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Zoetermeer, March 2009

SCALES
SCientific AnaLysis of Entrepreneurship and SMEs

This report is published under the SCALES-initiative (SCientific AnaLysis of Entrepreneurship and SMEs), as part of the 'SMEs and Entrepreneurship programme' financed by the Netherlands Ministry of Economic Affairs.

EIM Research Reports

reference number	H200907
publication	march 2009
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The Dynamics of Entry and Exit

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Abstract

The relation between profits and the number of firms in a market is one of the essential topics in the field of industrial organization. Usually, the relation is modeled in an error-correction framework where profits and/or the number of firms respond to out-of-equilibrium situations. In an out-of-equilibrium situation one or both of these variables deviate from some long-term sustainable level. These models predict that in situations of equilibrium, the number of firms does not change and hence, entry equals exit. Moreover, in equilibrium entry and exit are expected to be equal to zero. These predictions are at odds with real life observations showing that entry and exit levels are significantly positive in all markets of substantial size and that entry and exit levels often differ drastically. In this paper we develop a new model for the relation between profit levels and the number of firms by specifying not only an equation for the equilibrium level of profits in a market but also equations for the equilibrium levels of entry and exit. In our empirical application we show that our entry and exit equations satisfy the usual error-correction conditions. We also find that a one-time positive shock to entry or profits has a small but permanent positive effect on both the number of firms and total industry profits.

Keywords: entry, exit, profits, equilibrium, industrial organization

JEL codes: B50, J01, L00, L1, L26

Contact: André van Stel, ast@eim.nl

First version: February 2009 (preliminary work)

This version: March 2009 (still preliminary)

FileName: Entry_and_Exit_of_Firms_v4.doc

Savedate: 3/12/2009 9:44 AM

Acknowledgement: The paper has been written in the framework of the research program SCALES carried out by EIM and financed by the Dutch Ministry of Economic Affairs.

1. Introduction

In the classical economic framework firm entry and exit play the role of adjustment mechanisms which restore market equilibrium. Net-entry rises when incumbents' profits are supernormal and falls when they are at unsustainable low levels. Their only economic function is to be reactive and respond to disequilibrium profit levels. In equilibrium when profits are at normal levels they have no role and are assumed to be in a steady state where entry equals exit.

Baumol (2004) points out one of the most disappointing shortcomings in the classical approach in that it does not explain the enduring success of capitalism in generating economic growth. As Schumpeter (1947) argues, classical analysis is preoccupied with competition without innovation and by consequence is focused on the sub plot of adjustment around any given equilibrium. It does not enlighten our understanding of the main mystery which surrounds the determinants of the long-term dynamic equilibrium itself. Moving the focus of attention to this question involves the role of innovation. In doing so it also introduces the potential for an entrepreneurial function for entrants. No longer are they imitative 'me too' aspiring firms who seize their moment only when incumbents profits have become excessive. Instead, entrants bring innovation to the market and in the process introduce new profit opportunities. In this framework they reverse the classical causation so that equilibrium normal profit levels are determined by entry and exit rather than the other way around.

In this paper we seek to investigate the role played by entry and exit in this industrial development process. We make use of a rich data set on Dutch retailing. We construct a dynamic simultaneous equilibrium model of profits, entry and exit. We allow for both short- and long-run effects in order to capture the shorter term classical model effects of net-entry alongside longer term innovation model effects of entrepreneurial entry and exit. To our knowledge this is the first empirical analysis of the simultaneous interrelationship between entry, exit and industry profits. Previous analyses have only investigated these effects on a partial equilibrium basis. Therefore, this analysis seeks to shed light on the validity and strength of (once presumed, competing) economic models of entry and exit that have dominated debate in industrial economics for most of the last Century.

The next section of the paper provides a description of the data. This is followed by the specification of the model. The results are discussed in the next section and the paper closes with a discussion of their implications.

2. Data

We investigate the interrelation between entry and exit levels, the number of firms and profit levels. These four variables are the key variables in an error-correction model which we will develop in the next section. The model is estimated using data for a panel of shop types in the Dutch retail sector.[1] The current section describes the measurement and data sources for the key variables of our model as well as for the other covariates. This section also provides some descriptive statistics and a series of tests on stationarity and cointegration for the key variables in our analysis. The results of these tests are used to develop our error-correction model in the next section.

[1] The industries in our data base are defined at (approximately) fourth digit level. Hence, these industries are quite narrowly defined. Because firms in the retail sector are almost always shops, we use the terms shop type and industry interchangeably throughout this paper.

We use a data base for 41 shop types in the retail sector over the period 1980-2000. Our data base combines variables from two major sources: the Dutch Central Registration Office (CRK) and a panel of independent Dutch retailers (establishments) called 'Bedrijfssignaleringssysteem' (interfirm comparison system) which was operated by EIM Business and Policy Research in Zoetermeer. The data are complemented using information from several sources. As the number of shop types investigated in the 'Bedrijfssignaleringssysteem' has varied in the 1980s and 1990s, our data base is an unbalanced panel. By and large, we have 28 shop types with data for the 1980s and 1990s and 13 shop types with data for the 1990s only. The exact data period per shop type is given in Table 1. The table also contains averages for some key variables in our model. Details on the measurement and source for each variable are given below. We apply several corrections to the raw data in order to make the data ready for analysis.

