Fast Food- the early years: Geography and the growth of a chain-store in the UK*

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Abstract

We examine the development of UK outlets of a major fast food chain, from inauguration in 1974 until 1990, after which industry structure changed somewhat. The chain effectively introduced the counter-service burger concept. Locational spread across local authority district markets is explained by the characteristics of the areas where the outlets are sited. Of special interest is the effect of scale economies, measured by outlet numbers in neighboring districts. Both first and second entry are examined. We find that the hazard of first entry is positively influenced by market size and population density and negatively by distance from company headquarters.

Keywords: Fast food; Diffusion; Regional economic activity; Entry

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1. Introduction

One of the pervasive phenomena of the twentieth century is the spread of chain stores. In the latter part of the century, a prominent element of this has been the spread of chain fast food outlets. These have enjoyed remarkable success in expansion, so that fast food chains now constitute a significant industry. Our purpose in this paper is to examine determinants of the spread of a paradigmatic case. In doing so, we argue, we are casting light upon the phenomenon of the growth and development of chain stores generally.

No authoritative data exist for the size of the fast food sector in the UK, but they do for restaurants as a whole. A comparison[1] with farming is instructive in showing that restaurants are a very significant industry. There are over $2^1/_2$ times as many people employed in restaurants, as there are in agriculture, even including the large number of seasonal and casual workers in the farming industry. The total earnings of those employed in restaurants are roughly 80% above the earnings of people employed in agriculture. Gross turnover (output) in agriculture is roughly equivalent to turnover in restaurants. Thus, taken as a whole, restaurants are arguably at least as important an industry to the UK economy as is farming. Moreover, whereas farming is an industry in decline, both the restaurant sector and, most probably, the fast food element of it, are growing quite rapidly (with turnover in restaurants up approximately 32% over four years[2]). Consumption of most basic foodstuffs (meat, dairy products, potatoes, flour, bread etc.) in the home has been declining in terms of grams per person for many years, whilst eating out has increased rapidly as a proportion of consumer expenditure. Thus to study the growth of the fast food sector is to examine an industry of considerable and growing significance to the UK.

In this paper, we examine the growth of a particular fast food company, McDonalds (McD) in the counter service burger market. Our investigation, for reasons we explain in

[1] The data quoted below relate to the year 2000 or 1999 and all come from the UK *Annual Abstract of Statistics*, 2002.
[2] The manner in which these data have been collected has changed slightly over the period.

more detail later, centers on the growth from its inception in the UK until a period 17 years later when it first faced significant competition. A shorter subsequent phase, during which we examine a duopoly, is the subject of an earlier paper (Toivanen and Waterson, 2001). The company in question may justifiably lay claim to having innovated a method of food production in the UK (and elsewhere) and has demonstrated a long period of successful organic growth. However, our focus is on the more specific issue of uncovering the variables that explain the duration of time before which an outlet opens in a particular market location.[3] Our study is the first, to our knowledge, to examine timing of entry into regional markets.[4] Other features of interest in our paper include the investigation of second entry, the manner in which geographical characteristics of the market feature in the explanation of duration, and its focus on a service activity.

There are essentially two empirical literatures bearing upon the issue we examine. One relates to diffusion of innovations. The other concerns fertility. Modeling the duration of time before a client adopts an innovation is quite a popular activity in studies analyzing process innovation. Examples of such studies include Hannan and McDowell (1984), Rose and Joskow (1990) and Karshenas and Stoneman (1993) (recent surveys are Geroski (2000) and Stoneman (2001)). Hannan and McDowell (1984) use a duration model to investigate the decision by banks to adopt automatic teller machines (ATMs). They assume that a firm is more likely to adopt an ATM, the greater the profit differential between adopting and not adopting. In turn, they identify a number of firm and market characteristics that will help determine profitability; these include the wage rate in the market, market growth, and firm size. Rose and Joskow (1990) use data on coal-fired steam-electric generating technology to investigate the effect of firm size and ownership on technology diffusion. Karshenas and

[3] A legitimate question arises as to whether it would be more straightforward to ask the company themselves what factors influenced opening policy. We are not adopting this direct approach because we feel it is unlikely the company will have a corporate memory extending back almost 30 years, because they may not wish to articulate their policy to outsiders and, most importantly, because the tools used in the years we study may well have been implicit rather than explicit- certainly their approach towards opening outlets became more sophisticated only in the mid 1990s.

[4] There are certainly other studies that examine the distribution of firms across regional markets (following from

Stoneman (1993) construct a general duration model of technology diffusion that combines the main elements present in the competing theories of process-technology diffusion and apply them to data on the diffusion of computer numerically controlled machine tools (CNC) in the UK engineering industry. A hazard-rate approach is undertaken, with the conditional probability that a firm adopts a new technology in a given time being dependent upon variables from the rank, stock, order and epidemic effects models (although only the first and last of these prove significant). In more recent work, Battisti and Stoneman (2002) employ the same dataset in examining intra-firm diffusion. Overall, the key element these studies identify as being important for adoption time is the size of the purchaser market.

However, another aspect of the literature that provides a strong influence on our econometric work relates not to diffusion, but rather fertility. Heckman and Walker (1990) concern themselves with fertility dynamics. They estimate a reduced-form neo-classical model that brings together various factors, such as childlessness and inter-birth intervals, that relate to life-cycle fertility. They attempt to discover whether these factors are sensitive to male income and female wages. Previous studies indicate a negative relationship between a woman's education and the number of children she has (completed fertility), with a woman's education here being used as a proxy for her wage. The interesting aspect of this study is that it examines duration before first and second child. In a similar way we examine duration before first and before second entry into a market, something that has not been done previously.

