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Competition in the Netherlands

An analysis of the period 1993-2001

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Abstract in English

Competition in the Dutch market sector as a whole probably slightly declined during 1993-2001. Within the market sector, a large variety in competition development exists. Competition changes have been rather small in many industries competition, but a considerable number of industries experienced a sharp rise or strong fall in competition. These findings are puzzling in light of regulatory reforms that have been implemented in the period observed. Yet, econometric analysis suggests that regulatory reforms could have intensified competition. However, strong growth of market demand has weakened competition and it counterbalanced to some extent the impact of regulatory reforms. If demand grows more rapidly than supply, then incumbent firms compete less aggressively. This should attract new competitors if entry barriers are low. Although entry has a positive effect on competition, its contribution has been negligible or even slightly negative. The analysis is based on two competition indicators. The model considerably explains the development of both indicators at the industry level. However, several determinants have statistically insignificant coefficients, particularly the estimated coefficients of entry and exit rates.

Key words: competition, measurement, competition policy

JEL code: D4, L1, L5

Abstract in Dutch

De concurrentie in de Nederlandse marktsector is waarschijnlijk licht gedaald gedurende 1993-2001. In menig bedrijfstak veranderde de concurrentie weinig, maar dat geldt niet voor alle. Sommige bedrijfstakken laten een sterke daling of stijging zien. De concurrentiebevorderende beleidsmaatregelen hebben de concurrentie gestimuleerd. De sterk toegenomen vraag zorgde echter voor minder concurrentie. Als de vraag sterker toeneemt dan het aanbod kunnen bedrijven hogere prijzen vragen en hoeven ze onderling minder fel te concurreren. Hogere winsten zouden toetreding van bedrijven moeten uitlokken. Alhoewel toetreding gunstig uitwerkt op concurrentie, heeft het niet geleid tot een substantieel hogere concurrentie in de onderzochte periode. De analyse is gebaseerd op twee concurrentie indicatoren. Het model blijkt het concurrentieverloop van beide goed te kunnen verklaren. Wel blijken een aantal verklarende variabelen statistisch niet significant, met name die van toe- en uittreding.

Steekwoorden: concurrentie, maatstaven, concurrentiebeleid

Een uitgebreide Nederlandse samenvatting is beschikbaar via www.cpb.nl.

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Preface

During the 1990s and early 2000s, policy makers took various measures to stimulate competition. This document analyses to what extent competition in Dutch industries changed in the period 1993-2001. Competition development is measured with two indicators derived from a firm-level database containing approximately 87 000 firms. Furthermore, it tries to provide an explanation for the findings by using a model that relates competition to a number of explanatory variables, including policy measures, entry and exit of firms. The approach has a rather explorative character as this type of research is still in its infancy.

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The firm-level data are provided by the Centre for Research of Economic Microdata (CEREM) of Statistics Netherlands. The Dutch Ministry of Economic Affairs financed the project.

Coen Teulings
Director

Summary

Policy makers took various measures to raise the competitive pressure in product markets during the 1990s and early 2000s. International examples are the removal of barriers to the internal market of the European Union (EU) in 1992, the policy agenda set by the Lisbon European Council in 2000 and WTO-agreements. On top of that, Dutch policy makers renewed the Competition Act ('Mededingingswet') in 1998. They also reformed regulations in the so-called MDW-operation (in Dutch: Marktwerking, Deregulering en Wetgevingskwaliteit) to stimulate competition in specific industries, and they privatised sectors like telecommunication.

Policy is concerned about competition, because competition is important for productivity and economic growth. Competitive pressure stimulates firms to operate efficiently by, for instance, 'cutting the fat out' of their organizations. It also brings prices in line with marginal costs, lowering the rents of producers and increasing consumer surplus. Vigorous competition may therefore result in more productivity as resources and output are allocated to their most productive use. Competition may also stimulate firms to innovate, which enhances productivity and economic growth.

So far, the development of competition in the Netherlands since the early 1990s has hardly been investigated at an economy-wide scale. Despite policy interest and some illustrative studies, a clear overall view on whether or not competition has become fiercer and why, is still an unsettled research topic.

Questions

This lack of information leads to the key questions of this document:

- How has competition changed across Dutch industries between 1993 and 2001?
- To what extent can this change in competition be explained?
- What are the implications for policy?

Main conclusions

Using two indicators for competition, the intensity of competition in the Dutch market sector as a whole has probably slightly declined between 1993 and 2001. This decline is partly related to a shift in the industrial structure to services industries with on average less intense competition. At the industry level, there is a wide variety in competition developments across industries. Competition changes have been rather small in many industries, but a considerable number of industries experienced a sharp rise or strong fall in competition.

These findings are puzzling taking into account that policy took various measures in an attempt to raise competitive pressure. Empirical evidence reveals that regulatory reforms have likely had a positive impact on competition. In contrast, considerable growth of market demand in the

1990s had a negative impact on competition. If demand grows more rapidly than supply, incumbent firms compete less aggressively. This should attract new competitors to the market if entry barriers are limited. Although the entry of firms positively affects competition, the overall effect of entry on competition has been seemingly negligible.

At the industry level, the indicators frequently contradict in the direction of competition change. These contradictions are probably related to a different response of the indicators to a reallocation of output from inefficient to efficient firms.

The findings have the following main implications for policy. First, the insufficient pressure of (potential) entrants during the high economic growth in the second half of the 1990s may point to a lack of firm dynamics in relation with potential entry barriers on Dutch markets. Second, other determinants may counteract the impact of policy measures on competition as source to stimulate firms.

Indicators of competition

The analysis is based on two competition indicators: the price-cost margin and the relative profits measure, recently launched by Boone (2000a). The main idea of the relative profits measure is that fiercer competition enables efficient firms to earn higher profits than their inefficient competitors. In fact, fiercer competition induces efficient firms to exploit their efficiency advantage and push aside less efficient firms. The price-cost margin refers to the firms' ability to set their prices above their marginal cost. If there are many competitors on a market with a low level of demand, then competition forces their firms to reduce prices until marginal costs.

The indicators are computed from a comprehensive firm-level database of 87 000 Dutch firms. The database covers large parts of the Dutch market sector including industries of the manufacturing industry, construction, trade, transport and commercial services sector. Data availability limits the analysis to the period 1993-2001.

Both indicators can be biased for at least two reasons. First, both measures are based on average variable costs instead of marginal costs, as there are no data of marginal costs available. Furthermore, defining the relevant market is a notorious problem, and may consequently affect the outcome of the indicators.

No increase in competition during 1993-2001

We investigated the development of competition at two levels of aggregation: at the market sector as a whole sector and at the industry level.

At the level of the market sector, competition declined during 1993-2001 according to both indicators. This conclusion is based on two approaches to aggregate industry results. The first approach assumes that changes in competition in the market sector entirely depend on competition changes of each industry separately. We assume no substitutability of products between industries. The second approach states that differences in competition intensities across industries do have real economic consequences. Products of industries are to some extent substitutes. Hence, if changes in competition at the industry level alter the relative prices between the industries, they also affect the industrial structure. The second approach shows that part of the decline in competition of the market sector is due to a shift in the industrial structure from manufacturing towards services. In general, the level of competition is higher for the manufacturing industry than for services.

At the industry level, both indicators do not suggest that competition increased for most industries. Instead, they show a wide variety in competition developments across industries. Although competition changes have been rather small in many industries, a considerable number of industries experience a sharp rise or strong fall in competition.

Comparison of indicators per industry

Empirical evidence shows that the indicators frequently contradict each other on the direction of the change in competition per industry. The measures point in a different direction in half of all observed industries. These diverging results underline the theoretical notion that the relative profits measure and the (weighted) price-cost margin may contradict if reallocation effects within an industry are substantial. Such shifts in market shares occur if firms change their conduct and efficient firms behave more aggressively. As a result, efficient firms gain market shares (reallocation effect) and inefficient firms can even be forced to leave the market (selection effect). Both indicators respond differently to these reallocation effects.

Model explaining competition developments

For both indicators, we estimate a model relating competition to a number of explanatory variables at the *industry level*. The model specification includes explanatory variables as: entry, exit, market demand, import penetration, advertising and regulatory reforms. The explanatory variables are derived from either aggregating firm-level data or from additional data sources such as the National Accounts. The results are based on the annual observations of 92 industries over the period 1993-2001.

The regression results suggest that regulatory reforms probably intensified competition, but also that considerable growth of demand has weakened competition in the period 1993-2001. Moreover, although this document finds that entry is likely good for competition, its contribution to competition seems to be negligible in the period observed.

Overall, the model specification appears to be economically applicable for both competition indicators. The puzzling competition pattern and wide variety across industries from 1993 to 2001 is explainable by a number of explanatory variables. The signs of the estimated coefficients of those variables are consistent with theoretical expectations, except for the exit rate. Nevertheless, some explanatory variables have statistically insignificant coefficients, particularly those of entry and exit rates.

Implications for policy makers

Four implications for policy arise from this analysis. First, we find indications that the adjustment process of Dutch products market shows signs of inertia. Competition adjusts not immediately to changes in the explanatory variables. Moreover, the impact of entry and exit seems to be limited. Possible reasons are a lack of firm dynamics in relation with potential entry barriers.

The second issue for policy is that competition can change because of other determinants than policy measures. Hence, policy makers should be aware of those determinants that may have unintended effects on competition if the latter is used as a source to encourage firms to become efficient and innovative.

Next, both the relative profits measure and the price-cost margin can only be used as sort of thermometer to indicate the level of (or change in) competition. Both indicators do no indicate why competition has changed, or what the economic effects of such a change are. Moreover, they may contradict if reallocation effects are considerable.

Finally, policy aims to stimulate competition and wants to have the opportunity to monitor and to evaluate their competition measures. These types of analyses require detailed information. This information is costly as it increases the administrative burden for firms and contrasts with the policy to reduce the administrative burden.

1 Introduction

Policy makers took various measures to raise the competitive pressure in product markets during the 1990s and early 2000s. International examples are the removal of barriers to the internal market of the European Union (EU) in 1992, the policy agenda set by the Lisbon European Council in 2000 and WTO-agreements. On top of that, Dutch policy makers renewed the Competition Act ('Mededingingswet') in 1998. They also reformed regulations in the so-called MDW-operation to stimulate competition in specific industries, and they privatised sectors like telecommunication.

Policy is concerned about competition, because competition is important for productivity and economic growth.[1] Competitive pressure stimulates firms to operate efficiently by, for instance, 'cutting the fat out' of their organizations. It also brings prices in line with marginal costs, lowering the rents of producers and increasing consumer surplus. Vigorous competition may therefore result in more productivity as resources and output are allocated to their most productive use. Competition also stimulates firms to innovate, which enhances productivity and economic growth. However, if competition has become too intense to keep innovation profitable, firms may abstain from innovation.

So far, the development of competition in the Netherlands since the early 1990s has hardly been investigated at an economy-wide scale. Despite policy interest and some illustrative studies[2], a clear overall view on whether or not competition has become fiercer and why, is still an unsettled research topic.

Questions

This lack of information leads to three key questions:

- How has competition changed across Dutch industries between 1993 and 2001?
- To what extent can this change in competition be explained?
- What are the implications for policy?

[1] The relation between competition and welfare is not in all cases monotone as competition can induce less product variety that may reduce welfare. If consumers prefer product variety, then competition is not conducive to welfare (see Boone, 2000a).

[2] See Lever and Nieuwenhuijsen (1998), Boone and Weigand (2000), and Felsö et al., (2001). The former analysed the effect of product market competition on productivity in manufacturing. The authors found that competition has a positive influence on the level and growth of productivity. Using the RPM, Boone and Weigand analysed the change in competition during 1978-1992 in the bread and bakeries and periodical publishing industries. They found that competition fell in periodical publishing industries. Felsö et al. analysed competition in a large part of the market sector based on the concentration rate only. Their overall findings are indefinite. Competition in manufacturing increases during 1978-1996. In construction, retail trade and wholesale trade they could not observe a clear change in competition during the period 1988-1996.

Method

The first question is addressed with two competition indicators: the price-cost margin (abbreviated as PCM) and the recently developed relative profits measure (abbreviated as RPM), launched by Boone (2000a). This document shows the results for both indicators at two different levels of aggregation. First, we present the competition development for the Dutch market sector as a whole during 1993-2001. Here, we come across the issue on how to aggregate indicators across industries to provide an overall impression at an aggregated level. Whether or not industries compete with each other determines how to aggregate the detailed results. Second, we investigate changes in competition at the industry level. Additionally, we analyse the coherence of both indicators on the competition development, because the indicators may diverge due to the differences in their economic concepts.

To answer the second question, for both indicators, we use a model that relates competition at the *industry level* to a number of explanatory variables including policy measures, entry and exit of firms. Firm-level data are used to take account of firm specific behaviour.