Raw data on the number of firms (*N*) and the numbers of entries (*E*) and exits (*X*) are obtained from the Dutch Central Registration Office (CRK). CRK provides data on the number of new registrations and deregistrations of establishments for each shop type. Over time the sectoral classification of shop types used by CRK changed several times and we correct for trend breaks because of these changes.

Total industry profits (π) are computed by multiplying average profits per firm by the total number of firms in a shop type. Raw data on average (net) profit per firm are taken from the 'Bedrijfssignaleringssysteem' (BSS). This panel was started by EIM in the 1970s and each year a large number of firms were asked for their financial performance. Although the panel changes from year to year (each year some firms exit the panel while some others enter), it is important to note that we compute the relative change in average profit based on only those firms present in the panel in two consecutive years. Hence, the dynamics of these variables are not influenced by changes in the composition of the panel.[2] Until the beginning of the 1990s average profit levels are computed based on about seventy individual retail stores per shop type but from the beginning of the 1990s the coverage of the panel decreases, i.e., less firms participate so that shop type averages become less reliable. Fortunately, the timing of this decrease coincides with the start of average financial performance registration by Statistics Netherlands (CBS) at low sectoral aggregation levels. Hence, from the early 1990s onwards, we have information on the development over time of these variables from two sources: BSS and CBS. Differences between these two sources are small which supports the reliability of our constructed times series. From 1994 onwards we use the average of the annual relative change implied by these two sources.[3]

Data on total consumer spending on the products and services sold in a certain shop type is taken from Statistics Netherlands (publication 'Budgetonderzoeken' or Budget statistics).[4] The

[2] Hence we choose a base year to compute the level of average profits or turnover, and next we compute the levels for the other years making use of the relative changes of only those firms present in two consecutive years. As most firms stayed in the panel for many years, these relative changes are also based on a substantial number of firms, but this way we correct for trend breaks introduced by a changing composition of the panel (e.g. when a firm with exceptionally high profits would enter or exit the panel). For the base year we always choose a year for which the number of participating firms in the panel is high.

[3] Ideally, one would like to use information from Statistics Netherlands (CBS) as this is the national statistical office in the Netherlands. However, as the number of firms in a shop type (which is approximately fourth digit level) is often small, and the number of firms is rounded to thousands in CBS statistics, using the CBS data also implies some extent of measurement error. Therefore we use information from both sources to estimate the dynamic pattern of the profit and turnover variables.

[4] Total consumer spending was computed by multiplying the variables average household spending, the total number of households in the Netherlands and the share of a certain shop type in total household spending.

variables modal income and unemployment are also taken from Statistics Netherlands, while the (nominal) interest rates are taken from Thomson Datastream, a provider of financial data.[5]. Finally, for total industry profits, modal income, consumer spending, and the nominal interest rate, we use a consumer price index to correct for inflation.

In Table 1 we give an overview of the available data. Table 1 shows that some shop types have grown in terms of the number of shops over the sample period, while other shop types have shrunk. For instance, the average number of entrants for the shop type "grocers/supermarkets" is 743 while over the same period of time the average number of exits equals 932. This implies that the category shrunk with, on average, 189 shops each year. Over the entire sample period of 21 years this category shrunk with about 189 x 21 = 3969 stores. Note that at the same time this category witnessed an inflation-corrected yearly profit decrease of about 0.7% and an increase in consumer spending of about 0.3%. In all shop types there are relatively many stores entering the market and relatively many shops leaving the market (relative to the number of firms). In some shop types entry dominates exit, while in others exit dominates entry. Remarkably, even in shop types where there is no net change in the number of stores, there are still entrants and exits. For example, the category "fish shops" has on average 114 stores entering and 114 stores exiting the market, corresponding to 11% of the population of firms. Table 1 clearly shows that entry and exit levels are significantly positive over a longer period of time. This suggests that the "classical idea" of a steady-state level with entry and exit rates equal to zero may not be valid. It seems that there exists a long-term sustainable level of entry and exit in each shop type. As explained earlier, the current paper develops a model where these long-term entry and exit levels are explicitly specified.

[5] See www.datastream.com. In particular we used the series HOLIB1Y.

