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Essays in Economics

Submitted in fulfilment
of the requirements
for the degree of
Doctor of Philosophy

2011

Anne McGuinness

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Summary

This Ph.D thesis examines the following societal issues: the shortfall in Irish pension funding, households' decisions to provide for retirement, households' decision to own a home, and total factor productivity convergence through learning.

A discussion of the pension system in Ireland is presented in Chapter 3. It explains in detail how the system functions and the different types of pension schemes available. Corporate funding problems, caused by defined benefit pension deficits, and losses, suffered in defined contribution schemes, are examined. The expected funding gap caused by Ireland's ageing population and the measures taken by the Government are reviewed, highlighting the potential consequences of investing the National Pension Reserve Fund in the banking sector. The discussion concludes with recommendations for further restructuring of the pension system in Ireland to increase pension coverage and sustainability.

Building on this discussion, Chapter 4 examines factors that affect the probability of a household investing in additional pension policies over and above the standard State Pension. This is achieved by applying a Heckman two-stage model to the Household Budget Survey (HBS) data compiled by the Central Statistics Office. The benefit of a Heckman model is that it allows the decision of how much to invest in a pension to be estimated subject to the household making the initial decision to invest. The ability to identify each element of a household's decision separately ensures that more accurate policy can be implemented in relation to pension provisioning. The chapter finds that age, years of schooling and marital status are the driving force behind having a pension. It concludes that the only way to increase

pension coverage is to increase households' awareness of their need for a pension through higher levels of financial literacy.

Chapter 5 examines household tenure trends in Ireland over the past two decades. A probit model is used to identify HBS factors that affect the decision to become a homeowner. The availability of multiple HBS years allows for the examination of these factors over time. It finds that personal characteristics are the most consistently significant factors in the decision to own a home, while house prices and interest rates have become less important over time. This type of analysis is important as it gives an indication of households' willingness to become heavily indebted. Mortgaged households' repayment burdens are also analysed to determine how indebted 2005 households were compared with their 1988 counterparts. Stress-tests are applied to mortgaged households from the 2005 HBS, to assess if they are financially capable of dealing with interest rate and unemployment shocks. The results indicate that households mortgaged in 2005 would be able to meet their mortgage obligations in 2009 even if interest rates increased by nearly 5 per cent. However, if households suffers both an interest rate and an unemployment shock mortgage repayment burden would increase significantly, thereby increasing the probability of household defaults.

Finally, Chapter 6 moves away from the microeconomic household analysis discussed above, to analyse macroeconomic development and growth modelling. The Chapter investigates the effect that institutions have on Total Factor Productivity (TFP) growth. This is done by creating a TFP gap between the leader and each of the follower countries. The global leaders used are the USA and an average of OECD members. The Ordinary Least Squares (OLS) coefficient on the gap measures each country's ability to learn or absorb new technology from the more advanced leader. The results show that institutions do not seem to have as significant a role in TFP growth as other literature has suggested. The most influential variables are country-specific factors: this would indicate that a one-size-fits-all model will not help developing nations to catch up. When institutional variables are added to the model they manage to only explain 31 per cent of TFP difference. This implies that there is still a large portion of TFP growth that is random and not explicable using current economic models.

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To Gavin

thank you for all your love and support

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Chapter 1

Introduction

This thesis examines three distinct areas of economics: pension related issues, household indebtedness based on tenure choices and Total Factor Productivity (TFP) convergence. The primary data sources used for this analysis include the CSO's Household Budget Survey (HBS), and the Penn World Tables (PWT).

Pension Related Analysis

The motivation behind studying pensions comes from a social obligation to ensure that older members of society do not live in poverty. A national pension system allows an individual to maintain a relatively consistent standard of living throughout their life-cycle. This is achieved through consumption smoothing, where the individual deliberately sets aside income earned to fund their future. The system in Ireland ensures a basic pension is paid to all members of society, through the State Pension. This is funded as a Pay-As-You-Go (PAYG) system, where current workers and employers pay a Pay Related Social Insurance (PRSI) stamp into a fund along with the Exchequer to satisfy current State Pension obligations. Problems with this system develop when the population begins to age and there are insufficient contributions made to fund pension obligations. A pension shortfall is expected in Ireland from 2025 onwards, as the ratio of OAPs to workers is expected to increase from one-in-six to one-in-three people. This thesis discusses the measures taken by the Government to meet future State Pen-

sion obligations and the likelihood of these measures succeeding. It also examines the private pension element of the system, highlighting the different types of schemes (occupational or personal) and the different types of plans (defined benefit or defined contributions). These schemes are designed to provide households with additional pension income over and above the State Pension; however, these funds are also experiencing funding problems. This type of pension-related discussion is vital as funding gaps in the State Pension mean that the responsibility for retirement falls increasingly on the individual who is more than likely unaware that there is a problem within the pension system.

