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**AN ECONOMETRIC ANALYSIS OF IRISH
HOUSEHOLDS' FOOD AWAY FROM HOME
(FAFH) EXPENDITURE PATTERNS 1994 - 2000**

Conor Keelan B.A., M.A., H. Dip (Ed)

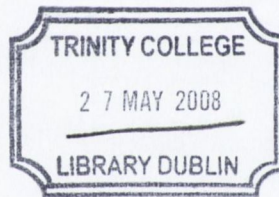
Department of Economics

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Thesis submitted to Trinity College Dublin in fulfilment of the requirements for the
degree of Doctor in Philosophy (Ph.D.)

October 2007



THESIS
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DECLARATION

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SUMMARY

In this thesis, the factors shaping Irish households' Food-Away-From-Home (FAFH) expenditure decisions are analysed using the 1994/5 and 1999/2000 Irish Household Budget Survey datasets.

Chapter 1 outlines why FAFH is selected as the variable of interest in this analysis, particularly as it has experienced considerable growth in Ireland in recent times. In addition, a comparative analysis is undertaken of FAFH expenditure in the UK. As the UK market is at a more mature stage of development than its Irish equivalent an analysis of this market may indicate factors which will influence growth in the Irish FAFH market into the future. Due to the diversity of the FAFH industry in both Ireland and the UK a disaggregated analysis is undertaken with the two largest components of the industry, the quick-service (fast food and takeaway) and full-service (hotel and restaurant meals) sectors being analysed separately. While a variety of factors are influencing growth in both sectors of the market health awareness and the demand for convenience have been identified as among the most important.

In chapter 2 the specific model use in this thesis, which is based on Household Production Theory, is derived. Chapter 2 discusses the econometric methodology used in this thesis which is required due to the presence of zero observations on the dependent variable. A number of different models are described in detail including the tobit and double hurdle model and semiparametric alternatives, namely the CLAD and the SCLS estimators. The benefits and problems with each approach are identified and specification issues are addressed in some detail.

In chapter 3, components of the 1994/5 and 1999/2000 Irish Household Budget Survey datasets are introduced together with the corresponding 2001/2 and 2002/3 UK Expenditure and Food Survey datasets. The sample and the variables used in the analyses of the thesis are described with specific attention paid to describing the chosen dependent and independent variables and how they relate to each other.

In chapters 4 and 5 an econometric analysis of quick-service and full-service expenditures in Ireland are presented based on the data described in chapter 3, with the Ireland-UK comparative analysis presented in chapter 6.

Chapter 4 of the thesis devotes itself to exploring alternative approaches to the standard maximum likelihood estimation (MLE) procedures usually used in the estimation of censored regression models. The SP models eliminate the need to transform MLE models to obtain consistent estimates in the presence of misspecification. However, in order to maintain their robustness they purge outlying observations therefore reducing the sample size. Many of the SP results performed poorly when compared to an unadjusted tobit model which raised questions about their efficiency as they had a reduced sample size. An adjusted tobit model proved far superior to the SP estimators indicating that with considerable asymmetry in the dataset the efficiency of the SP estimators is greatly reduced.

Chapter 5 presents an analysis of Irish household expenditure in each sector of the foodservice industry using a double hurdle model. Chapter 6 compares the factors determining FAFH expenditure in both Ireland and the UK using a double hurdle model. Perhaps the most interesting point to highlight is how similar the Irish and UK results for both quick-service and full-service expenditure are despite the UK industry being at a more mature stage of growth. For example UK households with high levels of health awareness are less likely to frequent quick-service outlets than other households, similar to the result found in the Irish analysis. The results also indicate the existence of a health-convenience trade-off. The most likely consumers of quick-service products are younger households with lower levels of education, social class and health knowledge. Additionally, in the Irish results these households are typically resident in urban areas. The more likely consumers of full-service products are younger households with higher levels of education, health awareness and social class as well as homeowners, and commuter households in Ireland. The UK results appear to suggest that households with high levels of health awareness are still less likely than others to consume quick-service products indicating that the quick-service sector will have to do more to counter its perceived unhealthiness into the future.

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Chapter 1

Introduction

1.1 The Research Question

The primary objective of this thesis is to identify the economic and socioeconomic factors influencing Irish households' expenditure on Food-Away-From-Home (FAFH). The project will utilise cross-sectional data and apply sophisticated econometric techniques, described in more detail in subsequent chapters, to analyse the determinants of FAFH expenditure. In addition, a comparative analysis of FAFH expenditure in the UK will be undertaken. The UK market is at a more mature stage of development than its Irish equivalent and this analysis should assist in projecting growth in the Irish FAFH market into the future. In this study food is classified as 'at home' and 'away from home' on the basis of where the food is prepared or obtained, not where it is consumed (Lin *et al.* 2001). This definition is important for the analysis in that it includes takeaway meals eaten at home. FAFH has been defined as a special type of demand as it incorporates the demand for convenience from eating away from home and the demand for pleasure derived from a social occasion (Lund, 1998). FAFH can be seen as a respite from domestic food preparation and also an attempt to derive pleasure and satisfaction from social intercourse. While it is expected that individuals with high time constraints would be more likely to consume FAFH, those with higher incomes may also have a preference for the luxury of eating out.

Ireland has seen record levels of economic growth correlated with rising incomes and increased employment in recent years. This has had corresponding effects on the leisure time of households and led to an increase in the number of ‘cash rich – time poor’ households and ‘time starved’ consumers. These prosperous times have seen growth also in the amount of weekly household expenditure. The 1999/2000 Household Budget Survey (HBS) dataset reports an average weekly level of household expenditure 46 percentage points higher than that reported in the 1994/5 HBS dataset (C.S.O. 1997, 2002).¹ During this time the proportion of total expenditure on food has fallen, from 23 percent in 1995 to 20 percent in 1999/2000 (C.S.O. 1997, 2002). This indicates that despite the growth in incomes and expenditures, socio-economic factors must be having a greater influence on food expenditure patterns. Further investigation indicates that an increasing amount has been spent on convenience products such as FAFH. Table 1.1 illustrates that in 1987 the percentage of the total food expenditure spent on FAFH was 14 percent while in 2000 this amounted to 23 percent (C.S.O. 1989, 1997, 2002).² Bord Bia (2003) estimated that in the European Union (EU) as a whole approximately 35 percent of food expenditure was spent on FAFH in contrast to a US average of approximately 50 percent.

Until the results of the 2004/2005 HBS become available it is difficult to get a concrete estimate of the current share of Irish food expenditure allocated to FAFH, however, it is thought that the figure is rapidly approaching the EU

¹ This represents a real increase of 35% when accounting for relative prices.

² In this thesis total food expenditure encompasses expenditure on all food and beverages.

average (Mintel, 2004a).³ This shift in consumer preferences for eating out of home in Ireland has been documented previously through qualitative studies but has not been supported by any econometric analysis (Mintel, 1999; 2001; 2002; 2004a). This study intends to address this deficiency. Table 1.3 illustrates that the percent of food expenditure spent on FAFH in the UK in 2001 was 33 percent. In 2002 this reached a level of 34 percent of total food expenditure, indicating a more mature market than the Irish FAFH equivalent.⁴

Research in Ireland using cross-sectional data to identify the determinants of demand for various food groups is in its infancy. Previous research (Newman *et al.* 2001; 2003) analysed the factors influencing the demand for meat and prepared meals.⁵ Among the findings of the research was the conclusion that convenience and health awareness were significant determinants influencing expenditure on meat and prepared meals. Investigating FAFH expenditure in Ireland is a natural progression from this research. In an increasingly consumer oriented society it becomes important to analyse factors that are contributing to this shift in preferences.

³ It was beyond the scope of this thesis to analyse the 2004/5 HBS. At the time of writing preliminary findings are available on the C.S.O.'s website but the whole dataset will not become available until at least November 2007.

⁴ These figures are derived from the Expenditure and Food Survey (EFS) for 2001 and 2002. The EFS is the UK equivalent of the Irish HBS though is compiled each calendar year. The 2001 and 2002 surveys were the most recent available when the thesis commenced. In the 2004/5 EFS FAFH expenditure was estimated at 38% of total household food expenditure (DEFRA, 2007).

⁵ Prepared or ready meals can be defined as meals which are cooked or microwaved directly without requiring any additional preparation.

The remainder of this chapter will discuss the foodservice industry in Ireland and the UK and will define the sectors of the industry that will be analysed in this thesis.⁶ There will follow a discussion of the major trends that are influencing current and future demand. The main findings of the literature review will then be summarised and the structure of subsequent chapters will then be outlined.

1.2 The Industry

This study will concentrate on the foodservice industry solely, which can be regarded as all outlets concerned with the provision of food and drink for consumption away from home.⁷ The foodservice industry is a constituent part of the wider food industry. The other part is the grocery retail sector, which includes the major multiple chains, independent retailers, local markets and speciality independents such as greengrocers and butchers. In the past the division between the two sectors was very apparent. However, a key development in the food market of recent times has been the involvement of traditional grocery retailers in the foodservice sector, which has led to the division between the foodservice and grocery retail sector becoming increasingly blurred (DEFRA, 2007). Retail outlets have expanded particularly into the market of home meal replacement and prepared meals in response to the increased demand for convenience. The growing blurring of the boundaries

⁶ The Irish foodservice industry in this thesis refers to the foodservice industry in the Republic of Ireland. The foodservice industry in Northern Ireland comprises part of the UK foodservice industry.

⁷ Irish household expenditure on prepared meals, a part of the grocery retail sector, has been analysed in the past (Newman *et al.* 2003). Additionally alcoholic drink consumed away from home is not included in this definition. This additional restriction applies to both the Irish and UK foodservice industries.

between the foodservice industry and the grocery retail sector emphasises how most of the western world is becoming a convenience oriented society.

Bord Bia (2004) valued the Irish foodservice industry at €5.7 billion, as against €3.5 billion in 2003. This compared to a figure of €1.4 billion in 2001 (Bord Bia, 2001).⁸ The extent to which the industry has grown can be seen further when it is noted that growth rates of 17 percent per annum were observed for the three years up to 2001 (Bord Bia, 2001). The UK foodservice industry was valued at €31.1 billion in 2004 making it the largest single employer in the UK food chain with some 1.5 million employees (DEFRA, 2007). It has been estimated that the UK foodservice industry will reach a value of £51 billion by 2012 (Lewis, 2006).⁹ Across Europe, an extra 12.9 billion additional eating out occasions are forecast in 2008 relative to 2003 while the corresponding figure for the US is an additional 8.8 billion meals (Datamonitor, 2005). While the foodservice industry is at a higher stage of development in the US, the European figures are converging. The foodservice industry continues to grow in Europe and the US as consumers continue to be pressed for time and accordingly have little desire to utilise their home kitchen (Datamonitor, 2005). In addition, FAFH has evolved as eating occasions are becoming increasingly less planned, and are no longer restricted to special evening occasions or at the weekend.

⁸ Bord Bia's valuation comprised €3.2 billion for beverages and €2.5 billion for food. The most recent valuation of Mintel valued the Irish foodservice industry at €5 billion but did not disaggregate (Mintel, 2007).

⁹ This is based on a compound annual growth rate (CAGR) of 4.61% between 2004 and 2012.

The foodservice industry is the FAFH industry. It ranges from prisons to five-star hotels and from chip shops to gourmet restaurants. It covers the entire spectrum of society, at work, at leisure and increasingly, in transit (Bord Bia, 2001). Outlets from where FAFH can be obtained include fast food outlets and takeaways (quick-service), hotels and restaurants (full-service), healthcare catering and catering for the prison sector and the armed forces. Table 1.2 shows the Irish FAFH expenditure categories available for analysis in this study. The proportion of expenditure in work canteens, quick-service outlets and on tea/coffee (away from home) has increased, while the proportion of expenditure on school meals and hotel and restaurant meals has decreased over this period. However, given the growth rates in recent times any decreases in any sub-sector share must be considered in the context of an overall growing market. The UK FAFH expenditure categories are illustrated in Table 1.4. It can be seen that while the proportion of expenditure in work canteens and on school meals decreased slightly between 2001 and 2002 the proportion spent on contract catering has increased substantially. The UK has seen a 50 percent increase in the number of meals served by contract caterers in the past 10 years, a finding which supports the trends discussed above (Out of Home Group, 2006). Table 1.4 also illustrates that the overwhelming share of UK FAFH expenditure is concentrated in the quick-service and full-service sectors. As noted above any declines must be viewed with caution given the dynamic nature of the industry in both countries.

It can be seen that the industry is extremely diverse and it can be further separated into the 'profit' and 'cost' sectors. The profit sector is typically run by private enterprises who strive to make a profit whereas the cost sector is heavily subsidised and in some cases free to its users (prison service, education-catering, etc.) School meals fall under the cost sector while both the full-service and quick-service expenditure categories comprise part of the 'profit' sector. Work canteens can be seen to occupy an intermediate position as many canteens are subsidised. In this study FAFH is further defined as meals prepared or obtained from commercial facilities solely. This is similar to the approach taken by McCracken and Brandt (1987) who argue, that including non-commercial sources of expenditure skewed the results. This is also in keeping with most previous literature that recognised that the differences in results across studies can be largely explained by different definitions of FAFH, primarily including non-commercial facilities together with commercial (McCracken and Brandt, 1987; Byrne *et al.* 1996, 1998). Losing the school meal sector does not diminish this study as it comprises less than 1 percent of total Irish FAFH expenditure and less than 3 percent of total UK FAFH expenditure. The work canteen sector is also excluded due to the subsidised nature of many work canteens and because this category is in itself quite diverse.¹⁰ Tea/coffee away from home and contract catering are only recorded in the Irish and UK studies respectively and are therefore excluded on the basis that no comparison could be made in either case.

¹⁰ Prepared sandwiches obtained from sandwich bars and delicatessens are also included under the work canteen expenditure category in the 1999/2000 Irish HBS making it difficult to obtain a clear picture of the category. It is hoped that this may be rectified in the 2004/5 HBS.

This thesis will focus on analysing the quick-service and full-service sectors solely. Many previous studies on FAFH in Europe have examined the entire market (Manrique and Jensen, 1998; Mihalopoulos and Demoussis, 2001; Mutlu and Gracia, 2004). However, little work has been done to date on disaggregating the market into its diverse sectors.¹¹ Given the diversity of outlets within the industry, and the fact that different factors will likely influence expenditure in different outlets in different ways, a disaggregated approach is considered crucial to obtain a better understanding of the dynamics of the FAFH industry in Ireland and the UK. FAFH expenditure in Ireland has grown rapidly in recent times, mirroring similar trends in Europe and America, while FAFH expenditure in the UK has consolidated and also grown at a constant rate.

1.2.1 The Quick-service Sector

The quick-service sector analysed in this study is in itself quite diverse. It comprises expenditure at the branded fast food chains, the traditional chip shop takeaway and ethnic takeaway, the most prevalent of which are Chinese and Indian (Mintel, 2001). Ethnic foods appear to be benefiting from less traditionalism in the Irish diet and greater exposure to foreign culture through increased travel and increased globalisation (Mintel, 2001). Within this sector the fast food chains and the ethnic takeaways are forecast to have the fastest growth potential at present, in contrast to the chip shop sector, which is expected to be affected negatively from the decline in cod stocks (Mintel,

¹¹ One study disaggregated the Greek market into expenditure on restaurant meals, expenditure in coffee houses and expenditure on takeaway meals and canteens (Lazaridis, 2002). The first such US study analysed both quick-service and full-service expenditure (McCracken and Brandt, 1987).

2004a). Overall the quick-service sector is seen as having the fastest growth potential of the overall FAFH market in Ireland (Mintel 2001; 2004a).

Datamonitor (2005) remarked that the importance of quick-service restaurants as a proportion of total foodservice transactions is significantly higher in the US than in Europe (with the exception of the UK and The Netherlands). Quick-service in the UK continues to be dominated by branded chains, such as McDonalds, accounting for some 54 percent of total sales (DEFRA, 2007). Sandwich bars and coffee shops have experienced substantial growth in recent years, however. These outlets, with the added focus on health and freshness, have been described as fast and casual bringing together a blend of quick-service and leisure (full-service) dining (Tragus Holdings, 2005). Quick-service restaurants have taken steps to improve their health credentials as a result. Regardless, the main threat to the quick-service sector in the UK is the highlighting of the sector as a potential contributory factor to obesity. The quick-service sector in both countries is at a transitional phase at present, attempting to re-brand itself in the wider foodservice industry, to one that has a healthier image.

1.2.2 The Full-service Sector

The full-service sector accounts for the majority of Irish household's expenditure on FAFH. However, as illustrated in Table 1.2, the share of household expenditure on hotels and restaurants has diminished, from 61 percent in 1994 to 53 percent in 1999. Recent years of growth, however, have seen a significant increase in the numbers of hotels and hotel rooms offering this service in Ireland. Between 1994 and 2005 the number of hotels has

increased by 25 percent, while the number of rooms increased by 85 percent (O'Connell *et al.* 2006). Hotels are an important outlet for meals out, particularly in smaller towns and rural areas, where eating out options may be limited. The number of restaurants has also expanded in Ireland in recent times. Growth in ethnic restaurants is likely to continue due to the prevalence of foreign travel which breeds familiarity with new tastes and cuisines, and as Ireland experiences continued net immigration. Similarly the ageing of the population is likely to benefit the full-service industry in the long-term with studies in the US finding a positive relationship between age and full-service options (Blisard *et al.* 2003; Blaylock, 2003). All sectors have shown growth to varying degrees, which illustrates that new start-ups have a high probability of success and that the demand for meals away from home is still quite buoyant. However, one potential threat to the full-service sector, particularly the hotel component, is a future shortage of qualified staff. The traditional Irish welcome is a unique selling point of the Irish hotel sector (Mintel, 1999). As the economy has developed in recent times fewer Irish people have been employed in the sector and job vacancies have been filled by immigrants, many from Eastern Europe, which may have diminished the Irish welcome as a selling-point.

In the UK growth in full-service restaurants has been attributed to increased disposable income and a decline in the price difference between eating out and cooking at home as more people use convenient products such as ready meals (Tragus Holdings, 2005). Growth has not been uniform within the sector, however, with some ethnic restaurants, particularly Chinese restaurants, suffering a decline. Chinese restaurants share of the market has declined by

over 1 percent since 1999 which has been attributed to a perception that Chinese food is fatty and laden with additives (Euromonitor International, 2006). This has also led to some outlets re-branding themselves as Malay or Thai which have a perception of being healthier. The majority of the expansion in the number of restaurants in the UK in recent years has been occurring in the pizza and pasta sector (Tragus Holdings, 2005). DEFRA (2007) estimated that the pub and restaurant sector will grow at a faster rate than the hotel sector into the future.

1.3 General Trends

Convenience and health awareness have been identified as having major influences on Irish and UK food expenditure patterns in recent times and are considered to be of significant importance in this analysis of FAFH expenditure patterns in both countries. This section highlights individual socio-economic and economic factors which are influencing the demand for convenience, and the demand for pleasure and thus FAFH expenditure. In addition health awareness is an increasingly important factor in influencing FAFH expenditure patterns due to increased awareness of health concerns associated with the global FAFH industry, indeed to such an extent that a health-convenience tradeoff is hypothesised to exist. Time starved households are assumed to demand FAFH products, specifically quick-service, because of the convenience associated with it. While the prime determinant of full-service expenditure is assumed to be the demand for pleasure full-service dining is also a form of energy saving as the household sub-contracts household production to the full-service outlet. Full-service dining can be viewed as energy saving rather than time saving. Health concerns are associated with all sectors of the

FAFH industry but it is assumed that the more health aware households are among the most likely consumers of full-service meals

1.3.1 Convenience

It is assumed that the demand for convenience is the prime determinant for quick-service meal eating occasions. It is further assumed that the demand for pleasure is the prime determinant of full-service expenditure, and not the demand for convenience, since full-service meal eating occasions can use up considerable time, potentially as much as home meal preparation (Cullen, 1994; De Boer *et al.* 2004). Full-service dining can be considered a form of pleasure or leisure and time-stressed households can be assumed to favour leisure dining in favour of household production.¹² It is expected that higher educated and higher social class households are likely consumers at full-service outlets on the basis that they value the pleasure aspect of full-service dining more highly than others. As full-service meals are on average more expensive than quick-service meals it is also assumed that higher income households and smaller households are more likely consumers of full-service meals. However, dining out has become less price sensitive due to increasing competition, particularly in urban areas (Datamonitor, 2005). As such, like FAFH, dining out has become less of a luxury and more of a necessity. Additional factors influencing the demand for convenience are discussed further in the remainder of this section.

¹² Household production is explained fully in chapter 2.

Declining household size and increasing single occupant households have increased the frequency with which FAFH is purchased. The benefits of home meal preparation diminish in smaller households (Mintel, 2004a; 2004b).

Increasingly urbanised societies contribute to the demand for FAFH, and for quick-service products in particular. Typically FAFH outlets are found in urban areas which can support a wide variety of outlets. Jekanowski (1999) found that increased quick-service outlet density (increased supply of convenience) results in an increase in quick-service expenditure.

Low unemployment rates and an overall buoyant economy are fuelling demand for FAFH in Ireland vis á vis the increased time constraints consumers face. Similar trends are being observed in the UK. Rising incomes have helped alter eating habits by making eating out less of a special occasion and more of a regular dining activity

Ireland has the youngest population within the European Union at present. This has also contributed to the higher level of demand for FAFH expenditure (Mintel, 2004a). The 15-44 age group are the most regular consumers of FAFH and the 15-24 age group are the highest consumers of quick-service meals overall in Ireland (Mintel, 2004a). A general decline in cooking skills among this age group is also cited as a factor contributing to the rising demand for FAFH (Mintel, 2004a). Young adults under 25 years are more likely than other groups to eat out in the UK (Mintel, 2004b). It has been suggested that the lack of culinary skills amongst young people may have supported demand in this sector (DEFRA, 2007).

Increasing female labour force participation in Ireland has changed the dynamic of the home environment in which women are traditionally the meal planners. The reduction in time available for household activities such as meal preparation also increases the demand for FAFH (Mintel, 2001; 2004a). Since 1984 the number of women in employment has grown by over 30 percent in the UK and the growth of women in employment has risen faster than the rate of men. This has led to increased financial freedom but also greater time constraints and has contributed to an increased demand for FAFH (Tragus Holdings, 2005).

It is assumed that the demand for convenience is the primary influence in increasing quick-service expenditure. The quick-service sector is currently regarded as having the best prospects for growth in the Irish market. Demographic trends, such as those as outlined above, are particularly favourable. Other factors such as the expanding commuter belt in Ireland and increasing urbanisation will benefit all outlets of FAFH. Furthermore it is assumed that very time-starved consumers will exhibit a preference for quick-service expenditure over full-service. In the UK, restaurants and pubs are expected to grow faster than hotels, though they are part of the full-service sector, and quick-service restaurants are viewed as being susceptible to increased concerns about health.

1.3.2 Health

Obesity is a major health concern throughout the world and linked with the growth in the foodservice industry are concerns about its potential contribution to obesity. Binkley *et al.* (2000) remarked that the trends in both increased US obesity and increased consumption of FAFH are unlikely to be coincidental. However, there has been some disagreement. Cutler *et al.* (2003) suggested that the growth in obesity rates has been due to reductions in the time cost of food which has allowed more frequent food consumption of greater variety and corresponding higher body weights.¹³ This study rejected the notion that the increase in labour force participation, particularly that of women, had increased the demand for eating out, and accordingly unhealthy food. Despite this much of the literature has followed the line of thought of Binkley *et al.* (2000). Quick-service in general, and fast food, in particular, has received much unfavourable media attention during the course of this debate. The other major component of the FAFH industry, full-service meals at hotels and restaurants, has not received any comparable attention despite little evidence that frequent eating at full-service outlets is significantly healthier than eating at fast food chains (Guthrie *et al.* 2002). Both sectors of the FAFH industry in Ireland and the UK will be examined in this analysis.

Guthrie *et al.* (2002) raised concerns about the increased volume of FAFH in the diet. In comparing the amount of calories consumed from FAFH as against food at home (FAH) during the periods 1977-78 and 1994-96, they concluded that FAFH has more calories associated with it per eating occasion, with a

¹³ The time cost of food, the time spent engaged in food preparation, has been considerably reduced throughout recent decades with technological advancement and new culinary appliances.

widening in this discrepancy over time. FAFH is characterised by more calories per eating occasion, a higher proportion of calories obtained from fats and saturated fats and a lower volume obtained from fibre, calcium and iron (Guthrie *et al.* 2002). In general, FAFH has been found to have lower nutritional quality than food prepared at home across international studies (McCrory *et al.* 1999; Burns *et al.* 2001; Thompson *et al.* 2004). Clemens *et al.* (1999), studying the effect of eating out on the diet of premenopausal women, found that women who eat out more often during the week were consuming a poorer quality of diet.

A number of studies have attempted to link quick-service products directly to obesity. Jeffrey and French (1998) found that increases in the availability of fast food and increases in television viewing may contribute to increasing obesity rates. French *et al.* (2001) found that frequent use of quick-service restaurants is associated with higher energy and fat intake and greater body weight, which could be an important risk factor for excess weight gain in the US population. Prentice and Jebb (2003) concluded that as many fast foods have higher energy densities, excess consumption of these products is likely to result in consumption of excess energy and increased weight gain. Bowman *et al.* (2004) found that children's fast food consumption in the US had an adverse effect on diet quality in ways that could increase obesity. Mello *et al.* (2003), in a discursive study of the fast food industry and its potential legal culpability for obesity, noted that most Americans remain of the belief that obesity is a matter of individual responsibility and at some level, moral failure. The public reaction to litigation on this issue in the US has been overtly negative and it is regarded as somewhat frivolous. Regardless, the sheer

volume of media publicity surrounding these suits may lead to quick-service products being seen in a negative light.

Most of the above studies have focused on the quick-service sector and there has been little investigation of full-service dining. There is little evidence to suggest that frequent full-service dining is anyway healthier than frequent quick-service dining (Binkley, 2005). However, it is expected that increased health awareness about the consequences of eating certain foods will have a greater impact on quick-service expenditure than full-service. In America research has shown that lower-income households' expenditure on FAFH is concentrated in the quick-service sector while for higher income households quick-service receives a very small proportion of total FAFH expenditure (Jekanowski and Binkley, 2000). This may be due to better-educated consumers being more aware of the potential negative health effects of excessive fast food consumption. In general, quick-service has been found to be most attractive to those with lower incomes, those in a hurry and those with simple and consistent food preferences (Brown, 1990). While consumers have been found to be increasingly health conscious, and prefer to have healthier options when eating out, they are typically less vigilant in calorie counting when they eat outside the home (Datamonitor, 2005). Mancino and Kinsey (2004) found that when individuals are hungrier, busier and consume FAFH, their information about health and nutrition has a smaller impact on their actual food choices. It may be that the demand for convenience has a greater impact than health awareness on the demand for FAFH. As there is little information on the nutritional content of food on restaurant menus consumers have difficulty making informed decisions away from home, however, concerns

about portion size and calorie count seem to be confined to quick-service eating occasions (Datamonitor, 2005).

In response to these concerns, many quick-service chains have re-evaluated their menus by offering more nutritious options, such as fruit and salads, in an effort to improve their consumers eating habits (Mintel, 2004a). The success of the Subway chain has proved that quick-service food need not necessarily be unhealthy. In Northern Ireland, for example, Subway have more outlets than McDonald's (Mintel, 2004a). In recognition of the fact that full-service meals can in themselves be unhealthy the Irish Heart Foundation runs a Happy Heart Catering Award in June of each year. The slogan of the 2007 Eat Out Campaign was 'Portion size matters.' The main reason why this campaign is run is that cardiovascular disease is the main killer of Irish adults each year.¹⁴

In this analysis it is expected that households with high levels of health awareness will be less likely to consume quick-service expenditure as against full-service expenditure. Accordingly households with higher levels of social class and education levels are also assumed to exhibit a preference for full-service outlets. The perception of the quick-service industry will be crucial to its future development in Ireland. Interestingly Mintel (2004a) found that 37 percent of Irish adults considered all quick-service products as junk, a figure considered relatively low given the recent negative media attention. At present, growth prospects in the UK for the full-service sector are better than

¹⁴ Irish Heart Foundation Website (2007). <http://www.irishheart.ie/iopen24/> Cardiovascular disease is also the main killer of adults in the UK each year (British Heart Foundation, 2007). <http://www.bhf.org.uk/>

its quick-service counterpart in part due to the latter's unfavourable image as a contributory factor to obesity.

1.4 Summary

The foodservice industries in both Ireland and the UK must be aware of which groups of consumers comprise the core market for their products so as to properly plan for future development. Similarly, rising FAFH expenditure will affect Irish and UK food manufacturers who are oriented towards the food at home market. An analysis of this nature is therefore very timely. The growing need for convenience has been a key driver of innovation in the food sector and a thorough understanding of convenience is critical to food producers. From the perspective of both the Irish and UK foodservice industries it is crucial that they are aware of the most recent consumer trends to assist them in strategy development.

The continued demand for convenient and time-saving products such as FAFH has been highlighted in this literature review. Economic and demographic trends predict a further increase in expenditure on FAFH into the future. This discussion has also highlighted the diversity of the FAFH industry in Ireland and the UK. Restricting the definition to expenditure at commercial outlets solely is in accord with most recent research and enables a disaggregated approach to analysis be undertaken. The quick-service and full-service sectors will be analysed separately to obtain an understanding of what factors are influencing demand in each sector. The quick-service industry is seen as having the fastest growth potential at present chiefly due to the growth in fast food outlets and the expansion of ethnic takeaways. At the same time no

analysis would be complete without an examination of the full-service sector which accounts for over half of all Irish and UK FAFH expenditure. Quantifying the demand for convenience together with the demand for health awareness will be an important part of this research as they are thought to be key factors influencing FAFH expenditure decisions. It is also expected that these factors will influence both quick-service and full-service expenditure in different ways.

1.5 Thesis Structure

Chapter 2 presents a discussion of the various methodological approaches considered. Chapter 3 provides a discussion of the data used in the thesis and explains the variables used to model household expenditure on FAFH. Chapter 4 presents an analysis of Irish household's quick-service expenditure patterns while Chapter 5 considers the Irish quick-service and full-service sectors. Chapter 6 presents a comparative analysis of Irish and UK household's expenditure on FAFH. Chapter 7 summarises the main findings and details the key policy recommendations for the food industry based on the findings.

Table 1A

Table 1.1 The Market for FAFH in Ireland

Years	1987	1994	1999
FAFH as % of total food expenditure	13%	18%	23%

Source: Derived from the HBS of 1994 and 1999 (Author's Calculations).

Table 1.2: The Distribution of FAFH Expenditure in Ireland

FAFH	1994	1999
School meals	0.67%	0.2%
Quick-service	17.63%	19.06%
Work Canteens	21.14%	25.99%
Full-service	60.56%	53.16%
Tea/Coffee away from home	-	1.58%

Source: Derived from the HBS of 1994 and 1999 (Author's Calculations).

Table 1.3: The Market for FAFH in the UK

Years	2001	2002
FAFH as % of total food expenditure	32%	33%

Source: Derived from the EFS of 2001 and 2002 (Author's Calculations).

Table 1.4: The Distribution of FAFH Expenditure in the UK

FAFH	2001	2002
School meals	2.88%	2.86%
Quick-service	29.11%	27.52%
Work Canteens	6.28%	5.93%
Full-service	61.06%	60.57%
Contract Catering	0.67%	3.12%

Source: Derived from the EFS of 2001 and 2002 (Author's Calculations).