Table 1: Shop types and key summary statistics

	Time span	Avg. no. firms ($\overline{N}$)	Avg. no. entries ($\overline{E}$)	Avg. no. exits ($\overline{X}$)	Avg. profit growth [1] ($\overline{\Delta \log \pi}$)	Avg. growth consumer spending [1] ($\overline{\Delta \log CS}$)
grocers/supermarkets	1980-2000	9044	743	932	-0.0074	0.0033
butchers	1980-2000	5885	448	590	-0.0443	-0.0222
greengrocers	1980-2000	4489	458	595	-0.0330	0.0014
fish shops	1980-2000	1019	114	114	0.0046	0.0095
bakers	1980-2000	5353	403	485	-0.0153	-0.0027
confectioners	1980-2000	2092	276	306	-0.0064	0.0094
tobacco shops	1980-2000	3421	149	270	-0.0141	-0.0050
liquor stores	1980-2000	2627	258	321	-0.0030	-0.0005
textiles men's wear	1989-2000	4986	190	399	-0.0180	0.0274
shoe stores	1980-2000	3598	291	325	0.0126	0.0073
households goods shops	1980-2000	2559	273	289	-0.0151	0.0041
furniture	1980-2000	4840	421	386	0.0596	-0.0165
furnishing + furniture (mixed)	1980-2000	4090	216	280	-0.0449	0.0069
paint, glass and wall-paper	1980-2000	5891	251	361	-0.0013	-0.0016
hardware stores	1980-2000	6364	266	333	0.0035	-0.0074
bicycle stores	1980-2000	4129	187	239	0.0166	0.0204
photographer's shops	1980-2000	1806	149	150	0.0126	-0.0099
jewelers	1980-2000	2585	232	221	0.0302	0.0250
drug stores	1980-2000	2982	228	216	0.0288	0.0353
florists	1980-2000	5475	874	883	0.0112	0.0077
pet shops	1980-2000	2119	227	221	0.0131	0.0106
poultry	1992-2000	711	55	82	-0.0212	-0.0128
dairy shops	1980-2000	4350	181	336	-0.0518	-0.0029
reform	1989-2000	1801	223	152	0.1198	-0.0061
baby's clothing	1989-2000	1537	225	218	0.0880	0.0522
children's clothing	1989-2000	1697	264	198	0.0535	0.0578
textiles underwear	1989-2000	739	160	115	0.1073	0.0772
clothing materials	1989-2000	1795	92	176	-0.0098	-0.0260
leather goods	1989-2000	875	100	104	-0.0115	0.0126
electrics	1980-2000	3472	236	305	-0.0111	0.0064
audiovisual devices	1980-2000	3211	538	471	0.0421	0.0021
musical instruments	1989-2000	772	75	68	0.0480	0.0108
sewing-machines	1980-2000	463	34	46	-0.0427	-0.0192
do-it-yourself shop	1989-2000	3886	486	389	0.0632	-0.0011
glass, porcelain and pottery	1980-2000	3567	341	322	0.0275	-0.0064
office and school materials	1980-2000	1327	125	123	-0.0369	0.0263
opticians	1980-2000	1607	160	121	0.0818	0.0776
videotheques	1989-1997	714	295	284	0.0593	0.0131
gardening centers	1989-2000	532	103	71	0.1294	0.0833
toys	1980-2000	1072	183	144	0.1043	0.0302
sport and camping equipment	1990-2000	2849	382	276	0.0462	0.0577

[1] Corrected for inflation.

Testing for stationarity and cointegration

Before we specify our model we test the key series for stationarity. To this end we use panel unit root tests. There are basically two sets of panel unit root tests. The first set assumes a common AR structure under the null and under the alternative. Popular examples are the Levin et al. (2002) test and the Breitung (2000) t- statistic. The second set of tests assumes individual AR structures. Popular examples in this class are the Im et al. (2003) W-statistic, and the Fisher-type tests (Maddala and Wu, 1999 and Choi, 2001). The alternative hypothesis in this second class of tests is that some of the panel members are stationary. We use the tests as they are implemented in EViews 6, with all the "automatic" options for lag and bandwidth selection. If the majority of the series show a trend we use the tests with the option of individual deterministic trends. Our final conclusion is based on the combined results of the tests. Note that the tests may contradict each other. Furthermore, our sample size is relatively small so that we should not expect a very large power of the tests nor can we be sure that the size of the tests is correct. We therefore see the results of these tests as a way to provide some further descriptive data.

We summarize the test results in Table 2. The log entry and log exit series do not appear to have a trend. The test results clearly indicate that the log entry and log exit series do not contain a unit root. For the number of firms we have to correct for possible deterministic trends. The tests clearly show that the log of the number of firms is not stationary. Note that entry and exit together measure the change in number of firms. For the log total profit and the log consumer spending in the shop type it is not so clear whether the series contain a trend. Therefore, we present the results for the tests without correcting for trends as well as those where the trend correction is made. Table 2 clearly shows that the log consumer spending does not contain a unit root. For the log of the total profit the results are less clear. We decide to classify this series as non-stationary.

Table 2: p-values of panel unit root tests (H_0: unit root (common or individual))

		Common unit root process		Individual unit root processes		
	Trend in test?	Levin, Lin and Chu t*	Breitung t-stat	Im, Pesaran and Shin W-stat	ADF – Fisher Chi-square	PP - Fisher Chi-square
log E	no	0.003	-	0.005	0.002	0.000
log X	yes	0.000	-	0.000	0.000	0.000
log N	yes	0.889	1.000	1.000	0.938	1.000
log π	no	0.027	-	0.219	0.127	0.351
	yes	0.000	0.334	0.001	0.000	0.003
log CS	no	0.000	-	0.010	0.001	0.004
	yes	0.000	0.659	0.000	0.000	0.000

We next test for cointegration between the number of firms and profits. In our panel set-up we test for cointegration by testing the hypothesis of a unit root in the residuals of a panel regression of log profit on log number of firms. Note that this hypothesis corresponds to no cointegration. More specifically we apply the procedure of Pedroni (1999, 2004). This procedure is similar to the Engle and Granger (1987) method for a single time series. Again we use this method as implemented in EViews 6 with all the automatic options. There are a number of different test statistics available. However, note that all of these tests are strictly speaking not valid. The tests all make the assumption that the cross-sections are independent. This is not likely to hold as all shop types are dependent on the development of the Dutch economy. Overall the results are mixed. After correcting for trends the Panel PP-Statistic as well as the Panel ADF-Statistic give a p-value of 0. This corresponds to the existence of cointegration between the two variables. However, other indicators point in the opposite direction. The exact reason for this apparent contradiction is extremely difficult to find. We attribute the finding to a possibly low power of these particular tests. Here we come to the overall conclusion that the profits and the number of firms are cointegrated.