Building on this discussion the thesis moves on to examine 2005 micro level HBS data with regard to households' pension decisions. The HBS participants were asked how much they and their employer contribute to a pension per week. Unfortunately, there is no stock figure available, nor is the pension data collected per resident in the household, so a household is only observed to have a pension if contributions were observed in the year of survey. Therefore some households who have made retirement provisions might not be observed because they do not contribute during the survey year. For example, self-employed pension contributions are not paid throughout the year but from the profits at year end. As a result there may be a number of reasons for no-contribution in a given year, i.e., in a bad year pension contributions will be postponed due to insufficient profits or the individual may choose to reinvest these profits in the business rather than contribute to their pension. Due to these unobserved elements in the data, a Heckman two-stage model is applied to the data. This allows for separate analysis of the two separate decisions involved in pension planning: first, the decision to participate in a scheme and second, how much to contribute. By isolating the factors that affect these decisions separately, policy makers can then make more informed legislative changes depending on which element they want to change. The Government's target is to have 70 per cent of workers between 30 and 65 years of age investing in pension coverage to supplement the State Pension. Currently only 35 per cent of non-retired individuals have a pension.

Household Tenure and Mortgage Repayment Burdens

The thesis then examines household tenure changes and mortgage related indebtedness. This is done by applying a Probit model to the HBS data, which allows for the identification of characteristics that affect the decision to be a home owner over the course of four surveys (1988, 1995, 2000 and 2005). Mortgaged households' indebtedness is also analysed by factors such as disposable income levels and age cohort in each survey, but also in comparison to their peer group in previous survey years. This analysis is important for two reasons: first, at an aggregate level the household sector can look financially sound (when total assets and liabilities are compared) which may not be the case, and second, the existence of an overly indebted section of the household sector can have a significant effect on the banking sector as the recent crisis demonstrates. For this reason, households that were surveyed in 2005 are stress-tested to determine how easily they would be able to deal with interest rate and unemployment shocks in 2009. The principal limitation with this analysis is that the data do not account for households that bought after 2005 at the peak of the property market bubble. It is likely that the excluded households are the most exposed and vulnerable in the household sector.

Total Factor Productivity Convergence

The final area of research undertaken in this thesis involves macroeconomic analysis of countries' ability to learn and absorb technologies from regional leaders to improve their productivity. Global and regional leaders are determined based on their technology levels, and all other countries are defined to be followers who have the ability to learn from the leaders. Global leaders are the USA and OECD members' average; regional leaders fluctuate over time depending on which country in the region has the highest technology level at a given point in time. The regions include Australasia, Europe, The Americas and the rest of the world. Ordinary Least Squares (OLS) regressions are run on data from the Penn World Tables (PWT). The 57 countries and the years (1960-2000) used in the analysis were determined based on the availability of the Barro-Lee educational attainment tables and Shliefer's institutional data. The institutions data include, but are not limited to social

and health benefits, political regimes, ease of doing business, labour laws and the education systems that exist in each country. Combinations of regressions are run to estimate the direct and indirect effects of these institutions on Total Factor Productivity (TFP). The TFP gap between the leader country and the followers along with country-specific variables, are controlled for in the analysis. This research is important because it allows poorer nations to learn for global and regional leaders so that they can catch-up in a more efficient manner.

This thesis is organised as follows. Chapter 2 describes summary statistics and calculations on the data used in the analysis. Chapter 3 is a discussion chapter in relation to the current pension system in Ireland, how it works and its shortcomings. Chapter 4 examines factors that affect a household's decision to participate in pension planning and how much they choose to invest. Chapter 5 analyses household tenure trends in Ireland over the past two decades and the consequence of a highly indebted household sector. Finally, Chapter 6 investigates the effect that institutions have on TFP growth.