Chapter 2

Econometric Methodology

2.1 Introduction

In this chapter, the various alternatives under which FAFH expenditure, and other cross-sectional data, can be modelled are presented. The specific model used in this analysis, which is based on Household Production Theory, is also derived. Cross-sectional data on household expenditure patterns are complicated by the existence of zero observations on expenditure, implying that the relationship between the independent variables and the expenditure variables may be more complex than assumed in conventional regression models.¹⁵ A variety of approaches have been considered in accounting for the presence of zero observations in studies of FAFH expenditure which will be outlined below.

The most common methodological approach has been to use various Limited Dependent Variable (LDV) models of which the standard censored tobit model is an example (McCracken and Brandt, 1987; Cai *et al.* 1998; Soberon-Ferrer and Dardis (1991); Ham *et al.* 2004; Ma *et al.* 2006). Other studies have utilised two-stage estimators such as the double hurdle model (Mihalopoulos and Demoussis, 2001; Pan and Jensen, 2002; Mutlu and Gracia, 2004). Alternatives to the traditional LDV framework have not been widely explored to date in the modelling of FAFH expenditure patterns. Min *et al.* (2004) devised a nonparametric estimator to model FAFH expenditure, and Marsh *et*

¹⁵ A zero observation is recorded when the survey respondent reports zero expenditure on the good in question.

al. (2003) used a Bayesian framework. To the author's knowledge no research to date has examined the possibility of incorporating Semiparametric estimators into the analysis. Semiparametric (SP) estimation of the censored regression model will also be considered in this thesis to ascertain whether the LDV or SP framework is more appropriate to this study.¹⁶

Section 2.2. outlines Household Production Theory and derives the model used in this analysis. Section 2.3 presents the standard tobit model. Problems associated with LDV models that are estimated using Maximum Likelihood Estimation (MLE) are identified in section 2.4. In section 2.5 SP estimators available for the censored regression model are defined. Section 2.6 discusses the rationale for using a two-stage approach and presents the double hurdle model as one particular alternative to the single-stage tobit model. A summary of the chapter is provided in section 2.7.

2.2 Household Production Theory

Traditional demand theory involves the analysis of consumer choice under a budget constraint and the prediction of the change in a consumer's chosen allocation of goods when prices change. Household production theory or new household economics, derived by Becker (1965) and augmented by Lancaster (1966, 1971), implies that household time as well as market goods and services enter the assumed utility maximisation process and views the household as both a producing and consuming unit. Integrating production and consumption is at odds with the traditional economic approach which assigns production to firms and consumption to households. Household Production Theory views

¹⁶ In econometrics the censored tobit model is also referred to as the censored regression model (Tobin, 1958, Powell, 1994).

households as small firms that maximise their utility subject to not only a budget constraint but also a time constraint. Whereas traditional demand theory distinguishes labour and leisure, household production theory distinguishes between labour, leisure and household production (household labour).¹⁷

This approach has been used to analyse the outsourcing of expenditures by households in areas such as meal preparation and household cleaning (Cornelisse-Vermaat, 2005). In this thesis we are interested in the former. Consumers demand not only food products in themselves but also the convenience of time-saving in food preparation. Therefore the relationship between the value of time and FAFH is of considerable importance (Mutlu and Gracia, 2006). Under certain assumptions on the consumption technology, the demand for market goods can be derived as a function of the price of the good and other goods, household income, a measure of the household's opportunity cost of time or value of time and other socio-economic variables (Lancaster, 1971). The household is seen as a consuming and a producing unit and individuals are assumed to maximise their utility subject to their ability to produce goods and services for their personal use, their budget constraint and constraints on their time. The model assumes that an increase in an individual's employment could cause a shift away from consumption of time-intensive commodities (such as food-at-home) towards time-saving devices such as FAFH (Nayga and Capps, 1992).

¹⁷ Traditional consumer theory demonstrates the labour-leisure tradeoff: the consumer's choice between leisure and labour. Leisure is considered one good and consumption the other. The consumer has a finite amount of time, T , and must choose between leisure, L , (which earns no income for consumption) and labour, L , (which does earn income). This can be summarised by the constraint: $L+L=T$.

2.2.1 The Model

Household utility can be represented as a function of commodities z_i , that are produced in the household using goods and services purchased in the market x_i and non-market time of the household.

Assuming the utility of each household can be represented as a function of a vector of l commodities, Z , that are produced in the household using m goods and services purchased in the market, G , and the non-market time of the household, T_{mw} , the utility function for a typical household can be represented as:

$$U(Z) \equiv U[f(G, T_{mw}, D)] \quad 2.1$$

where D is a vector of variables referring to the household's socio-economic characteristics. The household's time constraint can be defined as:

$$T = T_{mw} + T_w \quad 2.2$$

where T refers to the total time constraint of the household and T_w refers to the amount of time spent outside the home in the labour force. The household's budget constraint can be defined as:

$$T_w W + V = Y = \sum_{j=1}^m g_j p_j \quad 2.3$$

where W is the wage rate, V is the non-wage income of the household, Y is the total income of the household and p_j are the market prices of goods g_j which are used to produce household commodities Z .

Maximising equation 2.1 subject to the constraints in 2.2 and 2.3 will yield reduced form demand equations for each of the m market goods g_j :

$$g_j = f(p_j, Y, D, T_{mw}) \quad 2.4$$

and associated expenditure function:

$$p_j g_j = y_j = f(Y, D, T_{mw}) \quad 2.5$$

This equation represents household expenditure on market goods j , y_j , as a function of income, socio-economic characteristics and the amount of non-market time at a households' disposal which will influence the types of market goods purchased by the household for use in home production. This model underlies most analyses of FAFH expenditure to date (Kinsey, 1983; Yen, 1993; Manrique and Jensen, 1998; Mutlu and Gracia, 2004; 2006).

2.3 The Censored Tobit Model

The standard tobit model (Tobin, 1958) was originally developed to accommodate censoring in the dependent variable and was designed to overcome the bias associated with assuming a simple linear relationship between the dependent and independent variables in the presence of such censoring (see Appendix 2A for details). The tobit model is a form of limited dependent variable model. Like any such model, the latent variable, y_i^* , determines the value of the observed dependent variable, y_i , which in a model of household expenditure is the actual expenditure of the i th household. Within the model it is possible to observe the value of the latent variable within a certain range but not outside the range. In the case of a model of household expenditure the latent variable is only observed if it is greater than or equal to zero. The tobit model assumes that all zeros are attributable to standard corner solutions.¹⁸ This kind of model is a censored model with the censoring point lying at zero.

The latent variable is allowed to take negative values even though they cannot be observed. The intuition is that in the tobit model, expenditure can be regarded as desired consumption. In this way it is possible that a household dislikes the good so much that it would actually spend a negative amount on it.

¹⁸ There is an underlying continuous variable in this thesis, FAFH expenditure, but some subset of the range of values is coded to one number, in this case 0, thereby creating a mass point; a corner solution. The observation is present in the data, however, and not simply missing as in the case of truncation.

A household's decision to purchase a specific food item can be modelled by assuming that the household maximises utility subject to a standard budget constraint. The solution to this utility maximisation problem is demonstrated below (Verbeek, 2000):

$$\text{Max}U(y, e, \gamma) \tag{2.6}$$

subject to:

$$y + e = Y \tag{2.7}$$

$$e > 0 \tag{2.8}$$

$$y \geq 0 \tag{2.9}$$

y refers to the household's expenditure on a specific food item, e is all other expenditure of the household, Y is total household expenditure and γ represents the household's tastes and preferences. We must solve for the household's level of expenditure on y that maximises utility. Ignoring the constraint in 2.9 and under appropriate assumptions on U , the solution to this problem can be written in linear form as follows:

$$y^* = \beta_0 + \beta_1 Y + \sum_{s=1}^s \beta_s g_s + u \tag{2.10}$$

u in this case corresponds to unobserved heterogeneity and g are observed household characteristics. There are no restrictions on y in this solution thus implying that if a household could spend any amount they wanted on y , they would spend y^* . However, y must be greater than or equal to zero, as implied in the utility maximisation problem. Therefore the solution to the problem would be such that if the household wishes to spend a negative

amount on the food in question, that is $y^* < 0$, it would spend nothing at all on that item. Therefore:

$$\begin{aligned} y &= y^* && \text{if } y^* > 0 \\ y &= 0 && \text{if } y^* \leq 0 \end{aligned} \quad \mathbf{2.11}$$

This solution gives the standard Tobit model (Tobin, 1958) which can be formalised as:

$$\begin{aligned} y_i^* &= x_i' \beta + u_i && u_i \sim N(0, \sigma^2) && i = 1, 2, \dots, n \\ y_i &= y_i^* && \text{if } y_i^* > 0 \\ y_i &= 0 && \text{otherwise} \end{aligned} \quad \mathbf{2.12}$$

where x_i are a vector of variables corresponding to the i th household, including total household expenditure, Y_i .

MLE will produce consistent estimates of the parameters of the tobit model under appropriate assumptions i.e. homoskedasticity and normality of the error terms. In estimating the model the generation of positive and negative values of the latent variable are separated. Positive values of the latent variable can be generated from the tobit framework under the assumption that $u_i \sim N(0, \sigma^2)$.

The contribution to the likelihood function of a positive observation will equal:

$$f(y_i | y_i > 0) \cdot P(y_i > 0) \quad \mathbf{2.13}$$

where $f(\cdot)$ is the conditional density function. This can also be expressed as:

$$(2\pi\sigma)^{-1/2} \exp\left[-\frac{(y_i - x_i' \beta)^2}{2\sigma^2}\right] dy_i \quad \mathbf{2.14}$$

$$= \sigma^{-1} \phi\left[\frac{y_i - x_i' \beta}{\sigma}\right] dy_i \quad \mathbf{2.15}$$

where $\phi(\cdot)$ is the standard normal probability density function.

MLE, also allows information about the generation of such zero values to be incorporated into the estimation technique. The probability of observing a zero value of y_i is:

$$\begin{aligned}
 P(y_i = 0) &= P(y_i^* \leq 0) = P(x_i' \beta + u_i \leq 0) \\
 &= P(u_i \leq -x_i' \beta) = P\left(\frac{u_i}{\sigma} \leq -\frac{x_i' \beta}{\sigma}\right) \\
 &= 1 - \Phi\left(\frac{x_i' \beta}{\sigma}\right)
 \end{aligned}
 \tag{2.16}$$

where $\Phi(\cdot)$ is the standard normal cumulative distribution function.

MLE produces consistent estimates of the parameters of the tobit model under appropriate assumptions such as homoskedasticity and the normality of the error terms. From **2.15** and **2.16** the likelihood function for the tobit model can be written as (Tobin, 1958):

$$L(\beta, \sigma^2) = \prod_{y_i=0} \left[1 - \Phi\left(\frac{x_i' \beta}{\sigma}\right) \right] \prod_{y_i>0} \left[\sigma^{-1} \phi\left(\frac{y_i - x_i' \beta}{\sigma}\right) \right]
 \tag{2.17}$$

2.4 Misspecification Issues

As outlined in section 2.3, the tobit model can be estimated using MLE procedures. The consistency of MLE, however, requires a complete and correct specification of a parametric family of the error distribution. If the model is misspecified, model assumptions must be relaxed, and estimators are needed which remain consistent under more general assumptions. Typically the assumptions of homoskedasticity and normality of errors are the most

frequently violated (Verbeek, 2000). MLE of the tobit model will produce inconsistent parameter estimates when either assumption is violated. In this section, possible actions that can be taken when these assumptions are violated are presented.

2.4.1 Heteroskedasticity

One of the classical assumptions of the linear model is that of homoskedasticity. This implies that the error terms have a constant variance across observations. In general this means that:

$$\text{Var}(u_i) = \sigma^2 \tag{2.18}$$

If this assumption does not hold the error terms are heteroskedastic. The error variance is no longer constant and assumes different values for different observations. The error terms are still assumed to be normally and independently distributed. In LDV models, MLE produces biased and inconsistent parameter estimates when the errors are heteroskedastic (Arabmazar and Schmidt, 1981). Pudney (1989) has noted that if the conditional variance of the censored ML model, or its functional form, is not correctly specified, heteroskedasticity will be a major problem.

The standard approach to correcting for heteroskedasticity is to assume some functional relationship between the variance of the error term and the independent variables of the model. Here multiplicative heteroskedasticity of the following form is considered:

$$\sigma_i^2 = \sigma^2 h(z_i, \gamma) \tag{2.19}$$

where z_i are some variables of x_i and h is a continuous function such that $h(0)=1$ and γ are unknown parameters (see Mihalopoulos and Demoussis (2001) or Newman *et al.* (2001; 2003) for examples of applications that assume this form of heteroskedasticity).

2.4.2 Non-normality of Errors

Models such as the tobit model, built on the maximum likelihood principle, are heavily reliant on the assumption of normality in the error terms. In the presence of non-normal errors MLE will produce biased and inconsistent parameter estimates (Arabmazar and Schmidt, 1982). When this assumption breaks down the maximum likelihood estimates will be inconsistent. Tests for normality are tests for skewness and kurtosis in the residuals such as Pagan and Vella's (1989) conditional moments based test. A number of approaches have been attempted to transform the dependent and latent variables to accommodate the break down of the normality assumption. One such example is the Box-Cox transformation which takes the following form:

$$y^{\lambda} = \frac{y^{\lambda} - 1}{\lambda} \quad 0 < \lambda \leq 1 \quad \mathbf{2.20}$$

While the Box-Cox transformation includes as special cases the linear transformation, ($\lambda = 1$), and the logarithmic transformation, ($\lambda \rightarrow 0$), it is assumed that the parameter lies in between the two limits. The transformation helps improve the validity of LDV model assumptions. While problems have been highlighted with this transformation, in particular, that it cannot handle negative values, they are not thought to be significant in this case as there are no negative values in the dataset. Recent applications of the Box-Cox

transformation include Jones and Yen, (2000); Martínez-Espiñeira (2004) and Moffatt (2005), for the double hurdle model, and Han and Kronmal (2004) and Chaze (2005) for the tobit model.¹⁹

The log-likelihood function for the Box-Cox tobit model can be written as (Lankford and Wycoff, 1991; Han and Kronmal, 2004):

$$L(\beta, \sigma^2) = \prod y_i^{\lambda-1} \sigma^{-1} \Phi\left(\frac{y_i^\lambda - x_i' \beta}{\sigma}\right) \quad 2.21$$

2.5 Semiparametric Estimation

Section 2.4 has highlighted the reality that models based on MLE are susceptible to misspecification which results in bias and inconsistent estimates but that it is possible to transform the models to account for this misspecification. Another available option is to utilise estimators that are not dependent on such assumptions regarding the error term. Such estimators, called semiparametric (SP) models, are hybrids of parametric and nonparametric models. This literature was developed after problems with both estimation approaches had been identified. While parametric estimation is quite straightforward, estimation using this approach requires a correctly specified function form and knowledge of the correct error distribution. Nonparametric estimation does not assume any specific distribution and allows the shape of the distribution to be determined by the data, however, the major

¹⁹ The Inverse Hyperbolic Sine (IHS) transformation is an alternative approach to account for non-normality in the dataset. Originally proposed by Johnson (1949) the transformation did not gain popular currency until its benefits were highlighted by Burbidge *et al.* (1988). The transformation has also been used in some recent studies using LDV models (Mihalopoulos and Demoussis, 2001; Newman *et al.* 2001; Newman *et al.* 2003).

complication with nonparametric estimation is the curse of dimensionality (DiNardo and Tobias, 2001).²⁰ The SP approach has some considerable advantages. For example, SP estimators allow for a more general specification of the error term and are more consistent than corresponding parametric models while remaining typically more precise than their nonparametric counterparts (Powell, 1994). However, if the parametric model is correctly specified, they are in general less efficient than the corresponding maximum likelihood estimator (Powell, 1994). Typically the regression function is specified parametrically while the rest of the model is not parameterized.

Semiparametric estimators useful for the censored regression model include the censored least absolute deviation (CLAD) and symmetrically censored least squares (SCLS) estimators (Powell, 1984; 1986). Both are considered in this study as they are comparable to MLE of the tobit model and robust to misspecification problems such as heteroskedasticity and non-normality which impact severely on MLE based estimators as described in section 2.3.

2.5.1 Censored Least Absolute Deviation

The CLAD estimator was first proposed by Powell (1984). The CLAD model is a median estimator, is robust to heteroskedasticity and non-normality, and provides consistent estimates in the presence of censored data (Powell, 1984). It is therefore an obvious alternative to MLE if non-normality is suspected in the data. To make the estimator robust to misspecification problems, the

²⁰ Nonparametric regression estimates are dependent variable averages local to the point at which the regression function is to be estimated. The number of observations 'local' to the point of estimation decreases exponentially with the number of dimensions. This means that the variance of unconstrained nonparametric regression estimators of multivariate regression functions is often so great that the unconstrained nonparametric regression estimates are typically of no practical use (Pinkse, 2000).

sample is reduced through eliminating data points and observations that fall outside the uncensored region from the sample (the recensoring step).²¹ Only the uncensored observations are used as only if β exceeds the censoring point are the data considered informative. Least absolute deviations are then applied to the remaining observations (the regression step). Bootstrapping is used to compute the residuals. Pudney (1989) commented that the CLAD estimator is extremely robust as the median function remains correctly specified in heteroskedastic models. The estimator, however, may be less efficient than its parametric alternative depending on the extent to which outliers are a problem in the data.²² However, as the results will be robust to misspecification they will likely outperform MLE in terms of consistency.²³

To derive the CLAD model it is necessary to define a number of assumptions.

Firstly the expectation of the median, M , is defined below:

$$\Pr ob(x \leq M) = \frac{1}{2} \text{ and}$$

²¹ The uncensored region refers to the positive non-zero observations in the dataset (Pagan and Ullah, 1999).

²² Essentially the loss of any of the observations is undesirable as this will reduce the efficiency of the results as a whole, as would be the case with a truncated tobit model, for example. Arabmazar and Schmidt (1981:1982) demonstrated that the truncated tobit was less consistent than the corresponding full-sample tobit model in the presence of heteroskedasticity and non-normality. It is important to note that the truncated tobit, by itself, is also not adjusted for misspecification problems unlike the SP estimators considered here. The CLAD estimator considered here is designed for the censored regression model solely and is not applicable in the presence of truncated data (Deaton, 1997).

²³ Blisard *et al.* (2004) applied CLAD to analyse US household expenditure on fruits and vegetables finding it to be more robust to outliers than least squares estimation. Chay and Powell (2001), analysing the earnings gap between black and white households in the US, found that SP estimation produced much more precise estimates than MLE. Furthermore a number of studies considering the least absolute deviations approach without censoring as an alternative to the standard parametric models for dealing with censoring found the former to be superior in most cases (Fullerton, 1998; Yoo *et al.* 2000; Yoo, 2001). By contrast, Berg and Kaempfer (2001) failed to reject a heteroskedasticity adjusted model estimated using MLE in favour of the CLAD approach in their analysis of cigarette demand in South Africa.

$$\int_{-\infty}^M f(x) dx = \frac{1}{2} \quad 2.22$$

Secondly if M is the median of U then the median of $(A + U)$ is $(A + M)$.

By setting $Z = A + U$ and $dZ = dU$, therefore $f(Z) = f(U) = f(Z - A)$

$$\int_{-\infty}^{M^*} f(Z) dZ = \int_{-\infty}^{M^* - A} f(U) d(U) = \frac{1}{2}.$$

$$\therefore M^* - A = M \text{ so that } M^* = A + M \quad 2.23$$

Thirdly:

Let $y^* = bx + u$ where the value of u has a median of zero. Then the median of y^* is $bx = M^*$ such that $y_i = \text{Max}(0, y^*)$. 2.24

Figure 1a and Figure 1b below demonstrate graphically represent the CLAD estimator when the median, M^* , is negative and how zero observations reduce the sample size of the model. The reduced sample used in the estimation of the model is shown in Figure 1b. Figure 2a and Figure 2b represent the case when the median, M^* , is positive with the reduced sample shown in Figure 2b. The reduced samples are a cause for concern, particularly when working with datasets with a large amount of zero observations.

Figure1a: The median of y^* is negative

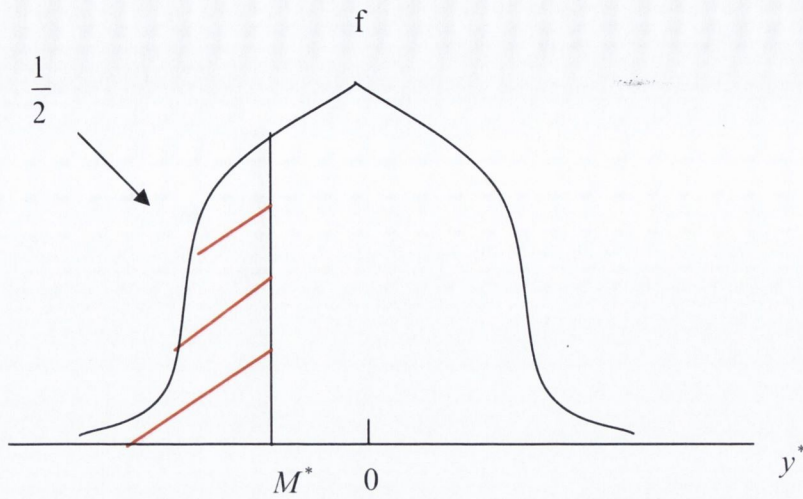
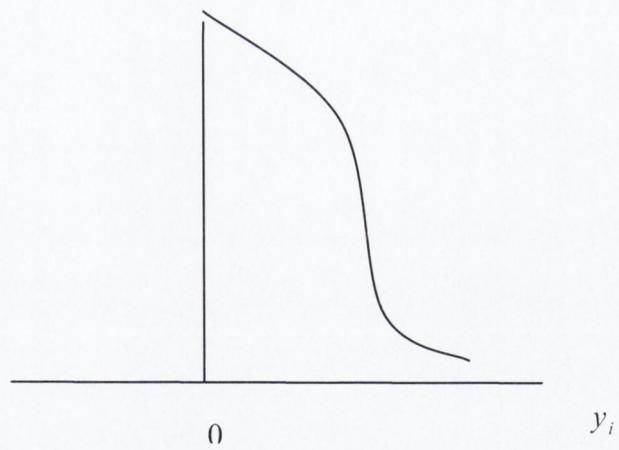


Figure1b: The reduced sample where the median of y^* is negative



The median of y_i is $\text{Max}(0, \text{Median } y^*) = \text{Max}(0, bx)$.

Figure 2a: The median of y^* is positive

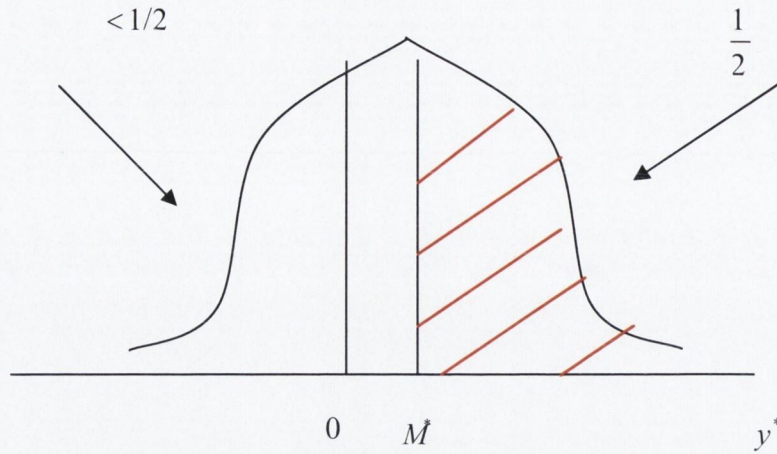
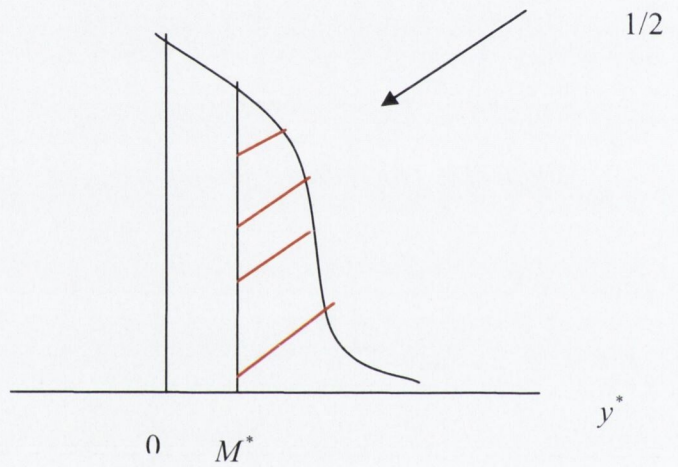


Figure 2b: The reduced sample where the median of y^* is positive



The median of y^* is M^* if M^* is positive. Therefore the median of y_i is

$$\text{Max}(0, M^*).$$

The value of A that minimises $E(|z - a|)$ is a such that a equals the median of

$$Z. E(|z - a|) = \int_{-\infty}^{+\infty} |z - a| f(z) dz \quad 2.25$$

$$E[g(x)] = \int_{-\infty}^{+\infty} g(x) f(x) dx \quad 2.26$$

$$= \int_{-\infty}^a (a-z)f(z)dz + \int_a^{+\infty} (z-a)f(z)dz \quad 2.27$$

$$\frac{\partial}{\partial a} E[|z-a|] = 0 =$$

$$\frac{\partial}{\partial \theta} \int_{b(b)}^{c(b)} h(xb)dx = \int_{b(b)}^{c(b)} \frac{\partial h(xb)}{\partial b} dx + \frac{dc(b)}{\partial b} h(c(b),b) - \frac{\partial h(b)}{\partial b} h(b(b),b) \quad 2.28$$

$$\frac{\partial}{\partial a} (E|z-a|) = \int_{-\infty}^a f(z)dz + (1)[(a-a)f(a)] \quad 2.29$$

$$1 \int_a^{\infty} f(z)dz - (1)[(a-a)f(a)] \quad 2.30$$

$$= \int_{-\infty}^a f(z)dz - \int_a^{\infty} f(z)dz = 0 \quad 2.31$$

$$= \int_{-\infty}^a f(z)dz = \frac{1}{2} \quad 2.32$$

$\therefore a$ = the median.

$$\sum_i^n |z_i - a|, \text{ the bacterial set of } a \text{ is the median of } z_i. \quad 2.33$$

$$\sum_i^n |z_i - bx_i| \quad 2.34$$

$$E(|z-b| - |z|) = E(|z-b|) - (E|z|) \quad 2.35$$

$$\text{Therefore the median of } y_i = \text{MAX}(0, M^*) \quad 2.36$$

2.5.2 Symmetrically Censored Least Squares

Powell (1986) revisited the CLAD estimator by acknowledging some of its limitations. The estimator can be computationally burdensome and estimating the asymptotic covariance matrix involves the estimation of the density of the error terms. This introduces a certain ambiguity about the amount of smoothing.²⁴ Powell (1986) proposed estimators for both the censored and truncated versions of the tobit model that are consistent and asymptotically efficient under suitable conditions. The estimators will be consistent if the error terms are not identically distributed and are robust to heteroskedasticity of an unknown form. This approach is closely related to the CLAD and while less general is computationally simpler.

The coefficients can be estimated by least squares with observations falling outside the uncensored region purged, using the symmetrically trimmed data only to arrive at the SCLS estimator. The motivation for using the symmetric trimming approach is that consistency will not be dependent on either homoskedasticity or the known distribution of the error terms (Powell, 1986). The imposition of a symmetric distribution imposes additional restrictions on this estimator, unlike the CLAD. All censored data points are ignored by the model, a considerable disadvantage as the imposition of symmetry leads to additional observations being lost. The sample size returned using this method is likely to be smaller than that used for both the CLAD model and corresponding MLE. Pudney (1989) remarked that the main advantage of the

²⁴ In the context of statistics to smooth a dataset refers to the creation of a function to capture important patterns in the data while omitting the noise.

estimator is the relatively simple computational form and that the limiting distribution of the estimator is known.²⁵

As this model is censored, only the values of x_i and $y_i \equiv \max\{0, y_i^*\}$ are observed as the censored data points have a value of 0. Were u_i continuously distributed then the dependent variable with censoring will be continuously distributed for the uncensored part of the sample and hold the value 0 for the remaining observations. Were u_i symmetrically distributed, and the values y_i^* observable, OLS estimation would be suitable and would provide consistent estimates of β (Greene, 1981; Anemiy, 1984). However, in the presence of censored data, the distribution will become asymmetric as the upper tail will be piled up at one point, 0 in this case (Chay and Powell, 2001). The SCLS estimator uses the principle of symmetric trimming to account for this. The dependent variable is symmetrically censored so as to restore symmetry to the distribution and to enable estimation by least squares. The rationale behind this approach is so that the consistency of the estimator is not dependent on homoskedasticity or a known distribution of the error term. Rather, the estimator depends on a symmetric error distribution.

²⁵ Chay and Powell (2001) also used the SCLS estimation to analyse the earnings gap between white and black households in the US, concluding that the CLAD estimator was superior due to its consistency under more general assumptions. Yoo (2003) found that SCLS significantly outperformed standard parametric alternatives in dealing with zero expenditures on mobile communications in South Korea.

To derive the SCLS estimator it is necessary to return to the OLS expression as shown below:

$$\sum (y - x\beta)^2 \quad 2.37$$

$$= 2 \sum (y - x\beta)(-x) \quad 2.38$$

$$= \sum x(y - x\beta) = 0 \quad 2.39$$

$$= \sum \left[y_i - \text{MAX} \left(\frac{y_i}{2}, \beta x \right) \right]^2 \quad 2.40$$

$$= \frac{y_i}{2} > \beta x \quad 2.41$$

$$= y_i > 2\beta x \quad 2.42$$

$$\text{Then } \frac{\partial}{\partial \beta} = 0 \quad 2.43$$

$$\text{If } \beta x > \frac{y_i}{2} \quad 2.44$$

$$\text{Then 2.42 equals } (y_i - \beta x_i)^2 \text{ where } \frac{\partial}{\partial \beta} \rightarrow 2(y_i - \beta x_i)x_i \quad 2.45$$

$$y^* = x' \beta + u \quad 2.46$$

$$\text{If } y^* > 0 \rightarrow u > -x' \beta \quad 2.47$$

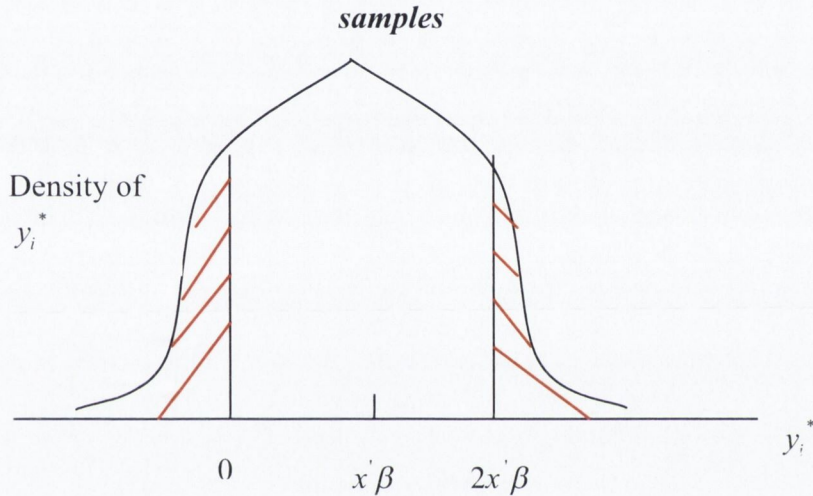
$$I(u > -x' \beta) = \int_{-x' \beta}^{\infty} f(y^* - x' \beta) dy^* \quad 2.48$$

$$I(u > -x' \beta) = \frac{\int_{-x' \beta}^{\infty} f(y^* - x' \beta) dy^*}{\int_{-\infty}^{\infty} f(y^* - x' \beta) dy^*} \quad 2.49$$

Figure 3 graphically represents the SCLS estimator and highlights how additional data points are omitted from the sample during the smoothing process to restore symmetry. The magnitude of the asymmetries in the dataset

is likely to impact on the efficiency of the results. The white area represents the symmetrically trimmed sample which has purged all the censored data together with additional uncensored observations at the right tail. These uncensored observations are purged when the estimator is truncated at $2x'\beta$. One problem with the estimator is that this cut-off point is entirely arbitrary.

