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Industry Dynamics and Entrepreneurship: An Equilibrium Model

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Industry Dynamics and Entrepreneurship: What Happens in Disequilibrium?

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Abstract

How does the interplay of firm entry, exit and profits work when distinguishing between short term relationships with fixed technology and longer term effects where entrants introduce innovation to market? We construct the first dynamic simultaneous equilibrium model of entry, exit, and profits and apply it to a dataset on Dutch retailing. The benefit of our model is twofold. First, it is able to discriminate between entrants' role of performing the entrepreneurial function of creating disequilibrium and their conventional equilibrating role of moving the industry to a new equilibrium. Second, the model allows for an analysis of the effect of entry and exit on market equilibrium, the duration of disequilibrium, and the patterns of adjustment. We find that entrants play an entrepreneurial function causing long periods of disequilibrium after which a new equilibrium is attained. We find support for the view that disequilibrium is the essence of economic progress.

Keywords: entry, exit, profits, equilibrium, industrial dynamics, retailing

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1. Introduction

What happens in disequilibrium? In the conventional neo-classical framework, entry and exit of firms 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. In this framework, the only economic function of entry and exit is to be reactive and to respond to disequilibrium profit levels. In equilibrium when profits are at normal levels, entry and exit have no role and are assumed to be in a steady state where entry equals exit. These predictions are at odds with real life observations (Newman and Wolfe 1961). As is also shown in Table 1 of the next section, entry and exit rates are usually not equal to zero, and their long-run averages are often also not equal to each other. Implicit in this framework is that adjustment is frictionless and hence it is forsaking the importance of the duration of the disequilibrium stage and the patterns of adjustment in disequilibrium. It is an adjustment process driven by firms having full and perfect information rather than by people having imperfect information and who are in need of learning. Reality seems to be different, and adjustment is not immediate.

An alternative perspective is to attach an entrepreneurial function to the firm. So, for example, while Schumpeter's driver of economic progress is about how entrepreneurs generate shocks which disrupt existing market equilibrium, that of Schultz is about how entrepreneurs adjust to these shocks. Schumpeter (1947) assumes that equilibrium is quickly restored after disruption. For Schultz (1975) disequilibria are inevitable features of economic progress.[1] It takes time to regain equilibrium and the adjustment patterns may vary according to the opportunities and restrictions of entrepreneurial behavior. The present paper is about all three phenomena which Schumpeter and Schultz identify as the essence of economic progress: the effect of entry and exit on market equilibrium, duration of disequilibrium, and patterns of adjustment.

Baumol (2002) points out that one of the most disappointing shortcomings in the neo-classical approach is that it does not explain the enduring success of capitalism in generating economic growth. This might have to do with the invisibility of the role of the entrepreneur in this approach (Barreto, 1989). As Schumpeter (1947) argues, neo-classical analysis is preoccupied with competition without innovation and by consequence is focused on the sub plot of adjustment around any given equilibrium. It also 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 and differentiation. It moves the attention from the price competition with fixed technology, which is central in the neo-classical framework, towards competition involving new goods and services or new technology and organization. In doing so, it also introduces the potential for an entrepreneurial function for entrants, i.e., to discover, experiment, refine, and exploit this potential. No longer are entrants assumed to be imitative 'me too' aspiring firms that seize their moment only when incumbents' profits have become excessive. Instead, entrants may bring innovation and differentiation to the market and in the process introduce new profit opportunities. In such a framework they reverse the causation so that equilibrium normal profit levels are determined by entry and exit rather than the other way around. In terms of entrepreneurial roles: it is the combination of the Schumpeterian entrepreneur creating instability and destruction and the Austrian entrepreneur combining resources to recreate stability (Wennekers and Thurik, 1999). The Schumpeterian entrepreneur creates potential and the Austrian entrepreneur realizes it (Nooteboom, 2000). This realization hinges around the process of market dynamics with the interplay of not just entry and exit but also profit as the indicators of competition (Kirzner, 1973).[2] Implementing this view in the world of economic modeling immediately raises the question how the interplay of entry, exit <u>and</u> profits works; particularly distinguishing between short term

[1] See also http://nobelprize.org/nobel_prizes/economics/laureates/1979/schultz-lecture.html: "The transformation of agriculture into an increasingly more productive state, a process that is commonly referred to as "modernization", entails all manner of adjustments in farming as better opportunities become available. I have shown that the value of the ability to deal with disequilibria is high in a dynamic economy (Schultz, 1975). Such disequilibria are inevitable. They cannot be eliminated by law, by public policy, and surely not by rhetoric. Governments cannot perform efficiently the function of farm entrepreneurs."

[2] The Kirznerian notion of entrepreneurial activity originates from the existence of disequilibria characterized by profit opportunities. See also Ikeda (1990).

relationships where the neo-classical assumption of fixed technology may be more realistic and longer term effects where entrants may introduce new disruptive technologies to the market.

