DEUTSCHE
BUNDESBANK

Time-dependent or state-dependent price setting? – micro-evidence from German metal-working industries –

Harald Stahl

Discussion Paper
Series 1: Economic Studies
No 25/2005

Deutsche Bundesbank, Wilhelm-Epstein-Strasse 14, 60431 Frankfurt am Main,
Postfach 10 06 02, 60006 Frankfurt am Main

Tel +49 69 9566-1
Telex within Germany 41227, telex from abroad 414431, fax +49 69 5601071

Please address all orders in writing to: Deutsche Bundesbank,
Press and Public Relations Division, at the above address or via fax +49 69 9566-3077

ISBN 3–86558–076–9

Abstract

Price setting in German metal-working industries is analysed using a monthly panel of individual price data for more than 2,000 plants covering the period from 1980 to 2001. Motivated by several models in the literature, a duration model is estimated. Price changes can be explained by a combination of state-dependence and time-dependence but time-dependence clearly dominates. Time-dependence is strongest if a price increase follows a price increase. This is typically the case during the observed period. A price increase is most likely to follow a price increase after 1, 4, 5, 8, 9, … quarters. This time-dependent effect is so strong and cost and price increases are so weak in the observed period that adjustment occurs before the sticky price sufficiently deviates from the flexible price, as traditional menu cost models assume. State-dependence seems to be most relevant in periods with decreasing demand. Then prices are reduced and the time between two price reductions only rarely exceeds four months.

Keywords: price rigidity, duration analysis, business survey data

JEL-Classification: D43, E31, L11

Non-Technical Summary

The last 20 years have seen a lively debate on whether firms decide to change a price in response to a change in economic conditions (state-dependent price setting) or whether this point of time is given exogenously (time-dependent price setting). Many macroeconomic models of price setting assume time-dependent price setting.

This paper analysis this question based on qualitative, firm-specific survey data for producer prices in the western German metal-working industry using a duration model. It shows for the period from January 1980 until November 2001 that firms follow mostly a time-dependent price setting rule under "normal" conditions, when price increases follow price increases, albeit with some time-lag. However, the point of time of a price change seems to depend on the state of the economic environment, if prices are reduced or a price increase follows a price reduction. Prices are reduced if demand has decreased since the preceding price change or demand decreases are expected. If competitors reduce their prices and the firm's last price change has already been a reduction it cuts its price further, probably for fear of losing market share. The timing of a price reduction is not affected by cost changes. Cost reductions do not decrease prices but temporarily increase profits.

There is only little evidence in favour of menu cost models that assume that if firms face a fixed cost of price adjustment continuously increasing costs or demand lead to a postponement of price changes. This may be the case because during the periods observed cost increases were relatively small.

The question of time-dependent price setting versus state-dependent price setting is, of course, only part of the price-setting process since it does not tell us anything about the size of a price change. However, if time-dependence cannot be rejected it greatly facilitates modelling the price-setting process and understanding its implications at the aggregate level.

Nicht technische Zusammenfassung

Während der letzten 20 Jahre fand eine lebhafte Debatte darüber statt, ob Firmen den Zeitpunkt einer Preisänderung von den wirtschaftlichen Gegebenheiten abhängig machen (Zustandsabhängigkeit) oder ob er davon unabhängig erfolgt (Zeitabhängigkeit). Viele makroökonomische Modelle des Preissetzungsverhalten unterstellen Zeitabhängigkeit.

In diesem Papier wird diese Frage anhand von qualitativen, firmenspezifischen Umfragedaten für die Produzentenpreise in der westdeutschen Metallindustrie beantwortet. Dabei wird ein Verweildauermodell verwendet. Es zeigt für einen Zeitraum von Januar 1980 bis November 2001, dass Firmen innerhalb eines "normalen" ökonomischen Umfelds, bei dem Preisanhebungen auf Preisanhebungen folgen, überwiegend eine zeitabhängige Regel befolgen. Dagegen scheint der Zeitpunkt der Preisänderung dann vom Zustand im Umfeld der Unternehmung abhängig zu sein, wenn Preise gesenkt werden oder eine Preiserhöhung auf eine Preissenkung folgt. Preise werden anlässlich eines tatsächlichen oder erwarteten Nachfragerückgangs gesenkt. Senken Wettbewerber ihre Preise und war die letzte Preisänderung eines Unternehmens eine Preissenkung, dann senkt das Unternehmen seine Preise weiter, möglicherweise aus Sorge um Marktanteile. Der Zeitpunkt eines Preisrückgangs wird nicht durch Änderungen in den Kosten beeinflusst. Sie führen nicht zu (unmittelbaren) Preisrückgängen, sondern zu einem (vorübergehenden) Anstieg der Gewinne.

Das Papier findet wenig Evidenz für Menükostenmodelle, wonach kontinuierliche Steigerungen bei den Kosten oder der Nachfrage bei fixen Preisanpassungskosten zu einer Verzögerung von Preisänderungen führen. Möglicherweise liegt das daran, dass im Untersuchungszeitraum die Kostensteigerungen vergleichsweise gering waren.

Die Frage, ob Preise zeitabhängig oder zustandsabhängig geändert werden, ist natürlich nur ein Teil des Preissetzungsprozesses, denn es sagt noch nichts über das Ausmaß der Preisänderung aus. Jedoch wird die Modellierung des Preissetzungsprozesses und das Verständnis seiner Auswirkungen auf aggregiertem Niveau wesentlich vereinfacht, wenn die Annahme der Zeitabhängigkeit nicht verworfen werden kann.

Contents

List of Tables

List of Figures

Time-dependent or state-dependent price setting? – Micro-evidence from German metal-working industries - *)

1 Introduction

There seems to be general agreement that, from a theoretical point of view, state-dependent models of price adjustment are more appealing than purely time-dependent models. The latter are, however, much more tractable than state-dependent models. In particular, the analysis of the effect of monetary shocks on aggregate output and prices is rather intricate in state-dependent models and leads to inconclusive results, as is shown by the theoretical analyses of Caplin and Spulber (1987), Caballero and Engel (1991) and Caplin and Leahy (1991).

Time-dependent models postulate that the timing of a price change is exogenous to the firm and that it only decides on the size of the adjustment. In state-dependent models not only the amount of the price change but also the timing is the outcome of an intertemporal optimisation by the firm. Well known time-dependent models have been introduced by Taylor (1980) and by Calvo (1983). Taylor-contracts have a deterministic length. It is assumed that prices are changed only at the beginning of the contract and not revised during the contract. Calvo-contracts are random contracts. Firms are only allowed to change their price if they receive a signal. This signal occurs with constant probability. The "invisible hand" tosses a coin for every firm until "head" occurs. Then the price is reset and the tossing starts anew. The statistical model underlying a prominent state-dependent model, the menu-cost model, goes one step further by observing gains and losses, the "gambler's wealth". The gambler gains one unit of money each time "head" occurs and he loses one unit of money each time "tail" occurs. The gambler decides each period whether he stops the game, i.e. whether he increases or reduces his price, if his "wealth" or his debt reaches a certain, not necessarily symmetric threshold. Then the game starts anew.

*) This paper was written as part of the joint Eurosystem "Inflation Persistence (research) Network" (IPN). I would like to thank in particular the ifo Institute in Munich for giving me access to its data and I. Angeloni, S. Cecchetti, J. Döpke, J. Gali, V. Gaspar, A. Levin, H. Herrmann, J. Hoffmann, J. Konieczny, H. Pesaran, J. Rotemberg, P. Vermeulen, the participants of the Conference on Inflation Persistence in Frankfurt and the participants of a joint (BuBa, OeNB and SNB) workshop in Zurich for

Attempts to quantify the importance of state-dependent pricing empirically have begun only recently. Using a variance decomposition, Klenow and Kryvtsov (2004) claim to show for US consumer prices that 95 percent of the total variance of monthly inflation can be attributed to variations in the size of price changes and only 5 percent to changes in the frequency of price changes. They take these results as evidence against state-dependence.

Golosov and Lucas (2003) investigate the relation of changes in the rate of inflation to real output and inflation. They develop a state-dependent model in which individual firms are subject to general inflation and large idiosyncratic shocks. The latter makes their model flexible enough to match historical data from high and low-inflation countries. High inflation is sufficient to warrant frequent price adjustments. If inflation is low, prices are changed nonetheless because the idiosyncratic shocks add to the inflation and small changes in the re-pricing probability already cause large changes in inflation in their model. Real aggregate effects of monetary instability are relatively small.

The empirical work of Golosov and Lucas is based on a subset of the Klenow and Kryvstov data. It contains data on prices only. Shocks are therefore identified indirectly by large price changes. The present study instead analyses a dataset that includes information not only on price changes but on explanatory variables as well. Common and idiosyncratic shocks can be distinguished. The data source is the monthly business cycle survey for manufacturing from the German business research institution, the ifo Institute. The data entail information on producer prices and cover the years 1980 to 2001. The data end in November 2001 because of confidentiality restrictions and a change in the questionnaire.

The criticism has often been made that producer prices are essentially list prices. Sales prices are different from contract to contract even for the same product and most contracts include non-price elements like delivery lags. Yet, most theories of price setting are much more suited to producer prices than to consumer prices. In addition, if consumer prices are set according to a simple pricing strategy like a fixed mark-up on

their helpful comments. The views expressed in this paper are those of the author and do not necessarily reflect the opinion of the Deutsche Bundesbank.

marginal unit costs, then it is the production sector that determines the inflation dynamics.

This study takes account of the heterogeneity of business conditions and price setting by focusing on a subset of industries that are more homogenous and change prices not too frequently compared with changes in the level of production. This subset consists of manufacturers of machinery, electrical machinery, precision instruments and motor vehicles. By type of goods, it covers basic goods, capital goods and durable consumer goods. In 1995 its share of GDP was 13 per cent and its share of the PPI 25 per cent. Common to these "metal-working industries", as they are called in Germany, is a more or less unique collective wage contract for western Germany that leads to synchronised wage increases.

Descriptive statistics show that in these industries price increases exhibit a strong seasonal pattern, whereas price decreases follow a different pattern. Furthermore, prices are often increased 12 months after the preceding price change but this matters only if the preceding price change was already an increase. This points to time-dependent price setting in the case of a stable economic environment and to a switch to state-dependent price setting if the environment becomes unstable. On the other hand, since wage contracts often have a duration of 12 (or 24) months, it is very natural to presume that wage contracts are the reason behind the regular price setting. Yet, the labour cost share in these industries is comparatively small, falling from 35 percent on average in 1980 to 32 percent in 1995. Rising prices at times of collectively bargained wage increases may antagonise customers less.

The analysis is restricted to western Germany, mainly for practical reasons. In the early 1990s there were a lot of drop-outs in the east German data so that the longer spells are probably selective. Ignoring eastern German data, on the other hand, should not be selective since its share in total German manufacturing is small. The wage bargaining process does not apply to eastern Germany, and including eastern Germany might increase unobserved heterogeneity due to restructuring after unification that creates substantial problems for duration analysis.

The paper is organised as follows. The next section introduces the data. Section 3 describes the wage bargaining process in these industries. Section 4 describes the

multivariate duration model and the variables used. Section 5 presents the results. Based on these estimates, mean and median durations are estimated for several periods for firms that participated in the business cycle survey during these periods in order to gain an impression of the impact of state-dependent price setting in this historic situation. Section 6 concludes.

2 The data

The data source is the monthly business cycle survey for manufacturing from the *ifo Institut für Wirtschaftsforschung* (Ifo Institute) in Munich from January 1980 to November 2001. A translated version of the questionnaire can be found in annex III. For topics as "Who answers the questionnaire" or "How do firms interpret specific questions" see Lindlbauer (1989) and the references cited therein. The subsample of the data for metal-working industries in West Germany contains 380,000 observations. Firms are asked at plant level. Each plant has a special identifier. Plants report for 144 narrow product groups. Some plants report for several product groups. Thus the plant identifier is not unique. Only the combination of the plant identifier and the code for the product group allows an unambiguous identification. Therefore this combination constitutes the identifier for the unit under investigation in this study. If the product group of a plant changes, the second part of this unique identifier is modified. The sample is not random but by purpose. Big plants are overrepresented. The number of participants fell from about 2,400 in 1980 (monthly average) to 800 in 2001. The data set is organised as a panel. If large plants do not answer, they are called by phone and asked to fill in the questionnaire. Once every quarter or half year it is investigated which firms had stopped reporting. A reminder is send to them and if they still do not report for about three months they are removed from the address list. Thus, if spells are interrupted, this is most likely for a period of one or two months. Tables A1 to A3 in the appendix provide some information on the length of participation.

The somewhat peculiar phrasing of question 7 in the questionnaire (see annex III) "Allowing for changes in sales conditions, our domestic sales prices (net) for XY compared to the past month were raised, left unchanged, reduced" was introduced during the early 1950s. At that time, researchers compared the answers of the business cycle survey with the official PPI by plotting the monthly share of plants with price

increases and the share of plants with price reductions against the change in the official PPI. Their idea was that if all prices are changed by the same amount, then the balances of price increases and price reductions should be proportional to the change in the PPI (Langelütke, 1951). They noticed that in the business cycle survey in January too many price changes were reported compared with the Producer Price Index. They assumed that plants reported list prices and contacted some plants for their interpretation. One contact person proposed the actual wording. Since the official producer price index and the estimated index from the survey data have roughly been in line since that time, nobody wants to change the wording again, even if it is only possible to state the intention behind the wording rather than what it really means.

There is no additional information on price changes beyond the answers to question 7 in the questionnaire. From four face-to-face interviews it can be presumed that firms do report for a 'representative' product. If a product is modified due to customer wishes it will be abstracted from the additional features. If a product is new, either no price change is reported or, if it accounts for only a small percentage of total sales, it is ignored. In case of quantity discounts there are often different lot sizes with a specific but fixed discount so that just one price change has to be reported.

Further monthly questions concern changes in demand (Q. 4) and inventories of finished products (Q. 3). In addition, there is a monthly question on expectations for the next six months on the "business sentiment" (Q. 12). Following other studies, e. g. König and Seitz (1991), the expectations on business sentiment serve as a proxy variable for expected demand. Additionally, there are quarterly quantitative questions on capacity utilisation. The item non-response rate for the quarterly questions is much higher than for the monthly qualitative questions. Unfortunately, there is no information on costs in the survey. Aggregated data has to be used instead.

2.1 Price spells

Since firms stop or interrupt reporting for a specific product group from time to time, some spells are right-censored. Thus, firm-specific information can only be collected until the time shortly before the censoring occurs. Therefore, in this study the additional assumption is made that prices are fixed one period in advance and that the firms' decision is based mainly on information that is available to the firm the month

before the actual price change happens. By the same token, expectations are formed shortly before the price changes. Contemporaneous effects can only be taken into account if they are not firm-specific, for example, a collectively negotiated wage increase in May can be already coded in April. A complete price spell starts with a price change and ends shortly before the next price change.

By comparing actual and planned price changes it is possible to assess in a model-free way how much information is contained in the data prior to the month of the price change. Table A4 shows that while it is a rare occurrence for a price increase not to have been anticipated the three preceding months beforehand, in every second case a price reduction has not been planned. The share of planned (expected) price changes, both increases or decreases, that were not realised within the three following months is equally high. Thus, an approach neglecting contemporaneous information may have difficulties explaining price reductions.

2.2 Price durations and hazard rates

The Calvo-model provides a good starting point for a first look at the data. It assumes an equal and constant probability for each firm of receiving a price signal given that it had not received a signal since the last price change. This "probability" is called hazard rate (see annex I for further details). The Calvo assumption can be investigated by allowing for hazard rates that are not constant. For example, hazard rates may vary with respect to the duration of the price spell or may depend on the sign of the actual and/or preceding price change. Assume for the moment that price increases take place all at once and price reductions in several small steps. Then the hazard rates depend on the sign of the actual price change in the event of a price increase and they depend on the sign of the preceding price change if it was a reduction since adjustment is not completed after the first price reduction. It should be obvious that there is a problem if price spells are left-censored. Then the hazard rate cannot be conditioned on the time since the preceding price change. Therefore left-censored spells are ignored under the assumption of independent censoring.

Figure A1 in the annex presents the four hazard rates for pure sequences of price increases and price reductions and mixed sequences of price increases and reductions. Price spells are ignored if there are more than two price changes without a month of no

price change in between, since these price spells do not fit well in the multivariate analysis pursued in section 4. According to figure A1 there is a large likelihood that a price increase is followed by another price increase after 11, 12 or 13 months. The likelihood of a price reduction, given that the preceding price change was a reduction, is much smaller and the hazard rate is more or less flat. If the preceding price change was a reduction, the likelihood of a price increase is very low and the hazard rate is flat whereas a further price reduction is quite likely in the first four months but definitely not after six months. Is this evidence of price reductions occurring in several small steps? Strictly speaking, it is not since it cannot be inferred from this figure whether there are a) different types of price setters, each reducing its price in one single step but one type after say two months, another type after, say, three months or b) only one type of price setter but reducing its price in several small steps, say, in three steps, the first after one month, the second after two months and the third after one month again. By the same token, it cannot be said whether there are three types of price setters, the first one only increasing its prices, the second only reducing its prices and the third one always changing sign. But clearly, there is not just one type of price setter receiving a price signal with a constant hazard rate as assumed by Calvo. In the case of a price increase following a price increase, it has to be noted that there are also a lot of short spells so that there appears to be lump-sum adjustment as well as incremental adjustment. At least, there are short durations too. A potential explanation is collective wage bargaining in the industries under scrutiny. Therefore the next section describes the collective wage bargaining procedure in more detail.