3. Model

Denote by π_{it} the total profit in shop type $i = 1, \ldots, N$ during year $t = 1,\ldots,T_i$. Next, E_{it} and X_{it} give the number of firms entering and exiting the market for shop type i in year t. Finally, N_{it} gives the number of firms in market i at the *beginning* of year t. The number of firms at the beginning of year t+1 is therefore given by $N_{it+1} = N_{it} + E_{it} - X_{it}$. In this section we develop a model describing the log of the total profits as well as the log of the number of entrants and the log of the number of exits. Note that this model also implicitly describes the number of firms.

We specify a model in which the changes in entry, exit and profit are related to short-term dynamics, changes in exogenous variables and to deviations to the steady-state of the market. We denote the exogenous variables related to market i in year t by Z_{it}. We specify an error-correction model for all three endogenous variables, which is consistent with the earlier findings that log entry and log exit are stationary and that log profits and log number of firms are cointegrated. We specify

$$\begin{pmatrix} \Delta \log E_{it} \\ \Delta \log X_{it} \\ \Delta \log \pi_{it} \end{pmatrix} = A \begin{pmatrix} \Delta \log E_{it-1} \\ \Delta \log X_{it-1} \\ \Delta \log \pi_{it-1} \end{pmatrix} + B\Delta Z_{it} + \Pi \begin{pmatrix} \log E_{it-1} - \log E^*_{it-1} \\ \log X_{it-1} - \log X^*_{it-1} \\ \log \pi_{it-1} - \log \pi^*_{it-1} \end{pmatrix} + \begin{pmatrix} \varepsilon_{it} \\ \eta_{it} \\ \xi_{it} \end{pmatrix}, \qquad (1)$$

where log E_{it}^*, log X_{it}^* and log π_{it}^* denote the steady state levels for log entry, log exit and log profit, respectively. The steady state levels depend on exogenous variables describing the market situations. These variables are denoted by W_{it}^E, W_{it}^X, and W_{it}^π. For profit the steady state relation also involves the number of firms. We model these steady state levels as

$$\begin{aligned} \log E^*_{it} &= \gamma_{1i} + W^{E}_{it}{}'\delta_1 \\ \log X^*_{it} &= \gamma_{2i} + W^{X}_{it}{}'\delta_2 \\ \log \pi^*_{it} &= \gamma_{3i} + W^{\pi}_{it}{}'\delta_3 + \lambda \log N_{it} + \kappa_i t \end{aligned} \qquad . \qquad (2)$$

For the steady state relation of profit and number of firms we allow for a trend. We therefore allow that the average profit increases or decreases in the steady state without a change in the number of firms or the market. Conversely, the number of firms could change in the equilibrium without an effect on the profits. The latter case would correspond to a difference in the equilibrium levels of entry and exit. One could test various restrictions on κ_i. Another interesting hypothesis to test is whether "on average" log E_{it}^* = log X_{it}^*. This would imply that in the steady state the market does not grow or shrink. To formalize this hypothesis, we will mean center the variables in W_{it} such that the hypothesis can be stated as $\gamma_{1i} = \gamma_{2i}$.

The error terms are expected to be correlated within a market. In particular, we expect a positive correlation between entry and exit. We assume that there is no correlation over time or across markets. That is, we specify

$$\begin{pmatrix} \varepsilon_{it} \\ \eta_{it} \\ \xi_{it} \end{pmatrix} \sim N(0, \Omega_i)\,. \qquad (3)$$

To economize on the number of parameters we restrict the covariance structure such that the correlations are the same across markets. We parameterize the variance such that

$$\Omega_i = \begin{pmatrix} \sigma_{\varepsilon_i} & 0 & 0 \\ 0 & \sigma_{\eta_i} & 0 \\ 0 & 0 & \sigma_{\xi_i} \end{pmatrix} \begin{pmatrix} 1 & \rho_{\varepsilon\eta} & \rho_{\varepsilon\xi} \\ \rho_{\varepsilon\eta} & 1 & \rho_{\eta\xi} \\ \rho_{\varepsilon\xi} & \rho_{\eta\xi} & 1 \end{pmatrix} \begin{pmatrix} \sigma_{\varepsilon_i} & 0 & 0 \\ 0 & \sigma_{\eta_i} & 0 \\ 0 & 0 & \sigma_{\xi_i} \end{pmatrix}. \qquad (4)$$

The ρ-parameters now denote the correlations between different error terms, while for example $\sigma^2_{\varepsilon_i}$ gives the variance of the error term associated with log entry for shop type *i*.

Operationalization of variables

We estimate our model for a collection of shop types (industries) in the retail sector in the Netherlands, for the period 1980-2000. We use the following variables:

Key variables

E_{it}	number of entries in shop type *i* during year *t*
X_{it}	number of exits in shop type *i* during year *t*
N_{it}	number of firms in shop type *i* at start of year *t*
π_{it}	total industry profit in shop type *i* in year *t* (in 1990 prices)

Variables included in vector W

modal income	average modal income (in 1990 prices)
consumer spending	total consumer spending in shop type (in 1990 prices)
unemployment	number of unemployed (in millions)

Variables included in vector Z

Vector *Z* contains the same variables as vector *W*. In addition, the real interest rate is included.

