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The Entrepreneurial Adjustment Process in Disequilibrium: Entry and Exit when Markets Under and Over Shoot

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Abstract

The main contribution of entrepreneurship theory to economics is to provide an account of market performance in disequilibrium but little empirical research has examined firm entry and exit in this context. We redress this by modelling the interrelationship between firm entry and exit in disequilibrium. Introducing a new methodology we investigate whether this interrelationship differs between market 'undershooting' (the actual number of firms is below the equilibrium number) and 'overshooting' (vice versa). We find that equilibrium-restoring mechanisms are faster in over than in undershoots. The results imply that in undershoots a lack of competition between incumbent firms contributes to restoration of equilibrium (creating room for new-firm entry) while in overshoots competition induced by new firms (in particular strong displacement) helps restore equilibrium.

Keywords: entry, exit, equilibrium, industrial organization, undershooting, overshooting

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

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Introduction

The main contribution that the theory of entrepreneurship has made to economics has been to provide an account of what happens in disequilibrium.[1] Put differently, it is about the role entrepreneurs play in the adjustment process involved in the movement from one equilibrium to another. Remarkably, by contrast nearly all empirical analysis of entrepreneurship does so in an equilibrium context – usually, in the form of estimating long-run relationships/equations to identify the determinants of firm entry, exit and growth.[2] By doing so the *raison d'être* of entrepreneurship theory is ignored which is to explain the role played by new firms in the adjustment process towards equilibrium. Therefore, the issue of how firm entry and exit behave when markets are above or below their equilibrium number of firms remains an almost completely unexplored area of empirical research.[3] As a result, we know very little about Schumpeter's (1934) creative destruction process in terms of how new firms displace existing firms. We do not know whether this effect differs when the actual number of firms in a market is below the equilibrium

[1] In classical economics entrepreneurship played little if any role simply because most of the models in this framework did not need entrepreneurs as they involved seamless movement from one equilibrium to another (Casson, 1982; Parker and Stead, 1991). By contrast economic theorists interested in entrepreneurship portrayed entrepreneurs as activists responsible for creating disequilibrium. Schumpeter (1934) argued that through introducing innovation (new combinations) to a market entrepreneurs created disequilibrium. This entailed a process of creative destruction as those firms who were unable to compete against new innovators went out of business. Other theorists such as Von Mises (1949) and Kirzner (1973) argued that the key attributes (in this process) that make an entrepreneur innovative are 'imagination' and 'alertness to new market opportunities' respectively – again disequilibrating forces heralding new innovation. However, even earlier, economists more closely associated with the classical tradition also recognised that disequilibrium was a core attribute associated with entrepreneurship. Knight (1921) argued that entrepreneurs' key attribute was an ability to deal with a state of flux where levels of uncertainty were high and entrepreneurs' actions involved impure (uninsurable) risk taking. It was not until the work of Nobel Laureate Theodore Schultz (1975, 1980) that the synergistic elements of both schools of thought became apparent. He argued that the core attribute of entrepreneurs involved in all of the above attributes of entrepreneurship is the ability to deal with disequilibria. He saw entrepreneurs as both the initiators of disequilibrium and then through diffusion of innovation (and imitation) they were also the pioneers of the new equilibrium. In essence, entrepreneurship was both a disequilibrating and equilibrating force. Casson (1982), took a similar view and derived a generic definition of the entrepreneur as a prime actor in a state of disequilibrium who took judgemental decision about the allocation of scarce resources. Both Schultz and Casson saw entrepreneurs as initially causing disequilibrium but also playing a major role in diffusion of innovation and hence in attaining the new equilibrium.

[2] An exception to this pattern has been a swathe of research focusing on the impact of the diffusion of radical and disruptive new technology. Papers such as Gort and Klepper (1982), Klepper and Graddy (1990), Agarwal and Gort (1996), Fein (1998), Jin, Perote-Pena and Troege (2004), Klepper and Simons (2005) and Baptista and Karaöz (2007) show how the equilibrium number of firms in a new industry changes as it grows and superior technology diffuses. This research explains how the development of new industries creates an initial overshoot above equilibrium in the number of firms in an industry later leading to a business shakeout.

[3] Audretsch, Baumol and Burke (2001) explain how new IO led to a focus on market dynamics which has been associated with a resurgence in interest in the economics of entrepreneurship. This has been manifested with a significant volume of papers on new firm entry, exit, survival and growth (see Parker, 2004, and Shane, 2003, for an overview). However, a notable feature of this research is that it has largely been undertaken without consideration of how entrepreneurs behave in disequilibrium. Carree and Thurik (1996) and Burke (1996) are exceptions but we will explain later in the paper why these approaches are incomplete; only considering part of the disequilibrium effect and using techniques with overly restrictive (unrealistic) economic properties.

(undershoot) from when it is above the equilibrium (overshoot).[4] By consequence, we do not know if Schumpeter's theory of creative destruction interacts with more orthodox theories of competition so that its effect might be expected to differ between under and overshoots – the latter usually being viewed as a more competitive market than the former. We also know very little about replacement effects in disequilibrium. So, for instance, we cannot answer the question of whether a firm exiting an industry creates more space for entry in an undershoot compared to an overshoot or whether it is the same in both circumstances. We also do not know if entry and exit react differently to market situations where there are excessive or deficient numbers of *incumbent firms* compared to market situations where the levels of *entry and exit* are relatively high or low. Finally, we do not know if the adjustment to equilibrium is different if the market is trying to adjust from a situation where there are too few firms (undershoot i.e. deficient supply of firms) compared to a situation where there are too many (overshoot i.e. over supply of firms). Against this background, it appears that entrepreneurs and managers who clearly utilise much of the aforementioned economics theory still have to make decisions based to some extent on speculation of how these processes operate in real life.[5] Likewise, the relentless policy approach across the globe where governments appear obsessed with encouraging a greater supply of entrepreneurs as a panacea for all economic woes seems questionable without first knowing whether these are being encouraged in an over or undershoot environment and without knowing their actual displacement effects. Furthermore, it also turns the spotlight on the role of exit and replacement effects; perhaps raising the question of whether there is any scope to focus policy on promoting firm survival (again, aware that the need and opportunity for such an initiative may vary between over and undershoots).

The aim of this paper is to start to rectify this situation. In particular, we ask ourselves if the interrelation between entry and exit is different in situations of under- and overshooting, and if the adjustment process towards equilibrium is different in these two types of disequilibrium. We offer

[4] The finance literature attributes the tendency for financial markets to overshoot to myopia and overoptimism (e.g. Barbarino and Jovanovic, 2007). The same features have been highlighted as important in the entrepreneurship literature in terms of the importance of learning and experience (Jovanovic, 1982; Evans and Jovanovic, 1989) as well as the tendency for entrepreneurs to be overoptimistic (De Meza and Webb, 1987; Cooper, Woo and Dunkelberg, 1989, and De Meza and Southey, 1996) but to also learn quickly once market reality kicks in (Burke, 1997, and Fraser and Greene, 2006). So it is reasonable to ask if established industries spend much time in disequilibrium and if so, what impact it has on firm entry and exit thereby examining a core area of entrepreneurship theory that has been neglected.

[5] The strategic management literature has also focused much attention on the need for new ventures to identify the propensity of a market to be subject to business shakeouts as well as which strategies they should employ in order to deal with them (for example, Willard and Cooper 1985, Utterback and Suarez 1993, Day 1997, and Fein, Day and Ruppersberger 2003).

two methodological approaches in order to answer these questions. *Firstly*, we simply suggest that one does not assume that the adjustment process in an undershoot is identical to that in an overshoot. By estimating an equation for the long-run sustainable number of firms to identify periods of over and undershooting, we divide the sample into periods of over and undershooting and then estimate entry and exit equations separately in each of these regimes. This enables us to see whether the specification of entry and exit equations differs between these two forms of disequilibrium. This method tests how (if) each type of disequilibrium affects the interaction between entry and entry differently but it still leaves the remaining issue of whether the scale of disequilibrium (e.g. whether a 5% compared to a 50% overshoot) also has an influence. Our *second* methodological approach tackles this latter question by introducing a revised error-correction model which accounts for the impact of the scale of disequilibrium and importantly decomposes the error-correction effect into unique effects attributable to the disequilibrium number of incumbent firms on the one hand, and the interrelation between entry and exit levels on the other hand. Therefore, we hope that we offer a simple methodological blue print of how one can unpack the behaviour of entry and exit in the various types and scales of disequilibrium.