3 Collective wage bargaining in the metal-working industries

Wage setting in the metal-working industries of western Germany is highly synchronised[1]. According to Kohaut and Schnabel (2001) 42 percent of firms and 66 percent of employees were covered by the collective agreement in 2000. An additional 30 percent of firms with 19 percent of employees applied the union wage rate without contractual obligation. Larger firms apply the union wage rate more often than the smaller firms. In the sample, larger firms are overrepresented. Hence, in the business

survey most firms should be subject to the union wage contract. If domestic costs, wages and intermediate inputs were a major determinant of price changes, one would expect a high degree of synchronisation in price setting within the metal-working industries. The usual duration of wage contracts is 12 months. Sometimes there are longer wage contracts, for example for 36 months, with wage increases taking place every 12 months. These agreed wages can serve as proxies for expected marginal costs, for both the econometrician and the firm owner. To explain the modalities of collective wage bargaining in the metal-working industries, the negotiation round in 2002 is briefly described. This round was chosen, though the dataset ends in 2001, since it includes all features of interest. This is not the case in every round.

The general procedure was agreed upon by the trade union and the employers federation in 1979. It is

1. The trade union makes its claim public four weeks before the contract expires.
2. Negotiations start two weeks before the contract expires.
3. Strikes are not permitted within four weeks after the contract expires.

In the 2002 negotiation round, the preceding agreement ended on 28 February 2002. The round started informally on 10 December 2001 when the trade union's board announced its recommendation: a range of between 5% and 7% and a duration of 12 months. It was motivated by an expected inflation rate of up to 2% in 2002 and an expected economy-wide productivity increase of up to 2%. "The rest is redistribution and backlog demand." Experience shows that the final result is about half, i.e. 3.0%. What was exceptional in this round was the sudden failure of the negotiation process because of rivalries within the trade union and the first strikes for many years.

The main stages were

10 December 2001	wage demand recommended by the trade union's board: 5% - 7%
28 January 2002	official wage demand: 6.5%
7 February 2002	start of negotiations in Bavaria

[1] This is different in other industries. There all regions normally apply the same percentage increase in basic wages but the date of the increase and other parts of the contracts depend on the weakness of the regions' firms relative to the strongest region.

15 March 2002	initial offer from employers in Baden-Württemberg: 2% from March 2002 and an additional 2% from March 2003
28 March 2002	first warning strikes
19 April 2002	failure of negotiations in Baden-Württemberg
25 – 30 April 2002	first trade union ballot (on strike): 90% yes vote
6 May 2002	start of strikes
15 May 2002	restart of negotiations and pilot agreement in Baden-Württemberg
21 – 25 May 2002	second trade union ballot (on agreement): 57% yes vote

The final agreement was: March and April 2002, no wage increase; in May a lump-sum payment of €120; from June 2002 4.0%; and from June 2003 an additional 3.1%. Duration 22 months (March 2002 – December 2003). A back-of-the-envelope calculation yields a 3¼% wage increase per year. That is ¼% higher than first expected, based on the recommendation on 10 December 2001, but fits well within the official wage demand.

Table A5 summarises the wage bargaining process for the years from 1980 to 2001. It shows that wages are increased normally after 10 to 13 months. Figure A2 shows, using "Machinery" as an example, that prices increases and price reductions follow a different pattern. The vertical lines represent the months during which wage increases have taken place. Prices are revised upwards mainly between January and the month of an increase in payments. During the periods of long-term wage contracts it was comparatively easy for firms to form expectations on the increase in marginal costs. However, figure A2 shows no different pricing pattern during the periods of long-term wage contracts. Whether the durations of wage contracts or the seasonal pattern is able to explain the durations of the price spells will be analysed by the multivariate analysis in the next section. There, not only the incidence of wage changes is taken into account but also the amount.

4 An empirical model for explaining price changes

The descriptive analysis so far has given some indication of potential factors influencing the price-setting decision. In this section the data is analysed within the

framework of a multivariate duration model. The model is empirical. The hazard rate, that is a constant in the Calvo-model by assumption, is allowed to vary with variables that try to capture several aspects of price setting, with an emphasis on time versus state-dependence and competitive behaviour.

4.1 Econometric specification

Let Y_t denote a random variable that is

$$k = \begin{cases} 0 & \textit{if} \quad \textit{no price change} \\ 1 & \quad \textit{price increase} \\ 2 & \quad \textit{price reduction} \end{cases} \tag{1}$$

The probability that firm i increases (reduces) its price at period t given that the preceding price change was an increase (reduction) is

$$\Pr\left(T_i = t \middle| Y_{it} = l \wedge Y_{i0} = k\right) = h_{it}^{kl} \prod_{j=1}^{t-1} \left(1 - \left[h_{ij}^{kl} + h_{ij}^{kl}\right]\right) \tag{2}$$

In case of right-censoring all that is known is that the price is changed at a later point in time

$$\Pr\left(T_i > t \middle| Y_{it} = l \wedge Y_{i0} = k\right) = h_{it}^{kl} \prod_{j=1}^{t-1} \left(1 - \left[h_{ij}^{kl} + h_{ij}^{kl}\right]\right) \tag{3}$$

Therefore, if $\delta_i = 1$ for a completed spell and $\delta_i = 0$ for a right-censored spell, the log-likelihood contribution of firm i is

$$L_i = \delta_i \log\left(h_{it}^{kl}\right) + (1 - \delta_i)\log\left(1 - \left[h_{ij}^{kl} + h_{ij}^{kl}\right]\right) + \sum_{j=1}^{t-1} \log\left(1 - \left[h_{ij}^{kl} + h_{ij}^{kl}\right]\right). \tag{4}$$

Ignoring the right-censored spells would result in a less efficient estimation and might even cause a selection bias.

As functional form for the hazard function the logit hazard function is chosen

$$h_{it}^{kl} = \frac{\exp\left(\lambda_t^{kl} + x_{it}'\beta^{kl}\right)}{1 + \sum_{l=1}^{m} \exp\left(\lambda_t^{kl} + x_{it}'\beta^{kl}\right)} \tag{5}$$

The hazard function is parameterised conditional on several variables X that are discussed in the next subsection. The baseline hazard λ is specified non-parametrically through monthly dummies since a parametric function may be too restrictive. A parametric setup may lead to unobserved heterogeneity that becomes unimportant if a non-parametric specification is used instead (Han and Hausman, 1990). Since modelling unobserved heterogeneity is not straightforward in the case of censored multiple spells (van den Berg, 2001) a further attempt has been undertaken to reduce unobserved heterogeneity so that ignoring the remainder may be acceptable. A potential source of what may show up in the regressions as unobserved heterogeneity is a large share of spells lasting only one month. Therefore, for estimation, series of more than two consecutive price changes have been ignored. These spells may reflect incremental price adjustment caused by convex adjustment costs. Including these spells would make it necessary to model the switch between lump-sum and incremental price change. Interesting as it is it is beyond the scope of this paper and the number of such cases is too small anyway.

An additional problem is a potential selectivity bias due to length-based sampling that would result in an oversampling of short spells. As a robustness check, all estimations have been performed on a subset of the data that was restricted to series of at least 48 contingent months without non-response. Almost no differences could be detected.

4.2 Economic specification

The available individual data is most informative on the demand side. The demand change since the last price change is constructed as the sum of the demand changes where a demand increase compared with the previous month is set to 1 and a demand decrease to -1. This variable measures the shift in the level of demand. If demand first increases by one unit and then decreases again by one unit, demand is at

the same level as at the beginning, although over the whole period one additional unit has been produced. Expected business situation for the following six months (up, down, equal) is taken as a proxy for demand expectations. It is assumed that the firm's expectation is not conditioned on its own price decision, meaning that the answer in the business survey refers to Y but not to Y^d. Since price changes of domestic competitors are included in the regression, the share of domestic competitors with increasing and decreasing demand is also included to account for common demand shocks.

Since the data does not contain individual information on costs, the construction of the respective variables deserves some comment. Price indices for imported and domestic intermediate inputs have been calculated using input-output tables and the respective sub-indices of the respective official price index.[2] A price change of intermediate inputs in the model has been calculated as the log difference of the level of the index at the current time to the level of the index preceding the firm's last price change.[3] This is justified as follows. The firm takes its actual costs at the last price calculation that is assumed to have been taken place the month before the last price change and adds the additional costs due to the change in the price of intermediate inputs. It applies a fixed mark-up on unit costs so that the mark-up can be ignored in the calculation of growth rates. The mark-up is large enough to account for volatility in the prices of intermediate inputs. If, other things being equal, these input prices increase too much, the product price will be raised as in an (s,S) model. One can either assume that the firm expects the input prices to stay constant or change at the same rate as assumed for the last price calculation. That is the more satisfactory explanation Cecchetti (1985) refers to. This does not correspond exactly to rational expectations, but may serve as a second-best solution. Owing to the backward-looking nature, it should already create some persistence.

The inclusion of wages is more complex. In section 3 the potential influence of the collective wage bargaining process was emphasised. In the basic Taylor-model the price is increased every time a new wage contract starts, and wage contracts have a

[2] The weights from the IO tables that are published every other year have been linearly interpolated to create monthly weights. In 1995 there was a change in the industry classification to Nace and from West German data to pan-German data. The respective price series and IO weights have been linked in 1995 to back estimate series in Nace classification.

[3] The input price series have been smoothed by an HP filter.

fixed duration. In this model, because the collective wage bargaining process consists of various steps, it is represented by a set of dummies: one dummy variable for the formal start of a new contract (i.e. the end of the previous contract), another for the month of the actual wage increase, a further dummy for the months in between and a separate dummy for the month of an increase during a long-term wage contract, i.e. for a wage increase that was known more than 12 months in advance and that takes place in a year where there are no negotiations and the other collective wage bargaining dummies are therefore zero. Since there is just one collective wage agreement in the industries under review, an overlap of contracts due to wage contracts can only occur if several stages of the wage bargaining process are relevant for price setting.

The dummies do not account for variations in the amount of the wage increase. Therefore an additional variable for wages has to be constructed. There are three sources for aggregate data on wages: the Deutsche Bundesbank's monthly index for collectively negotiated wages, yearly effective wages for two-digit industries from the National Accounts of the Federal Statistical Office and monthly effective wages for four-digit industries from the Monthly Manufacturing Survey (*Monatsbericht im Verabeitenden Gewerbe*). The index of negotiated wages does not account for changes in the labour force during the duration of a contract. It is therefore more rigid than an index for effective wages. On the other hand, the negotiated wage increase is common knowledge to all domestic parties involved in business activity. Monthly effective wages, even if seasonally adjusted, may be too flexible. They ignore the long-term relationship inherent in most labour contracts. As Kimball (1995) put it: "True marginal labor costs are a matter of the additional amount a firm is implicitly promising to pay a worker *someday* in return for working an additional hour." Prices may not rise because people are paid bonuses but bonuses may be paid at the time prices can be raised because demand is high. As an advantage, this kind of data already includes adjustment in the labour force as a result of wage increases that cannot be compensated for by higher product prices. A major drawback of the wages from the Monthly Manufacturing Survey is that there is no ready available measure for the productivity change in these industries. The yearly wages of the National Accounts do not suffer from this shortcoming. The National Accounts provide data on gross value added corresponding to the wages (labour costs) and therefore allow the calculation of the change in labour

productivity and in unit labour costs. However, one major drawback is a break in the series in 1995. Later, wages are reported for Germany as a whole and according to Nace Rev. 1. Before that, wages were reported for western Germany and according to a different classification that cannot be reconciled with Nace at the two-digit level. Therefore the two-digit industries have to be aggregated even further.

Wages have been included in the model in two variants. The first one is backward-looking and parallels the calculation of the changes in intermediate input prices, i.e. the log level shift is calculated. The alternative is forward-looking. For every month the cumulative wage rate for the next 12 months compared with the preceding 12 months is calculated.[4]

The share of domestic competitors with price increases and price reductions has been broken down in the contemporaneous change, the one period lagged change and in the change since the firm's last price change until two periods before the current period. The shares are calculated within four-digit industries (according to Nace Rev.1) by ignoring the own firm according to equation A15 in annex I. The price changes of foreign competitors have been calculated based on the input-output tables.

An output gap variable is calculated by subtracting the firm-specific mean from the firm-specific capacity utilisation. An additional question asks whether technical capacity given actual output and expected orders within the following 12 months is not sufficient, sufficient or more than sufficient. From this variable the net share of domestic competitors with not sufficient, sufficient and more than sufficient capacity is calculated within four-digit industries (according to Nace Rev.1) by ignoring the own firm. This share is split into two variables, depending on whether the number of firms reporting that their capacity will not be sufficient is larger than the number of firms reporting that their capacity will be more than sufficient or not (s. equation A15).

In addition to these variables dummy variables for industries, size class and whether the firm exports or not have routinely been included in the regression for accounting for otherwise unobserved heterogeneity. They are not discussed further. All nominal variables except the expected wage increases have been divided by the PPI to cope with collinearity problems. Since neither unit labour costs nor labour productivity

[4] Cumulative wage sum during 12 months over cumulative employment during the same 12 months.

and corresponding wages taken separately turned out to be significant they are not reported in table A8. The same is the case with monthly backward-looking wages. For a complete list of variables that are used in the regressions, see Table A6.

5 Results

The foremost question is whether price setting is purely time-dependent or if there is an additional state-dependent element and, if there is state-dependence, whether it really matters. The answer to the first question is discussed next, based on the estimated coefficients for the hazard functions. This discussion represents, at the same time, the micro perspective of the data since it tries to explain the heterogeneity within the micro data. A measure of the goodness of fit is the adjusted R-squared for the hazard function estimation. Gauging the importance of the contribution of state dependence is something different. In the aggregate, purely idiosyncratic changes may cancel out and the R-squared of the hazard rate estimation is not the appropriate measure anymore. Instead, this paper takes a more pragmatic approach. For four different periods individual survivor functions are estimated on a subsample of firms and aggregated (averaged) within these periods[5,6]. The locations of the distributions are characterised by their mean and median durations and the dispersion by the first and third quartiles so that the interquartile range can be calculated. The survivor functions including both state-dependent and time-dependent variables are then compared to the survivor functions including only time-dependent variables[7]. It turns out that idiosyncratic demand decreases are the most important source of price reductions whereas common factors, as common demand shocks, specific months of collective wage bargaining, price changes of domestic competitors, the general increase in the PPI and, last but not least, seasonality make price increases more likely.

5.1 State-dependence vs. time-dependence – the micro perspective

In stochastic terms, the sequence of price changes can be seen as a renewal process with two "states": "price increase" and "price reduction" with four possible

[5] The subsample of firms does not have to be identical for the three periods but is constant within each period.

[6] Note that this corresponds to calculating marginal effects.

transitions: increase-reduction, reduction-reduction, reduction-increase and increase-increase. The next four subsections are devoted to these transitions, i.e. to the columns of Table A8. Although path dependence is not modelled explicitly, it is best to understand and to describe these transitions as going through a business cycle.

5.1.1 A price reduction following a price increase

The estimates reveal that falling demand, expected (demexp[8]) or experienced (dem), and stocks of finished products (stocks) that are presumed to be too large appear to be the only reason why a firm starts to reduce its price after a preceding increase. Firms do not take into account variables that relate to other firms such as the demand changes faced by domestic competitors (demcomp) that may serve as a proxy for the business cycle. That non-exporting firms (export) are more likely to reduce their prices after a preceding increase should be a statistical artefact. This corroborates Golosov and Lucas (2003) finding that idiosyncratic shocks matter. As regards time-dependence, price reductions are less likely in December. The baseline hazard function is constant. Thus a price reduction after a preceding price increase is equally likely in every period, conditional on all the other variables.

5.1.2 A price reduction following a price reduction

If the firm's own demand shrinks (dem) or is expected to do so (demexp) prices are likely to be reduced. Capacity becomes underutilised and if it is assumed that this lasts for a longer period, i.e. if the technical capacity of the own firm, given actual and expected orders within the next 12 months (capexpown), is more than sufficient, price reductions will go on[9]. In this situation, the firm starts taking the behaviour of its competitors into account. If domestic competitors faced increasing demand (demcomp) during the preceding month, firms are less likely to reduce prices further. If domestic competitors (pricedomcomp1) reduce their prices, firms reduce their prices, too, but only within the same month (pricedomcomp1). A possible interpretation is that firms want to signal that they are not interested in a price war but will nonetheless retaliate if a competitor reduces its price. Figure A3 shows that short spells dominate over long

[7] Since the survivor function is 1 minus the distribution function, comparing the survivor functions is not different from comparing the distribution functions.
[8] Variable names in brackets refer to variables or groups of variables in table A8.
[9] Only coefficients that are significant at the 5 per cent level are taken into account.

spells. In other words, if firms think it is necessary to reduce the price further they do not hesitate to do so.

5.1.3 A price increase following a price reduction

If plants have experienced demand increases (dem) since their last price reduction, they are more likely to increase prices. This effect is amplified by increasing demand faced by domestic competitors (demcomp). Expected demand decreases (demexp) have an opposite effect. On the cost side, cost increases above the general increase of the producer price index (cost) have no impact yet the increase in the PPI itself since the firm's last price change raises the likelihood of a price increase. Collective wage bargaining (wagebarg) starts to matter too, particularly the month of the formal start of the contract and the mid-term permanent wage increase during a long term contract. Additionally, firms react to price increases (reductions) by domestic competitors (pricedomcomp1) with a higher (lower) likelihood of increasing prices within the same month. The sign of the coefficient of the impact of the price change of foreign competitors (priceforcomp) is counterintuitive. A possible interpretation is that firms collude in the case of domestic competitors but compete with foreign competitors. Yet this may simply be a statistical artefact.

A price increase following a price reduction is more likely if the length of the present and the preceding price spell are both twelve months or if its own length and the length of the preceding spell, taken together, add to twelve months. Both effects are not as important as the coefficient might suggest since, technically speaking, the constant is so low. In the last case, probably, the firm changes its price regularly after twelve months if it increases its price, but falling demand forced it to cut its price irregularly. In other words, the first price change is made in response to an external shock, it is state-dependent, and the second price change is made in accordance with a time-dependent rule. In the absence of the time-dependent price change, the next price change would be farther away and thus the price more sticky.

