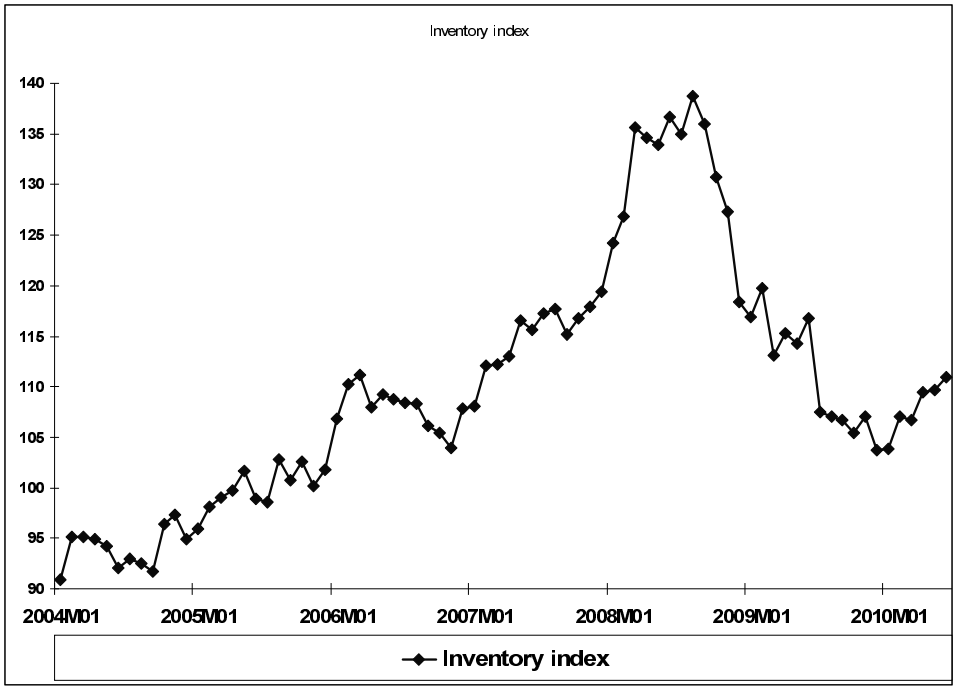


The seasonal adjustment was accomplished through the X12-ARIMA program. In the automatic mode, X12-ARIMA chooses a multiplicative seasonal adjustment and the chosen ARIMA model is `(2 1 0)(0 1 1)`. With one exception, for filtering the standard filters of X12-ARIMA were used. For the trend filtering the 12-term centered moving average and the 9-term and 13-term Henderson filter were used.

For the seasonal the 3x3 and 3x5 moving average were used. Only for the final seasonal filtering the 3x5 moving average filter was dynamically selected. The quality of the seasonal adjustment is given within X12-ARIMA by the M values, which should all be smaller than 1. Due to the clear seasonal pattern, all the M values where indeed much smaller than 1 and the overall "mark" was 0.28. The large jump in level at the end of 2008, is seen as an outlier and temporarily removed. After the seasonal adjustment the outlier is put back into the data. The critical value for the detection of outliers in X12-ARIMA was set to 3.8 (critical=3.8, types=all).

Probably due to the high aggregation level the inventory (value) index does not have a clear seasonal pattern according to X12-ARIMA. This is also clear from figure 2.2, depicting the inventory index. For this reason the inventory index has not been seasonally adjusted.

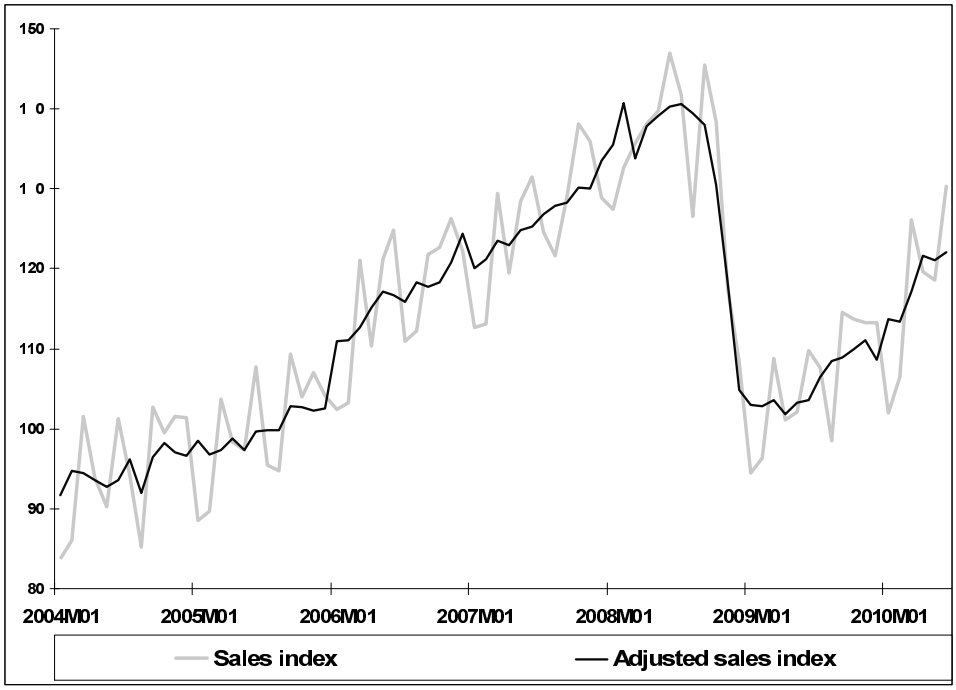
Graph 2.2; The manufacturing inventory (value) index of finished goods from January 2004 to June 2010.