Finally, we derive implications for policy based on the empirical findings.

Data

Both competition indicators and some explanatory variables are based on a comprehensive firm-level database of approximately 87 000 firms in the Netherlands across 119 industries, covering large parts of the Dutch market sector including industries of the manufacturing industry, construction, trade, transport and commercial services sector. Other determinants for explaining competition are derived from the General Firm Register (in Dutch ABR) and from the National Accounts, both from Statistics Netherlands. Appendix A discusses the firm-level database and the other data sources in more detail.

Limitations

This analysis has a number of restrictions limiting its scope. Data availability limits the analysis to the period 1993-2001. Furthermore, it faces commonly known issues working with (firm-level) data on competition. One traditional limitation, and a notorious problem, concerns the issue of the relevant market. We define the relevant markets to be the 3-digit SIC-level at the national level. The latter implies that we assume that firms compete within these industries at the national level. The empirical evidence could be blurred because firms do not compete at this level. The second limitation is that the analysis of this document only focuses on product markets neglecting the interrelationship between markets. For instance, recent studies point towards strong interactions between regulations at the product market and the labour market (see e.g., Nicoletti et al., 2000).

Extensive analysis of competition indicators in CPB Memorandum *Measuring competition in the Netherlands*

Creusen et al. (2006) compare four types of competition indicators (i.e. RPM, PCM, Herfindahl index and labour-income quote) based on two datasets. In fact, they use the firm-level database to analyse the RPM, the PCM and the Herfindahl index. The last indicator measures the concentration in market shares. For the market sector as a whole, they also compare those indicators with the PCM and the labour-income quote based on the input-output tables of the National Accounts. This document investigates only two indicators, but its main conclusions on the development of competition are similar to those in the Memorandum.

2 Competition in Dutch market sector in 1993-2001

We measure competition using the RPM and the PCM, both derived from firm-level data. The former indicator assumes that fiercer competition leads to relatively more profits for efficient firms. The PCM focuses on the market power of firms to set prices above marginal costs. At the aggregated level, the intensity of competition in the Dutch market sector probably slightly declined from 1993 to 2001 according to both indicators. This decline is partly related to a shift in the industrial structure to services industries with on average less intense competition than in manufacturing industries. Neglecting changes in the structure, the course of competition is less clear-cut at the industry level. Although competition changes have been rather small in most of them, a considerable number of industries experience a sharp rise or strong fall in competition. Moreover, at the industry level, the indicators frequently contradict in the direction of competition change. These contradictions are probably related to a different response of the indicators to a reallocation of output from inefficient to efficient firms.

2.1 Introduction

This chapter focuses on the first research question of this document:

How has competition changed across Dutch industries between 1993 and 2001?

Before answering the question, we define what competition is and how to measure it. Competition is a complex phenomenon and the way to measure competition is still an unsettled question in the literature. We regard product market competition as the game between firms on product markets in order to maximise their profits. This game is complex as many determinants are involved. For instance, firms' behaviour and their strategic interaction as well as external determinants like demand, number of competitors and the prevailing regulation determine the firms' output and prices.

It is difficult to capture all elements of competition in a single figure. Still, researchers in the Industrial Organisation literature suggest measuring competition by using (indirect) indicators.[3] Following this suggestion, this document applies two indicators of competition: the RPM or the RPM, and the price-cost margin or the PCM.

Section 2.2 discusses both indicators and their measurement. Section 2.3 shows how the intensity of competition in the Netherlands evolved over the period 1993-2001. It presents the results of competition at two different levels of aggregation: the Dutch market sector as a whole

[3] See e.g. Cabral (2000) and for a further elaboration Boone (2000a).

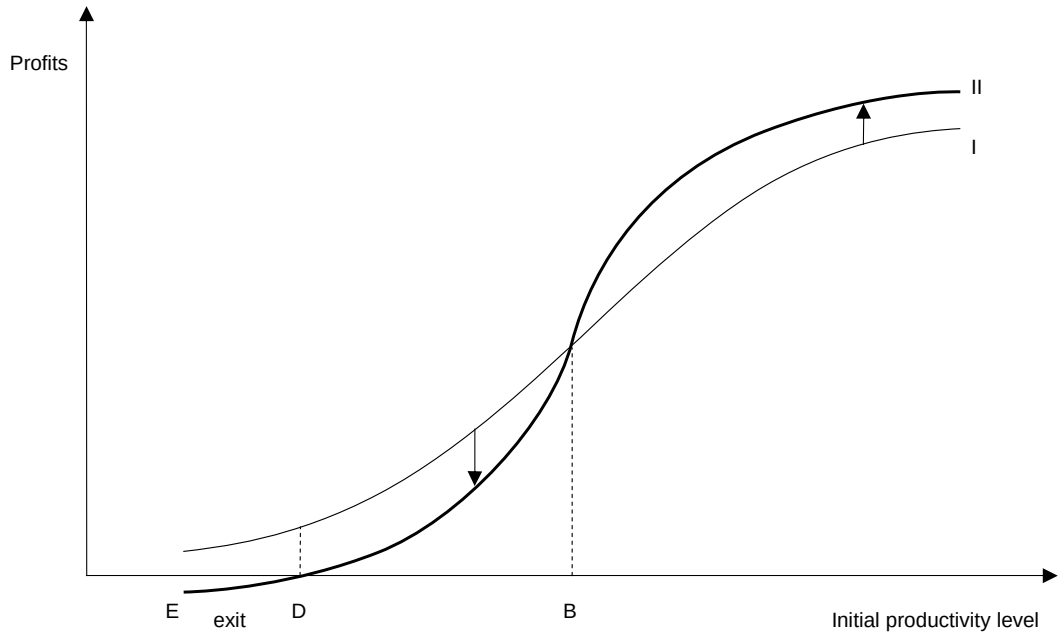
and across Dutch industries. Section 2.4 discusses the relation between both competition indicators, both conceptually and empirically. Finally, section 2.5 gives some conclusions.

2.2 Two indicators of competition

Relative profits measure

Boone recently developed a new way to measure competition (see Boone, 2000a): the relative profits measure (RPM). The idea behind this measure is that fiercer competition leads to (relatively) more profits of the high-productive firms at the expense of the low-productive firms, as efficient firms are forced to exploit their competitive advantage. Put differently, in a more competitive market firms are hurt more severely for being inefficient. The indicator rests on the approach that firms in an industry differ in their marginal costs, or stated otherwise, in their productivity level as the latter is inversely related to marginal costs.

Figure 2.1 Product-productivity curves of non-interacting firms



Fiercer competition can be observed by a steeper slope of the relation between relative profits of the firms and their relative levels of productivity. Figure 2.1 illustrates the general mechanism when competition changes. The horizontal axis ranks the firms according to their efficiency from high to low marginal costs or from low to high in terms of productivity level.

Line I of figure 2.1 shows the profit-productivity curve, which is the relation between the profits of a firm and its productivity level at the initial level of competition. The line slopes

upward, which implies that efficient firms earn more profits than less efficient firms do.[4] The slope of the curve indicates the extent of competition.

Now assume that competition intensifies because of an exogenous shock. Increasing the competitive pressure induces the highly efficient firms (i.e. firms with an efficiency greater than B) to exploit their efficiency advantage more. Therefore, they push aside the less efficient firms (firms with efficiency lower than B). Consequently, they earn relatively more profits at the expense of the low efficient firms (i.e. reallocation in profits). Firms with a productivity level lower than D even start to make losses, and they exit (i.e. selection effect). As a result, the profit-productivity line rotates counter-clockwise. Hence, an increase in competition is shown by an increase in the average slope from profit-productivity curve I to profit-productivity curve II.

Measurement of RPM

We estimate the RPM by the (negative) relation between firm's profit and its marginal costs at the 3-digit level. As data on marginal costs are not directly observable, we use the average variable costs as an approximation. Using regression techniques, the slope β in the basic relationship estimates the RPM:

$$log\ \pi_{it} = \alpha - \beta\ log\ c_{it} + \varepsilon_{it}$$

with π_i gross profit of firm *i* and c_i marginal costs of firm *i*. A high RPM (=β) corresponds with a high level of competition. In fact, β is estimated as an elasticity i.e. percentage increase in profits due to a 1 percent decrease in marginal costs. We approximate the firms' marginal costs by the average variable costs: the sum of the purchasing costs of intermediate products and labour costs, divided by the total sales. In order to estimate the RPM accurately, we adjusted the basic equation for firm-specific effects.[a]

[a] It turned out that if we do not control for firm-fixed effects the RPM will not always attain the appropriate theoretical sign.

Comparing the slope of the RPM over time provides an indication how competition developed. However, a change in the slope gives no clue on the reasons. It can either be due to (exogenous) changes in the institutional settings of the market or to changes in the conduct of firms. Moreover, adjustments in institutional settings may generate a second-order effect as it may alter the conduct of firms. Therefore, the RPM not only takes into account the exogenous effects of competition on specific markets but also changes in the conduct of individual firms within these markets.

[4] The reasoning in the text holds for a linear profit-productivity curve. More competition appears from a steeper slope of that relation. In contrast, the profit-productivity curve in figure 2.1 is S-shaped. The tails have economic significance. Boone (2000a) argues that more competition for firms in the high-efficient tail is an incentive for them to develop and launch new products and not to improve their production processes. In contrast, firms in the low-efficient tail abstain from innovation at all if competition intensifies. The type of innovation is not the topic of this paper, and therefore, the form of profit-productivity curve is not essential unless it is not positively related to competition.

Price-cost margin

The price-cost margin (PCM) – also known as 'Lerner index'– refers to the firm's ability to set its prices above its marginal costs. The idea is that fiercer competition is reflected by lower PCMs due to lower prices. If there are many competitors on a market with a low level of demand, then competition forces the firms to reduce prices until marginal costs. In case of perfect competition, prices are equal to marginal costs. Each individual firm cannot affect the prices on the product market. At the other extreme, a monopolist experiences no competition at all and thus can set the highest price to maximise profits.[5] In the range from no competition to perfect competition, the PCM falls.

Measurement of PCM

The PCM of industry *j* is measured as the (weighted) sum of the PCM of individual firms, each weighted by the firms' market share in output. The PCM of firm *i* is denoted as $(p_i - c_i)/p_i$, where c_i represents the marginal costs and p_i the price of firm *i*.[a] This document measures the (weighted) industry PCM as (see box for alternative approach):

$$PCM_t = \sum_i \left(m_{ti} * \frac{p_{ti} - c_{ti}}{p_{ti}} \right) \approx \sum_i \left(m_{ti} * \frac{s_{ti} - v_{ti}}{s_{ti}} \right) \text{ with } m_{ti} = \frac{s_{ti}}{\sum_i s_{ti}}$$

where p_{ti} denotes the price of firm *i* in year *t*, c_{ti} its average variable costs, v_{ti} total variable costs[b], s_{ti} value of total output, and m_{ti} denotes the market share. So, the average variable costs approximate the marginal costs. Finally, note that the PCM is calculated directly from the firm-level data, whereas the RPM is the result of an econometric regression.

[a] The PCM can also be derived from identifying parameters of a demand and cost function. Another similar way to measure the PCM is an approach initially put forward by Hall to measure the Solow residual and the mark-up (price over marginal costs). Hall pointed out that the mark-up can be estimated by using Solow's equation, differentiating between inputs and exogenous technological progress (see Ahn, 2002). Several studies have elaborated on this alternative as to overcome econometric issues (see Oliveira Martins et al., 1996)).

[b] I.e. the sum of labour costs and the costs of intermediate products.

Data issues

Both the RPM and the PCM are based on firm-level data derived from the 'Productiestatistieken' (PS) by Statistics Netherlands. For the year 2001, appendix B presents the levels of the RPM and the PCM for all 119 industries, and the trend growth of both the RPM and the PCM between 1993 and 2001 as indication for the change in competition over time. For the remaining of this chapter, we focus on 100 industries as we had to omit 19 industries due to statistical irregularities in the data for measuring both indicators.

[5] In case of high economies of scale, a monopoly with a high PCM is sustainable. High investment costs and substantial economies of scale by incumbents entail that entry of new firms is not profitable. Also from a social point of view entry is less desirable, because total demand and firms' individual output will be too small in relation to the high investments. In case of entry, firms cannot sufficiently benefit from the economies of scale.

Besides the limitations on delineating relevant markets (see chapter 1) and statistical irregularities, there is one other major problem involved with calculating the RPM and the PCM.[6] Both indicators use the marginal costs, but these costs are not directly observable. As is standard in the empirical literature, we approximate the firms' marginal costs by the average variable costs. However, this approximation may create a bias in the results for both indicators.