5.1.4 A price increase following a price increase

As opposed to the latter case, idiosyncratic demand changes since the firm's last price change (dem) do not matter anymore, yet an expected demand increase (demexp) raises the likelihood of a price increase as does increasing (contemporaneous) demand

faced by domestic competitors (demcomp). The effect of decreasing lagged demand by domestic competitors may be a statistical artefact.

On the cost side, again, cost increases above the general increase of the producer price index (cost) have no impact, but the increase in the PPI itself since the firm's last price change raises the likelihood of a price increase. Surprisingly, expected change in real wages (cost) has no impact on the likelihood of price increases either. Perhaps the wage share is too small in the industries under review. But, as expected, the likelihood of a repeated price increase rises during the specific months of the collective wage negotiations (wagebarg). The impact is the strongest if the month of an increase in the wage is known in advance during a long-term wage contract. Reducing customer anger (Rotemberg, 2002) may be a major reason for raising prices at a point of time at which every customer knows that costs are rising for suppliers. Another reason may be mitigating coordination failure: Firms may fear to lose customers in the event of a price increase if competitors do not raise their prices as well (Ball and Romer, 1991).

Capacity (over-) underutilisation (cap) (increases) lowers the likelihood of a price increase. It increases, too, if technical capacity given actual and expected orders within the next 12 months (capexpown) is not sufficient. If the share of competitors with expected capacity constraints (capexpcomp) increases, the likelihood of a price change increases, and if the share of competitors with spare capacity increases, the likelihood of a price increase decreases. If stocks of finished products (stocks) are too small price increases are more likely. This means that changes in stocks are not the consequence of price changes but prices change in order to smooth stocks. If competitors raise (reduce) their prices (pricedomcomp1), firms are more likely to raise (reduce) their prices within the same month.

A price increase following a price increase is more likely if the length of the present and the preceding spell are both twelve months or if its own length and the length of the preceding spell, taken together, add up to twelve months. Now, the impact matters, since the constant is much larger than in the preceding case. While the impact of the state-dependent factors is not really surprising if a price increase follows a price increase, the time-dependence is crucial to the whole price-setting process as will be seen in the next subsections. Even after taking many variables into account, it is still

much more likely that a price increase will follow a price increase after 1, 4, 5, 8, 9 quarters and so on than after 2, 3, 6, 7 … quarters. In the case of the spike of the baseline hazard function at 12 months there is no one-to-one relation with a price increase each January, since this is already captured by the relevant seasonal dummy. There *is* a higher probability that prices are changed in January. But price increases in January do not end only price spells of 12 month length but spells with a length of 3 months, 7 months, etc.., too, and all durations with almost equal probability. By the same token, there is no one-to-one relation with yearly wage contracts nor do all spells with a duration of 12 months belong to firms that change their prices only at 12 month intervals, since this is captured by a dummy-variable, which is significant. This is puzzling at first sight. But suppose, in the case of spells with a length of 12 months, that every firm always changes its price after 12 months and that most of the price changes take place during the first quarter of the year. Then some firms would always be price leaders and others always price followers. This could offend competitors. Thus, on the individual level, firms show a more regular, more time-dependent price setting pattern during periods when they can increase prices several times. Their behaviour is more state-dependent during other periods.

5.2 State dependence vs. time dependence – the aggregate perspective

In order to gain an impression of the contribution of state dependence to the adjustment of prices, various survivor functions have been estimated for three different periods: November 1986 to February 1990, November 1989 to February 1993 and November 1992 to February 1995. The first period was chosen because it covers a long-term wage contract. Furthermore, during the first period the frequency of price increases was increasing, during the second period decreasing, the third period covers a recession and the fourth period was mixed. The estimations are performed for firms that participated during the whole period so that information for all of the conditioning variables is available. The sample is further restricted to the cohort of firms with a price change in October, roughly 60 firms in each period. Starting in November, the survivor functions for the next forty months are estimated based on the estimated hazard functions. All regressors except those representing the history of the firms' own price setting (see table A8 in the appendix) have been taken into account.

5.2.1 Time-dependence

In a first step a model with four components has been estimated as a benchmark. In addition to the constant term sets of dummy variables for industries, different months and durations since the last price change (the baseline hazards) have been included. Further, a survivor function under Calvo's assumption of a constant hazard rate has been estimated. According to figure A4 the baseline hazards are more important than the seasonal dummies. The reason is the regular increase and decrease of the baseline hazard for price increases following price increases (see figure A5 and 5.1.4). The latter situation clearly dominates the price setting. The median under the Calvo assumption (5.7 months) is much smaller than the median under a non-constant hazard function (8.7 months). This may also explain the Bils and Klenows (2004) finding of a short adjustment period. Their estimates are based on a constant hazard function. Price increases are more frequent than price reductions. Most price reductions are observed within four months whereas price increases are observed either within three months or after 10 to 15 months (see figure A6).

5.2.2 The contribution of state-dependence

The estimation of the transition intensities involves a lot of variables, partly to take account of otherwise unobserved heterogeneity that should have resulted in steeper baseline hazard functions. The impact of these individual variables on the transition intensities has been discussed in section 5.1. This subsection groups variables together according to their economic content (s. table A6 in the appendix). It starts with a comparison of the purely time-dependent survivor function and the state-dependent survivor functions. Afterwards the importance of idiosyncratic vs. common shocks etc. is investigated.

The resulting survivor functions are shown in figure A8[10]. The solid line represents the survivor function using time dependent variables only. The median duration (Prob=.50) is 5 months compared with 7-8 months for state-dependence and the mean is 8.7 months compared with 11-18 months. Deviations from the state-dependent survival functions are substantial with the exception of 1989, during the German unification boom.

[10] Owing to limitations on space, the survivor function starting 1995 is not shown. But see table A7.

In order to gain an impression of the impact of various explanations the estimated coefficients in table A8 are used to first calculate the "conditional" time-dependent survivor function and, for example, a survivor function that includes the time-dependent part and the variables representing customer anger. Table A7 lists the quartiles and the mean of the durations.

According to the results, preventing customer anger has almost no impact. The median duration is about 1-2 weeks shorter than the conditional time-dependence and the mean 3-4 weeks. The interquartile range is reduced by 6 weeks. Idiosyncratic shocks reduce the adjustment period by roughly 6 weeks (see also figure A9). Common shocks make adjustment faster in 1989, during the German unification boom. The impact of competition is most severely felt in 1992 when it considerably slows down adjustment (see figure A10). The variables that are related to (s,S)-type models lead to results that are similar to the competition variables (see figure A11). This does not occur by chance, since there is an overlap of variables. The price changes of domestic competitors are included under competition as well as under (s,S)-type models and under common shocks. The capacity constraint of domestic competitors is included under common shocks as well as under competition and the cumulative price change by foreign competitors are included under competition as well as under (s,S)-type models. In order to disentangle these groups a separate analysis is performed for these variables. Capacity constraints of competitors do not have much impact. The major effect comes from foreign competition. It makes adjustment slower in the observed periods.

6 Summary and conclusions

For the "metal-working industries" in western Germany an empirical duration model is estimated. The data source is a panel of product groups from a monthly business survey for German manufacturing that covers the period from 1980 to 2001. The analysis is restricted to lump-sum price adjustment.

Price setting turns out to be state-dependent as well as time-dependent but time-dependence dominates. Time-dependence is most prevalent when a price increase follows a price increase. Then price increases are very likely to happen during the fourth and fifth quarter after the preceding price increase. A lag of 12 months is quite common,

even if seasonal effects and wage negotiations are accounted for. Despite the strong time-dependence almost every type of opportunity to justify a price increase is used by at least some firms. However, on average, durations are not much affected. For example, price increases at specific months related to the collective wage negotiations reduce median adjustment by just one to two weeks. The reason may be, that relatively important opportunities like increases in collectively negotiated wages or price increases by competitors allow firms to coordinate their price increases. A firm that otherwise would have changed its price e.g. in June, after 14 months, now uses the opportunity that a lot of competitors change their prices in April to change its price two months in advance. Another firm would have changed its price after seven months in March but waits for fear of losing market share and changes its price with a postponement of two months. In the aggregate, state-dependence averages out. Evidence on cost push in kind of (s,S)-models is only limited, since the estimation of mean and median durations have been performed under more or less historical conditions and, during the periods observed, cost increases were relatively small.

State-dependence seems crucial when prices are reduced or a price increase follows a price reduction. Prices reductions take place if demand has decreased since the preceding price change or demand is expected to decrease. Price changes in reaction to idiosyncratic demand shocks do not cancel out. They reduce the aggregate duration of price changes. If competitors reduce their prices and the firm's last price change has already been a reduction it cuts its price further, probably for fear of losing market share. The timing of a price reduction is not affected by cost changes. Cost reductions do not decrease prices but temporarily increase profits. Idiosyncratic cost shocks cannot be observed owing to data limitations.

While the business cycle survey data used in this paper are suited for the analysis of when, why and how often prices change, they give only a limited answer to the question why prices do not change. There are indications for coordination failure and fairness considerations but the results are not clear cut. For this reason the participants of the business cycle survey have been contacted in a special survey on price rigidity. The respective dataset can be merged with the business cycle survey. This will be analysed in a further paper.

References

Ball, L. and D. Romer, 1991, "Sticky Prices as Coordination Failure", American Economic Review, Vol. 81 No. 3, 539-552

Bils, M. and P. Klenow, 2004, "Some Evidence on the Importance of Sticky Prices", Journal of Political Economy. 2004, 112(5), 947-85

Calvo, G. A., 1983, "Staggered Prices in a Utility-Maximizing Framework", Journal of Monetary Economics, 12(3): 383-98

Caplin, A. and J. Leahy, 1991, "State-dependent Pricing and the Dynamics of Money and Output", Quarterly Journal of Economics, vol. 106, 683-708

Caplin, A. and Spulber, 1987, "Menu Costs and the Neutrality of Money", Quarterly Journal of Economics, 1987, vol. 102, 703-726.

Cecchetti, S. G., 1985, "The Frequency of Price Adjustments: A Study of the Newsstand Prices of Magazines", Journal of Econometrics, vol. 31, 255-274

Golosov, M. and Robert E. Lucas, Jr., 2003, "Menu Costs and Phillips Curves", NBER Working Paper, No. 10187

Han, A. and J. A. Hausman, 1990, „Flexible Parametric Estimation of Duration and Competing Risk Models", Journal of Applied Econometrics, 5, 1-28

Kalbfleisch, J. and R. Prentice, 1980, The Statistical Analysis of Failure Time Data, New York: Wiley

Kimball, M., 1995, "The Quantitative Analytics of the Basic Neomonetarist Model", Journal of Money, Credit, and Banking, 27, 1241-1277

Klenow, P. and O. Kryvtsov, "State-Dependent or Time-Dependent Pricing: Does it Matter for Recent U:S. Inflation", mimeo, http://www.econ.umn.edu/~oleksiy/research/research.htm

König, H. and H. Seitz, 1991, "Production and Price Smoothing by Inventory Adjustment?", Empirical Economics, 16, 233-252

Kohaut, S., and C. Schnabel, 2001, "Tarifverträge - nein danke!? Einflussfaktoren der Tarifbindung west- und ostdeutscher Betriebe", Discussion Papers No. 8, Friedrich-Alexander-Universität Erlangen-Nürnberg

Lancaster, T., 1990, The Econometric Analysis of Transition Data, Cambridge University Press

Langelütke, H., W. Marquardt and O. Anderson, 1951, Das Konjunktur-Test-Verfahren u. seine wirtschaftswissenschaftliche Bedeutung, München, Schriftenreihe d. Ifo-Inst. f. Wirtschaftsforschung, Band 13

Lindlbauer, J. D., 1989, „Die Umfragen des ifo-Instituts: Fragestellung, Datenerfassung und Auswertung" in „Handbuch der Ifo-Umfragen", by: Karl Heinrich Oppenländer, Günter Poser (eds.), Duncker & Humblot / Berlin-München

Rotemberg, J.J., 2002, "Customer Anger at Price Increases, Time Variation in the Frequency of Price Adjustment and Monetary Policy", NBER Working Paper, No. 9320

Taylor, J. B., 1980, “Aggregate Dynamics and Staggered Contracts”, Journal of Political Economy, 88, 1-23

Van den Berg, G. J., 2001, “Duration models: Specification, identification and multiple durations.“ In J.J. Heckman and E. Leamer (eds.), Handbook of Econometrics, Vol. 5, Elsevier Science B.V.

Annex I - Formulas

Discrete duration model and hazard rate:

The statistical model underlying the analysis in this paper is an extension of the tossing of a coin n times. Let Y_t denote a random variable that is 1 if a price change (= "head") occurs in the t th throw and 0 if no price change (= "tail") occurs.

$$Y_t = \begin{cases} 1 & \textit{if} \quad \textit{price changes} \\ 0 & \quad\quad \textit{price does not change} \end{cases}, \qquad t = 1, \ldots, n \tag{A1}$$

The probability that a price is held constant for t periods and then changes is given by the probability that the preceding price change happened in period 0, is changed in period t and is not changed at any period in between.

$$\Pr\left(Y_t = 1 \wedge Y_{t-1} = 0 \wedge \ldots \wedge Y_1 = 0 \middle| Y_0 = 1\right) \tag{A2}$$

In order to estimate this probability define the so called "hazard rate" h_t that is the probability of a price change in period t under the condition that it has not been changed before.

$$\begin{aligned} h_1 &= \frac{\Pr\left(Y_1 = 1\right)}{\Pr\left(Y_1 = 1 \vee Y_1 = 0\right)} \\ h_2 &= \frac{\Pr\left(Y_2 = 1 \wedge Y_1 = 0\right)}{\Pr\left(\left[Y_2 = 1 \vee Y_2 = 0\right] \wedge Y_1 = 0\right)} \\ &\vdots \\ h_t &= \frac{\Pr\left(Y_t = 1 \wedge Y_{t-1} = 0 \wedge \ldots \wedge Y_1 = 0\right)}{\Pr\left(\left[Y_t = 1 \vee Y_t = 0\right] \wedge Y_{t-1} = 0 \wedge \ldots \wedge Y_1 = 0\right)} \end{aligned} \tag{A3}$$

Let T be a random variable that denotes the time when a price change takes place the first time and define the so called "survivor function" $S(t)$ through the probability that the process has not stopped before time t

$$S(t) = \Pr(T \geq t). \tag{A4}$$

With this notation the hazard rates can be written as

$$h_t = \frac{\Pr(T = t)}{S(t)} = \frac{f(t)}{S(t)} = \frac{f(t)}{1 - F(t)} \tag{A5}$$

where f and F are the density and the cumulative density of T, the duration of the price spell. Since the survivor function is one minus the distribution function it contains the same information. The first quartile, median and third quartile of the survivor function is the third quartile, median and first quartile of the distribution function. The inter quartile range is therefore the same.

The probability that a price is changed after T periods and not before equals

$$\Pr(T = t) = h_t S(t) = h_t \prod_{j=1}^{t-1} (1 - h_j) \tag{A6}$$

if hazard rates are used and

$$\begin{aligned}
&\Pr(T = t) \\
&= \Pr(Y_t = 1 \wedge Y_{t-1} = 0 \wedge \ldots \wedge Y_1 = 0 | Y_0 = 1) \\
&= \frac{\Pr(Y_t = 1 \wedge Y_{t-1} = 0 \wedge \ldots \wedge Y_1 = 0)}{\Pr([Y_t = 1 \vee Y_t = 0] \wedge Y_{t-1} = 0 \wedge \ldots \wedge Y_1 = 0)} \\
&x \prod_{j=1}^{t-1} \left(1 - \frac{\Pr(Y_j = 1 \wedge Y_{j-1} = 0 \wedge \ldots \wedge Y_1 = 0)}{\Pr([Y_j = 1 \vee Y_j = 0] \wedge Y_{j-1} = 0 \wedge \ldots \wedge Y_1 = 0)} \right) \\
&= \frac{\Pr(Y_t = 1 \wedge Y_{t-1} = 0 \wedge \ldots \wedge Y_1 = 0)}{\Pr(Y_{t-1} = 0 \wedge \ldots \wedge Y_1 = 0)} \\
&x \prod_{j=2}^{t-1} \left(1 - \frac{\Pr(Y_j = 1 \wedge Y_{j-1} = 0 \wedge \ldots \wedge Y_1 = 0)}{\Pr(Y_{j-1} = 0 \wedge \ldots \wedge Y_1 = 0)} \right) \Pr(Y_1 = 0) \\
&= \Pr(Y_t = 1 | Y_{t-1} = 0 \wedge \ldots \wedge Y_1 = 0) \\
&x \prod_{j=2}^{t-1} (1 - \Pr(Y_j = 1 | Y_{j-1} = 0 \wedge \ldots \wedge Y_1 = 0)) \Pr(Y_1 = 0)
\end{aligned}$$

if conditional probabilities are used. The superiority of the former formulation is obvious.

As usual in binary models covariates can be taken into account by parameterising the hazard rate, for example taking the logit form

$$h_t = \frac{\exp(\lambda_t + X_t\beta)}{1+\exp(\lambda_t + X_t\beta)} \tag{A7}$$

where X_t is now a matrix of covariates that may also include time-varying covariates. To avoid endogeneity problems X should not include elements that depend on the decision under scrutiny. λ_t is a constant that may be different for every time t. β is a vector of parameters that are assumed to be constant for all times t. Of course, one could estimate a different β for every t, but then there would be no efficiency gain over separate binary regressions for every t.