Figure 3: Distribution of y_i in the censored and symmetrically censored samples



2.5.3 Model Comparison

Newey (1987) proposed a version of the Hausman test which enables testing between semiparametric and parametric alternatives of the censored tobit model. The null hypothesis for the test is that the parametric tobit model is consistent while the alternative is that the parametric tobit model is inconsistent indicating the presence of misspecification problems such as heteroskedasticity or non-normality. The CLAD and SCLS estimators will be consistent under both the null and the alternative hypotheses as they are both robust to such misspecification errors. The test statistic is given by (Newey, 1987):

$$H = (\hat{\beta}_{sp} - \hat{\beta}_{ml})' [V(\hat{\beta}_{sp}) - V(\hat{\beta}_{ml})]^{-1} (\hat{\beta}_{sp} - \hat{\beta}_{ml}) \quad 2.50$$

The statistic is distributed χ^2 with degrees of freedom equal to the number of parameters.

Both the estimators described above are an improvement on MLE based estimators as they are robust to misspecification problems such as heteroskedasticity and non-normality that make MLE based estimators inconsistent. Their robustness is therefore a considerable advantage. However, the fact that a number of observations in the dataset will be lost (certainly all the censored observations) in order to maintain the robustness of the estimator, and in the case of the SCLS, a symmetric distribution, raises questions as to the likely efficiency of the estimates as compared to full sample MLE. However, should the CLAD and the SCLS not suffer such efficiency losses, then the SP literature is a logical avenue to proceed with due to their robustness and the lack of additional transformations required to produce valid parameter estimates.

2.6 Double Hurdle Model

The tobit model is not only considered restrictive based on its statistical assumptions but is also restrictive on economic grounds. In the model zero observations are attributed to corner solutions solely. Corner solutions imply that consumers choose not to consume the good in question on the basis of current prices and income. This is a strong restriction to place on expenditure on food commodities as it ignores non-participation as a potential cause of the zero observations, which is likely to be implausible. The model assumes therefore that the same set of variables determine both the probability of a non-zero expenditure and the level of expenditure. Ignoring the multi-step nature

of the decision making process leads to potential bias and inconsistency concerns that result from censored responses (Byrne and Capps, 1996; Byrne *et al.* 1996; 1998). A number of empirical studies have highlighted these deficiencies in the tobit model in cross-sectional analysis (Blundell and Meghir, 1987; Jones, 1989; Blisard and Blaylock, 1993; Jensen and Yen, 1996; Newman *et al.* 2001; 2003). Recognising the problems associated with the tobit model has encouraged researchers to apply two-step models to the demand for food commodities including FAFH, an example of which is the double-hurdle model.

The double hurdle model was originally formulated by Cragg (1971) and is a bivariate generalisation of the tobit model. The model has been built upon by both Blundell and Meghir (1987) and Jones (1989; 1992). The double hurdle model assumes that individuals (or households) make two decisions when purchasing a certain good and that two separate hurdles must be passed before a positive level of expenditure can be observed. The first hurdle, the participation decision, involves the decision whether or not to purchase the good in question. The second hurdle, the expenditure decision, concerns how much of the good to purchase. The double-hurdle model allows these decisions to be determined by two separate sets of parameters by allowing each decision to be modelled using different explanatory factors. Zero observations are attributed to either non-participation or standard corner solutions.²⁶

²⁶ Non-participation implies that the household does not consume the good for reasons independent of prices and income, for example some conscientious objection (Pudney, 1989). Another potential source of zero observations, not considered in this analysis, is purchase infrequency. This implies that FAFH expenditure is related to the length of the survey period. A number of previous studies have found that the Infrequency of Purchase model is rejected in favour of the double hurdle model and that habitual non-consumption is the cause of the zero observations rather than purchase infrequency (Mihalopoulos and Demoussis, 2001; Mutlu and Gracia, 2004; 2006).

Separating the participation and expenditure decisions improves on the restrictive nature of the tobit model framework.

$$y_{1i}^* = w_i' \alpha + v_i \quad (\text{Participation Decision}) \quad \mathbf{2.51}$$

$$y_{2i}^* = x_i' \beta + u_i \quad (\text{Expenditure Decision}) \quad \mathbf{2.52}$$

These equations relate to expenditure in the following way:

$$\begin{aligned} y_i &= x_i' \beta + u_i && \text{if } y_{1i}^* > 0 \text{ and } y_{2i}^* > 0 \\ y_i &= 0 && \text{otherwise} \end{aligned} \quad \mathbf{2.53}$$

where:

y_{1i}^* : latent variable describing the household's decision to participate in a particular food market.

y_{2i}^* : latent variable describing household consumption of a specific food item.

y_i : observed dependent variable – household expenditure.

w_i : vector of variables explaining the participation decision.

x_i : vector of variables explaining the expenditure decision.

v_i, u_i : respective error terms assumed to be independent and distributed as

$$v_i \sim N(0,1) \text{ and } u_i \sim N(0, \sigma^2).^{27}$$

²⁷ Independence of the error terms is a common assumption in studies of this nature (Jensen and Yen, 1996; Su and Yen, 1996; Newman *et al.* 2001; 2003). Dependence is not considered in this analysis and there is some evidence that there is little to be gained from modelling dependence (Smith, 2003). A possible alternative would be to assume the participation decision dominates the expenditure decision, implying that all zero observations are generated by the participation decision. This approach was used before in analysing cigarette consumption (Jones, 1989).

The model is estimated using maximum likelihood estimation. As with the tobit model the sample is divided into households with zero expenditure and those with positive expenditure. The likelihood function for the full double-hurdle model, assuming independence between the error terms is (Cragg, 1971):

$$L(\alpha, \beta, \sigma^2) = \prod_0 \left[1 - \Phi(w_i' \alpha) \Phi\left(\frac{x_i' \beta}{\sigma}\right) \right] \prod_1 \left[\Phi(w_i' \alpha) \sigma^{-1} \phi\left(\frac{y_i - x_i' \beta}{\sigma}\right) \right] \quad 2.54$$

The double-hurdle model reduces to the tobit model if the restriction $\Phi(w_i' \alpha) = 0$ is imposed. This approach has problems similar to the tobit model due to the need to make restrictive assumptions on the error term as highlighted in section 2.3 and appropriate adjustments to the model should such specification errors be detected.

2.7 Summary

Censored data complicates the estimation of the expenditure models due to the presence of zero observations on the dependent variable. Traditionally some form of LDV model has been used, such as the tobit or the double-hurdle model, to account for this. These models, based on the principle of maximum likelihood, suffer the potential for biased and inconsistent estimates in the presence of misspecification problems such as heteroskedasticity and non-normality. When such problems are detected, transformations of the models are required to correct for these problems. Recognising the failings of these models, a variety of SP estimators have been developed that are comparable with LDV models for the censored regression model. Such models are robust to these problems and require no comparable adjustments implying they may

be somewhat superior to MLE. Alternate estimation has not been widely explored to date in the area of FAFH expenditure. Utilising SP estimators avoids the need for complex transformations to LDV models, while also serving to highlight the extent to which misspecification is a problem in the dataset. However, as has been highlighted the SP estimators considered in this thesis purge outlying observations from the sample to maintain robustness. Therefore a highly asymmetric distribution may undermine the efficiency of the SP estimates as this would result in a smaller sample size than corresponding MLE estimation. Bearing in mind the consequences of this approach, chapter 4 discusses the results of SP versus MLE estimation. Chapter 5 and 6 see the application of other estimators described in this chapter.

Appendix 2A

Ordinary Least Squares (OLS) is considered to be the best linear unbiased estimator according to the Gauss-Markov theorem. This estimator, however, performs poorly in the presence of censored data. With such data the variation in the observed dependent variable will understate the effect of the regressors on the true dependent variable. Standard OLS regression using censored data will typically produce estimates that are negatively biased. Following Greene, (1981); Goldberger, (1981); Anemiyama (1984) the standard tobit model can be defined as:

$$y_i^* = x_i' \beta + u_i \quad i = 1, 2, \dots, n, \quad \text{A.1}$$

$$y_i = y_i^* \text{ if } y_i^* > 0,$$

$$y_i = 0 \quad \text{if } y_i^* \leq 0, \quad \text{A.2}$$

Using OLS on the observed positive observations solely yields:

$$E(y_i | y_i > 0) = x_i' \beta + E(u_i | u_i > -x_i' \beta) \quad \text{A.3}$$

Even without assuming normality of the error terms the last term is typically observed as non-zero. This demonstrates the bias associated with least squares approach. Assuming normality and integrating **A.3** gives the following relationship:

$$E(y_i | y_i > 0) = x_i' \beta + \sigma \lambda(x_i' \beta / \sigma) \quad \text{A.4}$$

which further demonstrates that the least squares approach is both biased and inconsistent.

Equation **A.3** can be further rewritten as:

$$y_i^* = \beta_0 + \bar{x}_i' \beta_1 + u_i \quad \mathbf{A.5}$$

whereby $\bar{x}_i \approx N(0, \Sigma)$ and is independent of u_i (Goldberger, 1981). Taking the assumption of zero mean the asymptotic bias can be demonstrated below:

$$p \lim \hat{\beta}_1 = [(1 - \gamma)/(1 - \rho^2 \gamma)] \beta_1 \quad \mathbf{A.6}$$

where $\gamma = \sigma_y^{-1} \lambda(\beta_0 / \sigma_y) [\beta_0 + \sigma_y \lambda(\beta_0 / \sigma_y)]$, $\rho^2 = \sigma_y^{-2} \beta_1' \Sigma \beta_1$ and

$$\sigma_y^2 = \sigma^2 + \beta_1' \Sigma \beta_1.$$

In this case $0 < \gamma < 1$ and $0 < \rho^2 < 1$, implying that $\hat{\beta}_1$ shrinks β_1 towards zero (Anemiyu, 1984).

The bias implicit even when using the full sample can also be demonstrated below. Firstly the unconditional mean of y_i can be defined as:

$$E y_i = \Phi(x_i' \beta / \sigma) \cdot x_i' \beta + \sigma \phi(x_i' \beta / \sigma) \quad \mathbf{A.7}$$

From **A.5** the probability limit can be evaluated as:

$$p \lim \bar{\beta}_1 = \Phi(\beta_0 / \sigma_y) \cdot \beta_1 \quad \mathbf{A.8}$$

where $\bar{\beta}_1$ is the least squares estimator of β_1 (Greene, 1981).

Simply put with censored data y is a non-linear function of x, β and u . Accordingly, there is no reason to suspect that a linear regression of y on x should yield consistent estimates of β . Conventional regression analysis cannot accommodate zero expenditures on the dependent variable and the failure of OLS to deal properly with such data led to the development of estimators built on the principle of Maximum Likelihood.

Chapter 3

Data Description

3.1 Introduction

This chapter provides a detailed description of the data and variables used in this thesis. Most of the variables are selected on the basis of previous empirical findings from the literature described in detail in chapter 1. The inclusion of others is motivated by the theoretical model outlined in chapter 2. The chapter is structured in the following manner. Section 3.2 describes the datasets used in this study, both for Ireland and the UK. Section 3.3 defines each of the variables used in this study, both dependent and independent, with a detailed discussion of the rationale behind their choice provided. The chapter concludes with a brief summary in section 3.4. Tables are contained in section 3A

3.2 Data Sources

The Irish data used in this thesis are variables extracted from the 1994/5 and 1999/2000 Household Budget Surveys²⁸ (HBS) collected by the Central Statistics Office (CSO) of Ireland.²⁹ These studies represent the most recent available cross-sectional household level datasets. The HBS is conducted every 5 years.³⁰ The survey is a random representative sample of 7,877 and 7,644 Irish households in 1994 and 1999 respectively. Each survey is proportionally distributed on a regional basis to ensure the correct proportion

²⁸ The primary purpose of the HBS is to collect detailed household income and household expenditure for the purposes of updating the weighting basis of the Consumer Price Index.

²⁹ The 1994/5 and 1999/2000 HBS will hereafter be referred to as 1994 and 1999.

³⁰ The 2004/5 HBS became available in Summer 2007 but it was beyond the scope of this thesis to analyse the new dataset.

of urban and rural households are represented. Data is collected on households' socio-economic characteristics and an expenditure diary is recorded by the survey respondent of all expenditures during the two week survey period. The expenditure levels are averaged to obtain a weekly expenditure figure for each item recorded.

The UK data used in this thesis are variables extracted from the 2001/2 and 2002/3 Expenditure and Food Surveys (EFS) collected by the Office for National Statistics and the Department for Environment, Food and Rural Affairs in the UK. The EFS started in 2001 and resulted from a merger of the Family Expenditure Survey and the National Food Survey into one compatible survey. Both surveys had been in existence since the 1950s charting the changes in Britain's spending and food consumption patterns. The rationale for merging both surveys into one was to benefit users of the data and to remove the difficulties of reconciling data from the two different sources.³¹ The survey consists of a household questionnaire designed to account for household expenditures on regular and irregular items together with a diary of personal expenditure and an income questionnaire completed by each adult. Each child aged between 7 to 15 years maintains a simplified version of the diary. The survey period for each questionnaire and diary is two weeks. The sample contains 7,473 and 6,927 households in 2001 and 2002 respectively.

³¹ The primary purpose of the EFS is to provide information for the Retail Price Index and the National Accounts estimates of household expenditure.

After purging observations with incomplete information for household characteristics the reported samples for the Irish HBS are 7,721 and 7,526 households respectively for 1994 and 1999. The corresponding figures for the UK are 7,464 and 6,924 households in 2001 and 2002, respectively. A household is defined as any household containing at least one adult aged over 18 years of age.

Neither dataset indicates which household member is primarily responsible for household activities including meal preparation. The expenditure decisions of this individual (the household manager) will best explain the aggregate food expenditure patterns of households. In this analysis the household manager for single households is defined as the survey respondent while for married couples the household manager is defined as the person who works the least hours outside of the home. This approach, while straightforward for households of one adult or a married couple, becomes ambiguous for households of multiple unmarried adults (Stewart *et al.* 2004). In these cases the household manager is defined as the survey respondent.³² Where individual characteristics are used to explain expenditure on FAFH they refer to characteristics of the household manager defined in this way rather than the head of household as has been the case in previous studies. This approach adopts the rationale of other recent studies (Stewart *et al.* 2004, Stewart and Yen, 2004).

³² In the HBS the head of these household is assumed to be the oldest person in the household and given that the completion of the expenditure diary is in itself a task indicative of household management the choice of the head of household as the household manager can easily be justified.

3.3 Variable Selection

Empirical research has identified how specific economic and demographic characteristics of the household influence its demand for FAFH. Household size, households with children, households with high time constraints, age and education levels have been found, among others, to be significant factors that drive FAFH expenditure (See chapter 1, section 1.3.1 for a detailed discussion). In addition, the inclusion of other variables is motivated by Household Production Theory as outlined in chapter 2, section 2.2.

3.3.1 Dependent Variables

The dependent variables analysed are household expenditure on quick-service and full-service in Ireland and the UK. Each variable is adjusted for household size using EU adult equivalence scales.³³ Sample statistics for the dependent variables are presented in table 3.1 in section 3A.

Mean weekly per capita Irish household expenditure on quick-service meals rose from €1.072 to €1.947 between 1994 and 1999. This reflects how the level of FAFH expenditure spent on quick-service has risen during this time as discussed in chapter 1, section 1.2.2. The percentage of households reporting zero expenditure on quick-service has fallen during this time from 56 percent in 1994 to 50 percent in 1999. Possible reasons for zero expenditure are discussed in chapter 2, sections 2.2 and 2.5. The decline in the percentage of households reporting zero expenditure on quick-service highlights the increasing importance of this sector in the Irish FAFH industry.

³³ EU adult equivalence scales give the first adult a weight of 1, each other adult 0.7, and each child under 18 years a weight of 0.5. The same formula was used in both the Irish and UK datasets. An alternative approach would be to use per capita measures but as variables for household composition would be in the equation the results would be the same.

Mean weekly per capita Irish household expenditure on full-service rose from €4.473 in 1994 to €6.513 in 1999. While the proportion of Irish food expenditure on full-service declined between 1994 and 1999 this must be viewed within the context of a growing market. The percentage of households reporting zero expenditures on full-service declined from 48 percent to 47 percent between 1994 and 1999.

Mean weekly per capita UK household expenditure on quick-service rose from €4.461 to €4.632 between 2001 and 2002.³⁴ This reflects how FAFH expenditure in the UK on quick-service has risen between 2001 and 2002. The percentage of households reporting zero expenditure on quick-service fell from 30 percent in 2001 to 29 percent in 2002 reflecting how the FAFH industry in the UK is at a higher stage of development than the industry in Ireland as discussed in chapter 1, section 1.2.

Mean weekly per capita UK household expenditure on full-service also rose, from €10.735 in 2001 to €10.882 in 2002. The proportions of households spending zero expenditure on full-service declined from 30 percent in 2001 to 29 percent in 2002. Overall this suggests that the FAFH industry is more mature in the UK than Ireland with a higher average weekly expenditure per capita and an increased likelihood of a purchase being observed during the survey period but a slower rate of growth.

³⁴ The Sterling-Euro average exchange for 2001 and 2002 were 1.615037 and 1.588505 respectively. The exchange rates were computed using data obtained from the Irish Central Bank website at http://www.centralbank.ie/frame_main.asp?pg=sta_exch.asp&nv=sta_nav.asp

Neither dataset report price or quantity data. Consequently households are assumed to face similar relative prices. While restrictive, this is a common assumption in studies of this nature and is unavoidable given the data constraints (Byrne *et al.* 1998; McCracken and Brandt, 1987; Stewart *et al.* 2004). Quality differences are also uncontrolled for due to these data limitations.

3.3.2 Independent Variables

As with the dependent variables, the independent variables are described in table 3.1 in section 3A.

Many of the variables described in this section refer to the characteristics of the household manager such as education, social class, age, ethnicity and gender. Other variables concern general household characteristics such as household size and household income. Due to data limitations the same set of variables were not used in both the UK and in Ireland. Where the variable appears in both the Irish and UK analyses the discussion will be separated into different paragraphs within each sub-section.

Summary statistics for the Irish and UK variables are illustrated in section 3A in table 3.2 and table 3.3 respectively. Sample statistics for the independent variables are sub-grouped into participating and non-participating households and illustrated in section 3A beginning with table 3.4.

Income

The first continuous variable used in this analysis is income. Income is proxied by per capita average weekly household expenditure and is in log form. The variable is adjusted for household size using adult equivalence scales in the way described for the dependent variables. The mean value of weekly household income recorded for the Irish sample of households increased from €492 in 1994 to €529 in 1999. For the UK sample the mean level of household income has remained constant at €548 between 2001 and 2002.³⁵

In general, evidence has shown that rising incomes are important drivers of FAFH expenditure. Households with higher incomes have been shown to have higher expenditures on all components of FAFH (McCracken and Brandt, 1987; Byrne *et al.* 1998). Higher income households have a greater purchasing power than those on a lesser income. These households are likely to purchase at least one form of FAFH during the survey period. It is hypothesised that households with higher incomes are likely to favour full-service expenditure over quick-service and that full-service expenditure will be more responsive to shifts in income. Income squared is included to account for potential non-linearities.

³⁵ As before the Sterling-Euro average exchange for 2001 and 2002 were computed using data obtained from the Irish Central Bank website at http://www.centralbank.ie/frame_main.asp?pg=sta_exch.asp&nv=sta_nav.asp

Age

The age variable is ordinal and is coded from 1 to 8 in the Irish HBS, however, this variable is treated as a continuous variable. In the UK EFS the exact age of the household manager is identifiable. The log of age was therefore chosen as the age variable for UK households. The mean age for the sample of Irish household managers has risen from 51 to 53 years between 1994 and 1999. The mean age for the sample of UK household managers is 51 years in 2001 and 2002. Age squared is also included in both the Irish and UK analyses to account for potential non-linear age effects.

Expenditure on FAFH is expected to vary across age groups. Older meal planners are likely to have more traditional eating habits and are expected to spend more on meals at home than away from home (Blaylock, 2003; Blisard *et al.* 2002, 2003). Research has found that older households favour the full service option, such as meals in hotels and restaurants, and younger households spend relatively more on quick-service (Byrne *et al.* 1998). Recent US studies have indicated that older household managers indicate a preference for full-service meals as they age (Stewart *et al.* 2004; Stewart and Yen, 2004). Table 3.4 illustrates that the highest expenditure on quick-service in the Irish sample occurs in the 15-24 age group and declines thereafter. The highest expenditure on full-service occurs in the 25-34 age group in both years. Support for the inclusion of the age squared variable is illustrated by the rise in expenditure on both expenditure categories in the 45-54 age group in 1994 and on full-service expenditure in 1999. Similarly in 1994 there is a rise in quick-service expenditure in the 75 and over age group when compared to that of the 65-74 age group. While non-linearities are evident for the age variable there exists a

consistent trend overall that the average amount spent for each expenditure category declines with age. This result suggests that the Irish result is likely to be different to that cited in previous US studies (Stewart *et al.* 2004; Stewart and Yen, 2004). Table 3.5 illustrates that the highest quick-service expenditure in the UK sample occurs in the 15-24 age group in both 2001 and 2002 and thereafter declines. However, non-linearities are evident in the 2001 sample supporting the inclusion of the age squared variable. Concerning full-service the highest expenditure occurs in the 45-54 age group in both 2001 and 2002 and thereafter declines. Again non-linearities are evident in both the 2001 and 2002 samples.

Education

Similar to the Age variable, the education variables used in this analysis differ across the Irish and UK datasets. A number of education variables are used in the Irish analysis. *Secondary* is a dummy variable that takes the value of 1 if a household manager's highest level of education is the Leaving Certificate Examination in Ireland. The number of household managers in the sample with second level education rose from 46% in 1994 to 49% in 1999. The second category, *Tertiary*, is a dummy variable that takes the value of 1 if a household manager has completed some third level course. As expected the number of household managers in the Irish sample with tertiary education has also risen from 12% in 1994 to 19% in 1999. The highest level of education completed cannot be established in the UK EFS dataset. In the UK analysis therefore, the *Education* variable is a dummy variable which takes the value of 1 if the household manager completed his/her education at the age of 17 years or over,

0 otherwise. In 2001, 35% of households fell within this category and 36% in 2002.

Both variables will capture the effect that higher educated household managers have on FAFH expenditure patterns. It is assumed that the education level of the household manager will have a bearing on the decision to purchase some form of FAFH as better educated household managers would be expected to have more awareness of the effects of eating certain types of foods. Tables 3.6 and 3.7 illustrate the differences in average expenditure on quick-service and full-service in the Irish and the UK samples based on education level. It can be seen that, while higher educated household managers appear to spend more at each outlet in both countries than lower educated households, the differences in the quick-service category are very small. Higher educated household managers spend considerably more on full-service than other households, however. Accordingly household managers with higher levels of education are hypothesised to be more likely to favour full-service over quick-service expenditure. Amarasinghe *et al.* (2006) found that educational attainment had a significant and negative impact on the prevalence of obesity. As FAFH consumption, particularly quick-service, has received negative attention with regard to its contribution to obesity, as discussed in chapter 1, section 1.3.2, this finding supports this hypothesis.

Social Class

The social status of the household manager is included to ascertain potential differences between FAFH expenditure patterns among the various social groups. The variable has been found to be significant in food demand analyses in the past (Burton *et al.* 1996; Newman *et al.* 2001; 2003) and is considered worthy of incorporation in this analysis. In both the Irish and UK datasets households are separated into three different groups based on their social status. The first group, *Social1*, are households of a professional status. This variable takes the value of 1 if the household manager is a higher professional, lower professional, employer or manager. In Ireland, in 1994 this category represents 22 percent of the sample and 24 percent in 1999. The corresponding figures for the UK are 29 percent of households in both 2001 and 2002. The second variable, *Social2*, relates to households of an intermediate middle class position. The variable takes the value of 1 if the household manager is a salaried employee or a non-manual worker. In the Irish sample this category represents 22 percent of households in 1994 and 28 percent in 1999. The corresponding figures for the UK sample are 29 percent and 30 percent in 2001 and 2002. The base category, *Social3*, is composed of households whose manager is a manual worker, a farmer or other agricultural worker. In the Irish dataset this category represents 56 percent of households in 1994 and 48 percent in 1999. The corresponding figures for the UK are 42 percent and 41 percent in 2001 and 2002.

Table 3.8 and Table 3.9 illustrate the average expenditure levels of Irish and UK households of different social class. With regard to the Irish data in 1994 the highest professional group have the highest expenditure on full-service, while intermediate households have the highest expenditure on quick-service. In 1999, however, the highest professional group have the highest average expenditure on both expenditure categories. In both years the base category has the lowest average expenditure on each category. With regard to the UK data a similar pattern emerges whereby the highest professional group has the highest average expenditure on both quick-service and full-service in 2001 and 2002. However, in both datasets average expenditure on full-service by this group is considerably larger than that of other households whereas the gap on quick-service expenditure is negligible. It is hypothesised that higher professional groups are more likely to consume full-service than quick-service based on their higher average expenditures on full-service across both datasets. This will be explored further in the econometric analysis once income is controlled for.

Ethnicity

The ethnic origin of the household manager is included in the analysis to identify potential differences between ethnic groups with regard to FAFH expenditure patterns. This variable is used only in the UK analysis and is not available in the Irish HBS. Up until recent times Ireland has not experienced high rates of immigration unlike the UK, which has experience of this for many decades, and thus has an ethnically homogeneous population.³⁶ The ‘non-white’ variable is a dummy variable which takes the value of 1 if the household manager is Black, Asian or of mixed race, and 0 otherwise. The proportion of

³⁶ Ethnicity was included in the Irish Census of Population of 2005/6 for the first time.

non-white households has risen from 4 percent to 5 percent between 2001 and 2002 in the UK samples. Table 3.10 illustrates average UK expenditures of households of different ethnic origin. It can be seen that non-white households in the sample have a higher average expenditure than other households on quick-service but a lower average expenditure on full-service than other households.

A number of US studies have highlighted how Black households are less likely than other households to participate in the FAFH market (Byrne *et al.* 1996; Byrne and Capps, 1996). However, these studies were total market analyses and did not disaggregate by facility type. Byrne *et al.* (1998) found that Black households in the US were more likely to visit quick-service facilities than White households but that they were less likely to eat at full-service facilities. No consistent trends were found for other races such as Hispanics. A similar result was observed by Stewart *et al.* (2004). Stewart and Yen (2004), projecting future trends in the US FAFH market, determined that increases in the non-White population were more likely to benefit the quick-service sector relative to full-service.

Marital Status

The marital status of households in both datasets is divided into three categories: single-adult households, married couples and households composed of multiple adults, where households with multiple adults are the base category. With regard to the Irish data the proportion of single households has risen from 24 percent in 1994 to 27 percent in 1999. The corresponding figures for the UK are 38 percent in 2001 and 2002. In 1994, 47 percent of the

Irish sample are married households. This figure declined to 45 percent in 1999. The corresponding figures for the UK are 46 percent and 45 percent of the sample respectively in 2001 and 2002.

Tables 3.11 and 3.12 illustrate the average expenditure levels of households of different marital status. In both 1994 and 1999, for the Irish sample, single-adult households and married couples have lower expenditure on quick-service than other households. A similar result is found in the UK sample in both 2001 and 2002. With regard to full-service expenditure in the Irish sample it can be observed that both single-adult and married couples have higher average expenditure levels than other households with married couples having the highest average. However, returning to the UK sample, the base category again exhibits the highest average expenditure on full-service in both survey years.

The benefits of meal preparation diminish in small households and so single-adult households are expected to have higher levels of expenditure on FAFH. The single variable is composed of single pensioners, single adults and single parents and in itself it is quite diverse. To capture a potential age effect the interaction term, 'singleage', is included in some of the models estimated in the analysis.³⁷ It is hypothesised that married couples value the family meal-eating occasion more than other households and will in all likelihood favour home meal preparation over FAFH both in Ireland and in the UK. This is likely to be particularly evident for married couples with children who would incur higher costs per eating occasion than other households. Previous Irish studies on meat

³⁷ The variables 'singleage' and age squared will be used as complements to each other in the regression models. One or other will be used in each model, never both.

and prepared meals suggested that married couples were more likely to favour the family meal than other households (Newman *et al.* 2001; 2003).

Gender

The gender of the household manager is included to account for potential differences in FAFH expenditure patterns based on the sex of the household manager. The proportion of Irish female household managers in the sample increased from 50 percent to 53 percent from 1994 to 1999. Table 3.13 indicates that these households have a higher average expenditure on quick-service than those headed by males in both survey years. The pattern is reversed for full-service expenditure as Irish households headed by male household managers have a higher average expenditure on full-service than female headed households.

In the UK sample the proportion of female household managers declined from 62 percent of households in 2001 to 56 percent in 2002. Table 3.14 indicates that the gender patterns of Irish FAFH expenditure are also observed in the UK. UK households headed by a female household manager have a higher average expenditure on quick-service than male headed households while male headed households have a higher average expenditure on full-service than female headed households. It is hypothesised, therefore, that female headed households will be more likely to frequent a quick-service rather than a full-service outlet.

Household Size

Household composition has been considered an important variable in many studies of FAFH demand (Jensen and Yen, 1996; Manrique and Jensen, 1998; Lazaridis, 2002). The larger the household the increased likelihood that at least one member will spend some amount on FAFH during the survey period. As such the likelihood of participation can be expected to increase in larger households. However, larger households would also spend more than smaller households per visit which may be a significant outlay for lower income households. Larger households may also benefit from economies of scale and thus favour home meal preparation. Thus as average household size is declining this is likely to have benefits for the Irish FAFH market as a whole. Overall household size is expected to positively influence the likelihood of participation in the FAFH market. However, household size is expected to have a negative effect on FAFH expenditure. Household size squared is also included to account for possible non-linearities in this variable.

In the Irish sample average household size declined from 3.18 persons in 1994 to 3.10 in 1999. Table 3.15 illustrates that the average level of quick-service expenditure peaks with 3 persons in 1994 and thereafter declines while the average level of expenditure peaks with 4 persons in 1999 and thereafter declines. The average expenditure on full-service peaks in 1 person households in 1994 and declines, though there is a spike in households of 3 persons. In 1999 full-service expenditure peaks in households of 2 persons and declines thereafter.

In the UK sample average household size declined from 2.43 persons in 2001 to 2.39 in 2002. Table 3.16 illustrates the average expenditure levels of UK households based on household size. In both 2001 and 2002 the average level of full-service expenditure peaks in households of 2 persons and thereafter declines. For quick-service expenditure there is a somewhat different pattern observed as the average expenditure level increases through households with 4 persons until the largest group of 5 or more persons where the average expenditure level declines. Both of these findings appear to validate the assumption that larger households seem to benefit from economies of scale in household production. As the average cost of a visit to a full-service outlet would be more expensive than its quick-service equivalent it is not surprising that the decline in average full-service expenditure occurs at a lower household size.

