A Microdata Study of Company Expectations from Business Surveys. Part I; The Relationship with Turnover Realisations Third draft march 2006

Discussion paper 07006

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Explanation of symbols

.	= data not available
*	= provisional figure
x	= publication prohibited (confidential figure)
–	= nil or less than half of unit concerned
0 (0,0)	= less than half of unit concerned
–	= (between two figures) inclusive
blank	= not applicable
2005?2006	= 2005 to 2006 inclusive
2005/2006	= average of 2005 up to and including 2006
2005/'06	= crop year, financial year, school year etc. beginning in 2005 and ending in 2006
2003/'04?2005/'06	= crop year, financial year, etc. 2003/'04 to 2005/'06 inclusive

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

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Summary: *This study is based on a dataset containing business survey variables and actual turnover realizations at the firm level, which are used to study the link between production expectations and turnover realizations. The aim was to formally test the connection at the micro-level between expectations and realizations, and to test whether expectations are connected more to single month/short-term turnover developments, or more to medium-term developments.*

On their own, expectations were not very good at predicting turnover development, but when added to autoregressive or more complex models, they did add significant information. Production expectations were shown to possess a strong relation with firms' average turnover development over longer periods and a weaker or no relation with short-term (single month) turnover changes. The month-on-month and three-month measures of turnover development were shown to be dominated by seasonal fluctuations. The connection between these measures of turnover development and production expectations is mainly attributed to a similar seasonal pattern. The measures of average medium-term(six/twelve months) turnover development were more representative of developments in business conditions connected to the business cycle. The strong link between production expectations and these medium-term turnover developments shows that when reporting their expectations, producers are clearly influenced by trends in production and the general outlook for their business. Expectations are less representative of turnover realizations in individual months Overall, these results support the use of Business Survey data in business cycle analysis and forecasting.

Keywords: Business Survey, Industrial production, Business cycle, Manufacturing industry, production expectations, forecasting, micro-data, expectation formation.

1. Introduction

Surveys are widely used in economic analysis, as before realizations are available, they give a quick impression of current economic developments. Next to this, they are useful in forecasting. But maybe even more importantly, as they reflect consumers' and firms expectations, they can be used to gauge the future developments in the economy. Expectations also play an important role in economic theory, expectations of the future influence current behavior, and may influence the way people react to economic policy.

For the more practical uses, it is interesting to know how well expectations reflect actual turnover development and what measure of turnover development expectations reflect the best. This could be the short-term month-on-month changes in turnover, or monthly year-on-year changes, or some form of longer term moving average. Each of these measures of turnover development has distinct properties, and may reflect short-term developments in turnover or more medium-term developments in business conditions, connected to the business cycle. To give a more solid base for the use of Survey variables in economic analysis, it is important to address these questions. A number of studies have used aggregate survey data, both for consumers and for firms, to address these questions. Only a few have been able to use micro-data, which allows the researcher to study expectations of individual agents. In order to assess the quality of expectations, it is necessary for realizations to be available against which to test expectations. For this study, a combined data set at the firm-level of expectations and turnover realizations was constructed. Hence, individual expectations can be confronted with their corresponding actual realizations. Different measures of turnover development, both short- and medium-term, were compared with production expectations, to test which one has the strongest connection with expectations. Due to the qualitative nature of the Survey data, logit-models were used in all cases to perform the tests. It turns out that firms' expectations are rather complex, being both forward- and backward-looking, possessing a clear seasonal pattern but also a component related to medium-term, business cycle developments.

The first part of this study summarizes some results from earlier research, as background information. Then the dataset and the variables used are described. The results section consists of two parts; One looking at the properties of expectations and different measures of turnover development at the aggregate level. This gives a picture of how these variables have evolved in the time period considered, and their properties. Some preliminary conclusions can then be drawn as to how well expectations correspond to different measures of turnover development. Next, these relations were formally tested at the micro-level using logit-models.

2. Background

This section will review some empirical evidence from the literature on the nature and quality of survey outcomes from business surveys.

Aggregate macro-data have been used as well to study the quality of expectations. Mayers and Mors[1990] use different econometric models and the Kalman filter to evaluate how expectations react to new information. From the BCI-survey, expectations of new orders and employment were selected. They show that expectations can be satisfactorily modelled as random walks with drift or simple autoregressive processes. In the confrontation with realisations for new orders, simple random walk models or autoregressive ones yielded better predictions than expectations. The general conclusion is that firms do not respond adequately to new information. Temporary shocks tend to be interpreted as permanent changes, whilst permanent changes are only gradually recognised. Overall, firms seem to depend too much on prior beliefs, resulting in systematic errors. Holden et al.[1985] summarise a number of macro studies, both of consumer expectations and business expectations of various countries. Relatively simple ARIMA models were found to outperform expectations and readily available macro-economic information can improve the expectations.

These previous results seem to bode ill for the usefulness of Business Surveys. However, the value of business surveys is more in business cycle analyses and economic forecasting then in a one-on-one relation with production realisations. Quite a few studies have looked into this. Boehm[1993] analyses the usefulness of Business surveys in monitoring the business cycle for Australia and the UK. A clear relation is found, though simple net balances exhibit numerous extra cycles. Several components of the survey were found to be leading the business cycle by as much as nine months. Hinchcliffe and Pritchard [1999] from the Australian bureau of statistics see a definite, though noisy relation between expected changes from the business expectations survey and the realisations for a number of major economic variables. Batchelor[1982] used expectations in the manufacturing industry in Belgium, Italy, France and Germany. He found that though models containing business survey data were not without merit, they performed worse than simple ARMA models. On the other hand, business surveys were uniformly best in predicting turning points, a very useful property. Hanssens and Vanden Abeele [1987]found that the production expectations for three different sub sectors of the manufacturing industry in Belgium, the Netherlands, Italy, Germany and France did not Granger-cause industrial production. Madsen[1993] tested the value of business survey results in predicting industrial production for eight OECD countries. In all cases except one, the business confidence index was significant in predicting industrial production. For quarterly data, they even were useful two quarters ahead.

For monthly data, the most significant lags of the Business Conditions Index(BCI) was three to four months. In models using additional exogenous variables, such as interest rates, money stock and stocks of finished goods, the BCI variables remained significant. In out-of-sample forecasting, models with business survey variables performed better than those without. Bodo et al. [2000] tested a host of different models for predicting Euro area industrial production, both in the aggregate and for individual countries Adding the European business confidence Index improves results. Simpson et al.[2001] forecasted the quarterly change in the seasonally adjusted production index for Britain. Two important conclusions were drawn from this. The optimism balance reflects future developments of production, but it does not contain all available information, as in more comprehensive models financial variables are even more significant. This points to the presence of deficiencies in the forecasting process of firms. Two studies on forecasting Finnish and Swedish industrial output find survey data of limited use. [Rahiala and Terasvirta (1993), Kauppi et al. (1996)].Interestingly, for Sweden only the change in output-question was relevant, whilst for Finland only answers about new orders and exports. This may indicate that for different economies, different aspects of surveys are relevant.

3. Data description and considerations

Statistics Netherlands publishes both a monthly index of turnover in the manufacturing industry as well as a monthly Manufacturing Business Survey (MBS). Therefore, for both statistics data are available for individual firms, i.e. at the micro level. Combining these datasets creates the opportunity to study the interaction between producer's expectations and actual realisations. A combined dataset coupled at firm-level was created containing turnover data for the period 1999-2003 and survey data for the period 2001-2003. The sample consists of 1852 firms.

The Manufacturing Business Survey (MBS) uses a relatively straightforward approach to get a quick impression of firms' assessment of their current situation, business conditions, and their expectations of the near future. About a quarter of firms in manufacturing industry are surveyed, once every month. The survey process slightly complicates matters. Surveys arrive at the participating companies at the beginning of the reporting month, and answers are collected till day 24 of that month. Therefore, opinions about the developments in month t are collected during and before the end of that same month t.

Broadly speaking, two types of questions are asked; assessments of the current stance of some relevant quantity (normal, large, small), and expectations or tendency (increase/remain the same/decrease) of the development of some variable. This study focuses on the question concerning the "Expectation of the tendency of the level of production in the coming three months (compared to this month)", which will be referred to as "production expectations" (abridged as $\mathbf{PE}_{t+3|t}$). This question was singled out as this best reflects producers expectations of the future, and is therefore of the most theoretical and practical interest. The influence of the other survey questions on expectations is considered in a further study[Van Ruth (2006)].

Note that these questions only result in qualitative answers, one of three possibilities "increase", "decrease" and "no change". For the published aggregate survey statistics, the percentage of firms reporting an increase is computed, as well as the percentage reporting an decrease, and the balance of these two percentage is the reported statistic. The fraction reporting "no change" is ignored. This approach will be used in this study as well. Only cases reporting "increase" or "decrease" are considered as incorporating the "no change" category in the analysis creates numerous difficulties. What range of turnover changes constitutes no change is impossible to determine beforehand. Generally, it is assumed that turnover changes need to cross a certain threshold before an increase or decrease is reported. Techniques have been developed to derive these from the data [Mitchell et all.(2001), Pearsan(1984)] but these are rather cumbersome, and applying the

computed thresholds to individual firms is debatable. For the sake of simplicity therefore, all rises in measured turnover realisation are categorized as an “increase”, and all other realisations as an “decrease”. For each variable/question, a 0/1 dummy variable is created, with 0 indicating a “down”-answer, and 1 an “up”-answer.