Again, this model can be extended by discriminating between price increases and price reductions. Ignore for the moment covariates. Let there be $K = m + 1$ different states:

$$k = \begin{cases} 0 & \textit{if no price change} \\ 1 & \textit{price increase} \\ 2 & \textit{price reduction} \end{cases} \tag{A8}$$

The probability that a price is increased the first time after t periods given that the preceding price spell ended in a price reduction is

$$\Pr\left(Y_t = l \wedge Y_{t-1} = 0 \wedge \ldots \wedge Y_1 = 0 \middle| Y_0 = k\right) \tag{A9}$$

with $k = 2$ and $l = 1$. And the hazard rate is

$$h_t^{kl} = \frac{\Pr\left(Y_t = l \wedge Y_{t-1} = 0 \wedge \ldots \wedge Y_1 = 0 \middle| Y_0 = k\right)}{\Pr\left(\left[Y_t = 2 \vee Y_t = 1 \vee Y_t = 0\right] \wedge Y_{t-1} = 0 \wedge \ldots \wedge Y_1 = 0 \middle| Y_0 = k\right)} \tag{A10}$$

The probability that a price is increased after T periods and not before given that the preceding price spell ended in a price reduction equals

$$\Pr\left(T=t\middle|Y_t=l\wedge Y_0=k\right)=h_t^{kl}S^k\left(t\right)=h_t^{kl}\prod_{j=1}^{t-1}\left(1-\left[h_j^{kl}+h_j^{kl}\right]\right) \tag{A11}$$

Using again the logit form for parameterisation results in

$$\begin{aligned}&\Pr\left(T=t\middle|Y_t=l\wedge Y_0=k\right)\\&=\frac{\exp\left(\lambda_t^{kl}+X_t\beta^{kl}\right)}{1+\sum_{l=1}^{m}\exp\left(\lambda_t^{kl}+X_t\beta^{kl}\right)}\prod_{j=1}^{t-1}\frac{\exp\left(\lambda_j^{kl}+X_j\beta^{kl}\right)}{1+\sum_{l=1}^{m}\exp\left(\lambda_j^{kl}+X_j\beta^{kl}\right)}\end{aligned} \tag{A12}$$

Thus parameters are estimated by two separate multinomial logits, one for the preceding price spell ending in a price reduction and another for the preceding price spell ending in a price increase.

The relation to the Calvo-model is straightforward and needs only the recognition of an initial condition. The tossing of a coin is the process that describes whether a price signal occurs or not. "Head" means that the price signal occurs and that the price is changed. "Tail" means that the old price remains unchanged. The required initial condition is that at time 0 the preceding price change took place $Y_0\neq 0$.

Construction of variables

Let $p_{lt}^{+},p_{lt}^{-},p_{lt}^{0}$ be binary variables that denote whether the price of item l is higher, lower or the same at time t compared with time $t-1$. Then the frequency f_{jt}^{+},f_{jt}^{-} of a price increase or decrease at time t in category j is calculated as

$$\begin{aligned}f_{jt}^{+}&=\frac{\sum_{l\in U_j}p_{lt}^{+}}{\sum_{l\in U_j}p_{lt}^{+}+\sum_{l\in U_j}p_{lt}^{-}+\sum_{l\in U_j}p_{lt}^{0}}\\f_{jt}^{-}&=\frac{\sum_{l\in U_j}p_{lt}^{-}}{\sum_{l\in U_j}p_{lt}^{+}+\sum_{l\in U_j}p_{lt}^{-}+\sum_{l\in U_j}p_{lt}^{0}}\end{aligned} \tag{A13}$$

where U_j is the sample of all units (elements) belonging to category (set) j. The frequency of a price change f_{jt} at time t in category j is calculated as

$$f_{jt} = f_{jt}^{+} + f_{jt}^{-} \tag{A14}$$

Calculation of the price increases and decreases of competitors:

Let $p_{lt}^{+}, p_{lt}^{-}, p_{lt}^{0}$ be binary variables that denote, for example, whether the price of item l is higher, lower or the same at time t compared with time $t-1$. Then the frequency f_{ijt}^{+}, f_{ijt}^{-} of price increases and decreases of firm i's competitors at time t in category j is calculated as

$$f_{ijt}^{+} = \frac{\sum_{l \in U_j^c} p_{lt}^{+}}{\sum_{l \in U_j^c} p_{lt}^{+} + \sum_{l \in U_j^c} p_{lt}^{-} + \sum_{l \in U_j^c} p_{lt}^{0}}$$

$$f_{ijt}^{-} = \frac{\sum_{l \in U_j^c} p_{lt}^{-}}{\sum_{l \in U_j^c} p_{lt}^{+} + \sum_{l \in U_j^c} p_{lt}^{-} + \sum_{l \in U_j^c} p_{lt}^{0}}$$

where U_j^c is the sample of all units (elements) belonging to category (set) j except the firm i. From these frequencies the balance is calculated

$\Delta f_{it} = f_{ijt}^{+} - f_{ijt}^{-}$.

The balance is split into two variables for net increases and decreases

$$s_{it}^{+} = \begin{cases} +\Delta f_{it} & if \quad \Delta f_{it} \geq 0 \\ 0 & \Delta f_{it} < 0 \end{cases}$$

$$s_{it}^{-} = \begin{cases} -\Delta f_{it} & if \quad \Delta f_{it} < 0 \\ 0 & \Delta f_{it} \geq 0 \end{cases} \tag{A15}$$

Annex II - Figures and Tables

Table A1: Number of firms according to the length of their participation (including periods of non-participation)

Length of participation (m=months/y= years)	Number of firms	Percentage share
1m	169	6.7
2m to 12m	205	8.1
1< x <= 2y	163	6.5
2< x <= 3y	164	6.5
3< x <= 4y	120	4.8
4< x <= 5y	115	4.6
5< x <= 6y	98	3.9
6< x <= 7y	82	3.3
7< x <= 8y	69	2.7
8< x <= 9y	64	2.5
9< x <=10y	52	2.1
10< x <=11y	55	2.2
11< x <=12y	57	2.3
12< x <=13y	58	2.3
13< x <=14y	83	3.3
14< x <=15y	70	2.8
15< x <=16y	67	2.7
16< x <=17y	57	2.3
17< x <=18y	57	2.3
18< x <=19y	74	2.9
19< x <=20y	37	1.5
20< x <=21y	38	1.5
21< x <=22y	562	22.3
Total	2 516	100

Table A2: Number of censored and uncensored spells

Censoring	number of spells	Percentage share
Complete	24 091	48.5
left-censored	6 740	13.5
right-censored	6 740	13.5
left and right-censored	12 199	24.5
Total	49 770	100.0

Table A3: Number of observed periods according to the length of uninterrupted participation

Length of uninterrupted participation (m=months/y= years)	number of periods	Percentage share	number of monthly observations	Percentage share
1m	16 795	46.1	16 795	4.4
2m	5 044	13.9	10 088	2.7
3m	2 635	7.2	7 905	2.1
4m	2 387	6.6	9 548	2.5
5m	1 251	3.4	6 255	1.6
6m	834	2.3	5 004	1.3
7m	640	1.8	4 480	1.2
8m	507	1.4	4 056	1.1
9m	429	1.2	3 861	1.0
10m	361	1.0	3 610	1.0
11m	405	1.1	4 455	1.2
12m	300	0.8	3 600	1.0
1< x <= 2y	1 713	4.7	30 224	7.9
2< x <= 3y	827	2.3	25 264	6.6
3< x <= 4y	494	1.4	20 769	5.5
4< x <= 5y	300	0.8	16 148	4.2
5< x <= 10y	763	2.1	63 714	16.7
10< x <=15y	260	0.7	38 605	10.1
15< x <=20y	224	0.6	47 248	12.4
20< x <=22y	229	0.6	58 879	15.5
Total	36 398	100	380 508	100

Table A4: Planned and actual price changes.

	Increase		Reduction	
	1981-1990	1991-2000	1981-1990	1991-2000
Share of unexpected price changes	15	17	55	33
Share of planned price changes that did not happen	42	44	51	36

Note: A price increase/reduction is unexpected if in none of the preceding three months the question on expectations for the change in domestic sales prices (Q. 9) was marked. A price increase/reduction is planned and does not happen if Q9 is marked in a certain month but a corresponding price change is not reported in Q7 in any of the three following months. Since there are no data for December 2001 and no data on expected price changes for January 1980, the observation period is limited to 1981-2000.

Table A5: Collective wage negotiations, demands and final agreements

year	duration of contract	duration in months	wage demand	date of wage demand	agreement	date of agreement	date of wage increase
1980	1. Feb. 80 / 31. Jan. 81	12	10.5%	27. Dec.	6.8%	14. Feb.	1. Mar.
1981	1. Feb. 81 / 31. Jan. 82	12	8%	12. Dec.	Feb., Mar.: DM 160; 1. Apr.: 4.9%	29. Apr.	1. May
1982	1. Feb. 82 / 31. Jan. 83	12	7.5%	1. Dec.	Feb.: DM 120; 1. Mar.: 4.2%	8. Mar.	1. Apr.
1983	1. Feb. 83 / 31. Jan. 84	12	6.5%	17. Dec.	3.2%	6. Apr.	1. May
1984 1985	1. Feb. 84 / 31. Mar. 86	26	3% + 35h	14. Dec.	1. Feb. to 30. Jun. 84: 0%; 1. Jul. to 31. Mar. 85: 3.3%; 1. Apr. 85 to 31. Mar. 86: 2.0% + (3.9% = reduction of working hours from 40 to 38.5 h)	29. Jun.	1. Jul.
1986	1. Apr. 86 / 31. Mar. 87	12	7.5%	27. Mar.	Apr.: DM 230; 1. May: 4.4%	19. May	1. Jun.
1987 1988 1989	1. Apr. 87 / 31. Mar. 90	36			1. Apr. to 31. Mar. 88: 3.7 % 1. Apr. to 31. Mar. 89: 2.0% reduction of working hours from 38.5 to 37.5 h 1. Apr. to 31. Mar. 90: 2.5% reduction of working hours from 37.5 to 37 h	23. Apr.	1. May
1990	1. Apr. 90 / 31. Mar. 91	12	9% + 35h=12%	12. Dec. 89	Apr., May.: DM 215; 1. Jun. to 31. Mar.: 6.0% 1. Apr. 93: red. of working hours: 37h to 36h 1. Oct. 95: red. of working hours: 36h to 35h	4. May	1. Jun.

Table A5: Collective wage negotiations, demands and final agreements (cont.)

year	duration of contract	duration in months	wage demand	date of wage demand	agreement	date of agreement	date of wage increase
1991	1. Apr. 91 / 31. Mar. 92	12	10%	1. Feb.	Apr., May.: DM 290; 6.7%	7. May	1. Jun.
1992 1993	1. Apr. 92 / 31. Dec. 93	21	not below 6% (3.12.) 9.5% (27.4)	3. Dec.	1. Apr. to 31. Mar. 93: 5.4% 1. Apr. to 31. Dec. 93: 3.0%; reduction of working hours from 37 to 36 h (agreed in 1990) reduction of working hours to 35h till 1. Oct. 95	19. May	1. Jun.
1994	1. Jan. 94 / 31. Dec. 94	12	5.5%	before 6.12.93	1. Jan. to 31. May.: 0% 1. Jun. to 31. Dec.: 2%	5. Mar.	1. Jun.
1995 1996	1. Jan. 95 / 31. Dec. 96	24	6%	before 6. 12. 94	Jan to Apr.: DM 152.50 1. May to 31. Oct.: 3.4% 1. Nov. 95 to 31. Dec. 96 3.6%	7. Mar.	1. Apr.
1997 1998	1. Jan. 97 / 31. Dec. 98	24			Jan. Mar.: DM 200 1. Apr. to 31. Mar. 98: 1.5% 1. Apr. to 31. Dec.: 2.5%	5. Dec. 96	1. Jan.
1999	1. Jan. 99 / 29. Feb. 00	14	6.5%	"autumn"	Jan., Feb.: DM 350 + 1% yearly wage 1. Mar. to 29. Feb 00: 3.2%	19. Feb.	1. Mar.
2000 2001	1. Mar. 00 / 28. Feb. 02	24	4%	Nov.	Mar., Apr.: DM 165 1. May to 30. Apr. 01: 3.0% 1. May to 28. Feb. 02: 2.1%	28. Mar.	1. Apr.

Rem: The wage demand, the date of the wage demand and the date of the final agreement are taken from the "Handelsblatt", a German business newspaper or from the internet site of the trade unions (Tarifarchiv).

Table A6: Sample means, standard deviations and « theories » .

Explanatory variable	mean	Standard deviation	Time- vs. State-dependence (T/S)	Idiosyncratic vs. Common shock (I/C)	Tacit collusion, Customer anger, vs. sS-model (A/sS)	Competition (W)
Demand						
Net demand change since the time of the firm's last price change						
more than 4 reductions	0.0762	0.2653	S	I	sS	
4 reductions	0.0321	0.1763	S	I	sS	
2/3 "	0.1312	0.3376	S	I	sS	
1 "	0.1517	0.3587	S	I	sS	
no change	-	-	-	-	-	
1 increase	0.1420	0.3490	S	I	sS	
2/3 "	0.1109	0.3140	S	I	sS	
4 "	0.0221	0.1472	S	I	sS	
more than 4 increases	0.0419	0.2004	S	I	sS	
Expected demand change during the next six months						
demand decrease expected	0.2055	0.4041	S	I	sS	
no change expected	-	-	-	-	-	
demand increase expected	0.1509	0.3580	S	I	sS	
Demand faced by domestic competitors						
Increasing (contemporaneous)	0.0309	0.0808	S	C		
Decreasing (contemporaneous)	0.0510	0.1075	S	C		
Increasing (preceding month)	0.0296	0.0787	S	C		
Decreasing (preceding month)	0.0511	0.1067	S	C		
Costs						
Cost indices of intermediate inputs; log change of the respective index compared with the time of the firm's last price change						
Domestic†	0.0015	0.0078	S		sS	
Imported (increase of) †	0.0054	0.0123	S		sS	
Imported (decrease of)†	0.0145	0.0243	S		sS	
Expected wage increase (log change over the next 12 months)	0.0381	0.0153	S		sS	
Specific month of collective wage bargaining						
formal start of contract	0.0539	0.2258	S	C	A	
month before month of permanent wage increase (not in mid of long-term contract)	0.0596	0.2368	S	C	A	
month of permanent wage increase (not in mid of long-term contract)	0.0624	0.2419	S	C	A	
long term contracts only						
mid-term permanent wage increase	0.0231	0.1504	S	C	A	
Relative Prices						
PPI (log change compared to the time of t. firm's last price change)	0.0119	0.0162	S		sS	
Cumulated price change of domestic competitors since the time of the firm's last price change until time t-2 (remaining time)						
Increase†	0.0574	0.2456	S		sS	
Decrease†	0.0513	0.1908	S		sS	
Prices of domestic competitors						
Increasing (contemporaneous)	0.0269	0.0642	S	C	sS	W
Decreasing (contemporaneous)	0.0110	0.0377	S	C	sS	W
Increasing (preceding month)	0.0281	0.0655	S	C	sS	W
Decreasing (preceding month)	0.0108	0.0375	S	C	sS	W
Price index of foreign competitors; log change compared with the firm's last price change						
Price of foreign competitors†	0.0103	0.0240	S		sS	W

Table A6: Sample means, standard deviations and « theories »

Explanatory variable	mean	Standard deviation	Time- vs. State-dependence (T/S)	Idiosyncratic vs. Common (I/C)	Tacit collusion, Customer anger, vs. sS-model (A/sS)	competition
Capacity utilisation / Stocks of finished products / Exports						
log capacity over utilisation	-0.0111	0.1533	S	I		
Technical capacity given actual and expected orders within the next 12 months						
Own firm:						
not sufficient	0.0579	0.2337	S	I		
sufficient	-	-	-	-		
more than sufficient	0.2788	0.4484	S	I		
domestic competitors (share):						
not sufficient	0.0112	0.0384	S	C		W
more than sufficient	0.1837	0.1480	S	C		W
Stocks of finished products						
too large	0.1490	0.3561	S	I		
sufficient			-	-		
too small	0.0443	0.2059	S	I		
no stocks	0.4271	0.4946	S	I		
Exports						
No exports	0.0255	0.1577	S	-		
History of the firm's own price setting						
Length of the present price spell and the preceding price spell						
differ by one month	0.0731	0.2603	T			
is the same but not 12 months	0.0232	0.1505	T		(A)	
is the same and 12 months	0.0052	0.0725	T		(A)	
adds to 12 months	0.0323	0.1768	T		(A)	
Preceding spell is missing	0.2055	0.4040	T			
Employees / Industries / etc.						
Employees in product group <= 50	0.1321	0.3386				
Industry (base: nace295)						
nace291	0.1283	0.3344				
nace292	0.0737	0.2614				
nace293	0.0381	0.1914				
nace294	0.0843	0.2779				
nace297	0.0413	0.1991				
nace300	0.0069	0.0828				
nace311	0.0891	0.2850				
nace313	0.0262	0.1597				
nace315	0.0343	0.1821				
nace321	0.0378	0.1907				
nace322	0.0094	0.0969				
Nace323	0.0217	0.1458				
Nace334	0.0298	0.1700				
Nace335	0.0064	0.0800				
Nace341	0.0122	0.1100				
Nace343	0.0417	0.2001				
Nace35	0.0103	0.1010				

Table A6: Sample means, standard deviations and « theories »