Workers

While all studies analysing FAFH demand recognise the importance of including a variable for the opportunity cost of time of the household the measures that have been used have tended to vary across studies. Hours worked by the household manager has been used as the proxy in some studies (Mihalopoulos and Demoussis, 2001; Stewart *et al.* 2004; Stewart and Yen, 2004; Fanning *et al.* 2005). A number of other studies have assumed that the eldest female in the household is the meal planner and used the associated employment status to proxy for the opportunity cost of time (Mutlu and Gracia 2004; 2006; Nayga and Capps, 1992; Senauer, 1979). A similar approach was also adopted by Jensen and Yen (1996). Recognising the diverse number of proxies used in previous studies, a number of variables were created to

measure the effect of the opportunity cost of time of the household.³⁸ The variable selected as the proxy for the opportunity cost of time in this analysis is the number of workers employed outside the home in each household. A similar approach to measuring the opportunity cost of time was used in a Greek study (Lazaridis, 2002). Labour force participation of adult family members is hypothesised to impact on FAFH expenditure due to the substitution of family member labour away from food preparation to processed foods and other time saving devices (Prochaska and Schrimper, 1973). Firstly it is hypothesised that the greater the proportion of household members participating in the labour market, the less time will be available for the preparation of family meals. Secondly, expenditure on quick-service has been shown to increase with the number of hours spent in the work force and quick-service can be regarded as a convenient alternative to other components of the FAFH market such as full-service (Lazaridis, 2002; Stewart *et al.* 2004). It is further hypothesised that households with a higher opportunity cost of time will favour quick-service over full-service. As such the number of workers is likely to be a good proxy for the opportunity cost of time.

The mean number of workers in the Irish sample of households increased from 1.13 to 1.25 between 1994 and 1999. Table 3.17 illustrates that average quick-service expenditure increases in both 1994 and 1999 in the sample of Irish households as the number of workers in the household increase. A similar pattern is observed for full-service expenditure, although there is a fall in

³⁸ Hours worked by the household manager, a dummy variable accounting for the presence of a working spouse and a dummy variable for all-working households were also considered.

households with 3 workers, the average expenditure rises again in households of 4 or more workers.

The mean number of workers in the UK sample of households increased slightly from 1.35 to 1.36 between 2001 and 2002. Table 3.18 illustrates the average expenditure levels by the number of workers in each household in the UK sample. It can be observed that the average expenditure on both quick-service and full-service rises as the number of persons employed outside the home rises, again a similar pattern to that observed for the Irish sample.

Children

Two variables are used to capture the effect of the presence of children on FAFH expenditure. For the Irish sample: a dummy variable, *Youngkids*, takes the value of 1 if the children are aged less than 14 years, and 0 otherwise, while a dummy variable, *Oldkids*, takes the value of 1 if the children are aged between 15 and 18 years, and 0 otherwise. The proportion of households with older children has fallen from 21 percent to 19 percent between 1994 and 1999. Similarly, for younger children, 40 percent of households had young children in 1994 as against 38 percent in 1999. Table 3.19 and Table 3.20 illustrate the average expenditure levels for Irish households with and without children. It can be observed that households with children, be they older or younger, have a higher average expenditure on quick-service than other households in both the 1994 and 1999 samples. Correspondingly households with children, again older or younger, have a lower average expenditure on full-service than other households in both years.

Due to a different approach to collecting data the children variables are somewhat different for the UK sample. The variable, *Youngkids*, takes a value of 1 if children are aged between 1-5 years in the household, and 0 otherwise. The variable, *Oldkids*, refers to children aged between 5-18 years. The proportion of households with older children has fallen from 27 percent to 26 percent between 2001 and 2002 based on the UK data. The proportion of households with younger children has remained constant at 13 percent in both years. Table 3.21 and Table 3.22 illustrate the average expenditure levels for households with and without children. A similar pattern is observed to that described above for the Irish sample. In both 2001 and 2002 households with children, young and old, have a higher average expenditure on quick-service than other households. With regard to full-service expenditure, households with children both young and old, have a lower average expenditure compared with other households.

It is assumed therefore that the presence of children of either age group will have a negative effect on full-service expenditure as this is typically the most expensive source of FAFH expenditure. However, a positive effect is expected for quick-service expenditure as products such as Happy Meals and free gifts available at outlets such as McDonalds are marketed largely at children. Households with young children can be expected to display reduced levels of FAFH expenditure as they require more care from their parents than older teenagers who are likely to result in increased expenditure at all outlets, due to their increased independence, and possible access to independent income through part-time work.

Commuter

In both Ireland and the UK the ever expanding commuter belt in the country and the increase in the average commute to work, places greater time pressures on individuals commuting long distances compared to those that do not. It was decided to incorporate a variable for commuters into the analysis on the basis that such households would be among the most likely to purchase some form of FAFH. As such this variable can be regarded as an additional proxy for the opportunity cost of time. A dummy variable representing whether or not the household is a 'commuter' household is therefore included in the analysis. This variable takes the value of 1 if a household member is engaged in employment outside the home and if the household spends higher than the mean level of travel expenses during the survey period.³⁹ The mean level of commuter households in the Irish sample increased from 22 percent to 36 percent between 1994 and 1999. Table 3.23 illustrates that commuter households have a higher average expenditure on both quick-service and full-service than other households in both the 1994 and 1999 samples.

The proportion of commuter households within the UK sample remained constant at 32 percent in both 2001 and 2002. Table 3.24 illustrates that UK commuter households have a higher average expenditure level than other households for both quick-service and full-service. It is assumed therefore that being a commuter household will increase the likelihood that such a household will consume some form of FAFH during the survey period.

³⁹ For the Irish sample the mean level of travel expenses is €2.292 and €9.408 in 1994 and 1999, respectively. For the UK sample the mean level is €16.356 in 2001 and €16.675 in 2002. It is important to note at this juncture that this variable does not include cyclists who commute to work for whom there exists no data at present in either survey.

Homeowner

The homeowner variable is a dummy variable that takes the value of 1 if the household owns their own home, and 0 otherwise. In the Irish sample the proportion of homeowners rose from 81 percent to 84 percent between 1994 and 1999. Table 3.25 illustrates that Irish homeowners have a lower average expenditure on quick-service than other households. However, Irish homeowners have a higher average expenditure on full-service compared with other households.

In the UK sample the proportion of homeowners has risen from 71 percent to 72 percent between 2001 and 2002. Table 3.26 illustrates that, similar to the statistics for Irish homeowners, UK homeowners have a lower average expenditure on quick-service than other households but a higher average expenditure on full-service.

This variable has been used in other studies of FAFH expenditure patterns with differing results. Studies for the US and Japan have found that homeowners are less likely to purchase any form of FAFH (Yen, 1993; Manrique and Jensen, 1998). This result has been attributed to the fact that the act of owning a home can be seen as indicative of a commitment to household production. Renters, on the other hand, not having the same attachment to the house as homeowners, can be expected to be more likely to purchase some form of FAFH. Recent Spanish studies, however, have found that homeowners had a

positive influence on FAFH expenditure (Mutlu and Gracia 2004; 2006).⁴⁰ Due to the high level of homeownership in Ireland and the UK a significant relationship between homeownership and FAFH expenditure is expected but the direction of this relationship is *a priori* indeterminate. Furthermore it is hypothesised that higher average expenditure for full-service by homeowners relative to other households and relative to quick-service expenditure may provide evidence of a wealth effect.

Urban and Regional Variables

The urban variable is included in the analysis as it has been found to be significant in several FAFH expenditure studies. This dummy variable takes the value of 1 if the household is resident in an urban area, 0 otherwise. In the Irish sample, the proportion of households resident in urban areas has risen from 54 percent to 64 percent between 1994 and 1999. Table 3.27 illustrates that urban households in the sample have a higher average expenditure than other households for both quick-service and full-service.

A previous US study found that increasing urbanisation translated into higher household FAFH expenditure (Byrne *et al.* 1996). Jekanowski (1999) found that increased quick-service outlet density led to a corresponding rise in quick-service expenditure. It is therefore hypothesised that Irish urban residents will spend more on quick-service than their rural counterparts as more quick-service outlets are likely to be located in urban areas. Hotels are seen to be an important part of full-service expenditure for rural residents and likely to be the sole FAFH outlet in many rural areas. Urban-rural differences are assumed to

⁴⁰ None of these studies have disaggregated the FAFH category, however.

have less significance for the full-service sector. A Greek study determined that being an urban household had a negative effect on full-service expenditure suggesting that urban households spend less than rural households which was attributed to competition between outlets in urban centres making prices lower than in rural areas (Mihalopoulos and Demoussis, 2001).

While there is no urban-rural variable in the UK EFS dataset, regional data are available. The base category, 'South', refers to households resident in London or the South East and South West of England, generally regarded as the richest part of the UK. Five other variables are considered: 'Northern', which refers to households from the North East and North West of England including Merseyside, Yorkshire and the Humber; 'Mideast', which refers to households in the East and West Midlands and Eastern counties such as Norfolk; and 'Welsh', 'Scot' and 'NI', which refer to households located in Wales, Scotland and Northern Ireland respectively.

It can be seen that the proportion of Northern households in the sample fell slightly from 16 percent to 15 percent while the proportion of Mideast households remained constant at 24 percent from 2001 to 2002. Scottish households maintained a share of 8 percent as did Welsh households with 5 percent while the proportion of Northern Irish households in the sample increased from 7 to 8 percent between 2001 and 2002. Table 3.28 illustrates the average expenditures of the sample of UK households by regional location. It can be observed that the highest average expenditure on quick-service occurs in Northern Ireland in both years. The lowest average for quick-service expenditure occurs in the Mideast region in 2001 and in Wales in 2002. With

regard to full-service expenditure the highest average expenditure occurs in the base category, the Southern part of England including London in both survey years. The lowest average expenditure for full-service occurs in Wales in both 2001 and 2002.

An additional advantage of including these variables is that, in the absence of price data, incorporating the urban-rural and regional dummy variables into the analysis can control for some of the regional variations in expenditure patterns resulting from regional price differences across households.

Nosmoke

In this analysis, the behaviour of households in relation to the purchase of tobacco, a product associated with known health risks, is used to proxy the health awareness of households. *Nosmoke* is a dummy variable which takes the value of 1 if no household member spends a positive amount on tobacco products during the survey period in both Ireland and the UK, 0 otherwise. The proportion of Irish households sampled spending a zero amount on tobacco has increased from 52 percent to 56 percent between 1994 and 1999. These households are assumed to be more health conscious than other households in the sample. Table 3.29 illustrates that health conscious households have a lower average expenditure on quick-service than other households. The results for full-service, however, reveal that health conscious households have a higher average expenditure than other households in both survey years.

The percentage of households spending a zero amount on tobacco in the UK sample has increased from 69 percent to 70 percent between 2001 and 2002. Table 3.30 illustrates that UK health conscious households have a lower average expenditure on quick-service than other households. However, again similar to the Irish sample, health conscious households in the UK have a higher average expenditure on full-service than other households.⁴¹

As described in chapter 1, section 1.3, recent Irish studies of food expenditure patterns have indicated that health awareness and convenience are two competing factors influencing expenditure decisions on food (Newman *et al.* 2001, 2003). In general, FAFH has been found to have lower nutritional quality than food prepared at home across international studies (Burns *et al.* 2001; Guthrie *et al.* 2002). It is assumed in this analysis that higher levels of health awareness in households will result in a negative effect on quick-service expenditure. Chapter 1, Section 1.3.2 documented how most of the attention regarding health concerns has focused on the quick-service sector solely and that there has been little corresponding investigation of health issues in relation to full-service dining. Indeed there is also little evidence to suggest that frequent full-service dining is anyway healthier than frequent quick-service

⁴¹ Other proxy variables were considered for health awareness in this analysis but did not advance the results of the thesis significantly. The original health awareness proxy was an indicator for households with no expenditure on either tobacco or alcohol. However, feedback from a conference presentation remarked on how there are positive health benefits associated with a certain amount of alcohol. Accordingly alcohol expenditure was removed from the composition of this variable. Other health proxy variables had highly insignificant effects on FAFH expenditure. These variables were calculated using data in the Irish HBS such as visits to the doctor, nights spent in a health care institution to get a general variable for healthiness of Irish households. The EFS contains data on the nutritional intake of UK households, however, this data was absent from the 2001 and 2002 EFS at the time the analysis commenced and accordingly nutritional data could not be analysed.

dining (Binkley, 2005). Nonetheless, it is expected that health awareness will have a greater impact on quick-service expenditure than full-service given the media attention for the former in this regard.

Credit

One US study determined that ownership of credit cards increased the likelihood of a purchase of some form of FAFH (Hiemstra and Kim, 1995). It is also considered as an explanatory factor in this analysis. Credit cards are increasingly common in most Western countries in recent times as a form of payment. The variable, Credit, is incorporated into the analysis to examine the effect that possession of credit cards has on FAFH expenditure. In the Irish sample the proportion of households with a credit card rose from 26 percent in 1994 to 42 percent in 1999. Table 3.31 illustrates that Irish households with at least one credit card have a higher average expenditure on both quick-service and full-service than other households.

In the UK sample the proportion of UK households with at least one credit card rose from 59 percent in 2001 to 61 percent in 2002. Table 3.32 illustrates that UK households with a credit card have a higher average expenditure than other households for both forms of FAFH. This finding is again similar to the result observed for Ireland. It is hypothesised therefore that credit cards will increase the likelihood of a household's participation in both types of FAFH outlets, both in Ireland and the UK.

Seasonal Variables

Seasonal dummy variables are incorporated into the analysis to proxy for seasonal variations in expenditure patterns in the absence of price data. Seasonality is divided into four categories; spring, summer, autumn, winter. In the Irish sample the base category is expenditure in Winter. Table 3.33 illustrates that in the Irish sample the highest average expenditure for quick-service in 1994 is in Summer while it occurs in Autumn in 1999. The highest average expenditure for full-service occurs in Autumn in 1994 and in Autumn in 1999.

As with the Irish sample the base category of the UK sample is expenditure in Winter. Table 3.34 illustrates that the highest average expenditure for quick-service and full-service occurs in the Autumn of 2001 and 2002.

3.4 Summary

The 1994 and 1999 Household Budget Surveys and the 2001 and 2002 Expenditure and Food Surveys have been described in this chapter. The dependent variables have also been defined with summary statistics presented. Similarly, the independent variables used to explain FAFH expenditure patterns have also been defined together with their summary statistics. Where possible the variables used in the Irish and UK studies are close approximates of each other so as to ease the comparison of the results. As evidenced by the discussion in section 3.3.2, many of the independent variables in both the Irish and UK samples appear to have similar effects on FAFH expenditure in both countries. Households with high levels of health awareness and homeowners

report higher levels of expenditure on full-service, and lower levels of expenditure on quick-service, than other households in both countries. Households with a high opportunity cost of time, households with credit cards and commuter households report higher expenditures on both quick-service and full-service than other households in both countries. Quick-service and full-service expenditure appear to decline with both age and household size in Ireland and the UK.

As discussed in chapter 1 the UK FAFH industry is a more mature market than its Irish equivalent which has exhibited high growth rates but from a lower base. Nevertheless the trends observed in both markets are broadly similar. However, it is important to state that nothing can be said about the determinants of demand or the magnitude of the effects based on summary statistics alone. In chapters 4 and 5 an econometric analysis of quick-service and full-service expenditures in Ireland are presented based on the data described in this chapter, with the Ireland-UK comparative analysis presented in chapter 6.

3A Tables

Table 3.1: Description of the Variables used in the analysis

Dependent Variable	Description
Quick-service	Per capita average weekly expenditure on quick-service (€)
Full-service	Per capita average weekly expenditure on full-service (€)
Independent Variables	
Income	Proxied by per capita average total weekly household expenditure (€)
Income2	Income squared (€)
Age	Age of household manager (1-8)
Age2	Age squared
Hhold	Number of persons in the household
Hhold2	Household size squared
Workers	Number of persons in gainful employment outside the home
Singleage	Single * Age
Discrete Variables	
Education ^a	<p>Secondary = 1 if highest level of education completed was Leaving Certificate education.</p> <p>Tertiary = 1 if highest level of education completed was Third Level education.</p> <p>Base category = highest level of education completed was less than Leaving Certificate.</p>
Education ^b	<p>1 = Household manager left school at age 17 or over.</p> <p>0 = Household manager left school before the age of 17</p>
Social Class	<p>Social1 = 1 for household manager categorised as higher professional, lower professional, employer or manager, 0 otherwise</p> <p>Social2 = 1 for household manager categorised as salaried employee and non-manual workers, 0 otherwise</p> <p>Base category = household manager categorised as manual worker, farmer, other agricultural worker or fishermen</p>
Ethnicity ^b	<p>Black = 1 if household is Black</p> <p>Asian = 1 if household is Asian</p> <p>Mixed = 1 if household is of mixed race</p> <p>Base category = household is white</p>
Single, married	<p>Single=1 for single adult household with or without children, 0 otherwise</p> <p>Married=1 for married couple with or without children, 0 otherwise</p> <p>Base category = households with 2 or more adults with or without children</p>
Female	<p>1=Female household manager</p> <p>0=Male household manager</p>

Oldkids ^a	1 = Children aged 14-18 present 0 = No children aged 14-18 present
Oldkids ^b	1 = Children aged 5-18 present 0 = No children aged 5-18 present
Youngkids ^a	1 = Children aged less than 14 present 0 = No children aged less than 14 present.
Youngkids ^b	1 = Children aged less than 5 present 0 = No children aged less than 5 present.
Commuter	1 = A Household member is employed outside the home and incurs higher than the mean level of travelling expenses 0 = Household members are not in employment or do not incur higher than the mean level of travelling expenses
Homeowner	1 = Household owns their own home. 0 = Household does not own their own home
Urban ^a	1 = Urban household 0 = Rural household
Regional dummies ^b	Northern = Household is located in the North of England including Yorkshire, Merseyside and the North East. Mideast = Household is located in the East and West Midlands and Eastern counties of England Welsh = Household is located in Wales Scot = Household is located in Scotland NI = Household is located in Northern Ireland Base category = Household is located in the South of England including London.
Nosmoke	1 = Household spends nothing on tobacco during the survey period 0 = Household spends a positive amount on tobacco during the survey period
Credit	1 = Household possesses at least one credit card 0 = Household possesses no credit cards
Seasonal dummies	Spring = 1 if consumption occurred in Spring, 0 otherwise Summer = 1 if consumption occurred in Summer, 0 otherwise Autumn = 1 if consumption occurred in Autumn, 0 otherwise Base category = consumption occurred in Winter

^aUsed in Irish dataset solely.

^bUsed in UK dataset solely.

Table 3.2: Summary Statistics for the Irish Variables

	<i>Mean (€)</i>		<i>Standard Deviation</i>		<i>Maximum(€)</i>		<i>% Zeros</i>	
	<i>1994</i>	<i>1999</i>	<i>1994</i>	<i>1999</i>	<i>1994</i>	<i>1999</i>	<i>1994</i>	<i>1999</i>
<i>Dependent</i>								
Quick-service	1.072	1.947	2.126	3.433	35.56	84.65	56%	50%
Full-service	4.473	6.513	9.417	12.39	165.8	166.0	48%	47%
				1	9	2		
<i>Independent</i>	-							
<i>Continuous</i>								
Income (ln)	4.923	5.274	0.601	0.679	7.041	8.401		
Income ² (ln)	24.59	28.27	5.965	7.119	49.57	70.56		
	8	1			7	9		
Age	5.083	5.274	1.654	1.657	8	8		
Age ²	28.57	29.09	17.66	17.27	64	64		
	2	4	5	2				
Hhold	3.182	2.904	1.877	1.535	15	12		
Hhold2	13.64	10.78	15.40	10.67	225	144		
	7	9	5	6				
Workers	1.130	1.246	0.943	0.988	7	7		
Singleage	1.582	1.404	2.755	2.643	8	8		
<i>Independent</i>	-							
<i>Discrete</i>								
Secondary	0.464	0.493						
Tertiary	0.120	0.191						
Social1	0.218	0.242						
Social2	0.221	0.276						
Single	0.241	0.273						
Married	0.471	0.446						
Female	0.500	0.529						
Oldkids	0.211	0.186						
Youngkids	0.403	0.381						
Homeowner	0.807	0.842						
Urban	0.543	0.637						
Commuter	0.223	0.362						
Nosmoke	0.519	0.560						
Credit	0.265	0.419						
Spring	0.234	0.201						
Summer	0.263	0.295						
Autumn	0.247	0.303						

Table 3.3: Summary Statistics for the UK variables

	<i>Mean (€)</i>		<i>Standard Deviation</i>		<i>Maximum(€)</i>		<i>% Zeros</i>	
	<i>2001</i>	<i>2002</i>	<i>2001</i>	<i>2002</i>	<i>2001</i>	<i>2002</i>	<i>2001</i>	<i>2002</i>
<i>Dependent</i>								
Quick-service	4.461	4.632	6.114	6.343	62.316	64.017	37%	36%
Full-service	10.735	10.882	15.469	15.895	171.493	223.288	30%	29%
<i>Independent –</i>								
<i>Continuous</i>								
Income (ln)	5.482	5.483	0.626	0.629	8.090	8.511		
Income ² (ln)	30.442	30.455	6.874	6.891	65.447	72.432		
Age	3.850	3.869	0.365	0.360	4.585	4.585		
Age ²	14.957	15.101	2.773	2.754	21.022	21.022		
Singleage	1.490	1.328	1.914	1.872	4.585	4.585		
Hhold	2.427	2.395	1.324	1.281	12	11		
Hhold2	7.642	7.375	8.707	8.091	144	121		
Workers	1.353	1.357	1.004	1.001	6	6		
<i>Independent –</i>								
<i>Discrete</i>								
Education	0.352	0.359	0.478	0.480				
Social1	0.285	0.288	0.446	0.445				
Social2	0.293	0.297	0.385	0.388				
Non-white	0.042	0.050	0.218	0.201				
Single	0.381	0.383	0.486	0.473				
Married	0.458	0.447	0.498	0.497				
Female	0.617	0.562	0.486	0.496				
Oldkids	0.266	0.260	0.442	0.439				
Youngkids	0.132	0.128	0.339	0.334				
Homeowner	0.714	0.719	0.452	0.449				
Commuter	0.325	0.321	0.468	0.467				
Nosmoke	0.692	0.699	0.462	0.459				
Credit	0.594	0.610	0.491	0.488				
Northern	0.156	0.154	0.363	0.361				
Mid-East	0.244	0.236	0.429	0.425				
Scot	0.083	0.085	0.276	0.278				
Welsh	0.047	0.052	0.213	0.221				
NI	0.071	0.084	0.257	0.278				
Spring	0.250	0.253	0.433	0.435				
Summer	0.242	0.243	0.428	0.429				
Autumn	0.252	0.256	0.434	0.436				

Table 3.4: Mean Expenditure Levels of Irish Households by Age of Household Manager

	1994						
	1-2	3	4	5	6	7	8
Quick-service	2.578	1.678	1.192	1.229	0.818	0.407	0.443
Full-service	5.730	5.840	4.523	5.204	4.976	2.949	2.020
Sample Size	190	1276	1856	1466	1001	1178	754
	1999						
	1-2	3	4	5	6	7	8
Quick-service	4.362	3.179	2.576	2.255	1.419	0.578	0.295
Full-service	6.267	8.554	6.902	7.146	6.827	4.524	3.838
Sample Size	176	1056	1782	1533	1148	1106	725

Table 3.5: Mean Expenditure Levels of UK Households by Age of Household Manager

	2001						
	1-2	3	4	5	6	7	8
Quick-service	5.736	5.397	5.517	4.568	4.256	3.511	3.186
Full-service	10.217	11.788	10.721	11.961	10.935	9.280	8.645
Sample Size	318	1325	1581	1395	1049	979	817
	2002						
	1-2	3	4	5	6	7	8
Quick-service	6.500	5.761	5.334	4.792	3.716	2.889	2.794
Full-service	11.199	11.385	11.149	11.665	11.390	10.207	8.581
Sample Size	234	1212	1430	1200	1035	1008	805

Table 3.6: Mean Expenditure Levels of Irish Households by Education Level of Household Manager

	1994			1999		
	Secondary	Tertiary	Base	Secondary	Tertiary	Base
Quick-service	1.266	1.427	0.653	2.174	2.648	1.029
Full-service	4.993	10.577	2.034	6.360	12.159	3.293
Sample Size	3579	925	3217	3711	1436	2379

Table 3.7: Mean Expenditure Levels of UK Households by Education Level of Household Manager

	2001		2002	
	Education	Base	Education	Base
Quick-service	5.293	4.273	5.068	4.122
Full-service	14.978	8.426	14.843	8.667
Sample Size	2630	4834	2483	4441

Table 3.8: Mean Expenditure Levels of Irish Households by Social Class of Household Manager

	1994			1999		
	Social1	Social2	Base	Social1	Social2	Base
Quick-service	1.394	1.449	0.769	2.690	2.424	1.264
Full-service	9.188	5.484	2.208	10.970	7.316	3.713
Sample Size	1681	1703	4337	1822	2083	3621

Table 3.9: Mean Expenditure Levels of UK Households by Social Class of Household Manager

	2001			2002		
	Social1	Social2	Base	Social1	Social2	Base
Quick-service	6.102	5.948	3.453	5.900	5.870	3.265
Full-service	17.472	11.157	7.199	17.307	11.034	7.624
Sample Size	2153	2176	3135	2001	2084	2839

Table 3.10: Mean Expenditure Levels of UK Households by Ethnicity of Household Manager

	2001		2002	
	Non-white	White	Non-white	White
Quick-service	5.083	4.583	5.575	4.438
Full-service	7.660	10.819	9.124	11.023
Sample Size	313	7151	346	6578

Table 3.11: Mean Expenditure Levels of Irish Households by Marital Status of Household Manager

	1994			1999		
	Single	Married	Base	Single	Married	Base
Quick-service	0.790	1.051	1.200	1.141	1.952	2.482
Full-service	4.461	4.538	4.011	6.276	6.443	6.176
Sample Size	1810	3544	2367	2111	3441	1974

Table 3.12: Mean Expenditure Levels of UK Households by Marital Status of Household Manager

	2001			2002		
	Single	Married	Base	Single	Married	Base
Quick-service	4.102	4.375	6.608	3.836	4.127	6.339
Full-service	9.136	11.121	13.414	8.843	11.587	13.347
Sample Size	2844	3418	1202	2652	3095	1177

Table 3.13: Mean Expenditure Levels of Irish Households by Gender of Household Manager

	1994		1999	
	Female	Male	Female	Male
Quick-service	1.178	0.965	2.162	1.706
Full-service	4.374	4.572	6.256	6.801
Sample Size	3864	3857	3978	3548

Table 3.14: Mean Expenditure Levels of UK Households by Gender of Household Manager

	2001		2002	
	Female	Male	Female	Male
Quick-service	4.816	4.337	4.513	4.394
Full-service	10.373	11.316	10.382	11.523
Sample Size	4603	2861	3889	3035

Table 3.15: Mean Expenditure Levels of Irish Households by Household Size

	1994				
	1	2	3	4	5 or more
Quick-service	0.714	0.855	1.338	1.328	1.263
Full-service	5.027	4.816	4.914	4.699	3.217
Sample Size	1784	1632	1125	1302	1878
	1999				
	1	2	3	4	5 or more
Quick-service	0.882	1.465	2.352	2.739	2.536
Full-service	6.921	6.970	6.797	6.952	5.000
Sample Size	1500	1887	1147	1395	1597

Table 3.16: Mean Expenditure Levels of UK Households by Household Size

	2001				
	1	2	3	4	5 or more
Quick-service	3.331	4.009	6.002	6.038	5.488
Full-service	9.708	12.427	10.978	9.857	7.483
Sample Size	2018	2660	1173	1066	547

	2002				
	1	2	3	4	5 or more
Quick-service	3.295	3.596	5.940	6.235	5.784
Full-service	9.599	12.520	10.914	10.399	7.872
Sample Size	1851	2569	1082	953	469

Table 3.17: Mean Expenditure Levels of Irish Households by Number of Workers

	1994				
	0	1	2	3	4 or more
Quick-service	0.437	1.009	1.588	2.013	2.467
Full-service	2.062	4.790	6.203	5.714	6.427
Sample Size	2110	3169	1944	355	143

	1999				
	0	1	2	3	4 or more
Quick-service	0.403	1.888	2.815	3.273	4.333
Full-service	3.599	6.538	8.404	7.813	9.389
Sample Size	1918	2647	2362	424	175

Table 3.18: Mean Expenditure Levels of UK Households by Number of Workers

	2001				
	0	1	2	3	4 or more
Quick-service	2.396	5.148	6.268	7.016	7.673
Full-service	6.809	11.486	13.915	14.024	14.413
Sample Size	1493	2463	2605	584	319
	2002				
	0	1	2	3	4
Quick-service	2.255	4.990	6.160	6.436	7.4085
Full-service	6.970	12.287	13.281	15.398	16.357
Sample Size	1316	2314	2466	541	287

Table 3.19: Mean Expenditure Levels of Irish Households with Old Children

	1994		1999	
	Oldkids	No Oldkids	Oldkids	No Oldkids
Quick-service	1.412	0.981	2.786	1.755
Full-service	3.654	4.692	5.420	6.762
Sample Size	1628	6093	1400	6126

Table 3.20: Mean Expenditure Levels of UK Households with Old Children

	2001		2002	
	Oldkids	No Oldkids	Oldkids	No Oldkids
Quick-service	6.529	3.943	6.693	3.677
Full-service	8.817	11.431	9.307	11.435
Sample Size	1989	5475	1800	5124

Table 3.21: Mean Expenditure Levels of Irish Households with Young Children

	1994		1999	
	Youngkids	No Youngkids	Youngkids	No Youngkids
Quick-service	1.225	0.969	2.459	1.632
Full-service	3.474	5.147	5.388	7.204
Sample Size	3110	4611	2865	4661

Table 3.22: Mean Expenditure Levels of UK Households with Young Children

	2001		2002	
	Youngkids	No Youngkids	Youngkids	No Youngkids
Quick-service	5.216	4.543	5.190	4.355
Full-service	7.741	11.191	7.956	11.309
Sample Size	988	6476	883	6041

Table 3.23: Mean Expenditure Levels of Irish Commuter and Non-Commuter Households

	1994		1999	
	Commuter	Other	Commuter	Other
Quick-service	1.713	0.887	2.830	1.447
Full-service	7.262	3.671	8.909	5.156
Sample Size	1724	5997	2720	4806

Table 3.24: Mean Expenditure Levels of UK Commuter and Non-Commuter Households

	2001		2002	
	Commuter	Other	Commuter	Other
Quick-service	6.409	3.778	6.151	3.663
Full-service	15.086	8.643	15.933	8.498
Sample Size	2423	5041	2220	4704

Table 3.25: Mean Expenditure Levels of Irish Households by Homeownership

	1994		1999	
	Homeowner	Renter	Homeowner	Renter
Quick-service	1.030	1.248	1.862	2.401
Full-service	4.753	3.303	6.784	5.060
Sample Size	6233	1488	6340	1186

Table 3.26: Mean Expenditure Levels of UK Households by Homeownership

	2001		2002	
	Homeowner	Renter	Homeowner	Renter
Quick-service	4.568	4.793	4.447	4.496
Full-service	12.122	7.273	12.590	6.506
Sample Size	5329	2135	4980	1944

Table 3.27: Mean Expenditure Levels of Irish Urban and Rural Households

	1994		1999	
	Urban	Rural	Urban	Rural
Quick-service	1.319	0.638	2.500	1.291
Full-service	5.075	3.418	7.730	5.068
Sample Size	4085	3441	4916	2805

Table 3.28: Mean Expenditure Levels of UK Households by Regional Location

	2001					
	Northern	Mid-East	Welsh	Scot	NI	Base
Quick-service	4.528	4.325	4.696	4.704	5.638	4.583
Full-service	9.308	10.228	8.665	9.475	11.203	12.698
Sample Size	1165	1818	354	622	529	2377
	2002					
	Northern	Mid-East	Welsh	Scot	NI	Base
Quick-service	4.575	4.250	3.671	5.059	5.440	4.338
Full-service	9.950	10.787	8.456	10.120	9.647	12.588
Sample Size	1065	1634	357	585	584	2140

Table 3.29: Mean Expenditure Levels of Irish Households by Health Awareness

	1994		1999	
	Non-smoker	Smoker	Non-smoker	Smoker
Quick-service	0.897	1.260	1.662	2.310
Full-service	5.042	3.860	7.027	5.857
Sample Size	4006	3715	4217	3309

Table 3.30: Mean Expenditure Levels of UK Households by Health Awareness

	2001		2002	
	Non-smoker	Smoker	Non-smoker	Smoker
Quick-service	4.096	5.837	3.866	5.842
Full-service	11.261	9.552	11.520	9.401
Sample Size	5164	2300	4838	2086

Table 3.31: Mean Expenditure Levels of Irish Households by Credit Card Ownership

	1994		1999	
	Credit	None	Credit	None
Quick-service	1.483	0.924	2.564	1.502
Full-service	9.149	2.791	10.360	3.740
Sample Size	2043	5678	3152	4374

Table 3.32: Mean Expenditure Levels of UK Households by Credit Card Ownership

	2001		2002	
	Credit	None	Credit	None
Quick-service	5.014	4.075	4.837	3.873
Full-service	13.191	7.146	13.484	6.803
Sample Size	4431	3033	4227	2697

Table 3.33: Mean Expenditure Levels of Irish Households by Season

	1994			
	Spring	Summer	Autumn	Base
Quick-service	1.038	1.095	1.023	1.031
Full-service	4.285	4.426	4.515	4.613
Sample Size	1808	2032	1904	1760

	1999			
	Spring	Summer	Autumn	Base
Quick-service	1.891	1.968	1.977	1.888
Full-service	5.776	6.892	6.924	6.009
Sample Size	1511	2217	2281	1517

Table 3.34: Mean Expenditure Levels of UK Households by Season

	2001			
	Spring	Summer	Autumn	Base
Quick-service	4.468	4.536	4.733	4.784
Full-service	10.036	10.920	11.641	10.349
Sample Size	1865	1806	1881	1912

	2002			
	Spring	Summer	Autumn	Base
Quick-service	4.537	4.304	4.466	4.532
Full-service	9.567	10.950	12.301	10.695
Sample Size	1752	1685	1770	1717

Chapter 4

Parametric and Semiparametric Estimation of Quick-Service Expenditure in Ireland

4.1 Introduction

In this chapter, Irish households' quick-service expenditure patterns are analysed using both parametric and semiparametric estimation techniques. The estimators considered, the tobit, CLAD and SCLS models, are outlined in Chapter 2 and are each used to estimate quick-service expenditure in Ireland using the 1994 and 1999 Household Budget Survey datasets described in Chapter 3.