We apply this approach to a unique detailed data base on the Dutch retail industry which involves 41 shop types over a twenty-two year period (1980-2001). We develop an equilibrium function for the number of firms while introducing an error-correction framework. We investigate whether firm entry and exit relations and the equilibrium-restoring mechanisms differ in situations of ‘undershooting’ (the actual number of firms is below the equilibrium number) and ‘overshooting’ (the actual number of firms is above the equilibrium number). The organisation of the paper is as follows. We start with an outline of the basic theory underlying our methodological approach to account for entry and exit in disequilibrium. We also discuss a strategy to apply our methodological approach in an empirical setting. In the next sections we then discuss the empirical model and the data. We then discuss the results and conduct some simulations to illustrate the entry and exit adjustment process towards equilibrium. The final section is left for discussion and conclusions.

Theory and Methodologies to Account for Disequilibrium

We assume that the long-run natural or sustainable number of firms NOF_t in an industry is a function of factors $X_t = \{x_{i=1t},...,x_{nt}\}$ affecting the capacity of an industry to support viable firms. Therefore, the elements of vector X_t include elements relating to firm viability such as factors relating to the revenues and costs of firms, demand, entry/exit barriers, industry consumer spending and liquidity.

$$NOF_t = NOF_t(X_t) \tag{1}$$

First approach: modelling interrelations between entry and exit

Substituting equation (1) into the identity $NOF_t - NOF_{t-1} = ENTRY_t - EXIT_t$ (assuming the number of firms is measured at the end of year t) or $ENTRY_t = EXIT_t + (NOF_t - NOF_{t-1})$ provides the theoretical basis for estimating entry and exit equations in the following specific form.

$$ENTRY_t = \alpha_0 + \alpha_1 EXIT_t + \sum_{i=1}^{n} \alpha_i^{'}(x_{it} - x_{it-1}) \tag{2}$$

$$EXIT_t = \beta_0 + \beta_1 ENTRY_t + \sum_{i=1}^{n} \beta_i^{'}(x_{it} - x_{it-1}) \tag{3}$$

Carree and Thurik (1996) estimate entry and exit equations which are an adjustment of this basic form in order to account for equilibrating effects; particularly replacement and displacement relationships between entry and exit. Augmenting equations (2) and (3) to account for lagged entry and exit gives rise to equations (4) and (5). In equation (4) the long-run replacement effect can be computed as the sum of the coefficients belonging to the exit variables, corrected for the impact of the lagged entry rate. Hence, the replacement effect can be computed as $\frac{\alpha_1 + \alpha_2}{1-\alpha_3}$. Analogously, from equation (5) the long-run displacement effect can be computed as $\frac{\beta_1 + \beta_3}{1-\beta_2}$.

$$ENTRY_t = \alpha_0 + \alpha_1 EXIT_t + \alpha_2 EXIT_{t-1} + \alpha_3 ENTRY_{t-1} + \sum_{i=1}^{n} \alpha_i^{'}(x_{it} - x_{it-1}) \tag{4}$$

$$EXIT_t = \beta_0 + \beta_1 ENTRY_t + \beta_2 EXIT_{t-1} + \beta_3 ENTRY_{t-1} + \sum_{i=1}^{n} \beta_i^{'}(x_{it} - x_{it-1}) \tag{5}$$

This type of model has a number of properties which from an empirical perspective are quite restrictive as they impose questionable features on the equilibrium process. *Firstly*, either displacement dominates replacement or vice versa implying that the long term adjustment process tends to either a zero or infinite number of firms respectively.[6] *Secondly*, since replacement and displacement effects are constant they cannot vary depending on whether there are too many (relative to a sustainable number implied from equation 1) or too few firms in the market. In other words, these effects are unaffected by the intensity of competition in the market.[7] *Thirdly*, the model is not affected by the extent to which the actual number of firms deviates from the sustainable number so that it makes no difference whether there are 5% too few firms, 5% too many or indeed 500% too many firms relative to the sustainable number.

Second approach: specifying an error correction model

An alternative approach adopted by Burke (1996) involves using a formal econometric error correction mechanism (ECM). This requires explicit interpretation of a long-run sustainable or equilibrium number of firms NOF_t* from equation (1) where $NOF_t* = NOF_t(X_t)$. The existence of an equilibrating process is then tested through an error-correction model represented in equation (6) where the existence of an equilibrating process depends on the parameter *z* being negative and significant.

$$NOF_t - NOF_{t-1} = \omega_0 + \sum_{i=1}^{n} \omega_i (x_{it} - x_{it-1}) + z\left[NOF_{t-1} - NOF*_{t-1}\right] \qquad (6)$$

Letting λ =1 and again making use of $NOF_t - NOF_{t-1} = ENTRY_t - EXIT_t$ allows us to define entry and exit equations.

[6] This can be seen as follows. When the replacement effect dominates, on average in the long run the number of new firms replacing a given number of exits (say N exits), is higher than the number of exiting firms being displaced by the same number of entries N. In other words, if in the long run the exogenous shocks to entry and exit are in the same order of magnitude, the number of firms will increase to infinity as the number of new firms replacing exiting firms is higher than the number of exiting firms being displaced by new-firm entries. Vice versa, when displacement dominates, the process will –*ceteris paribus*– converge to zero firms.

[7] In a different context the importance of distinguishing between market situations of under and overshooting is acknowledged by Carree, van Stel, Thurik and Wennekers (2007). These authors estimate an equilibrium relation for the number of business owners across 23 OECD countries over the period 1972-2004. They find that deviations of the actual business ownership rate from the equilibrium rate have a negative effect on subsequent economic growth in case the number of business owners is below its equilibrium (i.e. undershooting) but deviations do not have a significant effect in case of overshooting. In other words, there appears to be a ‘growth penalty’ for having too few business owners but not so for having too many.

$$ENTRY_t = \omega_0 + \sum_{i=1}^{n} \omega_i (x_{it} - x_{it-1}) + z\left[NOF_{t-1} - NOF *_{t-1}\right] + \lambda EXIT_t \qquad (7)$$

$$EXIT_t = -\omega_0 - \sum_{i=1}^{n} \omega_i (x_{it} - x_{it-1}) - z\left[NOF_{t-1} - NOF *_{t-1}\right] + \lambda ENTRY_t \qquad (8)$$

By definition $NOF_t = NOF_{t-1} + ENTRY_t - EXIT_t$ so by substitution $NOF_{t-1} - NOF *_{t-1}$ can be rewritten as: $NOF_{t-1} - NOF *_{t-1} = NOF_{t-2} + ENTRY_{t-1} - EXIT_{t-1} - NOF *_{t-1}$. This means that equations (7) and (8) can be rewritten to reveal displacement and replacement effects as follows:

$$ENTRY_t = \omega_0 + \sum_{i=1}^{n} \omega_i (x_{it} - x_{it-1}) + zENTRY_{t-1} - zEXIT_{t-1} + z\left[NOF_{t-2} - NOF *_{t-1}\right] + \lambda EXIT_t \qquad (7a)$$

$$EXIT_t = -\omega_0 - \sum_{i=1}^{n} \omega_i (x_{it} - x_{it-1}) - zENTRY_{t-1} + zEXIT_{t-1} - z\left[NOF_{t-2} - NOF *_{t-1}\right] + \lambda ENTRY_t \qquad (8a)$$

Equations (7a) and (8a) illustrate the strength of the formal error correction approach in that it can be decomposed into effects attributable to incumbent firms and new and exiting firms. Therefore, estimation of equations (7a) and (8a) is more comprehensive than Carree and Thurik's (1996) specification as it accounts for displacement and replacement effects but unlike their model it also accounts for a disequilibrium in the number of incumbent firms. The new unearthed ECM term $z[NOF_{t-2} - NOF *_{t-1}]$ in equations (7a) and (8a) is intuitive as it gives a measure to the deviation from the actual number at the *start* of the previous year from the sustainable number *over* the year. Thus, it provides a good gauge of whether competition and hence profit opportunities are currently above or below a sustainable level – the exact sort of information one would expect to influence entry and exit decisions.

However, the weakness of the ECM approach is that the specification of equations (7a) and (8a) imply that a fixed parameter *z* applies to entry, exit and disequilibrium in the number of incumbent firms.[8] Unless one imagines an extreme and unrealistic scenario where firms are entirely homogeneous, there is little in economic theory to justify such a restriction.