The sales index has also been adjusted for trading day effects. First, it was examined whether sales can be adjusted individual days of the week with Sunday. The t-values for some of the weekdays turned out to be too small to be significant. The t-value for Tuesday. for example, was only 0.19. For this reason the data were only adjusted for weekdays versus weekend days. The t-values are now large, 13.82 for weekdays and thus -13.82 for the derived weekend days. The data has also been adjusted for holiday and bridge day effects. The specification of these variables is described in the Dutch document "Correctie voor feest- en brugdagen" by Michiel Jansen. The t-value of the corresponding regression variable is high: t=-3.26 showing that the correction is significant.

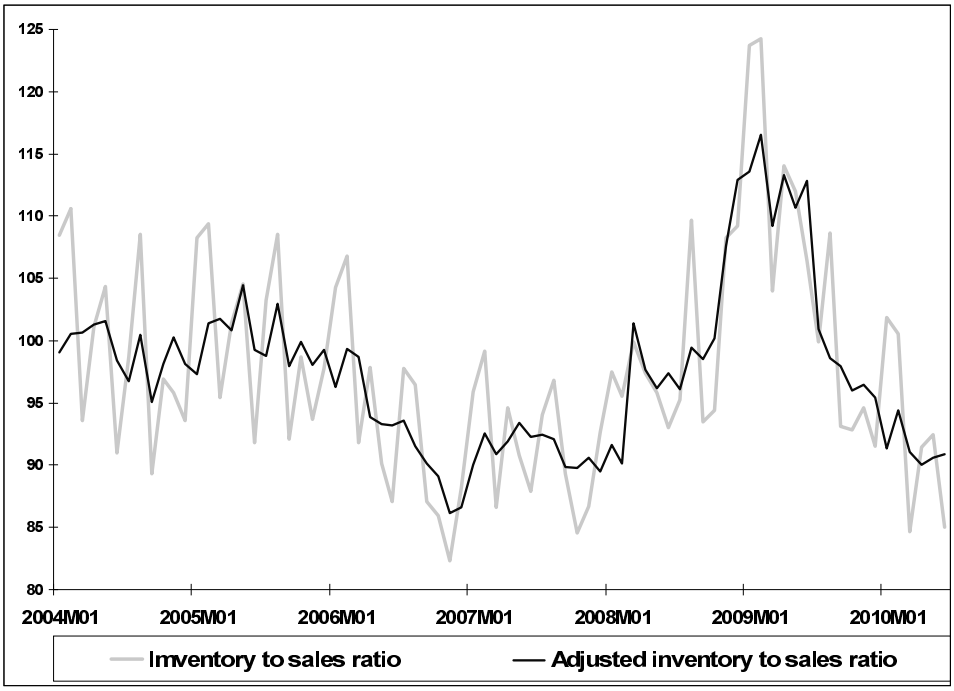
The final sales index adjusted for seasonal, trading day, bridge day and holiday effects, together with the unadjusted index, is depicted in figure 2.3.

Graph 2.3 ; The unadjusted and adjusted sales index from January 2004 to June 2010.



The corresponding unadjusted and the adjusted inventory-to-sales ratio are now shown in figure 2.4.

Graph 2.4 ; The unadjusted and adjusted inventory-to-sales ratio from January 2004 to June 2010.



The US versus the Dutch inventory-to-sales

In the United States the inventory-to-sales ratio has been compiled from 1992 onwards by the US bureau of the Census, and the results are freely available on the internet.

Graph 2.5 ; The US manufacturing inventory-to-sales ratio from January 1992 to June 2010.

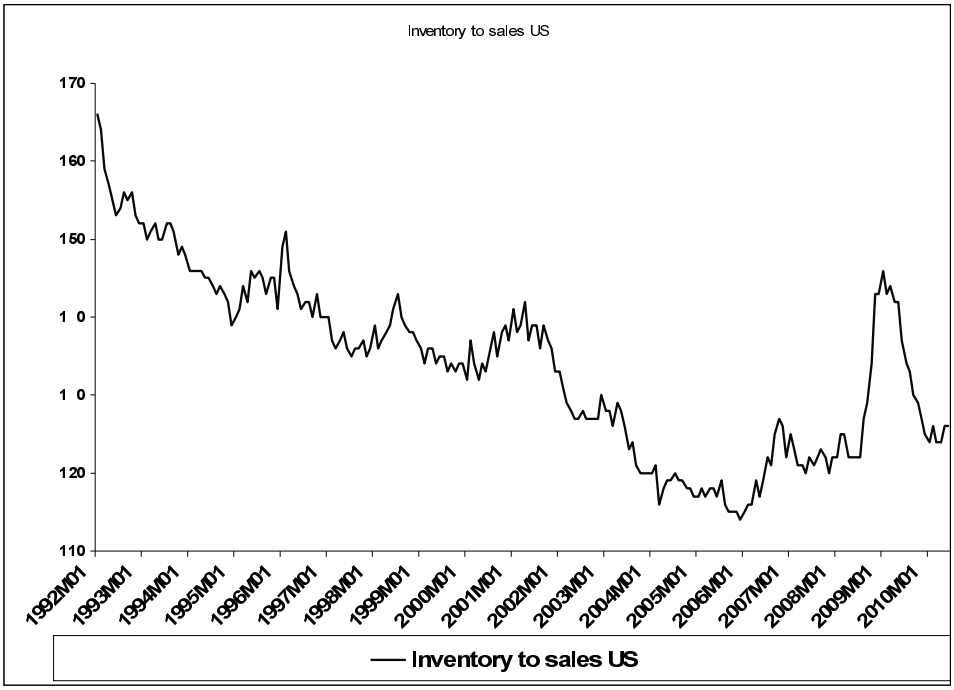
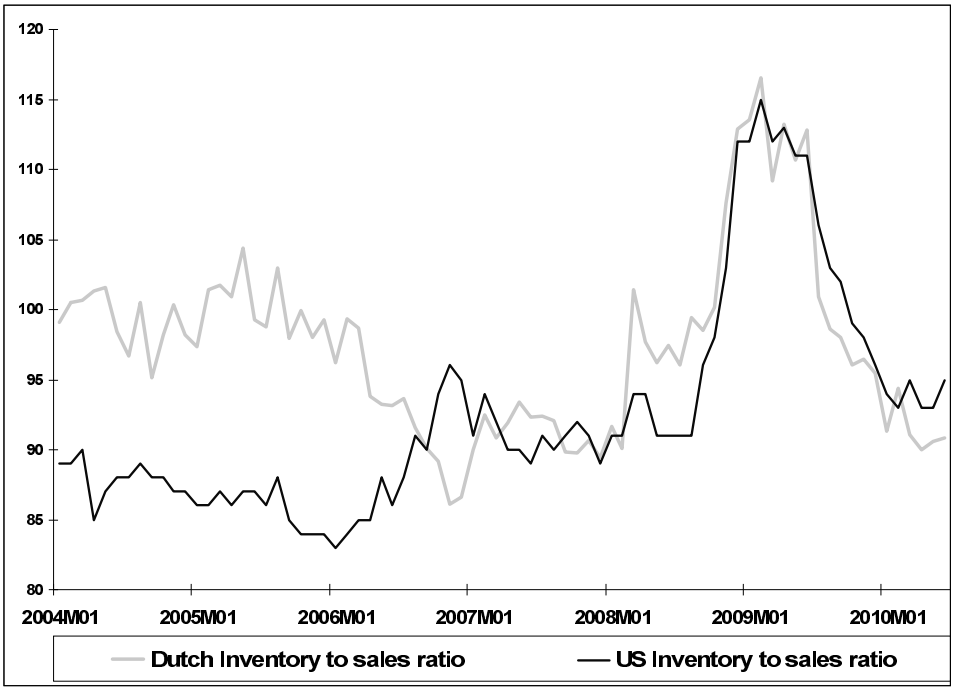