The main objective of this chapter is to compare some methodological alternatives which can be used in estimating models of household expenditure at the micro level. Both parametric and semiparametric (SP) alternatives are considered. In Chapter 2 the advantages of SP approaches over Maximum Likelihood Estimation (MLE) were highlighted. However, also discussed were the problems that arise when significant asymmetry is prevalent in the dataset as this will reduce the efficiency of the SP estimates. In this chapter, ML, CLAD and SCLS estimators of the censored regression model are compared with the aim of finding the most appropriate approach for use in this study. A secondary objective is to analyse the factors determining expenditure on quick-service meals by Irish households. The quick-service sector in Ireland is selected because it has been identified as the component of the Irish FAFH industry with the highest growth potential at present for reasons discussed in chapter 1, section 1.2. This sector has outperformed the wider eating out

market in recent times in terms of growing market share at the expense of full service options such as hotel and restaurant meals.

Chapter 1, section 1.3.1, describes certain characteristics that are fuelling the demand for convenience in Ireland. These include the growth of younger, single-adult households and overall declining household size, increasing urbanisation and increasing labour force participation, particularly that of females. It is assumed that the demand for convenience is the primary influence behind the growth in quick-service expenditure in Ireland. Chapter 1, section 1.3.2, highlighted the growing literature on the effect quick-service products are thought to be having on obesity rates. Health awareness is assumed to temper the demand for quick-service products, particularly among higher educated households for example who could be assumed to have a greater level of health awareness than others. Both the demand for convenience and health awareness are considered in this analysis.

This chapter is structured in the following manner. Section 4.2 discusses the specification of the model and describes the estimation techniques used. Section 4.3 discusses how the SP estimators compared against MLE of the tobit model while section 4.4 compares the results of the SP estimators to a tobit model adjusted for misspecification. The results of the latter model are subsequently discussed in section 4.5. The chapter is summarised in section 4.6.

4.2 Model Specification

The dependent variable used in this analysis is average weekly per-capita household quick-service expenditure. This variable is defined in chapter 3. Quick-service expenditure is expressed as a function of income, income squared, the opportunity cost of time, health awareness and various socio-economic variables assumed to underpin the tastes and preferences of the household and the household manager in particular. All independent variables are listed in Table 4.1.

The censored regression model is estimated using MLE and both the CLAD and the SCLS SP estimators. Each model is described in chapter 2 section 2.4.1 and section 2.4.2 and are comparable to each other. The consistency of MLE requires a complete and correct specification of a parametric family of the error distribution. If the model is misspecified, model assumptions must be relaxed, and estimators are needed which remain consistent under more general assumptions. Both the CLAD and the SCLS are robust to the typical misspecification errors that cause problems with MLE such as heteroskedasticity and non-normality (Chay and Powell, 2001). These estimators, however, may be less efficient than their parametric alternative depending on the extent to which outliers are a problem in the dataset. As such, while it may be expected that the results from the semiparametric estimation techniques are more consistent than MLE, depending on the extent of asymmetry in the dataset, and the amount of observations purged, they may be less efficient than MLE (Pudney, 1989; Powell, 1994).

MLE, CLAD and SCLS techniques were performed using the econometrics software package STATA S/E Version 8.⁴² The results of these models are presented in Tables 4.2, 4.3 and 4.4 respectively.

4.3 SP and MLE Comparison

The results from the tobit model presented in table 4.2 use the full sample which in 1994 is 7,721 observations. The sample sizes recorded for the CLAD and the SCLS are radically different as demonstrated in tables 4.3 and 4.4 respectively. The CLAD returns a sample of 3,447 observations as against 2,141 for the SCLS. Thus 4,274 observations are purged in the estimation of the CLAD model and 5,580 observations are purged by the symmetric trimming used to compute the SCLS estimator. These results indicate that the true distribution of the dependent variable is highly asymmetric and unlikely to be normal as so many observations are lost. The loss of observations appears to have reduced the efficiency of the SP results considerably. For some variables the standard errors reported using CLAD are lower than those estimated using the tobit model, for example, the workers, married and commuter variables, though in almost all cases the standard errors reported using the tobit are lower than the CLAD. There remains some significance in the CLAD results, however.

⁴² The respective ado files were obtained at <http://elsa.berkeley.edu/~kenchay>. For consistency, the residuals of the tobit model estimated using MLE are computed using bootstrapping.

While the coefficients for the models have mostly the same sign they diverge considerably in magnitude. For example, the income coefficient is 5.4 when the model is estimated using MLE, 5.5 when estimated using CLAD and 11.8 when estimated using SCLS. In particular, the results are extremely different when estimated using SCLS compared with the other techniques. The income coefficient alone is twice as large as the coefficient in the other two models. In addition, the estimated standard errors are much larger and there is no single significant coefficient.

With regard to the 1999 results, the sample reported using the CLAD and the SCLS is 4,259 and 4,065 observations respectively which compares with a full sample of 7,526 used in the tobit. Thus 3,267 and 3,461 observations are purged using the SP estimation techniques. This again raises issues of concern regarding the accuracy of these results. Despite more significance, the SCLS performs poorly again with standard errors larger in most cases than in both the CLAD and MLE approaches. However, the CLAD estimates have shown some improvements. Standard errors are lower for CLAD estimation than MLE for a few of the results (the results for secondary, *Youngkids*, commuter, nosmoke and autumn specifically). Overall there is greater accuracy in the SP estimates in 1999 when compared to 1994, however questions as to the efficiency of these results remain.

The generally accepted method to test between semiparametric and parametric estimators of the censored tobit model is a version of the Hausman test as proposed by Newey (1987) (see Yoo *et al.* (2000), Berg and Kaempfer (2000) and Yoo (2003) for recent applications). This test statistic is shown in chapter

2, section 2.4.3. In all cases the tobit model estimated using MLE is strongly rejected in favour of the semiparametric alternatives as shown in Table 4.5. However, as our discussion above revealed, the semiparametric estimates are far inferior to the MLE estimates in efficiency terms, particularly in 1994. There are two options as to how to proceed: on the one hand one could proceed with the semiparametric estimates accepting the loss in efficiency; or on the other hand one could attempt to adjust the tobit model so that MLE yields consistent estimates. The extent of the efficiency loss in using the semiparametric approaches is so great that the analysis proceeds with the latter option.

4.4 The Adjusted Tobit Model

The maximum likelihood estimates presented in table 4.2, while more efficient than the semiparametric estimates, are inconsistent as they are not robust to non-normality or heteroskedasticity. Further testing for these misspecification problems confirms these findings as both homoskedasticity and normality are rejected.⁴³ To correct for these problems, multiplicative heteroskedasticity of the form given in equation 2.20, chapter 2, section 2.3.1, with the continuous variables assumed to be the cause, and a Box-Cox transformation of the dependent variable, to allow for non-normality as shown in chapter 2, section 2.3.2. are both assumed.

⁴³ The results of a Lagrange Multiplier test for heteroskedasticity, and Pagan and Vella's (1989) moments based test for non-normality are presented in Table 4.6.

Likelihood ratio tests imply that the adjusted tobit model is superior to the standard tobit model in modelling quick-service expenditure using Irish data. Adjusted for heteroskedasticity and non-normality, the standard errors are dramatically lower than the unadjusted tobit and each of the semiparametric estimators for both years (table 4.7).

4.5 Results

The Box-Cox heteroskedastic tobit model is found to be the most appropriate choice for modelling quick-service expenditure in Ireland. The empirical results of the model are analysed in this section.

4.5.1 Income⁴⁴

Income has a positive effect on quick-service expenditure but at a decreasing rate in both survey years. This is in line with previous results: as households earn more income they purchase more leisure activities, including dining amenities (Byrne *et al.*, 1998; McCracken and Brandt, 1987). Income squared was included to attempt to capture non-linearities with regard to income. The results indicate that there exists a significant non-linear relationship as the coefficient for income squared is significant and negative. At higher income levels, households appear to move away from quick-service expenditure, potentially toward other full-service options.

⁴⁴ The results discussed for the income variable refer to the parameter values solely and not marginal effects or elasticities. In this analysis it is the sign of the variable that is considered important and useful in ascertaining present and future expenditure levels, not the magnitude of the effect. For example, there is little additional technical information to be gained by analysing the effect a 1% rise in the mean level of income would have on the mean level of quick-service expenditure. The signs of the coefficients will be unaffected using such procedures.

4.5.2 Age

The age of the household manager has a negative and statistically significant effect on quick-service expenditure. The negative age effect is common to many studies on FAFH demand that have shown that older households display reduced levels of expenditures compared to younger households. Stewart *et al.* (2004) found that older U.S. household managers are less likely to frequent quick-service outlets and have a preference for full-service options as they age. The significance of the age squared coefficient indicates that there exists a non-linear relationship between this variable and quick-service expenditure.

4.5.3 Household Size

Household size has a significantly positive effect on quick-service expenditure though at a decreasing rate as the squared term is negative. Lazaridis (2002) found that family size had a positive effect on expenditure on takeaway meals and attributed this to the fact that the more members in the household the greater the probability that at least one member will spend on FAFH. Mintel (2004a) found that households with four or more adults had the highest penetration for quick-service foods in Ireland, a result supportive of this finding. In contrast, it should be noted that Stewart *et al.* (2004) found that larger households spend less on all segments of FAFH, supporting their hypothesis that such households benefit from economies of scale in food preparation at home.

4.5.4 Workers

As expected the number of workers is positively related to quick-service expenditure, consistent with the hypothesis that households with a high opportunity cost of time will eat out more often than at home. This result is consistent with household production theory as households with higher time constraints would be expected to sacrifice time from household production to engage in other activities (Lazaridis, 2002). The commuter variable, which is considered a secondary proxy for the demand for convenience is insignificant in these results. With the ever expanding commuter belt in Ireland at present it was expected that this variable would have a positive impact on quick-service expenditure.

4.5.5 Education

Secondary

Household managers with second level education are less likely than other households to purchase quick-service meal options. This result is as expected. It is assumed that higher educated household managers will be more aware of the health consequences of consuming certain types of foods and, that this will impact negatively on quick-service expenditure.

Tertiary

In addition, having a third level education has significantly negative effect on quick-service expenditure. Household managers with third level education were hypothesised to be the least likely to purchase quick-service meal options. This could reflect, as hypothesised, and similar to the result observed for the secondary variable, that higher levels of education are consistent with greater

levels of health awareness. On the other hand, as found by Byrne *et al.* (1998), this result may reflect the fact that households with higher education levels may be more likely to consume FAFH at up-market facilities rather than at quick-service facilities. Further analysis will investigate this issue though the above results demonstrate the usefulness of disaggregating the education variable.

4.5.6 Urban

Households resident in urban areas have a significant and positive effect on quick-service expenditure. This can be explained by the fact that towns provide greater access to a variety of quick-service outlets compared with rural areas. Jekanowski *et al.* (2001) showed that increased outlet density of fast food restaurants enhanced the convenience associated with fast foods and thus increased quick-service expenditure. They suggested that most of the growth in fast food consumption is due to an increasing supply of convenience. In general one would expect residents of urban areas to have a faster pace of life than rural dwellers and thus be likely consumers at quick-service outlets. Similarly a wide variety of quick-service outlets in the same urban area would in all likelihood keep prices competitive and act as an incentive to consumers to frequent an outlet while also offering variety.

4.5.7 Marital Status

Single-adult

The results for single-adult households are surprising as they indicate that being in such households has a negative effect on quick-service expenditure. This result is contrary to expectations given that the benefits of preparing one's meals diminish in smaller households. It was therefore hypothesised that these households would indicate a preference for quick-service meals. This variable is made up of single parents, single pensioners and single professionals and is in itself diverse. In an attempt to compensate for a possible age effect here the age squared variable was created as discussed in Section 4.5.3.⁴⁵

Married Couples

Being a married couple has a negative effect on quick-service expenditure in both survey years. This result supports the hypothesis that married couples would be more likely to eat food at home. Such households could be expected to benefit from economies of scale in household production and possibly an added value associated with the family meal eating occasion. This result indicates that the family meal remains important for married Irish households.

⁴⁵ A variable *singleage* (single multiplied by age) was also created but returned no significance in the tobit estimates.

4.5.8 Children

Oldkids

The variable for older teenagers (oldkids) has a positive and significant effect on quick-service expenditure in both survey years. As children become more independent, and have independent disposable income, they are more likely to consume quick-service food products.⁴⁶ This is in line with recent findings that the 15-24 year old age group are the biggest consumers of these products in Ireland within the wider 15-44 age category (Mintel, 2004a). Habit formation can occur at a young age and if these children develop a regular taste for quick-service food products it can be expected that this influence may carry forward into the future.

Youngkids

Chapter 3 section 3.3.2 describes how households with younger children, aged less than 14 years, had a higher average expenditure on quick-service than other households in both 1994 and 1999. The results for the presence of younger children, however, were insignificant in both survey years. One would have expected young children to have a positive effect on quick-service expenditure given that advertising in the sector is heavily targeted at children.

⁴⁶ The effect may be understated in this study due to the data collection method and no separate diary of expenditure by teenagers.

4.5.9 Homeownership

Homeownership has a negative effect on quick-service expenditure. The act of owning a home can be considered indicative of a household investing time in household production, including meal preparation. Renters on the other hand, not having the same level of attachment to the home, and in all likelihood having more individualistic lifestyles, would be expected to favour quick-service as a convenience option. Manrique and Jensen (1998) found a similar result for Spanish households as did Yen (1993) for US households.

4.5.10 Nosmoke

The result for the health awareness variable highlights how there are two competing forces influencing demand for quick-service: the demand for convenience competes with the demand for a healthier lifestyle. This variable is negative and significant in both survey years indicating that households with high levels of health awareness are less likely to consume quick-service foods. This supports the interpretation of the results for the education variables presented in section 4.5.5.

4.5.11 Seasonality

Autumn

There is some evidence of seasonality in the results supporting the inclusion of seasonal dummies. The autumn dummy variable has a positive and significant effect on quick-service expenditure in both survey years indicating that there exists a greater likelihood of a purchase being observed in autumn than, the base category,(winter).

4.6 Summary

The main objectives of this chapter were to analyse the factors determining quick-service expenditure in Ireland and in so doing explore semiparametric alternatives to maximum likelihood estimation of tobit models. This study found that there was an efficiency/consistency trade-off when the semiparametric estimators were compared to the unadjusted tobit model. Despite the technical difficulties associated with estimating tobit models in the presence of heteroskedasticity and non-normality, the loss in efficiency suffered in the semiparametric approach was considered too great a sacrifice to make and so it was decided to proceed with an adjusted model. While the findings of this study correspond with most others in terms of the outright rejection of the MLE approach (see for example Chay and Powell (2001) and Yoo (2003)), in this case the semiparametric approaches were not considered efficient enough to be used as an alternative. This may be due to the larger dataset, more censoring and a greater number of outliers characteristic of the sample used in this study compared with others. Many of the results of the variables examined have the expected sign and most are significant. Household income, household size and urban residents have significant and positive influences on quick-service expenditure. Older households and older household managers, single households and married couples and households with higher levels of education and health awareness experience reduced expenditure levels.

Chapter 5 will extend the model further by considering the double-hurdle model as an alternative to the tobit approach used in this chapter. It will also extend the analysis of the FAFH industry to consider both quick-service and full-service expenditure.

4A Tables

Table 4.1 Explanatory Variables used in the Tobit Model

Income
Income²
Age
Age²
Household Size
Household Size²
Workers
Secondary
Tertiary
Single
Married
Oldkids
Youngkids
Urban
Homeowner
Commuter
Nosmoke
Autumn

Table 4.2 Maximum Likelihood Estimates of the Censored Regression

	Model	
	1994	1999
Constant	-15.3634*** (3.0456)	-24.2551*** (4.0487)
Income	5.3995*** (1.1838)	8.0529*** (1.4732)
Income ²	-0.3532*** (0.1164)	-0.5271*** (0.1353)
Age	-1.7369*** (0.2182)	-1.6584*** (0.3097)
Age ²	0.1149 (0.0213)	0.0572* (0.0303)
Household Size	0.5997*** (0.1401)	1.2637*** (0.2182)
Household Size ²	-0.0474*** (0.0122)	-0.0992*** (0.2051)
Workers	0.5970*** (0.0696)	0.5566*** (0.0989)
Secondary	-0.2232* (0.1195)	-0.5711*** (0.1825)
Tertiary	-0.7489*** (0.1785)	-1.0566*** (0.2318)
Single	-0.3357 (0.2242)	-0.9912*** (0.3246)
Married	-1.0149*** (0.1380)	-1.3732*** (0.1920)
Oldkids	1.2350*** (0.1379)	1.4996*** (0.1924)
Youngkids	0.0502 (0.1709)	-0.1394 (0.2360)
Urban	1.1904*** (0.1057)	1.7702*** (0.1402)
Homeowner	-0.4195*** (0.1402)	-0.5479*** (0.2036)
Commuter	0.1504 (0.1156)	0.1049 (0.1523)
Nosmoke	-0.3666*** (0.0991)	-0.2736** (0.1377)
Autumn	0.2954*** (0.0951)	0.1876 (0.1423)
σ	3.4379 (0.0455)	4.8547 (0.0595)
LL	-10921.054	-13067.895

Notes: ***significant at the 1% level, **significant at the 5% level, *significant at the 10 % level. Standard errors are given in parentheses.

Table 4.3 CLAD Estimates of the Censored Regression Model

	1994	1999
Constant	-14.5303*** (3.9125)	-29.5776*** (8.0176)
Income	5.5501*** (1.4623)	10.8430*** (2.8654)
Income ²	-0.4196*** (0.1395)***	-0.8392*** (0.2489)
Age	-1.4322*** (0.2168)	-1.7318*** (0.3239)
Age ²	0.1118** (0.0213)	0.1097*** (0.0310)
Household Size	0.3579* (0.1699)	0.9609*** (0.2339)
Household Size ²	-0.0322* (0.0166)	-0.0681*** (0.0235)
Workers	0.4401*** (0.0571)	0.2963** (0.0764)
Secondary	-0.1417 (0.1101)	-0.5098** (0.1772)
Tertiary	-0.5086** (0.1787)	-1.0240** (0.2361)
Single	-0.2827 (0.2924)	-0.4040* (0.3530)
Married	-0.5271*** (0.1147)	-0.6210*** (0.1593)
Oldkids	0.7729* (0.1165)	0.9631** (0.1495)
Youngkids	0.1249 (0.1624)	-0.4106** (0.1989)
Urban	0.7500*** (0.1009)	1.1544*** (0.1267)
Homeowner	-0.1701 (0.1557)	-0.3770** (0.2095)
Commuter	0.1560* (0.0836)	0.1244 (0.1175)
Nosmoke	-0.3546** (0.1138)	-0.3761** (0.1298)
Autumn	0.2155 (0.0881)	0.0842 (0.1319)

Notes: ***significant at the 1% level, **significant at the 5% level, *significant at the 10 % level. Standard errors are given in parentheses.

Table 4.4 SCLS Estimates of the Censored Regression Model

	1994	1999
Constant	-34.5076 (33.7891)	-47.4524*** (9.9882)
Income	11.774 (11.5192)	16.9380*** (3.5702)
Income ²	-2.0405 (1.2561)	-1.3430*** (0.3155)
Age	-2.0405 (1.2561)	-2.0648*** (0.4624)
Age ²	0.1525 (0.1391)	0.1400*** (0.0489)
Household Size	0.5025 (2.3101)	1.1142*** (0.3106)
Household Size ²	-0.0542 (0.0958)	-0.0858*** (0.0313)
Workers	0.7293 (1.5707)	0.3957* (0.0968)
Secondary	-0.1474 (0.4346)	-0.5553*** (0.1932)
Tertiary	-0.7247 (0.8096)	-1.3868*** (0.2540)
Single	-0.2450 (0.5692)	0.0008 (0.4813)
Married	-0.2300 (0.5692)	-0.4656*** (0.2281)
Oldkids	0.9414 (1.9559)	0.09852 (0.1856)
Youngkids	0.1771 (2.0804)	-0.4285* (0.2564)
Urban	1.8537 (1.5156)	1.5352*** (0.1575)
Homeowner	-0.2296 (0.4894)	-0.5682** (0.2549)
Commuter	0.2182 (0.3204)	0.1945 (0.1513)
Nosmoke	-0.8597 (0.3503)	-0.4439** (0.1514)
Autumn	0.2181 (0.2623)	0.1349 (0.1682)

Notes: ***significant at the 1% level, **significant at the 5% level, *significant at the 10 % level. Standard errors are given in parentheses.

Table 4.5 Hausman Test of Consistency of the Parametric Tobit Model

	1994		1999	
	Test Statistic	P-value	Test Statistic	P-value
MLE vs. SCLS	320.88	0.0000	167.93	0.0000
MLE vs. CLAD	115.40	0.0000	173.31	0.0000

Table 4.6 Specification Tests of the Adjusted and Unadjusted Tobit Model

				1994		1999	
				<i>Test</i>	<i>P-value</i>	<i>Test</i>	<i>P-value</i>
				<i>Statistic</i>		<i>Statistic</i>	
Lagrange	Multiplier	Test	for	5102.19	0.0000	2221.67	0.0000
Heteroskedasticity							
Ho: Homoskedasticity							
Conditional	Moments	Test	for Non-	344.38	0.0000	213.93	0.0000
normality							
Ho: Normality							
Likelihood	Ratio	Test	for Box-Cox	651.894	0.0000	700.906	0.0000
Heteroskedastic Tobit Model							
Ho: Unadjusted Model							

Table 4.7 Maximum Likelihood Estimates of the Box-Cox Heteroskedastic Tobit Model

Variable	1994		1999	
	Exp.	Hetero.	Exp.	Hetero.
Constant	-15.7875*** (2.4623)		-21.9075*** (2.9356)	
Income	5.0435*** (0.9566)		6.7905*** (1.0668)	
Income ²	-0.3499*** (0.0940)		-0.4657*** (0.0980)	
Age	-1.3436*** (0.1758)		-1.2144*** (0.2232)	
Age ²	0.0844*** (0.0171)		0.0426* (0.0218)	
Household Size	0.7182*** (0.1142)	0.1266*** (0.0111)	1.2130*** (0.1616)	0.0490*** (0.0162)
Household Size ²	-0.0581*** (0.0099)	-0.0103*** (0.0011)	-0.0883*** (0.0154)	-0.0003 (0.0021)
Workers	0.5075*** (0.0562)		0.4335*** (0.0715)	
Secondary	-0.1926** (0.0960)		-0.4557*** (0.1314)	
Tertiary	-0.6008*** (0.1435)		-0.8251*** (0.1672)	
Single	-0.4241*** (0.1803)		-0.6936*** (0.2340)	
Married	-0.8974*** (0.1109)		-1.0097*** (0.1385)	
Oldkids	1.0295*** (0.1109)		1.1258*** (0.1390)	
Youngkids	0.0685 (0.1375)		-0.1260 (0.1702)	
Urban	0.9943*** (0.0851)		1.3509*** (0.1019)	
Homeowner	-0.3396*** (0.1128)		-0.4285*** (0.1467)	
Commuter	0.1115 (0.0929)		0.0979 (0.1097)	
Nosmoke	-0.3216*** (0.0797)		-0.2369** (0.0992)	
Autumn	0.2540*** (0.0764)		0.1736* (0.1025)	
σ	2.7751*** (0.0408)		3.5151*** (0.0564)	
λ	0.5261*** (0.0224)		0.6101*** (0.0289)	
LL	-10595.112		-12717.442	

Notes: *** significant at 1% level, **significant at the 5% level, * significant at the 10% level. Standard errors are given in parentheses.

Chapter 5

An Econometric Analysis of Irish Households' Foodservice Expenditure Patterns

5.1 Introduction

In this chapter the various factors fuelling demand for FAFH in Ireland are analysed. The two largest components of this industry, the quick-service sector and the full-service sector (hotel and restaurant meals), are analysed separately using the most recently available Household Budget Survey datasets for Ireland. The quick-service sector is the fastest growing part of the Irish market.⁴⁷ The sector has outperformed the wider eating out market in recent times, in terms of market share, at the expense of full-service options such as hotel and restaurant meals. However, the full-service sector remains the most important component of this industry accounting for approximately half of all FAFH expenditure in the most recent dataset. Given the diversity of outlets within the foodservice sector in Ireland a disaggregated approach is important in understanding the dynamics of the FAFH industry. As discussed in chapter 1, section 1.3 it is expected that the demand for convenience is the primary factor driving quick-service expenditure, while full-service expenditure is fuelled primarily by the demand for the pleasure associated with the eating out occasion. Accordingly different variables are expected to fuel demand in both sectors in different ways.

⁴⁷ The quick-service sector is quite diverse in that its components include branded fast food chains, ethnic takeaways and traditional chip shop takeaways together with sandwich and juice bars and coffee shops (Mintel, 2004a). In this analysis only fast food and takeaways, both ethnic and traditional, are included.

In this context the main objective of this chapter, therefore, is to analyse the factors determining expenditure on both quick-service and full-service meals by Irish households. In chapter 4, section 4.1, motivations for analysing quick-service expenditure in Ireland were discussed with the key factor being that it is the fastest growing sector of the Irish food market. Incorporating the full-service sector into the analysis will facilitate a thorough understanding of the factors fuelling demand in the market, particularly given the differences between these market segments (as discussed in chapter 1, section 1.2). In addition, building on the methodological alternatives explored in chapter 4, in this chapter the tobit model is extended to a two-stage double-hurdle model both of which are estimated using Maximum Likelihood Estimation as opposed to semiparametric alternatives.

The chapter is structured into the following sections. Section 5.2 describes the model specification and estimation procedures. The results are presented and discussed in Section 5.3 and the chapter concludes with Section 5.4.

5.2 Model Specification and Estimation

The main conclusion of chapter 4 is that in the presence of a highly asymmetric dataset, with both heteroskedasticity and non-normality present, the semiparametric estimators do not provide the expected efficiency gains and are outperformed by a tobit model adjusted for misspecification (chapter 4, sections 4.3, 4.4). As a result, it was decided to continue this analysis using Limited Dependent Variable models. However, as discussed in chapter 2, section 2.6, the tobit model is restrictive both in its assumptions and on economic grounds. The model's assumption that corner solutions are the cause

of the zero observations is particularly restrictive. Concerns about the tobit model led to the development of the double hurdle model.

In the double hurdle model two hurdles must be passed before a positive level of expenditure can be observed. Firstly, in the participation stage, the decision of whether or not to consume FAFH is made. Secondly, the decision is made with respect to the level of consumption or expenditure. A different latent variable is used to model each decision process, with a probit part determining the participation decision and a tobit part determining the expenditure decision. Both decisions are modelled simultaneously. Most recent studies of FAFH expenditure patterns have used two-stage estimators such as the double hurdle model (Mihalopoulos and Demoussis, 2001; Pan and Jensen, 2002; Mutlu and Gracia, 2004; 2006).⁴⁸ Recognising the findings of the recent literature in this field, and recognising the restrictive nature of the tobit model, the methodological approach in this chapter compares tobit and double hurdle estimation of FAFH expenditure in Ireland.

Two dependent variables are used in this analysis: average weekly per-capita household quick-service expenditure and average weekly per-capita household full-service expenditure. Both variables are estimated separately and each variable is defined in greater detail in chapter 3, section 3.6.1. Both dependent variables are expressed as a function of income, the opportunity cost of time,

⁴⁸ To the author's knowledge the most recent study in this area found that the infrequency of purchase model to be the most appropriate in modelling FAFH expenditure (Angulo *et al.* 2007). This study was a total market analysis using Spanish panel data. As discussed in chapter 2 it was decided not to use the infrequency of purchase model in this analysis based on the findings of most recent studies. The above result may be explained by the use of panel data rather than a purely cross-sectional dataset. In addition the benefits of a disaggregated approach have been demonstrated in the results discussed here.

health awareness and various socio-economic variables assumed to underpin tastes and preferences of the household and the household manager in particular. The inclusion of these variables is motivated in part by household production theory (see chapter 2, section 2.2) and in part by previous empirical findings. Tables 5.1 and 5.2 list the independent variables used in this chapter in each stage of the final specification of the model. All the independent variables used here are thoroughly described in chapter 3, section 3.6.2. The tables in 3A provide descriptive statistics which give an indication as to the effect each variable will have on FAFH expenditure patterns.

Problems arise when trying to estimate the double hurdle model as there is no theoretical guidance as to which variables should be included in each hurdle of the model. If the same set of regressors is included in each, the model may not identify the parameters. Certain exclusion restrictions must be imposed based on previous studies of FAFH expenditure and *a priori* assumptions. Firstly, in this analysis it is assumed that once the decision to consume is made, there is little basis to suggest that the opportunity cost of time, proxied by the number of workers in the household, would effect the expenditure level. Accordingly the number of workers variable is assumed to only effect the participation decision (Byrne *et al.* 1998). Income is assumed to affect both the participation and the expenditure decisions. There is rationale for assuming that income will only affect the expenditure decision as decisions regarding prices and income give rise to corner solutions which are modelled by a tobit model. This strategy has been adopted in previous Irish studies of households' food expenditure patterns (Newman *et al.* 2001; 2003). However, all recent and significant studies of FAFH expenditure patterns that have used two-stage

models have incorporated income into both stages of the model on the basis of its high explanatory power in both decisions (Jensen and Yen, 1996; Manrique and Jensen, 1998; Mihalopoulos and Demoussis, 2001; Mutlu and Gracia, 2006). This study bows to the findings of this prior research in recognising the crucial role of income in the household production function described in chapter 2, section 2.2 and includes income in both stages so as to ensure the results have a greater accuracy. The seasonal dummies are assumed to impact on the expenditure decision solely as it is expected that seasonal variations in expenditure, but not participation, may occur. Statistically significant variables in each step of the double hurdle model will be retained within the model.