The present paper specifies a full equilibrium model explaining entry, exit and profit while also capturing the duration of disequilibrium and patterns of adjustment. We account for both short- and long-run effects making use of a rich data set on Dutch retailing. We construct a dynamic simultaneous equilibrium model of entry, exit, and profits allowing for both short- and long-run effects in order to capture the Schumpeterian disequilibrium effects as well as the conventional Austrian equilibrium effects of entrepreneurial entry, exit and profit. In this fashion we can also discriminate between three dimensions of the adjustment process towards a new equilibrium: net change of the entry, exit and profit levels as well as Schultz's time and pattern of these changes. To our knowledge this is the first empirical analysis of the simultaneous interrelationship between entry, exit and industry profits. The model we propose will be investigated using four types of one-time shocks to: profits, the number of entrants, the number of exits and consumer spending. Illustrating the adjustment process to a new equilibrium using shocks and discriminating between three dimensions is the main contribution of the present paper. Previous analyses have only investigated these effects on a partial equilibrium basis. Therefore, this analysis sheds 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 in the third section. The results are discussed in the succeeding section with a focus on the analysis of impulse response functions. Section five concludes.

2. Data

At an empirical level we investigate the interrelation between entry and exit levels, the number of firms and profit levels. These four variables will be the key variables in the error-correction model which we will develop in the next section. The model parameters are estimated using data for a panel of shop types in the Dutch retail sector.[3] 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.

Beforehand, we discuss the entry and exit rates of ten developed countries for a recent period.[4] From Table 1 it is clear that in practice, entry and exit rates are not equal to zero, and they are often also not equal to each other. Instead, firm entry and exit are observed to be a persistent feature of these economies. Taken together these observations indicate that disequilibria are likely to be vital characteristics of modern economies. Hence, the assumptions on the role of entry and exit made in the neo-classical economic framework may be overly restrictive by ignoring an entrepreneurial function.

[3] 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.

[4] In Table 1, an entry is defined as a new firm (either a new-firm start-up or a new subsidiary company), where at least one person is active for at least one hour per week (i.e. it has to be an active new firm). An exit occurs when an active firm leaves the market, either voluntarily or involuntarily. See EIM (2009) for details.

Table 1: Entry and exit as a percentage of the number of firms, 1997-2006

	Entry				Exit			
	1997	2000	2003	2006	1997	2000	2003	2006
Belgium	7.2	6.7	6.5	8.4	6.7	6.8	6.1	6.3
Denmark	10.4	11.7	10.8	13.3	10.0	9.5	10.5	13.3
Finland	9.7	8.6	9.4	11.5	7.8	7.4	7.6	7.9
France	6.8	6.9	7.8	6.6	7.0	5.5	4.8	5.2
Germany	12.0	9.6	9.7	8.1	8.0	7.1	6.9	6.8
Ireland	13.1	15.1	12.5	14.5	7.9	5.7	3.8	7.6
Italy	6.9	7.7	7.3	7.6	6.3	5.4	5.9	6.7
Netherlands	10.2	11.1	8.0	10.5	5.5	6.1	6.5	6.4
United Kingdom	12.7	13.3	13.2	12.1	11.0	13.1	12.7	9.3
United States	12.2	10.1	9.2	9.9	9.5	8.9	8.7	9.1

Source: EIM (2009).

Our data set

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' (BSS) (interfirm comparison system) which was operated by EIM Business and Policy Research in Zoetermeer. The data are complemented using information from several other sources. As the number of shop types investigated in BSS 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.[5] The exact data period per shop type is given in Table 2. 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) in a shop type 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 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.[6] Until the beginning of the 1990s average profit levels are computed based on about seventy individual retail stores per shop type but from the

[5] A small part of an early version of this data set (22 shop types for the 1981-1988 period) is used explaining entry and exit flows: in Carree and Thurik (1996) for their analysis of the role of incentives, barriers, replacement and displacement and in Carree and Thurik (1999) for their analysis of the role of carrying capacity.

[6] 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.

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.[7]

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).[8] Modal income and unemployment are also obtained from Statistics Netherlands, while the (nominal) interest rates are taken from Thomson Reuters Datastream, a provider of financial data.[9]. 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 2 we give an overview of the available data. Table 2 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 2 clearly shows that entry and exit levels are significantly positive over a longer period of time. This suggests that the neo-classical idea of a steady-state level with entry and exit rates equal to zero is not a sufficient account of the patterns in the data. It seems that there exists a long-term persistent 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.

[7] 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.

[8] 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.

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

Table 2: 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 exist basically two sets of panel unit root tests. The first set assumes a common AR structure across panel members under the null and a common AR structure 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. As is well known in the econometric literature, in practice it may happen that the tests 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 3. 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. Note that this fits with expectations based on economic theory. 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 3 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 3: 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. Again, 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 indeed cointegrated. The conclusion of cointegration matches with the economic reasoning that, in the long run, the number of firms is tied to the profit level.

3. Model

In this section we develop our model in which we discriminate between the short term disequilibrating and long term equilibrating roles of entry and exit. We explicitly make room for an analysis of the net change, the duration, and the pattern of the move from an initial to the next equilibrium.