2.3 Competition development during 1993-2001

2.3.1 Market sector as a whole

The problem of aggregation

To get an overall view for the market sector as a whole, it is clear that individual industry results must be aggregated. Obviously, competition changes of large industries should have more weight than competition changes of small industries. However, the precise definitions of the weights depend on how one interprets competition between industries within the market sector.

Two extreme approaches

We employ two approaches to aggregate competition over industries. First, we assume that changes in competition within industries do not affect the industrial structure, and use fixed weights to aggregate. The second approach assumes that changes in competition at the industry level also affect the industrial structure. Both approaches differ if changes in the industrial structure occur, but they increasingly correspond if changes in the structure are smaller (see box for the formulas).

Approach 1: No competition between industries

The first approach assumes that changes in the level of competition in the market sector entirely depend on competition changes of each industry separately. We assume no substitutability of products between industries despite changes in the relative prices due to competition. Hence, we argue that changes in competition within industries do not affect the industrial structure.

This approach requires that the industrial structure is fixed to the situation in 1993. Therefore, competition growth of the market sector equals the fixed weighted sum of the

[6] See Creusen et al. (2006) for a more extensive assessment on the empirical measurement of the indicators.

competition level of the industries over time. The 1993 market shares (in terms of turnover) of each industry in the market sector are used as fixed weights.[7]

Defining competition growth op the market sector: the formulas

Given the two approaches, the formulas of the competition growth rates for the market sector are denoted as follows.

Approach 1: No competition between industries

Competition growth of the market sector in year t is defined as $\overset{\circ}{c}_t = (\Delta c_t)/c_{t-1}$ with

$$c_t = \sum_i \left(c_{i,t} * s_{i,1993}\right)$$

where c_{it} denotes the competition intensity of industry *i* , $s_{i,1993}$ denotes the share of industry *i* in the turnover of the market sector in 1993.

Approach 2: Competition between industries

Competition growth of the market sector is defined as $\overset{\circ}{c}_t = (\Delta c_t)/c_{t-1}$ where $c_t = \sum_i s_{it} c_{it}$; s_{it} denotes the share of industry *i* in the turnover of the market sector and c_{it} denotes the competition intensity in industry *i* . This expression is the sum of three components, viz. 1) within component: competition growth due to competition changes within industries; 2) between component: changes due to shifts in the industrial structure and 3) cross component: the interdependency between changes in competition of industries and changes of the industrial structure. The decomposition can be expressed as follow:

$$\overset{\circ}{c}_t = \begin{pmatrix} \sum_i \left(\frac{c_{i,t-1}}{c_{t-1}} s_{i,t-1}\right) \overset{\circ}{c}_{it} & \text{within - industry component} \\ + \sum_i \left(\frac{c_{i,t-1}}{c_{t-1}}\right) \Delta s_{it} & \text{between – industry component} \\ + \sum_i \left(\frac{c_{i,t-1}}{c_{t-1}}\right) \overset{\circ}{c}_{it}\, \Delta s_{it} & \text{cross component} \end{pmatrix}$$

The term $c_{i,t-1}/c_{t-1}$ measures the deviation of competition intensity of industry *i* from competition intensity in the market sector in the previous year.

Approach 2: Competition between industries

A second way to aggregate competition across industries is to assume that differences in competition intensities across industries do have real economic consequences. In this case, products of industries are to some extent substitutes. Hence, if changes in competition at the industry level alter the relative prices between the industries, it also affects the industrial

[7] Note that this method does not control for measurement problems regarding comparing levels of competition across industries. Indexing the levels of competition of each industry to 1993 is not an adequate solution because the aggregated result will then be biased towards an index larger than 1993.

structure. This approach can be implemented by using a shift-share analysis. Such analysis allows us to decompose competition growth at the aggregated level as follows:

- The 'within-industry component' includes the competition growth due to changes in competition of the industries with weights of the previous year. The economic interpretation comes close to the interpretation of competition growth according to approach 1 except that the weights are not fixed but flexible.
- The 'between-industry component' reflects competition changes at the aggregated level due to shifts in the industrial structure. If the structure shifts to industries with higher levels of competition, then competition in the market sector rises, even if competition within industries remains unchanged.
- The 'cross component' presents the competition development as the product of changes in competition across industries and changes in the industrial structure. If both elements are positive or negative, they contribute to more competition in the market sector.

Note that the 'between-industry component' primarily depends on differences in structural economic growth between industries. In general, shifts in the economic structure arise from differences in income elasticities across the industries as well as differences in price elasticities of demand. The industrial structure also depends on the development of (labour) costs in the Netherlands compared with foreign countries. Shifts in competition affect relative prices and therefore may also alter the industrial structure but presumably, this effect is small.

Results according to both approaches

Table 2.1 presents the average annual growth rates of the Dutch market sector between 1993 and 2001 according to both approaches.[8] It turns out that both indicators in both approaches point to less intensified competition over time. Depending on the indicator and on the aggregation approach, competition in the market sector has declined between ½ to 1½ percent on average per year.

[8] To improve the comparability between the indicators, we have harmonized the developments of the indicators in the following way. For each indicator we assume that the index starts at 100 in 1993, so the level of competition in 1993 is the starting point. Then the value of the index of the RPM equals its value of the previous year plus the annual percentage change of the RPM, because an increase in the RPM entails more competition. The value of the index of the PCM equals its value of the previous year *divided* by the annual percentage change of the PCM, because increases in the PCM would point to decreases in competition.

Table 2.1	**Trends competition growth market sector between 1993 and 2001**				
Conditions	Approach 1	Approach 2			
Industrial structure	Fixed to 1993	Flexible			
		Total	Components		
			Within-industry	Between-industry	Cross
		Average percentage annual competition growth			
RPM	– 0.49	– 1.59	0.28	– 1.76	– 0.09
PCM	– 1.00	– 1.26	– 0.58	– 0.20	– 0.53

Figures 2.2 (approach 1) and 2.3 (approach 2) show the year-by-year development in competition according to both indicators. Note that both figures present an index (1993=100) for each competition indicator for which an *increase* points to more competition (and vice versa). As already noticed, the figures reveal that both approaches lead to comparable developments for both indicators in the longer run. However, the RPM is relatively more volatile than the PCM in the short term.

Figure 2.2 **Competition Dutch market sector (1993=100): approach 1, 1993-2001**

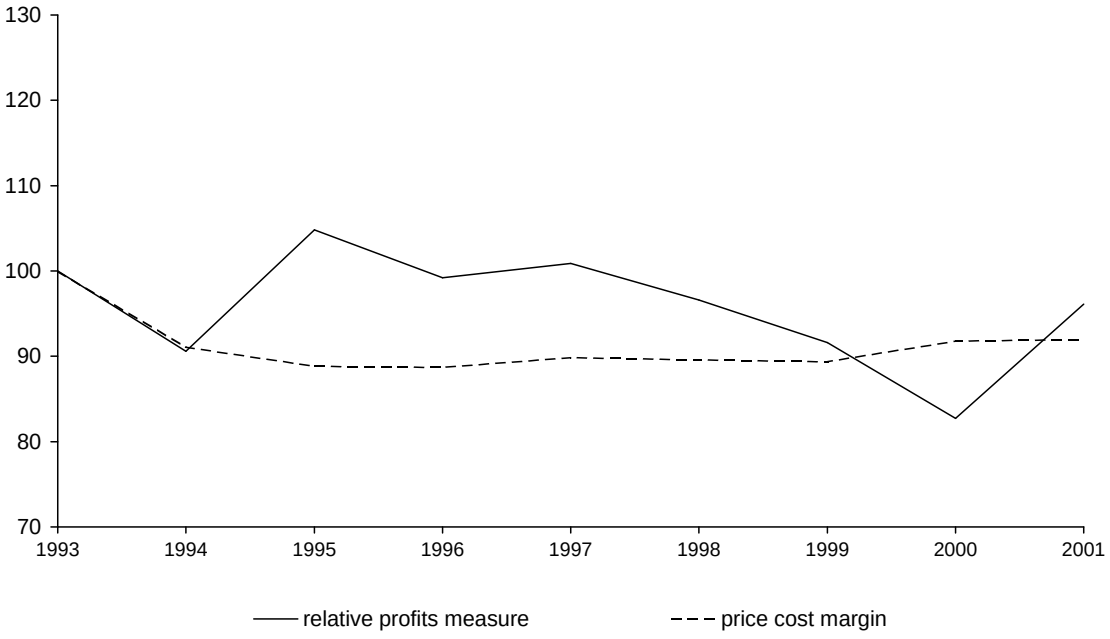
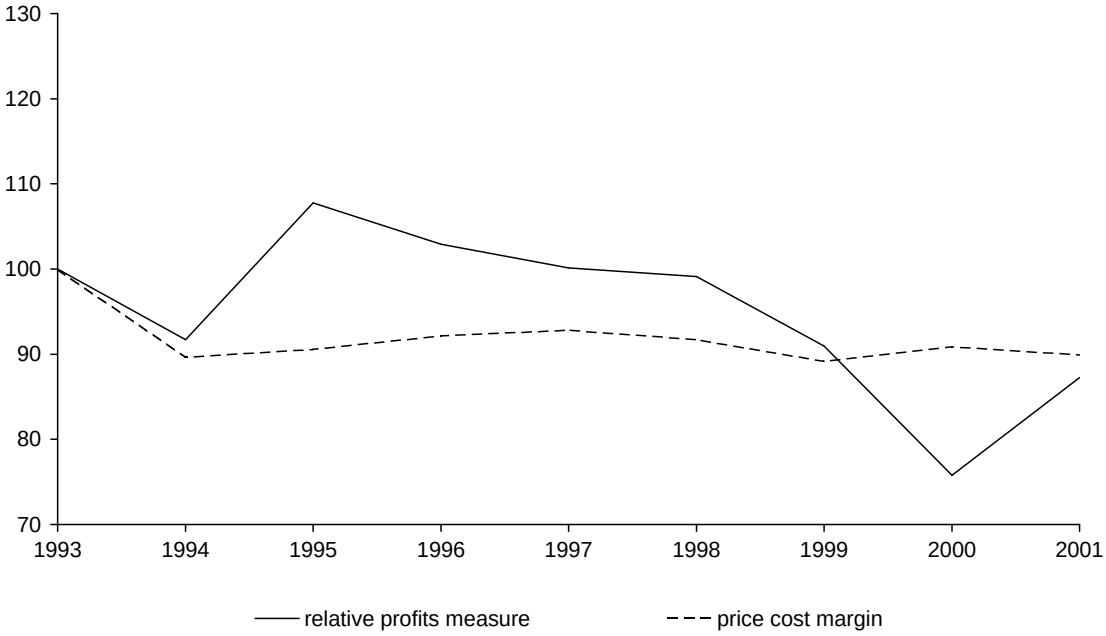


Figure 2.3 Competition Dutch market sector (1993=100): approach 2, 1993-2001



Decomposition competition growth

The shift-share analysis of approach 2 allows looking at the underlying components of the change in competition at the aggregated level. Here, the indicators do not completely agree. The *within-industry component* contributed positively to the overall RPM-result in the period 1993-2001, whereas this component negatively contributed to the PCM. The indicators cohere with respect to the other components.

The *between-industry component* is negative for both indicators indicating that a change in the industrial structure has contributed to the decrease in competition of the Dutch market sector. This particularly holds for the RPM. Apparently, the industrial structure shifted from industries with high levels of competition to industries with low levels of competition from 1993 to 2001. To be more precise, it illustrates the ongoing shift from manufacturing to services as the latter sector has a lower level of competition (see table 2.2).

The *cross component* is negative for both indicators contributing to a decline in competition in the Dutch market sector. Competition especially declined in the fastest growing industries in terms of market shares in the market sector. Again, this particularly holds for the PCM. Obviously, this statistical outcome does not take into account the determinants in this process. Still, if we assume fast growing industries and entry positively correlate than the results could indicate that the entry of firms in these industries has been insufficient to give sufficient countervailing power with regard to competition.