In the turnover survey, firms are asked to report the value of goods and services billed to costumers this month. This poses two problems as far as investigating the relation between expectations and realisations is concerned. Firstly, the business survey inquires into production expectations and realisations, whilst the turnover survey, of course, inquires after turnover. Price effects can cause production, defined by statisticians as a (deflated) volume quantity, and turnover to diverge. However, there are two reasons why I expect this not to be a great problem. The typical time span of interest in the business survey is one to three months, a period in which for most industries price effects are probably not very important. Furthermore, even though asked about production, a producer’s assessment of the state and direction of his business will probably be at least partly determined by the money value of production. For a start there is the possibility of monetary illusion. More importantly, the natural measures to assess the state of a business are turnover and profits, both monetary quantities. Therefore, turnover probably constitutes a good proxy for production as measured by the business survey.

A more serious problem is that turnover as billed to customers might be a poor reflection of current production/turnover levels in a firm. Some firms may work mainly on a few large projects, for which clients are billed only intermittently or after delivery. Also, the time lag between production and billing is unclear and may vary greatly. Using turnover to assess the quality of production expectations can therefore be difficult. The problem of infrequent billing can be mitigated by using longer-term averages of reported turnover. This will also help in the (potential) time lag problem, by including billings further in the future into the evaluation. It may also be the case that for many firms the time lag causes little problems. This will be the case in high-frequency or just-in-time production environments. But also if turnover develops somewhat smoothly over time, the general trend in turnover will match the trend reported in the business survey, even though it might possibly be shifted in time somewhat. Therefore, though turnover as reported in the Statistics Netherlands survey is an imperfect measure for comparison with firms’ expectations, a case can be made that the exercise should be possible and can yield valid information and conclusions.

An explorative study by Statistic Netherlands into the quality of Survey responses at the firm level found that on average 12.6% of firms always answered “remained the same” on the expectations question, irrespective of the actual realisations (in this case, month-on-month turnover changes). A further 27.5% gave answers which seemed to have no relation with the realisations, suggesting random completion of the survey. [Nieuwstad (2004)] This still means that at least 60% of the response contains meaningful information.

To determine how developments in turnover influence expectations and to address the concerns mentioned above, several different measures of firm turnover development were constructed:

1. The relative month-on-month change in turnover:

$$TOmom_t = \left(\left(turnover_t - turnover_{t-1} \right) \Big/ turnover_{t-1} \right)$$

As this quantity probably contains an important seasonal component, the year-on-year change was computed as well:

2. The relative year on year change in turnover:

$$TOyoy_t = \left(\left(turnover_t - turnover_{t-12} \right) \Big/ turnover_{t-12} \right)$$

Firms' production expectations as surveyed in the MBS concern the average development in the coming three months. Therefore a statistic was computed comparing the level of turnover in the current month t to the average turnover level in the coming three months:

3. The turnover in the current month compared to the average turnover in the coming three months.

$$TOma3F_t = \left(\left(\left(\sum_{i=1}^{i=3} turnover_{t+i} \right) \Big/ 3 \right) \Big/ turnover_t \right) - 1$$

A complementary statistic is the development relative to the past three months:

4. The turnover in the current month compared to the average turnover in the past three months.

$$TOma3L_t = \left(turnover_t \Big/ \left(\left(\sum_{i=1}^{i=3} turnover_{t+i} \right) \Big/ 3 \right) \right) - 1$$

The value of these statistics depends for a large part on the value of the turnover in month t. Large fluctuations in single month turnover values can therefore cause large fluctuations in the computed three-month development, which may not be representative for the overall tendency of production. A remedy is to compare the turnover in the coming three months to the turnover in the last three months. This

will smooth out the influence of irregular fluctuations, and also mitigate somewhat the problem of intermittent turnover bookings.

5. The turnover in the coming three months compared to the turnover in the past three months.

$$TOma3FL_t = \left(\frac{\sum_{i=1}^{i=3} turnover_{t+i}}{\left(\sum_{i=1}^{i=3} turnover_{t-i} \right)} \right) - 1$$

This last statistic helps in reducing the effect of random fluctuations and is probably more representative of the trend in production. Longer term averages will be even more successful at this. Using one year averages would be ideal, as this would completely eliminate seasonal effects. As the available dataset contains only three years of data, this would result in an unacceptable reduction of available observations. As a compromise, 6 month averages were computed. These statistics are interesting for another reason as well. They represent medium term trends in turnover, which might influence expectations in a different, perhaps more meaningful manner than the shorter-term turnover development measures.

6. The turnover in the current month compared to the average turnover in the coming six months.

$$TOma6F_t = \left(\left(\left(\sum_{i=1}^{i=6} turnover_{t+i} \right) \Big/ 6 \right) \Big/ turnover_t \right) - 1$$

7. The turnover in the current month compared to the average turnover in the past six months.

$$TOma6L_t = \left(turnover_t \Big/ \left(\left(\sum_{i=1}^{i=6} turnover_{t-i} \right) \Big/ 6 \right) \right) - 1$$

8. The turnover in the coming six months compared to the turnover in the past six months.

$$TOma6FL_t = \left(\frac{\sum_{i=1}^{i=6} turnover_{t+i}}{\left(\sum_{i=1}^{i=6} turnover_{t-i} \right)} \right) - 1$$

As a different approach to capturing medium-term trends in turnover, two multinomial categorical variables were created. These compare in the coming six months the number of months with declining turnover to the number of months with increasing turnover. Both month-on-month and year-on-year turnover changes were used.

9. NoyoyF6 = number of months in coming 6 months with positive year-on-year changes in turnover – number of months with negative changes

10. NomomF6 = number of months in coming 6 months with positive month-on-month changes in turnover – number of months with negative changes

Lagged values of both statistics, for the past six months, were computed as well. These were named avnodyL6 and avnodpL6.

These two statistics are generalized, medium term measures of whether the developments are positive or negative. The developments in each month are thus given equal weight, unlike in the previous statistics constructed to represent medium term trends,. In some cases, especially with sporadic large deliveries, this might result in an unrepresentative statistic. But in general they will probably be an interesting representation of each of the coming six months influence on the producer's expectations.

It should be noted that each of the statistics described here was transformed into a binomial variable when entered as the dependent variable in the logit-models. These categorical variables take the value 0 if the original statistic is smaller than zero (a decrease in turnover), and the value 1 for realisations larger than zero (an increase in turnover).

4. Results

4.1 Methodology

To formally test the significance and quality of the expectations, logit-models will be used. This choice of statistical techniques arises from the nature of the data. Expectations, as defined here, are up/down binary variables. When these are entered as the dependent variable in a logit-model, a logarithmic transformation is used to obtain a continuous probability distribution (for details see Appendix 1). This allows the model to estimate the probability of obtaining a 1 or 0 value for the dependent variable as a function of the explanatory variables, at the same time testing the significance of the exogenous variables in explaining the observed values. A positive coefficient of an explanatory variable then means that a positive realisation of this variable will increase the probability of obtaining a "1" (here: an increase in turnover) realisation for the dependent variable. The output of the model is a standardized probability. By convention, probabilities larger than 0.5 are assumed to translate to a value of 1 for the dependent, whilst values smaller tan 0.5 result in a 0. This allows the output of the model to be compared to the 0/1 realisations.

When using a turnover variable as dependent variable, it is of course not necessary to use a logit-model, as these are normal, continuous variables. But the aim here is not to predict a quantitative value for turnover, but to assess how well expectations predict turnover and which measure of turnover corresponds best with expectations. Therefore, it is more pure to transform the turnover variables into an up/down variable as well. When entered as a dependent variable, turnover change variables will be set to 1 if they are positive, and to 0 if they are negative. When used as exogenous variables, they will be entered in their normal, continuous form.