Therefore, a more theoretically and empirically robust approach is to estimate equations (7a) and (8a) directly where the parameter values on (current and lagged) ENTRY and EXIT and deviations of the actual number of incumbents from the equilibrium number are freely estimated rather than constrained to be uniform. This gives rise to the following entry and exit disequilibrium adjustment equations.[9] The main novel contribution of this approach is that it identifies the unique roles played by new and incumbent firms in the disequilibrium adjustment process.

$$ENTRY_t = \alpha_0 + \sum_{i=1}^{n} \alpha_i (x_{it} - x_{it-1}) + \psi (NOF_{t-2} - NOF^*_{t-1}) + \varphi\, ENTRY_{t-1} + \gamma\, EXIT_{t-1} + \mu\, EXIT_t \qquad (9)$$

$$EXIT_t = \beta_0 + \sum_{i=1}^{n} \beta_i (x_{it} - x_{it-1}) + \theta (NOF_{t-2} - NOF^*_{t-1}) + \rho\, ENTRY_{t-1} + \tau\, EXIT_{t-1} + \phi\, ENTRY_t \qquad (10)$$

Distinguishing between different types of disequilibrium

This then leaves us with the remaining problem we noted earlier in that such an estimation implies that the coefficients on the replacement and displacement effects are uniform in both under and overshoots. However, we postulate that the adjustment process may not be symmetric when comparing market overshoots $NOF_t > NOF^*_t$ and undershoots $NOF_t < NOF^*_t$. Competition is excessive in an overshoot to the point that the number of firms must decline. In such circumstances one would expect a considerable body of vulnerable weak firms – weak in terms of their ability to compete in terms of price (cost) and product characteristics or sustain in terms of liquidity. Correspondingly in an undershoot more profit opportunities exist and incumbent firms are able to earn temporary monopolistic profits where even weak firms find it easier to be sustainable (Tirole, 1988). Furthermore, if network effects play a role (as one would expect in retailing) then if the actual number of firms is below the equilibrium, additional entry, far from threatening the viability of existing firms, may in fact enhance viability. In essence, more retail outlets raise the appeal of the retail region thereby drawing in more customers. To the contrary, when the number of firms is above the equilibrium level one would expect these network effects to be overpowered by competition effects where additional entries cause more firms to exit. So one might reasonably expect the displacement effect (entry causing exit) to be weaker in an undershoot compared to an overshoot. Correspondingly, one would expect the replacement effect (exit causing entry) to be

[8] As derived above equations (7a) and (8a) also imply that displacement and replacement effects are identical; if $\lambda = 1$ then both the replacement and the displacement effect equal $(\lambda - z)/(1 - z) = (1 - z)/(1 - z) = 1$. This is not realistic.

[9] Bosma, de Wit and Carree (2005) also specify entry and exit equations which include the disequilibrium number of incumbent firms. However, they do not include entry and exit variables on the right-hand-side of the equation so that they cannot measure replacement and displacement effects. Moreover, due to data restrictions they are forced to estimate their model using 13 observations only.

stronger in an undershoot where there are more market opportunities. Hence, in these circumstances, the adjustment process is not symmetric.

Therefore, we propose an approach which involves splitting the data set into over and undershoots and then estimate the new entry and exit equations as follows (where superscripts *u* and *o* indicate undershoot and overshoot sample equations respectively). For brevity we only report the undershoot equations.

$$ENTRY_t^u = \alpha_0^u + \sum_{i=1}^{n} \alpha_i^u (x_{it} - x_{it-1}) + \psi^u (NOF_{t-2} - NOF*_{t-1}) + \varphi^u ENTRY_{t-1} + \gamma^u EXIT_{t-1} + \mu^u EXIT_t \quad (9u)$$

$$EXIT_t^u = \beta_0^u + \sum_{i=1}^{n} \beta_i^u (x_{it} - x_{it-1}) + \theta^u (NOF_{t-2} - NOF*_{t-1}) + \rho^u ENTRY_{t-1} + \tau^u EXIT_{t-1} + \phi^u ENTRY_t \quad (10u)$$

We can now write the replacement (*R*) and displacement (*D*) effects for under (u) and overshoots (o) as:

$$R^u = \frac{\gamma^u + \mu^u}{1-\varphi^u}; \quad R^o = \frac{\gamma^o + \mu^o}{1-\varphi^o}; \quad D^u = \frac{\rho^u + \phi^u}{1-\tau^u}; \quad D^o = \frac{\rho^o + \phi^o}{1-\tau^o} \quad (11)$$

In addition, the role of the scale of disequilibrium in the number of incumbent firms in restoring equilibrium is reflected by parameters ψ^u and θ^u (undershooting) and ψ^o and θ^o (overshooting). Together with the replacement and displacement effects from equation (11) these parameters determine the course of the error-correction process.

This approach gives a key insight into the cyclical means through which entry and exit can propagate or prevent economies from achieving equilibrium. By consequence, it gives a more rich insight into the challenges for enterprise policy; particularly promoting enterprise when there are not enough firms compared to managing excess supply of enterprise when there are too many. It also highlights a cyclical dimension in terms of the extent to which new firms displace existing firms as well as the speed of adjustment towards equilibrium. This approach, based on the bedrock of economic theory, raises the question of whether enterprise policy should in fact have counter cyclical elements i.e. should it vary in its intensity of encouraging business start-ups across over and undershoots and should it be more focused on survival (combating exit)?

Empirical strategy

In broad lines our empirical application will consist of joint estimation of equations (1)-(9)-(10). In the next sections we will present our empirical model for the Dutch retail industry including operationalisation of the various model variables. However, in the current subsection we will first present our estimation strategy in terms of the theoretical equations derived earlier in this section.

As described earlier, our first approach to account for disequilibrium in entrepreneurship consists of modelling the interrelation between entry and exit. This approach is capable of accommodating different replacement and displacement effects but this approach does not feature equilibrium restoring behaviour. Either the replacement effect dominates or the displacement effect so that in the long run the number of firms goes to infinity or to zero. This is not realistic.

Using the entry/exit model equilibrium-restoring behaviour can be accommodated by allowing the replacement and displacement effects to be different in situations where the number of firms is below or above its long-run sustainable value. In particular, an equilibrium-restoring process is consistent with a dominant *replacement* effect in case of undershooting and a dominant *displacement* effect in case of overshooting. Therefore our first aim is to investigate whether we actually find these error-correction characteristics if we estimate the entry/exit model separately for under- and overshooting. For this test, we refrain from the second equilibrium restoring process, i.e. we do not include the variable measuring the extent of disequilibrium $(NOF_{t-2} - NOF*_{t-1})$, so that we obtain a 'pure' comparison of the replacement and displacement effects. In other words, we estimate the model formed by equations (1)-(9)-(10) but without estimating parameters ψ^u, θ^u, ψ^o and θ^o.

In order to be able to make a distinction between situations of under- and overshooting, we will start by estimating the long-run sustainable number of firms (equation 1). Observations for which $NOF_t < (>) NOF*_t$ are characterized by undershooting (overshooting). Next, as just described, we estimate the model separately for under- and overshooting while excluding the $(NOF_{t-2} - NOF*_{t-1})$ variable. This will give us some first insights about (a) the equilibrium-seeking behaviour of the entry/exit model in under- and overshooting, and (b) the ability of the estimated long-run function to empirically distinguish between under- and overshooting situations. If the error-correction requirements of the model are met by the estimation results, this would provide some confidence that the entry/exit model is not mis-specified, and, in addition, that the estimation of the long-run number of firms is also not implausible.

The final step of our regression exercises will be to estimate the full model (including parameters ψ^u, θ^u, ψ^o and θ^o), again separately for under and overshooting. This will allow us to investigate whether the extent of disequilibrium adds to the explanation of entry and exit levels, next to the replacement and displacement effects. It will also shed light on the question which mechanism is more important for restoration of equilibrium: the interrelation between entry and exit (replacement and displacement effects) or the autonomous effect of the number of firms being out-of-equilibrium (variable $(NOF_{t-2} - NOF^*_{t-1})$). We can also see whether these mechanisms work out differently for under and overshooting situations. We then conclude the analysis with a series of simulations illustrating how the adjustment process operates in disequilibrium for both over and undershoots.