Denoted 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 by definition equal to $N_{it+1} = N_{it} + E_{it} - X_{it}$. 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 from the steady-state of the market. We denote the exogenous variables related to market i in year t by Z_{it}. We specify a vector error-correction model for the 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 $\log \pi_{it}^*$ 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. Consistent with the finding of cointegration, the steady state relation for profit also involves the number of firms. We model these steady state levels as

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

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

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

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

Operationalization of variables

We estimate our model for the earlier mentioned collection of shop types (industries) in the retail sector in the Netherlands, for the period 1980-2000. Below we summarize the key variables and list the control variables we use:

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).

The vector Z in (1) contains exogenous explanatory variables for (changes in) entry, exit, and profit levels. In our application this 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 expenditure 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 a determinant of 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 income (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 relationship is positive.[10] 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

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

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 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 4. 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.[11] 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

[10] 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.
[11] Turbulence is the sum of entry and exit.

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 different from one though.

The estimates for the adjustment parameters presented in Table 4 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 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 4: 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 relationships						
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 investigate the impact of shocks to a market in equilibrium. We consider impulse response functions for four types of one-time exogenous shocks which give an insight into the economic development of the retail industry: a shock to profits, to the number of entrants, to the number of exits, and to consumer spending. In each of these cases we investigate three dimensions of the adjustment process to equilibrium caused by the impact of these shocks: net change, time of adjustment and the pattern of adjustment. Net change measures the total effect of the shock comparing the initial and the new equilibrium states. It is the Schumpeterian element of our investigation. Time is about the duration of disequilibrium between these states. It tests Schultz's assumption that disequilibrium is the norm rather than a rarity. Pattern is about the route that the adjustment process takes from the initial to the new equilibrium. Its analysis is important because economic analyses are often based upon comparative statics and monotonic adjustment processes.[12] 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 κ_i=0. This situation enables an analysis of the effect of shocks. Furthermore, we assume that all exogenous variables are constant and equal to their observed mean values over time. Of course, in the case of the shock to consumer spending all other exogenous variables are assumed constant. In other words, we consider a one-time purely exogenous shock to an otherwise 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. In our discussion of the four types of one-time shocks, we first describe the patterns in the adjustment process and then necessarily move beyond the confines of our model in order to provide an interpretation. The objective is to reveal the importance of the dynamic economic adjustment process and not to argue that any particular interpretation is conclusive.

Figure 1 shows the impact of a 1% shock to profits on five elements of the model including relative change in entry, exit, total profit, number of firms and profit per firm. Note that the various graphs have different scales on the vertical 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 fewer exits. 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.

In terms of the three dimensions of the adjustment process to equilibrium, we observe that the positive shock to profits has long term economic effects. First, we note that while there are no long term changes to entry and exit, the short term rise in profits causes a permanent increase in the number of firms. This is associated with lower average profits per firm but higher total industry profits. Therefore, in terms of net change, the shock to profits has a permanent effect on the economic size of the retail industry. Second, the adjustment process lasts approximately five years between the initial and the new equilibrium for profits but 15 years for entry, exit and the total number of firms. Thirdly, the pattern of the adjustment process is in part fairly straightforward – after the profit shock net entry rises and the rise in the total number of firms causes profits to converge monotonically to the new equilibrium. However, the exit rate oscillates, initially 'undershooting' and then 'overshooting' the long run equilibrium.

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 one was to interpret the shock in profits as product differentiation innovation by some incumbents (the industry induces a higher willingness to pay by offering new and more valuable products or services), we see that this 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. The turbulence (high entry and exit rates) in the first decade after the shock are a clear sign of the learning process of the industry: entry through use of innovation and exits as a result of being unable to keep up with innovation.

[12] Clearly, there are many exceptions explaining passage to equilibrium and non-monotonic adjustment. See for instance Reid (2007) with examples for the world of small businesses or Jovanovic and MacDonald (1994) and Carree and Thurik (2000) for that of the tire industry.

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.