In order to investigate duration models of diffusion adequately, Karshenas and Stoneman (1993, p.513) state that the project dataset employed should satisfy a particular set of criteria: "[T]he ideal would be a dataset with complete life histories of the population of potential adopters, as well as the characteristics of a well-defined new technology over a sufficiently long period beginning with the appearance of the technology in the market." Essentially, this is what we have. In the current study, the potential adopters of the new

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Bresnahan and Reiss, 1989), but these commonly take a snapshot or compare two periods of time.

technology, that is a McDonalds outlet, are the Local Authority Districts within the UK. Data relating to McDonalds is available for the full 1974-1990 period, commencing with outlet data for the first McDonalds which opened in Greenwich in October 1974. Local Authority data is also available for the period of study, and therefore their proposed requirements are fully met in our data set.

Our plan for the remainder of the paper is as follows. We first discuss the characteristics of the market we study in section 2, then develop our economic model of entry in section 3, explain our econometric method in section 4 and discuss our results in section 5. We conclude with some implications of our findings.

2. Characteristics of the Market and the Data

We argue that the fast food counter-service burger market is a well-defined (and dominant) segment of the general fast food market. Counter service is significantly different from table service, because of the very different amounts of time involved in supplying food. Over the period in question (from 1974 to 1990), counter service burger sales grew significantly in the UK at the expense of earlier fast food activities, primarily fish and chips. However, the nature of the outlets is very different. Fish and chip sales were (and are) concentrated very much at particular established times of day, early lunchtime and evening, often very late evening, and do not normally operate outside those times. Nor, for historical reasons, did they operate on Sundays. By contrast, burger outlets commonly open from around 9am, seven days a week and supply continually until mid or late evening. Fish and chip outlets seldom incorporate seating. They employ batch rather than continuous production methods.

Geographically, we define the local market to be equivalent to the local authority district. People in the UK do not travel far to satisfy their fast food needs, in part because much of the custom arrives on foot. The local authority district is a convenient level at which to perform the analysis, since comparable data on key variables are available for long periods, something required for this analysis.[5] It is also the administratively relevant level of activity, since it is local authority districts that are charged with implementing planning guidance, and in order to open a fast food outlet, that outlet/ location must have been designated as "A3" usage.[6] Moreover, it is of significance that local authority districts differ considerably in their core characteristics such as size.

TABLE 1 HERE

Table 1 shows some key features of the markets, illustrating this diversity in terms of factors such as population and wages, and the differences in the samples of the markets for first and second entry. Note, for example, that the maximum (male) wage is larger in the sample for second entry. This is due to two facts: first, there is general wage inflation as second entry observations by definition are later in calendar time than first entry observations from the same market. Second, there is a selection effect. If McDonalds systematically enters markets with above average wages earlier, the average (and maximum) wages in the sample for second entry will be higher than those in the sample for first entry. Further, note that average geographical size of markets at risk of second entry is considerably *smaller* than that of market at risk of first entry. The average population of second entry markets is larger by some 40%. Clearly, they are much more densely populated.

Because of the large variation in characteristics, we may expect that some markets are considerably more attractive prospects to enter than others and hence will be entered sooner. Our estimation strategy relies on the position that the characteristics of the innovator remain essentially constant, whilst the characteristics of the units of observation vary considerably, so that we may hope to identify precisely the key elements of districts that influence the decision process in determining duration before entry.

TABLE 2 HERE

[5] By lucky chance, the last major re-organization of the structure of districts was completed in 1974, since which all changes have been minor. Basic demographic data is available since 1974. To these we add data on distance of the district from McDonalds Head Office, in miles by road- see later.

[6] Prevailing planning guidance states that sufficient supply from existing outlets is not a criterion for refusing an A3 listing to a proposed new outlet. However, the number of A3 outlets in total within an area may be

The market as defined above is very amenable to study of innovative entry. Table 2 illustrates some key chronological features of the market as a whole. McDonalds introduced the counter service concept in 1974 and the established market player Wimpy eventually perceived it as a threat (Pollard, 1985). However, because it was dominated by existing franchised table-service outlets, Wimpy never strongly embraced the counter service concept, and indeed in a major industry reorganization in 1990, abandoned counter service altogether for many years. It is also not a chain that has experienced strong growth at any time since McDonalds' entry into the market. By contrast, the growth of counter service burger outlets in the hands of McDonalds has been remarkable in extent, so that we have plenty of activity to observe, and remarkable also in that virtually no closures have taken place- we are observing entry without exit. Thus, we are observing a successful innovation, embraced wholeheartedly by the company. McDonalds went from 0 to 381 outlets in 17 years, with but a single confirmed exit. We finish our main exploration of the data in 1990, since in 1991 Burger King becomes a credible second force in the industry for the first time. Prior to this, McDonalds had no powerful competitors. However, we plan to re-examine this later period using the same maintained assumption to check the nature of the impact upon the McDonalds expansion process. One other feature worthy of note is that in the UK, McDonalds largely developed as a management-operated company, not through franchise operation. Franchising did not start until 12 years had elapsed since the first entry and even by 1995, only 20% of outlets were franchise operations. Moreover, it is a highly centralized company, whose franchisees do not make independent decisions about location of outlets. Therefore, we consider the location decision to be a prerogative of central management and aggregate franchised and managed outlets together.

FIGURE 1 HERE

Figure 1 shows that, viewed as an innovation, McDonalds' spread across local authority districts does indeed take on the characteristic "S"-shaped diffusion pattern observed

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constrained.

in so many previous studies. Similar figures drawn for second and for third entry into a district do not exhibit a slackening of growth in the later periods, indicating a less mature degree of fill-in, as might be expected. However, our purpose is not to demonstrate that an S-shape exists, but rather to examine the much more sophisticated issue of explaining duration before entry into particular districts. In this context, the firm McDonalds represents the supply side in this study, and it is assumed to be the decision-making unit, choosing where to supply each subsequent McDonalds outlet.