Figure 2.5 depicts the US inventory-to-sales ratio over a period of 18 years for the manufacturing industry. It shows that inventory-to-sales ratio has decreased steadily over time, an indication of the improved control over inventory due to, among other things, developments in information technology. Figure 5 also shows that in the second half of 2008 there has been an unprecedented increase in the inventory-to-sales ratio.

The US inventory-to-sales ratio is determined directly from the level of sales and the level of inventory. For example, in June 2010, in millions of dollars, the level of sales was 411177, while the level of inventory equaled 519999. From these figure the inventory-to-sales ratio for manufacturing is directly obtained: 519999/411177*100=126. The Dutch inventory-to-sales ratio is determined from the index of sales and the index of inventory, so the Dutch inventory-to-sales ratio should actually be called the inventory index to sales index ratio. The reason for using indices instead of levels is that the inventory index is composed via a chained index. The inventory index is expressed as a product of month-to-month inventory level ratios, using only companies that have responded in both months with plausible values. In this way response errors and nonresponse effects are corrected.

The US inventory-to-sales ratio pertains to the US economy while the Dutch inventory-to-sales ratio pertains to the Dutch economy, and so the two ratios are not equal. Fig. 2.6 shows the US inventory-to-sales ratio together with the Dutch inventory-to-sales ratio. Although the inventory-to-sales ratios of the two countries tend to develop differently, the sudden increase in inventory-to-sales ratio is visible in both.

Graph 2.6 ; The US and Dutch manufacturing inventory-to-sales ratio from January 2004 to June 2010



It is quite remarkable that these two indices, compiled independently and in a slightly different way, have such a similar change over time in a period of sudden increase. The US and Dutch inventory-to-sales ratios increased and decreased at the same time. This shows that this was a response to a financial crises which had an almost immediate effect on both the US and Dutch economy. A gradual crisis in the real economy of the US would have a delayed effect on the Dutch economy.

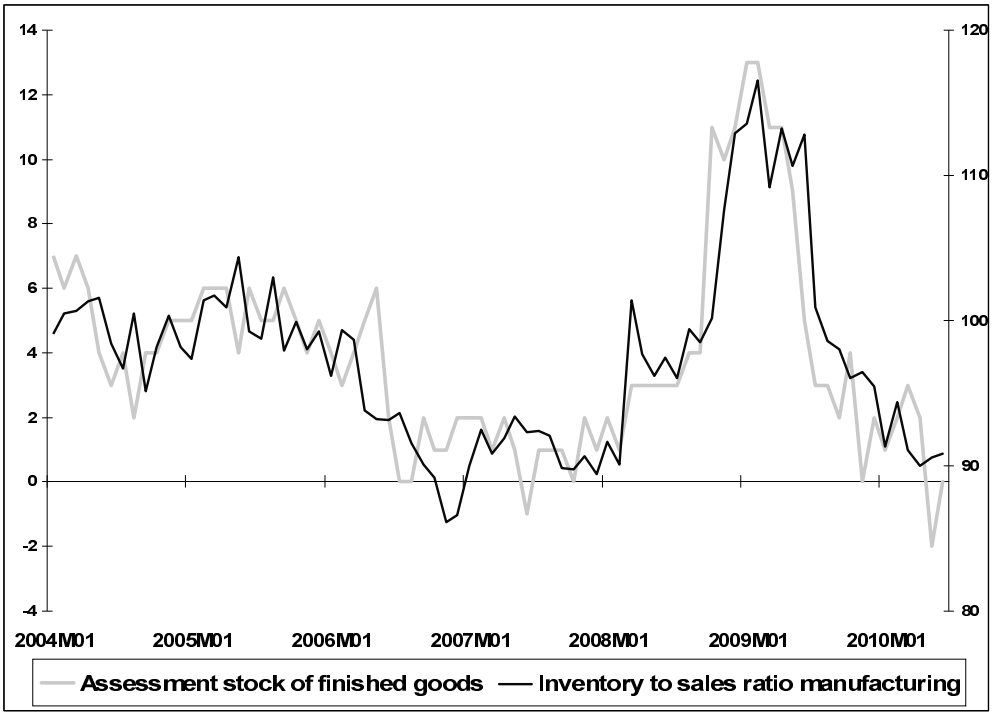
3. Inventory to sales ratio and assessment stock of finished goods