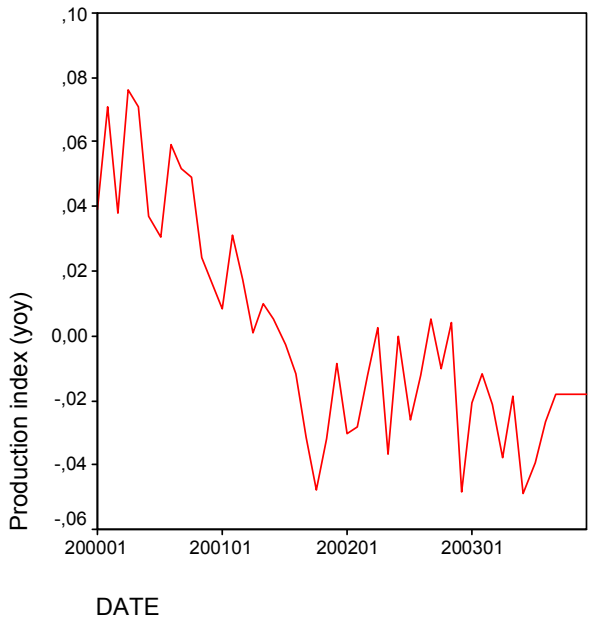
A short note on the interpretation of the results. The nature of the logit-model and the different types of variables entered in the models makes it difficult to use the value of the estimated coefficients to determine the importance of the exogenous variables in explaining the dependent variable. Significances can be interpreted as in linear models, and the sign of the coefficient shows the direction of the relation between exogenous and dependent variable. When evaluating the fit of a logit-model, generally the Chi-square statistic, in combination with the degrees of freedom, is used to compare the fit of different models. In this study, this will in general not be possible, as I will compare models with different dependent variables and different samples sizes due to differing patterns of missing values in the exogenous variables. Therefore, emphasis will be given to two other commonly employed methods for evaluating logit-models; Cox&Snell/Nagelkerke R^2 and the

percentage of observations correctly predicted. Models containing only a constant are used as a benchmark in this type of modelling. They will predict all ones or all zeros, usually the realisation which dominates the realisations, and are in fact a type of naïve prediction. In this sample, pessimism dominates the expectations with overall more expected decreases (0) than increases (1). Therefore, the benchmark model predicts only zeros, thus obtaining the best fit possible with only a constant in the model. The fit of an estimated model can now be evaluated by comparing its overall percentage correct to that of the benchmark model. The Cox&Snell/Nagelkerke R^2 measures compare the likelihood of the estimated model to that of a model only containing a constant. They vary between 0 (no improvement) and 1 (perfect fit).

4.2 Analysis at the aggregate level

Before reporting on the actual research, it is informative to describe the general developments in the Dutch industry in the period concerned. The period 2001-2003 was not a very prosperous one for the Dutch Industry. In 2000, the business cycle turned and a glide into recession commenced. This is clearly visible in the development of the Index of Industrial production over the period.

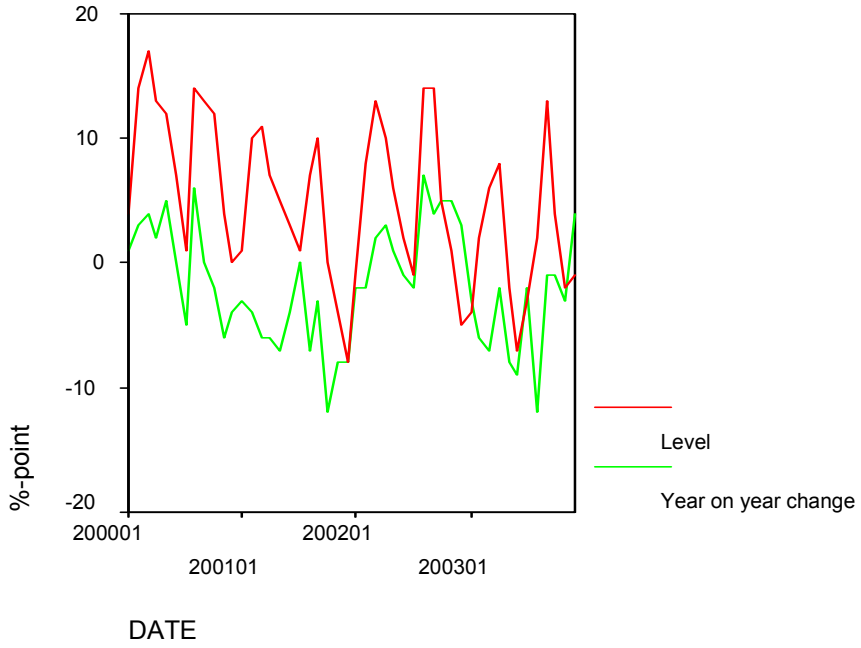
Graph 4.1;Monthly relative year-on-year changes in the manufacturing production index 2000-2003.



From 2000 onwards conditions worsen, whilst in the second half of 2002 a sort of stabilisation in a state of constantly shrinking production takes place. These developments are also visible in the results of the Manufacturing Business Survey, for example in the balance of positive and negative production expectations of the

manufacturing industry. These show a general downward trend, though this is better visible in the values of the absolute year-on-year change in the balance. Halfway 2000, these turn negative and only in the beginning of 2002 a temporary recovery is visible. Superimposed on these long term trends is a strong seasonal pattern.

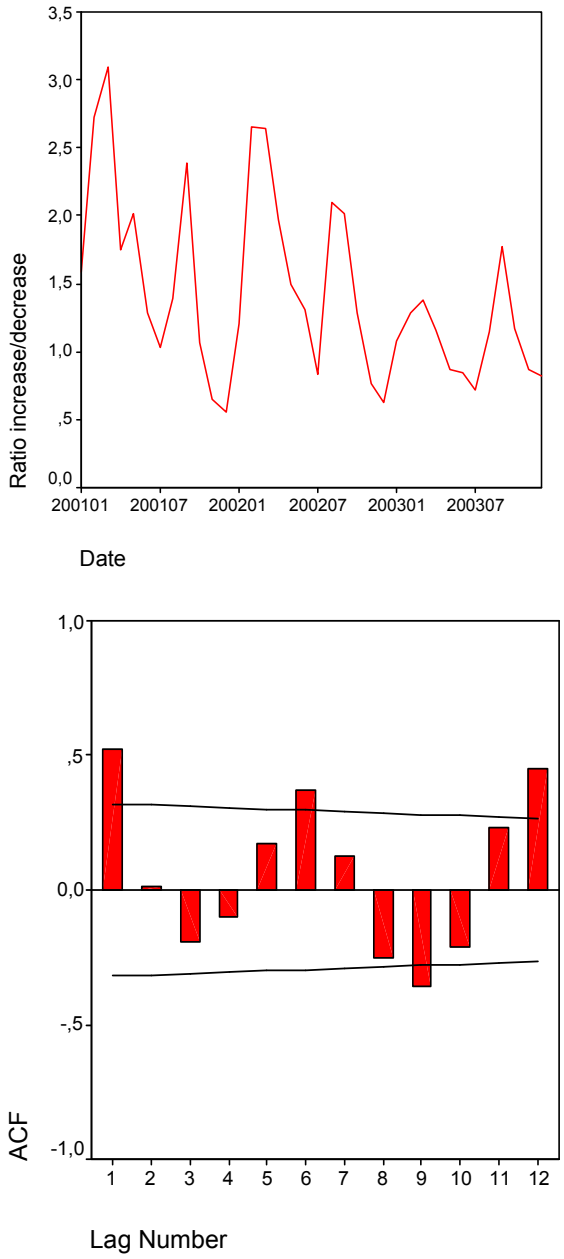
Graph 4.2. Manufacturing industry balance of opinion on production expectations concerning the coming three months, level and year-on-year change.



Now, a closer look will be taken at the micro-data. First, the data will be studied at the aggregate level, typically by computing for every month the ratio between the number of firms reporting an increase, and those reporting a decrease. This is done both for Survey variables and the turnover measures described in the previous section. A large majority of firms reporting an increased turnover probably corresponds to an increase in industrial production. Thus, patterns in time become visible which will make it possible to draw conclusions on the evolution and properties of the underlying statistic. As will become clear, it matters greatly which measure of turnover development is considered. For survey variables, computing the ratio of firms answering increase to the number of firms answering decrease is quite similar to the conventional method of computing the net balance.

The first variable to be considered is the expected tendency of production in the coming three months (PE) from the Business Survey, see graph 4.3.

Graph 4.3. Ratio of number of firms answering that production will increase in the coming three months to number of firms answering decrease, and autocorrelations.