McDonalds outlet data was obtained direct from the Company's UK head office. It embodies information on store location, including the postcode and telephone number, store type (owned or franchised, drive through or not), exact opening date and store number[7]. There are 381 outlets included in the main estimation dataset and each is matched to a Local Authority District using either a Midas "Postzon" package based on UK postcodes, the Bartholomew Postcode Atlas of Great Britain and Northern Ireland (a Royal Mail publication), or the website www.upmystreet.com.

The Local Authority Districts are physical places and they represent the demand side in this study. This is the smallest consistent unit of local government in the UK, and generally consists of a city, or a town with some hinterland, or a largely rural area. The estimation dataset relates to 455 districts, since districts in Northern Ireland and most island-based districts (the Scilly Isles, Orkney, Shetland and the Western Isles) are not included in this study. There are 17 consistent annual observations for each of the 455 districts within the estimation sample, namely; geographical area, population, the distance from the district to the McDonalds headquarters, the number of McDonalds outlets in neighboring districts and full-time male wages. The geographical area and population data mainly come from Regional Trends (formerly Regional Statistics).[8] In certain cases, the definition of the districts has

[7] The store number provides a very useful cross-check on opening data and enables us to verify exit.
[8] A full list of district-level data is not available for all years, and therefore various Regional Trends sources (Office of Population Censuses and Surveys and Annual Report — Registrar General Scotland) are used in addition. The wage data are at sub-regional level.

changed in minor ways during the 1974-1990 period.[9] Population and area data for the districts in question is transformed to be consistent with the 1990 definition of the districts[10]. The distance from each district to the McDonalds headquarters in Finchley is calculated by assuming that the location of the district is at the named place in the case of a district based on a particular name e.g. Coventry in the case of Coventry district. In some cases, the district's name does not correspond to a name on a map, and in this case, the location of the main council offices is taken to be the place. Distance is then calculated using the Automobile Association product 'A to B'; a commercial software product designed to help people plan their journeys.

For each year of study in each district, the number of pre-existing McDonalds' in neighboring local authority districts is calculated. Neighboring districts are identified by using maps from the Office for National Statistics. A neighboring district is defined as any district connected continuously by more than a single point to the district in question.

Using the panel of market-level data described above, *the hazard of McDonalds opening an outlet in market j in year t* is investigated. We view the prime question as being whether or not an outlet is opened, rather than the size of the outlet opened, which is a second-order decision. Also, the time to first and to second entry within a district is analyzed, allowing differences between first and second entries to emerge. Time starts running from January 1974 where the first entries are concerned, whereas time for the second entries starts running from the opening of the first outlet. Hence, second and higher outlets have different calendar times.

FIGURE 2 HERE

In Figure 2 we depict the empirical hazard rate of first entry. As can be seen, it rises relatively quickly to 7-8%, and shows signs of decline towards the end of the sample period.

9 We use geographical area data to check consistency in local authority definition over time, with any discrepancy >1% investigated.

10 In order to construct the revised population data, the percentage of an area that is to be added to another is multiplied by the former area's population figure to give the amount by which the latter's population has to increase. Consequently, the former area's population is reduced by the same amount.

This reflects most likely two facts: first, the best markets by then already have a first outlet, and second, the remaining markets without outlets are less attractive than is second (or higher) entry into those markets where the first outlet is already in place. Figures 3 and 4 respectively show how the sample for second entry evolves, and the empirical hazard rate for second entry. Note that the hazard is not calculated in calendar time, but in years from first entry. Figure 3 shows that more markets are "at risk" of having a second entry, the later the time in the sample we consider. Figure 4 shows the empirical hazard. It exhibits a relatively steady increase over time, the exception being year 14, in which no entries occurred.

FIGURES 3 AND 4 HERE

3. Modeling Entry

Let us first consider the hazard of McDonalds opening a first outlet in market j in year t. Our approach is very reduced form and assumes the company selects new locations on the basis of expected profitability, choosing to locate in a subset of districts in any one year.[11] We assume that all districts are potentially "at risk" each year[12] and assume that in principle the firm opens everywhere where it is profitable to do so at that time. However, we know that exploring and investing in new sites is a time-consuming activity and development of the chain takes many years. There are several possible explanations for this pattern. Either there may be a limit on how many outlets can be accurately assessed per year, for institutional reasons (so that for example a multi-stage decision is taken, with some opportunities examined in more detail than others), or development costs may fall over time as a result of innovations and economies in the process,[13] or demand may rise over time as consumers become more used to buying the product, so rendering increasing numbers of sites viable. Whichever of these is the case, it will become profitable in surveying potential locations over

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[11] Presumably, in principle decisions regarding exit are also taken, but we ignore these on de minimis grounds.
[12] There is strong evidence in the data for an annual planning round.
[13] As an example, there is some indirect evidence on this coming from a presentation by McDonalds executives to a conference at CIFE, Stanford in 1997. The emphasis in this presentation was on a new approach to developing outlets that reduced the time and money spent on developing outlets through linking the work of architects, contractors, etc much more closely through use of common technology platforms. This approach was

time to open outlets in previously sub-marginal areas. Thus at any given point in time, whichever of these processes is in operation, choices are made about the next sites to open. The likely main influences on the process can be discerned from the literature reviewed earlier.