As discussed in chapter 2, section 2.6, the double hurdle model is estimated using Maximum Likelihood Estimation and is programmed using STATA 8.1.⁴⁹ Maximum likelihood estimates of both models are presented in Tables 5.4 and 5.5 with the necessary specification adjustments. The assumption of homoskedastic error terms is rejected in favour of a multiplicative variance specification (chapter 2, section 2.3.1) and the use of the Box-Cox transformation of the model is justified by the significance of the λ parameter. The tobit model is rejected in favour of the double hurdle model. The various test statistics are described in Table 5.3. This result is supported by other recent studies in the literature that have found the double hurdle model the most appropriate for modelling FAFH expenditure patterns (Mihalopoulos and Demoussis, 2001; Mutlu and Gracia, 2004; 2006).

⁴⁹ The STATA code used in this chapter was adapted from that of Peter Moffatt and Roberto Martínez-Espineira (Martínez-Espineira, 2004; Moffatt, 2005).

5.3 Results

The results of the Box-Cox double hurdle models of Irish and UK quick and full-service expenditure respectively are presented in tables 5.4-5.5. The Box-Cox parameter is significantly different from zero in each model supporting its inclusion. The participation results, for both expenditure types, are listed in Table 5.4 and the expenditure results are listed in Table 5.5. For each variable the participation stage results are described first and then the expenditure stage results.⁵⁰

5.3.1 Income⁵¹

The income variable has a positive and significant effect on participation in both sectors of the FAFH market in Ireland in both years. Higher incomes represent an increased ability to pay which here is found to lead to a higher likelihood of consuming FAFH which itself is typically more expensive than Food-At-Home (Byrne and Capps, 1996). The positive effect for income on participation in both sectors of the FAFH market is in agreement with many other studies (Byrne *et al.* 1996; Jensen and Yen, 1996; Manrique and Jensen, 1998; Mutlu and Gracia, 2004).

Income also has a positive effect on quick-service expenditure in both 1994 and 1999 but at a decreasing rate in 1999. The large positive coefficient for income in both the 1994 and 1999 results for full-service expenditure is also as

⁵⁰ Total FAFH expenditure, quick-service and full-service expenditure combined, was also analysed as a corollary to this analysis. In almost all cases the results were similar to those reported for full-service expenditure, not surprising given that the larger share of expenditure is on full-service products. This also helps vindicate the decision to disaggregate the expenditure category so as to obtain a more complete picture of the market and to gain some insight into the differences in the motivation underlying each expenditure type.

⁵¹ As in chapter 4 the results discussed for the income variable, and the other independent variables, refer to the parameter values solely and not marginal effects or elasticities.

expected. There is no significance for the income squared variable in either 1994 or 1999 for full-service expenditure. These findings are also in line with previous results: as households earn more income they purchase more leisure activities, including dining amenities (McCracken and Brandt, 1987; Byrne *et al.* 1998).

5.3.2 Age

The age variable has a significant and negative effect on the likelihood of participating in the quick-service sector, in both 1994 and 1999. This result supports the hypothesis that older household managers are less likely to eat away from home than younger households. This finding is in line with several US studies (Blaylock, 2003; Blisard *et al.* 2002, 2003). The variable has no significance in determining participation in the full-service sector which appears to indicate that there is no evidence that older Irish household managers have a preference for full-service over quick-service as they age.

The age of the household manager has a negative and statistically significant affect on expenditure in both sectors in both survey years. Previous US studies have found that US household managers were more likely to purchase full-service products over quick-service as they age but this result is not observed in this study (Stewart *et al.* 2004; Stewart and Yen, 2004). The FAFH share of the US dollar is approximately 50 percent so frequenting a FAFH outlet is a more common occurrence for older US household managers than in Ireland (chapter 1, section 1.1). In time, as the Irish market develops further a similar effect may be observed. Non-linearities are also apparent in the results for the age variable with expenditure declining by an increasing magnitude the older

the household manager.⁵² This is further discussed in the results of the marital status of the household manager below.

5.3.3 Household Size

Household size has a positive and significant effect on participation in the quick-service market in 1994 and 1999. The household size squared term has a negative effect in both 1994 and 1999. Larger households have an increased likelihood of participating in the quick-service sector though at a decreasing rate. This result suggests that very large households may benefit from economies of scale in home meal preparation as the probability of participation increases at a decreasing rate with household size. Household size also has a positive effect on participation in the full-service sector. The results for the full-service sector also support the hypothesis that the probability of observing a purchase rises with more persons in the household. The household size squared term had no significance in determining participation in the Irish full-service sector but is included regardless as a control variable.

Household size has a negative affect on both full-service and quick-service expenditure in both survey years. This result is largely as expected with the significance of the squared term indicating that non-linearities also exist. This could be explained by an income effect: that is, for a given level of total household income, per-capita income will be lower in larger households reducing the amount spent on FAFH. Alternatively, a number of US studies have found that larger households spend less on FAFH in all segments, suggest

⁵² Both age2 and singleage were used to attempt to capture non-linearities in the age variable. One or other was used in the regressions to capture this age effect, never both.

that such households benefit from economies of scale in food preparation at home (McCracken and Brandt, 1987; Stewart and Yen, 2004). The result found here is also supportive of this hypothesis.

5.3.4 Workers

The number of workers variable is the proxy for the household's opportunity cost of time. This variable is positively related to participation in both sectors, supportive of its inclusion. The results suggest that household managers highly pressured by time are more likely to frequent FAFH outlets than other households. The value of household time has been found to exhibit a consistently positive effect across studies of FAFH expenditure (Mihalopoulos and Demoussis, 2001; Lazaridis, 2002). As a whole quick-service facilities could be considered the most attractive facility for time constrained households. Full-service facilities may approach or indeed surpass the time requirements for preparing food at home and accordingly may not be as attractive to time starved households. However, full-service dining can be viewed as a form of leisure or alternatively energy saving as consumption in a full-service outlet saves energy rather than time (Botonaki *et al.* 2007). Accordingly households with a number of workers present may be more likely to frequent such establishments as this activity represents a transfer from time spent on household production to leisure time (Byrne *et al.* 1998).

5.3.5 Education

Secondary

Being a household manager with second level education significantly increases the likelihood of participation in the full-service sector in the 1999 study while decreasing the likelihood of participating in the quick-service sector. Also household managers with secondary education spend less on quick-service than other households in 1999. This finding is as expected given the descriptive statistics presented in chapter 3, section 3.3.2 and may be an indication that higher educated households, with associated higher levels of health awareness, are more aware of the negative health effects associated with quick-service food products. McCarthy *et al.* (2006) found that lower education levels are associated with higher levels of obesity in Ireland which is supportive of this result.

Tertiary

A similar positive and significant result with regard to participation in full-service expenditure is observed for household managers with tertiary level education in 1994. By contrast, tertiary education has a negative effect on participation in the quick-service market in both 1994 and 1999. A higher probability of participation in the full-service sector by more educated households may suggest that full service options are perceived favourably from a health perspective.⁵³ Household managers with tertiary education spend significantly less on quick-service products than other households in both survey years. This result is also largely as expected. As hypothesised in

⁵³ Lee and Tan (2007) used education of the household manager as a proxy for the opportunity cost of time as well as to measure the effect of health knowledge on FAFH expenditure. The rationale was that higher educated household managers have a higher opportunity cost of time and are accordingly more likely to eat out on a regular basis.

chapter 1, section 1.3.2, a possible proxy for health awareness is education: better educated households may be expected to be more aware of the health consequences of consumption of certain food products. There is no significance for the variable in the corresponding full-service expenditure stage regressions.

5.3.6. Social Class

There is some evidence that the social class of the household manager has a bearing on the likelihood of participation in both sectors. The *Social1* dummy variable, comprised of higher professional household managers, has a significant and positive effect on participation in the full-service sector in both survey years. The variable has a negative effect on participation in the quick-service sector in the 1994 study. *Social1* has a significantly negative effect on participation in the quick-service sector in 1994, however. Similarly, households with household managers of intermediate and lower middle class, *Social2*, also have a positive and significant effect on participation in the full-service sector in 1994. This result supports the hypothesis that higher professional household managers are more likely to participate in the full-service sector than quick-service.

In the 1994 study household managers in the higher social class bracket, spend significantly more on full-service compared with other households. With regard to quick-service expenditure there is a significantly negative effect observed in 1994 for households with household managers of the higher social class bracket, *Social1*. The *Social2* variable has a positive and significant effect on full-service expenditure in 1994 but there is no significance for the

Social2 variable in the quick-service expenditure results, however. The results for the expenditure stage are similar to those observed for participation with higher social class households more likely to participate, and spend more, in full-service outlets. Full-service dining can be viewed as a form of leisure activity and in this analysis higher social class households appear to substitute time spent on household production for leisure time. Again these results highlight that there are different drivers influencing expenditure patterns in each FAFH expenditure category and validate the assumption made in chapter 3, section 3.3.2 that higher social class households would be more likely to favour full-service over quick-service.

5.3.7 Urban

The urban variable has a positive effect on determining participation in the Irish quick-service sector in both 1994 and 1999. It is likely that towns will have a higher number of quick-service outlets than rural areas due to their larger populations. Higher outlet density in an area increases the households' eating out choices and their likelihood of participation (Jekanowski, 1999). Moreover, urban households are expected to have a faster pace of life than rural households and thus be more likely to favour convenient meals on a regular basis. Urban households also spend more on quick-service than their rural counterparts as the variable has a positive effect on quick-service expenditure in both survey years. These findings are supportive of those of an American study which found that increasing urbanisation translated into higher household FAFH expenditure, particularly on quick-service (Byrne *et al.* 1996).

The urban variable also has a positive and significant coefficient on participation in the full-service sector in 1994 but not in 1999. It is possible that in the interim rural locations could have seen a higher density of outlets which could explain this insignificant result. Being an urban household has a negative effect on full-service expenditure in both 1994 and 1999, however, suggesting that urban households spend less than rural households on full-service. This may be a result of competition between outlets in urban centres making prices lower than in rural areas and the fact that full-service outlets are likely to be the sole FAFH outlet in many rural areas as discussed in chapter 1, section 1.2.1. A similar result was found in a Greek FAFH total market analysis (Mihalopoulos and Demoussis, 2001). In this context, it appears that urban households are more likely to substitute time on household production for leisure time, such as eating out at a FAFH outlet.

5.3.8 Marital Status

Single-adult

Being a single adult household has a negative effect on participation in the quick-service sector in both years which is contradictory to expectations. A positive effect is observed for single-adult households on quick-service expenditure in both survey years, however. Being a single adult household has a negative effect on participation in the full-service sector in 1994 and the variable also has a positive effect on full-service expenditure in both 1994 and 1999. These results appear to suggest that while these households are less likely to participate, in either sector than other households, as discussed above when they do, they spend more. The benefits of home meal preparation diminish in single adult households compared to larger households and these

households would not benefit from economies of scale with regard to household production and as such are more likely to spend more on either FAFH sector relative to other households, particularly those of the base category: households of multiple adults such as student and renter households. The age squared variable is also significant in each of the expenditure stage regressions for both quick-service and full-service. Here this variable controls for a possible age effect within single adult houses (i.e. single pensioners).

Married Couples

Being a married couple has a significantly negative effect on participation in the quick-service sector in both years and in the full-service sector in both survey years. The results for the participation stage indicate that married couples are much less likely than other households to consume FAFH as a whole. Married households were assumed to value the importance of the family meal to a greater extent than other households and accordingly be more likely to eat food-at-home as a result. The results discussed here are supportive of this hypothesis. The variable has no significance in the expenditure stage results of either quick-service or full-service, however. Chapter 3, section 3.3.2 discussed how married couples had the highest average expenditure on full-service in Ireland in 1994 and 1999 but the results presented here indicate that controlling for all other factors, being a married couple has no effect on influencing expenditure in the FAFH market in Ireland.

5.3.9 Children⁵⁴

The presence of older children in the household, aged between 15 to 18 years, appears to increase the likelihood of participation in the quick-service sector. This variable, *Oldkids*, is significant and positive in the 1994 and 1999 studies. As children become more independent, and have access to independent disposable income, they are more likely to consume quick-service food products. This variable has no significance on determining participation in the full-service sector, however. The variable also had no significance in the expenditure stage results for either dependent variable. The *Youngkids* variable, children aged less than 15 years, had no significance in determining participation or expenditure for either the quick-service or full-service sectors in either survey year. This result is contrary to expectations. As discussed in chapter 3, section 3.3.2 households with younger children report a higher average expenditure on quick-service than other households but when time constraints and other factors are controlled for this variable has a negative affect. This may also reflect the likely importance of the family meal for married couples.

5.3.10 Homeownership

Homeownership has a positive influence on participation in the full-service market in the 1999 study and a negative effect on participation in the quick-service sector in the 1994 and 1999 studies. The former is supportive of a number of recent Spanish studies which found that homeowners had a positive influence on participation in the FAFH market (Manrique and Jensen, 1998;

⁵⁴ Regressions using one combined variable for children returned no significance, which supported the use of the two distinct dummy variables.

Mutlu and Gracia, 2004, 2006). This result is likely to be an indication that the social aspect of full-service dining is a significant attraction to homeowners and may also be evidence of a wealth affect. The latter result suggests that the act of owning a home is indicative of a commitment to engage in household production. Renters, without having the same commitment to their residence as homeowners, are accordingly less likely to engage in household production, such as cooking meals. Yen (1993), in a US study, and Manrique and Jensen (1998), in a Spanish study, found that homeowners spend less than renters on FAFH at all types of FAFH. Homeownership has no affect for either variable in the expenditure stage regressions.

5.3.11 Commuter

The commuter variable has a positive and significant effect on participation in the full-service sector in both survey years. Commuters are more likely to be effected by time constraints than those who do not commute to work. This can be interpreted as a further demand for convenience by commuters and is as expected providing further evidence for the opportunity cost of time playing a role in household production decisions. Households with a number of commuters present may be more likely to frequent full-service establishments as this activity represents a transfer from time spent on household production to leisure time as full-service dining can be viewed as a form of leisure. A positive effect for quick-service expenditure was also expected but the commuter variable has no significance in the quick-service results.

As discussed in chapter 3, section 3.3.2 commuter households were assumed to be more likely than other households to purchase some form of FAFH during the survey period. It is somewhat surprising therefore that there is no significance for this variable in the quick-service estimates. The commuter variable has a positive and significant effect on full-service expenditure in 1994, however, which is, as discussed, according to expectations. This may also reflect how full-service dining represents a form of energy saving rather than time saving. With the ever expanding commuter belt in Ireland at present these households can be expected to influence the growth of full-service expenditure into the future.

5.3.12 Nosmoke

The proxy variable for health awareness (no expenditure on tobacco) is significantly negative in both the 1994 and 1999 quick-service results. This result highlights how there are two competing forces influencing demand for FAFH in general and quick-service in particular in this study. Households with higher levels of health awareness appear less likely to participate in the quick-service sector compared to households that do not, once time constraints are controlled for. This variable has no significance in the full-service participation results, however. Overall this finding may also reflect the linking of quick-service consumption with obesity and other health issues while the full-service sector has not received the same level of negative attention (see chapter 1, section 1.3.2).

This variable also has a significantly negative effect on quick-service expenditure in both survey years. Households with high levels of health awareness spend less than other households on quick-service products. However, a positive affect is observed for full-service expenditure in both years. While health awareness reduces the likelihood of participation and expenditure in the quick-service sector there is no comparable affect observed with regard to full-service. This result again gives credence to the hypothesis that quick-service expenditure is perceived in a poor light, from a health and nutritional perspective, by households who have high levels of health awareness. It was assumed that households with high levels of health awareness would be less likely to consume quick-service than other households and this assumption has been vindicated (chapter 3, section 3.3.2). It was also noted that such a finding for full-service expenditure was unlikely given that most of the negative media attention with regard to obesity and other health issues has been largely confined to the quick-service sector to date.

5.3.13 Credit

Hiemstra and Kim (1995) found that possession of credit cards increased the likelihood of purchase of some form of FAFH. The finding of a positive and significant coefficient for full-service in both years validates the assumption that the possession of credit cards influences participation in the full-service sector. It also appears to indicate that households with credit cards are more likely to frequent a full-service outlet over quick-service as the significantly negative coefficient for quick-service in 1999 is contrary to expectations. This may indicate that credit card usage is not as common at quick-service facilities compared to full-service facilities.

Ownership of credit cards also has a significant and positive effect on full-service expenditure in both survey years. Hiemstra and Kim (1995) also found that the use of credit cards was a significant factor in increasing foodservice expenditure. Ownership of credit cards increases one's disposable income and purchasing power. It has been noted, for the income variable, that increased affluence increases the demand for leisure activities, of which full-service dining is an example. There is no significance for quick-service expenditure, however.

5.3.14 Seasonality

There is some evidence of seasonality in the results supporting the inclusion of seasonal dummies. The autumn variable is significant for both quick-service and full-service expenditure in the 1994 results, and for full-service expenditure in 1999. No seasonal dummy is significant in the 1999 expenditure results, however. The results indicate the importance of accounting for seasonality in studies of this nature. The main rationale for including seasonal dummy variables is to account for potential variations in price due to the absence of price data as discussed in chapter 3, section 3.3.2. Such variations may occur as the HBS is collated over a 12-14 month period.

5.4 Summary

This chapter analyses the factors determining FAFH expenditure by disaggregating the expenditure category into its two main components and analysing them separately. A double hurdle model, adjusted for misspecification, outperforms the more restrictive tobit and is used in this analysis. This approach is similar to that of many recent analyses of FAFH expenditure which have used two-stage estimators such as the double hurdle model rather than single-stage estimators such as the tobit. The results from the double hurdle model estimation suggest that different variables influence expenditure in each sector in different ways, thus vindicating the use of a disaggregated approach and also highlight that a number of variables influence the participation and expenditure decisions differently. Foregoing a two-stage estimator may inhibit a complete understanding of the factors influencing participation and expenditure in the Irish FAFH industry and present a skewed picture of results. It should be noted, however, that a number of variables also affect both dependent variables in the same way, for example, income and age and the number of workers variable.

Health awareness significantly reduces the likelihood of participation and reduces the amount of expenditure on quick-service but no similar effect is observed for full-service. It is important to reiterate here that other sectors of the quick-service sector such as juice and sandwich bars and coffee shops are not included in the definition of quick-service in this analysis due to data constraints. The finding that the demand for convenience is a strong driver of quick-service expenditure also indicates that there exists a health-convenience trade-off. The results indicate that the most likely consumers of quick-service

products are younger households with lower levels of education, social class and health knowledge who are resident in urban areas. The more likely consumers of full-service products are younger households with higher levels of education and social class as well as homeowners and commuter households. The finding that households with a high opportunity cost of time are more likely to participate in either sector of the FAFH market than other households is also consistent with household production theory. Similarly the results indicate that certain households substitute time spent on household production for leisure time, i.e. full-service dining, again consistent with theory, particularly higher educated and higher social class households, commuters, and homeowners.

Given the current demographic trends in Ireland and, in particular, the growth of a young adult working urbanised population the prospects for the FAFH industry appear buoyant at present. The impact of increased health awareness may impinge on growth in certain segments of the quick-service sector into the future but at the same time this provides encouragement for the full-service sector given the apparent lack of a similar negative perception from a health perspective. Both sectors must work to develop a favourable healthy image to maintain their growth into the future. In chapter 6 a comparison of UK and Ireland FAFH expenditure will be discussed using the double hurdle model and adopting a similar disaggregated approach to that detailed in this chapter.

5A Tables

Table 5.1 Explanatory Variables used in the Participation Equations of the Box-Cox Heteroskedastic Double Hurdle Model

1994 Quick	1994 Full	1999 Quick	1999 Full
Income	Income	Income	Income
Age	Age	Age	Age
Workers	Workers	Workers	Workers
Household	Household	Household	Household
Size	Size	Size	Size
Household	Household	Household	Household
Size ²	Size ²	Size ²	Size ²
Secondary	Secondary	Secondary	Secondary
Tertiary	Tertiary	Tertiary	Tertiary
Social1	Social1	Social1	Social1
-	Social2	-	Social2
Urban	Urban	Urban	Urban
Single	Single	Single	Single
Married	Married	Married	Married
Oldkids	Oldkids	Oldkids	Oldkids
Youngkids	-	Youngkids	-
Homeowner	Homeowner	Homeowner	Homeowner
Commuter	Commuter	Commuter	Commuter
Nosmoke	-	Nosmoke	-
Credit	Credit	Credit	Credit

Table 5.2 Explanatory Variables used in the Expenditure Equations of the Box-Cox Heteroskedastic Double Hurdle Model

1994 Quick	1994 Full	1999 Quick	1999 Full
Income	Income	Income	Income
Income ²	-	Income ²	-
Age	Age	Age	Age
Age ²	Age ²	Age ²	Age ²
Household	Household	Household	Household
Size	Size	Size	Size
Household	Household	Household	Household
Size ²	Size ²	Size ²	Size ²
Secondary	Secondary	Secondary	Secondary
Tertiary	Tertiary	Tertiary	Tertiary
Social1	Social1	Social1	Social1
-	Social2	-	Social2
Urban	Urban	Urban	Urban
Single	Single	Single	Single
Married	Married	Married	Married
Youngkids	-	Youngkids	-
-	Commuter	-	Commuter
Nosmoke	Nosmoke	Nosmoke	Nosmoke
-	Credit	-	Credit
-	Summer	-	Summer
Autumn	Autumn	Autumn	Autumn

Table 5.3 Specification Tests of the Adjusted and Unadjusted Double Hurdle Model

				1994 Quick		1994 Full	
				<i>Test</i>	<i>P-value</i>	<i>Test</i>	<i>P-value</i>
				<i>Statistic</i>		<i>Statistic</i>	
Lagrange	Multiplier	Test	for	5232.29	0.0000	2747.26	0.0000
Heteroscedasticity							
Ho: Homoscedasticity							
Conditional	Moments	Test	for	342.39	0.0000	374.39	0.0000
Normality							
Ho: Normality							
Likelihood	Ratio	Test	for	1195.406	0.0000	1967.46	0.0000
Box-Cox Het. Double Hurdle Model							
Ho: Box-Cox Het. Tobit Model							

				1999 Quick		1999 Full	
				<i>Test</i>	<i>P-value</i>	<i>Test</i>	<i>P-value</i>
				<i>Statistic</i>		<i>Statistic</i>	
Lagrange	Multiplier	Test	for	2486.62	0.0000	1575.47	0.0000
Heteroscedasticity							
Ho: Homoscedasticity							
Conditional	Moments	Test	for	212.13	0.0000	266.52	0.0000
Normality							
Ho: Normality							
Likelihood	Ratio	Test	for	2965.88	0.0000	1460.98	0.0000
Box-Cox Het. Double Hurdle Model							
Ho: Box-Cox Het. Tobit Model							

Table 5.4 Maximum Likelihood Estimates of the Box-Cox Heteroskedastic Double Hurdle Model (Participation Results)

	1994 Quick	1994 Full	1999Quick	1999 Full
Constant	-2.5704*** (0.2471)	-4.9720*** (0.2526)	4.7951*** (1.8369)	-5.1748*** (0.2557)
Income	0.4817*** (0.0392)	0.9178*** (0.0397)	0.4569*** (0.0374)	0.8461*** (0.0369)
Age	-0.1696*** (0.0151)	-0.0182 (0.0142)	-0.2139*** (0.0164)	0.0183 (0.0150)
Workers	0.2184*** (0.0256)	0.1306*** (0.0253)	0.1426*** (0.0267)	0.0904*** (0.0252)
Household Size	0.3147*** (0.0493)	0.0768* (0.0438)	0.4476*** (0.0597)	0.1157** (0.0473)
Household Size ²	-0.0230*** (0.0043)	0.0013 (0.0044)	-0.0305*** (0.0058)	-0.0028 (0.0051)
Secondary	-0.0576 (0.0421)	0.1294*** (0.0405)	-0.0981** (0.0463)	0.0464 (0.0431)
Tertiary	-0.1575** (0.0673)	0.2759*** (0.0699)	-0.1679*** (0.0628)	0.0657 (0.0599)
Social1	-0.0958** (0.0470)	0.1392** (0.0527)	-0.0462 (0.0444)	0.1028** (0.0479)
Social2	- (0.0436)	0.1363*** (0.0436)	- (0.0444)	0.0528 (0.0410)
Urban	0.3604*** (0.0362)	0.1081*** (0.0351)	0.4043*** (0.0361)	0.0294 (0.0341)
Single	-0.2583*** (0.0770)	-0.1889*** (0.0693)	-0.3324*** (0.0832)	-0.0899 (0.0704)
Married	-0.4744*** (0.0483)	-0.2316*** (0.0450)	-0.3990*** (0.0496)	-0.1596*** (0.0443)
Oldkids	0.5812*** (0.0484)	-0.0689 (0.0480)	0.5109*** (0.0523)	-0.0111 (0.0481)
Youngkids	0.0504 (0.0625)	- (0.0625)	-0.0797 (0.0651)	- (0.0651)
Homeowner	-0.0969** (0.0477)	0.0733 (0.0466)	-0.1290** (0.0513)	0.1143** (0.0493)
Commuter	0.0579 (0.0417)	0.1889*** (0.0438)	0.0365 (0.0397)	0.2041*** (0.0388)
Nosmoke	-0.1220*** (0.0343)	- (0.0343)	-0.0617* (0.0353)	- (0.0353)
Credit	-0.0427 (0.0435)	0.1915*** (0.0445)	-0.0768* (0.0410)	0.1450*** (0.2557)

Standard errors are given in parenthesis.

**** indicates significance at the 1% level, ** indicates significance at the 5% level, * indicates significance at the 10% level*

**Table 5.5a Maximum Likelihood Estimates of the Box-Cox
Heteroskedastic Double Hurdle Model (Expenditure Results)**

	1994 Quick	1994 Full	1999 Quick	1999 Full
Constant	-4.5113*** (1.1991)	-3.9257*** (0.3471)	-5.3384*** (1.1488)	-2.3647*** (0.3533)
Income	2.0838*** (0.4663)	1.2311*** (0.0523)	2.1902*** (0.0416)	0.9850*** (0.0523)
Income ²	-0.1475*** (0.0457)	-	-0.1528*** (0.0380)	-
Age	-0.5627*** (0.0815)	-0.2025** (0.0903)	-0.2287*** (0.0826)	-0.2258*** (0.0868)
Age ²	0.0533*** (0.0084)	0.0243*** (0.0089)	0.0111 (0.0084)	0.0281*** (0.0086)
Household Size	-0.1844*** (0.0449)	-0.2740*** (0.0471)	-0.0490 (0.0493)	-0.2791*** (0.0541)
Household Size ²	0.0138*** (0.0040)	0.0167 (0.0046)	0.0051 (0.0047)	0.0198*** (0.0059)
Secondary	-0.0540 (0.0432)	0.0562 (0.0532)	-0.1145** (0.0480)	0.0218 (0.0551)
Tertiary	-0.1356** (0.0684)	-0.0145 (0.0755)	-0.2211*** (0.0619)	0.0928 (0.0700)
Social1	-0.0781* (0.0459)	0.1824*** (0.0591)	-0.0161 (0.0419)	0.0824 (0.0546)
Social2	-	0.1117** (0.0528)	-	0.0367 (0.0497)
Urban	0.2830*** (0.0389)	-0.1290*** (0.0441)	0.3183*** (0.0363)	-0.0681* (0.0409)
Single	0.2123*** (0.0789)	0.2534*** (0.0852)	0.2052** (0.0804)	0.1761** (0.0835)
Married	-0.0613 (0.0466)	-0.0598 (0.0499)	-0.0749 (0.0463)	-0.0169 (0.0470)
Youngkids	-0.0171 (0.0536)	-	-0.0609 (0.0529)	-
Commuter	-	0.1469*** (0.0456)	-	0.0613 (0.0424)
Nosmoke	-0.0975*** (0.0356)	0.0708* (0.0417)	-0.1010*** (0.0348)	0.0669* (0.0403)
Credit	-	0.1900*** (0.0474)	-	0.0764* (0.0455)
Summer	-	0.0332 (0.0472)	-	0.0736 (0.0461)
Autumn	0.0814** (0.0342)	0.1146*** (0.0419)	0.0167 (0.0361)	0.0924** (0.0455)
λ	0.1227*** (0.0144)	0.1205*** (0.0100)	0.1374*** (0.0137)	0.1145** (0.0118)
σ	0.9777*** (0.0134)	1.2556*** (0.0226)	1.0201*** (0.0176)	1.1818*** (0.0307)
LL	-9925.9363	-15867.183	-12161.32	-17247.344

Standard errors are given in parenthesis.

**** indicates significance at the 1% level, ** indicates significance at the 5% level, * indicates significance at the 10% level*

Table 5.5b Heteroskedastic Terms (Used in Expenditure Stage)

	1994 Quick	1994 Full	1999 Quick	1999 Full
Income	0.0256** (0.0453)	0.3511** (0.0652)	-	-
Age	-0.0120* (0.0125)	-0.0452* (0.0435)	-	-0.0554** (0.0263)
Household Size	-	-	0.2122** (0.0317)	0.0173** (0.0235)

Chapter 6

An Econometric Analysis of Foodservice Expenditure Patterns in Ireland and in the UK

6.1 Introduction

This chapter presents a comparative analysis of the foodservice industries in both Ireland and the UK. Each industry is analysed separately using the most recently available Household Budget Survey datasets for Ireland and the most recent Expenditure and Food Datasets for the UK. Each industry is disaggregated into its two largest components; the quick-service and the full-service sectors. As discussed in chapter 1, section 1.1, analysing the factors fuelling the demand for FAFH expenditure in the UK should assist in projecting growth in the Irish foodservice industry into the future as the UK foodservice industry is at a more mature stage of development than its Irish equivalent. Additionally, to the author's knowledge, an econometric analysis of UK FAFH expenditure patterns has not been conducted to date.

The main objective of this chapter is to analyse the factors determining expenditure on both quick-service and full-service meals by Irish and UK households. In chapter 5 the tobit model was extended to a two-stage double-hurdle model both of which were estimated using Maximum Likelihood Estimation. The double hurdle model was found to be the most appropriate to analyse FAFH expenditure patterns in Ireland. In this chapter the results of a double hurdle model of UK FAFH expenditure patterns will be compared with the results of a double hurdle model of Irish FAFH expenditure patterns.

The chapter is structured into the following sections. Section 6.2 describes the model specification and estimation procedures. The results are presented and discussed in Section 6.3 and the chapter concludes with Section 6.4.

6.2 Model Specification and Estimation

Most recent studies of FAFH expenditure patterns have used two-stage estimators such as the double hurdle model (Mihalopoulos and Demoussis, 2001; Pan and Jensen, 2002; Mutlu and Gracia, 2004; 2006). Recognising the findings of the recent literature in this field, and acknowledging the restrictive nature of the tobit model, the methodological approach in this chapter compares double hurdle estimation of FAFH expenditure in Ireland and the UK.⁵⁵

Four dependent variables are used in this analysis. These are average weekly per-capita household quick-service and full-service expenditure for the UK and Ireland (see chapter 3, section 3.6.1 for more detail on these variables).⁵⁶ Each dependent variable is modelled separately and in doing so is expressed as a function of income, the opportunity cost of time, health awareness and various socio-economic variables assumed to underpin tastes and preferences of the household and the household manager in particular. As in previous chapters, the inclusion of these variables is motivated in part by household production theory (see chapter 2, section 2.2) and in part by previous empirical findings.