Empirical Model

Carree and Thurik (1996) used an earlier version of the dataset to investigate replacement and displacement effects and we adopt many of their independent variables. Using the theoretical framework outlined in the previous section, our model enables us to investigate whether error-correction actually takes place, the extent to which error-correction runs through entry, exit, or incumbent firms, whether the speed of adjustment is high or low, and whether the magnitudes of the displacement and replacement effects are different in situations of undershooting and overshooting. Basically the model consists of an equation describing the long-run sustainable number of firms (equation 1 below), as well as an entry and an exit equation structured in line with equations (9) and (10) in the previous section.

The long-run sustainable number of firms in an industry depends on elements of the revenues and costs of the entrepreneur, demand, and entry and exit barriers. Estimation of the long-run number of firms allows us to empirically distinguish between situations of undershooting and overshooting, and also to establish the extent of disequilibrium (i.e. the difference between the actual and the long-run sustainable number of firms). The entry and exit equations include entry and exit terms on the right-hand-side as well, describing the interrelations between the two variables (i.e. replacement and displacement effects). The extent of disequilibrium derived from equation (1) is also included in the entry and exit equations, along with a number of control variables describing the attractiveness of the industry, demand conditions, entry and exit barriers and macro-economic (business cycle) conditions. A more elaborate description of the rationale behind our model will be provided at the end of this section.

Our model reads as follows.

$$NOF_{it} = \gamma_{1i} + \gamma_2 \pi_{it} + \gamma_3 MI_t + \gamma_4 CS_{it} + \gamma_5 TUR_{it} + \gamma_6 IR_t + \gamma_7 HP_t + \nu_{it} \tag{1}$$

$$\begin{aligned} ENTRY_{it} = {} & \alpha_{0\,i} + \alpha_1 PMI_{it-1} + \alpha_2 DCS_{it-1} + \alpha_3 UN_{t-1} + \alpha_4 DUN_{t-1} + \alpha_5 DF_{it-1} + \alpha_6 SSP_{it-1} + \alpha_7 FS_{it-1} + \\ & \alpha_8 EXIT_{it} + \alpha_9 EXIT_{it-1} + \alpha_{10} ENTRY_{it-1} + \alpha_{11}\left(NOF_{it-2} - NOF^*_{it-1}\right) + \varepsilon_{it} \end{aligned} \tag{9}$$

$$\begin{aligned} EXIT_{it} = {} & \beta_{0\,i} + \beta_1 PMI_{it-1} + \beta_2 DCS_{it-1} + \beta_3 UN_t + \beta_4 DUN_t + \beta_5 DF_{it} + \beta_6 SSP_{it} + \beta_7 FS_{it} + \\ & \beta_8 ENTRY_{it} + \beta_9 EXIT_{it-1} + \beta_{10} ENTRY_{it-1} + \beta_{11}\left(NOF_{it-2} - NOF^*_{it-1}\right) + \eta_{it} \end{aligned} \tag{10}$$

Where:

NOF	logarithm of the number of firms (end of year)
NOF^*	logarithm of the equilibrium number of firms
π	logarithm of the average profit per store (in 1990 prices)
MI	logarithm of the average modal income (in 1990 prices)
CS	logarithm of the total consumer spending (in 1990 prices)
TUR	logarithm of turbulence (sum of entry and exit)
IR	ten years interest rate
HP	index of average house price
$ENTRY$	entry rate: number of entries divided by number of firms at start of year
$EXIT$	exit rate: number of exits divided by number of firms at start of year
PMI	average profit divided by modal income
DCS	(relative) change in real consumer spending
UN	number of unemployed (in millions)
DUN	(absolute) change of number of unemployed (in millions)
DF	degree of franchising: number of franchisees as a fraction of the total number of firms
SSP	small store presence: share of small firms (less than ten employees) in total industry turnover
FS	floorspace requirement (in 10,000 square meters)
ν	disturbance term of equation (1)
ε, η	disturbance terms of equations (9) and (10), possibly correlated
i, t	indices for shop type (industry) and year, respectively

A novelty of our model is that it includes a function for the long-run sustainable number of firms in an error-correction framework. The aim is to investigate whether or not there is an autonomous effect on entry and exit if the number of firms in an industry is in disequilibrium. In other words, if the number of firms is lower than may be expected on the basis of some key determinants of the long-run number of firms, this may indicate incentives to entry (e.g. competition may be relatively low which may make it easier for an entrant to make profits) and disincentives to exit (low competition makes it easier to survive). Analogously, a situation where the number of firms is relatively high may make it less attractive to enter and may cause exit levels to be higher (as competition between incumbents may be higher). Hence, parameters α_{11} and β_{11} are expected to be negative and positive, respectively.

The equilibrium function (1) is defined in log-levels (as we explain the absolute number of firms, not a ratio) and we include the self-employment income (i.e. net profit), the opportunity costs of self-employment (i.e. modal income), the demand for products and services sold in the shop type and the level of turbulence, which is a measure of entry and exit barriers.[10] In addition, we include the interest rate and the average house price which are indicators for the cost of capital and cost of property, respectively. See equation (1).

The effect of profits (parameter γ_2) is indeterminate from theory. Higher profits will attract more firms but once more firms enter the market (in particular imitative entries), average profits will drop. Hence, in the long run the relation could be either positive or negative (Burke, van Stel and Thurik, 2008). A higher modal income reflects higher opportunity costs of entrepreneurship hence γ_3 is expected to be negative. Higher demand creates room for more firms (γ_4 positive), and higher turbulence indicates lower barriers which is associated with room for more firms in the market (γ_5 positive).[11] If the costs of attracting loans or the costs of renting floor space increase over time, less people may be inclined to start businesses: γ_6 and γ_7 are expected to be negative. In

[10] Our model contains three more indicators of entry and exit barriers: DF, SSP and FS. However, we do not include DF or SSP here as an indicator of barriers because these are ratio variables. Since we are explaining the (log of) the absolute number of firms we want to include a variable which is also defined in numbers. Although FS is defined in numbers (of squared kilometres), this is a very specific variable, and we want to include a more general indicator of the level of barriers. We choose the level of turbulence (sum of entry and exit) for this.

[11] As both the number of firms and the turbulence level are included in levels, parameter γ_5 may to some extent also capture market size differences between the industries.

addition, we include industry-specific constants γ_{1i} (i.e. fixed effects). These dummy variables capture structural differences between industries such as the minimum efficient scale, capital requirements, market size, and so on.

Equations (9) and (10) contain several determinants of entry and exit used by Carree and Thurik (1996). As profits are a good reflection of the income of entrepreneurs in the retail industry (the vast majority runs unincorporated businesses) we use the profits to modal income ratio (PMI) to measure the relative attractiveness to enter a shop type. Demand growth is measured by the growth rate of consumer expenditures on the goods and services sold in the shop type (DCS). While the variables PMI and DCS are expected to have a positive impact on entry, they are expected to have a negative impact on exit at the same time. Unemployment (UN) and change in unemployment (DUN) may have a positive effect on entry as the (newly) unemployed may have limited alternative employment options in the wage sector. High unemployment is also a disincentive to exit as economic circumstances are not favourable to find a different occupation. Following Carree and Thurik (1996), three indicators of entry and exit barriers are included. The degree of franchising (DF) may have a negative impact on entry and a positive impact on exit because franchisees enjoy certain benefits associated with the membership of a franchise chain. This may make it more difficult for independent new firms to enter or, when entered, to survive. Small store presence (SSP) is a general indicator of (low) entry and exit barriers. In industries with a high output share of small firms, economies of scale are apparently not so important, and entry and exit may occur more often. Hence the expected sign is positive on both entry and exit. The variable 'floorspace requirements' (FS) is an indicator of required investments. When a large shop is needed to run a business, more capital is required which may be difficult to obtain. Also, once entered, often large investments are made which makes the entrepreneur less flexible to exit the shop type. Hence the expected effect is negative, both for entry and exit. In addition, industry fixed effects are included to capture structural differences in market dynamics between different industries. Note that all variables are entered with a lag except for the unemployment and barrier variables for the exit equations, which are assumed to have an immediate impact.

Replacement and displacement effects are measured in line with the definitions in equation (11). In the entry equation (9) the replacement effect is captured by the exit and lagged exit terms. As entry rates tend to be highly autocorrelated over time, we also include a lagged dependent variable. In the long run, the replacement effect can be computed as the sum of the coefficients belonging to the exit variables, corrected for the impact of the lagged entry rate on the right hand side. Hence, the replacement effect can be computed as $\frac{\alpha_8 + \alpha_9}{1 - \alpha_{10}}$. Analogously, from equation (10) the displacement effect can be computed as $\frac{\beta_8 + \beta_{10}}{1 - \beta_9}$. As explained in the previous section these can be estimated separately for under and overshoot sample splits.