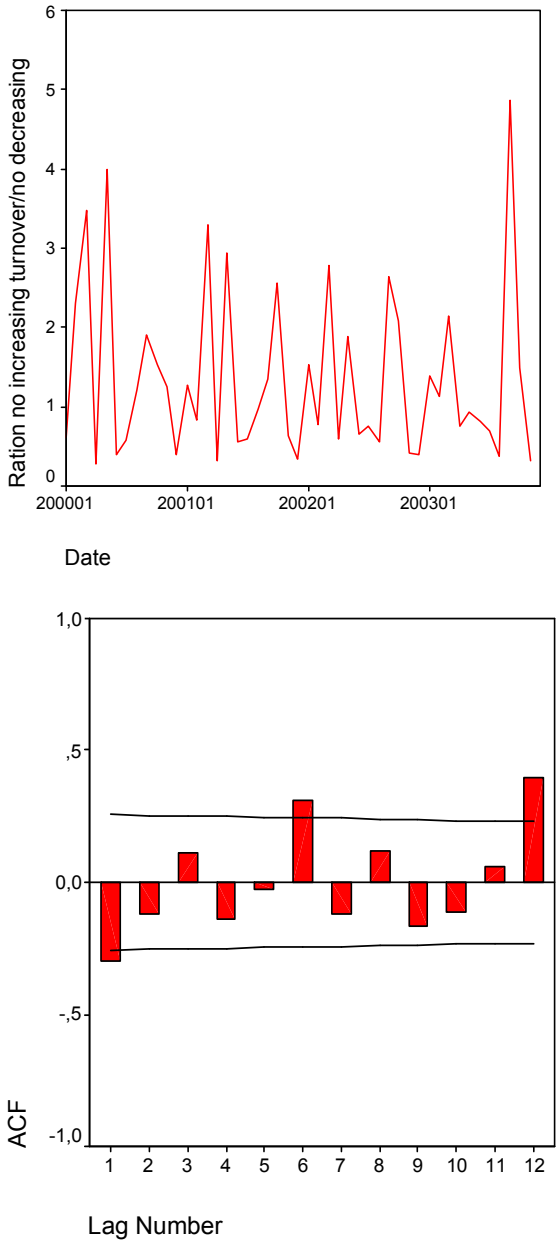


Interestingly, this quantity exhibits a distinct seasonal pattern, even though respondents are asked to ignore seasonal fluctuations. The pattern is visible in the autocorrelations as well. The presence of this seasonal component is quite important for the results in this study, as will become apparent later. Still, a clear downward trend is visible, reflecting increasingly pessimistic overall expectations. It is important to note that in this study, the terms “trend”, “long(er) term” and ”medium-term” are used somewhat loosely, indicating all non-seasonal developments, or developments with periods longer than several months. This includes both trend and cyclical components.

Having seen how production expectations developed over time, it is now interesting to see in how far this corresponds to the patterns of the different measures of

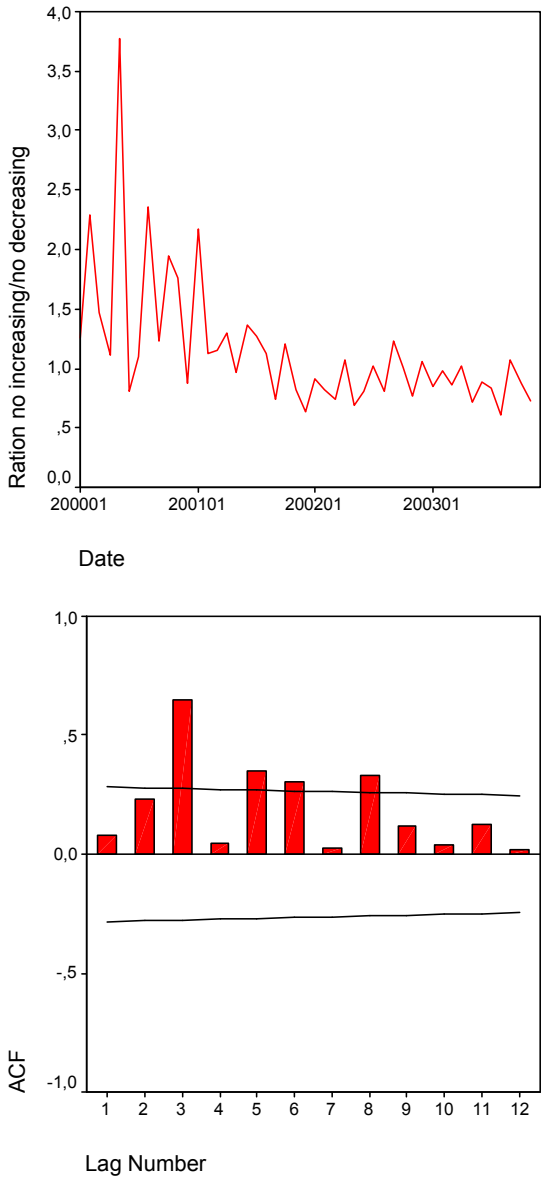
turnover development. The first turnover measure considered is the month-on-month change in turnover, which may be relevant as it is probably most directly observed by producers.

Graph 4.4; Ratio of firms reporting a positive month-on-month turnover change to number of firms reporting a negative one, and autocorrelations.



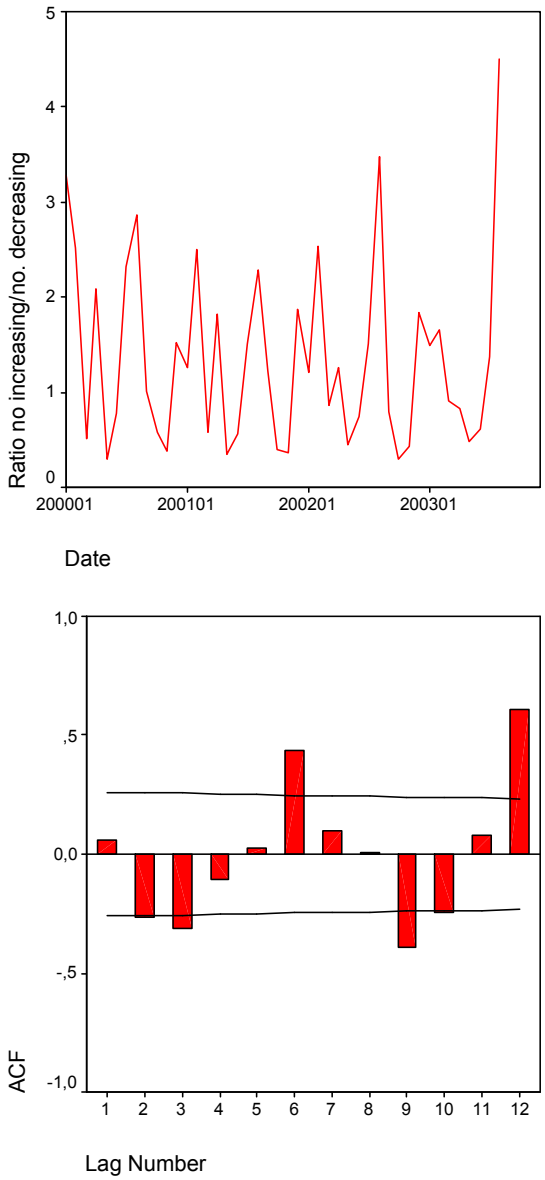
With some difficulty, a slight downward trend is visible. It is only weakly present though, drowned out by random and a strong seasonal pattern. So it seems that this measure of turnover development is not very suitable to characterize the situation in the manufacturing industry. It almost completely fails to represent the worsening of economic conditions. On the other hand, the strong seasonal pattern does correspond to the seasonal pattern found in the production expectations. These effects should be less of a problem when year-on-year changes in turnover are considered:

Graph 4.5; Ratio of firms reporting a positive year-on-year turnover change to number of firms reporting a negative one, and autocorrelations.



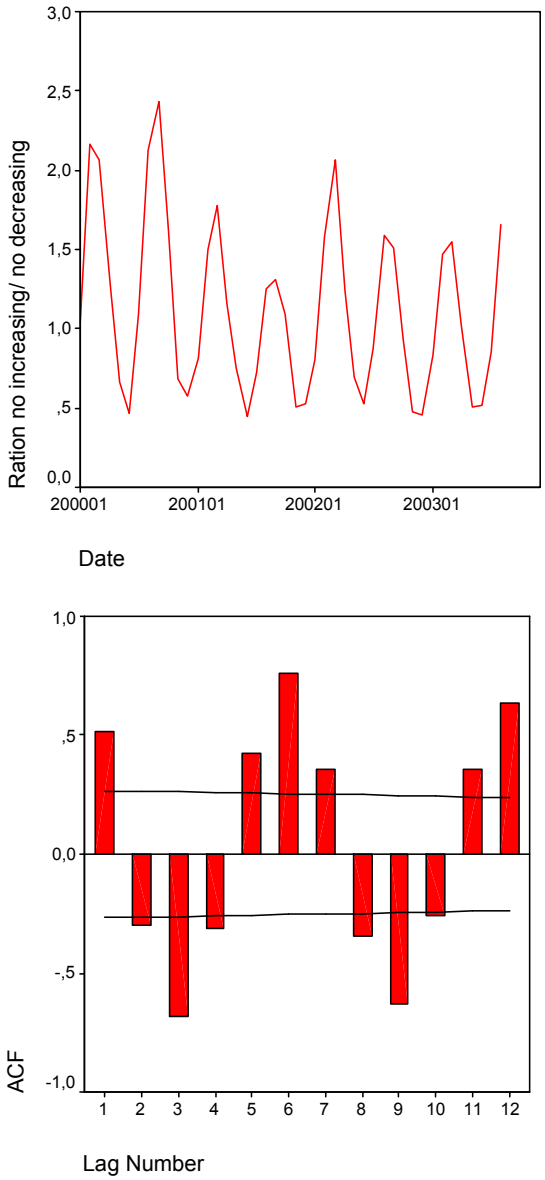
In this case, the downward trend is more clearly visible, though the series does seem to contain quite some noise. As expected, this measure of turnover development contains little or no seasonal effects, as confirmed by the autocorrelation pattern. In the Survey, firms are asked to report the tendency of the average level of production in the coming three months. The turnover statistic with the closest match to this is the development of average turnover in the coming three months ($TOma3F_t$). For this statistic, the ratio of positive to negative realisations shows little trend.