A natural test of the plausibility and meaning of the inventory to sales ratio in manufacturing is to compare it to the assessment of the stock of finished goods from the business survey in the manufacturing industry. A good match is expected as manufacturers are asked whether in their opinion;

> *Taking into consideration the expected level of sales, we judge the level of stocks of finished goods to be:*
>
> *1) (too) large*
>
> *2) sufficient*
>
> *3) (too) small*

The assessment series is produced from this survey by taking the balance of the percentage of respondents answering (too) large and the percentage answering (too) small. Important is that producers are not asked for their assessment of the level of stocks per se, but in relation to the (expected) level of sales, which means that there is a clear conceptual link to an inventory to sales ratio. Given that, after seasonal correction, sales do not change all that much from month to month, using current sales in stead of future sales is an acceptable approximation. This conceptual match between the ISR and the assessment of the stock of finished goods is accompanied by the strong resemblance visible in the actual data, see graph 3.1. This close match is even more significant given the fact that these statistics result from completely separate surveys.

Graph 3.1; Inventory to sales ratio manufacturing industry compared to assessment stock of finished goods (balance) from manufacturing industry survey.



The correlation at lag 0 between the ISR and the assessment of the stock of finished goods is 0.837. Correlation has a maximum of 0.870 at a lead of one month for the survey assessment. These correlations are high, indicating a strong link between the ratio of inventory to sales and the assessment of the stock of finished goods. The slight lead of the assessment is somewhat puzzling. It seems to suggest that inventories are adjusted to reach some desired level relative to sales. However, the assessment question in the survey asks whether stocks of finished goods are *too* high or *too* low relative to expected turnover. Therefore, a high realisation of the assessment question indicates that stocks are considered too high, which makes a further increase, as suggested by the lead over the ISR, undesirable. It seems therefore more plausible that the lead of the assessment is not causal, but reflects some kind of information lead or a certain forward looking aspect in assessing the level of inventories.

A number of modelling exercises were performed to further investigate the relationship between the ISR and the assessment of the stock of finished goods. The Kwiatkowski, Phillips, Schmidt, and Shin and Ng and Perron indicated that both series are stationary. Thus all further estimations were performed on the untransformed series. A pairwise Granger causality test was performed, using 1 lag as indicated by lag length tests (table 3.1).

Table 3.1; Results of Granger causality tests between Inventory to sales ratio in manufacturing industry (ISR) and the assessment of the stock of finished goods from the manufacturing industry survey. Both series in levels.

Pairwise Granger Causality Tests
Date: 09/02/10 Time: 15:18
Sample: 2004M01 2010M12
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
ISR does not Granger Cause assessment	77	3.16343	0.0794
assessment does not Granger Cause ISR		33.1357	2.E-07

Table 3.2; VAR of Inventory to sales ratio in manufacturing industry (ISR) and the assessment of the stock of finished goods from the manufacturing industry survey. Both series in levels, lag length tests indicated use of 1 lag.

Vector Autoregression Estimates
Date: 09/02/10 Time: 15:18
Sample (adjusted): 2004M02 2010M06
Included observations: 77 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	assessment	ISR
assessment(-1)	0.699989	1.015915
	(0.10714)	(0.17649)
	[6.53351]	[5.75636]
ISR(-1)	0.091599	0.474632
	(0.05150)	(0.08484)
	[1.77860]	[5.59475]
C	-7.840529	47.11530
	(4.67867)	(7.70703)
	[-1.67580]	[6.11329]
R-squared	0.743451	0.839975
Adj. R-squared	0.736517	0.835650
Sum sq. resids	195.0106	529.1606
S.E. equation	1.623354	2.674102
F-statistic	107.2219	194.2140
Log likelihood	-145.0343	-183.4665
Akaike AIC	3.845048	4.843286
Schwarz SC	3.936365	4.934603
Mean dependent	3.844156	97.38589
S.D. dependent	3.162548	6.596190
Determinant resid covariance (dof adj.)		17.21269
Determinant resid covariance		15.89757
Log likelihood		-325.0139
Akaike information criterion		8.597765
Schwarz criterion		8.780399

The Granger causality test results suggest a very strong influence of the assessment of the stock of finished goods on the inventory to sales ratio, while the effect the other way round was not significant at the 5% level. This again suggests that the direction of causation is from the assessment of the stock of finished goods to the ISR. This is confirmed by performing a VAR-analysis, where the block exogeneity test shows that the ISR can be dropped from the equation explaining the assessment of the stock of finished goods, but that the assessment is significant in explaining ISR, see tables 3.2 and 3.3. R^2 of both equations in the VAR were high, at 0.743 for assessment of stock of finished goods and 0.840 for ISR. Residual tests were acceptable.

Table 3.3; Block exogeneity test from VAR of Inventory to sales ratio in manufacturing industry (ISR) and the assessment of the stock of finished goods from the manufacturing industry survey.

VAR Granger Causality/Block Exogeneity Wald Tests
Date: 09/02/10 Time: 15:20
Sample: 2004M01 2010M12
Included observations: 77