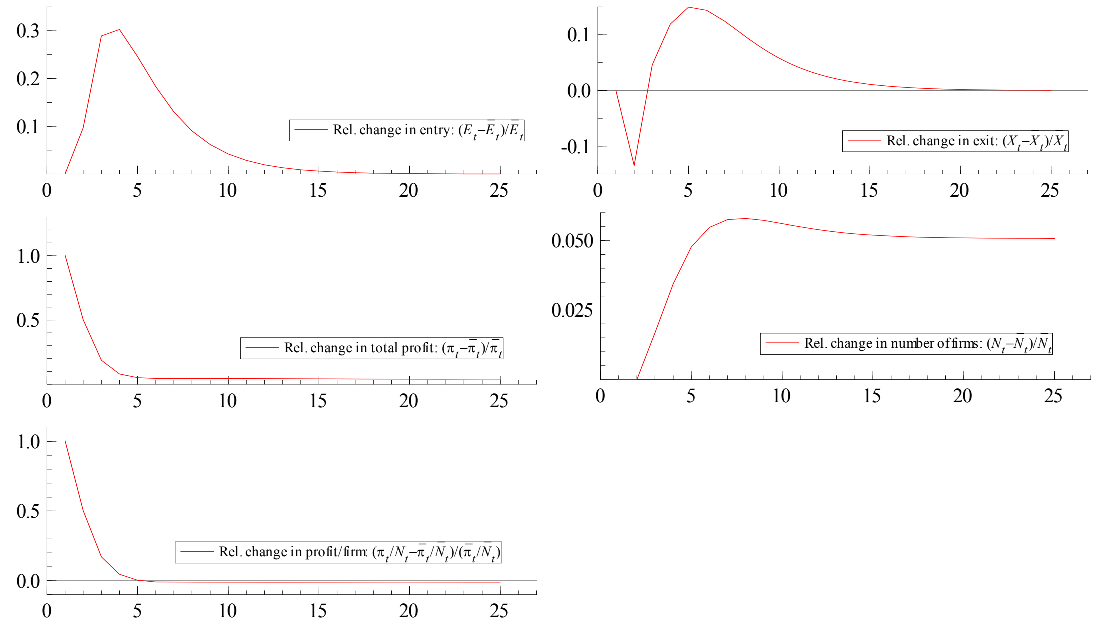
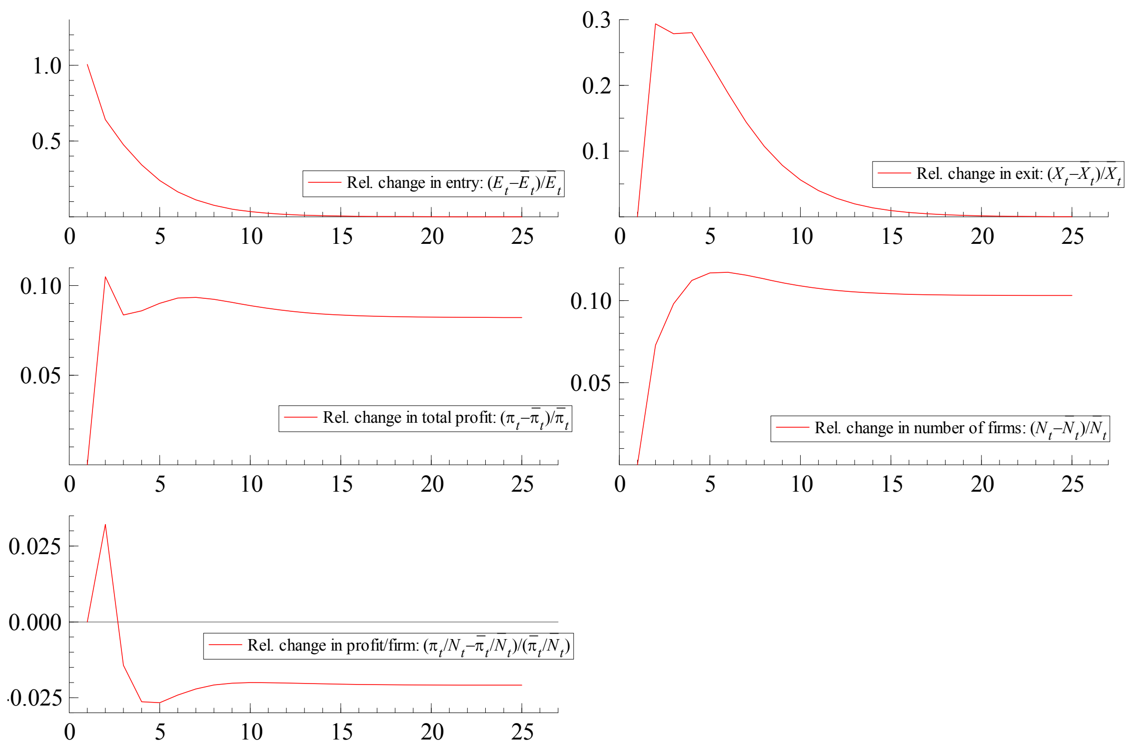


Figure 2 shows the result of a 1% shock to entry on the five elements of the model including relative change in entry, exit, total profit, number of firms and profit per firm. The result of this shock is to cause more exit for at least 15 years, and permanently higher levels of total profits and the number of firms. However, since the increase in the number of firms is slightly larger than the increase in total profits, the average profit per firm decreases by 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. In terms of the three dimensions of the adjustment process to equilibrium, we again observe the shock to entry is insightful. First we note that while there are no long term changes to entry and exit, the short term rise in net entry causes a permanent increase in the number of firms. This is associated with lower average profits per firm but higher total industry profits. Therefore, in terms of net change the shock to entry has a permanent effect on the economic size and competitiveness of the retail industry. Second, the timing of this adjustment process is far from instantaneous lasting approximately ten years between the initial and the new equilibrium. Thirdly, the pattern of the adjustment process is non monotonic and oscillates before it settles on a convergent path towards the new equilibrium. This is particularly noticeable with profits per firm which first 'overshoots' and then 'undershoots' before finally converging towards the new equilibrium.