Graph 4.6; Ratio of firms reporting an increase in the average turnover in the coming three months when compared to the turnover this month, and autocorrelations.



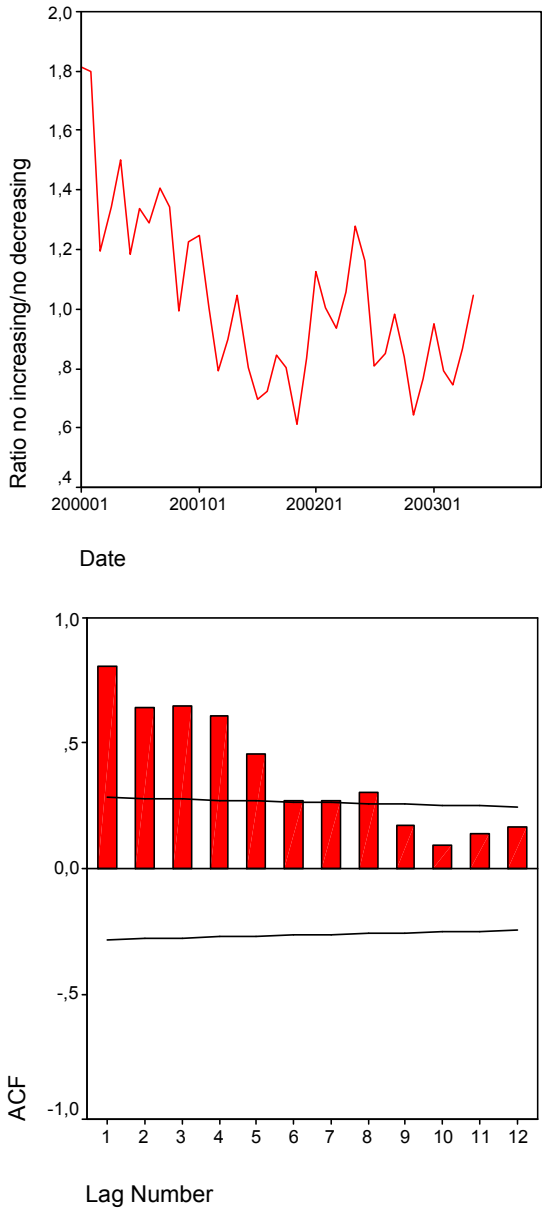
It seems beforehand that this is a problematic statistic to evaluate the quality of expectations against. No real development is visible in this measure, though the aggregate production index and year-on-year changes in graph 4.5 clearly show that over this period a downward trend is present in turnover. This three-month turnover measure is rather noisy and seems to be dominated by seasonal effects. It is ill-suited to characterize the (development of) business conditions for the manufacturing industry. Production expectations are meant to reflect these developments, and have been shown to at least partly do so in practice [Batchelor(1982), Boehm(1993), Vanden Abeele(1987)]. Therefore, it is questionable in how far production expectations are connected with turnover development in the coming three months. Comparing the coming three months turnover to the past three months' ($TOma3FL_t$) hardly improves matters.

Graph 4.7; Ratio of firms reporting an increase in the turnover in the coming three months when compared to the turnover in the past three months, and autocorrelations.



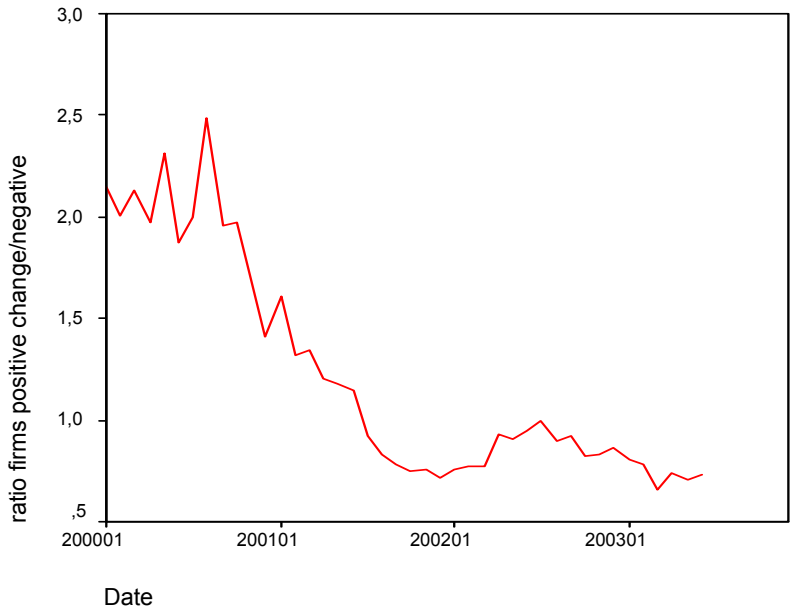
Though smoother, in this three-month turnover measure seasonal effects seem to dominate as well. The seasonal pattern in the autocorrelations is quite distinct. Little trend or more structural developments are visible. Evaluating turnover developments over six-month periods ($TOma6FL_t$) improves on this:

Graph 4.8; Ratio of firms reporting an increase in the turnover in the coming six months when compared to the turnover in the past six months, and autocorrelations.



The ratio of turnover in the coming six months to turnover in the last six months exhibits a clear medium-term downward trend, which corresponds quite well to the trend in production expectations (fig. 4.2). This measure of turnover development offers a much better representation of developments in the industry and changes in business conditions. The worsening of conditions from 2000 onwards and the temporary recovery in the middle of 2002, as visible in the aggregate index of manufacturing production and the Business Survey production expectations, are clearly present in this measure of turnover development. The same goes for the ratio of firms with more positive turnover realisations in the coming six months to firms with more negative turnover realisations (the noyoyF6 measures).

Graph 4.9; Ratio of number of firms with a positive noyoyf6 to a negative npyoyf6. This is the number of firms with more positive year-on-year turnover changes in the coming six months compared to the number of firms with more negative ones.



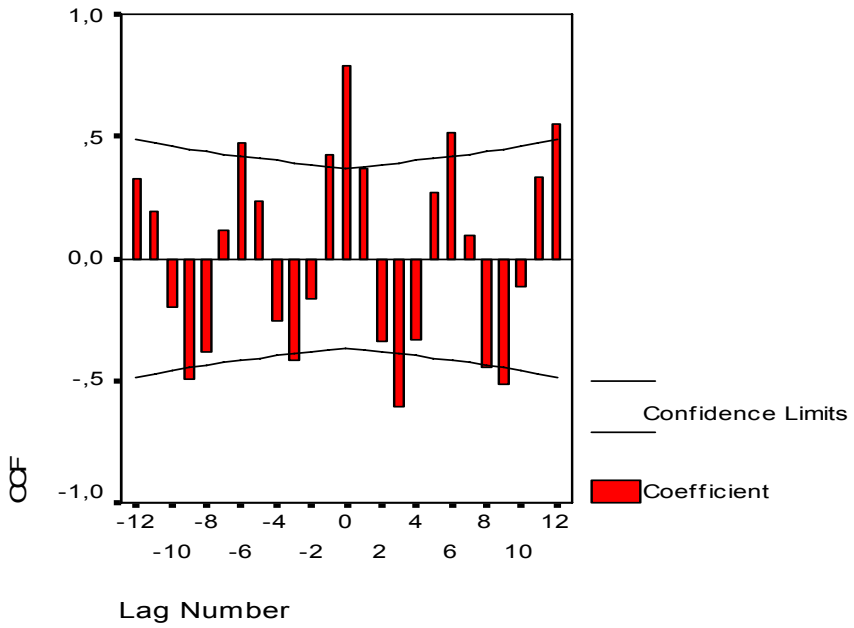
Clearly, the medium term (6/12 month) measures of turnover development contain more relevant information than monthly or three-monthly turnover measures. The month-on-month and three-monthly changes in turnover are dominated by seasonal effects, and seem to offer little information on business conditions. The medium-term measures are more representative of developments in aggregate production linked to the business cycle and of those in firms' production expectations.

Several conclusions can be drawn from this analysis, however keep in mind that they are preliminary and of a qualitative nature. For a start, Firms' production expectations reflect both seasonal and medium-term developments in industry. A preliminary conclusion is that the correspondence between production expectations and the shorter-term measures of turnover development is mainly due to similar seasonal patterns, whilst the correspondence with the medium-term measures is more due to the influence of business conditions. The medium-term component in expectations and turnover is of course of much more importance for economic analysis, as it is connected to the business cycle. This medium-term component is most clearly present in the six-month measures of turnover development (fig. 4.8 and 4.9). The similarity between production expectations (fig. 4.3) and the month-on-month turnover changes (fig. 4.4) is purely based on the common (strong) seasonal pattern. The same goes for turnover changes over three month periods (fig. 4.6 and 4.7). The overall trend in monthly year-on-year changes is similar to the one in production expectations, but the turnover changes are much more volatile than the production expectations.