Dependent variable: assessment

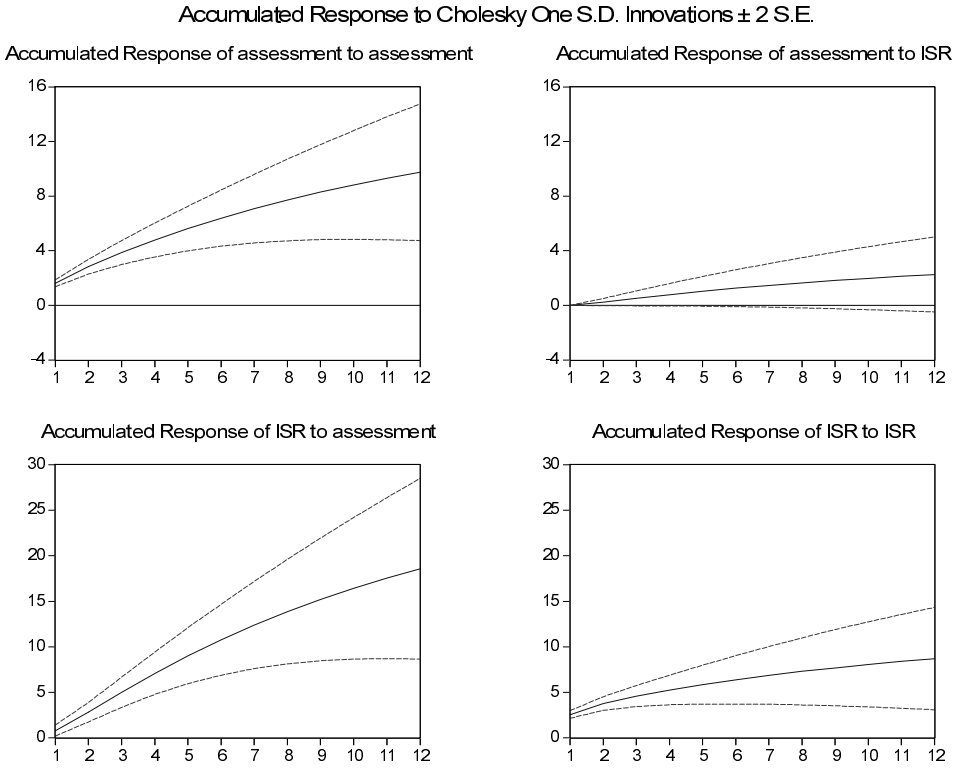
Excluded	Chi-sq	df	Prob.
ISR	3.163428	1	0.0753
All	3.163428	1	0.0753

Dependent variable: ISR

Excluded	Chi-sq	df	Prob.
assessment	33.13570	1	0.0000
All	33.13570	1	0.0000

Impulse response (1 sd) analysis, graph 3.2, also shows a far stronger response of ISR to assessment of stocks than the other way round.

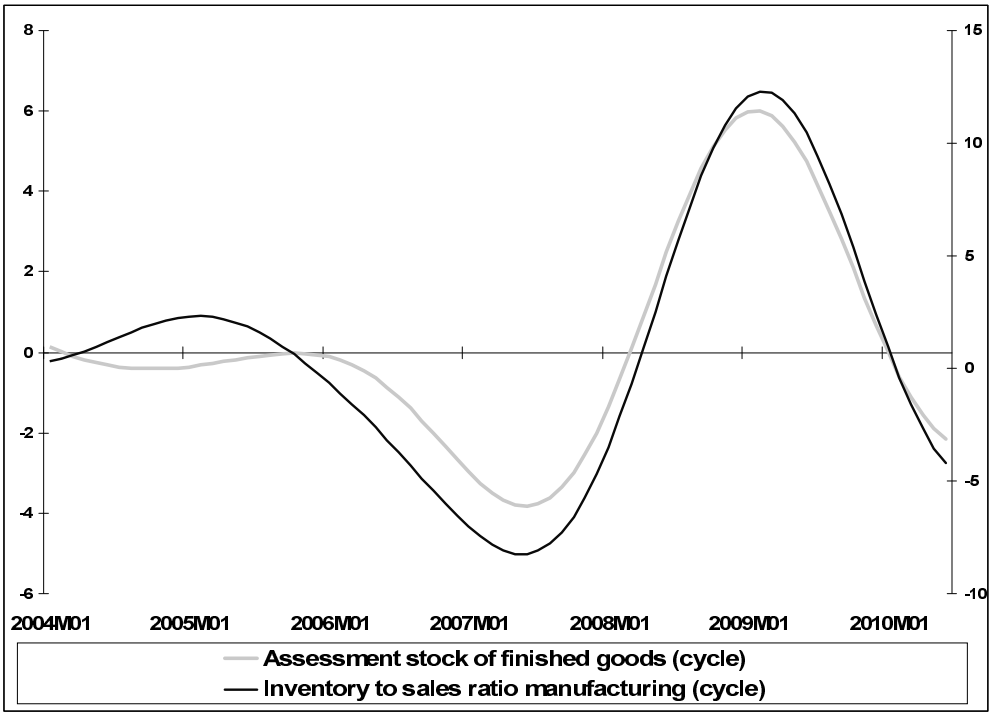
Graph 3.2; Impulse response analysis of VAR of inventory to sales ration (ISR) and assessment of stock of finished goods in manufacturing. VAR contained 1 lag, graphs show cumulative response to 1 standard deviation shock.



Again, these results are somewhat puzzling. As explained earlier, a causal link between the assessment of inventories from the survey and the ISR is unlikely, given the nature of the assessment question. Assessing the level of inventories as too high (a high assessment realisation) would logically result in an lowering of the ISR if a causal link was present, i.e. a negative coefficient of the assessment in the ISR-equation of the VAR. As mentioned before, the leading/causal nature of the survey assessment is probably due to some type of information lead. An alternative possible explanation here is that the assessment series is less nosy than the ISR, resulting in better predictive properties in a time-series analysis context.

The somewhat noisy character of both indicators makes it difficult to perform a turning point analysis. This is better done by comparing the cyclical component of both series. Using the Christiano-Fitzgerald bandpass filter, the short-term and trend components were filtered out. This means that only medium-term, or business cycle, frequencies remain, the so-called cycle. The resulting series are much smoother, highlighting the very close match between the ISR and the stock assessment, see graph 3.3.

Graph 3.3; Cycle of Inventory to sales ratio manufacturing industry compared to cycle assessment stock of finished goods (balance) from manufacturing industry survey. Cycle computed using full sample Christiano-Fitzgerald filter, 24 months-120 months.