If one interprets the shock to entry as driven by an entrepreneurial desire to introduce innovation we see that it causes a permanent increase in the size of an industry and total industry profits. In the process it causes a turbulent environment for firms with long periods of disequilibrium and with profits per firm fluctuating before finally converging on lower average profit levels per firm. The question now is why this shock eventually leads to reduced firm level profits and more firms? We think the clue is in the pattern of adjustment to the new equilibrium which shows average profits per firm initially rising above the pre shock equilibrium level and then gradually adjusting to a new equilibrium with an even lower average profit per firm. The first part of this adjustment process is consistent with innovation which expands market size by making the retail sector more attractive to consumers through effects such as expanding product variety (Krugman, 1979) and creating new market segments. Looking at this from a product differentiation perspective the entrants' innovation expands market space thereby creating disequilibrium. The emergence in supernormal profits then attracts new entrants and the competitive process is then akin to models of product differentiation (e.g. Chamberlin's 1933 model of monopolistic competition or Hotelling's 1929 model of spatial competition) where average profits per firm decline. The interesting empirical result here is that they do not decline to the previous equilibrium average profits per firm but move to a lower level. There are many possibilities as to why the parameters estimated in our model illustrate this effect. These include the possibility that a shock increase in entry is associated with a fall in barriers to entry so that the new equilibrium would involve more firms, more competition and lower average profits per firm (Shivardi and Viviano, 2010). An alternative view is that entry shocks might be associated with reductions in resource constraints for entrants such as lack of finance (Evans and Jovanovic 1989, Black et al 1996, Burke et al 2000) thereby moving an imperfectly competitive market to a more competitive equilibrium. Many other explanations and indeed associated counter arguments for these can be advanced (e.g. Cressy, 1996, 2002) but as we noted earlier our research contribution is uncovering the adjustment process and highlighting its economic significance. A definitive interpretation of the estimated parameters is beyond the scope of this paper and hence is raised as an area for future research.

Figure 2: Effect of a 1% shock to 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 vertical axes for entry and exit). In the new steady state profit levels have decreased 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%.

In terms of the three dimensions of the adjustment process to equilibrium, we observe the following. First we note that there is no permanent change to the equilibrium rate of entry and exit. However, there is a net decrease in the equilibrium number of firms and industry profit meaning that the industry does not fully recover to its initial equilibrium. The equilibrium average profit per firm rises; associated with the fall in the total number of firms. Second, the timing of the adjustment process to the new equilibrium is slow taking between ten to fifteen years. Thirdly, the pattern of the adjustment process is not monotonic. Initially the shock to exit has a sustained affect causing the exit rate to stay above equilibrium for 6 years, over and beyond which the entry rate also falls below the long run equilibrium, so that both then contribute to the net fall in the total number of firms. Hence, in the case of a positive shock to exit the striking result is that the market never fully recovers: the size of the market decreases, both in terms of the number of firms, and in terms of total industry profit.[13]