Explanatory variable	mean	Standard deviation	Time- vs. State-dependence (T/S)	Idiosyncratic vs. Common (I/C)	Tacit collusion, Customer anger, vs. sS-model (A/sS)	competition
Year (base: 1987)						
1980	0.0198	0.1395	S			
1981	0.0509	0.2199	S			
1982	0.0601	0.2378	S			
1983	0.0588	0.2354	S			
1984	0.0590	0.2356	S			
1985	0.0585	0.2348	S			
1986	0.0580	0.2338	S			
1988	0.0562	0.2304	S			
1989	0.0527	0.2236	S			
1990	0.0484	0.2146	S			
1991	0.0482	0.2143	S			
1992	0.0468	0.2113	S			
1993	0.0423	0.2014	S			
1994	0.0407	0.1976	S			
1995	0.0395	0.1948	S			
1996	0.0373	0.1896	S			
1997	0.0352	0.1845	S			
1998	0.0334	0.1797	S			
1999	0.0331	0.1789	S			
2000	0.0324	0.1771	S			
2001	0.0295	0.1693	S			

† real values, measured relative to the PPI

Table A7: Means and quartiles of durations for different explanations

Explanation	Year	Quartiles			Mean
		75%	50%	25%	
Calvo	1980-2001	2.3	5.7	11.3	8.6
Conditional time-dependence	1986	2.3	8.3	17	14.1
	1989	3.6	11.3	23.5	16.1
	1992	2.0	6.0	15	11.8
	1995	2.3	8.3	18	13.4
State-dependence	1986	2.3	8	17.5	13.1
	1989	2.3	8	13	10.7
	1992	2	7	27.3	18.2
	1995	2	7	17.5	14.0
Customer anger	1986	2.3	8	16.7	13.3
	1989	3.7	11.3	23	15.7
	1992	2	5.7	14	11.3
	1995	2.3	8	15.5	12.6
Idiosyncratic demand shocks	1986	2	7	15	12.8
	1989	3	11	20	14.5
	1992	2	5	13.3	10.4
	1995	2	7	15.3	12.1
Common shocks	1986	3	7.7	16	11.9
	1989	2.7	8.7	17	13.7
	1992	2	5.5	14.3	11.3
	1995	2.3	8.3	16	12.8
Competition	1986	2.5	7.5	23	14.3
	1989	3	10	22	16.1
	1992	2.3	8.5	30	21.6
	1995	2.3	9	22	15.4
sS-type model	1986	2.3	9	19	13.2
	1989	3	10.7	18	13.7
	1992	2	7	18.7	18.8
	1995	2	8	25	14.0
Domestic competition	1986	2	8	16	13.7
	1989	3	11	21	14.8
	1992	2	5.7	14.7	11.6
	1995	2	8	17	13.2
Foreign competition	1986	2.5	9.7	23	15.2
	1989	4	11.5	24.5	17.4
	1992	2.3	8.3	29	21.6
	1995	2.5	9	21	15.0
Capacity constraints of Domestic competitors	1986	2.5	9	19.3	14.2
	1989	3.7	11.3	23	15.3
	1992	2.3	8	24.7	17.8
	1995	2.5	9	21	14.7
PPI (part of nominal variables included)	1986	2.3	9	29	13.0
	1989	4	11.3	23	15.2
	1992	2.3	8	24.7	17.4
	1995	2.5	9	21	14.7

Table A8: Logit-estimation

Explanatory variable	increase		reduction		reduction	increase	increase	
Demand								
Net demand change since the time of the firm's last price change (dem)								
more than 4 reductions	0.5253	(0.1336)***	0.2543	(0.1301)*	-0.0533	(0.1918)	-0.1455	(0.0584)**
4 reductions	0.6103	(0.1547)***	0.3487	(0.1378)**	0.0803	(0.2195)	-0.0931	(0.0776)
2/3 "	0.3850	(0.1099)***	0.1985	(0.0687)**	0.1535	(0.1307)	-0.0004	(0.0447)
1 "	0.0404	(0.1170)	0.1027	(0.0552)*	0.0872	(0.1230)	-0.0305	(0.0391)
no change	-	-	-	-	-	-	-	-
1 increase	0.0582	(0.1261)	-0.0157	(0.0682)	0.2977	(0.1222)**	0.0569	(0.0363)
2/3 "	0.1654	(0.1358)	-0.0990	(0.0869)	0.2823	(0.1240)**	0.0732	(0.0438)*
4 "	0.2860	(0.2539)	-0.2728	(0.2258)	0.3550	(0.2116)*	0.1494	(0.0783)*
more than 4 increases	-0.1636	(0.2580)	-0.2433	(0.1787)	0.3350	(0.1665)**	0.1222	(0.0665)*
Expected demand change during the next six months (demexp)								
demand decrease expected	0.5369	(0.0792)***	0.2528	(0.0493)***	-0.4448	(0.1079)***	-0.0422	(0.0346)
no change expected	-	-	-	-	-	-	-	-
demand increase expected	0.0770	(0.1096)	-0.0358	(0.0613)	0.0579	(0.0937)	0.1501	(0.0331)***
Demand faced by domestic competitors (demcomp)								
Increasing (contemporaneous)	-0.5746	(0.6193)	0.4641	(0.3013)	1.3042	(0.4603)**	0.4736	(0.1720)**
Decreasing (contemporaneous)	0.1121	(0.3969)	0.1680	(0.2522)	0.7231	(0.4961)	0.1279	(0.1625)
Increasing (preceding month)	-0.6307	(0.6165)	-0.9513	(0.3288)**	0.0353	(0.4782)	0.1349	(0.1769)
Decreasing (preceding month)	0.1701	(0.4188)	0.2141	(0.2587)	0.0182	(0.5248)	0.4051	(0.1677)**
Cost								
Cost indices of intermediate inputs; log change of the respective index compared with the time of the firm's last price change (cost)								
Domestic	2.0811	(6.1431)	4.2443	(5.8017)	6.4821	(7.6619)	2.3764	(2.7110)
Imported (increase of)	-8.2458	(5.2850)	-6.1631	(3.2592)*	5.6001	(3.3098)*	0.3209	(1.4502)
Imported (decrease of)	3.0583	(2.4657)	0.6416	(2.5137)	-2.0967	(2.9878)	-1.0795	(0.9751)
Expected wage increase (log change over the next 12 months)	-3.4510	(3.2125)	-2.8589	(1.8482)	5.9073	(3.1325)*	0.4100	(1.1798)
Specific month of collective wage bargaining (wagebarg)								
formal start of contract	-0.2053	(0.1584)	-0.1331	(0.0939)	0.4082	(0.1272)**	0.1832	(0.0435)***
month before month of permanent wage increase (not in mid of long-term contract)	-0.2053	(0.1681)	0.0797	(0.0939)	0.2803	(0.1519)*	0.2721	(0.0501)***
month of permanent wage increase (not in mid of long-term contract)	-0.2471	(0.1683)	-0.0375	(0.0979)	0.2195	(0.1515)	0.3624	(0.0519)***
long-term contracts only (longterm)								
mid-term permanent wage increase	0.0015	(0.2420)	0.0048	(0.1438)	0.4334	(0.2058)**	0.6502	(0.0685)***
Relative prices								
PPI (log change compared to the time of t. firm's last price change)	-2.4217	(4.6375)	-0.2670	(4.2544)	13.3561	(5.1562)**	7.2563	(1.8267)***
Prices of domestic competitors (pricedomcomp1)								
increasing (contemporaneous)	-0.2561	(0.8098)	-0.2016	(0.5903)	2.3005	(0.5880)***	2.0999	(0.1710)***
decreasing (contemporaneous)	1.4186	(0.9454)	1.8383	(0.4432)***	-4.9512	(1.7088)**	-1.9452	(0.7219)**
increasing (preceding month)	-0.7278	(0.8241)	-1.0322	(0.6590)	0.8819	(0.7065)	-0.2330	(0.2343)
decreasing (preceding month)	-1.1757	(1.0644)	-0.4955	(0.5211)	1.1277	(1.3517)	0.6011	(0.6598)
Cumulated price change of domestic competitors since the time of the firm's last price change until time t-2 (remaining time) (pricedomcomp2)								
Increase	0.2269	(0.1483)	-0.1315	(0.2576)	-0.0976	(0.2230)	-0.0467	(0.0598)
Decrease	-0.0600	(0.1630)	0.1049	(0.1387)	0.1506	(0.1747)	-0.2184	(0.1363)
Price indices of foreign competitors; log change compared to the firm's last price change (priceforcomp)								
Price of foreign competitors	1.0524	(2.3580)	-0.6486	(2.0257)	-6.7381	(2.5524)**	-0.7569	(0.9162)
constant	-6.1438	(0.3264)***	-1.8739	(0.1632)***	-4.0160	(0.3054)***	-2.0968	(0.0928)***

Table A8: Logit-estimation

Explanatory variable	increase	reduction	reduction	reduction	reduction	increase	increase	increase
Capacity utilisation / Stocks of finished products / Exports								
log capacity over utilisation (cap)	-0.2133	(0.2274)	-0.0525	(0.1253)	0.1728	(0.2332)	0.3664	(0.0933)***
Technical capacity given actual and expected orders within the next 12 months								
Own firm: (capexpown)								
not sufficient	-0.2160	(0.1960)	0.1831	(0.1084)*	0.0938	(0.1629)	0.2029	(0.0466)***
sufficient	-	-	-	-	-	-	-	-
more than sufficient	0.1141	(0.0790)	0.1084	(0.0465)**	0.0943	(0.0879)	0.0193	(0.0318)
Domestic competitors (share): (capexpcomp)								
not sufficient	0.0653	(1.1414)	-1.4580	(0.8638)*	-2.3820	(1.2549)*	0.8327	(0.3207)**
more than sufficient	0.5034	(0.3061)	0.1128	(0.1825)	-0.6488	(0.3602)*	-0.3608	(0.1221)**
Stocks of finished products (stocks)								
too large	0.3701	(0.0922)***	0.0698	(0.0573)	0.0508	(0.1044)	0.0210	(0.0389)
Sufficient	-	-	-	-	-	-	-	-
too small	-0.2375	(0.2249)	-0.1863	(0.1328)	0.3899	(0.1668)**	0.1539	(0.0518)**
no stocks	0.0016	(0.0868)	-0.0081	(0.0543)	-0.2298	(0.0940)**	-0.0398	(0.0295)
Exports (export)								
No exports	0.4296	(0.1781)**	0.1315	(0.0974)	-0.1729	(0.1887)	-0.0043	(0.0810)
History of the firm's own price setting								
Length of the present price spell and the preceding price spell (history)								
differ by one month	0.1328	(0.1372)	0.3440	(0.0642)***	0.2513	(0.1351)*	0.3473	(0.0453)***
is the same but not 12 months	0.3798	(0.1950)*	0.2185	(0.0948)**	0.3735	(0.1797)**	0.2936	(0.0782)***
is the same and 12 months	1.0719	(0.3702)**	1.0873	(0.6681)	2.2934	(0.6188)***	1.3575	(0.0849)***
adds to 12 months	0.5203	(0.1735)**	0.0777	(0.1221)	0.9445	(0.1462)***	0.7575	(0.0448)***
Preceding spell is missing	-0.0949	(0.0938)	-0.0145	(0.0593)	0.0124	(0.1056)	-0.0528	(0.0314)*
Employees/Industries / etc.								
Employees in product group <=50	-0.2593	(0.1082)**	-0.0445	(0.0633)	-0.0605	(0.1141)	0.0006	(0.0355)
Industry (base: nace295)								
nace291	0.0314	(0.1148)	0.0932	(0.0774)	0.3507	(0.1256)**	0.1877	(0.0381)***
nace292	0.5490	(0.1243)***	0.0737	(0.0794)	0.1361	(0.1347)	0.0953	(0.0490)*
nace293	-0.2948	(0.1999)	0.0168	(0.1737)	0.6211	(0.2203)**	0.3908	(0.0597)***
nace294	-0.2948	(0.1416)**	-0.1320	(0.0963)	0.3037	(0.1498)**	-0.0750	(0.0464)
nace297	0.0606	(0.1809)	-0.1359	(0.1408)	0.0443	(0.1875)	0.1238	(0.0634)*
nace300	1.5244	(0.3496)***	0.3497	(0.1522)**	-1.1885	(0.3650)**	-0.7528	(0.2977)**
nace311	0.3955	(0.1246)**	0.1440	(0.0734)*	-0.0562	(0.1368)	0.1551	(0.0467)**
nace313	1.3991	(0.1617)***	0.4264	(0.1006)***	0.5256	(0.1738)**	0.2096	(0.0848)**
nace315	-0.0744	(0.2147)	0.2598	(0.1364)*	0.1839	(0.2333)	0.1159	(0.0661)*
nace321	0.6334	(0.1826)**	0.5104	(0.0896)***	-0.6730	(0.2104)**	0.0959	(0.0730)
nace322	0.5083	(0.3924)	0.3269	(0.1427)**	-1.8447	(0.5920)**	-0.1666	(0.1606)
nace323	1.4799	(0.2006)***	0.2701	(0.1090)**	-0.9775	(0.2166)***	-0.2914	(0.1289)**
nace334	-0.7614	(0.2787)**	-0.3501	(0.1914)*	-0.4188	(0.3227)	-0.0019	(0.0758)
nace335	0.0476	(0.4656)	-0.1088	(0.2391)	-0.3619	(0.4125)	-0.0717	(0.1882)
nace341	-0.7432	(0.4591)	-1.5335	(1.0178)	0.1573	(0.6206)	0.5689	(0.0876)***
nace343	0.5979	(0.1647)***	0.4106	(0.0899)***	-0.3022	(0.1980)	0.1300	(0.0647)**
nace35	0.2085	(0.3914)	-0.2827	(0.3771)	0.2455	(0.4855)	0.3542	(0.1424)**
Month								
January	-0.0562	(0.1606)	0.1723	(0.0926)*	0.4799	(0.1345)***	0.5281	(0.0454)***
February	-	-	-	-	-	-	-	-
March	-0.1620	(0.2009)	0.0348	(0.1172)	-0.1513	(0.1992)	0.0005	(0.0598)
April	-0.0122	(0.1694)	0.0527	(0.1003)	0.1801	(0.1534)	-0.0306	(0.0499)
May	-0.1113	(0.1603)	-0.0647	(0.0951)	-0.1975	(0.1623)	-0.3399	(0.0534)***
June	-0.0008	(0.1902)	0.2152	(0.1139)*	-0.0950	(0.2187)	-0.5685	(0.0774)***
July	-0.2033	(0.1574)	-0.1840	(0.0939)*	-0.4374	(0.1754)**	-0.5835	(0.0622)***
August	-0.0811	(0.1540)	-0.1261	(0.0929)	-0.8816	(0.2069)***	-0.7721	(0.0694)***
September	-0.1571	(0.1968)	-0.0924	(0.1167)	-0.5621	(0.2512)**	-0.6042	(0.0895)***
October	-0.1002	(0.1558)	-0.0356	(0.0915)	-0.5491	(0.1785)**	-0.2663	(0.0584)***
November	-0.1904	(0.1563)	-0.1177	(0.0919)	-0.5749	(0.1757)**	-0.5301	(0.0599)***
December	-0.5977	(0.2321)**	-0.2892	(0.1217)**	-0.5523	(0.2379)**	-0.4691	(0.0775)***