The most important factor potentially involved in explaining duration before entry (or the hazard of entry, which is what we actually examine) is market size, of which the proximate determinant is population- the greater is population of potential consumers, the greater the hazard of entry. Given market size, we may argue, the more densely populated is the market the greater the hazard, so that the larger the geographic area covered by the local authority, ceteris paribus, the lower the hazard. But in both cases these are likely to be non-linear relationships- e.g. doubling market size is unlikely to halve the time before an outlet opens in that district. Given population, demographics may also have an influence.

Distance from Head Office of McDonalds is also likely to have an influence, either in terms of demand or, perhaps more plausibly, in terms of costs. The further away is the district from head office, the greater the costs of surveying potential sites and arranging construction, the more likely are tastes to be unknown or undeveloped and the more costly to monitor and to service the outlet with inputs. Again these factors are likely to have a non-linear impact on the hazard and we take this into account in our empirical formulation by using each variable and its square as explanatory variables.

Wage levels are also likely to have an impact, coming either from the demand or the cost side. In terms of demand, higher wage levels in an area increase demand, other things equal. In terms of costs, higher wage levels mean greater costs of operating an outlet. Hence the overall impact is unclear. Again, there is no reason to expect the effect to be linear. We include only the squared (male) wage rate into the estimation equation. The reason is that having both the linear and squared term created problems in the second entry estimations, and to retain the comparability of first and second entry results, we dropped the linear term from

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being introduced as a concept in the US starting in 1993.

the first entry estimation as well.[14]

Outlets in neighboring districts present a more difficult problem. In developing an area, if there are already outlets in neighboring areas, we conjecture it makes it more likely that an outlet will open *ceteris paribus* - there are economies of density in examining locations and in servicing sites.[15] In line with Toivanen and Waterson (2001), it is also possible that McDonalds learns about "true" market size through outlets in neighboring districts. This happens if regional tastes (initially unobserved by McDonalds) are correlated across districts. If indeed these factors are important, then "geography matters"- the development of the chain will be conditioned by the fact of where it started. We measure neighbors by dividing the number of outlets in neighboring districts (at the beginning of the period) with the geographical area of the district itself. The idea is that the larger the geographical district, the smaller are the potential economies of scale, and the learning effects from outlets in neighboring districts. We treat this variable as exogenous for two reasons. First, since it is measured at the end of the previous period, it is by design independent of the contemporaneous error term.[16] To explain the second, consider market i. We allow that entry decisions into i are affected by the (area-weighted) number of neighboring outlets, and that entry decisions into i's neighboring markets are affected by the number of outlets in i. For the neighbor-variable to be endogenous, entry decisions into neighboring markets would have to be affected by the unobservable of market i over and above the effects of existing outlets in market i. We consider this very unlikely.[17]

We consider second entry to be subject to the same basic determining factors as is first entry[18], although we have very much less in terms of previous work to guide us in this area, since it has barely been considered within the diffusion literature. Thus, for example, the

[14] The linear wage always obtained an insignificant coefficient.
[15] On the other hand, it is possible that neighboring area outlets will "spoil" a market if they are too close.
[16] Notice that our model does not involve forward- looking behaviour on McDonalds' part.
[17] Blundell and Powell (2001) propose a method (control function estimation) that would allow us to treat neighboring outlets as an endogenous variable.
[18] This is in line with Battisti and Stoneman (2002) who use inter-firm diffusion approaches in their investigation of intra- firm diffusion.

larger the population, the earlier a second outlet will be opened in a district, ceteris paribus. Hence, our basic estimating equation in both cases is along the following lines:

Hazard = f(**pop**, **area**, **dist**, **wage**, neighbor) (1)

4. Econometric Method

Our objective is to model the conditional probability that a McDonalds outlet will enter a particular district, conditional upon one not having entered up to that point in time. We estimate the time duration (hazard) to first entry using a non-parametric baseline hazard estimation procedure, on top of which we place a parametric explanatory element using the variables listed in (1) above.

Although the underlying process can be thought of as occurring in continuous time, the data are not observed in that form. The survival times have been grouped into discrete intervals of time (years) so that observed spell lengths are summarized using positive integers. For the purpose of this study, the observations on the transition process are therefore assumed to occur in discrete time. The discrete-time hazard can be thought of as a conditional probability rather than a rate and is therefore bounded between zero and unity. We use the Prentice-Gloeckler (1978) model incorporating a gamma mixture distribution to summarize unobserved heterogeneity, as proposed by Meyer (1990). This is a proportional-hazards model, also known as a log-relative hazards model, that implies that absolute differences in explanatory variables lead to proportionate differences in the hazard rate at each point in time. Explanatory variables included in the model are either fixed over time (area and distance) or are time-varying (population and neighbors). The time-varying covariates are assumed to vary between time intervals but to be constant within each of them.

The discrete-time model we consider can be obtained by grouping time in the continuous-time proportional-hazards model. Each district $i = 1,\ldots n$, faces the possibility that a McDonalds outlet will open within its border at time $t = 0$. The continuous-time hazard function for district i at time $t > 0$ takes on the proportional hazards form

$$l\left(t;x_i\left(t\right);u_i\right)=l_0\left(t\right)u_i\exp\left\{x_i\left(t\right)'b\right\} \qquad (2)$$

where $\lambda_0(t)$ is the baseline hazard at time *t*, *u* is a gamma distributed random variable, exp(.) is the exponential function, $x_i(t)$ is a vector of covariates summarizing observed differences between individuals at *t* and β is a vector of parameters to be estimated. The baseline hazard is assumed to take on a non-parametric form that allows differential effects between years. This strategy focuses on estimation of the regression coefficients β leaving the underlying baseline hazard describing the data completely unspecified.