Table 2.2 Competition levels manufacturing industry and services sector, 1993[a]

	Manufacturing	Services sector
	Market sector =100	
Firm-level data		
RPM	150	54
PCM	120	73

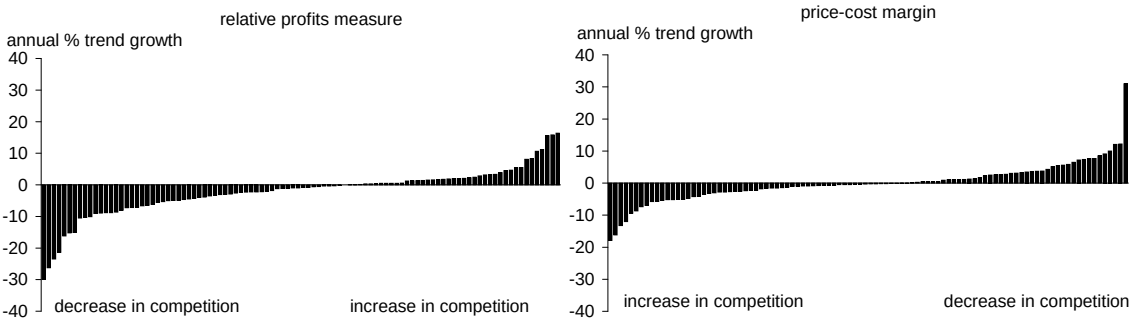
[a] The (weigthed) average indicators for the manufacturing sector and for the services sector are indexed with as base the (weighted) average indicators for the market sector. For the PCM the ratio is reversed, as a higher PCM points to less competition.

2.3.2 Across industries

Here we discuss how competition developed across Dutch industries between 1993 and 2001. Figure 2.3 shows the distributions of the growth rates of competition across industries for both indicators. Each bar represents the (trend) results for an observed industry between 1993 and 2001.[9]

Overall, both indicators do not suggest that competition increased economy-wide. Instead, they show a wide variety in competition developments across industries. Although competition changes have been rather small in many industries, a considerable number of industries experience a sharp rise or strong fall in competition.

Figure 2.4 Distribution of competition changes across Dutch industries, 1994-2001



This inconclusive picture of competition is puzzling, as beforehand one would at least expect a positive impact of the competition enhancing policies referred to in section 1. The outcomes including the ones of section 2.3.1 suggest that either these policies have not been effective or other determinants have offset the positive impact of these policies. The large variety in

[9] The percentage change of competition in each industry is the change of the estimated trend for the whole period 1993-2001 and not the observed change. The former provides a better impression of the structural development of competition, because it corrects for potential outliers in 1993 and 2001.

competition changes across industries is a puzzle as well, as common factors like the new Competition Act affected all those industries.

These puzzles hold for both indicators suggesting mutual coherence on the competition development between both of them. Nonetheless, taking a closer look at figure 1, the indicators do not entirely correspond with each other with respect to the number of industries where competition intensified or respectively declined.

Table 2.3 presents the number of industries and their corresponding market share with an increase or a decrease in competition during 1993-2001. Now, differences between both indicators become more pronounced. First, according to the PCM, the number of industries with a rise in competition exceeds the number with a decline, while the RPM points to a larger number of industries with a decline. Second, it shows that, according to the RPM, the majority of industries with lower competition have a (slightly) higher market share than the ones with fiercer competition. With regard to the PCM, it is just the other way round. Finally, taking into account the different outcome of the within-industry component of table 2.1, it suggests that at the industry level the indicators not only disagree in a number of cases but also that the (absolute) changes in competition differ between both indicators.

Table 2.3 Competition changes in Dutch industries, 1994-2001[a]

	Industries with fiercer competition		Industries with lower competition	
	Number of industries	% market share[a]	Number of industries	% market share[a]
RPM	41	49	59	51
PCM	58	53	42	47

[a] I.e. the sum of market shares in 1993 of the industries in the market sector.

2.4 Matching the indicators by industry

Indicators based on different concepts

Although both indicators have much in common, a theoretical assessment points out that the indicators may come up with a different story on changes in competition (see Boone, 2000a, Boone et al., 2006, and Creusen et al., 2006). This is due to their focus on different aspects of competition. The RPM emphasises differences between firms in terms of efficiency levels and analyses the impact of efficiency levels on profits. The (weighted) PCM at the industry level, however, abstracts from these differences in efficiency, and only focuses on the overall level of profits (relative to total industry sales).[10]

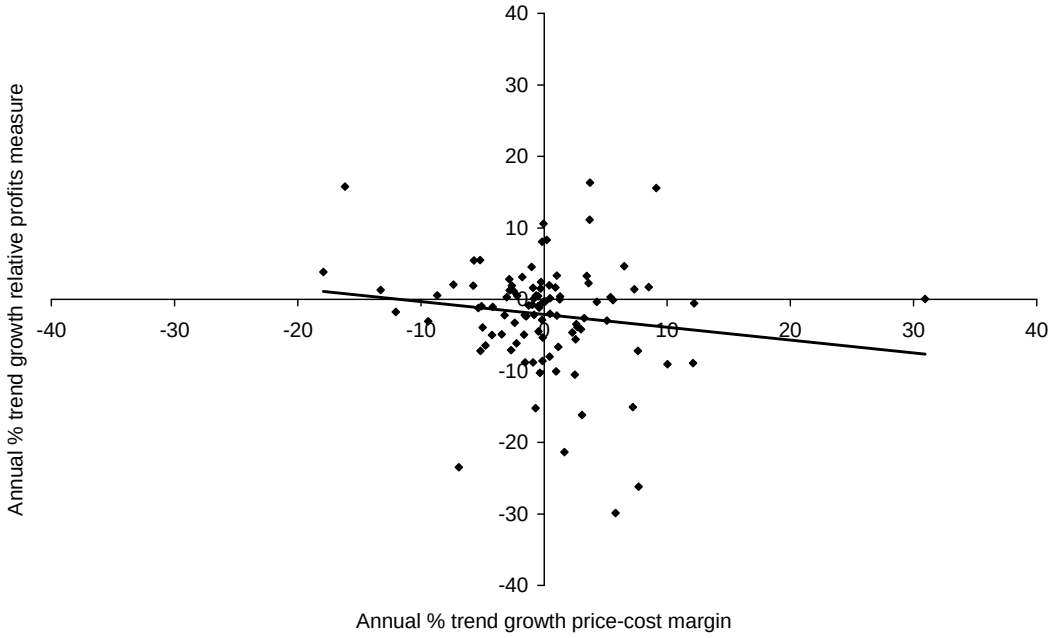
[10] In fact, the (industry) PCM can be rewritten as the sum of firms' profits relative to the total industry sales.

If differences in efficiency among firms are large, the PCM and RPM may disagree in their story on competition at the industry level. Changes in the PCM at the industry level are the result of changes in the individual PCMs of firms as well as changes in their market shares in a specific industry. Suppose competition intensifies for some reason. The increase in competition will reduce the PCMs of all individual firms. But it may also raise the *market shares* of the efficient firms at the expense of inefficient firms. As efficient firms have a larger PCM than the inefficient firms, the former can lower their margins (or prices) relatively more causing their market shares to rise. If the latter (reallocation) effect on PCM is positive and larger than the negative individual effects, the PCM at the industry level may rise, suggesting less competition. In case of the RPM, such intensified (strategic) interaction between firms entails that efficient firms gain higher relative profits at the expense of inefficient firms, which induces an increase in the RPM suggesting intensified competition.

Comparing indicators within industries

The difference in focus of the RPM and the PCM becomes apparent by comparing the indicators per industry. Figure 2.4 plots the average growth rates per industry over the period 1993-2001 according to the RPM (vertical axis) and the PCM (horizontal axis).

Figure 2.4 Changes PCMs and RPMs across Dutch industries, 1993-2001



If the indicators would agree completely on the change in competition by industry, then the figure should show a negative relationship as an increase in the PCM and a decrease in the RPM indicate weaker competition (and vice versa). Although a negative relationship is present, this relationship is not significant as for many industries the indicators contradict each other on

the sign of the change in competition. In fact, in half of all observed industries the indicators do not agree on the direction of the change. As stated above, this can be due to considerable reallocation of market shares among firms within these industries.

2.5 Conclusions

This chapter employs two indicators on the intensity of competition, i.e. the RPM and the PCM. The RPM builds on the idea that more competition rewards efficiency, so that efficient firms gain (relatively) more profits at the expense of inefficient firms. The PCM denotes that if competition is low, firms have less power to set prices above marginal costs (and visa versa).

For the Dutch market sector as a whole, both indicators suggest that competition in the market sector has declined during 1993-2001. This conclusion holds for two approaches for aggregating individual industry results. The first approach abstracts from differences in the level of competition intensity in industries, assuming that these differences have no impact on the industrial structure. The second approach assumes that differences in competition intensities across industries may have real economic consequences. If industries differ in income elasticities or are to some extent substitutable, then changes in national income or relative prices between the industries affect the industrial structure. The second approach also reveals that part of the decline in competition in the market sector is due to a shift in the industrial structure.

At the industry level, the indicators point to a wide variety in competition developments. Although competition changes have been rather small in many industries, a considerable number of industries experience a sharp rise or strong fall in competition in the period 1993-2001. This inconclusive picture of competition at the industry level is puzzling taking into account the expected positive impact of the competition enhancing policies.

Comparing the two indicators per selected industry provides more puzzling results. It turns out that the indicators frequently contradict each other on the direction of change in competition per industry. Both measures point in the same direction in half of all observed industries. These diverging results underline the theoretical notion that in some industries reallocation effects may occur, and hence both indicators contradict. In fact, the RPM and the PCM may point to opposite directions for the development of competition due to reallocation of output. For example, more competition forces efficient firms to conduct more aggressively so that they gain market share at the expense of inefficient firms. The RPM and the (weighted) PCM respond differently to these reallocation effects.

3 Explaining competition over time

We estimate the impact of a number of explanatory variables on both the RPM and the PCM across Dutch industries for each year during 1993-2001. It turns out that strong growth in market demand contributed to a decline in competition. Regulatory reforms seemed to have had a positive impact on competition. Although entry is good for competition, its contribution to competition has been negligible or even slightly negative. The model can substantially explain the development of both indictors. However, several determinants have statistically insignificant coefficients, particularly those of entry and exit.

3.1 Introduction

This chapter focuses on the second question of this document:

To what extent can the development in competition be explained?

The answer to this question may shed more light on the large variety in competition development across industries and to differences between the indicators at the industry level. Therefore, for both indicators we estimate a model that explains competition out of a number of explanatory variables for the period 1993-2001.

The structure of this chapter is as follows. Section 3.2 discusses the model, and section 3.3 presents the estimation results of the model for both indicators. Section 3.4 presents the contributions of the explanatory variables on the change in competition. Section 3.5 analyses the entry and exit results in more detail, because those results are puzzling. Section 3.6 draws some main conclusions.

3.2 Model explaining competition

3.2.1 Dependent and explanatory variables[11]

Theory, particularly the theory of Industrial Organization[12], has put forward several determinants of competition. In general, competition can become more intense in two ways. First, the number of firms can increase given the conduct of firms. The number of firms increases due to lower entry costs and new business opportunities. Second, competition intensifies if firms' conduct becomes more aggressive given the number of firms. Changes in competition policy may also initiate both ways. Hence, the determinants of competition are related to the market structure of industries, conduct of firms and policy issues.

[11] The data sources are mentioned in appendix A.

[12] See for example Tirole (1988).

To explain the RPM and the PCM at the industry level, our model specification includes the following explanatory variables: entry and exit of firms to the market, market demand, import penetration, strategic interaction between firms, advertising and competition policy measures. Finally, it can be argued that competition adjusts not immediately to changes in the explanatory variables. Therefore, we also add the competition level of the previous year to the model.

Entry rate

More entry of firms to a market is expected to have a positive impact on competition. For instance, lower entry barriers or increased demand attracts more entrants. Given the conduct of incumbents, this will raise competition. The explanatory variable is the number of firms that enter an industry in a year as percentage of the total number of firms at the beginning of that year.

Exit rate

More exit of firms from a market is expected to have a negative impact on competition. Tighter security or environmental requirements or lower demand may force firms to exit the market reducing the intensity of competition. The explanatory variable is the number of firms that exit an industry in a year as percentage of the total number of firms at the beginning of that year.

Market demand

An increase in market demand (linked to economic growth) is expected to reduce competition, and vice versa. Then, incumbent firms can (at least temporarily) set their prices above marginal costs and gain high profits without being impeded by competitors' price-cutting. Hence, higher demand is expected to weaken competition.

The explanatory variable is real gross product after an adjustment.[13] The adjustment is determined by using instrumental variables to control for supply-side effects in the changes of total sales. Supply-side effects include labour productivity and the number of firms.

Import penetration

An increase in international trade intensifies competition between firms operating in different countries. In fact, the opening of the European market reduced transportation and transaction costs, and consequently raised international trade. The explanatory variable is the share of imports on the Dutch market in gross production.[14]

[13] (The year-index of) the value of total industry sales is deflated by the GDP-price index to remove disturbances of general inflation.

[14] Note that lower transportation costs makes (physical) entry and direct investments of foreign firms on the Dutch market less urgent reducing the extent of import penetration. Still, lower transportation costs entail more intense competition.