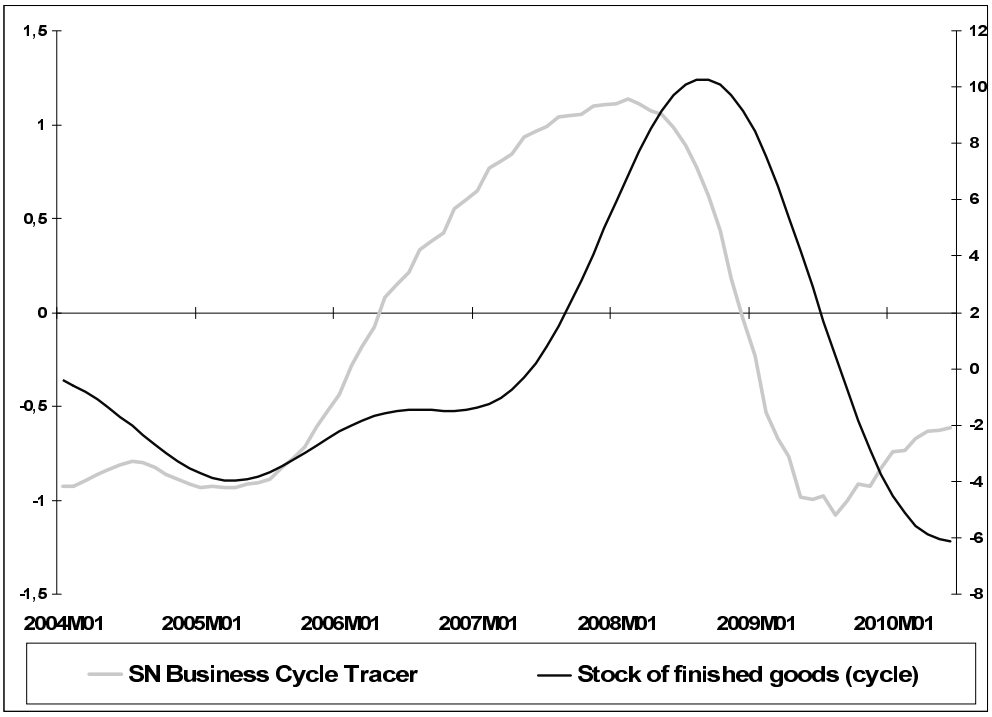


At business cycle frequencies the correlation between the two series is exceedingly high, a maximum of 0.973 at lag 0. The major turning points also occur in both cyclical series at the same time, see table 4.1. Having computed the cyclical component of the ISR, a next logical step is to compare the ISR-cycle to the Dutch business cycle in general.

4. Inventory to sales ratio and the Dutch business cycle

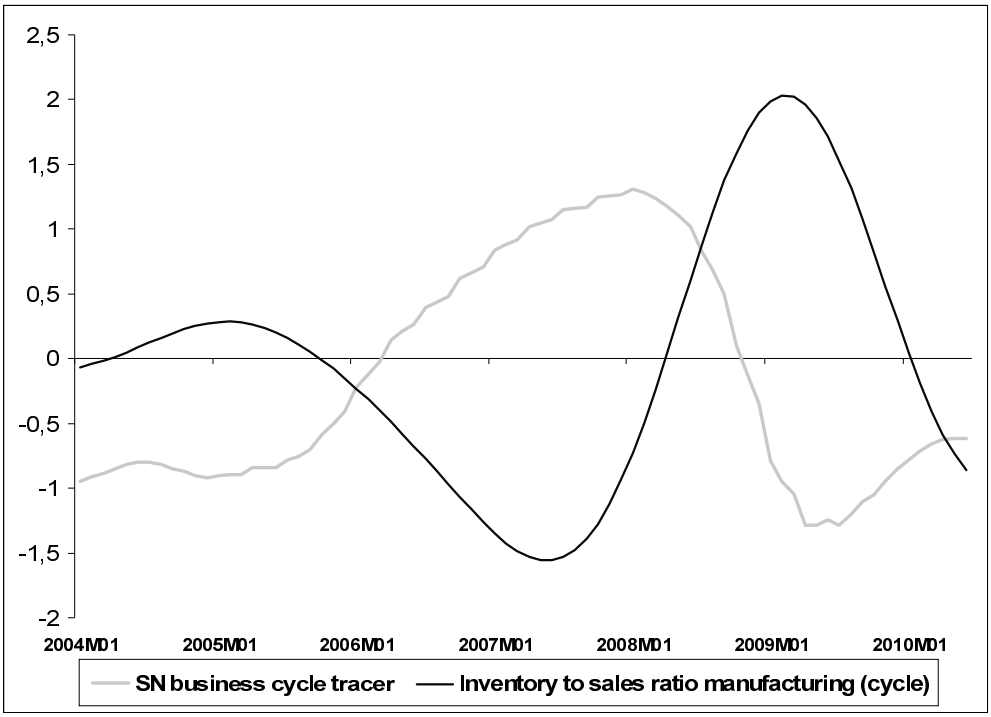
For analytical reasons, it is interesting to consider first the cycle of the stock of finished goods in the manufacturing industry per se. In graph 4.1 this is compared to the Dutch business cycle, which is characterised using the core indicator of the Statistics Netherlands Business Cycle Tracer. It is the simple average of the component indicators of the BCT, which are all (trend)filtered and normalised.

Graph 4.1; Dutch business cycle 2004-2010 m6 according to Statistics Netherlands Business Cycle Tracer compared to cycle of stock of finished goods in manufacturing (cycle computed using full sample Christiano-Fitzgerald filter, 24 months-120 months).



As shown, the manufacturing inventory-cycle (finished goods) lags the general business cycle, though it is procyclical and has a high correlation of 0.900 at a lag of 9 months. Now, graph 4.2 shows the BCT indicator next to the cyclical component of the inventory to sales ratio. This exhibits rather different behaviour.

Graph 4.2; Dutch business cycle 2004-2010 m6 according to Statistics Netherlands Business Cycle Tracer compared to cycle of inventory to sales ratio in manufacturing (cycle computed using full sample Christiano-Fitzgerald filter, 24 months-120 months). Both indicators have been normalised.