Chapter 2

Review of Data Sources

2.1 Introduction

This thesis uses a number of different data sources. The Household Budget Survey (HBS) is used in the analysis for both Chapter 4 and Chapter 5. The Penn World Tables (PWT) are the primary source for analysis in Chapter 6. Chapter 3 examines the Irish pension system; it is a policy-based chapter, using aggregated data, to provide background information for the analysis conducted in Chapter 4 using the HBS.

As discussed in McCormack (2006) the HBS is undertaken by the Central Statistics Office (CSO) approximately every five years. It is a random sample of the population used to establish the spending patterns of households in Ireland. The HBS is a rich data source in terms of household behaviour, providing detailed information on consumption decisions, weekly expenditure and household types. There are two key limitations with the HBS. First, the data tend to be lagged due to the size and detail of the project. Second, due to the fact that it is a budget survey, it does not collect stock level data. Repayments on loans and weekly savings are collected but the original loan value and total stock of savings are not. Notwithstanding these limitations, information on household tenure and personal characteristics are very detailed.

The HBS is used to examine a household's decision to make provision

for retirement as shown in Chapter 4. This analysis is possible because HBS data reveal the amount a household contributes to a pension in a given year and also how much their respective employer contributes (if they contribute) to the household's pension.

Chapter 5 analyses a household's decision to own its home, evaluating household characteristics that increase the probability of home ownership. Subsequently, the HBS data are restricted to analyse mortgaged households and their mortgage repayment as a percentage of disposable income is examined over the available dataset. Stress tests are applied to households' mortgage burdens, by imposing unemployment and interest rate shocks to the data.

The data used in Chapter 6 are drawn from the Penn World Tables (PWT) in conjunction with country institutions data compiled by Andrei Shleifer in order to analyse the effect of institutions on Total Factor Productivity (TFP). This is done by creating a productivity gap between the regional leader and each of the following countries in that region. The coefficient of the gap variable measures the following country's ability to learn from the respective leader.

The purpose of this chapter is to review the various data sources used within this thesis. This chapter outlines in detail the principle data sources used in the analysis. The remainder of the chapter is organised as follows. Section 2 reviews the HBS, its purpose, methodology, survey-specific changes and summary statistics. Section 3 discusses additional data sources and defines the variables used in Chapters 3, 4 and 5. Finally, Section 4 outlines the PWT and Shleifer's institutions data used in Chapter 6.

2.2 Household Budget Survey (HBS)

The Household Budget Survey (HBS) is carried out by the CSO. The purpose of the HBS is to gather expenditure data on households' consumption patterns so that accurate weighting can be applied to products that are included in the Consumer Price Index (CPI) basket. However, the HBS also represents a rich micro level household data set that can be used to analyse areas such as consumption patterns, health, tenure, and financial activity.

The CSO began surveying in the 1950s. However, post-1994, surveys became more regular and have been carried out on a five-yearly basis. HBS data are available for the following years: 1951/52, 1965/66, 1973, 1980, 1987/88, 1994/95, 1999/00 and 2004/05. The original surveys were carried out on urban households only. Rural households have been included since 1973. Each survey builds on the previous questionnaire, allowing for new products and trends to be captured in the data. For example, the inclusion of rural households in 1973 significantly improved the quality of the data, while more recent surveys include new factors such as buy-to-let properties, the internet and mobile phones to name but a few.

This thesis uses data from the following four surveys: 1987/88, 1994/95, 1999/00, and 2004/05. For the remainder of the thesis, surveys will be referred to by the year of completion. The study is restricted to these years because the financial variables needed for the analysis were not collected prior to 1988. These variables include investment sources, deposit and savings accounts, dividends and interest earned and credit card debt. Other excluded data include the original mortgage value (available from 1995 onwards), employers' pension contributions and Personal Retirement Savings Accounts (PRSA) which were only collected in the 2005 survey.

Notwithstanding the shortcomings, the primary benefit of the HBS micro level data is that it allows for the analysis of households' preferences in relation to financial products over time. It not only enables analysis of how households' financial positions have changed in relation to interest rates and unemployment, but it also facilitates household analysis by age, sector, income and region.