Failure to control for any unobserved or omitted district-specific effects that may affect the hazard function will lead to inconsistent parameter estimators (Lancaster, 1990). Unobserved or omitted heterogeneity between districts is addressed in the above model by including a gamma distributed random variable *u*, with unit mean and constant variance σ^2. A maintained assumption is that *u* is distributed independently of *x* and *t*.

The associated continuous-time survivor function is

$$S\left(t;x_i\left(t\right);u_i\right)=\exp\left\{-u_i\exp\left(x_i\left(t\right)'b\right)H\left(t\right)\right\} \qquad (3)$$

where $H\left(t\right)=\int_0^t l_0\left(t\right)dt$ is the integrated baseline hazard

The underlying continuous durations are, as mentioned above, only observed in disjoint time intervals $[0=a_0, a_1)$, $[a_1, a_2)$, $[a_2, a_3)$,…,$[a_{k-1}, a_k=\infty)$. Given that a proportional-hazards model is assumed, the discrete-time survivor function for the *j*th interval has the same form as (3),

$$S\left(a_j;x_i\left(t\right);u_i\right)=\exp\left\{-u_i\exp\left(x_i\left(t\right)'b\right)d_j\right\} \qquad (4)$$

where $d_j=H\left(t\right)$ for $j=1,\dots,k$

and the discrete-time hazard in the *j*th interval is

$$h_j\left(x_{ij};u_i\right)=1-\exp\left\{-u_i\exp\left(x_{ij}'b\right)g_j\right\} \qquad (5)$$

where $g_j=\int_{a_{j-1}}^{a_j} l_0\left(t\right)dt$

All intervals are assumed to be of unit length, and the recorded duration for each district *i* corresponds to the interval $[t_{i-1}, t_i)$. Those districts having a McDonalds entry during the interval are identified using the censoring indicator c_i = 1, and those that remain in the state are identified using c_i = 0. The latter have no entry during the interval and are right-censored. Given these assumptions, the log-likelihood function for the sample of N districts is

$$\text{LogL} = \sum_{i=1}^{N} \log\left\{(1-c_i)A_i + B_i\right\} \tag{6}$$

where

$$A_i = \left[1 + s^{2} \sum_{j=1}^{t_i} \exp\left[x_{ij}'b + q(j)\right]\right]^{-s^{-2}}$$

and

$$B_i = \left[1 + s^{2} \sum_{j=1}^{t_i - 1} \exp\left[x_{ij}'b + q(j)\right]\right]^{-s^{-2}} - A_i \qquad \text{if } t_i > 1$$

or

$$B_i = 1 - A_i \qquad \text{if } t_i = 1$$

where *q(j)* is a function describing duration dependence in the hazard rate.

5. Estimation Results

Column 1 in Table 3 shows the results of the estimation of the first entry hazard. All models control for unobserved (Gamma distributed) heterogeneity. Tests showed that models with such controls are preferred to models without. Results with parametric baseline hazards and without controlling for unobserved heterogeneity were very similar and are therefore not shown. We see that almost all explanatory variables have a significant impact on the hazard of first entry; in each case the effect is non-linear. Population has an increasing impact on the hazard, tailing off as population increases, but still comfortably positive at the mean. Distance, in an opposite manner, has an initial negative influence on hazard, but the influence tails off as distance increases. At the mean, it is still negative. Area of the district has an essentially similar impact to distance, with the implication being that with population held constant, as population density increases, the hazard increases, but at a decreasing rate. The number of outlets in neighboring districts has a positive impact on hazard of entry, indicating economies of scale and/or learning effects of there being nearby outlets. All these variables have a statistically very significant impact upon the hazard.

TABLE 3 HERE

FIGURE 5 HERE

Figure 5 shows the basic pattern of the underlying estimated baseline hazard: The hazard increases strongly in the later years, although the estimates of the values for the later year dummies are admittedly somewhat imprecise. Comparisons with the raw entry rate depicted in Figure 2, are interesting. As can be seen in Figure 2, the hazard increases rapidly after about the first seven years of presence, then shows signs of tailing off towards the end of the period of observation,[19] in a way broadly consistent with the estimated values. Figure 5 also demonstrates the effects of geography by displaying the difference in the estimated hazard at sample mean of distance from the estimated hazard at the sample minimum (6.1 miles) of distance- as can be seen the impact is very significant.

Turning then to the second entry results in column (2) and comparing them with column (1), we see that the pattern of signs is reversed for population, while results for area are close to each other. What is slightly puzzling is that the population effect is negative at the mean of (2nd entry sample) population. Distance results are close, although now the linear distance term obtains an insignificant coefficient. Wages have the opposite (positive) effect on second entry. Interestingly, the number of outlets in neighboring districts (divided by own geographical area) now carries a large negative coefficient. A plausible story for this is that (on average) the neighboring outlets have a negative effect on sales of the 2nd outlet due to partial spoiling of the market.

6. Conclusions

Our results show that the basic structure of explanatory variables we have developed is capable of capturing very nicely the underlying elements of the hazard of entry of a McDonalds fast food outlet into a district of the UK. One implication worthy of note is the extent to which "geography matters" to the result- it matters not just what the characteristics

[19] There is thus no strong evidence that the introduction of franchising led to an increase in the hazard of first entry.

of the district are, but also how far it is from head office, and whether the firm has a presence nearby or not. In this respect, we may conjecture that if McDonalds had started in Glasgow, or Birmingham or Manchester say, rather than Greenwich in London, the overall pattern of development would have been very different. It would be interesting indeed if it transpires that this result is true more generally, something we intend to examine in later papers.

Furthermore, the findings regarding neighboring outlets, whilst obviously subject to caveats, are also intriguing, because they reinforce the influence of distance on the outcome. They also imply that chance regarding the location of early outlets (for a given distance from head office, and given population etc.) can have an influence on the spread of a chain. For example, it would seem that if a chain develops first in a westerly direction, then this westerly bias is likely to continue. This is a fascinating possibility, which obviously requires further investigation.