Table A8: Logit-estimation

Explanatory variable	increase	reduction	reduction	reduction	reduction	increase	increase	increase
Year (base: 1987)								
1980	-0.5510	(0.3973)	-0.0956	(0.2313)	0.6384	(0.3470)*	0.1495	(0.1012)
1981	-0.0869	(0.2636)	-0.0886	(0.1780)	0.7204	(0.2596)**	0.2993	(0.0832)***
1982	-0.1188	(0.2329)	-0.0733	(0.1519)	0.4940	(0.2455)**	-0.0146	(0.0813)
1983	0.3264	(0.2209)	-0.1169	(0.1430)	-0.3600	(0.2395)	-0.0051	(0.0773)
1984	0.0575	(0.2412)	-0.1322	(0.1510)	-0.2212	(0.2341)	0.0728	(0.0778)
1985	-0.4252	(0.2557)*	-0.1627	(0.1706)	0.0943	(0.2403)	0.1022	(0.0765)
1986	0.0055	(0.2145)	-0.1927	(0.1769)	-0.0310	(0.2595)	0.0893	(0.0741)
1988	-0.1176	(0.2552)	-0.2208	(0.1567)	-0.5019	(0.2428)**	0.1464	(0.0779)*
1989	-0.1860	(0.2784)	-0.4065	(0.2103)*	-0.2592	(0.2578)	0.1293	(0.0797)
1990	-0.5922	(0.3154)*	-0.0588	(0.2089)	-0.2282	(0.2936)	0.2120	(0.0802)**
1991	0.0534	(0.2471)	0.3509	(0.1657)**	-0.1664	(0.3020)	0.1609	(0.0818)**
1992	0.6573	(0.2091)**	0.2003	(0.1405)	-0.3046	(0.2765)	0.1295	(0.0810)
1993	0.9802	(0.2125)***	0.2143	(0.1325)	-1.3741	(0.3229)***	-0.3167	(0.1024)**
1994	0.3664	(0.2678)	0.0512	(0.1303)	-0.8763	(0.2351)***	-0.4481	(0.1132)***
1995	0.1401	(0.2778)	0.1830	(0.1398)	-0.2430	(0.2241)	0.3359	(0.0898)***
1996	0.7748	(0.2179)***	-0.0038	(0.1355)	-0.7773	(0.2782)**	-0.2445	(0.1039)**
1997	0.4198	(0.2709)	-0.0563	(0.1456)	-0.7410	(0.2692)**	-0.0952	(0.1126)
1998	0.0872	(0.2794)	0.0549	(0.1402)	-1.2256	(0.2978)***	-0.1912	(0.1079)*
1999	0.3738	(0.2625)	0.0501	(0.1385)	-0.6668	(0.2707)**	-0.3100	(0.1157)**
2000	0.2308	(0.3527)	0.0519	(0.1714)	-0.5864	(0.2727)**	0.0341	(0.1067)
2001	-0.1007	(0.2829)	-0.1854	(0.1671)	-0.6731	(0.3103)**	-0.0097	(0.1055)
dummies for the baseline hazard								
tt2	0.8454	(0.2457)**	0.0338	(0.0692)	0.2237	(0.2026)	-0.8695	(0.0522)***
tt3	0.9917	(0.2389)***	-0.1967	(0.0745)**	0.7036	(0.1898)***	-1.3634	(0.0612)***
tt4	1.0863	(0.2400)***	-0.5665	(0.0888)***	0.6855	(0.1998)**	-1.5021	(0.0732)***
tt5	1.0650	(0.2486)***	-0.7605	(0.1034)***	0.7961	(0.2034)***	-1.2757	(0.0755)***
tt6	0.8134	(0.2549)**	-0.7591	(0.1148)***	0.9223	(0.2114)***	-1.3194	(0.0748)***
tt7	1.0961	(0.2515)***	-0.9694	(0.1301)***	0.9854	(0.2170)***	-1.4451	(0.0827)***
tt8	0.8708	(0.2692)**	-1.4393	(0.1662)***	0.6755	(0.2417)**	-1.1576	(0.0798)***
tt9	0.7014	(0.2727)**	-0.8119	(0.1455)***	0.9257	(0.2409)***	-1.0070	(0.0730)***
tt10	0.6086	(0.2828)**	-1.0682	(0.1664)***	0.5322	(0.2686)**	-0.6087	(0.0704)***
tt11	0.8118	(0.2916)**	-1.0665	(0.1788)***	0.4492	(0.2764)	-0.1052	(0.0699)
tt12	0.9222	(0.3060)**	-0.9559	(0.1862)***	0.6066	(0.2855)**	0.6401	(0.0700)***
tt13	1.2366	(0.2987)***	-1.3498	(0.2264)***	0.3345	(0.3232)	0.1334	(0.0821)
tt14	0.9643	(0.3387)**	-1.7802	(0.2765)***	0.6844	(0.3042)**	-0.3029	(0.1028)**
tt15	0.5905	(0.3683)	-2.0715	(0.3263)***	0.7272	(0.3155)**	-0.6732	(0.1150)***
tt16	0.7835	(0.3589)**	-1.8451	(0.3163)***	0.4410	(0.3471)	-1.4264	(0.1666)***
tt17	0.8118	(0.3749)**	-1.3648	(0.2656)***	0.5952	(0.3471)*	-1.6493	(0.1992)***
tt18	0.7581	(0.3777)**	-2.1602	(0.3803)***	0.3052	(0.3992)	-1.4722	(0.1773)***
tt19	0.8055	(0.3810)**	-2.1320	(0.4043)***	0.5282	(0.3809)	-1.4957	(0.1862)***
tt20	0.4067	(0.4682)	-1.7831	(0.3500)***	0.3449	(0.4043)	-1.4917	(0.1969)***
tt21	1.0531	(0.3814)**	-1.6382	(0.3378)***	0.2258	(0.4363)	-1.2528	(0.1618)***
tt22	1.2229	(0.3751)**	-1.8003	(0.3867)***	0.6725	(0.4016)*	-1.3911	(0.1789)***
tt23	0.6137	(0.4775)	-2.5060	(0.5246)***	0.8051	(0.3918)**	-0.7784	(0.1578)***
tt24	1.6046	(0.3730)***	-1.5557	(0.3734)***	1.0707	(0.3889)**	0.0230	(0.1246)
tt25	1.1499	(0.4254)**	-2.2903	(0.5273)***	-0.2215	(0.5745)	-0.5890	(0.1611)***
tt26	1.0971	(0.4673)**	-2.2872	(0.5282)***	-0.1248	(0.5744)	-0.8779	(0.1975)***
tt27	0.7164	(0.5125)	-2.1852	(0.5311)***	-0.0520	(0.5820)	-1.5296	(0.2417)***
tt28	-	-	-3.5716	(1.0165)***	-0.2899	(0.6496)	-1.6841	(0.2967)***
tt29	1.3584	(0.4630)**	-2.1696	(0.5325)***	-0.2115	(0.6532)	-1.5707	(0.3084)***
tt30	0.1760	(0.6625)	-3.4063	(1.0177)**	0.9464	(0.4664)**	-1.4987	(0.2806)***
tt31	-	-	-3.4141	(1.0186)**	-0.2715	(0.7716)	-1.6669	(0.3101)***
tt32	0.3586	(0.6673)	-1.8263	(0.4889)***	-0.2552	(0.7722)	-1.8414	(0.3532)***
tt33	0.8305	(0.5621)	-2.5900	(0.7360)***	-0.8226	(1.0473)	-1.9833	(0.3238)***
tt34	0.3244	(0.6739)	-1.6064	(0.4946)**	0.2861	(0.6614)	-1.6533	(0.3025)***
tt35	0.5974	(0.6792)	-2.5516	(0.7388)**	0.9221	(0.5214)*	-0.6924	(0.2227)**
tt36	0.1687	(0.7939)	-1.3375	(0.4667)**	0.6244	(0.6035)	-0.7454	(0.2105)***
Number of observations		118 945		118 945		118 945		118 945
Pseudo R-squared		0.1447		0.1447		0.1447		0.1447
Log-Likelihood		-31 911		-31 911		-31 911		-31 911

Standard errors in parentheses.
*** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level

Table A9: Logit-estimation: time-dependent variables only

Explanatory variables	increase	reduction	reduction	reduction	reduction	increase	increase	increase
Constant	-5.7170	(0.1725)***	-1.6989	(0.0775)***	-4.0907	(0.1730)***	-1.7745	(0.0385)***
dummies for the baseline hazard								
tt2	0.7189	(0.1726)***	0.1655	(0.0518)**	0.4965	(0.1794)**	-0.8468	(0.0427)***
tt3	0.8204	(0.1740)***	-0.1479	(0.0599)**	0.9643	(0.1722)***	-1.2904	(0.0527)***
tt4	0.9307	(0.1739)***	-0.5873	(0.0730)***	0.9789	(0.1783)***	-1.4869	(0.0638)***
tt5	0.8680	(0.1787)***	-0.8075	(0.0839)***	1.1748	(0.1773)***	-1.2870	(0.0628)***
tt6	0.7891	(0.1862)***	-0.8576	(0.0916)***	1.2197	(0.1821)***	-1.2475	(0.0625)***
tt7	1.0756	(0.1791)***	-1.0509	(0.1053)***	1.3738	(0.1821)***	-1.2866	(0.0661)***
tt8	0.7475	(0.1957)***	-1.5124	(0.1349)***	1.1044	(0.1988)***	-1.1668	(0.0627)***
tt9	0.8180	(0.1962)***	-0.9579	(0.1138)***	1.2656	(0.1982)***	-1.0133	(0.0562)***
tt10	0.8233	(0.2011)***	-1.2546	(0.1358)***	0.8942	(0.2247)***	-0.5605	(0.0503)***
tt11	0.8808	(0.2102)***	-1.2157	(0.1413)***	1.1959	(0.2129)***	0.0099	(0.0444)
tt12	1.4723	(0.2016)***	-1.0067	(0.1368)***	1.1031	(0.2256)***	1.0372	(0.0389)***
tt13	1.3421	(0.2182)***	-1.5539	(0.1843)***	0.8498	(0.2534)**	0.0992	(0.0566)*
tt14	1.4360	(0.2211)***	-1.8836	(0.2246)***	0.9820	(0.2502)***	-0.4192	(0.0756)***
tt15	1.0333	(0.2611)***	-2.2116	(0.2727)***	1.1066	(0.2473)***	-0.7597	(0.0921)***
tt16	1.0864	(0.2614)***	-2.1404	(0.2729)***	0.8679	(0.2773)**	-1.4366	(0.1395)***
tt17	0.9658	(0.2770)***	-1.5490	(0.2161)***	1.1102	(0.2674)***	-1.5903	(0.1570)***
tt18	1.0137	(0.2833)***	-2.1277	(0.2944)***	0.6839	(0.3242)**	-1.5156	(0.1509)***
tt19	1.1262	(0.2775)***	-2.1445	(0.3073)***	0.8810	(0.3056)**	-1.5882	(0.1629)***
tt20	0.8947	(0.3138)**	-1.9848	(0.2950)***	0.9438	(0.3059)**	-1.6214	(0.1650)***
tt21	1.2252	(0.2835)***	-1.8260	(0.2842)***	0.7957	(0.3367)**	-1.3389	(0.1344)***
tt22	1.3632	(0.2769)***	-1.8258	(0.2956)***	1.0444	(0.3156)**	-1.4107	(0.1484)***
tt23	0.8021	(0.3636)**	-2.6380	(0.4519)***	1.1430	(0.3072)***	-0.8054	(0.1154)***
tt24	1.8105	(0.2623)***	-1.7425	(0.3090)***	1.4124	(0.2929)***	-0.0056	(0.0863)
tt25	1.4406	(0.3127)***	-2.4873	(0.4525)***	0.4433	(0.4364)	-0.6637	(0.1291)***
tt26	1.4416	(0.3236)***	-2.6518	(0.5049)***	0.6518	(0.4087)	-0.8398	(0.1490)***
tt27	0.8053	(0.4340)*	-2.1824	(0.4145)***	0.4260	(0.4735)	-1.4890	(0.2099)***
tt28	-0.2616	(0.7225)	-2.8397	(0.5819)***	-0.0910	(0.5982)	-1.5807	(0.2475)***
tt29	1.2790	(0.3655)***	-2.4882	(0.5055)***	0.5373	(0.4742)	-1.7617	(0.2820)***
tt30	0.5488	(0.5223)	-2.6966	(0.5824)***	1.3648	(0.3537)***	-1.5675	(0.2556)***
tt31	0.5826	(0.5223)	-3.7512	(1.0030)***	0.1703	(0.5991)	-1.7917	(0.2937)***
tt32	0.3572	(0.5969)	-2.0780	(0.4543)***	0.2399	(0.5994)	-1.9435	(0.3065)***
tt33	1.2486	(0.4072)**	-2.9685	(0.7117)***	-0.8044	(1.0131)	-1.9533	(0.2830)***
tt34	0.4681	(0.5966)	-1.6383	(0.3870)***	0.3098	(0.6004)	-1.7594	(0.2731)***
tt35	1.2838	(0.4352)**	-2.4106	(0.5837)***	1.0708	(0.4408)**	-0.8885	(0.1834)***
tt36	0.2496	(0.7231)	-1.6322	(0.4179)***	1.1444	(0.4413)**	-0.7717	(0.1729)***
Month								
January	-0.0873	(0.1508)	0.1697	(0.0858)**	0.5011	(0.1212)***	0.6422	(0.0408)***
February								
March	-0.0805	(0.1476)	0.0127	(0.0884)	-0.0725	(0.1376)	0.0392	(0.0426)
April	-0.0815	(0.1475)	0.0391	(0.0882)	0.3324	(0.1265)**	0.2867	(0.0413)***
May	-0.1687	(0.1481)	-0.0290	(0.0893)	-0.3157	(0.1472)**	-0.2843	(0.0466)***
June	0.1271	(0.1394)	0.1679	(0.0860)*	-0.5218	(0.1567)**	-0.6150	(0.0543)***
July	-0.1415	(0.1480)	-0.1405	(0.0899)	-0.7464	(0.1657)***	-0.6765	(0.0582)***
August	-0.0173	(0.1438)	-0.0703	(0.0886)	-1.2588	(0.1981)***	-0.9174	(0.0660)***
September	-0.0303	(0.1459)	-0.0012	(0.0872)	-0.9856	(0.1777)***	-0.8050	(0.0642)***
October	-0.0173	(0.1459)	0.0083	(0.0872)	-0.8310	(0.1684)***	-0.3091	(0.0540)***
November	-0.1287	(0.1468)	-0.0601	(0.0874)	-0.8293	(0.1656)***	-0.6411	(0.0566)***
December	-0.4601	(0.1615)**	-0.2403	(0.0902)**	-0.7387	(0.1594)***	-0.5094	(0.0527)***

Table A9: Logit-estimation: time-dependent variables only

Explanatory variable	increase	reduction	reduction	reduction	reduction	increase	increase	increase
Industry (base: nace295)								
nace291	0.1465	(0.0987)	0.0753	(0.0687)	0.3222	(0.1093)**	0.2200	(0.0332)***
nace292	0.5164	(0.1099)***	0.0335	(0.0719)	0.0923	(0.1198)	0.1055	(0.0443)**
nace293	-0.0755	(0.1685)	-0.1216	(0.1564)	0.8625	(0.1854)***	0.3501	(0.0501)***
nace294	-0.1894	(0.1282)	-0.0285	(0.0858)	0.1544	(0.1358)	-0.0461	(0.0416)
nace297	0.3286	(0.1436)**	-0.1970	(0.1160)*	0.3988	(0.1503)**	0.2338	(0.0523)***
nace300	1.4254	(0.2877)***	0.1977	(0.1214)	-0.7442	(0.3255)**	-0.7017	(0.2583)**
nace311	0.4105	(0.1075)***	0.1684	(0.0635)**	-0.1766	(0.1197)	0.1771	(0.0408)***
nace313	1.2552	(0.1308)***	0.4719	(0.0801)***	0.5416	(0.1414)***	0.3284	(0.0695)***
nace315	-0.1286	(0.1863)	0.1775	(0.1133)	0.2798	(0.1952)	0.1578	(0.0560)**
nace321	0.6104	(0.1483)***	0.4053	(0.0686)***	-0.3463	(0.1671)**	0.1576	(0.0624)**
nace322	0.2952	(0.3400)	0.3370	(0.1183)**	-1.6495	(0.5061)**	-0.1314	(0.1440)
nace323	1.2787	(0.1649)***	0.1104	(0.0859)	-0.5257	(0.1823)**	-0.1499	(0.1088)
nace334	-0.5245	(0.2312)**	-0.4327	(0.1734)**	-0.3738	(0.2883)	-0.0772	(0.0652)
nace335	0.2489	(0.3843)	-0.1791	(0.2103)	-0.2117	(0.3451)	0.0181	(0.1546)
nace341	-1.0140	(0.4515)**	-1.8841	(1.0101)*	0.6183	(0.4684)	0.6565	(0.0747)***
nace343	0.5665	(0.1398)***	0.2338	(0.0762)**	-0.3387	(0.1705)**	0.2549	(0.0554)***
nace35	0.4	(0.2849)	-0.5605	(0.2289)**	-0.5432	(0.3432)	0.3854	(0.1061)***
Number of observations		147 752		40 886		40 886		147 752
Pseudo R-squared		0.1095		0.0814		0.0814		0.1095
Log-Likelihood		-40 496.0		-15 727.1		-15 727.1		-40 496.0

Standard errors in parenthesis.