Explanation of variables included in the model

Equation (1) of our model describes the interrelations between entry, exit and total industry profits. Many studies of industrial organization model the interrelation between entry and exit (e.g. Carree and Thurik, 1996, Burke and van Stel, 2009). When a firm leaves the market, there is room for entry (replacement). When a firm enters the market, some other firm may be forced to leave the market because it is no longer competitive enough (displacement). Also, when profits in an industry are high, this attracts more firms (positive effect on entry) and incentives for firms to leave the market are low (negative effect on exit). Furthermore, when entry, exit or profits are above or below equilibrium, error-correction will cause these variables to move towards the steady-state level again. All these type of interactions between entry, exit and profits are captured by the coefficients contained in matrices *A* (short-term effects) and Π (adjustment effects) in (1).

Vector Z in (1) contains exogenous explanatory variables for (changes in) entry, exit and profit levels. In our application the vector includes the variables modal income, consumer spending, unemployment and real interest rate. Modal income acts as an opportunity cost for running a retail shop, and hence this variable is expected to have a negative impact on entry and a positive impact on exit. Furthermore, an increase in modal income level may signal an overall upturn of the economy from which shopkeepers benefit as well (Carree and Thurik, 1994). Hence the expected impact on profits is positive. The growth rate of consumer expenditures on the goods and services sold in a shop type is an indicator for demand growth. This variable is expected to have a positive impact on entry, a negative impact on exit, and a positive impact on profits. Changes in unemployment may have a positive effect on entry as the (newly) unemployed may have limited alternative employment options in the wage sector (Thurik *et al.*, 2008). Increasing unemployment rates are also a disincentive to exit as economic circumstances are not favorable to find a different occupation. Increasing unemployment will also put pressure on profit levels (expected effect on profits negative). High interest rates, finally, make running a business more expensive, hence the expected impact on entry is negative. Also, profit levels may be lower when interest rates are high.

With the exception of the real interest rate, the variables from vector Z are also included in the vector W capturing the long-term influences on entry, exit and profits. By and large, the arguments are the same as for the short-term impacts described above. The interest rate is not included in the long-run relationships for two reasons. First, the interest rate appears to be nonstationary. Therefore this variable cannot be related to the steady state levels of the stationary variables entry and exit. Second, the interest rate is expected to only affect the markets in the short run. That is, the interest rate mainly influences the moment to start a business (hence an impact in the short run) but not the decision as such to start a business. To the contrary modal incomes (indicator of opportunity costs), consumer spending (indicator of shop type-specific demand) and unemployment (indicator of general business conditions) may be seen as more structural, long-run, impacts on entry and exit. Note that the effects of unemployment in the long-run equations may be different from those in the short-term. In particular, the positive effect of unemployment on entry may be a short-term effect only, primarily relating to individuals who have just recently become unemployed, and want to start a business. In the long-term though, a structurally high level of unemployment indicates bad conditions for running businesses, implying a negative relation with entry.

As mentioned earlier, the profit equation also includes the number of firms. A higher number of firms or a higher level of total industry profits reflect a bigger market hence the expected relation is positive.[6] What is interesting is whether the parameter for the number of firms in the long-run profit equation (equation 2 in the model) is bigger or smaller than one. Note that we can rewrite the long-run relation for total profit as

$$\log\left(\frac{\pi_{it}^{*}}{N_{it}}\right) = \gamma_{3i} + W_{it}^{\pi}{}'\delta_3 + (\lambda - 1)\log N_{it} + \kappa_i t \,. \tag{5}$$

The left hand side of this equilibrium relation gives the profit per firm. A λ coefficient in excess of one suggests a positive relation between the equilibrium profit per firm and the number of firms. This implies that more firms leads to larger profits per firm. In other words, total

[6] A coefficient of zero would imply that total industry profits remains the same (i.e. the market does not get bigger) when the number of firms increases, implying that the average profits per firm decrease proportionally with the increase in firms.

industry profits increase disproportionally with an increase in number of firms. On the contrary, a coefficient smaller than one corresponds to decreasing average profits per firm.

4. Estimation results

We use the model as described in (1) to (4) to analyze 41 different shop types in the Dutch retail sector. Parameter estimation is done by numerically maximizing the log likelihood function using Ox 5.1 (Doornik, 2007). The likelihood function can straightforwardly be obtained from the model specification

We present the estimation results in Table 3. First we comment on the long-run relationships. Modal income is negatively related to the long-run levels of entry and exit. This implies that if the modal income is high there are fewer firms entering the market and fewer firms leaving the market at any point in time. In other words, there is less turbulence.[7] The impact of modal income on entry is the largest, this perfectly corresponds to our conjecture that modal income acts as opportunity costs. Modal income and consumer spending have a positive impact on the long-run total profit levels. In this case, both variables indicate good economic conditions. The consumer spending also significantly impacts the long run entry and exit levels. If consumer spending is high entry levels are high. However, many of these entrants replace other firms as the coefficient of consumer spending on exit is comparable in magnitude and sign. If unemployment is high, business conditions are bad. Hence few firms enter the market and few firms exit. Turbulence in this case will be low. The equilibrium profit levels turn out to be significantly related to the number of firms. More firms correspond to higher total profit levels in equilibrium. However, the increase in profit levels is not large enough, that is average profit per firm decreases as the number of firms increases. The parameter estimate is not significantly smaller than one though.