2.2.1 Methodology

The HBS is carried out on a random sample of the population based on the Census of Population which is usually carried out in the first and sixth year of every decade.[1] The CSO employs a two-stage sample selection procedure

[1]Ireland's first Census was carried out in 1821 and continued at 10-year intervals until 1911. Upon gaining Independence a full census was carried out in 1926 and continued at 10-year intervals until 1951, when 5-year intervals were introduced. The Census is now carried out in the first and sixth year of every decade. However, there have been two

to identify the households included in the sample. The first stage divides the country into different categories depending on population density, i.e. county, suburbs, towns of varying sizes or rural. The second stage randomly samples households from each area identified in stage one. This process controls for variation in responses by town size and region [for more detail on this process see McCormack (2006)]. Households' responses are then combined with the National Farm Survey (NFS) carried out by Teagasc. In order to avoid duplication of farming households in the final survey, farming households[2] surveyed in the CSO's two-stage sample section are identified and deleted.

The field work involved in these surveys is extensive. Each survey is compiled over a period of approximately 14 months, in order to ensure that seasonal consumption behaviour is accounted for. Each household surveyed is given a diary to record their weekly expenditure over a period of two weeks.[3] In addition to this detailed expenditure account, each household participates in a detailed questionnaire. The areas covered within the questionnaire that are used in this thesis include:

- Personal Characteristics - age, sex, marital status, education, occupation, number of dependents;
- Housing Variables - owner-occupied, property type, mortgage type, original mortgage amount, weekly mortgage repayments, principal outstanding, number of rooms and location;
- Financial Information - disposable income, buy-to-let properties, stocks and shares, current and saving accounts, foreign and domestic investments;

instances where the Census was not carried out to this schedule. First, the 1976 Census was cancelled due to economic stress in the State with a short version being complied in 1979 instead. Second, the 2001 Census was postponed until 2002 due to foot and mouth disease.

[2]A farming household is identified as any household that has farming as their primary or secondary activity.

[3]To ensure accurate expenditure reporting, households are asked to retain all till receipts relating to purchases. This allows for more accurate coding by the CSO, not only in relation to what products are purchased but also by price, quantity, weight (grams) and volume (litres).

- Insurance Expenditure - pensions, health, motor, property, content, income protection, and other insurance; and
- Additional Income - social welfare benefits, benefits in kind, overtime, rent-a-room, dividends.

Each respondent in the sample is given a weight indicating the percentage of the population they represent, allowing population level analysis to be conducted. This weighting is based on the proportion of the Census of Population they represent based on the two-stage sampling techniques used. The sample is also capped at survey specific income thresholds in order to prevent the identification of high income households in the sample.

The limitations of the HBS dataset are two-fold. First, there is a significant publication lag on the data, which limits its use in policy-related decision making. Second, the dataset is a budget survey for households, not a wealth survey, limiting its use in analysing the overall financial position of households (as there are no stock or flow data available). Notwithstanding these limitations, households' financial strain derived from changes in the economic climate can be assessed even with limited knowledge of households' savings or investment stock.

2.2.2 HBS Summary Statistics

Table 2.1 reviews the characteristics of the four HBS years used in this thesis. The table provides both the publication data of each HBS and the period over which the field work was carried out (approximately 14 months). The table highlights the lag in HBS publications due to the volume of work required to calibrate all the responses. This process usually takes approximately 18 months, but the 2005 survey was lagged by 27 months. The year of the Census of Population is also provided in the table.[4]

[4]The CSO also makes a number of assumptions in relation to population changes between the Census year and the survey year in order to ensure that the most accurate weights are given to each household in the survey. Year specific elements must also be taken into consideration when comparing large datasets such as the HBS. For example, HBS data up to and including 1995 are listed in Irish Pounds, while the 2000 and 2005 surveys are recorded in euros. It was necessary to convert the earlier surveys to euros

The initial sample size, the number of uninhabited addresses and the effective sample of each survey are also illustrated in Table 2.1. "Uninhabited" represents the number of drawn addresses that are vacant, demolished, boarded-up, boarding houses and any other addresses excluded from the survey. Over time, the percentage of excluded addresses has increased from 7 per cent in 1988 to a peak of 12 per cent in 2000. This could be due to the increase in activity in the construction sector, where many areas in the country have undergone significant redevelopment.

Table 2.1 also displays the response rate of each HBS. Over time fewer people have been willing to participate in the survey. In order to ensure a consistent final sample size across surveys, the CSO must compensate for the lower participation rates by increasing numbers in the initial and effective sample sizes. Response rates in the 2000 survey were down 4 per cent on the previous survey year, with the 2005 survey falling by an additional 8 per cent.