Strategic interaction

If firms compete more aggressively than competition is expected to be fiercer. Responses of firms to competitors' actions cannot be observed in our dataset. However, there is a way out if we include differences between both competition indicators as an explanatory variable. As discussed in the previous chapter, if the RPM and the PCM differ in their sign of competition change this may point to changes in conduct suggesting intensifying strategic interaction as efficient firms use their (cost) advantage at the expense of inefficient firms.[15] These responses in behaviour induce lower PCMs for each firm but also reallocation effects of output within industries increasing the market shares of efficient firms. The RPM will register the result of both effects as an increase in competition, whereas the PCM may register it as a decrease in competition at the industry level.

The explanatory variable is a counting variable. This variable increases (decreases) in some year by one if in that year both the RPM and the PCM increase (decrease), suggesting a change in intensity of strategic interaction.

Advertising

The second explanatory variable referring to the conduct of firms is transparency approximated by advertising. Its impact on competition is, however, ambiguous. In fact, advertising can raise competition if it increases market transparency, but it may also reduce competition if it lowers product substitutability and effectively raises an entry barrier.

On the one hand, firms may use advertising to introduce new products and to inform clients on the product attributes increasing the transparency. In this way, advertising may enhance competition. On the other hand, lack of transparency on product quality may hinder competition. Transparency issues particularly hold in the (business) services sector (see Kox, 2002), as clients are not easily able to judge on the quality before or even just after the purchase of the service. Clients can only build on firms' reputation.[16] Building up a strong reputation of supplying high-quality products is a difficult, lengthy and costly process. This gives incumbents an initial advantage over entrants. Additionally, incumbents may also use advertising to reduce product substitutability. Here, advertising expenditures have a negative impact on competition.

The explanatory variable is the expenditures on advertising as percentage of the sales.

[15] Firms' interactions may intensify because of increases in product substitutability, lower market demand, diminishing response of competitors to an offensive action, and a shift from (lax) quantity competition to (fierce) price competition (see Boone, 2000).

[16] In some cases, customers even have to pay search cost to select the most appropriate product.

Regulatory reforms

Regulatory reforms are supposed to have intensified competition in the observed period in the Netherlands. Empirically these effects are difficult to capture in measurable variables (see OECD, 2005).

The explanatory variable is a counting variable on regulation as the sum of two elements. The first one is the impact of the MDW-operation (Competition, Deregulation and Legislative quality): several partial MDW-projects resulted in policy reforms that changed competitive conditions in specific industries; e.g., the MDW-operation resulted in the enactment of the new shop hours act in 1996 (liberalization of the shop opening hours) and the new taxi-act in 2000 (deregulation of the taxi-market). The second one is the impact of the new Competition Act in 1998 (in Dutch Mededingingswet), which may have affected competition in all industries. When a policy reform was enacted in a year than the counting variable increases with one for that same year.

Lagged competition indicator

We expect that competition intensity does not adjust instantaneously to changes in the explanatory variables. The delay can be due to firms' inertia and refers to the gradual adjustment of firms' competitive behaviour to changes in competitive settings. This feature is well known for other economic variables such as capital. The explanatory variable is the one-year lagged dependent variable (RPM respectively PCM).

Sector dummies

Finally, to cope with heterogeneity and different markets, we control for differences between industries by adding sectoral dummies to the competition equation. As table 2.2 illustrates, the level of competition is higher in manufacturing than in the services sector. The explanatory variables are two dummies: one for all industries belonging to the services sector and one for all industries belonging to the construction sector. Moreover, we test for further segmentation of the markets.

3.2.2 Estimation procedure

We estimated the model using the observations of 92 industries over the period from 1993 to 2001. We left out 27 industries, because for these industries data on the explanatory variables were missing for several years.

Before discussing the estimation results for competition, we embark on the specific relationship between competition, entry and exit. This relationship is not straightforward because of the endogeneity problem.

Formal model and used estimation technique

The model exists of simultaneous equations for competition, entry and for exit. We estimated this simultaneous model for both competition indicators separately, i.e. the RPM and the PCM.

The main equation explains the development in competition. After taking logarithms of the respective competition indicator $CI_{tj} = RPM_{tj}, PCM_{tj}$ as the dependent variable and all the explanatory variables of industry *j* in year *t*, the regression equation for competition reads as:

$$CI_{tj} = \alpha_0 + \alpha_1 \overline{Entry_{tj}} + \alpha_2 \overline{Exit_{tj}} + \alpha_3 MD_{tj} + \alpha_4 ADV_{tj} + \alpha_5 SI + \alpha_6 RR + \lambda_{tj} \quad (1)$$

with $\overline{Entry}$ estimated number of entrants as percentage of total number of firms

$\overline{Exit}$ estimated number of exiting firms as percentage of the total number of firms

MD market demand, i.e. total sales adjusted for supply-side effects

ADV advertising rate, i.e. advertising costs as percentage of total sales

SI dummy on strategic interaction [a]

RR indicator on regulatory reforms, i.e. the sum of a dummy on a MDW-operation (1996 and later) and a dummy on the new Competition Act (1998 and later)

The fitted values of the entry and exit rate ($\overline{Entry_{tj}}$ and $\overline{Exit_{tj}}$) capture the joint effects of all determinants on competition that go through entry and exit. Using the 2-Stage Least Squares approach, these predicted values are obtained from two other equations, because entry and exit may be endogenous variables. Therefore, we separately determined the impact of several exogenous determinants on entry and exit by regressing the entry rate ($Entry_{tj}$) and exit rate ($Exit_{tj}$) of industry *j* in year *t* on lagged determinants. We used a one year lag, because it is likely that entry and exit only take place whenever the change in the determinant becomes more settled and definite.[b] Stated formally, we estimated:

$$Entry_{tj} = \beta_0 + \beta_1 Entry_{t-1,j} + \beta_2 CI_{t-1,j} + \beta_3 TS_{t-1,j} + \beta_4 DEP_{t-1,j} + \beta_5 ADV_{t-1,j} + \beta_6 RR_{t-1,j} + \mu_{tj} \quad (2a)$$

$$Exit_{tj} = \gamma_0 + \gamma_0 Exit_{t-1,j} + \gamma_2 CI_{t-1,j} + \gamma_3 TS_{t-1,j} + \gamma_4 DEP_{t-1,j} + \gamma_5 ADV_{t-1,j} + \gamma_6 RR_{t-1,j} + v_{tj} \quad (2b)$$

with *TS* total sales

DEP capital intensity, measured by depreciation costs as percentage of total sales

The equations can be estimated in two sequential steps by the Ordinary Least Squares-technique. This procedure is known as the 2-Stage Least Squares-technique to correct for endogeneity problems (see for example Verbeek, 2004).

[a] A positive and significant correlation between the RPM and the PCM points to the existence of reallocation effects, i.e. when changes in competition also induce shifts in market shares (see Creusen et al., 2006). These reallocation effects, however, typically emerge if competition is altered by changes in strategic interaction. So, simultaneous increases (decreases) in the RPM and the PCM point to an increase (decrease) in firm's strategic interaction.

[b] Note that these lagged variables eventually serve as instrumental variables for the system of all equations.

Entry affects competition as more entry will have a positive effect on competition. However, on its turn, competition also affects entry. Intensified competition reduces profits and given the fixed costs entrants do not enter the market. Theoretically, it is not straightforward how to interpret changes in the number of firms in a market with regard to competition. In fact, it may

depend on the causes of a change in competition. For instance, the number of firms may increase due to lower entry barriers, attracting more entry, which points to more competition. In contrast, the number of firms may decline if more aggressive conduct of firms enhances competition, for example due to regulatory reforms, forcing (inefficient) firms to leave the market.

Therefore, we control for simultaneity between the competition indicators and entry and exit. In fact, we use the fitted values of entry and exit rates in the explanation of competition (see box on the formal model). The fitted values are calculated from additional equations for entry and exit using instrumental variables.[17]

3.3 Estimation results for competition

Dependent variable: RPM

Table 3.1 presents the estimated coefficients as well as the expected sign of each explanatory variable of the RPM (equation (1) in the formal model).

The model explains a considerable part of the variety in competition across industries. The goodness of fit (R-squared) is considerable: the determinants explain 62% of the variation of competition. However, it should be noted that the lagged competition indicators substantially contribute to this value. Nevertheless, the strongly significant t-value of the lagged indicator puts no burden on the explanatory power of the regression as a whole, because omitting the lagged indicator does not harm the sign or the significance of the other determinants.

The estimated coefficients of five determinants are statistically significant, i.e. those of the market demand, import penetration, the strategic interaction, the regulatory reforms, and the lagged competition indicator. Additionally, the model specification appears to be economically applicable. The signs of the coefficients of the explanatory variables are consistent with theoretical expectations, except for the exit rate. For instance, the estimated coefficients suggest that market demand has had a negative effect on competition, and regulatory reforms have had a positive effect on competition in the period 1993-2001.[18]

Given our model specification, the result for the exit rate is puzzling, since it suggests that more exits have had a positive effect on competition. However, the associated t-values indicate that the hypothesis of a zero (or negative) effect cannot be rejected.[19] In section 3.5, we elaborate on the entry and exit results in more detail.

[17] The fitted values of the entry rate and the exit rate are based on the estimated coefficients of equations (2a) or (2b), and the observed explanatory variables.

[18] Differentiating between the new Competition Act and the specific reforms by the MDW-operation does not alter the message, because both reforms have had a positive impact on competition (see appendix C).

[19] Critical t-value for a twofold test at 10% confidence level is 1.65; at 5% confidence level is 1.96.

Table 3.1 Explanation of competition by regressing the RPM, 1994-2001

Determinants	Expected sign[a]	Estimated coefficient	t-value
(Fitted) entry	+	0.06	0.41
(Fitted) exit	–	0.35	1.25
Market demand	–	– 0.31	– 2.38
Import penetration	+	0.05	2.42
Strategic interaction	+	0.08	5.38
Advertising rate	?	0.01	0.37
Indicator regulatory reforms	+	0.08	2.12
Lagged RPM		0.44	12.85
Dummy construction sector		– 0.87	– 4.13
Dummy services sector		– 0.65	– 5.35
Intercept		– 0.22	– 0.41
R- squared		0.62	
Degrees of freedom		693	
Durbin's h-statistic		– 1.68	
F-value		115.33	

[a] Positive coefficient indicates positive effect on competition, and visa versa.

Next, we highlight three additional results of table 3.1. First, the statistically significant coefficient of the indicator for strategic interaction suggests that competition increased due to changes in the behaviour of (efficient) firms. It, therefore, supports the idea that reallocation of market shares between firms has been important in the period 1993-2001. Hence, different signals on the change in competition between both indicators could be related to this reallocation effect.

Second, the size of the coefficient of lagged indicator suggests an adjustment of firms' competitive behaviour to changes in the other determinants in the previous year. The coefficient of 0.44 implicates that competition is fully adjusted to initial changes of other determinants after two years.

Finally, higher advertising expenditures intensify competition, suggesting that those expenditures increase market transparency and, consequently, increase the competitive pressure. However, the coefficient of advertising is statistically insignificant.

Additional econometric issues

Other model specifications did not improve the overall findings or the significance of estimated parameters.
First, we have also estimated the equation with other variable-specifications, such as annual percentage changes, adjustments for industry specific factors or with lagged variables. These estimations all ended in poorer results in statistical sense as well as economic sense.
Second, correlations between the determinants point to some multi-collinearity or heteroskedasticity. Particularly, the predicted entry correlates with the predicted exit. Both variables also correlate with the dummy for services. Adjusting the regressions for heteroskedasticity and autocorrelation does not fundamentally change the overall findings.
Third, we controlled for differences in the number of firms per industry as indication for separate markets. Again, it turned out that this diversification did not change the overall results.

Dependent variable: PCM

Table 3.2 presents the regression results for the PCM as the dependent variable. Remember that the signs of the explanatory variables for RPM should be mostly opposite to the ones for the PCM, because the two indicators measure changes in competition in the opposite way. The only exceptions are the parameters of the lagged indicators, the indicator on strategic interaction due to its definition, and the advertising expenditures as for the latter, the sign is beforehand not clear-cut.

Table 3.2 Explanation of competition by regressing the PCM , 1994-2001

Determinant	Expected sign[a]	Estimated coefficient	t– value
(Fitted) entry rate	–	– 0.15	– 1.58
(Fitted) exit rate	+	– 0.21	– 1.25
Market demand	+	0.16	1.94
Import penetration	–	– 0.01	– 1.05
Strategic interaction	+	0.03	3.60
Advertising rate	?	0.02	0.94
Indicator regulatory reforms	–	– 0.06	– 2.48
Lagged PCM	+	0.84	36.75
Dummy construction sector		0.07	0.59
Dummy services sector		0.20	2.87
Intercept		0.45	1.35
R-squared		0.79	
Degrees of freedom		687	
Durbin's h-statistic		– 5.46	
F-value		254.01	

[a] Negative coefficient indicates positive effect on competition, and visa versa.