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

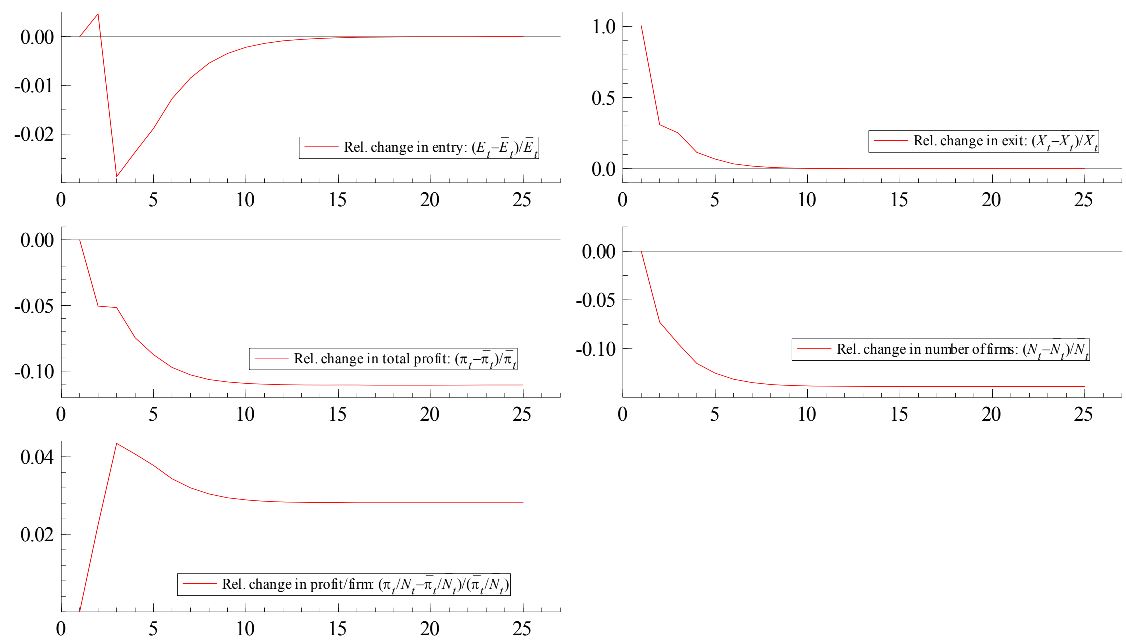


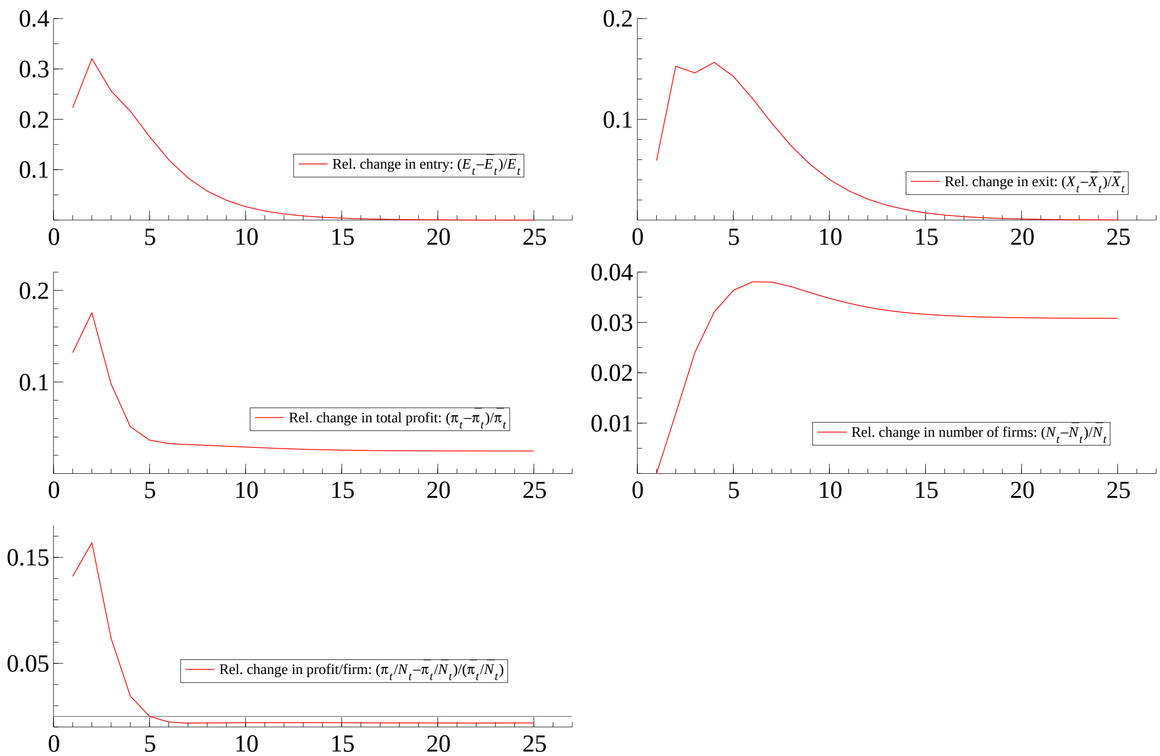
Figure 4 shows that a shock in consumer spending leads to more entry and exit for at least 15 years while leading to a higher number of firms and total profits. Since the increase in the number of firms is slightly higher than the increase in total profits, average profits per firm decreases.

In terms of the three dimensions of the adjustment process to equilibrium, we first note that there are again no long term changes to entry and exit. However, the shock in consumer spending leads to permanent increase in the number of firms. This is associated with lower average profits per firm but higher industry profits. The shock in consumer spending appears to have a permanent effect on economic size and competitiveness of the industry. Second, the timing is again far from instantaneous: it seems that the number of firms and industry profits are close to their new equilibrium while in the subsequent decade there is still some turbulence (entry and exit). Third, the pattern of the adjustment process is not monotonic but there is an upsurge in all variables before a monotonic path to equilibrium is reached. The adjustment process of this shock to consumer spending is similar to that of entry with the

[13] An interpretation is that a demand shock is at the origin of industry events. Marginal firms cannot keep up with a change in consumer preferences and leave the market. The adapting incumbents together with differentiated entrants are able to convince consumers to lower their price sensitivity given their new taste. As can be seen in Figure 3, entry is frustrated with a delay after the change in consumer preferences because of uncertainty signalled by the wave of exits. The resulting higher prices lead to higher industry profits in an altogether smaller market. Those firms which 'survive' the shock to exit are slightly better off, as average profits increase.

exception that the early oscillations are weaker (of course, a one percent shock in consumer spending cannot be compared to a one percent shock in total entry).[14]

Figure 4: Effect of a 1% shock to consumer spending, all graphs give the change relative to the steady state levels prior to the shock.



In general, the four shocks described above lead to permanent changes in the industry, i.e., a new equilibrium. In these processes entrants are found to play two roles. Initially, they perform an entrepreneurial function of creating disequilibrium; permanently undermining the existing equilibrium. Thereafter they play the conventional equilibrating role of moving the industry to a new equilibrium. For instance, a shock to exit has a permanent effect in that the market does not recover as opposed to one in profits which has a permanent positive effect on the size of the market. These shocks cause a long period of disequilibrium, typically 10 to 15 years, indicating the importance of the entrepreneurial function of entry and exit. This provides support for the Schultzian view that disequilibrium is the norm rather than the oddity. Moreover, we observe not only long periods of disequilibrium but also many non-monotonic adjustment processes which highlight their complexity. Frequently these processes are initially 'erratic' before earnest convergence to the new equilibrium sets in.