All summary and comparative tables discussed in this thesis have been adjusted for inflation using the CSO's annual Consumer Price Index (CPI) with 2005 taken as the base year. The increase in the CPI from 1988 to 2005 was 67.7 per cent, 38 per cent from 1995 to 2005 and 18.9 per cent from 2000 to 2005. The 2000 to 2005 CPI increase differs from the published figure in the 2005 HBS accompanying documentation. This is due to revisions made in the CSO's CPI data.

The HBS data reveal dramatic changes in general expenditure and income patterns in Ireland since 1988. Table 2.2 shows that in real terms, national (State) weekly expenditure increased from €475 to €787 between 1988 and 2005, an increase of more than 60 per cent. Over the same period, average household weekly disposable income increased by 96 per cent from €428 in 1988 to €842 in 2005. Urban households earned between 8 and 12 per cent more that rural households over this period; however, given that the cost of living is typically higher in urban areas this is to be expected.[5]

using the fixed Irish pound-euro exchange rate of 0.787564. In addition, data before 2005 are given in pennies rather than pounds implying that these data must be scaled.

[5]The HBS defines Urban Households "as being located in cities and towns of all sizes distinguished for Census of Population purposes including suburban areas".

Table 2.2 also indicates that the survey to survey growth rates of disposable income and expenditure have been very high. Disposable income growth doubled from 15.6 per cent between 1988/1995 to 32.5 per cent between 1995/2000. Although remaining high, disposable income growth rates declined to 28.5 per cent between 2000/2005. The increase highlights the significant improvement in households' living standards over this period due to the "Celtic Tiger". Growth rates in expenditure followed the same pattern, however, expenditure at a percentage of disposable income has fallen over time, with the average household spending less than they earned in 2005.

Changes in expenditure patterns over time are illustrated in Table 2.3. The share of total expenditure allocated to food has remained relatively constant at between 20 and 25 per cent. However, services, transport and housing have significantly increased their share of household expenditure. Housing costs (rents and mortgages) increased by almost 50 per cent increasing from approximately 9 per cent in 1988 to 17 per cent in 2005. These developments highlight the increasing cost of accommodation caused by the initial undersupply of units in the 1990s and 2000s due to net migration and demographic changes.

Households are often broken down by income deciles, the purpose of which is to compare behaviour/standards of lower income households with other wealthier households. Table 2.4 illustrates households' weekly disposable income by deciles per survey year. Over the period of time examined within the HBS, there has been a significant increase in household income. The final column in Table 2.4 relates to the growth rate of disposable income over the period 1988 to 2005. Disposable income increased in all income deciles with the top three income deciles (i.e., the wealthiest 30 per cent of the population) experiencing an increase in disposable income of more than 100 per cent. The second income deciles experienced the lowest increase in their disposable income, possibly due to the fact that this income bracket is where welfare supplements stop and income tax is paid on a small percentage of salaries. The poorest households increased their average disposable income by 62.6 per cent over the same period. This increase may indicate that increases in social welfare payments have significantly increased the

standard of living for poorer households. The significant differences in the growth rate of disposable income across various income deciles highlights the dramatic divergence in equality across the economy, where the wealthiest in the population have enjoyed much higher income growth rates.

Table 2.5 gives a breakdown of household expenditure and disposable income by employment. It shows that there has been a real increase in disposable income across all groups including both those out of work and retired households. The ratio of expenditure to income has also improved across all groups with the exception of those out of work who consistently spend more than their income. The general increase in households prosperity and disposable income since the 1980s have allowed more households to invest in housing, pensions, and stocks and shares than ever before. This thesis analyses these decisions in relation to pensions and housing.

The principle variables used in Chapters 4 and 5 have been divided into subsections based on *Household Characteristics*, *Income* and *Debt* as defined in Table 2.6. In additional to these subsections, Chapter 4 also investigates households' use of financial products such as *Insurance*, *Savings & Investment* and *Unsecured Credit*, which are defined in Table 2.8. Corresponding means and standard deviations are given in Tables 2.7 and 2.9, where all monetary values are given in 2005 euro prices. Where possible, the HBS code is also provided, headers (variables with prefix "hdr") are comprised of control and observation variables, trailers (denoted with prefix "t") contain quantities and values, i.e., income, expenditure, weights and quantities consumed.