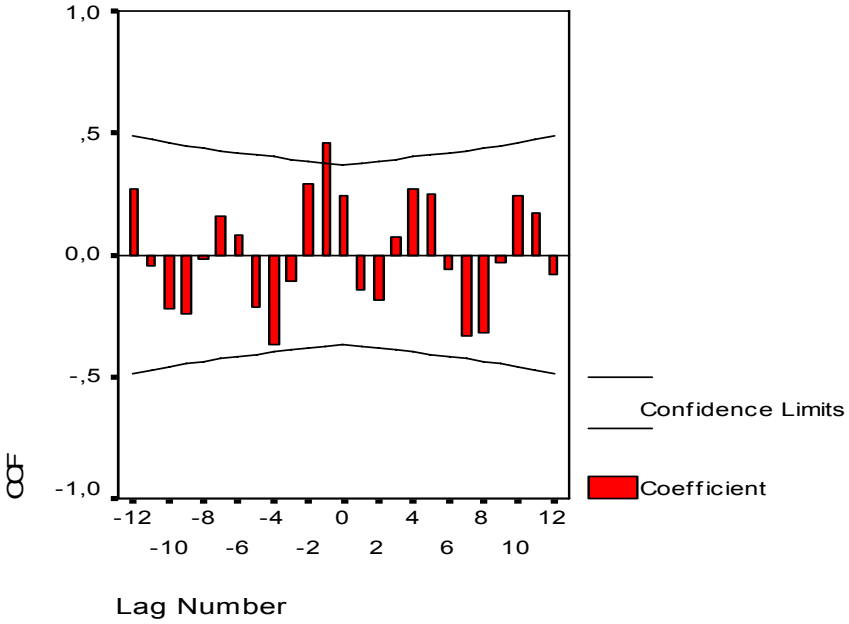
In order to investigate this further, a somewhat crude seasonal adjustment was performed on the aggregate production expectations. Due to the limited time series available, it was not possible perform a direct seasonal adjustment on the aggregate production expectations as computed here. In stead, a seasonal pattern was obtained by performing a seasonal analysis, using the Census X-12 program, of the normal aggregate production expectations as published by Statistics Netherlands. This pattern was then used to seasonally adjust the aggregate production expectations as computed in this study. The cross correlations of this adjusted expectations series and the original series with aggregate turnover development over the next six months (TOma6FL) and the next three months (TOma3FL) were computed (graphs 4.10 and 4.11)

Graph 4.10; Cross-correlations of original and seasonally adjusted aggregate productions expectations (ratio firms answering "increasing" to firms answering "decreasing") with aggregate turnover over the next three months TOma3FL (ratio of firms reporting an increase in turnover in the next three months compared to the pas three months to firms reporting a decrease)

4.10a; production expectations, *original*

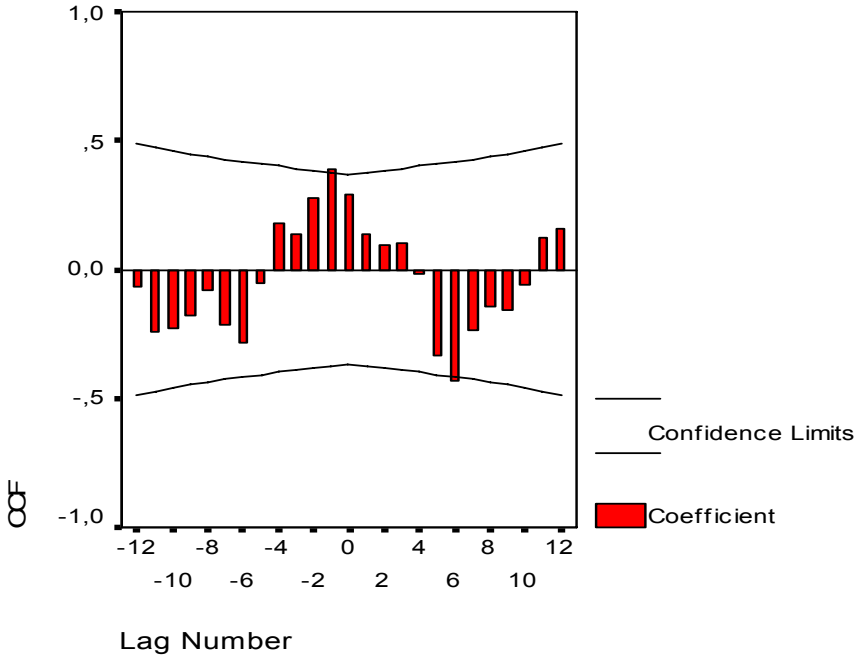


4.10b: *Seasonally adjusted* production expectations

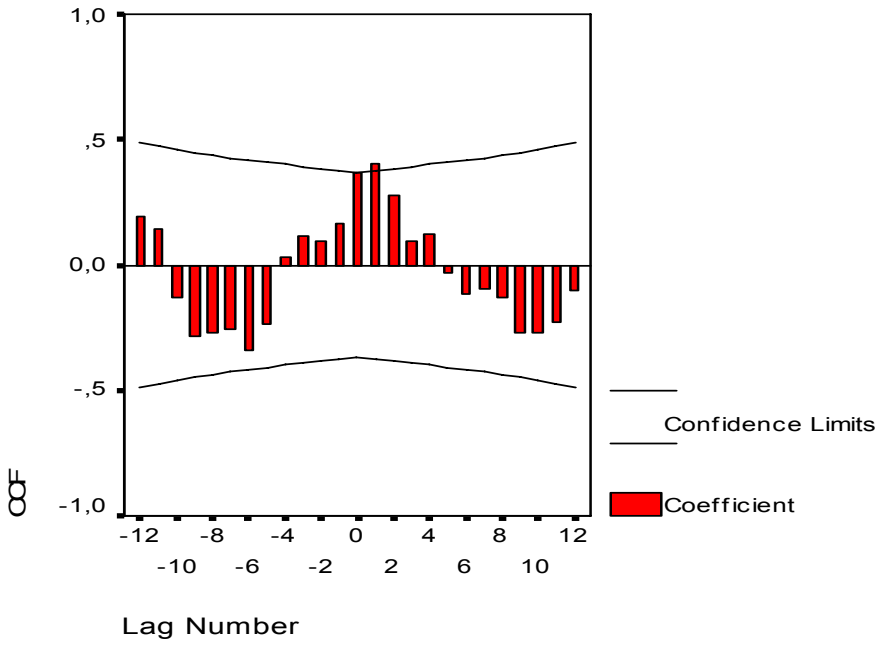


Graph 4.11; Cross-correlations of original and seasonally adjusted aggregate productions expectations (ratio firms answering "increasing" to firms answering "decreasing") with aggregate turnover over the next six months TOma6FL (ratio of firms reporting an increase in turnover in the next six months compared to the past six months to firms reporting a decrease)

4.11a; production expectations, *original*



4.11b: *Seasonally adjusted* production expectations



The cross-correlations between the original aggregate production expectations and the turnover development over the next three months (TOma3FL) are rather strong and show a very strong seasonal pattern. When the expectations are seasonally adjusted, the cross-correlations become much weaker. For turnover development over the next six months (TOma6FL), the reverse is true. Cross-correlations with expectations actually become a little stronger when these are seasonally adjusted.

Another way of looking at these qualitative results is that firms' Survey expectations are more representative of medium-term developments in turnover than accurate reflections of turnover realisations in an individual month. The results on the month-on-month developments are completely dominated by seasonal effects. In the next section, it will be formally tested how well firms' expectations match turnover development, and which measure of turnover has the closest link with expectations.

4.3 Logit-modelling of the match between expectations and turnover realisations

In this section, it is formally tested how well the production expectations for the next three months ($PE_{t+3|t}$) predict the actual development of turnover. This is tested for the different measures of turnover development discussed before, in order to find out which one is most relevant for expectations. As a matter of convenience, table 4.1 contains the codes for the different turnover variables entered as dependent variable with a short description.

Table 4.1; Description and codes of different measures of turnover development at the firmlevel(All 0/1 (down/up) dummies).

Exogenous variables	
TOma3FL	turnover change next 3 months compared to last 3
TOma6FL	turnover change next 6 months compared to last 6
noyoyF6	Number of months with yoy change >0 – Number of months with yoy change < 0 in coming 6 months
nomomF6	Number of months with m.o.m. change >0 – Number of months with m.o.m. change < 0 in coming 6 months
TOma3F	Average turnover coming 3 months compared to present month
TOma3L	Average turnover last 3 months compared to present month
TOma6F	Average turnover coming 6 months compared to present month
TOma6L	Average turnover last 6 months compared to present month
TOmom(t-1, t, t+1)	Month-on-month turnover change at different lags
TOyoy(t-1, t, t+1)	year-on-year turnover change at different lags

4.3.1 Logit-modelling of the predictive power of expectations for turnover development

For each turnover statistic, four models are estimated; a benchmark model containing only a constant, an autoregressive model with just lagged values of the dependent variable, a model containing only the expectations and a constant, and a model containing both the expectations and autoregressive variables. An important first result is that in all cases except one, the autoregressive model was a better predictor of turnover development than expectations. The exception was the month-on-month turnover change of the *current* month. In table 4.2, a summary of the outcomes for models containing expectations can be found.