The results for the PCM are in line with the findings for the RPM. The signs of the coefficients of the explanatory variables are consistent with theoretical expectations, except for the exit rate. Hence, the model specification appears to be also economically relevant for the PCM as well.

The similarity in regression results indicates the robustness of the explanatory variables, although fewer determinants are significant. Nonetheless, two main differences occur between both indicators: 1) the sign of advertising on competition differs, 2) the long-term parameters.

First, the negative impact of advertising on the PCM suggests that advertising is used as a mean to reduce competition instead of more competition in the case of the RPM. However, an alternative interpretation is that efficient firms have used their advertising expenditures to demonstrate their competitive advantage thereby increasing market transparency, resulting in relatively higher profits and market shares of those efficient firms increasing the overall PCM at the industry level.

Second, the coefficients of the lagged competition indicator differ considerably between the RPM and the PCM. The adjustment process is much slower according to the PCM-model. But again, omitting the lagged PCM as an explanatory variable does not affect the significance of the other determinants.

3.4 Contribution explanatory variables to competition change

Dependent variable: RPM

Hitherto, we focused on the econometric results with respect to the sign and significance of the coefficients of the explanatory variables. This section presents the contributions of the determinants to the overall change of both indicators over the period 1995-2001.

Table 3.3 Contributions determinants to change in RPM, 1995-2001[a]

Determinant	Long Term-parameter	Average annual % change	Contribution
Dependent variable: RPM		– 0.12	
(Fitted) entry rate	0.11	– 0.09	– 0.01
(Fitted) Exit rate	0.62	– 1.41	– 0.88
Market demand	– 0.56	1.91	– 1.07
Import penetration	0.09	0.93	0.08
Strategic interaction	0.15	– 3.64	– 0.54
Advertising	0.02	– 2.03	– 0.04
Indicator regulatory reforms	0.15	16.30	2.41
Explained			– 0.04
Unexplained			– 0.08

[a] Results based on aggregation of industries with fixed industry weights 1994. For regulatory reforms the average difference per year, because in the regression the indicator of regulatory reforms is included as a straight variable, not as a variable in logarithm like all other exogenous and endogenous variables.

Those contributions are based on their long term (Long Term-parameter) estimated coefficient[20] and their overall change at the aggregated level. As most variables are in logarithms, the coefficient can be interpreted as an elasticity: percentage change in competition due to a one percent increase of a determinant. For instance, if the import penetration rises with 10%, competition according to the RPM will become 0.9% higher (see table 3.3).

The contributions suggest that the decline in competition is partly caused by considerable growth of market demand. In fact, firms did not have to compete aggressively in order to attain sufficient sales and profits. Regulatory reforms likely reinforced competition. An overall impact of the entry rate, however, was absent despite favourable business opportunities. Hence, incumbents have hardly been threatened by entrants. We discuss the finding for the strategic interaction at the same time as the results for the PCM.

Dependent variable: PCM

Likewise, table 3.4 presents the contributions of all explanatory variables to the development of the PCM. As the model includes the same explanatory variables, the contributions have similar effects on competition except for advertising and for strategic interaction.

Table 3.4 Contributions of determinants to change in PCM, 1995-2001[a]

Determinant	Long Term-parameter	Average annual % change	Contribution
Dependent variable: PCM		– 0.98	
(Fitted) entry rate	– 0.89	– 0.15	0.13
(Fitted) exit rate	– 1.26	– 1.48	1.86
Market demand	0.96	1.72	1.66
Import penetration	– 0.08	0.56	– 0.05
Strategic interaction	0.21	– 3.82	– 0.79
Advertising	0.12	– 2.26	– 0.27
Indicator regulatory reforms	– 0.36	15.99	– 5.74
Explained			– 3.20
Unexplained			2.21

[a] Results based on aggregation of industries with fixed industry weights 1994. For regulatory reforms the average difference per year, because in the regression the indicator of regulatory reforms is included as a straight variable, not as a variable in logarithm like all other exogenous and endogenous variables.

Section 3.3 already discussed the discrepancy between the RPM and the PCM in advertising. Here, we elaborate on the findings for the strategic interaction. This indicator picks up differences between both indicators with respect to competition. These differences are related to

[20] Actually, the long term parameters are derived from the error correction model. It can be estimated by multiplying the short term parameters (second column in table 3.1 and table 3.2) with the lag-multiplier, which is related to the parameter of the lagged RPM (1/(1-0.44)) respectively the lagged PCM (1/(1-0.84)).

the reallocation effect of output. As the overall contribution to the RPM is negative, the model suggests that firms reacted less aggressively to each other after 1993.

Recent developments

Availability of firm-level data limits our analysis to the early 2000s. Recent developments can be deducted from other sources. For instance, one can use the PCM and labour income ratio derived from National Accounts data as competition indicators as well (see Creusen et al., 2006). The most recent National accounts provide data for the year 2004. Both alternative indicators suggest that competition did not significantly increase even during the downturn in the business cycle. The period 1993-2001 covered a cyclical upswing, but thereafter, economic growth fell back. Taking account of the negative relationship between (excess) market demand and competition, a clear revival of the competitive pressure was to be expected ceteris paribus other determinants.

3.5 Development of entry and exit rates

The estimation results of section 3.3 in explaining competition point to remarkable results on the impact of entry and exit on competition. The estimated coefficients of the (fitted) exit rate point to a positive effect on competition, which contrasts with the theoretical expectation. The estimated coefficients of the (fitted) entry rate are insignificant, particularly in case of the RPM.

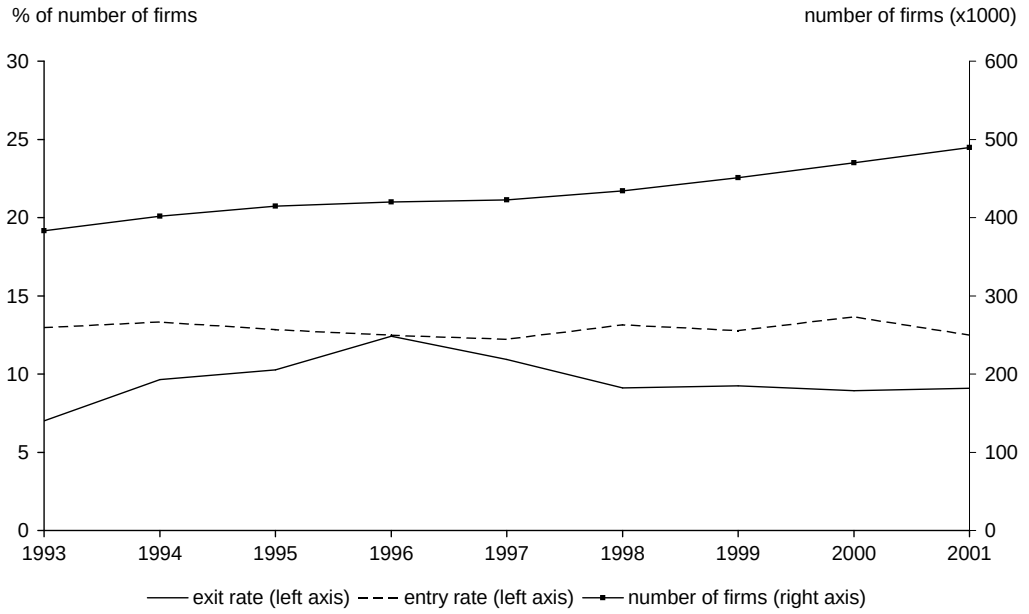
This section explicitly investigates the development of the entry and exit rate over the period 1993-2001. First, we start with a brief discussion on the observed development of entry and exit during the period of investigation. Next, we elaborate on the explanation of the exit rate as well as the entry rate.

Observations on entry and exit 1993-2001

The total number of firms in the Dutch market sector gradually increased from 1993 to 2001 from approximately 400 thousand to almost 500 thousand firms (see figure 3.1).[21] Hence, the number of entrants is higher than the number of exiting firms over time. The entry rate – the number of entrants as percentage of the number of firms in a particular year – has been rather stable over time. Hence, there seems to be no fundamental change in the aggregated entry rate in the period 1993-2001 despite the business cycle and changes in the regulatory reforms. In contrast, the exit rate is more volatile than the entry rate and seems to be inversely related to the business cycle. The exit rate rose until 1996 but declined afterwards in line with the upsurge in the Dutch economy.

[21] Note that these figures refer to the observed industries and not to the total economy.

Figure 3.1 Entry, exit and total number of firms in Dutch market sector, 1993-2001[a,b]



[a] I.e. for those industries for which data on the number of firms are available for all years.
[b] Total number of firms refers to the average of the number of firms at the start of each year and the number at the end of each year.
Source: ABR, Statistics Netherlands

Model specification

The fitted values of the entry and exit rate are derived from the explanation of the observed entry rate and exit rate. As discussed in section 3.2.2, to handle the endogeneity problem, we estimate both entry and exit separately by using almost all lagged determinants as the model specification for competition. Exceptions are capital intensity, sales[22] and strategic interaction.

First, we added capital intensity (depreciation costs as a percentage of total sales) to the entry and exit equations. A high level of capital intensity or put it loosely, substantial economies of scale may act as an entry barrier for new firms to enter the market. Exogenous changes in capital costs might lower these entry barriers stimulating firm dynamics and eventually competition. Capital intensity may also serve as an exit barrier. For incumbents, capital may partly entail sunk costs and cannot be sold due to their uniqueness. In that case, incumbents are tied to their sunk capital and will be impeded to exit the market.

Strategic interaction is excluded from the entry and exit equations. As the lagged RPM and the PCM also refer to the impact of previous changes in competition on entry and exit, these explanatory variables will be correlated with the indicator on strategic interaction. Hence, the

[22] Instead of market demand, we use total (deflated) sales as both entry and exit depend on developments of the total market.

impact of strategic interaction on entry and exit can only be determined by using more advanced techniques, but that is beyond the scope of this document.

Estimation results

Tables 3.5 and 3.6 show the expected sign and estimates of the coefficients of each explanatory variable on entry respectively on exit.

Table 3.5 Estimation results of entry rate, 1994-2001

Estimated with		RPM		PCM	
Determinants	Expected sign	Coefficient	t-value	Coefficient	t-value
Lagged total sales (deflated)	+	0.64	6.87	0.64	6.88
Lagged capital intensity/depreciation	–	– 0.04	– 1.97	– 0.04	– 1.78
Lagged advertising rate	–	– 0.11	– 4.89	– 0.10	– 4.05
Lagged indicator regulatory reforms	+	– 0.21	– 6.92	– 0.21	– 6.84
Lagged RPM	–	0.03	0.90		
Lagged PCM	+			– 0.03	– 0.83
Lagged entry	+	0.05	4.75	0.05	4.71
Dummy construction sector		0.34	2.69	0.29	2.54
Dummy services sector		0.45	8.47	0.42	9.72
Intercept		– 0.61	– 1.40	– 0.64	– 1.44
R-squared		0.31		0.31	
Degrees of freedom		705		703	

Table 3.6 Estimation results of exit rate, 1994-2001

Estimated with		RPM		PCM	
Determinants	Expected sign	Coefficient	t-value	Coefficient	t-value
Lagged total sales (deflated)	–	0.08	0.93	0.07	0.84
Lagged capital intensity/depreciation	–	– 0.04	– 2.00	– 0.04	– 2.39
Lagged advertising rate	–	– 0.00	– 0.02	– 0.01	– 0.58
Lagged indicator regulatory reforms	+	– 0.12	– 4.48	– 0.12	– 4.43
Lagged RPM	+	0.00	0.15		
Lagged PCM	–			0.04	1.38
Lagged exit	+	0.02	3.43	0.02	3.48
Dummy construction sector		– 0.17	– 1.50	– 0.18	– 1.72
Dummy services sector		0.31	6.37	0.29	7.33
Intercept		1.82	4.60	1.97	4.92
R-squared		0.17		0.17	
Degrees of freedom		701		699	

First, a note of a warning, the R-squared indicates a small fit for a level equation. Nonetheless, most of the signs of the coefficients of the explanatory variables are consistent with our expectations, except for the competition indicators and the regulatory reforms. For instance, changes in total sales are significant and positively related to entry as favourable business opportunities attract new firms. Further, entry is significant and negatively related to capital intensity and advertising, whereas higher capital intensity negatively correlates with exit. These findings do not reject the existence of entry and exit barriers.

As said, two results are opposite to our expectations: i.e. competition indicators and the regulatory reforms. Both results need further consideration but that is beyond the scope of this study.