⁵⁵ Similar to the methodological approach used in chapter 5 the double hurdle model was found to outperform the tobit model of UK quick-service and full-service expenditure. The UK results presented here relate to the double hurdle model solely.

⁵⁶ In the Irish analysis only expenditure on fast food and takeaways, both ethnic and traditional, are included in the quick-service definition. Expenditure in sandwich and juice bars together with coffee houses are included in the UK quick-service definition as well as fast food and takeaways.

Certain exclusion restrictions must be imposed on the double hurdle model based on the findings of previous FAFH studies and *a priori* assumptions. If the same set of regressors is included in each hurdle of the model the model may not identify the parameters correctly. Firstly, in this analysis it is assumed that once the decision to consume is made, there is little basis to suggest that the opportunity cost of time, proxied by the number of workers in the household, would affect the expenditure level. Accordingly, the number of workers variable is assumed to only affect the participation decision (Byrne *et al.* 1998). Income is assumed to affect both the participation and the expenditure decisions. There is rationale for assuming that income will only affect the expenditure decision as decisions regarding prices and income give rise to corner solutions which are modelled by a tobit model. This strategy has been adopted in previous Irish studies of households' food expenditure patterns (Newman *et al.* 2001; 2003). However, all recent and significant studies of FAFH expenditure patterns that have used two-stage models have incorporated income into both stages of the model on the basis of its high explanatory power in both decisions (Jensen and Yen, 1996; Manrique and Jensen, 1998; Mihalopoulos and Demoussis, 2001; Mutlu and Gracia, 2006). The rationale for including income in both stages is that income is an integral part of the household production function described in chapter 2, section 2.2 and excluding the variable from the participation decision may skew the results considerably. This study follows this approach. The seasonal dummies are assumed to impact on the expenditure decision solely.

Due to data limitations the same set of variables could not be used in the Irish and UK analyses. Ethnicity and regional variables are only used in the UK analysis while the urban variable is only used in the Irish analysis. Only one education variable is used in the UK analysis compared to two in the corresponding Irish study. The tables in chapter 3, section 3A provide descriptive statistics which give an indication as to the effect each variable will have on FAFH expenditure patterns. Statistically significant variables in each step of the double hurdle model will be retained within the model. Tables 6.1-6.4 list the variables used in each stage of the final specification of the double hurdle model. All the independent variables used here are described in chapter 3, section 3.6.2.

As discussed in chapter 2, section 2.6, the double hurdle model is estimated using Maximum Likelihood Estimation and is programmed using STATA 8.1.⁵⁷ Maximum likelihood estimates of both models are presented in tables 6.7-6.10 with the necessary specification adjustments. The assumption of homoskedastic error terms is rejected in favour of a multiplicative variance specification (see chapter 2, section 2.3.1 for more discussion) and the use of the Box-Cox transformation of the model is justified by the significance of the λ parameter. The various test statistics are described in tables 6.5 and 6.6.

⁵⁷ As in previous chapters, the STATA code used in this chapter was adapted from that of Roberto Martínez-Españeira and Peter Moffatt (Martínez-Españeira, 2004; Moffatt, 2005).

6.3 Results

The results of the Box-Cox double hurdle models of quick and full-service expenditure respectively, are presented in tables 6.7-6.10. The Box-Cox parameter is significantly different from zero in each model supporting its inclusion. The variables used in the participation stage of the double hurdle models of the Irish and UK quick-service and full-service expenditure are listed in tables 6.1 and 6.2 respectively, while the variables used in the expenditure components of these models are listed respectively in tables 6.3 and 6.4. In the discussion below, quick-service expenditure in Ireland is compared with quick-service expenditure in the UK and a similar approach is adopted for full-service expenditure in both states. Additionally the participation stage results are discussed before those of the expenditure stage.⁵⁸

6.3.1 Income⁵⁹

The income variable has a positive and significant effect on participation in the Irish quick-service sector in both survey years. A similar effect is observed in the UK in both 2001 and 2002. Higher incomes represent an increased ability to pay which here is found to lead to a higher likelihood of consuming FAFH which itself is typically more expensive than Food-At-Home (Byrne and Capps, 1996). Income also has a positive effect on Irish quick-service expenditure in both 1994 and 1999 but at a decreasing rate in each year. Similarly, income also has a positive and significant effect in both survey years

⁵⁸ Total UK FAFH expenditure, quick-service and full-service expenditure combined, was also analysed here. In almost all cases the results were similar to those reported for full-service expenditure, not surprising in itself given that the larger share of expenditure is on full-service products. This also helps vindicate the decision to disaggregate the expenditure category so as to obtain a more complete picture of the market.

⁵⁹ As in chapter 4 the results discussed for the income variable, and the other independent variables, refer to the parameter values solely and not marginal effects or elasticities.

in the UK results but at a decreasing rate in 2001. The income squared variable is used here to capture potential non-linearities in the income variable. These results indicate that quick-service expenditure may be viewed as an inferior good by households with higher incomes.

Income has a positive effect on participation in the full-service sector in both 1994 and 1999. Once again a similar effect is observed for UK households which is also as expected. The positive effect for income on participation in both sectors of the Irish and UK FAFH markets is in agreement with many previous studies (Byrne *et al.* 1996; Jensen and Yen, 1996; Manrique and Jensen, 1998; Mutlu and Gracia, 2004). A positive coefficient for income is observed in both the 1994 and 1999 Irish full-service expenditure results. Again a similar positive result is found in the UK full-service expenditure results. These findings are also in line with previous results: as households earn more income they purchase more leisure activities, including dining amenities (McCracken and Brandt, 1987; Byrne *et al.* 1998).

6.3.2 Age

The age of the household manager has a significant and negative effect on the likelihood of participating in the Irish quick-service sector, in both 1994 and 1999, supporting the hypothesis that older household managers are less likely to eat away from home than younger households. This finding is in line with several US studies (Blaylock, 2003; Blisard *et al.* 2002, 2003). The age of the household manager also has a negative and statistically significant effect on Irish quick-service expenditure and the age squared variable is significant in the 1994 results. The results demonstrate the significance of the age variable

with expenditure declining by an increasing magnitude among older household managers.⁶⁰ This is further discussed in the results for the marital status variables below. In the UK results the age of the household manager also has a negative and significant effect on participation in the quick-service sector in 2001. In the 2001 expenditure stage results the age variable has a positive effect on quick-service expenditure while the age squared variable is also significant.

While the age variable has no significance in determining participation in the Irish full-service sector the variable has a negative and statistically significant effect on Irish full-service expenditure in both 1994 and 1999. The age variable has a significantly negative effect on participation and expenditure in the UK full-service sector in both the UK survey years. The age squared variable has a significant effect in both years of the Irish and UK results. Again, as discussed in the quick-service results, this variable controls for a potential age effect from single pensioners. This is further discussed in the results of the marital status of the household manager below.

Previous US studies have found that US household managers were more likely to purchase full-service products over quick-service as they age (Stewart *et al.* 2004; Stewart and Yen, 2004). A similar finding is not observed in this analysis. The overall trend in the results appears to indicate that quick-service and full-service expenditure declines with age in both Ireland and the UK.

⁶⁰ Both *age2* and *singleage* were used to attempt to capture non-linearities in the age variable. One or other was used in the regressions to capture this age effect, never both. Only the *age2* variable was significant in the results discussed in this chapter.

6.3.3 Household Size

Household size has a significantly positive effect on participation in the Irish quick-service sector in both survey years, though at a decreasing rate, as indicated by the negative sign on the squared term in 1994 and 1999. In the UK results household size also has a significantly positive effect on quick-service expenditure at a decreasing rate in both the 2001 and 2002 results. These results give credence to the argument that very large households may benefit from economies of scale in home meal preparation as the probability of participation increases at a decreasing rate with household size. Household size has a negative effect on Irish quick-service expenditure in 1994. This result is largely as expected with the significance of the squared term indicating that non-linearities also exist. This could be explained by an income effect: that is, for a given level of total household income, per-capita income will be lower in larger households reducing the amount spent on FAFH. With regard to the UK results a negative coefficient is observed for quick-service expenditure in 2002 while the 2001 result is insignificant. The significance of the household squared term in 2002 also indicates that non-linearities are present in the data as was highlighted in chapter 3, section 3.3.2.

Household size also has a positive effect on participation in the Irish and UK full-service sectors across all surveys with the exception of the 2002 UK survey. These results support the hypothesis that the probability of observing a purchase rises with more persons in the household regardless of country. The household size squared only had significance in determining participation in either the Irish or UK full-service sectors in the UK 2001 results. Household size has a negative affect on full-service expenditure in both countries across

all surveys years. This result is also largely as expected. The squared term is significant in the 1999 Irish study and the 2002 UK study indicating that non-linearities also exist. These findings could be explained by an income effect similar to that outlined for quick-service expenditure. Several US studies have found that larger households spend less on FAFH in all segments and concluded that this suggests that such households benefit from economies of scale in food preparation at home (McCracken and Brandt, 1987; Stewart and Yen, 2004). The Irish and UK results found here are also supportive of this hypothesis.

6.3.4 Workers

As expected the number of workers variable, the proxy for the household's opportunity cost of time, is positively related to participation in both the quick-service sectors of Ireland and the UK in each survey year. The results suggest that household managers highly pressured by time are more likely to frequent FAFH outlets than other households. Most studies differ in their quantification of, and results reported for, the value of household time but it has been seen to exhibit a consistently positive effect (Mihalopoulos and Demoussis, 2001; Lazaridis, 2002). As a whole quick-service facilities could be considered the most attractive facility for time constrained households. The number of workers variable also has a positive effect on participation in the Irish and UK full-service sectors which is also as expected. Since full-service facilities may approach or indeed surpass the time requirements for preparing food at home, it could be expected that these facilities would be not as attractive to time starved households. However, up scale dining can be viewed as a form of leisure and of energy saving. Accordingly, households with a number of

workers present may be more likely to frequent such establishments as this activity represents a transfer from time spent on household production to leisure time (Byrne *et al.* 1998).

6.3.5 Education

Secondary

Being a household manager with second level education significantly reduces the likelihood of participation in the 1999 Irish quick-service study. The 1999 expenditure stage results also indicate that higher educated households spend less on quick-service than other households. In contrast, household managers with secondary education have an increased likelihood of participation in the Irish full-service sector according to the 1994 full-service results. These findings are as expected given the descriptive statistics presented in chapter 3, section 3.3.2 and may be an indication that higher educated households, with associated higher levels of health awareness, are more aware of the negative health effects associated with quick-service food products.

Tertiary

The 1994 and 1999 Irish quick-service results indicate that households with tertiary education have a reduced likelihood of participating in the quick-service market. Similarly the 1994 and 1999 expenditure stage results also indicate that higher educated households spend less on quick-service than other households. Regarding the full-service results a positive and significant result with regard to participation in full-service expenditure is observed for household managers with tertiary level education in 1994. A higher probability of participation in the full-service sector by more educated households may

suggest that full service options are perceived favourably from a health perspective (Lee and Tan, 2007). As hypothesised in chapter 1, section 1.3.2, a possible proxy for health awareness is education: better educated households may be expected to be more aware of the health consequences of consumption of certain food products. There is no significance in the corresponding Irish full-service expenditure stage regressions.

Education

Only one education variable is used in the UK analysis. The variable has a significantly negative effect on participation in the quick-service sector in both the 2001 and 2002 survey years. This result indicates that higher educated UK households are less likely than other households to participate in the quick-service sector. The negative effect on quick-service expenditure in both the 2001 and 2002 expenditure estimates also indicates that while these households are less likely to participate they also spend less than other households. While there is no significance for the education variable in the participation stage for the corresponding full-service regressions, a positive effect is observed for full-service expenditure in the 2001 expenditure estimates. Overall the results here are similar to those of the Irish analysis as they suggest that higher educated households are more likely to favour full-service over quick-service which is in accordance with the hypotheses set out in chapter 3, section 3.3.2.

6.3.6 Social Class

The *social1* dummy variable, comprised of higher professional household managers, has a significant and negative effect on participation in the quick-service sector in the 1994 Irish study. The *social1* variable also has a significantly negative effect in the Irish 1994 quick-service expenditure stage results. Households headed by household managers of a higher social class appear less likely than other households to consume quick-service products. Neither the *social1* or *social2* variables have an effect on participation in the quick-service sector in either the 2001 or 2002 UK results.

The *social1* dummy variable has a significant and positive effect on participation in the full-service sector in both years of the Irish results. The *social2* variable, comprised of lower professional household managers, also has a positive and significant effect on full-service in the 1994 study. The social class of the household manager is also an important determinant of Irish full-service expenditure. In the 1994 results the results of the *social1* variable indicate that households with managers of a high social class spend significantly more on full-service than other households. Similarly, the *social2* variable also has a positive and significant effect on full-service expenditure in 1994. The *social1* variable has a significant and positive effect on full-service expenditure in both years of the UK study. The *social2* variable also has a positive effect in both the 2001 and 2002 results.

These results support the hypothesis that higher professional household managers are more likely to participate in the full-service sector than quick-service, in either Ireland or the UK, based on their higher average expenditures on full-service (chapter 3, section 3.3.2). The results for Ireland and the UK discussed above are very similar. Full-service dining can be viewed as a form of leisure activity and in this analysis higher social class households appear to substitute time spent on household production for leisure time. A similar effect is not observed for lower social class households in either the Irish or UK results.

6.3.7 Ethnicity

Due to data limitations the ethnic origin of the household manager is used as a variable in the UK analysis solely. The *non-white* variable, comprised of household managers of an ethnic background i.e. Black or Asian, has a negative effect on participation in the quick-service sector but a positive effect on quick-service expenditure in the 2001 results. This result indicates that non-white household managers are less likely than others to buy quick-service products but, when they do, they spend more than other households. While the non-white variable is insignificant in the 2002 quick-service participation results a positive effect is observed for quick-service expenditure in 2002. By contrast the *non-white variable* has a negative and significant effect on participation in the full-service sector in both the 2001 and 2002 surveys. The results appear to indicate that non-white household managers are more likely to favour quick-service over full-service once the decision is made to purchase some form of FAFH. Byrne *et al.* (1998) found that black households in the US were more likely to visit quick-service facilities than white households but

that they were less likely to eat at full-service facilities. No consistent trends were found for other races such as Hispanics, however. Stewart and Yen (2004), projecting future trends in the US FAFH market, determined that increases in the non-white population were more likely to benefit the quick-service sector relative to full-service.

6.3.8 Urban and Regional Variables

The urban variable has a significant and positive effect on determining participation in the Irish quick-service sector in both 1994 and 1999. This finding indicates that the degree of urbanisation plays an important role in determining the probability of participation in the quick-service market. It is likely that towns will have a higher number of quick-service outlets than rural areas due to their larger populations. Higher outlet density in an area increases the household's eating out choices and their likelihood of participation (Jekanowski, 1999). Moreover, urban households are expected to have a faster pace of life than rural households and thus be more likely to favour convenient meals on a regular basis. In this context, it appears that urban households are more likely to substitute time on household production for leisure time, such as eating out at a FAFH outlet. The urban variable also has a positive and significant coefficient on quick-service expenditure in both survey years. These findings are supportive of those of an American study that found that increasing urbanisation translated into higher household FAFH expenditure, particularly on quick-service (Byrne *et al.* 1996).

Being an urban household has a positive effect on participation in the quick-service market in the 1994 results. The variable is insignificant in the 1999

participation stage results. However, being an urban household has a negative effect on full-service expenditure in 1994 and 1999, suggesting that urban households spend less than rural households on full-service. This may be a result of competition between outlets in urban centres making prices lower than in rural areas and the fact that full-service outlets are likely to be the sole FAFH outlet in many rural areas as discussed in chapter 1, section 1.2.1. A similar result was found in a Greek FAFH total market analysis (Mihalopoulos and Demoussis, 2001).

The UK EFS does not provide data on whether a household is resident in an urban or rural area, possibly because of the greater level of urbanisation in the UK. Accordingly regional dummy variables were derived to control for some of the regional variations in expenditure patterns resulting from regional price differences across households. In the UK quick-service results only the Scottish and Northern Irish variables are significant. Only the Northern Irish dummy variable is significant in the 2001 and 2002 full-service expenditure results.

6.3.9 Marital Status

Single-adult

Being a single adult household has a negative effect on participation in the Irish quick-service sector in both survey years. As the benefits of home meal preparation diminish in single households a positive effect was anticipated but the results do not bear this out. By contrast the UK results illustrate that single households are more likely to participate in the quick-service sector than other households. Being a single adult household in Ireland has a positive effect on

quick-service expenditure in both 1994 and 1999, however. This result appears to suggest that while single Irish households are less likely to participate than other households, when they do they spend more. In the UK results a positive effect is observed in the 2001 quick-service expenditure stage results. As discussed in chapter 3, section 3.3.2 single adult households have lower average expenditures on quick-service than other households comprised of multiple adults, which forms the base category. The finding that single adult households had a lower average expenditure on quick-service than other households was attributed to a possible age effect from single pensioners. The age squared variable is significant in the Irish 1994 and the UK 2001 quick-service expenditure results.

In the 1994 full-service participation stage results the single variable has a positive effect but is insignificant in 1999. A positive effect is observed for single-adult households on full-service expenditure in both survey years in the Irish study. The benefits of home meal preparation diminish in single adult households compared to larger households. As such households that do not benefit from economies of scale with regard to household production are more likely to spend more on FAFH compared to other households. The age squared variable is also significant in each of the expenditure stage regressions for full-service. Here this variable controls for a possible age effect within single adult houses (i.e. single pensioners). In the UK results the single variable has no significance in determining participation in the full-service sector or the amount of expenditure.

Married Couples

Being a married couple has a significantly negative effect on participation in the Irish quick-service sector in both survey years. The married variable has no significance in the Irish expenditure stage results. Being a married couple also has a negative effect on participation in the UK quick-service sector in the 2002 results. In both years being a married couple has a negative effect on quick-service expenditure. These findings are as expected. It was hypothesised that married households may value the importance of the family meal more than other households and accordingly be more likely to engage in household production and eat food-at-home.

Being a married couple also has a negative effect on participation in the Irish full-service sector in both 1994 and 1999. The variable has no significance in the full-service expenditure stage results, however. Chapter 3, section 3.3.2 discussed how married couples had the highest average expenditure on full-service in Ireland in 1994 and 1999 but the results presented here indicate that controlling for all other factors, being a married couple has no effect on influencing expenditure in the full-service sector in Ireland. Being a married couple also has a negative effect on participation in the UK full-service sector in the 2001 results and the variable also has a negative effect on full-service expenditure in both the 2001 and 2002 UK results. The results for both countries are broadly similar and indicate that married couples are much less likely than other households to consume FAFH as a whole.

6.3.10 Children⁶¹

The presence of older children in the household increases the likelihood of participation in the Irish quick-service sector. This variable, *Oldkids*, is significant and positive in the both the 1994 and 1999 results. A similar effect is observed for the *Oldkids* variable in both years of the UK quick-service results. As children become more independent and have access to independent disposable income, they are more likely to consume quick-service food products. The variable has no effect in the quick-service expenditure stage results, however, in either the Irish or UK results. The *Oldkids* variable has a significantly negative effect on participation in the full-service sector in both the 2001 and 2002 surveys but has no effect on the corresponding expenditure stage results. The variable has no significance in either the participation or expenditure stage results for Irish full-service expenditure.

The *Youngkids* variable has no significance in determining participation in the Irish quick-service sector in either survey year. In the UK results however, both in 2001 and 2002, this variable has a significantly negative effect on quick-service expenditure. The variable also has no effect on quick-service expenditure in the Irish results. However, the *Youngkids* variable also has a negative effect on UK quick-service expenditure in both survey years. The *Youngkids* variable has no effect on either the participation or expenditure stage results for full-service.

⁶¹ Two dummy variables, *Youngkids* and *Oldkids*, are used in both the Irish and UK analyses. Due to a different approach in collecting data the variables are derived in a different manner. In the Irish analysis *Oldkids* are defined as children aged between 14-18 years while in the UK *Oldkids* are defined as children aged 5-18. *Youngkids* are defined as between 1-14 years in the Irish analysis and between 1-5 years in the UK analysis.

While the results for full-service expenditure for both children variables, are as expected the findings for quick-service expenditure are somewhat contrary to expectations as households with younger children report a higher average expenditure on quick-service than other households as discussed in chapter 3, section 3.3.2. Controlling for other factors the variable has a negative effect. This may also reflect the likely importance of the family meal for married couples.

6.3.11 Homeownership

In the Irish results in both survey years homeownership has a negative influence on participation in the quick-service sector. There is no significance in the UK quick-service sector in either survey, however. These results suggest that the act of owning a home is indicative of a commitment to engage in household production. Renters, without having the same commitment to their residence as homeowners, are accordingly less likely to engage in household production, such as cooking meals. This variable has no significance in the quick-service expenditure stage results in either Ireland or the UK. Homeownership has a positive influence on participation in the Irish full-service sector in the 1999 study and a similar result is found for the 2002 survey of the UK results. This result is supportive of a number of recent Spanish studies which found that homeowners had a positive influence on participation in the FAFH market (Manrique and Jensen, 1998; Mutlu and Gracia, 2004, 2006). These results likely indicate that the social aspect of full-service dining is a significant attraction to homeowners and may also be evidence of a wealth affect. Yen (1993), in a US study, and Manrique and Jensen (1998), in a Spanish study, found that homeowners spend less than

renters on FAFH at all types of FAFH. Homeownership has no effect for either variable in the expenditure stage regressions in either the Irish or UK analyses.

6.3.12 Commuter

The commuter variable has a positive and significant effect on participation in the quick-service sector in the UK in both 2001 and 2002. A positive effect for quick-service expenditure was also expected in the Irish analysis but the commuter variable has no significance in the Irish quick-service results. Commuters are more likely to be affected by time constraints than those who do not commute to work and this can be interpreted as a further demand for convenience by commuters. This also provides further evidence for the opportunity cost of time playing a role in household production decisions. This variable has no effect in the expenditure stage regressions in either the Irish or UK analyses.

The commuter variable has a positive and significant effect on participation in the full-service sector in both survey years of the Irish analysis. In the UK analysis the commuter variable also has a positive effect on participation in both years of the full-service results. The 1994 Irish full-service expenditure stage results indicate that commuters spend more than other households on quick-service though the variable is insignificant in 1999. A similar finding is observed in both years of the UK full-service expenditure stage results. Households with a number of commuters present may be more likely to frequent full-service establishments as this activity represents a transfer from time spent on household production to leisure time as full-service dining can be

viewed as a form of leisure.⁶² As discussed in chapter 3, section 3.3.2 commuter households were assumed to be more likely than other households to purchase some form of FAFH during the survey period.

6.3.13 Nosmoke

The proxy variable for health awareness (no expenditure on tobacco) has a significantly negative effect on both the Irish 1994 and 1999 quick-service participation results. The variable also has a significantly negative effect on participation in the UK quick-service sector in the 2002 study. Households with higher levels of health awareness appear less likely to participate in the quick-service sector compared to households that do not, once time constraints are controlled for. This variable also has a significantly negative effect on Irish quick-service expenditure in both survey years and in both years of the UK quick-service expenditure stage results. Households with high levels of health awareness spend less than other households on quick-service products. Overall this finding may also reflect the linking of quick-service consumption with obesity and other health issues whereas the full-service sector has not received the same level of negative attention (see chapter 1, section 1.3.2).⁶³

⁶² It is important to note there are likely to be substantial differences between Irish and UK commuters. Due to the expansion of the commuter belt on the east coast of Ireland commuter distances are likely to be of a longer distance than in the UK. In the UK urban commuters are likely to form a greater proportion of overall commuters and can be expected to commute within urban areas whereas in Ireland many Irish commuters travel from rural areas to their place of work.

⁶³ With regard to the UK in recent times much of the media focus has been on the perceived poor quality of school meals which was highlighted by the television chef, Jamie Oliver. School meals are not analysed in either the Irish or UK analyses as they make up part of the cost or non-commercial sector.

While the *nosmoke* variable has no significance in the full-service participation results in either Ireland or the UK, a positive effect is observed for full-service expenditure in both the Irish and UK analyses. This result again gives credence to the hypothesis that quick-service expenditure is perceived in a poor light from a health and nutritional perspective, by households who have high levels of health awareness. It was assumed that households with high levels of health awareness would be less likely to consume quick-service than other households and this assumption has been vindicated (chapter 3, section 3.3.2). It was also noted that such a finding for full-service expenditure was unlikely given that most of the negative media attention with regard to obesity and other health issues has been largely confined to the quick-service sector to date. While the UK quick-service sector is at a more mature stage of development than its Irish equivalent it appears that households with high levels of health awareness are still less likely to participate in the sector.

6.3.14 Credit

Ownership of credit cards has a negative and significant effect on participation in the quick-service sector in the Irish 1999 study but there is no significance in the corresponding UK results. This may indicate that credit card usage is not as common at quick-service facilities compared to full-service facilities. It appears that households with credit cards are more likely to frequent a full-service outlet over quick-service as the credit card variable has a significant and positive effect on full-service in both the Irish 1994 and 1999 participation and expenditure stage results. In the UK results possession of credit cards has a positive and significant effect on participation in both years of the full-service sector and has a positive effect on full-service expenditure in the 2002 results.

The results are supportive of a previous US study which found that possession of credit cards increased the likelihood of purchase of some form of FAFH (Hiemstra and Kim, 1995). These results also may also indicate the presence of a wealth effect.

6.3.15 Seasonality⁶⁴

There is some evidence of seasonality in the results supporting the inclusion of seasonal dummies. The autumn variable is significant for both quick-service and full-service expenditure in the Irish 1994 results and for Irish full-service expenditure in the 1999 expenditure results. In the UK results the autumn variable is significant in both the 2001 and 2002 full-service regressions but there is no significance in the equivalent quick-service results. The summer variable is significant in the 2002 full-service expenditure results. These results have indicated the importance of accounting for seasonality in studies of this nature. The main rationale for including seasonal dummy variables is to account for potential variations in price due to the absence of price data as discussed in chapter 3, section 3.3.2.

6.4 Summary

This chapter compares the factors determining FAFH expenditure in both Ireland and the UK. The expenditure category is disaggregated into its two main components: quick-service and full-service, and each is analysed separately. The rationale for conducting a comparison between Irish and UK quick-service and full-service expenditure is that the UK foodservice industry

⁶⁴ The EFS is conducted over a 12 month period while the HBS is conducted over a 12-14 month period. Accordingly seasonality may play a role in determining expenditure patterns.

is at a more mature stage of development than its Irish equivalent. Thus analysing the UK industry may give an indication as to what factors may influence growth in the Irish industry into the future. A double hurdle model, adjusted for misspecification, is used in this analysis. The results from the double hurdle model estimation suggest that different variables influence expenditure in each sector in different ways, thus vindicating the use of a disaggregated approach and also highlight that a number of variables influence the participation and expenditure decisions differently. A number of variables also affect both dependent variables in the same way, for example, income and age and the number of workers variable, but differences have been apparent throughout the discussion in this chapter. Perhaps the most interesting point to highlight is how similar the Irish and UK results for both quick-service and full-service expenditure have been despite the UK industry being at a more mature stage of growth. Despite the education, age and children variables being defined in a different manner due to data constraints each variable has a similar effect on the dependent variables analysed.

Health awareness significantly reduces the likelihood of participation and reduces the amount of expenditure on quick-service but no similar effect is observed for full-service in either Ireland or the UK. Potentially healthier and convenient sectors of the Irish quick-service sector, such as juice and sandwich bars and coffee shops, are not included in the definition of quick-service in the Irish analysis due to data constraints though they are present in the UK definition. The finding that the demand for convenience is a strong driver of quick-service expenditure also indicates that there exists a health-convenience trade-off in both countries. The results indicate that the most likely consumers

of quick-service products are younger households with lower levels of education, social class and health knowledge. Additionally in the Irish results these households are typically resident in urban areas. The more likely consumers of full-service products are younger households with higher levels of education, health awareness and social class as well as homeowners, and commuter households in Ireland. The finding that households with a high opportunity cost of time are more likely to participate in either sector of the FAFH market than other households is also consistent with household production theory. Similarly the results indicate that certain households substitute time spent on household production for leisure time, i.e. full-service dining, again consistent with theory. The results for the ethnicity variable indicate that *non-white* households are less likely to frequent any FAFH outlet than other households. As such growing immigration into Ireland may diminish the expansion of the FAFH industry into the future.

The current demographic trends in Ireland and, in particular, the growth of a young adult working urbanised population, the prospects for the FAFH industry appear buoyant at present as it converges on the level of growth of its UK neighbour. As has been seen throughout this chapter discussion for almost all variables, similar effects are observed indicating that stable growth may continue into the future. The impact of increased health awareness may impinge on growth in the quick-service sector into the future but at the same time this provides encouragement for the full-service sector given the apparent lack of a similar negative perception from a health perspective. This will require further analysis and possibly greater disaggregation in the data to enable a distinction to be made between healthy and convenient outlets such as

sandwich and juice bars from other quick-service outlets such as branded fast food chains and takeaways.