The ISR is both countercyclical and leading. All in all, the ISR is shown to be an excellent business cycle indicator. For a start, it matches all the major developments in the Dutch business cycle, as represented by the BCT-indicator, without any interfering idiosyncratic cycles. This is reflected in a very high correlation of -0.852, with a lead of 6 months for the cycle of ISR compared to the BCT-indicator. That is the second reason why the ISR is an important business cycle indicator, it is a pure leading indicator as the lead is also present at turning points, see table 4.1. Good leading indicators are relatively rare. Usually, these are sentiment or financial indicators. The ISR is a pure real indicator, based on sales and inventory of goods, and this is the third reason why the ISR is a valuable new business cycle indicator. Its leading properties are somewhat “harder”.

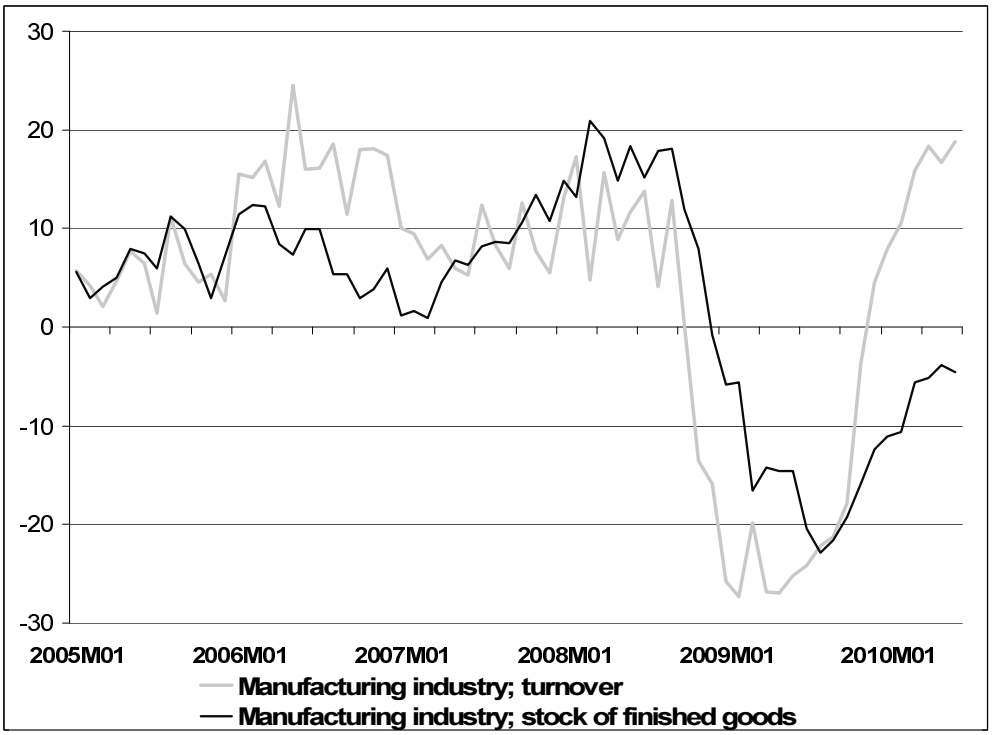
Table 4.1; Dating of major business cycle turning points in the period 2004-2010 m6, according to Statistics Netherlands business cycle tracer, and the cycles of inventory to sales ratio manufacturing and assessment of stock of finished goods manufacturing industry survey (cycles computed using full sample Christiano-Fitzgerald filter, 24 months-120 months).

	Business cycle tracer	*Inventory to sales ratio (cycle)*	*Assessment stock of finished goods (cycle)*
Peak 2008	2008 m1	2007 m6	2007 m6
Trough 2009	2009 m7	2009 m2	2009 m2

The ISR is a countercyclical indicator, i.e. it moves against the general business cycle. One explanation could be that in a business cycle upswing, sales will grow fast, and demand tends to be higher than expected, depleting inventories. Thus, as the business cycle swings up, the inventory to sales ratio will go down. In a downturn, the reverse will be true, with lower sales resulting in increasing inventories, and thus in an increasing ISR. But Bils and Kahn (2000) argue that developments in the inventory to sales ratio are far too persistent (i.e. last too long) to be caused by short-term sales surprises. A better explanation might be the production smoothing model, which states that as adjusting production is difficult and/or costly, firms prefer to let inventory adsorb fluctuations in sales [Bils and Kahn(2000), Khan(2003)]. This means that in upswings, inventories will be run down as sales increases. In downswings, unsold production will end up in the inventory. The net effect is a countercyclical inventory to sales ratio. This reasoning applies especially to the stock of *finished* goods [Tsoukalas (2005)], and therefore to the ISR as presented in this paper. Another explanation is offered by the paper of Bils and Kahn (2000), which states that stocks are maintained to meet expected demand. Countercyclical ISR's are explained by the relatively high cost of holding inventory during economic boom phases. The advantage of this theory is that it can explain the observed positive correlation between sales and inventory and the procyclicality of inventory itself [Bils and Kahn(2000), Khan(2003), Khan and Thomas(2007), Tsoukalas (2005)]. Other theories focus more on the cost of ordering and processing inventory [Khan and Thomas(2007)]. In that approach, firms order only new inventory when a critical lower level is reached, and then they order in large quantities. This kind of theories results in a procyclical ISR, but does not seem to be relevant for the stock of finished goods, as considered here.

A qualitative analysis of the behaviour of the (year on year) growth rate of both turnover and the stock of finished goods in the Dutch manufacturing industry can be helpful here, see graph 4.3.

Graph 4.4; Relative year-on-growth rates of indices of turnover and stock of finished goods in the Dutch manufacturing industry.