It is notable that in all four cases industry profits and number of firms move in the same direction: upwards in the case of a shock to profits, entrants and consumer spending and downwards in the case of a shock to exits. In the model this is linked to the positive coefficient for number of firms in the steady state specification of profits. Let us take the case of the entry shock. There are two possible reasons why entry may be associated with higher long-term industry profits. One is an exogenous and lasting increase in market size; the other is that the industry induces a higher willingness to pay by offering more

[14] An interpretation of this direct (consumer spending) demand shock is not necessarily similar to that of the indirect (entry) demand shock. An upward shift in consumer spending provokes entry of firms using a better technology. This new competition leads to lower profits per firm while total industry profits as well as the number of firms grow due to increased consumer spending.

valuable products (i.e., there is some kind of innovation). Distinguishing between these two causes of the entry shock is not possible given our present analysis. In the demand-driven case, there is no reason why entrants, rather than incumbents, should respond to the shock. For instance, it makes more sense for there to be an adjustment phase with entry and exit rates deviating from their normal levels if entry is innovative (differentiated) and thus has less certain consequences. In the case of the direct shock in consumer spending entrants with a new technology bring about competition together with a turbulent phase involving both entry and exit while ultimately industry profits and number of firms increase.

5. Conclusions

There has been much research on the role firm entry and exit in industrial performance[15] but none to our knowledge have addressed the question of what happens in disequilibrium? This area of investigation is especially important if economic performance is predominantly comprised of periods of disequilibrium. 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 to the retail sector we show that our entry and exit equations satisfy usual error-correction conditions. We also find that a one-time positive shock to entry, profits or consumer spending has a small but permanent positive effect on both the number of firms and total industry profits. This is consistent with the introduction of innovation and/or product differentiation.

The empirical results shed light on some long standing debates in economics. They indicate that both the neo-classical and entrepreneurial models of the interrelationship between entry, exit and profits have an empirical foundation. Contrary to the premise for the stand off between neo-classical economists and Schumpeterian and Austrian economists, the results show that these models coexist. They both explain different parts of industry dynamics. Moreover, we created room for the Schultzian view that disequilibria are inevitable features of economic progress and measured the duration and patterns of these disequilibria. We provide evidence of the length and the complexity of the adjustment processes. This supports Schultz, Baumol and the Austrians when they argue that the main challenge of economics is to explain disequilibrium processes. The results indicate that entry has a short term conventional competitive positive effect on exit as well as a Schumpeterian disequilibriating one. But we also find a long term positive Austrian 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 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.

[15] The development of industries and economies is driven to a large extent by the process of entry and exit of firms. It is an important determinant of market performance in terms of productivity and structure. Much is known about the interplay between entry and exit (Carree and Thurik 1996), their variability over time and industries (Dunne, Roberts and Samuelson 1988; Geroski 1995) and the way they bring about change (Beesley and Hamilton 1984; Audretsch 1995; Baumol 2002; Bartelsman et al. 2004; Reid 2007). Industries with a low rate of entry and exit are vulnerable to misallocation of resources, limited innovativeness and forms of collusion (Geroski and Jacquemin 1985). The relation between profits and the number of firms in a market is another essential topic in economics. 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 deterministic 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.

References

Audretsch D. 1995. *Innovation and Industry Evolution*. MIT Press, Cambridge, MA.

Barreto H. 1989. *The Entrepreneur in Microeconomic Theory: Disappearance and Explanation.* Routledge, London.

Bartelsman E, Haltiwanger J, Scarpetta S. 2004. Macroeconomic Evidence of Creative Destruction in Industrial and Developing Countries. IZA discussion paper series No. 1374, Bonn.

Baumol, WJ. 2002. *The Free-Market Innovation Machine: Analyzing the Growth Miracle of Capitalism*. Princeton University Press, Princeton, NJ.

Beesley ME, Hamilton RT. 1984. Small Firms' Seedbed Role and the Concept of Turbulence. *Journal of Industrial Economics* 33: 217–231.

Black, J., de Meza, D. and Jeffreys, D., 1996. House Prices, the Supply of Collateral and the Enterprise Economy, *Economic Journal*, v106, n434, pp. 60-75.

Breitung J. 2000. The Local Power of Some Unit Root Tests for Panel Data. In *Advances in Econometrics: Nonstationary Panels, Panel Cointegration, and Dynamic Panels*, Baltagi B. (ed.), vol. 15, JAI Press: 161-177.

Burke, AE., FitzRoy, F.R. and Nolan, M.A. 2000. When less is more: distinguishing between entrepreneurial choice and performance, *Oxford Bulletin of Economics and Statistics*, 62: 565-587.