Table 1

Descriptive Statistics on Local Authority Districts				
First Entry Sample	**Mean**	**Standard Deviation**	**Minimum**	**Maximum**
Area (1000 square km)	0.557	0.765	0.003	6.497
Population (Hundred thousands)	0.108	0.090	0.005	1.087
Wage (£1000)	0.134	0.064	0.040	0.345
Distance (miles)	182.139	133.9086	6.1	674.4
Second Entry Sample	**Mean**	**Standard Deviation**	**Minimum**	**Maximum**
Area (1000 square km)	0.116	0.061	0.003	5.236
Population (Hundred thousands)	0.153	0.087	0.004	1.022
Wage (£1000)	0.211	0.056	0.043	0.535
Distance (miles)	110.2019	88.75329	6.1	565.3

NOTE: Number of observations in the first entry sample 6342, in the second entry sample 1276.

Table 2
Key Dates in the UK History of Burger Retailing

Date	Event
1955	Wimpy brand established as offshoot of J Lyons
1974	McDonalds opens first store
1977	Wimpy chain bought by United Biscuits
1978	Wimpy establishes first counter-service outlet
1982	Wimpy has 35 counter service outlets
1983	McDonalds exceeds 100 outlets
1986	Wendy's leaves the UK, selling last 16 restaurants
	McDonalds exceeds 200 outlets
	McDonalds starts to franchise outlets
1988	Burger King brand (at this time small) bought by Grand Met
1989	Grand Met buys Wimpy from United Biscuits
1990	Burger King has 60 outlets
	Grand Met’s burger operations separated into table and counter service
	Counter Service operations mostly rebadged as Burger King
	Wimpy International formed with 220 table-service outlets by management buy-out from Grand Met. Grand Met insists on 3 year agreement preventing Wimpy opening counter service or drive in outlets
1993	June: Grand Met/ Wimpy agreement expires
	Wendy's plans return
	McDonalds has around 500 outlets
1994	Wimpy has 240 outlets, all eat-in
end 1995	Burger King has approx. 300 outlets McDonalds has over 600 outlets
May 1996	Wimpy has 272 outlets
	McDonalds and Burger King each opening around 70 restaurants per year
1998	Wendy’s has around 10 outlets
2001	Wimpy still has less than 300 outlets, McDonalds over 1000 outlets

Table 3
Estimation Results

Variable	First Entry	Second Entry
Population	20.352***	-58.282***
	(2.960)	(8.019)
Population squared	-20.600***	69.100***
	(4.230)	(12.100)
Area	-2.824***	-2.465**
	(0.466)	(1.243)
Area squared	0.456***	0.059
	(0.084)	(0.053)
Distance from HQ	-16.695***	-15.653
	(3.190)	(10.292)
Distance squared	22.700***	50.100*
	(6.27)	(27.600)
Wage (male) squared	-0.047***	0.104***
	(0.016)	(0.021)
Neighbors per unit area	0.5745**	-3.4162***
	(0.2620)	(0.7310)
Nobs.	6342	1276
LogL.	-763.0101	-339.5886
LR	490.4942***	295.8743***
	(24)	(20)
Unobs. Het.	0.000	0.000

Notes: Numbers reported are coefficient and standard error. All estimations incorporate a non-parametric baseline hazard and Gamma distributed unobserved heterogeneity. Separate period dummies for all those periods where entry occurs.
LR = LR-test of the joint significance of the model (d.f.). Differences in degrees of freedom is due to different grouping of period indicators in the baseline hazard.
Unobs. Het. = p-value for the Gamma-distributed unobserved heterogeneity.
*, **, *** denote significance at 10, 5, and 1% level.