The estimates for the adjustment parameters presented in Table 3 give insight in the way an out-of-equilibrium situation is corrected. If the entry level is too high relative to the equilibrium level this leads to a short-term decrease in entrants in the next period and a short-term increase in the number of exits. The impact on profit levels is negligible. Interestingly, if the exit level is too high, this only gets corrected by a lower exit level in the next period. The entry rates and profit levels are not directly affected. Finally, excessive profits are corrected through a change in profits itself and by a (temporarily) higher number of entrants, who are attracted by the high profit level.

The short-run effects of the (lagged) endogenous variables can be best shown using impulse response functions. Such functions give insight on how external shocks affect all variables. The short-run effects of the exogenous variables are easier to evaluate as they correspond to the direct impact of a particular change. The direct impact of an increase in modal income is that entry levels drop and profit levels increase. The magnitude of these effects is relatively large. An increase in consumer spending again leads to a direct change in entry and profits: both variables increase. An increase in unemployment directly leads to an increase in entry and a decrease in profit. Finally, the interest rate has a direct impact on entry: an increase in the interest rate corresponds to lower entry levels as expected.

Finally, we discuss the estimated correlation structure. We find a relatively large correlation (0.42) between the error terms associated with entry and exit. This positive correlation implies

[7] Turbulence is the sum of entry and exit.

that many shocks lead to a change in both variables, that is, they tend to affect turbulence. The correlation between the errors in entry or exit and profit are rather small.

Table 3: Parameter estimates for model given in (1) – (4), standard errors in parentheses

	$\Delta\log E_{it}$		$\Delta\log X_{it}$		$\Delta\log \pi_{it}$	
Long-run relationship						
Log modal income	-4.815	***	-2.862	**	0.913	**
	(1.527)		(1.235)		(0.378)	
Log consumer spending	0.669	***	0.535	***	0.185	**
	(0.217)		(0.178)		(0.091)	
Log unemployment	-0.552	**	-0.374	**	-0.095	
	(0.215)		(0.174)		(0.062)	
Log N_{it}	-		-		0.797	***
					(0.266)	
Adjustment parameters						
$\log E_{it-1}-\log E^*_{it-1}$	-0.290	***	0.307	***	0.050	*
	(0.047)		(0.032)		(0.027)	
$\log X_{it-1}-\log X^*_{it-1}$	-0.040		-0.544	***	-0.028	
	(0.052)		(0.040)		(0.037)	
$\log \pi_{it-1}-\log \pi^*_{it-1}$	0.276	***	-0.008		-0.579	***
	(0.068)		(0.074)		(0.037)	
Short-run effects						
$\Delta\log E_{it-1}$	-0.071		-0.014		0.055	***
	(0.047)		(0.034)		(0.021)	
$\Delta\log X_{it-1}$	0.044		-0.147	***	-0.023	
	(0.040)		(0.038)		(0.023)	
$\Delta\log \pi_{it-1}$	-0.179	***	-0.127	**	0.082	**
	(0.065)		(0.051)		(0.035)	
Δlog modal income$_t$	-2.055	***	0.125		1.669	***
	(0.484)		(0.363)		(0.210)	
Δlog consumer spending$_t$	0.223	**	0.059		0.132	***
	(0.102)		(0.073)		(0.051)	
Δlog unemployment$_t$	0.314	***	0.011		-0.169	***
	(0.062)		(0.047)		(0.036)	
Δreal interest rate$_t$	-0.004	***	0.000		0.001	
	(0.001)		(0.001)		(0.001)	
Estimated correlation structure						

$$\begin{pmatrix} 1 & 0.416 & -0.040 \\ 0.416 & 1 & 0.019 \\ -0.040 & 0.019 & 1 \end{pmatrix}$$

*,**,***: parameter is significantly different from 0 at 10%, 5%, or 1%, respectively

Impulse response analysis

In this section we use impulse response functions to study the impact of shocks to a market in equilibrium. We consider impulse response functions for three types of one-time shocks: a shock to the number of entrants, a shock to the number of exits, or a shock to profits. In all cases we consider a situation in which in the steady state there is no growth in the number of firms or total industry profits, that is, $\log E^*=\log X^*$ and $\kappa_i=0$. This situation enables to make an easier analysis of the effect of shocks. Furthermore, we assume that all exogenous variables are constant and equal to the observed mean value over time. In other words, we consider a one-time purely exogenous shock to a stable system. The size of the shock is taken as 1% of the steady state value prior to the shock. To initialize the simulation of the shock we need to set the initial number of firms. We select the first shop type available in the sample and use the first observed value of the number of firms as the initial value. The results do depend on this choice of initial value. This holds especially for the impact on the number of firms. The size of the shock on entry and exit is taken relative to its steady state. Depending on the turbulence in the shop type the resulting number of entrants or exits can be relatively small or relatively large.

We will graphically represent the effect of the shock for all variables in our model. Additionally, we show the impact on the profit per firm. Each time we show a key variable relative to its steady state level prior to the shock.

Figure 1 shows the impact of a 1% shock to profits. Note that the various graphs have different scales on the y-axis. The graph shows that the impact on total industry profits reduces quickly over the course of the succeeding four to five years. Note however that the effect of the shock does not completely die out. In the end the profits are 0.04% higher. The effects on entry, exit and the number of firms are longer lasting. After the shock there is more entry and less exit. In later periods the entry rate stays above the original steady state level and the peak in the effect is obtained in year 4. For exit we find that the initial drop in the number of exits is followed by a rise. Probably some of the additional entrants either displace incumbent firms or exit the market relatively quickly. The model implies that the entry and exit levels return to their original steady state levels. The total number of firms increases permanently with about 0.05% as a result of the shock. In the long run the shock has almost no impact on the average profit per firm. It turns out to be slightly smaller than before the shock. Note that this is consistent with the parameter for log N being smaller than one in the long-run profit equation.