*** significant 1% level, ** significant 5% level, * significant 10% level

Table A10: Logit-estimation: time-dependent variables and PPI

Explanatory variable	increase	reduction	reduction	reduction	reduction	increase	increase	increase
PPI (log change compared with the time of t. firm's last price change)	-9.3590	(2.1577)***	31.0623	(2.5733)***	-15.0127	(2.6241)***	11.2602	(0.7847)***
Constant	-5.6957	(0.1725)***	-4.1833	(0.1739)***	-1.6777	(0.0776)***	-1.8056	(0.0386)***
dummies for the baseline hazard								
tt2	0.7355	(0.1727)***	0.4629	(0.1795)**	0.1795	(0.0519)**	-0.8686	(0.0427)***
tt3	0.8518	(0.1742)***	0.8908	(0.1723)***	-0.1182	(0.0601)**	-1.3305	(0.0527)***
tt4	0.9748	(0.1741)***	0.8593	(0.1787)***	-0.5410	(0.0735)***	-1.5442	(0.0639)***
tt5	0.9250	(0.1791)***	1.0048	(0.1781)***	-0.7438	(0.0845)***	-1.3608	(0.0630)***
tt6	0.8579	(0.1867)***	1.0098	(0.1833)***	-0.7787	(0.0926)***	-1.3361	(0.0628)***
tt7	1.1553	(0.1799)***	1.1243	(0.1838)***	-0.9583	(0.1064)***	-1.3909	(0.0666)***
tt8	0.8371	(0.1966)***	0.8225	(0.2008)***	-1.4063	(0.1360)***	-1.2864	(0.0634)***
tt9	0.9166	(0.1973)***	0.9607	(0.2006)***	-0.8405	(0.1154)***	-1.1444	(0.0570)***
tt10	0.9288	(0.2023)***	0.5464	(0.2277)**	-1.1240	(0.1374)***	-0.7078	(0.0516)***
tt11	0.9929	(0.2115)***	0.8111	(0.2166)***	-1.0734	(0.1432)***	-0.1497	(0.0460)**
tt12	1.5865	(0.2031)***	0.6757	(0.2299)**	-0.8496	(0.1392)***	0.8755	(0.0406)***
tt13	1.4623	(0.2197)***	0.3866	(0.2581)	-1.3869	(0.1863)***	-0.0745	(0.0582)
tt14	1.5604	(0.2227)***	0.5011	(0.2550)**	-1.7069	(0.2264)***	-0.6002	(0.0769)***
tt15	1.1637	(0.2626)***	0.5749	(0.2533)**	-2.0219	(0.2744)***	-0.9493	(0.0934)***
tt16	1.2235	(0.2630)***	0.2949	(0.2834)	-1.9415	(0.2748)***	-1.6401	(0.1405)***
tt17	1.1105	(0.2787)***	0.5172	(0.2741)*	-1.3375	(0.2188)***	-1.8026	(0.1579)***
tt18	1.1659	(0.2850)***	0.0509	(0.3309)	-1.9017	(0.2967)***	-1.7358	(0.1519)***
tt19	1.2897	(0.2796)***	0.2338	(0.3127)	-1.9114	(0.3096)***	-1.8256	(0.1641)***
tt20	1.0701	(0.3159)**	0.2786	(0.3136)	-1.7435	(0.2976)***	-1.8756	(0.1663)***
tt21	1.4092	(0.2861)***	0.1108	(0.3442)	-1.5739	(0.2872)***	-1.6035	(0.1361)***
tt22	1.5518	(0.2797)***	0.3119	(0.3259)	-1.5606	(0.2987)***	-1.6892	(0.1502)***
tt23	0.9959	(0.3658)**	0.4	(0.3173)	-2.3716	(0.4540)***	-1.1005	(0.1180)***
tt24	2.0058	(0.2654)***	0.6410	(0.3043)**	-1.4683	(0.3123)***	-0.2982	(0.0895)**
tt25	1.6519	(0.3158)***	-0.3789	(0.4466)	-2.2042	(0.4548)***	-0.9800	(0.1319)***
tt26	1.6610	(0.3269)***	-0.1661	(0.4185)	-2.3567	(0.5072)***	-1.1718	(0.1517)***
tt27	1.0357	(0.4366)**	-0.4042	(0.4823)	-1.8842	(0.4174)***	-1.8269	(0.2119)***
tt28	-0.0202	(0.7242)	-0.9270	(0.6054)	-2.5349	(0.5841)***	-1.9176	(0.2491)***
tt29	1.5277	(0.3691)***	-0.3281	(0.4841)	-2.1717	(0.5081)***	-2.1020	(0.2834)***
tt30	0.8083	(0.5250)	0.5180	(0.3655)	-2.3826	(0.5847)***	-1.9154	(0.2572)***
tt31	0.8481	(0.5253)	-0.6769	(0.6070)	-3.4336	(1.0044)**	-2.1453	(0.2951)***
tt32	0.6348	(0.5997)	-0.6415	(0.6079)	-1.7524	(0.4575)***	-2.3222	(0.3083)***
tt33	1.5303	(0.4115)***	-1.7062	(1.0188)*	-2.6374	(0.7138)***	-2.3255	(0.2847)***
tt34	0.7583	(0.5997)	-0.7047	(0.6219)	-1.3002	(0.3911)**	-2.1559	(0.2751)***
tt35	1.5790	(0.4396)***	0.0888	(0.4601)	-2.0786	(0.5864)***	-1.3166	(0.1874)***
tt36	0.5497	(0.7260)	0.1006	(0.4624)	-1.2833	(0.4219)**	-1.1974	(0.1765)***
Month								
January	-0.0861	(0.1509)	0.5058	(0.1217)***	0.1746	(0.0859)**	0.6404	(0.0409)***
February	-	-	-	-	-	-	-	-
March	-0.0853	(0.1476)	-0.0652	(0.1382)	0.0065	(0.0885)	0.0458	(0.0426)
April	-0.0899	(0.1475)	0.3575	(0.1271)**	0.0296	(0.0883)	0.2995	(0.0414)***
May	-0.1748	(0.1481)	-0.2823	(0.1477)*	-0.0388	(0.0894)	-0.2734	(0.0466)***
June	0.1220	(0.1393)	-0.4907	(0.1572)**	0.1598	(0.0861)*	-0.6036	(0.0544)***
July	-0.1446	(0.1479)	-0.7194	(0.1661)***	-0.1457	(0.0899)	-0.6668	(0.0583)***
August	-0.0110	(0.1438)	-1.2457	(0.1984)***	-0.0715	(0.0887)	-0.9185	(0.0660)***
September	-0.0221	(0.1458)	-0.9711	(0.1781)***	-0.0017	(0.0873)	-0.8085	(0.0643)***
October	-0.0090	(0.1459)	-0.8108	(0.1688)***	0.0080	(0.0873)	-0.3116	(0.0541)***
November	-0.1286	(0.1467)	-0.8075	(0.1660)***	-0.0604	(0.0875)	-0.6377	(0.0567)***
December	-0.4587	(0.1615)**	-0.7257	(0.1598)***	-0.2382	(0.0902)**	-0.5086	(0.0527)***

Table A10: Logit-estimation: time-dependent variables and PPI

Explanatory variable	increase	reduction	reduction	reduction	reduction	increase	increase	increase
Industry (base: nace295)								
nace291	0.1339	(0.0988)	0.4278	(0.1105)***	0.0603	(0.0687)	0.2321	(0.0332)***
nace292	0.5080	(0.1099)***	0.1016	(0.1204)	0.0369	(0.0720)	0.1138	(0.0444)**
nace293	-0.0941	(0.1686)	0.9187	(0.1861)***	-0.1201	(0.1563)	0.3770	(0.0502)***
nace294	-0.1868	(0.1282)	0.2150	(0.1366)	-0.0371	(0.0858)	-0.0540	(0.0416)
nace297	0.3157	(0.1437)**	0.4533	(0.1511)**	-0.1958	(0.1160)*	0.2472	(0.0523)***
nace300	1.4363	(0.2878)***	-0.8966	(0.3282)**	0.2079	(0.1216)*	-0.6918	(0.2581)**
nace311	0.4116	(0.1075)***	-0.0872	(0.1207)	0.1615	(0.0635)**	0.1759	(0.0409)***
nace313	1.2759	(0.1309)***	0.6085	(0.1423)***	0.4655	(0.0801)***	0.3094	(0.0696)***
nace315	-0.1471	(0.1863)	0.3762	(0.1961)*	0.1616	(0.1133)	0.1792	(0.0560)**
nace321	0.5984	(0.1483)***	-0.3304	(0.1675)**	0.4058	(0.0686)***	0.1762	(0.0625)**
nace322	0.3351	(0.3401)	-1.6147	(0.5065)**	0.3249	(0.1183)**	-0.1874	(0.1448)
nace323	1.2973	(0.1650)***	-0.5700	(0.1827)**	0.1244	(0.0860)	-0.1904	(0.1092)*
nace334	-0.5299	(0.2312)**	-0.2831	(0.2891)	-0.4422	(0.1734)**	-0.0738	(0.0653)
nace335	0.2485	(0.3843)	-0.1459	(0.3463)	-0.1825	(0.2103)	0.0214	(0.1549)
nace341	-1.0334	(0.4515)**	0.6854	(0.4697)	-1.8860	(1.0103)*	0.6767	(0.0748)***
nace343	0.5715	(0.1399)***	-0.3012	(0.1710)*	0.2282	(0.0763)**	0.2489	(0.0555)***
nace35	0.4377	(0.2850)	-0.5683	(0.3440)*	-0.5537	(0.2290)**	0.3292	(0.1065)**
Number of observations		147 752		40 886		40 886		147 752
Pseudo R-squared		0.1120		0.0865		0.0865		0.1120
Log-Likelihood		-40 384.1		-15 639.7		-15 639.7		-40 384.1

Standard errors in parenthesis.

*** significant 1% level, ** significant 5% level, * significant 10% level

Figure A1:

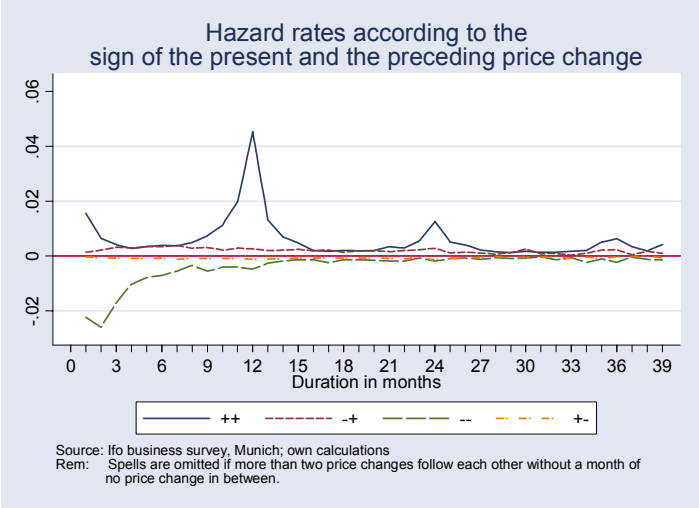


Figure A2:

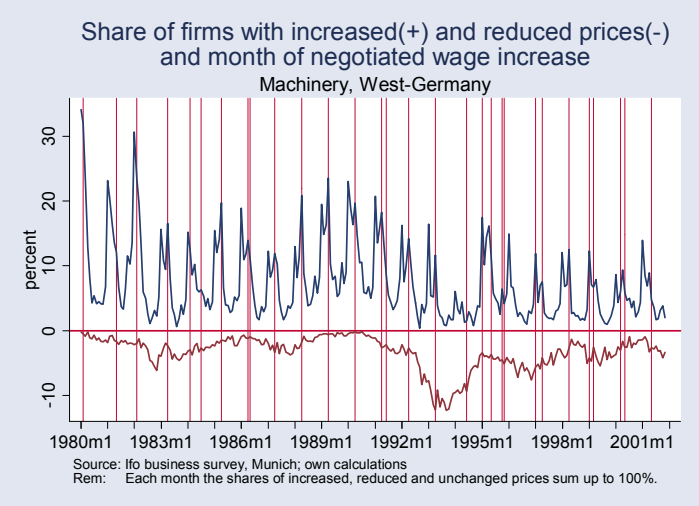


Figure A3:

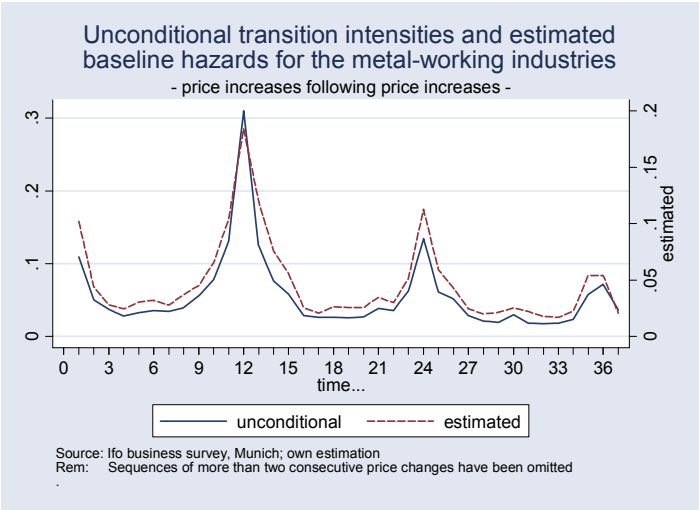


Figure A4:

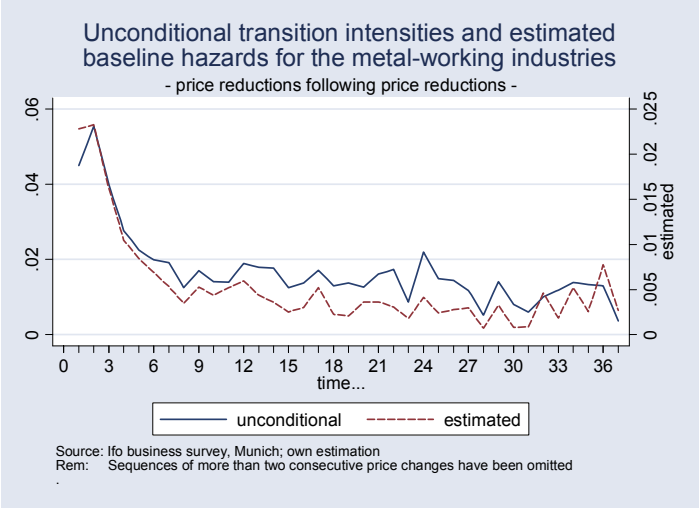


Figure A5:

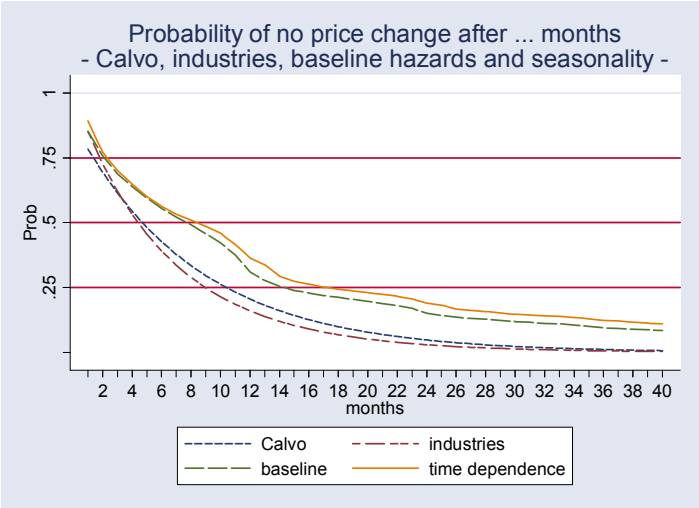


Figure A6:

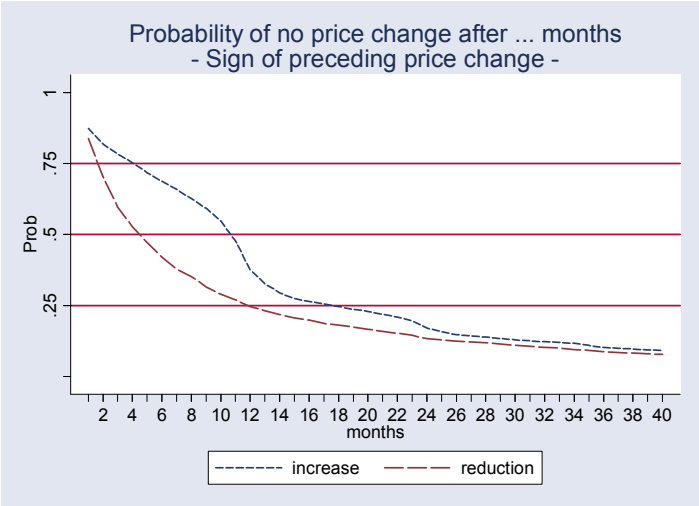


Figure A7:

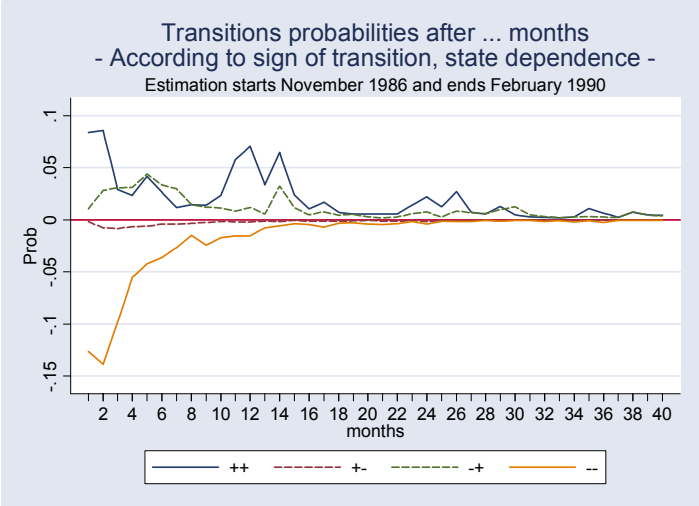


Figure A8:

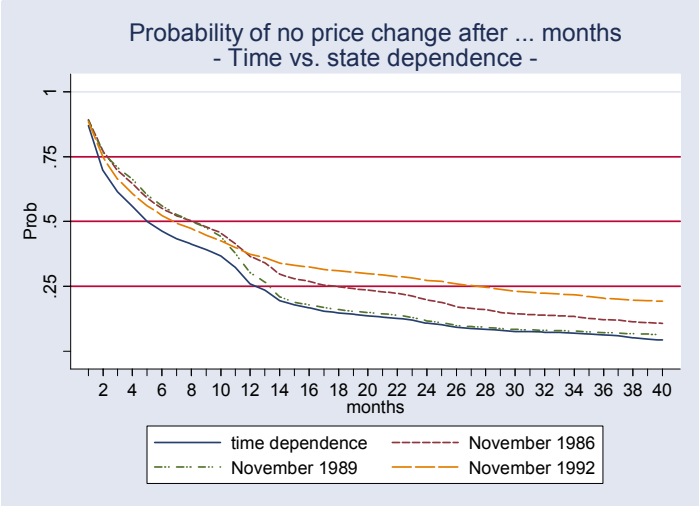


Figure A9:

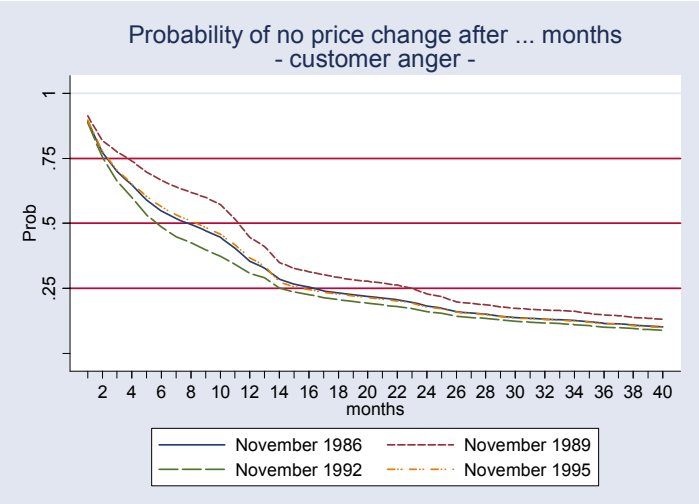


Figure A10:

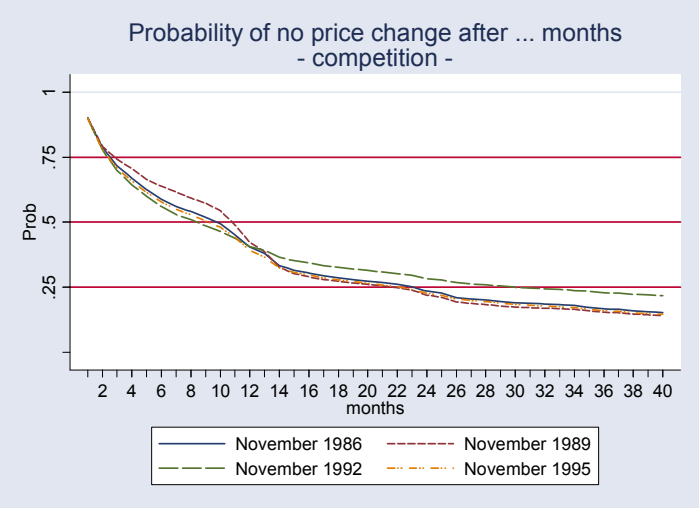
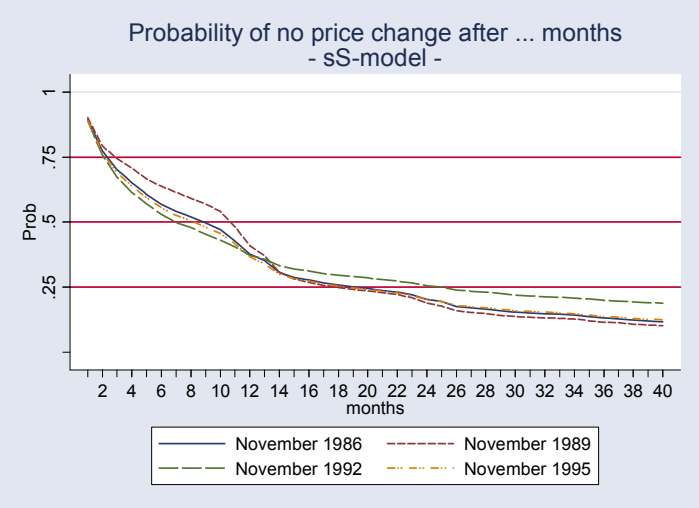


Figure A11:



Annex III – Questionnaire ifo business cycle survey

Ifo Institute
for Economic Research

Ifo Business Survey
Manufacturing

The questions refer to the product printed below (in the following named XY). Please mark the appropriate box.