Table 4.2; Summary of outcomes of models explaining different measures of turnover development. Models containing as exogenous variables respectively only production expectations ($PE_{t+3|t}$); production expectations($PE_{t+3|t}$) and autoregressive variables; and only a constant (benchmark).

Dependent (turnover) variables	***Only $PE_{t+3\|t}$ as explanatory variable***			***$PE_{t+3\|t}$ and autoregressive***			***Bench-mark***
	Cox&snell / Nagel-kerke R^2	% correct	PE coefficient	Cox&snell/ Nagel-kerke R^2	% correct	PE coefficient	% correct
$TOmom_{t+1}$	**0.004/ 0.005**	**53.2**	0.25 (0.000) (34.8)	**0.027/ 0.036**	**56.7**	0.415 (0.000) (57.7)	51
$TOmom_t$	**0.024/ 0.032**	**57.8**	-0.631 (0.000) (249.1)	**0.044/ 0.059**	**59.2**	0.705 (0.000) (196.6)	51
$TOmom_{t-1}$	**0.001/ 0.002**	**52.1**					51
$TOyoy_{t+1}$	**0.004/ 0.005**	**53.2**	0.311 (0.000) (52.8)	**0.077/ 0.103**	**63.8**	0.314 (0.000) (32.1)	53
$TOyoy_t$	**0.006/ 0.008**	**53.3**	0.306 (0.000) (58.5)	**0.074/ 0.098**	**62.9**	0.333 (0.000) (42.1)	53
$TOyoy_{t-1}$	**0.002/ 0.002**	**51.8**					53

Table 4.2; continued

Dependent (turnover) variables	***Only $PE_{t+3\|t}$ as explanatory variable***			***$PE_{t+3\|t}$ and autoregressive***			***Bench-mark***
	Cox&snell / Nagel-kerke R^2	% correct	PE coefficient	Cox&snell/ Nagel-kerke R^2	% correct	PE coefficient	% correct
TOma3FL	**0.06/ 0.08**	**62.1**	1.021 (0.000) (627.2)	**0.132/ 0.176**	**65.8**	0.905 (0.000) (452.4)	52
TOma6FL	**0.052/ 0.069**	**60.9**	0.954 (0.000) (482.9)	**0.128/ 0.157**	**64.4**	0.866 (0.000) (368.5)	51.8
noyoyF6	**0.019/ 0.005**	**62.2**	0.580 (0.000) (175.4)	**0.149/ 0.203**	**69.1**	0.583 (0.000) (149.7)	62.2
nomomF6	**-**			**-**			
TOma3F	**0.005/ 0.007**	**53.8**	0.0291 (0.000) (54.5)	**0.104/ 0.138**	**57.9**	0.544 (0.000) (169)	52
TOma3L	**0.026/ 0.035**	**57.9**	0.661 (0.000) (273.8)				52
TOma6F	**0.001/ 0.001**	**51.7**	0.121 (0.000) (8.4)	**0.195/ 0.260**	**73.6**	0.490 (0.000) (105.1)	51.2
TOma6L	**0.022/ 0.029**	**56.9**	0.608 (0.000) (227.8)				51.8

A general pattern is visible in these results. In almost all cases, the purely autoregressive models have more explanatory power for turnover realisations than models containing only expectations. On the other hand, expectations are significant in almost all models. In all models, the coefficient of expectations had the correct sign, an "increase" answer indicating a higher probability of an increase in turnover. Even more, models combining expectations and autoregressive variables outperform all other models. It can therefore be concluded that individual production expectations are poor predictors of turnover development in themselves, but that they do contain significant new information on turnover development.

These results also highlight the presence in expectations of both components connected to seasonal developments, and of components more related to medium-term business cycle developments. Month-on-month changes, dominated by seasonal effects, are better predicted than year-on-year changes, indicating the presence of a seasonal pattern in expectations. This is confirmed by the explanatory power of expectations for the three-month turnover changes, which are dominated by seasonal effects. But the informational content of expectations is as great for the six-month measures of turnover changes, which mainly reflect medium-term trends in production and business cycle conditions. In general, the link between expectations and moving averages of turnover development is stronger that the link between expectations and turnover realisations in individual months.

4.3.2 Logit-modelling of the explanatory power for expectations of different turnover measures

A different way to assess how realisations and expectations are connected is to reverse the modelling process. Here, I will study to what extent expectations are influenced by different measures of turnover realisations. The expectations will be entered as the dependent variable in the models to find out which turnover measures have the most explanatory power for expectations. This was done for the three "types" of turnover measures; month-on-month turnover changes, three-month turnover changes and six-month turnover changes. Expectations should of course relate to future turnover developments. However, past and current developments are likely to have a, possibly even stronger, influence as well. To find out how turnover development influences expectations, all these options should be studied. Therefore, for each type of turnover measure a number of different variables were used, representing either past developments, future ones, or both. As a benchmark, the explanatory power of the first lag of expectations was tested as well.

Table 4.3; Production expectations ($PE_{t+3|t}$) explained by different simple models of month-on-month turnover change (TO_{mom}), compared to models with lagged production expectations. A positive sign means that the coefficient of the explanatory variable is positive, indicating that an increase in this variable results in a higher probability of obtaining an "increase" expectation.

Explanatory variable	*Cox&Snell/ Nagelkerke R^2*	*% correct*	*coefficient*	*Significance/Wald*
$TOmom_t$	0.018/0.025	58.9	0.007	0.000/171.9
$TOmom_{t-1}$	0.000/0.000	57.4	ns	ns
AR(3) TOmom	0.026/0.034	60.2		
$TOmom_{t+1}$	0.002/0.003	58.3	0.003	0.000/22.2
PE_{t-1}	0.176/0.236	72.4	1.884	0.000/1619
constant	-	57.4	0.317	0.000/244.4

For the month-on-month turnover changes, the present and past seem to have the most influence on expectations. The one period ahead turnover change barely improves on the constant-only benchmark model. The R^2 measures are very low and the percentage of case predicted correctly is almost equal to that of a model containing only a constant. Using a model containing several lags of month-on-month turnover changes gives the best fit. The models using the turnover realisation of a single period have lower explanatory power, the best single explanatory variable being the current month's turnover change.

Table 4.4; Production expectations ($PE_{t+3|t}$) explained by different simple models of year-on-year turnover change (TOyoy), compared to models with lagged production expectations. A positive sign means that the coefficient of the explanatory variable is positive, indicating that an increase in this variable results in a higher probability of obtaining an "increase" expectation.

Explanatory variable	*Cox&Snell/ Nagelkerke R^2*	*% correct*	*coefficient*	*Significance/Wald*
$TOyoy_t$	0.003/0.004	57.4	0.003	0.000/31.3
$TOyoy_{t-1}$	0.000/0.000	57.4	ns	ns
AR(3) TOyoy	0.003/0.004	57.6		
$TOyoy_{t+1}$	0.005/0.006	57.6	0.003	0.000/41.6
PE_{t-1}	0.176/0.236	72.4	1.884	0.000/1619
constant	-	57.4	0.317	0.000/244.4

Individual year-on-year mutations in turnover have on all counts little explanatory power for expectations. The models barely improve on the constant-only model.

Table 4.5; Production expectations ($PE_{t+3|t}$) explained by different simple models of turnover change over a three-month period(TOma3), compared to models with lagged production expectations. A positive sign means that the coefficient of the explanatory variable is positive, indicating that an increase in this variable results in a higher probability of obtaining an "increase" expectation.

Explanatory variable	*Cox&Snell/ Nagelkerke R^2*	*% correct*	*coefficient*	*Significance/wald*
$TOma3FL_t$	0.000/0.000	57.5	ns	n.s./
$TOma3L_t$	0.026/0.035	58	0.462	0.000/76.1
$TOma3F_t$	0.005/0.007	57.6	0.093	0.005/7.9
PE_{t-1}	0.176/0.236	72.4	1.884	0.000/1619
constant	-	57.4	0.317	0.000/244.4

These results are a little puzzling. The change in turnover compared to the average turnover in the past three months ($TOma3L_t$) is clearly significant in explaining expectations, and so is the change in the future three months ($TOma3F_t$), though only barely so. However, the average change in turnover of the coming three months compare to the last three months is not.

Table 4.6; Production expectations ($PE_{t+3|t}$) explained by different simple models of turnover change over a six-month period (TOma6), compared to models with lagged production expectations. A positive sign means that the coefficient of the explanatory variable is positive, indicating that an increase in this variable results in a higher probability of obtaining an "increase" expectation.