The Data

We use a data base for 41 shop types within the retail sector over the period 1980-2001. 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 and enriched 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 for which entry and exit rates are available is given in Table 1.[12] The table also contains shop type averages for the entry and exit rates. Details on the measurement and source for each variable are given below. We applied several corrections to the raw data in order to make the data ready for analysis.

Raw data on the number of firms (NOF) and the numbers of entries and exits 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. The number of new registrations (deregistrations) divided by the number of firms (at start of year) equals the entry (exit) rate (variables $ENTRY$ and $EXIT$), while the (logarithm of the) sum of new registrations and deregistrations equals TUR. Over time the sectoral classification of shop types used by CRK changed several times and we corrected for trend breaks that were introduced by these changes.

[12] Due to missing values for other variables in the model (in particular degree of franchising and small store presence), the sample represented in Table 1 is not exactly the same as the sample used for the regression analysis.

Raw data on average (net) profit per store 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 year t and t-1. Hence, the dynamics of this variable are not influenced by changes in the composition of the panel.[13] Until the beginning of the 1990s average profit levels were 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. It turned out that differences between these two sources were small which increases confidence in our constructed times series. From 1994 onwards we use the average of the annual relative change implied by these two sources.[14] In our model the average profit level per store is used both in levels (variable π) and relative to modal income (i.e. it is also used as the nominator of the PMI variable). Variable FS (floorspace requirements) is also taken from the ‘Bedrijfssignaleringssysteem’. A similar correction for changes in the composition of the panel has been applied to this variable.

Data on total consumer spendings on the products and services sold in a certain shop type CS is taken from Statistics Netherlands (publication ‘Budgetonderzoeken’ or Budget statistics).[15] The variables modal income MI, small store presence SSP, and unemployment UN are also taken from Statistics Netherlands. Modal income is also used as denominator of the PMI variable. Data on the degree of franchising DF have been obtained from the Netherlands Central Board for the

[13] Hence we choose a base year to compute the level of average profits, 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.

[14] 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 variable.

[15] Total consumer spending was computed by multiplying the variables average household spending, the total number of households

Retail Trade (HBD), while the ten years interest rate *IR* and the home price index *HP* are taken from ORTEC, a distinguished financial research firm based in the Netherlands. Finally, for the variables profits, modal income and consumer spendings we used a consumer price index to correct for inflation.

in the Netherlands and the share of a certain shop type in total household spendings.

Table 1: Entry and exit rates for shop types

Shop type	Period	Average entry rate	Average exit rate	N
Grocers/supermarkets	1980-2001	0.086	0.107	22
Greengrocers	1980-2001	0.083	0.110	22
Liquor stores	1980-2001	0.082	0.103	22
Shoe stores	1980-2001	0.077	0.086	22
Furnishing + furniture (mixed)	1980-2001	0.070	0.088	22
Bicycle stores	1980-2001	0.047	0.060	22
Jewelleries	1980-2001	0.088	0.084	22
Drug stores	1980-2001	0.086	0.082	22
Florists	1980-2001	0.115	0.116	22
Butchers	1980-2001	0.078	0.106	22
Fish shops	1980-2001	0.111	0.111	22
Bakers	1980-2001	0.076	0.093	22
Confectioners	1980-2001	0.104	0.116	22
Tobacco shops	1980-2001	0.050	0.086	22
Households goods shops	1980-2001	0.090	0.097	22
Paint, glass, wall-paper	1980-2001	0.058	0.085	22
Hardware stores	1980-2001	0.066	0.084	22
Photographer's shops	1980-2001	0.082	0.084	22
Pet shops	1980-2001	0.104	0.101	22
Textiles mens wear	1989-2001	0.045	0.097	13
Furniture	1980-2001	0.129	0.115	22
Dairy shops	1980-2001	0.045	0.096	22
Electrics	1980-2001	0.071	0.090	22
Audiovisual devices	1980-2001	0.141	0.135	22
Sewing-machines	1980-2001	0.065	0.095	22
Glass, porceline and pottery	1980-2001	0.129	0.121	22
Office and school materials	1980-2001	0.099	0.099	22
Opticians	1980-2001	0.098	0.072	22
Toys	1980-2001	0.155	0.119	22
Poultry	1989-2001	0.069	0.105	13
Clothing materials	1989-2001	0.056	0.111	13
Musical instruments	1989-2001	0.093	0.085	13
Do-it-yourself shop	1989-2001	0.129	0.105	13
Videotheques	1989-2001	0.328	0.309	13
Gardening centres	1989-2001	0.160	0.095	13
Reform	1989-2001	0.215	0.144	13
Baby’s clothing	1989-2001	0.156	0.163	13
Children’s clothing	1989-2001	0.272	0.193	13
Textiles underwear	1989-2001	0.203	0.138	13
Leather goods	1989-2001	0.112	0.115	13
Sport and camping equipment	1990-2001	0.151	0.113	12

Note: The second column contains the period for which the entry and exit rates are available. The third and fourth column contain the entry and exit rates, averaged over the period indicated in the second column. The final column contains the number of observations on which the shop type averages are based.
Source: Dutch Central Registration Office (CRK) and EIM Business and Policy Research.

Results and Simulations

As the error terms of equations (9) and (10) are correlated, we estimate the entry and exit equations using three stage least squares (3SLS). In addition, equation (1) is estimated using OLS and the fitted (i.e. predicted) values of this estimation serve as NOF^*_t. This allows us to compute variable $(NOF_{t-2} - NOF^*_{t-1})$ which is then subsequently inserted into equations (9) and (10). Furthermore, as the variance of the error terms systematically differs between shop types we make a correction by estimating the variance of the error terms for each shop type and adjusting the models accordingly. These estimates are obtained by regressing the squared residuals of the uncorrected models on a set of shop type dummy variables. The coefficients obtained in this way give an estimate of the variance in a particular shop type. Our models are then adjusted by dividing each explanatory and dependent variable by the appropriate square root of the estimated variance. This is in effect similar to a weighted least squares estimation and solves the problem of heteroscedasticity caused by the different shop types (Stewart, 1991).

As described in the last part of the Theory section, our estimation strategy consists of first estimating equations (1)-(9)-(10) without the error-correction mechanism of the incumbent firms (i.e. excluding variable NOF_{t-2}-NOF^*_{t-1}), to see whether the entry/exit interrelation mechanism shows equilibrium-restoring behaviour, and then adding the NOF_{t-2}-NOF^*_{t-1} variable to see whether the scale of disequilibrium further adds to the explanation of entry and exit levels. The models are estimated separately for under- and overshooting.

After removing seven outliers, we have an unbalanced panel of 568 observations distributed over 41 shop types.[16] Estimation results for the long-run sustainable number of firms are presented in Table 2 while the results for the entry and exit equations, excluding the $(NOF_{t-2} - NOF^*_{t-1})$ variable, are in Table 3. As mentioned, these results are presented separately for under and overshooting. New-firm entry in situations of 'undershooting' (relatively few firms in the market) may not only put pressure on incumbents to exit, but there may also be a countereffect in the sense that new entries into a (geographical) market may attract more customers to an area of retail shops, from which the incumbent firms benefit as well (i.e. there is a positive network effect). Hence the displacement effect may be weaker in case of undershooting compared to overshooting. We investigate these differences by splitting the original sample of 568 observations into a subsample for which the actual number of firms is lower than the estimated equilibrium number of firms (undershooting) and a subsample for which the actual number of firms is higher than the estimated equilibrium number of firms (overshooting).

Table 2: Estimation results long term relation log of number of firms (N=568)

	Long term relation, dependent variable NOF
π	-0.007
	(0.2)
MI	-1.46 ***
	(4.9)
CS	0.183 ***
	(3.2)
TUR	0.491 ***
	(19.1)
IR	0.549
	(0.6)
HP	-0.001 *
	(1.9)

Note: The long term relation is estimated from an OLS regression. Absolute heteroskedasticity-consistent t-values are between brackets. Dependent variable is the log of the number of firms. Industry fixed effects are included but not reported.
* significant at 0.10 level
** significant at 0.05 level
*** significant at 0.01 level

[16] The number of observations used in the regressions is lower than suggested by the total number of observations in Table 1. This is due to several missing values for certain model variables, in particular for the degree of franchising and small store presence.