2.3 Additional Data Sources

2.3.1 Supplementary Pensions Data

Chapters 3 and 4 analyse pensions in Ireland. There are a number of sources from which aggregated macro level data is sourced for Chapter 3. The HBS dataset is the primary data source used in Chapter 4 for micro level analysis, however, it is also supplemented with additional macro level data. The macro level data used are summarised in Table 2.10 and are obtained from the following sources:

1. The Irish Pension Board (IPB) is a regulatory body which has three functions: first, it protect interests of pension scheme members, second, it promotes the development of efficient national pension structures and third, it monitors and collects pension scheme's data. The data it collects are published in the IPBs annual reports (2000-2010). The data include information on the number of pension schemes in Ireland and their membership, along with information relating to the type of schemes held.

2. Irish Association of Pension Funds (IAPF) was established in 1973 and it conducts an annual survey in relation to occupational pension assets held in Ireland. The IAFP represents over 340 corporate members, representing 200,000 employees or approximately 25 per cent of occupational pensions. The body also engages with the National Pensions Board and the Department of Social Protection on behalf of its members. It is represented at a European level through its membership of the European Federation of Retirement Provisions (EFRP). IAPF surveys used in this thesis include the *Asset Allocation Survey* from 1987-2003, which was replaced by the *Pension Investment Survey* for 2009-2010 and the *Defined Benefit Survey*. The data collected include information on all occupational pensions (both defined benefit and defined contribution), it focuses on the allocation of pension funds' assets and investments, and monitors the value of the funds held.

3. The CSO's *Quarterly National Household Survey's* Special Modules on pensions was also used. These Special Modules are carried out every quarter; however, the pension related modules are only available for 2002Q1, 2004Q1, 2005Q1 and Q4, 2007Q1, 2008Q1 and 2009Q4. The QNHS collects household related pension data, which include personal pension plan information not collected by the IAPF. Unfortunately, this survey does not distinguish between defined benefit and defined contribution schemes.

4. National Pension Reserve Fund (NPRF) was established in 2004 by the Government to spread the burden of the State's future pension obligations over time. It is administered by the National Treasury

Management Agency (NTMA), which releases data on asset allocation and performance of the fund. Quarterly data from 2004Q2 to 2010Q4 were sourced from the website's Asset and Performance page.[6]

5. Department of Finance (2010) data are sourced from the annual *Analysis of Exchequer Pay and Pensions Bill* reports. These data provide information relating to the cost of providing public sector employees with their defined benefit pensions.

6. Department of Social Protection (2010) releases data in relation to State welfare administered to the public. These include all information relating to the cost of providing the State Pension, both contributory and non-contributory (means-tested) pensions.

7. Attain Consultants[7] are an Irish firm that specialise in pension and financial planning for their clients. They produce a regular *Pension Funding Index* which provides interpolated aggregate level data based on ISEQ listed companies annual reports. The annual deficit/surplus of 25 ISEQ listed companies with defined benefit pensions was sourced from Attain.

2.3.2 Supplementary Macroeconomic Data

Chapter 5 uses data relating to the year households move into their home, (as a renter or owner occupier). These data are sourced from the Central Bank of Ireland (CBI), the CSO and the Department of the Environment, Heritage and Local Government (DoEHL). The historical data include, annual interest rates, inflation rates, house prices, loan-to-value ratios and rental values. Additional data used include, first-time-buyer information, disposable income and saving rates for both 2007 and 2009. Summary statistics for these data and their sources are given in Tables 2.11, 2.12, and 2.13.

[6] http://www.nprf.ie/Performance/selectYear.htm
[7] http://www.attain.ie/

2.4 Penn World Tables & Institutional Variables

There are three data sources used in Chapter 6, the Penn World Tables (PWT), the Barro-Lee Tables and Shleifer's Institutions data. Each source is discussed within this section.