Hence, as a result of the positive shock to profits, the number of firms permanently increases and the average profit per firm permanently decreases. However, the latter effect is smaller than the former effect, implying a permanent increase in total industry profits. If we interpret the shock in profits as innovation, we see that innovation has a small but lasting positive effect on the size of the market, both in terms of the number of firms and in terms of total industry profits.

Figure 1: Effect of a 1% shock to total industry profits, all graphs give the change relative to the steady state levels prior to the shock.

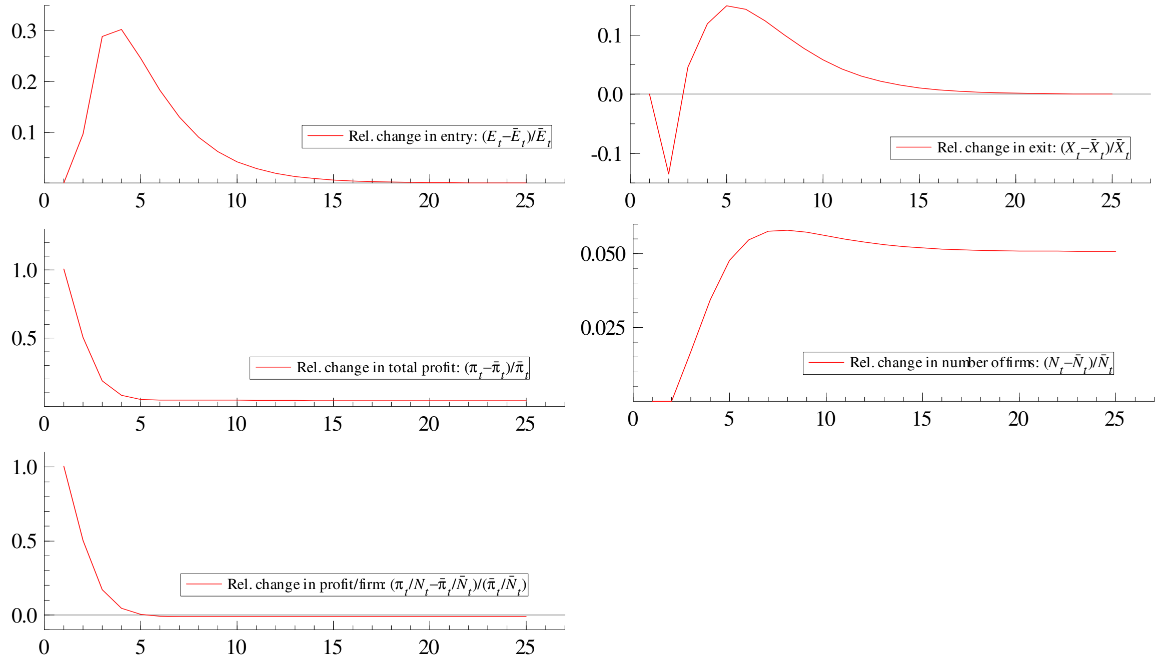
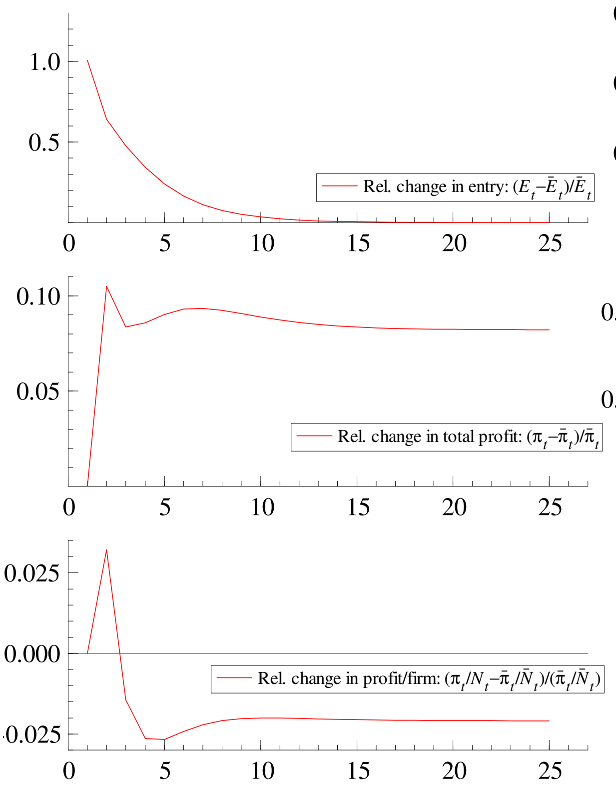


Figure 2 shows the result of a 1% shock to entry. The result of this shock is more exit during at least 15 years, and permanently higher levels of total profits and the number of firms. However, since the increase in the number of firms is slightly bigger than the increase in total profits, the average profit per firm decreases with about 0.02%.