Your answers will be treated as **strictly confidential**. Statutory data protection is fully guaranteed.

ID No

January **2002** Please see also the **reverse**

Product (XY):

Present situation and trends

(1) We consider our present **business situation** for XY as being

good
satisfactory
poor.

(2) Our domestic **production activity*** for XY compared to the past month has

strengthened
remained unchanged
weakened.
No significant domestic production.

(3) We consider our present stock of unsold **finished products** of XY as being

too small
satisfactory (usual seasonal stock)
too large.
Stockpiling not customary.

(4) **Demand conditions** for XY compared to the past month have

improved
remained unchanged
worsened.

(5) Our **orders on hand** (domestic and foreign, *in terms of value*) for XY have compared to the past month

increased
remained largely unchanged or not customary
decreased

* Disregarding differing number of days per month and seasonal fluctuations.

(6) We consider our present **orders on hand** for XY as being

	total orders	export orders
relatively large		
adequate (usual seasonal stock)		
or not customary		
too small		
We do not export XY.		

(7) Allowing for changes in sales conditions, our **domestic sales prices** (net) for XY compared to the last month were

raised
left unchanged
reduced.

Expectations for the next 3 months

(8) Our domestic **production activity*** regarding XY will presumably increase

remain largely unchanged
decrease.
No significant domestic production.

(9) Allowing for changes in sales conditions, our **domestic sales prices** (net) for XY will presumably

rise
remain largely unchanged
fall.

(10) Taking into account export contracts already concluded and negotiations in progress, the volume of our **export business** regarding XY will presumably

increase
remain largely unchanged
decrease.
We do not export XY.

(11) **Persons employed*** (domestic enterprises only)
The number of employees producing XY will

increase
remain largely unchanged
decrease.

Expectations for the next 6 months

(12) As regards the business cycle***, business conditions** for XY will

tend to improve
remain largely unchanged
tend to worsen.

---

* Disregarding differing number of days per month and of seasonal fluctuations.

Special questions *(January, April, July, October)*

(**A**) At present**,** our **orders on hand** for XY correspond to a production period of

No orders on hand	up to about ... month(s)											If more than 10 months, please indicate number
	½	1	2	3	4	5	6	7	8	9	10	

(B) **Capacity utilisation** in respect of the production of XY (standard full utilisation = 100 %) at present amounts to up to ... %

30 40 50 60 70 75 80 85 90 95 100 more than 100 %, namely:

(C) In the light of our *present* orders on hand and the new orders *expected* for the next 12 months, we consider our present **technical capacity** for XY as being

more than sufficient

sufficient
not sufficient.

(D1) Our domestic **production activity** is at present being hampered

Yes No

(D2) **If yes,** by which factors:

Not enough orders
Lack of skilled labour
Lack of raw materials and/or primary products

Insufficient technical capacity

Financing squeeze
Other factors

(E) **Competitive conditions** of our firm for XY in the last 3 months – compared with the previous 3 months – have developed as follows

	Domestic market	***Foreign markets***	
	within	outside	the European Union
Improved			
Remained unchanged			
Worsened			
We do not export XY			

Special questions *(February, May, August, November)*

(A) **Stocks of raw materials and primary products**

Our stocks of raw materials and primary products essential for the production of XY will at present last for a

No stocks	Less than 1/2	production of ... **weeks****							
		½	1	2	3	4	5	6	more than 6 weeks, namely

** In terms of the present production volume.

(B) **Stocks of finished products**

Our stocks of unsold finished products of XY at present correspond to a

No stocks	Less than ½	production of ... **weeks****							
		½	1	2	3	4	5	6	More than 6 weeks, namely

** In terms of the present production volume.

(C) **Innovations**[11]

(1) We assume that the market for XY in the **medium run** (about 5 years), ie excluding purely cyclical fluctuations, will

	Germany	Abroad	Total	
grow significantly				(1)
grow slightly				(2)
remain unchanged				(3)
contract slightly				(4)
contract significantly				(5)

(2) Innovations regarding the production of XY in **2001** in our firm were

	Product	Production
completed		
discontinued		
planning completed		
still in planning		
not planned.		

(3) In terms of their total turnover, the following phases applied in 2001 to our products of the product range XY (estimates will do):

Phase of market introducution (Innovation)	..... %
Growth phase	..... %
Stagnation phase	..... %
Contraction phase	..... %

[11] Innovations mean new developments and major improvements in the product and/or production.

Special questions *(March, June, September, December)*

(A1) We are currently working overtime

Yes No

(A2) **If yes**, more than is customary

Yes No

(B1) We are currently working **short time**

Yes No

(B2) We will presumably **work short time** within the next 3 months

Yes No

(A) In the light of foreseeable sales trends for XY, we consider that our present staff numbers for the **next 12 months** will be

- too large (e. g. reduction in staff numbers necessary)
- appropriate
- too small (e. g. additional persons must be employed)

(B) In 2001 our enterprise generated its **turnover** at the following **production sites:**
(estimates will do)

		In % of total turnover
Own production		
- in Germany		%
- abroad		%
Contract production		
- in Germany		%
- abroad		%
Additional purchases of merchandise		
- in Germany		%
- abroad		%
Total turnover	**100%**	

The following Discussion Papers have been published since 2004:

Series 1: Economic Studies

1	2004	Foreign Bank Entry into Emerging Economies: An Empirical Assessment of the Determinants and Risks Predicated on German FDI Data	Torsten Wezel
2	2004	Does Co-Financing by Multilateral Development Banks Increase "Risky" Direct Investment in Emerging Markets? – Evidence for German Banking FDI	Torsten Wezel
3	2004	Policy Instrument Choice and Non-Coordinated Monetary Policy in Interdependent Economies	Giovanni Lombardo Alan Sutherland
4	2004	Inflation Targeting Rules and Welfare in an Asymmetric Currency Area	Giovanni Lombardo
5	2004	FDI versus cross-border financial services: The globalisation of German banks	Claudia M. Buch Alexander Lipponer
6	2004	Clustering or competition? The foreign investment behaviour of German banks	Claudia M. Buch Alexander Lipponer
7	2004	PPP: a Disaggregated View	Christoph Fischer
8	2004	A rental-equivalence index for owner-occupied housing in West Germany 1985 to 1998	Claudia Kurz Johannes Hoffmann
9	2004	The Inventory Cycle of the German Economy	Thomas A. Knetsch
10	2004	Evaluating the German Inventory Cycle Using Data from the Ifo Business Survey	Thomas A. Knetsch
11	2004	Real-time data and business cycle analysis in Germany	Jörg Döpke

12	2004	Business Cycle Transmission from the US to Germany – a Structural Factor Approach	Sandra Eickmeier
13	2004	Consumption Smoothing Across States and Time: International Insurance vs. Foreign Loans	George M. von Furstenberg
14	2004	Real-Time Estimation of the Output Gap in Japan and its Usefulness for Inflation Forecasting and Policymaking	Koichiro Kamada
15	2004	Welfare Implications of the Design of a Currency Union in Case of Member Countries of Different Sizes and Output Persistence	Rainer Frey
16	2004	On the decision to go public: Evidence from privately-held firms	Ekkehart Boehmer Alexander Ljungqvist
17	2004	Who do you trust while bubbles grow and blow? A comparative analysis of the explanatory power of accounting and patent information for the market values of German firms	Fred Ramb Markus Reitzig
18	2004	The Economic Impact of Venture Capital	Astrid Romain, Bruno van Pottelsberghe
19	2004	The Determinants of Venture Capital: Additional Evidence	Astrid Romain, Bruno van Pottelsberghe
20	2004	Financial constraints for investors and the speed of adaption: Are innovators special?	Ulf von Kalckreuth
21	2004	How effective are automatic stabilisers? Theory and results for Germany and other OECD countries	Michael Scharnagl Karl-Heinz Tödter

22	2004	Asset Prices in Taylor Rules: Specification, Estimation, and Policy Implications for the ECB	Pierre L. Siklos Thomas Werner Martin T. Bohl
23	2004	Financial Liberalization and Business Cycles: The Experience of Countries in the Baltics and Central Eastern Europe	Lúcio Vinhas de Souza
24	2004	Towards a Joint Characterization of Monetary Policy and the Dynamics of the Term Structure of Interest Rates	Ralf Fendel
25	2004	How the Bundesbank really conducted monetary policy: An analysis based on real-time data	Christina Gerberding Andreas Worms Franz Seitz
26	2004	Real-time Data for Norway: Challenges for Monetary Policy	T. Bernhardsen, Ø. Eitrheim, A.S. Jore, Ø. Røisland
27	2004	Do Consumer Confidence Indexes Help Forecast Consumer Spending in Real Time?	Dean Croushore
28	2004	The use of real time information in Phillips curve relationships for the euro area	Maritta Paloviita David Mayes
29	2004	The reliability of Canadian output gap estimates	Jean-Philippe Cayen Simon van Norden
30	2004	Forecast quality and simple instrument rules - a real-time data approach	Heinz Glück Stefan P. Schleicher
31	2004	Measurement errors in GDP and forward-looking monetary policy: The Swiss case	Peter Kugler Thomas J. Jordan Carlos Lenz Marcel R. Savioz

32	2004	Estimating Equilibrium Real Interest Rates in Real Time	Todd E. Clark Sharon Kozicki
33	2004	Interest rate reaction functions for the euro area Evidence from panel data analysis	Karsten Ruth
34	2004	The Contribution of Rapid Financial Development to Asymmetric Growth of Manufacturing Industries: Common Claims vs. Evidence for Poland	George M. von Furstenberg
35	2004	Fiscal rules and monetary policy in a dynamic stochastic general equilibrium model	Jana Kremer
36	2004	Inflation and core money growth in the euro area	Manfred J.M. Neumann Claus Greiber
37	2004	Taylor rules for the euro area: the issue of real-time data	Dieter Gerdesmeier Barbara Roffia
38	2004	What do deficits tell us about debt? Empirical evidence on creative accounting with fiscal rules in the EU	Jürgen von Hagen Guntram B. Wolff
39	2004	Optimal lender of last resort policy in different financial systems	Falko Fecht Marcel Tyrell
40	2004	Expected budget deficits and interest rate swap spreads - Evidence for France, Germany and Italy	Kirsten Heppke-Falk Felix Hüfner
41	2004	Testing for business cycle asymmetries based on autoregressions with a Markov-switching intercept	Malte Knüppel
1	2005	Financial constraints and capacity adjustment in the United Kingdom – Evidence from a large panel of survey data	Ulf von Kalckreuth Emma Murphy

2	2005	Common stationary and non-stationary factors in the euro area analyzed in a large-scale factor model	Sandra Eickmeier
3	2005	Financial intermediaries, markets, and growth	F. Fecht, K. Huang, A. Martin
4	2005	The New Keynesian Phillips Curve in Europe: does it fit or does it fail?	Peter Tillmann
5	2005	Taxes and the financial structure of German inward FDI	Fred Ramb A. J. Weichenrieder
6	2005	International diversification at home and abroad	Fang Cai Francis E. Warnock
7	2005	Multinational enterprises, international trade, and productivity growth: Firm-level evidence from the United States	Wolfgang Keller Steven R. Yeaple
8	2005	Location choice and employment decisions: a comparison of German and Swedish multinationals	S. O. Becker, K. Ekholm, R. Jäckle, M.-A. Muendler
9	2005	Business cycles and FDI: evidence from German sectoral data	Claudia M. Buch Alexander Lipponer
10	2005	Multinational firms, exclusivity, and the degree of backward linkages	Ping Lin Kamal Saggi
11	2005	Firm-level evidence on international stock market comovement	Robin Brooks Marco Del Negro
12	2005	The determinants of intra-firm trade: in search for export-import magnification effects	Peter Egger Michael Pfaffermayr

13	2005	Foreign direct investment, spillovers and absorptive capacity: evidence from quantile regressions	Sourafel Girma Holger Görg
14	2005	Learning on the quick and cheap: gains from trade through imported expertise	James R. Markusen Thomas F. Rutherford
15	2005	Discriminatory auctions with seller discretion: evidence from German treasury auctions	Jörg Rocholl
16	2005	Consumption, wealth and business cycles: why is Germany different?	B. Hamburg, M. Hoffmann, J. Keller
17	2005	Tax incentives and the location of FDI: evidence from a panel of German multinationals	Thiess Buettner Martin Ruf
18	2005	Monetary Disequilibria and the Euro/Dollar Exchange Rate	Dieter Nautz Karsten Ruth
19	2005	Berechnung trendbereinigter Indikatoren für Deutschland mit Hilfe von Filterverfahren	Stefan Stamfort
20	2005	How synchronized are central and east European economies with the euro area? Evidence from a structural factor model	Sandra Eickmeier Jörg Breitung
21	2005	Asymptotic distribution of linear unbiased estimators in the presence of heavy-tailed stochastic regressors and residuals	J.-R. Kurz-Kim S.T. Rachev G. Samorodnitsky
22	2005	The Role of Contracting Schemes for the Welfare Costs of Nominal Rigidities over the Business Cycle	Matthias Pastian
23	2005	The cross-sectional dynamics of German business cycles: a bird's eye view	J. Döpke, M. Funke S. Holly, S. Weber

24	2005	Forecasting German GDP using alternative factor models based on large datasets	Christian Schumacher
25	2005	Time-dependent or state-dependent price setting? – micro-evidence from German metal-working industries –	Harald Stahl

Series 2: Banking and Financial Studies

1	2004	Forecasting Credit Portfolio Risk	A. Hamerle, T. Liebig, H. Scheule
2	2004	Systematic Risk in Recovery Rates – An Empirical Analysis of US Corporate Credit Exposures	Klaus Düllmann Monika Trapp
3	2004	Does capital regulation matter for bank behaviour? Evidence for German savings banks	Frank Heid Daniel Porath Stéphanie Stolz
4	2004	German bank lending during emerging market crises: A bank level analysis	F. Heid, T. Nestmann, B. Weder di Mauro, N. von Westernhagen
5	2004	How will Basel II affect bank lending to emerging markets? An analysis based on German bank level data	T. Liebig, D. Porath, B. Weder di Mauro, M. Wedow
6	2004	Estimating probabilities of default for German savings banks and credit cooperatives	Daniel Porath
1	2005	Measurement matters – Input price proxies and bank efficiency in Germany	Michael Koetter
2	2005	The supervisor's portfolio: the market price risk of German banks from 2001 to 2003 – Analysis and models for risk aggregation	Christoph Memmel Carsten Wehn
3	2005	Do banks diversify loan portfolios? A tentative answer based on individual bank loan portfolios	Andreas Kamp Andreas Pfingsten Daniel Porath
4	2005	Banks, markets, and efficiency	F. Fecht, A. Martin

5	2005	The forecast ability of risk-neutral densities of foreign exchange	Ben Craig Joachim Keller
6	2005	Cyclical implications of minimum capital requirements	Frank Heid
7	2005	Banks' regulatory capital buffer and the business cycle: evidence for German savings and cooperative banks	Stéphanie Stolz Michael Wedow

Visiting researcher at the Deutsche Bundesbank

The Deutsche Bundesbank in Frankfurt is looking for a visiting researcher. Visitors should prepare a research project during their stay at the Bundesbank. Candidates must hold a Ph D and be engaged in the field of either macroeconomics and monetary economics, financial markets or international economics. Proposed research projects should be from these fields. The visiting term will be from 3 to 6 months. Salary is commensurate with experience.

Applicants are requested to send a CV, copies of recent papers, letters of reference and a proposal for a research project to:

Deutsche Bundesbank
Personalabteilung
Wilhelm-Epstein-Str. 14

D - 60431 Frankfurt
GERMANY