Table 3: Estimation results, under- and overshooting, excluding error-correction mechanism for incumbent firms

	Undershooting (N=305)		Overshooting (N=263)	
	ENTRY	EXIT	ENTRY	EXIT
PMI $_{t-1}$	0.016 ***	-0.015 ***	0.006 *	-0.007 **
	(3.2)	(4.2)	(1.8)	(2.0)
DCS $_{t-1}$	0.010	-0.010	-0.005	0.008
	(0.7)	(0.9)	(0.6)	(0.8)
UN $_{(t-1)}$	-0.059 ***	0.009	0.021 **	-0.040 ***
	(3.2)	(0.7)	(2.0)	(3.2)
DUN $_{(t-1)}$	0.079 ***	-0.098 ***	0.033 ***	0.004
	(3.5)	(4.8)	(3.0)	(0.3)
DF $_{(t-1)}$	-0.014	0.012	0.004	0.001
	(0.4)	(0.5)	(0.1)	(0.1)
SSP $_{(t-1)}$	0.065 *	-0.032	-0.009	0.031
	(1.9)	(1.3)	(0.4)	(1.3)
FS $_{(t-1)}$	-0.033	0.356	0.236	0.073
	(0.1)	(1.2)	(0.8)	(0.4)
EXIT	1.178 ***		0.848 ***	
	(14.8)		(17.8)	
ENTRY		0.804 ***		1.189 ***
		(20.5)		(20.5)
EXIT $_{t-1}$	-0.296 ***	*0.207* ***	-0.202 ***	*0.241* ***
	(3.4)	*(3.3)*	(3.4)	*(3.8)*
ENTRY $_{t-1}$	*0.176* **	-0.113 **	*0.212* ***	-0.246 ***
	(2.5)	(2.3)	*(4.4)*	(4.7)
Replacement effect	1.07		0.82	
Displacement effect		0.87		1.24

Note: Results are from 3SLS regressions. Absolute heteroskedasticity-consistent t-values are between brackets. Both the entry and exit equations include industry fixed effects dummies (not reported). NOF* is the predicted value of (the log of) the number of firms, computed from the estimated long term relation reported in Table 2. The undershooting sample includes those observations for which NOF $_{t-1}$ < NOF* $_{t-1}$. The overshooting sample includes those observations for which NOF $_{t-1}$ > NOF* $_{t-1}$. The variables UN, DUN, DF, SSP and FS are one period lagged only for the entry equation. The replacement (displacement) effect is computed by summing the coefficients for current and lagged exit (entry), and dividing this sum by one minus the coefficient for lagged entry (exit). Coefficients for lagged endogenous variables are in italics.
* significant at 0.10 level
** significant at 0.05 level
*** significant at 0.01 level

Regarding the long-run function for the number of firms (Table 2), the coefficients for modal income (negative), consumer spending (positive) and turbulence (positive) are highly significant and in the hypothesised direction. The effect of profits is not significant, perhaps indicating that the positive effect of higher profits attracting more firms is neutralised by the negative effect of imitative entry lowering the average profit level in the industry (Burke, van Stel and Thurik, 2008). We find a negative effect of the house price index, which we use as a rough indicator for the cost of renting floor space. We do not find an effect of the interest rate.

Results excluding the NOF_{t-2}-NOF^*_{t-1} variable

From the entry and exit equations in Table 3, we see that there is a positive effect of profits (PMI) on entry and a negative impact on exit. Higher financial returns to running a business are an incentive to enter and a disincentive to exit. The result is stronger for undershooting, possibly indicating that higher profits are even more attractive when there are relatively few competitors in the market. Changes in consumer spending have no impact on entry and exit rates, perhaps indicating that fluctuations in demand are captured by expansion and contraction of incumbent firms. Concerning unemployment (variables UN and DUN), by and large we find positive effects for entry and negative effects for exit, as hypothesised. An exception is the pattern for entry in case of undershooting: we find a negative effect on entry of the level of unemployment but a positive effect of the change in unemployment. This may indicate that primarily the *newly* unemployed are inclined to set up shop while those who are already unemployed for a longer spell are discouraged to employ new initiatives. Because in situations of undershooting there is more room in the market for new-firm entry, the stronger coefficient of DUN (compared to overshooting) is not surprising. Of the barrier variables DF, SSP and FS, we only find a significant positive effect of small store presence in the case of undershooting. Lower entry and exit barriers lead to more entry.

Concerning interrelations between entry and exit, we see that replacement is stronger than displacement for undershooting, while displacement is the dominant market process in case of overshooting. These results are consistent with a mechanism of error-correction: for undershooting replacement dominates, ceteris paribus leading to an increase of the number of firms, while for overshooting the stronger displacement effect leads to a decrease of the number of firms. In both cases the number of firms thus moves in the direction of the long-run sustainable number of firms. As equilibrium-seeking behaviour is a standard characteristic of an economic model, these results provide confidence in the specification of our model, formed by equations (1)-(9)-(10). The magnitude of the replacement and displacement effects in case of overshooting are 0.82 and 1.24, respectively. This means that, *ceteris paribus* in the long run, on every 100 exiting firms 82 new firms enter the market place. On the other hand, on average, every 100 new-firm entries cause 124 (presumably inefficient) firms to exit. We also note that the (absolute) difference between the replacement effect and the displacement effect is lower for undershooting (0.20) compared to overshooting (0.42). This implies that the speed of adjustment towards equilibrium is slower for undershooting than for overshooting. Finally, the higher sum of replacement and displacement effects in case of overshooting (2.06 versus 1.94) suggests that in this mode economic dynamism, in terms of the interrelation between entry and exit, is somewhat higher.

From the lags in the model specification it is clear that the effect of entry on exit and the vice versa effect do not take place immediately, but instead take a number of periods (years) to capitalise. In Table 4 we illustrate the time lags involved in the replacement effect implied by the parameter estimates of the (lagged) entry and exit variables in case of undershooting (see left column of Table 3). As we can see the immediate impact is by far the biggest (1.178), and already after two periods the long-term replacement effect of 1.07 has almost been reached. Hence, although there are lags involved in the entry and exit interrelation process, the replacement and displacement effects capitalise quite fast.[17]

Table 4: Illustration replacement effect, case of undershooting

Time period	Effect on entry	Cumulative effect on entry
0	1.178*1 = 1.178	1.178
1	-0.296*1 + 0.176*1.178 = -0.089	1.089
2	0.176*-0.089 = -0.016	1.074
3	0.176*-0.016 = -0.003	1.071
4	0.176*-0.003 = -0.0005	1.070
5	0.176*-0.0005 = -0.0001	1.070
Replacement effect (converging effect over time):		1.070

Note: The table shows the entry effects over time of a unit shock to exit at time 0.

Results including the NOF_{t-2}-NOF^*_{t-1} variable (complete model)

We now move on to the results when the variable NOF_{t-2}-NOF^*_{t-1} is included in the model. See

Table 5. Results for profits, change in consumer spending, (change in) unemployment, and the degree of franchising hardly change when compared to Table 3. Results for small store presence and floorspace requirements change somewhat. In particular, for small store presence there is now a negative effect on exit for undershooting and a positive effect on exit for overshooting. The negative effect is counterintuitive. Both effects are significant at 10% level only. We also find a positive effect of floorspace requirements on exit in case of undershooting. Again, the effect is only significant at 10% level.

Our focus is, of course, on the equilibrium-seeking characteristics of the model. Results in Table 5 reveal that error-correction takes place through different mechanisms. For *undershooting*, we see that the replacement and displacement effects are almost equal. These effects approximately cancel each other out, thereby contributing only marginally to error-correction. Instead, the autonomous effect of the variable $NOF_{t-2}\text{-}NOF^*_{t-1}$ plays a more important role in restoring equilibrium. The extent of disequilibrium contributes positively to entry and negatively to exit. The coefficients for undershooting imply that, when at a certain point in time the number of firms is below equilibrium by a certain magnitude, then in the subsequent year 4.8% of the gap is reduced autonomously by means of a higher number of entries[18] and 3.9% by means of a lower number of exits. When there are relatively few firms in the market, several economic agents smell opportunities to make a profit and start new businesses. Also, less firms exit.