6A Tables

Table 6.1 Explanatory Variables used in the Irish Participation Equations of the Box-Cox Double Heteroskedastic Hurdle Model

1994 Q	1994 F	1999 Q	1999 F
Income	Income	Income	Income
Age	Age	Age	Age
Workers	Workers	Workers	Workers
Household Size	Household Size	Household Size	Household Size
Household Size ²	Household Size ²	Household Size ²	Household Size ²
Secondary	Secondary	Secondary	Secondary
Tertiary	Tertiary	Tertiary	Tertiary
Social1	Social1	Social1	Social1
-	Social2	-	Social2
Urban	Urban	Urban	Urban
Single	Single	Single	Single
Married	Married	Married	Married
Oldkids	Oldkids	Oldkids	Oldkids
Youngkids	-	Youngkids	-
Homeowner	Homeowner	Homeowner	Homeowner
Commuter	Commuter	Commuter	Commuter
Nosmoke	-	Nosmoke	-
Credit	Credit	Credit	Credit

Table 6.2 Explanatory Variables used in the UK Participation Equations of the Box-Cox Heteroskedastic Double Hurdle Model

2001 Q	2001 F	2002 Q	2002 F
Income	Income	Income	Income
Age	Age	Age	Age
Workers	Workers	Workers	Workers
Household Size	Household Size	Household Size	Household Size
Household Size ²	Household Size ²	Household Size ²	Household Size ²
Education	Education	Education	Education
Social1	Social1	Social1	Social1
Non-White	Non-White	Non-White	Non-White
Single	Single	Single	Single
Married	Married	Married	-
Oldkids	Oldkids	Oldkids	Oldkids
Youngkids	-	Youngkids	-
Homeowner	Homeowner	Homeowner	Homeowner
Commuter	Commuter	Commuter	Commuter
Nosmoke	-	Nosmoke	-
Credit	Credit	Credit	Credit

Table 6.3 Explanatory Variables used in the Irish Expenditure Equations of the Box-Cox Heteroskedastic Double Hurdle Model

1994 Q	1994 F	1999 Q	1999 F
Income	Income	Income	Income
Income ²	Income ²	Income ²	Income ²
Age	Age	Age	Age
Age ²	Age ²	Age ²	Age ²
Workers	Workers	Workers	Workers
Household Size	Household Size	Household Size	Household Size
Household Size ²	Household Size ²	Household Size ²	Household Size ²
Secondary	Secondary	Secondary	Secondary
Tertiary	Tertiary	Tertiary	Tertiary
Social1	Social1	Social1	Social1
-	Social2	-	Social2
Urban	Urban	Urban	Urban
Single	Single	Single	Single
Married	Married	Married	Married
Youngkids	-	Youngkids	-
Nosmoke	Nosmoke	Nosmoke	Nosmoke
-	Commuter	-	Commuter
-	Credit	-	Credit
-	Summer	-	Summer
Autumn	Autumn	Autumn	Autumn

Table 6.4 Explanatory Variables in UK Expenditure Equations of the Box-Cox Heteroskedastic Double Hurdle Model

2001 Q	2001 F	2002 Q	2002 F
Income	Income	Income	Income
Income ²	Income ²	Income ²	Income ²
Age	Age	Age	Age
Age ²	Age ²	Age ²	Age ²
Household Size	Household Size	Household Size	Household Size
Household Size ²	Household Size ²	Household Size ²	Household Size ²
Education	Education	Education	Education
Social1	Social1	Social1	Social1
-	Social2	-	Social2
Non-White	-	Non-White	-
Single	-	Single	-
Married	Married	Married	Married
Nosmoke	Nosmoke	Nosmoke	Nosmoke
Scot	Scot	Scot	Scot
NI	NI	NI	NI
-	Summer	-	Summer
Autumn	Autumn	Autumn	Autumn

Table 6.5 Specification Tests of the Irish Adjusted and Unadjusted Double Hurdle Model

				1994 Quick		1994 Full	
				<i>Test</i>	<i>P-value</i>	<i>Test</i>	<i>P-value</i>
				<i>Statistic</i>		<i>Statistic</i>	
Lagrange	Multiplier	Test	for	5232.29	0.0000	2747.26	0.0000
Heteroscedasticity							
Ho: Homoscedasticity							
Conditional	Moments	Test	for Non-	342.39	0.0000	374.39	0.0000
normality							
Ho: Normality							
Likelihood	Ratio	Test	for Box-Cox	1195.406	0.0000	1967.46	0.0000
Het. Double Hurdle Model							
Ho: Box-Cox Het. Tobit Model							

				1999 Quick		1999 Full	
				<i>Test</i>	<i>P-value</i>	<i>Test</i>	<i>P-value</i>
				<i>Statistic</i>		<i>Statistic</i>	
Lagrange	Multiplier	Test	for	2486.62	0.0000	1575.47	0.0000
Heteroscedasticity							
Ho: Homoscedasticity							
Conditional	Moments	Test	for Non-	212.12	0.0000	266.52	0.0000
normality							
Ho: Normality							
Likelihood	Ratio	Test	for Box-Cox	2965.88	0.0000	1460.98	0.0000
Het. Double Hurdle Model							
Ho: Box-Cox Het. Tobit Model							

Table 6.6 Specification Tests of the UK Adjusted and Unadjusted Double Hurdle Model

				2001 Quick		2001 Full	
				<i>Test</i>	<i>P-value</i>	<i>Test</i>	<i>P-value</i>
				<i>Statistic</i>		<i>Statistic</i>	
Lagrange	Multiplier	Test	for	1497.33	0.0000	2045.21	0.0000
Heteroscedasticity							
Ho: Homoscedasticity							
Conditional	Moments	Test	for Non-	621.17	0.0000	910.00	0.0000
normality							
Ho: Normality							
Likelihood	Ratio	Test	for Box-Cox	1831.45	0.0000	4345.65	0.0000
Het. Double Hurdle Model							
Ho: Box-Cox Het. Tobit Model							

				2002 Quick		2002 Full	
				<i>Test</i>	<i>P-value</i>	<i>Test</i>	<i>P-value</i>
				<i>Statistic</i>		<i>Statistic</i>	
Lagrange	Multiplier	Test	for	2623.16	0.0000	576.48	0.0000
Heteroscedasticity							
Ho: Homoscedasticity							
Conditional	Moments	Test	for Non-	557.40	0.0000	785.00	0.0000
normality							
Ho: Normality							
Likelihood	Ratio	Test	for Box-Cox	1787.795	0.0000	5017.42	0.0000
Het. Double Hurdle Model							
Ho: Box-Cox Het. Tobit Model							

Table 6.7 Maximum Likelihood Estimates of the Irish and UK Box-Cox Heteroskedastic Double Hurdle Participation Stage Results for Quick-service

	1994 Quick	1999 Quick	2001 Quick	2002 Quick
Constant	-2.5704*** (0.2471)	4.7951*** (1.8369)	1.4475*** (0.3574)	1.4734*** (0.3609)
Income	0.4817*** (0.0392)	0.4569*** (0.0374)	0.3380*** (0.0333)	0.3200*** (0.0346)
Age	-0.1696*** (0.0151)	-0.2139*** (0.0164)	-1.0282*** (0.0679)	-0.9994*** (0.0693)
Workers	0.2184*** (0.0256)	0.1426*** (0.0267)	0.1145*** (0.0299)	0.1519*** (0.0300)
Household Size	0.3147*** (0.0493)	0.4476*** (0.0597)	0.6343*** (0.0881)	0.5837*** (0.0879)
Household Size ²	-0.0230*** (0.0043)	-0.0305*** (0.0058)	-0.0332*** (0.0116)	-0.0337*** (0.0127)
Secondary	-0.0576 (0.0421)	-0.0981** (0.0463)	-	-
Tertiary	-0.1575** (0.0673)	-0.1679*** (0.0628)	-	-
Education	-	-	-0.1771*** (0.0426)	-0.2115*** (0.0434)
Non-white	-	-	-0.2193*** (0.0820)	0.0139 (0.0926)
Social1	-0.0958** (0.0470)	-0.0462 (0.0444)	-0.0700 (0.0504)	-0.0319 (0.0505)
Urban	0.3604*** (0.0362)	0.4043*** (0.0361)	-	-
Single	-0.2583*** (0.0770)	-0.3324*** (0.0832)	0.3319*** (0.0841)	0.1615** (0.0700)
Married	-0.4744*** (0.0483)	-0.3990*** (0.0496)	-0.0764 (0.0596)	-0.1726*** (0.0518)
Oldkids	0.5812*** (0.0484)	0.5109*** (0.0523)	0.3154*** (0.0786)	0.4569*** (0.0731)
Youngkids	0.0504 (0.0625)	-0.0797 (0.0651)	-0.5241*** (0.0782)	-0.4243*** (0.0778)
Homeowner	-0.0969** (0.0477)	-0.1290** (0.0513)	-0.0288 (0.0443)	-0.0583 (0.0458)
Commuter	0.0579 (0.0417)	0.0365 (0.0397)	0.0895* (0.0480)	0.1583*** (0.0489)
Nosmoke	-0.1220*** (0.0343)	-0.0617* (0.0353)	-0.0661 (0.0406)	-0.1918*** (0.0416)
Credit	-0.0427 (0.0435)	-0.0768* (0.0410)	-0.0358 (0.0402)	-0.0264 (0.0416)

Standard errors are given in parenthesis.

**** indicates significance at the 1% level, ** indicates significance at the 5% level, * indicates significance at the 10% level*

Table 6.8a Maximum Likelihood Estimates of the Irish and UK Box-Cox Heteroskedastic Double Hurdle Model Expenditure Stage Results for Quick-service

	1994 Quick	1999 Quick	2001 Quick	2002 Quick
Constant	-4.5113*** (1.1991)	-5.3384*** (1.1488)	-7.2420*** (2.0431)	-2.6913 (2.6154)
Income	2.0838*** (0.4663)	2.1902*** (0.0416)	1.6908*** (0.4164)	1.0076** (0.4135)
Income ²	-0.1475*** (0.0457)	-0.1528*** (0.0380)	-0.0951** (0.0372)	-0.0367 (0.0369)
Age	-0.5627*** (0.0815)	-0.2287*** (0.0826)	2.5216*** (0.9582)	1.1877 (1.2868)
Age ²	0.0533*** (0.0084)	0.0111 (0.0084)	-0.4681*** (0.1289)	-0.2737 (0.1720)
Household Size	-0.1844*** (0.0449)	-0.0490 (0.0493)	0.0592 (0.0590)	-0.1701** (0.0661)
Household Size ²	0.0138*** (0.0040)	0.0051 (0.0047)	0.0035 (0.0076)	0.0317*** (0.0089)
Secondary	-0.0540 (0.0432)	-0.1145** (0.0480)	-	-
Tertiary	-0.1356** (0.0684)	-0.2211*** (0.0619)	-	-
Education	-	-	-0.2427*** (0.0469)	-0.2435*** (0.0464)
Social1	-0.0781* (0.0459)	-0.0161 (0.0419)	-0.0406 (0.0501)	-0.0283 (0.0492)
Non-white	-	-	0.2826*** (0.0915)	0.1666* (0.0948)
Urban	0.2830*** (0.0389)	0.3183*** (0.0363)	-	-
Single	0.2123*** (0.0789)	0.2052** (0.0804)	0.1775** (0.0678)	0.1011 (0.0650)
Married	-0.0613 (0.0466)	-0.0749 (0.0463)	-0.2152*** (0.0544)	-0.1746*** (0.0491)
Youngkids	-0.0171 (0.0536)	-0.0609 (0.0529)	-0.3280*** (0.0627)	-0.2938*** (0.0622)
Nosmoke	-0.0975*** (0.0356)	-0.1010*** (0.0348)	-0.2462*** (0.0439)	-0.1824*** (0.0432)
Scot	-	-	0.1708** (0.0743)	0.2538*** (0.0730)
NI	-	-	0.3244*** (0.0762)	0.3121*** (0.0688)
Autumn	0.0814** (0.0342)	0.0167 (0.0361)	0.0044 (0.0452)	-0.0042 (0.0455)
λ	0.1227*** (0.0144)	0.1374*** (0.0137)	0.2486*** (0.0115)	0.2059*** (0.0124)
σ	0.9777*** (0.0134)	1.0201*** (0.0176)	1.4286*** (0.0272)	1.3115*** (0.0281)
LL	-9925.9363	-12161.32	-18180.719	-15924.201

Standard errors are given in parenthesis.

*** indicates significance at the 1% level, ** indicates significance at the 5% level, * indicates significance at the 10% level

Table 6.8b Heteroskedastic Terms (Used in Quick-service Expenditure Stage)

	1994 Quick	1999 Quick	2001 Quick	2002 Quick
Income	0.0256** (0.0453)			
Age	-0.0120* (0.0125)			
Household Size	-	0.2122** (0.0317)		

Table 6.9 Maximum Likelihood Estimates of the Irish and UK Box-Cox Heteroskedastic Double Hurdle Participation Stage Results for Full-service

	1994 Full	1999 Full	2001 Full	2002 Full
Constant	-4.9720*** (0.2526)	-5.1748*** (0.2557)	-2.1846*** (0.3586)	3.9105*** (17.4260)
Income	0.9178*** (0.0397)	0.8461*** (0.0369)	0.7097*** (0.0380)	0.3125*** (0.0721)
Age	-0.0182 (0.0142)	0.0183 (0.0150)	-0.4609*** (0.0687)	-0.8705*** (0.1382)
Workers	0.1306*** (0.0253)	0.0904*** (0.0252)	0.0874*** (0.0318)	0.1677* (0.0952)
Household Size	0.0768* (0.0438)	0.1157** (0.0473)	0.5423*** (0.0672)	-3.0769 (26.1124)
Household Size ²	0.0013 (0.0044)	-0.0028 (0.0051)	-0.0383*** (0.0086)	1.3184 (8.7036)
Secondary	0.1294*** (0.0405)	0.0464 (0.0431)	-	-
Tertiary	0.2759*** (0.0699)	0.0657 (0.0599)	-	-
Education	-	-	0.0466 (0.0483)	0.0608 (0.0911)
Non-white	-	-	-0.5631*** (0.0824)	-0.4409** (0.1795)
Social1	0.1392** (0.0527)	0.1028** (0.0479)	0.0663 (0.0618)	-0.1317 (0.1255)
Social2	0.1363*** (0.0436)	0.0528 (0.0410)	-	-
Urban	0.1081*** (0.0351)	0.0294 (0.0341)	-	-
Single	-0.1889*** (0.0693)	-0.0899 (0.0704)	-	-
Married	-0.2316*** (0.0450)	-0.1596*** (0.0443)	-0.1195** (0.0517)	-
Oldkids	-0.0689 (0.0480)	-0.0111 (0.0481)	-0.2468*** (0.0731)	-0.4439* (0.2341)
Homeowner	0.0733 (0.0466)	0.1143** (0.0493)	0.0664 (0.0462)	0.3504*** (0.0777)
Commuter	0.1889*** (0.0438)	0.2041*** (0.0388)	0.1164** (0.0577)	0.2660* (0.1371)
Credit	0.1915*** (0.0445)	0.1450*** (0.2557)	0.1400*** (0.0427)	0.1863** (0.0808)

Standard errors are given in parenthesis.

**** indicates significance at the 1% level, ** indicates significance at the 5% level, * indicates significance at the 10% level*

Table 6.10a Maximum Likelihood Estimates of the Irish and UK Box-Cox Heteroskedastic Double Hurdle Model Expenditure Stage Results for Full-service

	1994 Full	1999 Full	2001 Full	2002 Full
Constant	-3.9257*** (0.3471)	-2.3647*** (0.3533)	1.4761 (1.8104)	2.3388 (5.6826)
Income	1.2311*** (0.0523)	0.9850*** (0.0523)	1.3249*** (0.0486)	3.5416*** (0.1163)
Age	-0.2025** (0.0903)	-0.2258*** (0.0868)	-3.6811*** (0.9875)	-10.0952*** (3.0922)
Age ²	0.0243*** (0.0089)	0.0281*** (0.0086)	0.5215*** (0.1328)	1.3418*** (0.4122)
Household Size	-0.2740*** (0.0471)	-0.2791*** (0.0541)	-0.1213** (0.0558)	-0.5070*** (0.1562)
Household Size ²	0.0167 (0.0046)	0.0198*** (0.0059)	0.0059 (0.0077)	0.0741*** (0.02235)
Secondary	0.0562 (0.0532)	0.0218 (0.0551)	-	-
Tertiary	-0.0145 (0.0755)	0.0928 (0.0700)	-	-
Education	-	-	0.1184** (0.0460)	0.1569 (0.1104)
Social1	0.1824*** (0.0591)	0.0824 (0.0546)	0.3587*** (0.0585)	0.6994*** (0.1425)
Social2	0.1117** (0.0528)	0.0367 (0.0497)	0.1737** (0.0585)	0.3282** (0.1398)
Urban	-0.1290*** (0.0441)	-0.0681* (0.0409)	-	-
Single	0.2534*** (0.0852)	0.1761** (0.0835)	-	-
Married	-0.0598 (0.0499)	-0.0169 (0.0470)	-0.1254*** (0.0456)	-0.6653** (0.1071)
Scot	-	-	0.0178 (0.0795)	0.1180 (0.1736)
NI	-	-	0.3524*** (0.0795)	0.2994* (0.1738)
Commuter	0.1469*** (0.0456)	0.0613 (0.0424)	0.1451*** (0.0470)	0.4471*** (0.1151)
Nosmoke	0.0708* (0.0417)	0.0669* (0.0403)	0.0831* (0.0447)	0.3758*** (0.1077)
Credit	0.1900*** (0.0474)	0.0764* (0.0455)	-0.0113 (0.0461)	0.3509*** (0.1125)
Summer	0.0332 (0.0472)	0.0736 (0.0461)	0.0623 (0.0487)	0.4381*** (0.1172)
Autumn	0.1146*** (0.0419)	0.0924** (0.0455)	0.1731*** (0.0482)	0.6420*** (0.1148)
λ	0.1205*** (0.0100)	0.1145** (0.0118)	0.1863*** (0.0085)	0.4926*** (0.0065)
σ	1.2556*** (0.0226)	1.1818*** (0.0307)	1.5290*** (0.0290)	3.6010*** (0.0652)
LL	-15867.183	-17247.344	-23423.045	-22164.174

Standard errors are given in parenthesis.

*** indicates significance at the 1% level, ** indicates significance at the 5% level, * indicates significance at the 10% level

Table 6.10b Heteroskedastic Terms (Used in Full-service Expenditure Stage)

	1994 Full	1999 Full	2001 Full	2002 Full
Income	0.3511** (0.0652)	-		
Age	-0.0452* (0.0435)	-0.0554** (0.0263)		
Household Size	-	0.0173** (0.0235)		
Workers	-	-		

Chapter 7

Conclusions and Policy Recommendations

7.1 Overview

The aim of this thesis has been to identify the economic and socioeconomic factors that are fuelling demand for FAFH expenditure in Ireland and the UK. The most recent accessible datasets, the Irish HBS from 1994 and 1999, and the UK EFS from 2001 and 2002, have been used to create relevant variables to accurately model Irish and UK households FAFH expenditure patterns.

Chapter 1 discusses the motivation for analysing FAFH expenditure and the rationale for using a disaggregated approach in the analysis is documented. Among the factors fuelling demand in the market are: increasing employment and labour force participation, especially that of women; increasing urbanisation; declining household size; and the demographic structure of the Irish population with a large percentage of the population under thirty years of age. These factors have given rise to an increased demand for convenience in all aspects of food consumption from preparation through to final consumption leading to an increase in the demand for FAFH. Simultaneously, however, increasing demand is tempered by growing levels of health awareness. A discussion of some of the expanding literature that has identified FAFH, and quick-service in particular, as a contributing factor to increased obesity rates also takes place in this chapter.

Chapter 2 discusses the econometric methods used in the thesis which are required due to the presence of zero observations on the dependent variable. A number of different models are described in detail including the tobit and double hurdle model and semiparametric alternatives, namely the CLAD and the SCLS estimators. The benefits and problems with each approach are identified and specification issues are addressed in some detail.

Chapter 3 discusses the data used in this thesis. The variables used in the analysis are defined and the rationale for choosing specific independent and dependent variables presented.

Chapters 4, 5 and 6 analyse FAFH expenditure patterns using the data described in chapter 3 and the models discussed in chapter 2. Chapter 4 is primarily methodological and identifies the best approach to take in estimating the censored regression model using these data. Chapter 5 discusses the disaggregated FAFH markets in Ireland and chapter 6 sees a comparative study of the Irish and UK markets.

In this chapter, the main findings will be discussed in section 7.2. This will be followed by a discussion of potential problems that may question the reliability of the results in section 7.3. The main implications of the thesis for the foodservice industry will be outlined in section 7.4 and the chapter will conclude with ideas for future research in section 7.5.

7.2 Results

An important objective of this thesis is to establish the most appropriate methods for analysing FAFH expenditure using the available data. Chapter 4 of the thesis devotes itself to exploring alternative approaches to the standard maximum likelihood estimation (MLE) procedures usually used in the estimation of censored regression models. Alternative estimation has been rarely applied in the FAFH literature to date. The CLAD and the SCLS, both semiparametric (SP) estimators, consistently estimate the censored regression model and, more importantly, are robust to misspecification problems such as heteroskedasticity and non-normality which biases the results of MLE based models. Such models, therefore, eliminate the need to transform MLE models to obtain consistent estimates in the presence of misspecification. However, in order to maintain their robustness SP estimators purge outlying observations, including all the censored observations, therefore reducing the sample size. Depending on the extent to which misspecification is a problem in the dataset, this could dramatically impact on the efficiency of the results.

In chapter 4, MLE is compared with the CLAD and SCLS approaches in an application to quick-service expenditure patterns. Tests for misspecification identified that both heteroskedasticity and non-normality were present as was implied by the large reduction in the sample size of both of the SP estimators. Many of the SP results performed poorly when compared to an unadjusted tobit model raising questions about their efficiency. An adjusted tobit model proved far superior to the SP estimators indicating that with considerable asymmetry in the

dataset the efficiency of the SP estimators is greatly reduced. As a result, the remainder of the thesis focused on the traditional LDV framework using parametric estimation procedures. Further analysis identified the importance of using a two-step framework, the double hurdle model in this case, to analyse FAFH expenditure, the results of this model outperforming considerably the single-stage tobit approach.

In recognition of the diversity inherent within the FAFH industry a disaggregated approach was adopted. Following the most common approach in the literature the definition of FAFH expenditure was restricted to expenditure on commercial outlets solely: quick-service and full-service expenditure. Chapter 5 presents an analysis of Irish household expenditure in each sector. The results highlight the importance of this approach as different variables influence expenditure on either outlet category in different ways. A double hurdle model, adjusted for misspecification, proved superior to the corresponding tobit model. Lower educated, lower social class, younger urbanised households with low levels of health awareness appear to be the most likely consumers of quick-service products. Correspondingly, higher educated and higher social class households appear much more likely to consume FAFH at full-service outlets than quick-service. Health awareness does not impact on full-service expenditure as it does on quick-service. The results indicate that households with a high opportunity cost of time are more likely to participate in either sector of the FAFH market than other households which is also consistent with household production theory. The results also indicate that certain households substitute time spent on household

production for leisure time, i.e. full-service dining, again consistent with theory while also highlighting the existence of a health-convenience trade-off. Given the demographic trends in Ireland and, particularly, the growth of a young adult working urbanised population the prospects for the FAFH industry, and quick-service in particular, appear buoyant at present. The impact of increased health awareness may impinge on growth in certain segments of the quick-service sector into the future but at the same time this provides encouragement for the full-service sector given the apparent lack of a similar negative perception from a health perspective.

Chapter 6 compares the factors determining FAFH expenditure in both Ireland and the UK. Following the approach used to date, the expenditure category is disaggregated into its two main components: quick-service and full-service, and each is analysed separately. Given that the UK foodservice industry is at a more mature stage of development than its Irish equivalent, analysing the UK industry may give an indication as to what factors may influence growth in the Irish industry into the future. A double hurdle model, adjusted for misspecification, is used in this analysis. Perhaps the most interesting point to highlight is how similar the Irish and UK results for both quick-service and full-service expenditure are despite the UK industry being at a more mature stage of growth. For example UK households with high levels of health awareness are less likely to frequent quick-service outlets than other households, similar to the result found in the Irish analysis. The UK results again indicate the existence of a health-convenience trade-off. The results indicate that the most likely consumers of quick-service

products are younger households with lower levels of education, social class and health knowledge. Additionally, in the Irish results these households are typically resident in urban areas. The more likely consumers of full-service products are younger households with higher levels of education, health awareness and social class as well as homeowners, and commuter households in Ireland. The finding that non-white households are less likely than others to participate in either UK FAFH sector indicates that continued high immigration into Ireland may impinge on growth in the industry into the future. This will require further analysis, though other factors, including some discussed above, may compensate for any potential immigration effect. Additionally there remains the opportunity for subsequent analysis using the infrequency of purchase model. While perceived healthy and convenient sectors of the Irish quick-service sector such as juice and sandwich bars and coffee shops are not included in the definition of quick-service in the Irish analysis they are present in the UK dataset. Despite their presence in the UK datasets it appears that households with high levels of health awareness are still less likely than other households to consume quick-service products indicating that the quick-service sector will have to do more to counter its perceived unhealthiness into the future.

7.3 Data Issues

The analysis throughout this thesis has sought to select variables to best approximate the characteristics of Irish and UK households. However, there remain a number of issues that if addressed could improve the accuracy of the results.

The two-week expenditure diary compiled by each household in the HBS purports to include all expenditure on goods and services by all household members. An issue of concern remains whether teenagers' expenditures are captured within the HBS, particularly with regard to FAFH. A significant number of these teenagers may be engaged in some form of part-time work and have access to a certain amount of disposable income. Educational catering is not widespread in Ireland, unlike the UK for example, and a very small portion of Irish FAFH expenditure is on school meals. A study of female schoolchildren in Cork, Ireland indicated that these adolescents typically consume some form of FAFH at lunch-time and that over 30 percent of guardians may know little of their eating habits during the school day (Collins and McCarthy, 2005). The potential for under-reporting of FAFH expenditure by this group within the HBS is thus a possible caveat of the analysis presented in this thesis.

Work canteens are another outlet for FAFH expenditure. As discussed in Chapter 1, such expenditures are not included in this analysis due to the fact that in the 1999 HBS, expenditure on prepared sandwiches was included in the category. This is a fast growing sector of the market in the Republic of Ireland and worthy of

analysis. However, since actual expenditure levels cannot be accurately determined from the available data, it has been excluded. Similarly, pizza products purchased at commercial outlets (which would fall under the FAFH definition) and those purchased at retail sector outlets (classed as food consumed at home) are included in the same category of expenditure in the current dataset and as such are excluded from this analysis.

A further caveat of this study is that differences in the quality of the products consumed by households cannot be deciphered. However, realistically analysing the effect of quality may be unquantifiable with a variable such as FAFH. This would require a rating for each of the disaggregated categories, i.e. each outlet, and, for completeness, a quality rating would be required for the non-commercial sectors as well which is likely to be unfeasible. One possible way to allow for this could be to attempt to link expenditure datasets with nutritional datasets, however. Perhaps the C.S.O. should consider incorporating nutritional information into the HBS as is the case with the UK EFS. Another issue which cannot be analysed given the available data is the issue of price. Chapter 2 discussed the importance of this variable in several studies of FAFH expenditure patterns. In its absence, seasonal variables and urban/rural dummy variables were used to attempt to capture potential regional and seasonal variations in price. It is difficult to state conclusively how this issue can be addressed given the nature of the dataset other than to incorporate additional regional variables in future studies.

7.4 Conclusions and Implications

The key result of this thesis has been, whilst acknowledging the continuing importance of traditional variables such as income, the identification of a health-convenience trade-off when deciding whether or not to consume FAFH expenditure. It does appear that the quick-service sector is perceived less favourably from a health perspective than the full-service sector. At the same time the results indicate that increasingly time-pressed households, who demand greater convenience as a result, are the more likely consumers at quick-service outlets. Time-pressed households, even those with high levels of health awareness, are increasingly more likely to consume FAFH at quick-service outlets. This finding has positive implications for the future growth of both sectors in Ireland.

The full-service sector appears to have a comparative advantage over the quick-service sector with regard to health perception in that the sector appears to be portrayed in a positive light. The full-service sector must strive to maintain this perception while the quick-service sector must aspire to creating healthier meal options to negate its apparent negative image from a health perspective. Of course in itself full-service dining can be viewed as a form of leisure and time-stressed households favouring leisure over household production is consistent with household production theory. One caveat here is that healthier and convenient segments of the Irish quick-service sector such as sandwich and juice bars and coffee shops are not included in the 1994 or 1999 HBS. However, these segments are included in the UK quick-service analysis and the results indicate that the UK quick-service sector retains a negative perception from a health perspective

regardless. The Irish Heart Foundation's Happy Heart Catering Award and other such programmes must be expanded to promote awareness in the foodservice industry of healthier and more nutritious meal options. Food suppliers must also be educated in this regard to ensure there are no problems with regard to the supply chain in getting access to both healthier ingredients and healthier products and there is also need for a greater input from institutions such as the Food Safety Promotion Board to educate consumers about healthy options. Nonetheless, these initiatives need to be realistic and acknowledge consumer demand for convenience, both in terms of time and energy saving.

However, as well as a proactive approach on the part of policy makers to assist the development of the foodservice industry, thought should be given to incentivising consumers to shift their preferences to healthier meal options. Such approaches to change behaviour need to recognise the different consumer profile that exists for different sectors of the FAFH industry as indicated by this research. One approach is so-called "fat taxes" to discourage the purchase of those foods that are less nutritious or most harmful. This approach is modelled on the use of excise duties to discourage cigarette use. Such a tax, however, is regressive and likely to hit low-income families hardest. Fat taxes have also been met with considerable opposition from the foodservice industry. In Canada in April 2004, the Ontario State Government proposed to add the eight percent Provincial Sales Tax (PST) to the price of basic meals priced at under Can\$4 which had been previously subject to a waiver. The State Government withdrew their proposal later that month in the

face of significant opposition from the Canadian restaurateurs association.⁶⁵ Before the implementation of such a tax, consideration should be made for the existence of food deserts.⁶⁶ Food deserts are defined as areas of relative exclusions where people experience physical and economic barriers to accessing healthy food. Some studies in the UK have documented that the exodus of large retailers from the high street and inner city areas to out of town greenfield sites has created food deserts, particularly fresh food deserts. The remaining residents are dependent on corner shops, where prices are higher, and quick-service outlets. Lack of access to lower priced fruit and vegetables, for example, is likely to have negative health outcomes. Additionally the results from the Irish quick-service analysis found that urban residents have higher expenditures than rural residents which indicates that the impact of access is of some importance. More research is needed in the Irish market to ascertain the extent to which food deserts exist. Cash *et al.* (2005), in a Canadian study, argued that a “thin subsidy” provided to fruit and vegetables (with known health benefits) would provide the greatest benefits to the most disadvantaged consumers when compared to the possible regressive effects of price-increasing regulation. A similar approach may be worth exploring in Ireland, particularly in relation to tackling food deserts. An approach using subsidies, however, may be tempered by current EU agricultural policy.

⁶⁵ url= http://www.crfa.ca/newsroom/2004/strong_opposition_meal_tax.asp and
url=http://www.ctv.ca/servlet/ArticleNews/story/CTVNews/20040420/ont_fattax_040420?s_name=&no_ads.

⁶⁶ The term is attributed to a resident of a public sector housing scheme in the west of Scotland. Information taken from Food Deserts Website ([url=http://www.fooddeserts.org/images/whatisfd.htm](http://www.fooddeserts.org/images/whatisfd.htm)).

7.5 Future research

While the data used in this thesis are the most recently available in an Irish context it is difficult to make predictions about Irish households' future FAFH expenditure patterns on the basis of data from 1994 and 1999. This was the main rationale for conducting an analysis of the UK FAFH industry given that the UK industry is at a more mature stage of growth than its Irish equivalent. At the time of writing the preliminary results of the 2004/5 HBS are available on the C.S.O. website and it is hoped that the complete dataset will become available at the end of November 2007. It is expected that this dataset will contain additional FAFH categories which will enable additional disaggregation and a more accurate picture of the FAFH market with expenditure on meals in ethnic restaurants, among others, included in the new dataset. It is expected that the share of food expenditure on FAFH will have risen considerably and that the share of FAFH from quick-service will also have shown significant growth. This new dataset will give a more complete picture of the effect of the Celtic Tiger years on FAFH expenditure with rising incomes, increasing female participation in the labour force, the growth in commuting and expanding urbanisation all fuelling growth in the market. Additionally it is hoped that it will be possible to analyse healthy and convenient segments of the quick-service sector such as juice and sandwich bars and coffee shops. Another factor that must be analysed in the future is the impact immigration is having on the FAFH market. The C.S.O. estimate that approximately ten percent of the current Irish population is made up of non-nationals (C.S.O., 2006).⁶⁷ The effect of immigration must be analysed in greater

⁶⁷ url= http://www.cso.ie/census/2006_preliminaryreport.htm C.S.O Preliminary Report 2006.

detail in subsequent research. No variable in the current HBS can capture the impact of immigration while the UK analysis has indicated that ethnic households are less likely than white households to frequent any FAFH outlet. Accordingly continued high levels of immigration may not assist growth in the Irish FAFH industry into the future.

The results from chapter 6 have highlighted how a number of variables have similar effects in both the Irish and UK FAFH analyses. Accordingly subsequent research to project the likely growth of the future Irish FAFH industry should consider examining the US or other countries with high levels of FAFH penetration.

Chapter 1 highlighted examples of the literature regarding the effect that the consumption of quick-service products is having on obesity rates. This thesis has demonstrated that households with greater health awareness are less likely to consume quick-service products, while favouring full-service expenditure. Information on nutritional intakes could clarify the extent that quick-service sector is directly responsible for weight-gain and obesity. Subsequent analysis of this sector should attempt to combine nutritional diary data and expenditure data from the HBS to gain a complete picture of the health effects of quick-service, and FAFH, expenditure. Subsequent analysis should also endeavour to create additional variables to proxy the effect of health awareness on FAFH expenditure. Combining a study of this nature with data on nutrition would likely assist the analysis.

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