Burke AE, van Stel AJ. 2009. The Entrepreneurial Adjustment Process in Disequilibrium. Tinbergen Institute Discussion Paper TI 2009-005/3. Amsterdam-Rotterdam: Tinbergen Institute.

Carree MA, Thurik AR. 1994. The Dynamics of Entry, Exit and Profitability: An Error Correction Approach for the Retail Industry, *Small Business Economics* 6: 107-116.

Carree MA, Thurik AR. 1996. Entry and Exit in Retailing: Incentives, Barriers, Displacement and Replacement, *Review of Industrial Organization* 11: 155-172.

Carree MA, Thurik AR. 1999. Carrying Capacity and Entry and Exit Flows in Retailing, *International Journal of Industrial Organisation* 17: 985-1007.

Carree MA, Thurik AR. 2000. The Life Cycle of the US Tire Industry, *Southern Economic Journal* 67: 254-278.

Chamberlin, E.H. 1933, *The Theory of Monopolistic Competition*, Harvard University Press, Cambridge MA.

Choi I. 2001. Unit Root Tests for Panel Data. *Journal of International Money and Finance* 20: 249-272.

Cressy, RC., 1996. Are business startups debt-rationed? *The Economic Journal*, 106 (September): 1253-70

Cressy, RC., 2002. Funding Gaps: A Symposium, *The Economic Journal*, 112 (February): F1-F16.

Doornik JA. 2007. Object-Oriented Matrix Programming Using Ox, 3rd ed. London: Timberlake Consultants Press and Oxford: www.doornik.com.

Dunne T, Roberts MJ, Samuelson L. 1988. Patterns of Firm Entry and Exit in U.S. Manufacturing Industries. *RAND Journal of Economics* 19: 495–515.

EIM (2009). Internationale Benchmark Ondernemerschap 2009 (in Dutch). EIM Report A200913, Zoetermeer, NL: EIM.

Engle RF, Granger CWJ. 1987. Co-integration and Error Correction: Representation, Estimation, and Testing. *Econometrica* 55: 251-276.

Evans, D. and Jovanovic, B. (1989), An Estimated Model of Entrepreneurial Choice under Liquidity Constraints, *Journal of Political Economy*, 97(4): 519-535.

Geroski PA. 1995. What Do We Know about Entry? *International Journal of Industrial Organization* 13:421–440.

Geroski PA, Jacquemin A. 1985. Industrial Change, Barriers to Mobility, and European Economic Policy. *Economic Policy* 1: 169–204.

Hotelling, HH. 1929. Stability in Competition, *The Economic Journal,* 39: 41-57.

Ikeda S. 1990. Market-Process Theory and 'Dynamic' Theories of the Market. *Southern Economic Journal* 57: 75–92.

Im K, Pesaran MH, Shin Y. 2003. Testing for Unit Roots in Heterogeneous Panels. *Journal of Econometrics* 115: 53-74.

Jovanovic B, MacDonald GM. 1994. The life cycle of a competitive industry. *Journal of Political Economy* 102: 322-347.

Kirzner IM. 1973. *Competition and Entrepreneurship*. University of Chicago Press, Chicago.

Krugman, P.R. 1979. Increasing Returns, Monopolistic Competition and International Trade, *Journal of International Economics*, 9: 469-479.

Levin A, Lin C, Chu C. 2002. Unit Root Tests in Panel Data: Asymptotic and Finite-Sample Properties. *Journal of Econometrics* 108: 1-24.

Maddala G, Wu S. 1999. A Comparative Study of Unit Root Tests with Panel Data and a New Simple Test. *Oxford Bulletin of Economics and Statistics* 61: 631-652.

Newman P. and Wolfe JN. 1961. Model for the Long-Run Theory of Value. *The Review of Economic Studies* 29: 51-61.

Nooteboom B. 2000. *Learning and Innovation in Organizations and Economies.* Oxford University Press, Oxford.

Pedroni P. 1999. Critical Values for Cointegration Tests in Heterogeneous Panels with Multiple Regressors. *Oxford Bulletin of Economics and Statistics* 61: 653-670.

Pedroni P. 2004. Panel Cointegration; Asymptotic and Finite Sample Properties of Pooled Time Series Tests with an Application to the PPP Hypothesis. *Econometric Theory* 20: 597-625.

Reid GC. 2007. *The Foundations of Small Business Enterprise: an Entrepreneurial Analysis of Small Business Inception and Growth*. Routledge, London.

Schultz TW. 1975. The Value of the Ability to Deal with Disequilibria. *Journal of Economic Literature* 13 (6): 827-846.

Schumpeter, JA. 1947. Theoretical Problems of Economic Growth. *Journal of Economic History* 7: 1-9.

Shivardi F. and Viviano E. 2010. Entry Barriers in Retail Trade, *The Economic Journal*, Published online first March 2010.

Thurik AR, Carree MA, van Stel AJ, Audretsch DB. 2008. Does Self-employment Reduce Unemployment? *Journal of Business Venturing* 23 (6): 673-686.

Wennekers S, Thurik AR. 1999. Linking Entrepreneurship to Economic Growth. *Small Business Economics* 13 (1): 27-55.