Figure 1: McDonalds First-Outlet Diffusion

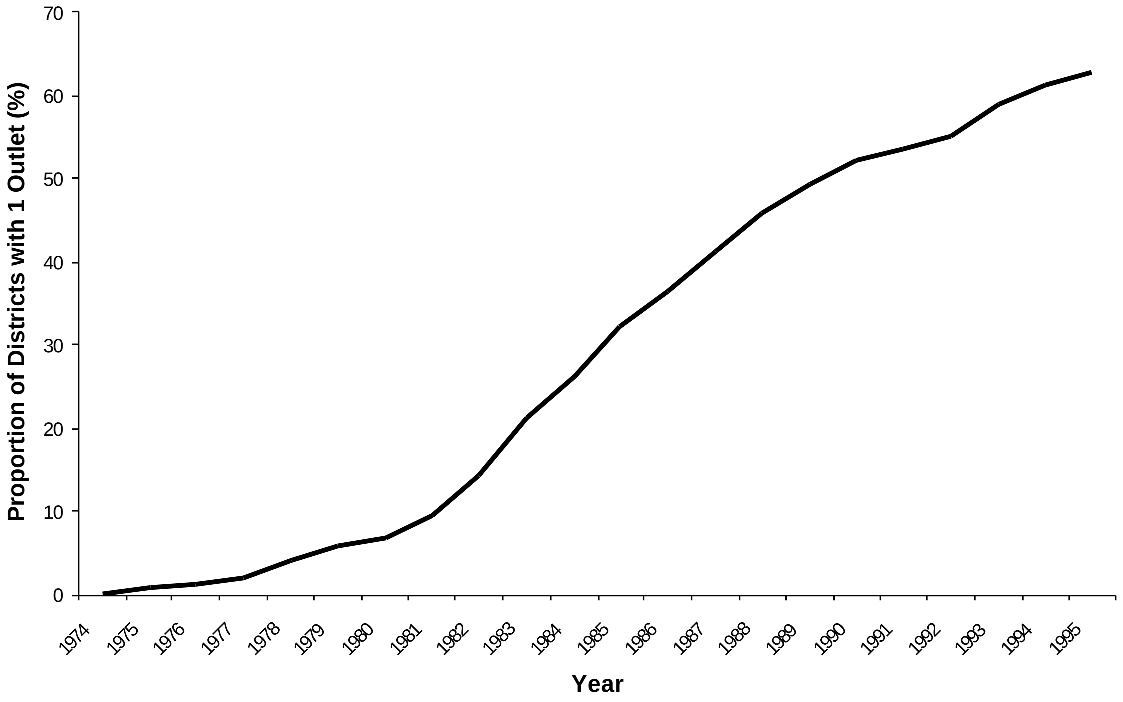


Figure 2
1st Entry Empirical Hazard Rate

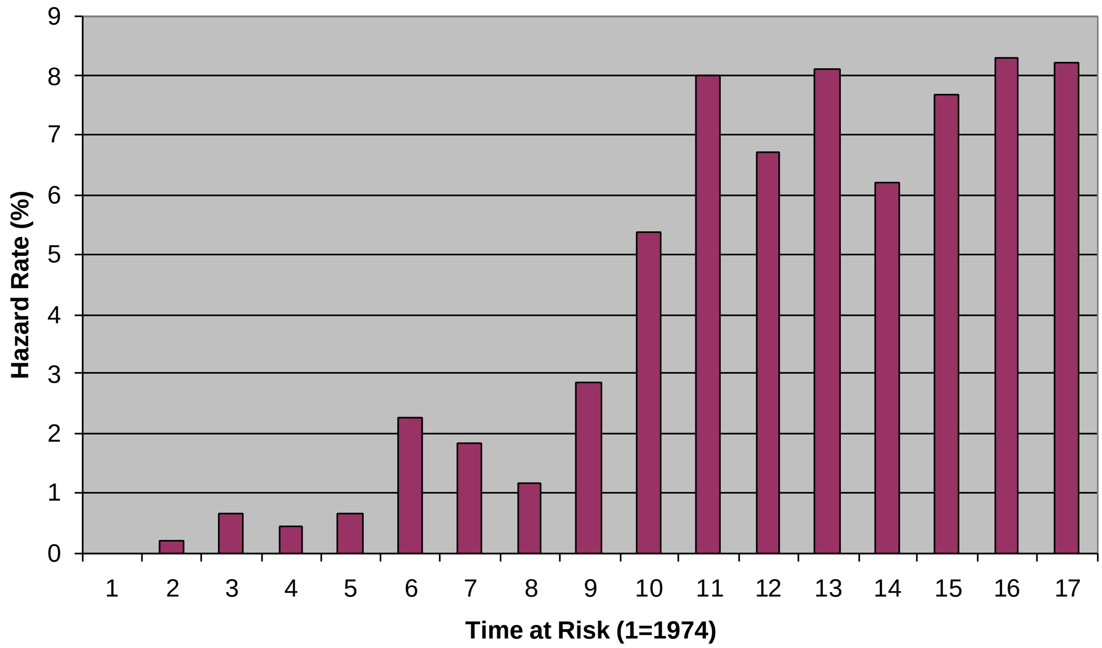


Figure 3
Distribution of Time at Risk for 2nd Entry

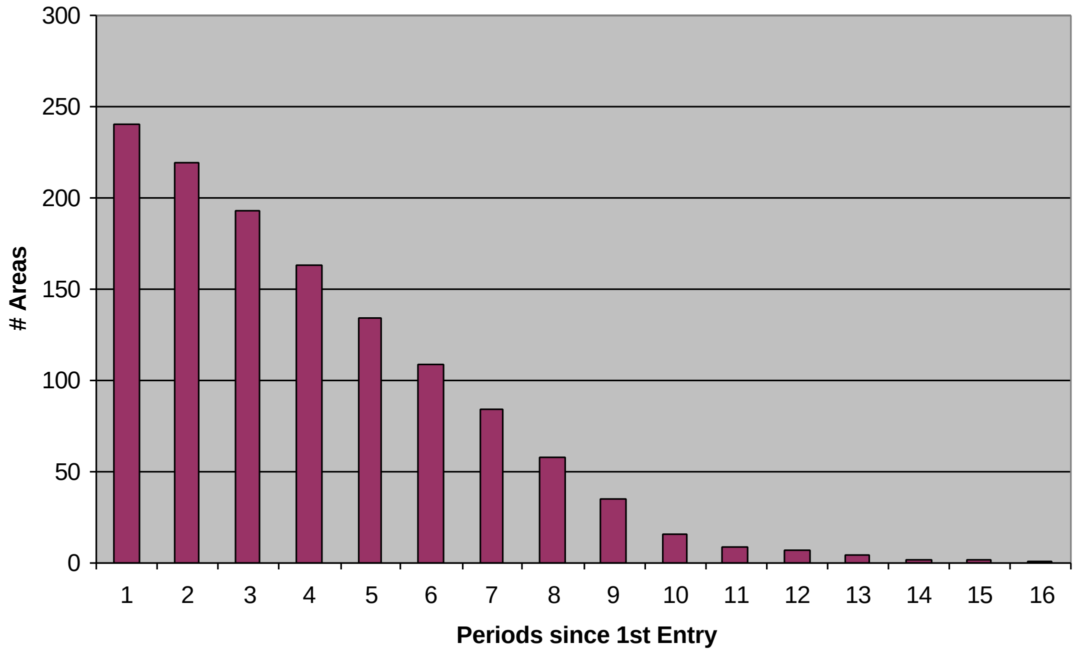
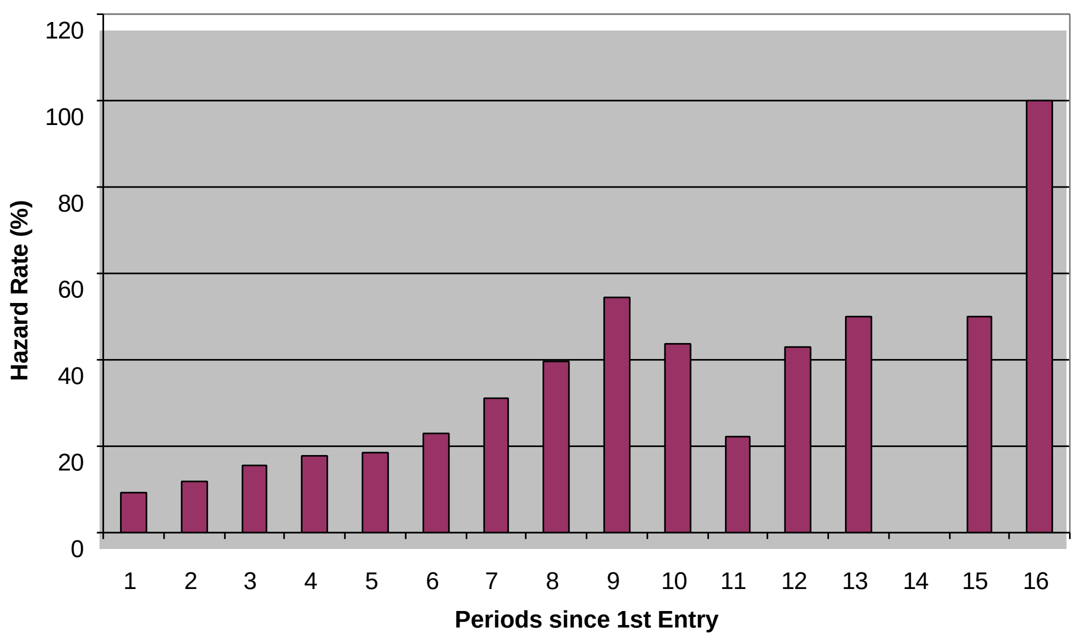