Hence, similar to the shock to profits (Figure 1), as a result of the positive shock to entry, total profits as well as the number of firms permanently increase and the average profit per firm permanently decreases. Again, if we interpret the shock in entry as innovation, we see that innovation has a small but lasting positive effect on the size of the market, both in terms of the number of firms and in terms of total industry profits.

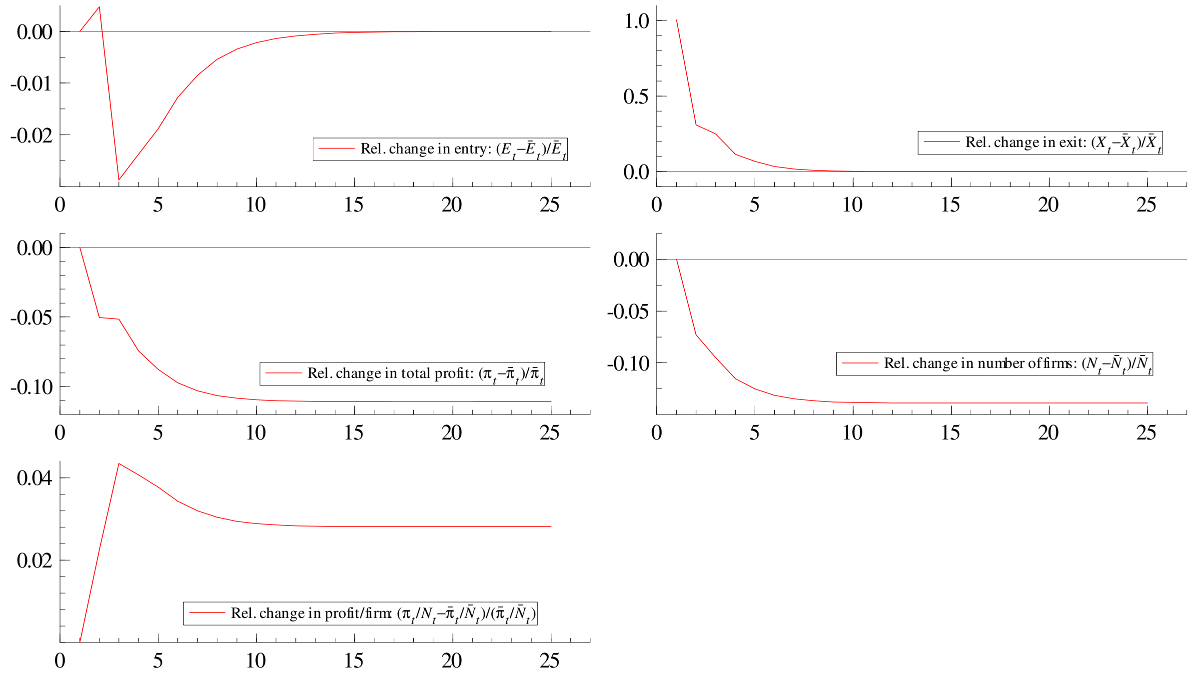
Figure 2: Effect of a 1% shock to total entry, all graphs give the change relative to the steady state levels prior to the shock.



An exogenous shock to the number of exits has a somewhat different impact. Figure 3 shows that, although initially this shock results in more entrants, overall the shock leads to less entrants during a relatively long period of time. However, the size of this impact is relatively small (note the different scales on the y-axes for entry and exit). In the new steady state profit levels have decreases by more than 0.10%, the number of firms has decreased by about 0.14%. In terms of average profit per firm, this shock leads to an increase of approximately 0.03%.

Hence, in the case of a positive shock to exit, the size of the market decreases, both in terms of the number of firms, and in terms of total industry profit. Those firms which 'survive' the shock to exit are slightly better off though, as average profits increase.

Figure 3: Effect of a 1% shock to exit, all graphs give the change relative to the steady state levels prior to the shock.



5. Conclusions

The relation between profits and the number of firms in a market is one of the essential topics in the field of industrial organization. Usually, the relation is modeled in an error-correction framework where profits and/or the number of firms respond to out-of-equilibrium situations. In an out-of-equilibrium situation one or both of these variables deviate from some long-term sustainable level. These models predict that in situations of equilibrium, the number of firms does not change and hence, entry equals exit. Moreover, in equilibrium entry and exit are expected to be equal to zero. These predictions are at odds with real life observations showing that entry and exit levels are significantly positive in all markets of substantial size. Moreover, entry and exit levels often differ drastically. In this paper we develop a new model for the relation between profit levels and the number of firms by specifying not only an equation for the equilibrium level of profits in a market but also equations for the equilibrium levels of entry and exit. In our empirical application we show that our entry and exit equations satisfy usual error-correction conditions. We also find that a one-time positive shock to entry or profits has a small but permanent positive effect on both the number of firms and total industry profits.

The results indicate that both the classical and innovation/entrepreneurial models of the interrelationship between entry, exit and profits have some empirical foundation. Contrary to the premise for the stand off between Austrian and classical economists in the last Century, the results show these models can coexist. The results indicate that entry has a short term classical competitive positive effect on exit. But we also find a long term positive effect of entry on both the number of firms and total industry profits. This evidence is consistent with a view where entrants are entrepreneurial and have creative destruction competitive effects on average profits of firms. Interestingly, the results run counter to a common view which associates innovation with the generation of monopolistic power as our results for Dutch retailing indicate exactly the opposite. In fact, entrepreneurial entrants seem to play a dual beneficial role in terms of being both pro competitive and innovative.

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