For *overshooting* these effects are 2.7% (less entries)[19] and 3.7% (more exits) of a certain gap between the actual and the equilibrium number of firms. Apparently, individuals are aware when markets are saturated, and in case the number of firms is above equilibrium, entry levels are lower and exit levels are higher. However, from Table 5 we see that for overshooting, displacement is much stronger than replacement, implying a strong tendency for the number of firms to decline (new entries cause relatively many exits while exiting firms are replaced by new firms only to a limited extent). This interplay between entry and exit is in fact by far the dominant equilibrium-restoring mechanism in case of overshooting, as we will illustrate in the next subsection.

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[17] Intuitively, this is also clear from the fact that the coefficients of the contemporaneous entry and exit variables are much bigger than those of the lagged variables.

[18] Note that the variable (NOF – NOF*) is negative in case of undershooting, hence the negative coefficient implies *more* entries.

[19] Note that the variable (NOF – NOF*) is positive in case of overshooting, hence the negative coefficient now implies *less* entries.

Table 5: Estimation results, under- and overshooting, including error-correction mechanism for incumbent firms

	Undershooting (N=305)		Overshooting (N=263)	
	ENTRY	EXIT	ENTRY	EXIT
PMI $_{t-1}$	0.017 ***	-0.018 ***	0.004	-0.007 *
	(3.9)	(4.9)	(1.4)	(1.8)
DCS $_{t-1}$	0.014	-0.014	-0.006	0.010
	(1.0)	(1.3)	(0.7)	(1.0)
UN $_{(t-1)}$	-0.049 ***	0.001	0.006	-0.031 **
	(2.9)	(0.1)	(0.6)	(2.4)
DUN $_{(t-1)}$	0.074 ***	-0.099 ***	0.037 ***	-0.022
	(3.4)	(4.9)	(3.4)	(1.3)
DF $_{(t-1)}$	0.006	0.011	-0.012	0.015
	(0.2)	(0.5)	(0.4)	(0.5)
SSP $_{(t-1)}$	0.065 **	-0.042 *	-0.012	0.044 *
	(2.1)	(1.7)	(0.7)	(1.8)
FS $_{(t-1)}$	-0.355	0.492 *	0.263	0.083
	(0.7)	(1.6)	(0.9)	(0.4)
EXIT	1.06 ***		0.680 ***	
	(12.0)		(12.2)	
ENTRY		0.855 ***		1.445 ***
		(17.3)		(15.9)
EXIT $_{t-1}$	-0.236 ***	*0.173* ***	-0.132 **	*0.196* ***
	(3.0)	*(2.8)*	(2.3)	*(2.9)*
ENTRY $_{t-1}$	*0.131* **	-0.082 *	*0.184* ***	-0.257 ***
	(2.0)	(1.7)	*(4.2)*	(4.7)
NOF $_{t-2}$-NOF* $_{t-1}$	-0.048 ***	0.039 ***	-0.027 ***	0.037 ***
	(4.9)	(4.9)	(3.1)	(3.0)
Replacement effect	0.95		0.67	
Displacement effect		0.93		1.48

Note: Results are from 3SLS regressions. Absolute heteroskedasticity-consistent t-values are between brackets. Both the entry and exit equations include industry fixed effects dummies (not reported). NOF* is computed from the estimated long term relation reported in Table 2. The undershooting sample includes those observations for which NOF $_{t-1}$ < NOF* $_{t-1}$. The overshooting sample includes those observations for which NOF $_{t-1}$ > NOF* $_{t-1}$. The variables UN, DUN, DF, SSP and FS are one period lagged only for the entry equation. The replacement (displacement) effect is computed by summing the coefficients for current and lagged exit (entry), and dividing this sum by one minus the coefficient for lagged entry (exit). Coefficients for lagged endogenous variables are in italics.

* significant at 0.10 level

** significant at 0.05 level

*** significant at 0.01 level

Restoration of Equilibrium in Undershooting and Overshooting

We now focus in more detail on the relative importance of both equilibrium-restoring mechanisms (i.e. replacement and displacement versus the effect of the variable NOF_{t-2}-NOF^*_{t-1}) using simulations –based on the estimated coefficients of Table 5– for under and overshooting. In particular, we assume a starting situation where the equilibrium number of firms in a market equals 100, and the absolute number of entries and exits both equal 10. In the first simulation, we assume that the actual number of firms initially equals 90 (undershooting) while in the second simulation we assume that the actual number of firms initially equals 110 (overshooting).[20] For ease of exposition we also assume that the equilibrium number of firms does not change over time. In Tables 6 and 7 we show what happens to entry, exit, the number of firms and the extent of disequilibrium ($NOF_t - NOF^*_t$) when we assume that the other variables in the model remain unchanged (in other words we make the usual *ceteris paribus* assumption), and only the replacement and displacement effects, and the effect of variable $(NOF_{t-2} - NOF^*_{t-1})$ influence the entry and exit levels, and the associated changes in the number of firms. For simplicity we also assume that the full cumulative replacement and displacement effects of an exogenous shock capitalize in one period of time. This is not far from reality, as was illustrated in Table 4.

Several important observations can be drawn from these tables.[21] *First*, for undershooting

[20] We use absolute numbers in this illustration as this is more insightful. It is also consistent with the coefficients reported in Table 5. In our econometric model, both the entry and exit rate are scaled on the number of firms. In addition, the log difference between the actual and equilibrium number of firms approximately equals the absolute difference divided by the number of firms. So, basically all variables that play a role in equilibrium restoration are scaled on the number of firms. Therefore we may use the absolute numbers.

[21] The tables should be read as follows. In Table 6, the starting situation is described in the first two rows (t=0 and t=1). At the end of period 0 the number of firms equals 90 while entry and exit in period 1 both equal 10. By definition the number of firms at the end of period 1 then also equals 90 (using $NOF_t = NOF_{t-1} + ENTRY_t - EXIT_t$). In period 2 entry equals $0.95 \times Exit_{t-1} - 0.048 \times (NOF_{t-2} - NOF^*_{t-1})$ = 0.95 x 10 -0.048 x -10 = 9.98 which is rounded to 10.0 (coefficients are taken from the left panel of Table 5). Analogously exit equals $0.93 \times Entry_{t-1} + 0.039 \times (NOF_{t-2} - NOF^*_{t-1})$ = 0.93 x 10 +0.039 x -10 = 8.91. At the end of period 2 this leads to an increase of the number of firms of 1.07 (=9.98-8.91), hence the number of firms at the end of period 2 is 91.1 (rounded to one decimal). In the column "Contribution to error-correction" the net-entry effect is divided between a contribution of the entry and exit interrelation mechanism (i.e. the interaction of replacement and displacement effects) and a contribution of the extent of competition between incumbent firms (i.e. the effect of the variable $NOF_{t-2} - NOF^*_{t-1}$). So, for instance, the entry/exit effect for period 2 equals 0.95 x 10 – 0.93 x 10 = 0.2. On the other hand, the isolated effect of $NOF_{t-2} - NOF^*_{t-1}$ equals -0.048 x -10 – 0.039 x -10 = 0.9, (0.87 when rounded to two decimals). Hence, in period 2 the contribution of the entry/exit mechanism to the net-change in the

(Table 6) the process of convergence is slow and this is because the replacement and displacement interactions (column entry/exit) actually contribute to a *divergence* of the process away from equilibrium. This divergence effect is compensated by the incumbents mechanism (i.e. the effect of $NOF_{t-2} - NOF*_{t-1}$), which does contribute to the restoration of equilibrium. In concreto, this mechanism leads to a 15.8 increase in the number of firms over the period considered, which compensates for the negative contribution to error-correction of -5.8 of the entry/exit mechanism. *Second*, for overshooting (Table 7) the process converges much faster: after four periods the number of firms already ‘shoots’ through its equilibrium value. Here the process converges much faster because both mechanisms work in the same direction: they both contribute to a decline of the number of firms (see the two columns under the header “Cumulative contribution” which display only negative values, at least until convergence is reached), and hence positively to the error-correction process, in this case. We also see that the contribution of the entry/exit mechanism is much stronger (-15.5) compared to that of the incumbent mechanism (-1.3). *Third*, combining the two observations above, we note that the equilibrium-restoring mechanisms are different for under and overshooting. Our estimation results imply that for undershooting, a lack of competition between *incumbent* firms contributes to restoration of equilibrium (creating room for new-firm entry) while in overshooting competition induced by *new* firms (in particular strong displacement) causes the number of firms to move towards equilibrium. *Fourth*, as an illustration, in Table 7 we also compute the effects when the process has already shot through its equilibrium, (erroneously) assuming that the coefficients estimated for overshooting also apply to situations of undershooting. We see that the number of firms keeps declining away from equilibrium. This illustrates that it is necessary to distinguish between undershooting and overshooting situations when modelling the interrelation between entry and exit, because otherwise the process modelled shoots through its equilibrium and never returns (see the NOF column in Table 7). This is not realistic.