3.6 Conclusions

This chapter presents the regression results of the model which explains the development of the RPM and PCM across industries during 1993-2001. The econometric analysis suggests that regulatory reforms indeed intensified competition, but also that considerable growth of market demand may have weakened competition. Moreover, we find indications for a lack of firm dynamics as well, with a puzzling impact of regulatory reforms on entry and exit. During the second half of the 1990s, demand grew considerably reducing the extent of competition. In principle, incumbents gained more returns, making competition among them less intense. These higher profits and better business opportunities, however, did not generate sufficiently firm dynamics in terms of attracting new firms to the market and forcing firms to leave the market.

These findings do not differ whether the RPM is used as indicator of competition or the PCM. Overall, the model specification appears to be economically relevant for both indicators as large part of their variation is explained. The signs of the coefficients of the explanatory variables are generally consistent with theoretical expectation. Furthermore, the analysis suggests that part of the differences between the RPM and PCM could be related to the reallocation effect of output.

4 Implications for policy

The analysis has four implications for policy. First, we find indications that the adjustment process on the Dutch market shows signs of inertia. Possible reasons are a lack of firm dynamics in relation with potential entry barriers. The second implication is that competition can change in unintended directions because of other determinants. Hence, policy should be aware of those determinants. Third, both competition indicators have shortcomings. Finally, to some extent a trade-off arises between the aim to increase competition and the aim to reduce the administrative burden for firms.

Four implications arise from the preceding analysis:

Implication 1: Insufficient adjustment process of entry and exit

We argue that the adjustment process on (particular) Dutch product markets likely shows signs of inertia and thus be of concern for policy. There seems to be a lack of (firm) dynamics and/or entry barriers. The (effect of) net entry on competition seems to be too small given the favourable business cycle in the course of the 1990s. This can be due to limited number of entrants (see figure 3.1) or that entrants do not really compete with incumbents due to product differentiation, existence of niches or economies of scale (see Kox et al., 2006). Hence, incumbents on those markets may sustain longer periods of supranormal profits with consumer prices deviating from competing prices.[23] In that respect, it is noteworthy that the regulatory reforms had a negative effect on both entry and exit at the industry level instead of the expected positive effect. This finding is puzzling and needs further consideration.

Implication 2: Be aware of other effects

Regulatory reforms has likely had a positive impact on the intensity of competition in the period observed. The analysis in the previous chapter illustrates, however, that competition can be due to other (exogenous) determinants as well. In fact, fierce demand reduced the competitive pressure. Hence, policy should be aware of other determinants that may have unintended effects on competition. Needless to say that competition is a source for enhancing welfare, so welfare should be a target for policy and not competition itself.

Implication 3: Both indicators have shortcomings

This document employs the relative profits measure and the price-cost margin as indicators for competition. Both indicators have their (theoretical) weaknesses. Not every aspect of competition seems to be fully accountable by them. Particularly, the behaviour of firms, for

[23] See Bain (1951 and 1956), referred in Tirole (1988).

instance, in terms of collusion or price discrimination, is difficult to get under control in empirics (see Creusen et al., 2006).
The indicators are also based on different concepts. As a result, they may in some cases point to diverging directions on the change in competition (see section 2.4). Creusen et al. (2006) explores this issue in more detail.

Further, the competition measures can only act as a sort of thermometer. Each indicator provides an indication of the competition intensity or the change in it. However, monitoring and evaluating the extent of competition require additional information on the determinants that could have had an effect on competition. Changes in competition may be due to changes in institutional settings, but other determinants such as the business cycle and consumer behaviour may affect the extent of competition as well.

So, to deal with these shortcomings to some extent, it is preferable to use more indicators at once and to investigate the impact of several determinants to get a better impression of competition issues.

Implication 4: Trade-off between competition and administrative burden

To some extent a trade-off arises between the aim to increase competition and to reduce the administrative burden for firms. On the one hand, policy wants to reduce the administrative burden of legislation and regulation for firms, particularly for small and medium sized firms. On the other hand, policy tries to stimulate competition and wants to have the opportunity to monitor and to evaluate their competition measures. These types of analyses require detailed information. This information is costly as it increases the administrative burden for firms and contrasts with the policy to reduce the administrative burden.

Moreover, although Dutch firm-level surveys of Statistics Netherlands contain a tremendous amount of interesting information, additional information is indispensable if one wants to get a grip on the competitive behaviour of firms. Particularly, information on firm-level prices and product differentiation is needed.[24]

This research was explicitly confronted with the borders of analysing firm-level data for the Netherlands. Due to cutback in samples and other changes, the availability and quality of these types of data have been substantially under pressure. Moreover, confidentiality sometimes forbids researchers to examine certain industries due to (threshold) restrictions of Statistics Netherlands. These unobservable industries may include industries that would be very interesting from a competitive point of view.

[24] Note also that e.g. the RPM does not explicitly take into account issues as collusion, mergers, predation and first mover advantages. Information on these issues should also be collected to assess the intensity of competition in a market.

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Appendix A Data

Both indicators based on firm-level data set

The RPM and the PCM are based on firm-level data. These data are derived from the yearly survey among enterprises carried out for the 'Productiestatistieken' (PS) by Statistics Netherlands. The survey gives complete coverage of firms with at least 20 employees, while firms with fewer than 20 employees are sampled.[25] However, unprocessed firm-level data can be erratic. In order to obtain reliable firm-level data, several cleaning activities are necessary at the outset. We employed the following five sequential cleaning activities to our dataset: 1) firms with no turnover and/or no employment were neglected; 2) firms with a negative value added were also deleted; 3) firms with a turnover less than labour costs were removed; 4) firms with identical output and employment data in two consecutive years were ignored; 5) firms with huge changes in key variables as output and employment were also removed from the dataset.

Eventually, the firm-level database contains information of 87 000 firms in the Netherlands across 119 industries at the 3-digit SIC-level.[26] Table A.1 presents an overview of the main sectors where data are available. The dataset covers a large part of the Dutch market sector.[27] This document cannot observe the agriculture and fishing industry, banking and insurance, public utilities and health care industries, because of a lack of data. This document focuses on the period 1993-2001 since for this period the largest consistent firm-level dataset is available.

Table A.1 Overview of available data for selected industries

Sector	SIC-code	Period
Manufacturing	151-366	1978-2001
Construction	45	1982-2001
Retail	52	1988,1990,1992-2001
Wholesale	50-51	1988,1990-2001
Transport	6	1993-2001
Other services	55, 7	1989-2001

[25] The raising factors are used to generate population results.

[26] SIC stands for the "Standaard Bedrijfsindeling", the 1993 version of Statistics Netherlands.

[27] Note, that not every industry within manufacturing or services is included in the PS as well. For instance, for the transport sector no information is available for industries like railways. In addition, firms belonging to the financial and insurance industries are lacking.

Data sources of explanatory variables

The explanatory variables are drawn from the following three data sources:

- The firm-level database, which provides the advertising rate (advertising expenditures as a percentage of total sales) and the capital intensity (depreciation costs as a percentage of total sales).
- General Firm Register (in Dutch: "Algemeen BedrijfsRegister", ABR) provides the data on the number of firms and entry and exit. This database contains information for each firm on its SIC-code, its date of birth and its date of death (if relevant). From these figures, we can determine the total number of firms for each observed industry, as well as the entry and exit rate.[28]
- National Accounts. From this source we extract those explanatory variables that cannot be derived from the previous sources. It concerns the import penetration (total imports as a percentage of total sales on the Dutch market) as well as the market demand at the industry level. The latter is determined by adjusted total sales on the Dutch market (national for supply effects such as increases productivity growth (also based on National Accounts) and the number of firms (ABR).

[28] I.e. the number of firms that entered and/or exited during some year as a percentage of the total number of firms at the beginning of that year.

Appendix B Competition by industry

The tables below present the main results for the 119 industries in the firm-level database. For each industry, they give a quick glance at the intensity of competition by presenting the levels of the RPM and the PCM, and at the changes in competition by the annual trend-growth of both indicators over the period 1994-2001.

The analysis of chapter 2 and 3 are based on a part of the 119 industries. Tables B.1 and B.2 present the competition indicators for 100 industries discussed in chapter 2. Here, 19 industries have been deleted due to one of the following reasons: 1) industries for which the RPM is negative in at least one year, as a RPM is not defined in theory; 2) post, telecommunication and 'other services' (respectively SIC codes 641, 642 and 930), as these industries experience implausible large shocks in the dataset; 3) garages and car dealers (SBI code 501), as we encountered probably a statistical error in combination with large weight of the PCM.

Tables B.1 and B.3 present the 92 industries that are used for estimating the model in chapter 3. For the 27 industries that have been left out, data on the explanatory variables is missing for several years. It concerns particularly data on the number of firms and the entry and exit rate. Finally, 17 of the 119 industries are not used in either analysis of chapter 2 or 3. The latter industries are mentioned in table B.4.

Table B.1 Changes in competition by industry (used in chapters 2 and 3)

SIC-code	Name	Level 2001		Annual % trend-growth 1994-2001	
		RPM	PCM	RPM	PCM
151	Production, processing and preserving of meat and meat products	5.52	3.90	3.3	1.1
152	Processing and preserving of fish and fish products	5.57	7.19	– 2.0	0.5
153	Processing and preserving of fruit and vegetables	0.32	9.60	10.6	0.0
154	Manufacture of vegetable and animal oils and fats	18.72	4.50	– 16.2	3.1
157	Manufacture of prepared animal feeds	7.99	3.76	– 0.9	– 5.1
158	Manufacture of other food products	8.53	12.75	– 0.8	– 0.9
159	Manufacture of beverages	2.48	33.41	8.1	– 0.2
160	Manufacture of tobacco products	1.79	59.73	– 2.6	3.3
172	Textile weaving	6.21	6.78	– 8.6	– 0.1
173	Finishing of textiles	8.98	16.27	– 2.3	– 1.4
174	Manufacture of made-up textile articles, except apparel	5.14	8.64	– 8.8	– 1.5
175	Manufacture of other textiles	10.65	7.51	– 2.2	– 0.8
182	Manufacture of other wearing apparel and accessories	7.16	6.46	– 7.1	– 2.7
192	Manufacture of luggage, handbags and the like, saddlery and harness	11.37	10.49	– 3.0	5.1
193	Manufacture of footwear	21.12	6.01	– 6.5	– 4.7
203	Manufacture of builders' carpentry and joinery	5.85	9.36	– 4.7	2.3
204	Manufacture of wooden containers	5.04	10.88	– 9.1	10.0
205	Manufacture of other products of wood; manufacture of articles of cork, straw and plaiting materials	6.06	1.26	3.8	– 17.9
211	Manufacture of pulp, paper and paperboard	12.38	16.31	– 0.3	– 0.1

Table B1 Continued

212	Manufacture of articles of paper and paperboard	5.55	9.70	2.8	– 2.8
221	Publishing	4.46	16.66	– 1.2	– 0.4
222	Printing and service activities related to printing	4.56	11.72	– 1.0	– 0.5
232	Manufacture of refined petroleum products	4.16	12.72	15.5	9.1
241	Manufacture of basic chemicals	6.42	10.02	0.5	– 2.2
243	Manufacture of paints, varnishes and similar coatings, printing ink and mastics	16.56	– 0.44	1.3	– 13.3
244	Manufacture of pharmaceuticals, medicinal chemicals and botanical products	4.31	7.95	– 1.8	– 12.0
245	Manufacture of soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations	5.66	10.37	2.2	3.6
246	Manufacture of other chemical products	5.68	9.15	2.1	– 7.3
251	Manufacture of rubber products	7.40	7.45	– 15.2	– 0.7
252	Manufacture of plastic products	3.50	11.39	0.4	1.3
261	Manufacture of glass and glass products	6.91	15.33	– 3.3	– 2.4
264	Manufacture of bricks, tiles and construction products, in baked clay	2.79	22.98	– 4.9	– 3.5
266	Manufacture of articles of concrete, plaster or cement	4.68	15.46	– 2.9	– 0.2
267	Cutting, shaping and finishing of stone	1.22	5.90	– 2.2	– 1.6
268	Manufacture of other non-metallic mineral products	4.69	13.76	– 10.3	– 0.3
274	Manufacture of basic precious and non-ferrous metals	7.75	8.21	0.5	– 0.6
275	Casting of metals	10.28	4.41	1.9	– 5.8
281	Manufacture of structural metal products	4.03	7.49	– 6.7	1.1
282	Manufacture of tanks, reservoirs and containers of metal; manufacture of central heating radiators and boilers	10.48	7.98	– 5.6	2.5
284	Forging, pressing, stamping and roll forming of metal; powder metallurgy	8.00	7.48	1.2	– 2.5
285	Treatment and coating of metals; general mechanical engineering	5.94	13.49	0.5	– 0.6
286	Manufacture of cutlery, tools and general hardware	5.66	8.95	1.3	– 2.8
287	Manufacture of other fabricated metal products	6.83	8.55	– 8.8	– 0.9
291	Manufacture of machinery for the production and use of mechanical power, except aircraft, vehicle and cycle engines	4.73	9.04	– 5.3	– 0.1
292	Manufacture of other general purpose machinery	8.65	5.08	– 1.1	– 4.2
293	Manufacture of agricultural and forestry machinery	8.32	7.16	1.9	– 2.6
295	Manufacture of other special purpose machinery	4.46	9.58	– 4.9	– 1.6
297	Manufacture of domestic appliances n.e.c.	9.38	7.53	– 8.0	0.4
311	Manufacture of electric motors, generators and transformers	7.74	54.79	0.0	30.9
312	Manufacture of electricity distribution and control apparatus	3.75	4.12	– 3.9	– 5.0
313	Manufacture of insulated wire and cable	10.30	3.38	0.6	– 8.7
316	Manufacture of other electrical equipment n.e.c.	2.98	11.37	– 3.5	2.6
331	Manufacture of medical and surgical equipment and orthopaedic appliances	5.60	27.72	– 0.5	12.2
332	Manufacture of instruments and appliances for measuring, checking, testing, navigating and other purposes, except industrial process control equipment	2.86	9.12	– 7.2	– 5.2
334	Manufacture of optical instruments and photographic equipment	2.73	27.99	4.6	6.5
341	Manufacture of motor vehicles	17.36	9.68	3.3	3.5
342	Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers	3.28	3.94	– 6.1	– 2.2