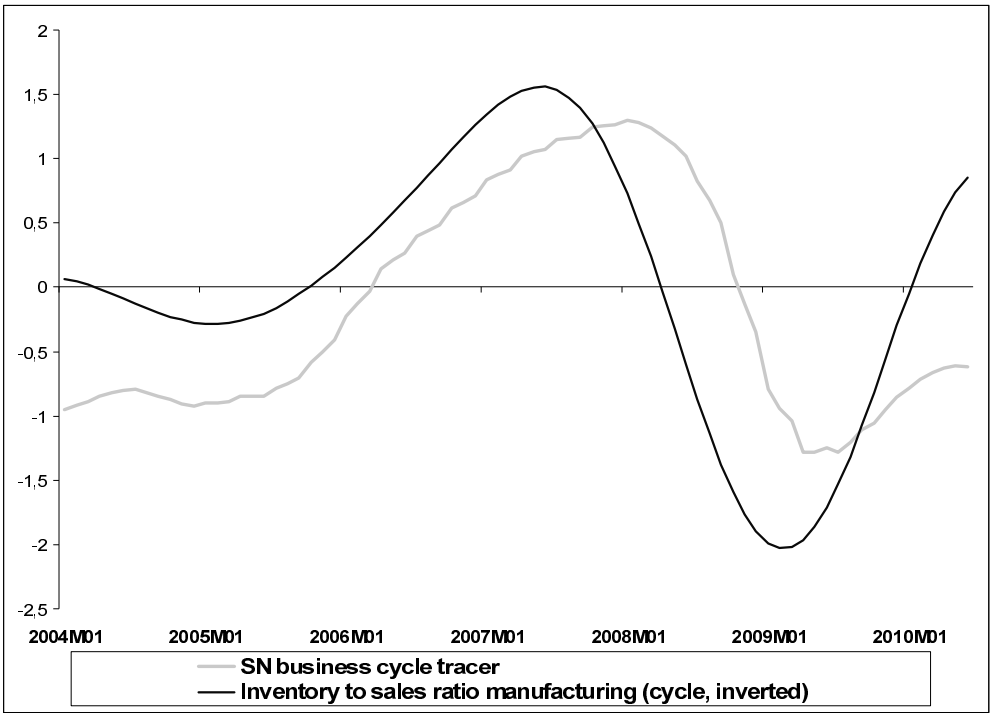


It is immediately visible that the development of inventories tracks that of turnover. Thus, production smoothing does not seem to be present, as this would require an inverted relationship between turnover and inventory development. It does seem to be the case that inventories are managed to meet expected demand; i.e. when turnover growth is high, inventories are build up to prevent being unable to meet customer demand. When turnover growth slows down or becomes negative, inventories are run down to prevent ending up with unsold goods. The cyclical behaviour of the ISR in this period has two causes; inventory development is generally somewhat weaker than turnover development, resulting in *relative* declines and increases of inventories compared to sales. An in 2008-2009 there seems to be a phase difference, where inventories lag sales, resulting in an increase in the ISR.

What is clear is that the inventory to sales ratio behaves different from inventory by itself, as this lags the business cycle. The ISR allows a more nuanced and relevant analysis of the development of inventory and sales. Why the ISR is leading is less clear. In the Netherlands manufacturing *production* is roughly coincident with the general business cycle, whilst in the United States the ISR is part of the Conference Boards lagging indicator. One explanation for this difference in behaviour could be that the inventory to sales ratio commonly used as a business cycle indicator for the United States concerns total business, i.e. manufacturing and trade.

The nonetheless excellent match between the ISR-cycle and the general Dutch business cycle becomes much clearer when the IR-cycle is inverted, i.e. reflected in the x-axis, see graph 4.4.

*Graph 4.4; Dutch business cycle 2004-2010 m6 according to Statistics Netherlands Business Cycle Tracer compared to **inverted** cycle of inventory to sales ratio in manufacturing (cycle computed using full sample Christiano-Fitzgerald filter, 24 months-120 months). Both indicators have been normalised.*



5. Discussion and recommendations

This paper presents a method to construct a new business cycle indicator from the indices of sales and stocks of finished goods in the manufacturing industry. The so-called inventory to sales ratio (ISR) in manufacturing is computed by first correcting sales for seasonal and trading day effects, and then dividing the inventory index by the sales index. The ISR offers a radically different way of analysing developments in the stock of finished goods. It shows how the stock of finished goods develops relative to the development of sales, scaling it as it were. Not only has an increase in stocks a rather different interpretation depending on whether sales are rising or falling at the same time, but it is also relevant whether sales or stocks increase faster. This study shows that the ISR is very tightly connected to the assessment of the stock of finished goods from the manufacturing industry survey. Tests show causation to run from the assessment to the ISR, suggesting that manufacturers adjust the level of stocks to bring it into line with (expected) sales. It is argued here that this is unlikely, as a high assessment, which leads large values of the ISR, means that producers already find their level of inventories *too* high. The lead of the survey assessment is more likely due to some kind of information lead or the presence of a certain forward looking component.

The main use of the ISR is as a business cycle indicator. Whereas the cycle of the stock of finished goods by itself lags the Dutch business cycle, the cycle of the ISR leads the business cycle, with a lead of about six months both on average and at turning points, at least in the period for which data are available. A note of caution is required here. Data on the stock of finished goods in the Dutch manufacturing industry are only available from 2004 onwards. This means that the whole analysis here is based on the relatively short time span of six and a half years, less than a full business cycle. On the other hand though, the ISR is a rare example of a "real" leading indicator. Most leading business cycle indicators tend to be sentiment or financial indicators. Correlation with the Dutch business cycle is high, and there is no evidence of distorting minor cycles. The ISR does develop countercyclically, i.e. the ISR cycle is at a minimum when the business cycle peaks and vice versa. This is not a problem for a business cycle indicator. It is shown here that stocks of finished goods are managed to meet expected demand, increasing with increasing sales and decreasing with decreasing sales. The cyclical behaviour of the ISR is explained mainly by the relatively weak response of inventories. At this aggregate level, there is no evidence for the use of inventories for. production smoothing. The general conclusion is that the inventories to sales ratio in manufacturing is a sensitive indicator for changes in the business cycle.

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