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number of firms is 0.2, while the contribution of the incumbents mechanism is 0.9. Note that the sum of these contributions exactly equals the difference between entry and exit (i.e. 10.0-8.9=0.2+0.9=1.1). The final column contains the cumulative contributions of these two equilibrium restoring mechanisms. So, for instance for undershooting we see that after 91 periods the number of firms has increased with ten firms (i.e. from 90 to 100; the process has thus converged to equilibrium) and this increase can be split between the two mechanisms in -5.8 and 15.8. Note that the entry/exit mechanism actually causes the number of firms to move away from equilibrium. Results in Table 7 are computed in a similar fashion, this time using the coefficients of the right panel of Table 5.

Table 6: Equilibrium restoration in case of undershooting, simulation

						Contribution to error-correction		Cumulative contribution	
Time	NOF*	NOF	NOF-NOF*	Entry	Exit	Entry/exit	Incum-bents	Entry/exit	Incum-bents
0		90.0							
1	100	90.0	-10.0	10.0	10.0				
2	100	91.1	-8.9	10.0	8.9	0.2	0.9	0.2	0.9
3	100	91.1	-8.9	8.9	8.9	-0.8	0.9	-0.6	1.7
4	100	92.0	-8.0	8.9	8.0	0.1	0.8	-0.5	2.5
5	100	92.1	-7.9	8.0	7.9	-0.7	0.8	-1.2	3.3
6	100	92.9	-7.1	7.9	7.1	0.1	0.7	-1.1	4.0
7	100	93.0	-7.0	7.1	7.0	-0.6	0.7	-1.7	4.7
8	100	93.7	-6.3	7.0	6.4	0.0	0.6	-1.6	5.3
9	100	93.8	-6.2	6.4	6.3	-0.5	0.6	-2.1	5.9
10	100	94.3	-5.7	6.3	5.7	0.0	0.6	-2.1	6.4
30	100	98.2	-1.8	2.0	1.8	0.0	0.2	-4.7	12.9
31	100	98.3	-1.7	1.8	1.8	-0.1	0.2	-4.8	13.1
32	100	98.4	-1.6	1.7	1.6	0.0	0.2	-4.8	13.2
90	100	99.9	-0.1	0.1	0.1	0.0	0.0	-5.8	15.7
91	100	100.0	0.0	0.1	0.1	0.0	0.0	**-5.8**	**15.8**

Note: All variables in the table refer to absolute numbers. In the column “Contribution to error-correction” entry/exit refers to the replacement and displacement interactions while the column incumbents refers to the effect of the extent of disequilibrium in the number of (incumbent) firms. The bold-printed numbers in the last two columns at period 91 indicate the cumulative contribution of the two error-correction mechanisms at the time of convergence.

Table 7: Equilibrium restoration in case of overshooting, simulation

						Contribution to error-correction		Cumulative contribution	
Time	NOF*	NOF	NOF-NOF*	Entry	Exit	Entry/exit	Incum-bents	Entry/exit	Incum-bents
0		110.0							
1	100	110.0	10.0	10.0	10.0				
2	100	101.3	1.3	6.4	15.2	-8.1	-0.6	-8.1	-0.6
3	100	101.3	1.3	9.9	9.9	0.6	-0.6	-7.5	-1.3
4	100	93.2	-6.8	6.6	14.7	-8.0	-0.1	**-15.5**	**-1.3**
5	100	93.2	-6.8	9.8	9.8	0.1	-0.1	-15.4	-1.4
6	100	85.7	-14.3	6.8	14.3	-7.9	0.4	-23.3	-1.0
7	100	85.7	-14.3	9.7	9.7	-0.4	0.4	-23.8	-0.6
8	100	78.7	-21.3	6.9	13.9	-7.9	0.9	-31.7	0.3
9	100	78.7	-21.3	9.7	9.7	-0.9	0.9	-32.6	1.3
10	100	72.2	-27.8	7.1	13.6	-7.8	1.4	-40.4	2.6

Note: All variables in the table refer to absolute numbers. In the column "Contribution to error-correction" entry/exit refers to the replacement and displacement interactions while the column incumbents refers to the effect of the extent of disequilibrium in the number of (incumbent) firms. The bold-printed numbers in the last two columns at period 4 indicate the cumulative contribution of the two error-correction mechanisms at the time the number of firms 'shoots' through its equilibrium value.

Conclusions

Despite the fact that the main contribution of entrepreneurship theory to economics has been to provide an account of the performance of markets in disequilibrium, little empirical research on entrepreneurship has examined firm entry and exit in this context. In this paper, we attempt to redress this by modelling the interrelationship between firm entry and exit rates in disequilibrium. Using a data base of Dutch retail industries over the period 1980-2001, we are able to distinguish between displacement (entry causing exit) and replacement (exit causing entry) effects. We introduce a new methodological approach which allows us to investigate whether the relations under consideration differ between situations of 'undershooting' (the actual number of firms is below the equilibrium number) and 'overshooting' (vice versa). We find that the equilibrium-restoring mechanisms are different in these two situations – being faster in over than undershoots. Our estimation results also imply that for undershooting, a lack of competition between *incumbent* firms contributes to restoration of equilibrium (creating room for new-firm entry) while in overshooting competition induced by *new* firms (in particular strong displacement) causes the number of firms to move towards equilibrium.

The research helps to embed entrepreneurship theory into mainstream economics in a manner that adds greater insight into the performance of markets in disequilibrium. The mechanisms of replacement and displacement (particularly displacement) are consistent with Schumpeter's (1934) depiction of creative destruction where marginal, inefficient firms are displaced by new (sometimes innovative) firms. Therefore, the results seem to imply that creative destruction plays a bigger role when the number of firms in the market is relatively high. In this case (i.e. overshooting) it may be expected that there are more 'marginal' entrepreneurs than in case of undershooting, hence the displacement effect is stronger. However, we also note that in undershooting, the displacement effect is also relatively strong (compared to replacement). This means that, even when the number of firms in a market is relatively low, incumbent firms are also threatened by these new firms. But it is clear that displacement is much stronger for overshooting. These results appear to indicate that variety and selection in a Schumpeterian sense, where industries are rejuvenated by high levels of replacement and displacement - assuming that firms are being displaced by new firms that are more efficient - primarily takes place in industries where the number of firms is above the long-run sustainable number of firms.

We also find that the the speed of adjustment towards equilibrium is slower for undershooting than for overshooting. Likewise, we find another asymmetry between over and undershoots in that in each of these forms of disequilibrium entry and exit react differently to an excessive or deficient stock of incumbent firms compared to the entry of new firms or the exit of incumbent firms. Disequilibrium in the number of incumbents drives the entry/exit equilibrating process in undershoots whereas replacement and particularly displacement effects dominate in overshoots. In line with orthodoxy, we interpret the relatively low number of firms in a market characterised by undershooting as an indication of a lack of competition between incumbent firms, where a higher gap indicates a lower level of competition. The low level of competition makes it easier to enter the market, and, once entered, to survive in the market. This causes the number of firms to move up towards equilibrium. In overshooting competition induced by *new* firms (in particular strong displacement) causes the number of firms to move down towards equilibrium.

From a policy perspective the results indicate that the importance to have an ongoing supply of new firms is likely to be a more pressing issue in an under than in an overshoot (i.e. slow adjustment back to equilibrium when markets are below equilibrium). This raises the question whether policy initiatives aimed at increasing the supply of entrepreneurs should vary in intensity in an undershoot compared to an overshoot. Furthermore, it is unclear in an overshoot whether the strong displacement effect is just a faster 'revolving door' effect where the throughput of entrants to exit just becomes faster (i.e. the failure rate among new ventures accelerates) or whether this form of Schumpeterian creative destruction displaces weak incumbents. In sum, we believe the analysis has made a small but important step towards more closely embedding entrepreneurship theory within mainstream economics in a manner that adds greater insight into the performance of markets in disequilibrium. In the process, we believe it raises some important considerations for policy as well as insights for managers and entrepreneurs.

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