Explanatory variable	*Cox&Snell/ Nagelkerke R^2*	*% correct*	*coefficient*	*Significance/wald*
$TOma6FL_t$	0.037/0.049	62.7	1.365	0.000/278.9
$TOma6L_{-t}$	0.022/0.029	57.6	0.530	0.000/91.4
$TOma6F_t$	0.001/0.001	57.4	0.061	0.004/3.1
PE_{t-1}	0.176/0.236	72.4	1.884	0.000/1619
constant	-	57.4	0.317	0.000/244.4

Using the six-month measures of turnover development to explain production expectations yields slightly different results. As before, the future turnover development adds little explanatory power, unlike the turnover development

compared to the past six months. But here, the turnover development of the next six months compared to the past six months performs the best. This variable even has the highest R^2 values of all models considered in this section, and also the highest percentage of correctly predicted expectations.

Overall, the results of testing the explanatory power for expectations of turnover variables confirms the results of the previous sections. There is a clear and significant link between turnover realisations and production expectations. In all the cases, an increase in turnover corresponds to a higher probability of positive production expectations. Both the shorter-term (month-on-month, year-on-year, three month periods) turnover development measures and the medium-term ones (six month periods) are (somewhat) significant in explaining production expectations. However, the link between single month turnover realisations (month on month and year on year changes) is weak. Turnover developments over longer periods are more important for explaining expectations. This goes for turnover development over three month and six month periods. Of these, the turnover development in the next six months compared to the previous six months (TOma6FL) has by far the most explanatory power for expectations.

Again, the explanation is that the link between expectations and the shorter-term and three-month turnover measures is caused by a similar seasonal pattern, whilst expectations also reflect the trends visible in the medium-term (six-month) turnover developments. This distinction was formally tested by constructing two additional models for the expectations. One contained monthly dummies for January, February etc, till November, and the development of turnover over a three-month period (TOma3FL), the other the same seasonal dummies and the development of turnover over a six-month period (TOma6FL). In the last model, all monthly dummies and the turnover variable were highly significant in explaining expectations, each modelling a different component of the expectations. In contrast, in the first model only the monthly dummies were significant, not the turnover development over three-month periods. Therefore, when the seasonal pattern in expectations is adequately modelled by other variables, the turnover development over three-month periods is no longer relevant for explaining expectations. The link between these short-term turnover measures and expectations is mostly based on a similar seasonal pattern, while the link between expectations and medium-term turnover development measures is separate from seasonal effects.

A few further general conclusions can be drawn from these results. First, some attention needs to be paid to the models containing lagged production expectations. This variable is the overall most significant predictor of expectations, with the highest R^2 measures and the highest number of correct predictions. It is worth taking a closer look at this last result. It means that the probability of expectations remaining unchanged from one month to another is 72.4%. This points to a high level of persistence in expectations, higher than in the turnover realisations. It is

known from previous research that respondents are relatively reluctant to change their expectations [Mayers and Mors (1990)]. Another factor which might play a role in causing expectations to be relatively stable is that firms pay more attention to medium-term changes in business conditions than to relatively short term turnover fluctuations. This is indicated by the greater power of the medium-term turnover averages in explaining expectations. It was shown that these are more closely related to medium-term trends in the manufacturing industry.

5. Discussion and Conclusions

This study set out to assess what firms' production expectations from the monthly Dutch Manufacturing Business Survey actually relate to and how good they are at predicting future production. This was done by testing how well expectations reflect developments in turnover, either in single months or over longer periods. As Business Survey outcomes are widely used in economic analysis and in reporting on the business cycle, it is important to know how well these actually gauge the developments in business conditions. On a more theoretical level, expectations play a large roll in many economic theories. How expectations are formed and what influences them is crucially important for these theories. It was possible here to contribute to understanding of these issues because of the availability of a dataset containing firms' responses to the Business Survey and reported monthly turnover realizations, linked at the firm-level. This micro-data approach made it possible to confront expectations with the corresponding actual realizations. Throughout this study, the logit-model was used to model the interactions. The dependent variable is not explicitly modeled, but the probability of observing a certain value of the dependent variable, "increase" or "decrease", as function of the explanatory variables.

Preliminary investigations and results from literature suggested that expectations contain a seasonal component next to information on medium-term trends in production. The term "trend" is used here meaning any medium- or long-term development, so covers cyclical as well as trend developments. Different measures of turnover development were constructed, both short-term like individual month-on-month and year-on-year changes, and somewhat longer term measures which averaged developments over three, six or twelve-month periods.

On the whole, the predictive value of expectations on the level of the individual firm proved to be significant but weak. In almost all cases, relatively simple autoregressive models had more explanatory power than expectations. Interestingly though, when added to autoregressive models, expectations remained highly significant. Moreover, these combined models performed better than purely autoregressive models. It seems that though expectations are imperfect predictors of turnover, they do contain new information on developments herein.

After establishing the existence of a connection between turnover and expectations, the main point of investigation was whether expectations are more a reflection of short-term, monthly developments or of medium-term developments in business conditions. The conclusion is that production expectations have only a weak link with single-month turnover changes, either month-on-month or year-on-year. Models of the relation between expectations and measures of turnover development

over longer periods (three, six, or twelve months) usually possessed a much better fit. The relatively strong relation between expectations and the contemporaneous month-on-month turnover change and the change in turnover over the coming three months was shown to be due to a similar seasonal component in these series. These two measures of turnover development are actually dominated by seasonal effects. The Survey inquires after the expected turnover development over the coming three months, but corrected for seasonal influences. It seems that for some firms this distinction is difficult to make. However, though expectations contain a clear seasonal pattern, they were also shown to possess a component linked to medium-term developments in turnover.

This is the most important result, that expectations have the strongest relation with medium-term (six/twelve months) measures of turnover development. In contrast to the shorter-term measures of turnover development, these exhibited a clear correspondence to the general developments in industry as measured by year-on-year changes in the manufacturing production index. Therefore, the development of these medium-term turnover measures is clearly linked to the business cycle and changes in business conditions. The models linking these turnover variables and expectations possessed the highest fit and the largest percentage correct predictions. This indicates that when expressing their expectations, a large proportion of producers are more concerned with, or influenced by, the longer-term outlook for their firms and the general trend of turnover development, than with trying to accurately predict next period's turnover development. This supports the use of Business Survey results in general economic and business cycle analysis.

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Appendix 1; Logit models

The logit model is used in cases where the dependent variable can only take a limited number of values, for example with qualitative data. The most basic form is a dichotomous dependent variable, which can only take the values 0 and 1, in this study representing “increase” and “decrease”. The aim op the model is to estimate the probability that the dependent assumes the value 1 as function of the explanatory variables:

$$\log\left(\frac{P_i}{1-P_i}\right) = \sum b_k X_{ik} \equiv Z_i \qquad \text{A2-1}$$

P_i = probability dependent variable event i

b_k = regression coefficient

$x_{i,k}$ = exogenous variable

The probability of the dependent variable taking the value 0 is than simply 1-P(Y=1). This way, the influence of the explanatory variables on the probability of P(Y=1) can be studied. The basis of this type of models is in the log-linear models which via probability analysis try to assess the relationship between (qualitative) variables.

The logit model assumes that the probability by a transformation into probability space. Not the 1/0 dependent variable itself is modeled, but the probability of arriving at a certain realization Y(i) as a function of the independent variables X(i). For this to be possible, a certain probability distribution needs to be assumed for the dependent. In this study, the logistics function is used.

$$F(Z) = \frac{e^z}{1+e^z} \qquad \text{A2-2}$$

This results in a smooth, continuous probability distribution for Y(i) and only minimal restrictions. The result is a relatively complex, non-linear relationship between the explanatory variables bX=Z and the resulting probability. The relationship is on the other hand rather logical, with changes in the explanatory variables having relatively little influence on the estimated possibility for the very high and low probability ranges. In the intermediate probability range on the other hand, the estimated probability is much more sensitive to changes in the explanatory

variables. If the odds of either obtaining a 0 or a 1 are about even, it is more logical for the probability to be sensitive to the exogenous variables, than when the chance of obtaining a "1" realization is 95%. This points to a difficulty in interpreting the results of logit models. The influence of a certain variable on the dependent variable cannot be readily deduced from its coefficient in the model. The change in probability which is the result of a certain change in a independent variable X(i) depends on aggregate probability and therefore on its own value and on the value of all other variables in the model. A solution is to evaluate the effects of all variables at their average values. It is however impossible to simply quantify the influence of X(i) on (the probability) of Y(i). It is possible to use the Wald statistic of a variable as a guide for the influence of the corresponding variable in the model. It represents the change in the goodness of fit of the model if the coefficient is set to zero. A small value for the Wald statistic means that the variable contributes relatively little to the model. What is always clear from the estimated coefficients is the direction of the effect of X(i) on the probability Y(i), whether X increases the probability of a "1" or decreases it. This follows from the sign of the coefficient. A positive coefficient means that positive realizations of X(i) are in general more likely to coincide with a "1" realization for Y(i).

The multinomial logit, where the dependent variable has more than two categories, works along the same lines. Only now, all probabilistic are compared to one the probability of obtaining one, reference category. For example the probability of obtaining a 1 compared to a 0, or a 2 compared to a 0. This is how all variables then must be interpreted, as raising (or lowering) the probability of obtaining for example an "increase" (1) against "no change"(0), and the same for "decrease" (2) versus "no change".