Table B1 Continued

343	Manufacture of parts and accessories for motor vehicles and their engines	11.42	7.19	5.4	– 5.7
354	Manufacture of motorcycles and bicycles	3.86	11.19	– 10.1	1.0
361	Manufacture of furniture	4.96	10.01	– 4.5	– 0.5
366	Other manufacturing n.e.c.	6.31	18.45	1.5	– 0.3
451	Site preparation	0.81	14.99	– 10.5	2.5
452	Building of complete constructions or parts thereof; civil engineering	1.58	6.89	1.7	8.5
454	Building completion	1.12	13.88	– 7.2	7.6
455	Renting of construction or demolition equipment with operator	0.90	20.37	2.4	– 0.3
512	Wholesale of agricultural raw materials and live animals	3.00	17.36	2.0	0.4
513	Wholesale of food, beverages and tobacco	3.91	22.80	1.6	– 0.9
514	Wholesale of household goods	3.35	22.23	– 0.9	– 1.2
515	Wholesale of non-agricultural intermediate products, waste and scrap	2.76	23.37	0.5	– 0.5
516	Wholesale of machinery, equipment and supplies	3.48	24.06	1.6	0.9
517	Other wholesale	3.78	26.46	0.1	– 0.8
521	Retail sale in non-specialized stores	3.19	21.41	– 0.3	0.1
522	Retail sale of food, beverage and tobacco in specialized stores	1.35	34.67	0.1	0.5
523	Retail sale of pharmaceutical and medical goods, cosmetic and toilet articles	1.82	26.32	4.5	– 1.0
524	Other retail sale of new goods in specialised stores	1.68	27.09	0.0	1.3
525	Retail sale of second-hand goods in stores	1.24	32.64	– 5.0	– 4.2
526	Retail sale not in stores	1.16	39.25	0.3	– 3.0
527	Repair of personal and household goods	1.09	45.25	0.3	5.4
721	Hardware consultancy	1.49	17.26	16.3	3.7
722	Software consultancy and supply	1.45	15.63	11.1	3.7
723	Data processing	0.98	21.09	– 21.4	1.7
725	Maintenance and repair of office, accounting and computing machinery	6.74	10.17	– 23.5	– 6.9
741	Legal, accounting, book-keeping and auditing activities; tax consultancy; market research and public opinion polling; business and management consultancy; holdings	1.06	23.04	– 2.3	1.0
742	Architectural and engineering activities and related technical consultancy	1.51	15.41	– 0.3	4.3
744	Advertising	1.46	14.32	– 0.6	– 0.2

Table B.2 Changes in competition by industry (used in chapter 2 on top of table B.1)

SIC-code	Name	Level 2001		Annual % trend-growth 1994-2001	
		RPM	PCM	RPM	PCM
502	Maintenance and repair of motor vehicles	1.94	18.51	– 4.2	3.0
503	Sale of motor vehicle parts and accessories	1.72	24.60	1.4	7.3
504	Sale, maintenance and repair of motorcycles and related parts and accessories	1.47	34.09	– 8.9	12.1
552	Camping sites and other provision of short-stay accommodation	1.84	29.81	3.1	– 1.8
612	Inland water transport	1.00	39.29	8.3	0.2
620	Air transport	4.65	5.56	15.8	– 16.2
631	Cargo handling and storage	0.86	18.38	5.5	– 5.2
632	Other supporting transport activities	1.28	42.77	– 1.2	– 5.3
633	Travel agencies and tour operators; tourist assistance activities n.e.c.	4.42	4.65	– 2.2	– 3.2
634	Activities of other transport agencies	2.68	7.84	– 3.1	– 9.4
711	Renting of automobiles	1.98	50.59	– 15.1	7.2
712	Renting of other transport equipment	1.44	41.74	– 0.1	5.6
713	Renting of other machinery and equipment	0.95	30.08	n.a.	5.8
714	Renting of personal and household goods n.e.c.	0.82	43.08	n.a.	7.7

Table B.3 Changes in competition by industry (used in chapter 3 on top of table B.1)

SIC-code	Name	Level 2001		Annual % trend-growth 1994-2001	
		RPM	PCM	RPM	PCM
155	Manufacture of dairy products	2.71	3.65	5.8	– 7.9
294	Manufacture of machine-tools	14.32	– 2.98	– 1.7	3.1
351	Building and repairing of ships and boats	2.12	7.68	– 14.2	8.4
743	Technical testing and analysis	8.03	11.39	24.1	– 1.4

Table B.4 Changes in competition by industry (not used)

SIC-code	Name	Level 2001[a]		Annual % trend-growth 1994-2001	
		RPM	PCM	RPM	PCM
315	Manufacture of lighting equipment and electric lamps	8.53	– 1.35	35.2	– 23.1
453	Building installation	1.51	9.12	13.3	– 8.5
501	Sale of motor vehicles	1.79	15.78	5.1	– 0.2
505	Retail sale of automotive fuel	1.23	22.48	– 3.0	5.8
511	Wholesale on a fee or contract basis	2.71	25.72	– 7.6	n.a.
551	Hotels	4.33	22.29	– 3.2	2.7
553	Restaurants	2.68	20.87	– 0.8	1.0
554	Bars	1.55	24.20	– 3.2	0.2
555	Canteens and catering	0.43	9.08	– 8.2	3.2
602	Other land transport	3.04	13.16	9.1	– 7.4
611	Sea and coastal water transport	5.13[a]	14.47[a]	16.0	– 1.6
641	Post and courier activities	0.27	18.31	2.9	11.7
642	Telecommunications	1.52	32.83	n.a.	– 11.3
745	Labour recruitment and provision of personnel	4.60	9.00	– 3.9	2.7
747	Building-cleaning activities	1.58	14.72	0.6	0.9
748	Other business activities n.e.c.	1.04	17.18	– 2.7	– 7.8
930	Other service activities	0.98	31.53	– 0.8	1.3

[a] Level of 2000.

Appendix C Additional results on regulatory reforms

The indicator on regulatory reforms provides an overall view on the impact of regulation in general, and it implicitly assumes complementarity between regulatory reforms.[29] However, the weighing of the separate regulatory reforms is debatable. Therefore, we also estimated the model by using two separate dummies. One dummy is related to the MDW-operation in specific industries[30], the other one refers to the enactment of the new Competition Act in 1998 (relevant for all industries). This alternative model provides more information on the impact of each regulatory reform, but it removes at the same time the overall view of the impact of regulation in general.

Table C.1 Explanation of competition by regressing the RPM, 1994-2001, separate regulatory reforms

Determinant	Expected sign [a]	Estimated coefficient	t-value
(Fitted) entry	+	0.09	0.52
(Fitted) exit	–	0.39	1.40
Market demand	–	– 0.31	– 2.36
Import penetration	+	0.06	2.66
Strategic interaction	+	0.08	5.45
Advertising rate	?	0.01	0.39
Regulatory reforms	+		
Dummy on MDW-operation	+	0.22	1.83
Dummy on Competition Act	+	0.07	1.66
Lagged RPM	+	– 0.29	– 0.53
Dummy construction sector		– 0.85	– 4.01
Dummy services sector		– 0.68	– 5.13
Intercept		– 0.58	– 0.91
R- squared		0.63	
Degrees of freedom		692	

[a] Positive coefficient indicates positive effect on competition.

[29] In a similar way, for each OECD-country the OECD has constructed an overall indicator on regulation by weighing and adding up the impact of specific regulatory reforms (see OECD, 2000). However, these indicators are based on a single survey across the OECD-countries (i.e. in 1996), and thus only take a snapshot of the intensity of regulation.

[30] Note that the MDW-operation contains regulatory reforms in specific industries which are enacted in different years. So the MDW-dummy is industry-specific, and signals the years after the respective MDW-operation.

Table C.2 Explanation of competition by regressing the PCM, 1994-2001, separate regulatory reforms

Determinant	Expected sign [a]	Estimated coefficient	t– value
(Fitted) entry rate	–	– 0.14	– 1.41
(Fitted) exit rate	+	– 0.21	– 1.30
Market demand	+	0.15	1.88
Import penetration	–	– 0.01	– 0.82
Strategic interaction	+	0.03	3.63
Advertising rate	?	0.02	0.97
Regulatory reforms	–		
Dummy on MDW-operation	–	– 0.06	– 0.74
Dummy on Competition Act	–	– 0.06	– 2.49
Lagged PCM	+	0.84	36.93
Dummy construction sector		0.08	0.65
Dummy services sector		0.20	2.65
Intercept		0.50	1.29
R-squared		0.79	
Degrees of freedom		686	

[a] Negative coefficient indicates positive effect on competition, and visa versa.

Table C.3 Estimation results of entry rate, 1994-2001, separate regulatory reforms

Estimated with		RPM		PCM	
Determinants	Expected sign	Parameter	t-value	Parameter	t-value
Lagged total sales (deflated)	+	0.54	5.53	0.54	5.53
Lagged capital intensity/depreciation	–	– 0.03	– 1.54	– 0.03	– 1.41
Lagged advertising rate	–	– 0.11	– 4.70	– 0.10	– 3.93
Regulatory reforms					
Lagged dummy on MDW-operation	+	– 0.50	– 5.80	– 0.50	– 5.78
Lagged dummy on Competition Act	+	– 0.15	– 4.26	– 0.15	– 4.18
Lagged RPM	–	0.03	0.90		
Lagged PCM	+			– 0.02	– 0.72
Lagged entry	+	0.05	4.50	0.04	4.45
Dummy construction sector		0.36	2.82	0.31	2.68
Dummy services sector		0.50	9.19	0.48	10.43
Intercept		0.28	0.61	0.27	0.56
R-squared		0.32		0.32	
Degrees of freedom		704		702	

Table C.4 Estimation results of exit rate, 1994-2001, separate regulatory reforms

Estimated with		RPM		PCM	
Determinants	Expected sign	Parameter	t-value	Parameter	t-value
Lagged total sales (deflated)	–	0.07	0.78	0.06	0.68
Lagged capital intensity/depreciation	–	– 0.03	– 1.94	– 0.04	– 2.33
Lagged advertising rate	–	0.00	0.01	– 0.01	– 0.56
Regulatory reforms	+				
Lagged dummy on MDW-operation	+	– 0.15	– 1.91	– 0.15	– 1.93
Lagged dummy on Competition Act	+	– 0.12	– 3.70	– 0.12	– 3.63
Lagged RPM	+	0.00	0.15		
Lagged PCM	–			0.04	1.39
Lagged exit	+	0.02	3.40	0.02	3.45
Dummy construction sector		– 0.17	– 1.49	– 0.18	– 1.71
Dummy services sector		0.31	6.21	0.29	7.07
Intercept		2.01	4.72	2.16	5.02
R-squared		0.17		0.17	
Degrees of freedom		700		698	

The tables below present the results of this alternative model. Table C.1 shows that according to the regression of the RPM, both regulatory reforms have positively affected competition. Table C.2, representing the regression results of the PCM, confirms the positive impact of the new Competition Act on competition, but points to a non-significant impact of the MDW-operation. Tables C.3 and C.4 confirm the remarkable negative and significant effect of both regulatory reforms on the entry and exit rate (see section 3.3).