Figure 4
2nd Entry Empirical Hazard Rate



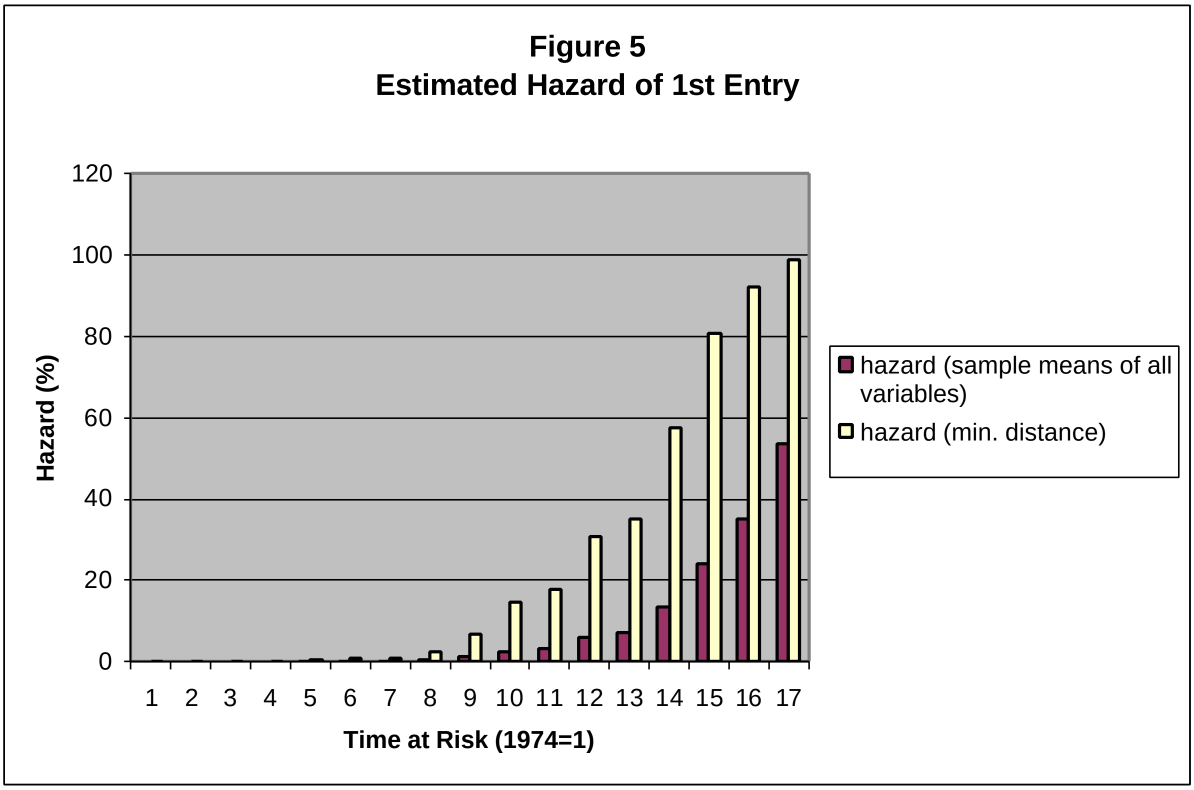


Figure 5
Estimated Hazard of 1st Entry
Hazard (%)
120
100
80
60
40
20
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
Time at Risk (1974=1)
hazard (sample means of all variables)
hazard (min. distance)

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