2.4.1 Penn World Tables (PWT)

The Penn World Tables (PWT) provides economic national accounts data by country. There are approximately 30 variables available for approximately 167 countries over some or all of the period 1950 to 1998. Data are also available relating to country demographics, capital stock and relative prices within and between countries. Variables are available in common prices and currency (US dollars), facilitating real quantity comparisons across country. There are a number of papers written about the PWT and how they were developed; however, the principle articles are Kravis *et al.* (1978) and Summers and Heston (1991). Additional information about the PWT can be sourced from the University of Pennsylvania, PWT website.[8]

The PWTs are the result of many years of international co-operation. In the beginning, the dataset was compiled as the System of National Accounts (SNA), which is a national accounting framework for economic activity. It has been maintained by the majority of United Nations (UN) members since 1963. While the SNA represented a quality dataset for both time-series and cross sectional country analysis, it did not allow cross-country comparisons to be made. In 1968, the first cross country purchasing power comparisons were developed at Penn in the form of the International Comparison of Prices Program (ICP) based on the SNA data. This initial work included international comparisons involving conversions of countries accounts at PPPs.

The initial benchmark studies (1967, 1970 and 1975) were carried out at Penn. However, since the 1980s a number of regionalised benchmark studies have been arranged by the United Nations (UN), the Organisation for Economic Cooperation and Development (OECD), Eurostat and the World Bank. These studies involved collecting the prices of a number of standard quality goods and services in different countries. Prices were used to

[8]Source: http://pwt.econ.upenn.edu/

calculate indices which were applied to countries SNA data to generate comparable country statistics in relation to national income and its components. The PWT is a combination of these regional estimates into a world benchmark data source. Summers and Heston (1991) give a full description of the Penn World Tables.

The analysis in Chapter 6 uses Penn World Tables (PWT) version 6.2 which is discussed in Heston *et al.* (2006). Statistics on 57 countries are drawn over 41 years (1960-2000) from the PWTs. The final 57 countries and 22 PWT variables are listed in Table 2.14 and Table 2.15, respectively.

2.4.2 Barro-Lee Tables

The Barro-Lee tables were developed by Barro and Lee in 2000. The construction of the data is described in Barro and Lee (2001). They created a data series of educational attainment at various levels for a number of countries. Two different age groups are estimated (over 15 and over 25) by sex. These groups are provided in five-year intervals over the period 1960 and 2000. The data also provide the number of years of schooling achieved by the average person at the various levels of schooling and cumulative schooling attained.

Country selection in Chapter 6 is based on the availability of Barro-Lee tables. This is because the construction of human capital is based on the average years of schooling, which is an essential element of the TFP function. Therefore, the dataset was restricted to countries where educational attainment is available from the Barro-Lee tables. This variable also restricts the years of the sample to the period 1960-2000.

2.4.3 Shleifer's Institution Variables

The availability of institutional data also determines which countries can be incorporated in to the analysis. This section describes the various institution indicators used in the analysis. Institutions refer to a number of different elements in society. These include, political regimes, structure of the education system, financial institutions, social welfare systems, etc. This type of information can help measure a country's level of corruption, how easy it

is to implement new technology and whether or not a country is reaching it maximum productive level.

The data were obtained from Andrei Shleifer's website.[9] The data were downloaded as cross sections, combined and then formed into a panel. A number of the variables do not change over time, and these that do are not year on year changes but instead 5 and 10 year averages. However, this is not necessarily a problem given that institutional change can take a long time to implement and even longer before the effects may be seen. In addition, when these variables are interacted with the TFP gap between the lead and follower country (which does change over time), they become time varying indicators.

The data set is sub-divided into groupings that give general indications of the influence of institutions in a given country. The groupings can be taken as indicators of the country's commitment to development and change. These indicators are Political Government Variables, Citizens' Rights, Health Benefits, Social Security Benefits and Labour Regulations. The majority of these indicators are inter-related and correlated. This inter-relatedness is to be expected as a country with good government policy will tend to have good social, health and education standards (Table 2.16). The components and source of each indicator are defined as follows:

1. The *Social Benefits* variables are all sourced from Botero *et al.* (2004); they examine the effects of social security, industrial and labour laws on labour force participation rates. The measures used are: labour union power, collective disputes, availability of alternative employment, social security provided by the state, employer requirements, unemployment, old age and maternity benefits. The purpose of this group is to determine the effects of unions and social policies of the state.

2. The *Health Benefits* are a combination of health indicators taken from Botero *et al.* (2004), Djankov *et al.* (2002) and Glaeser *et al.* (2004). These indicators combine the responsiveness of the health service, sick

[9]All the institutions data sourced from Shleifer are available from: http://www.economics.harvard.edu/faculty/shleifer/dataset

benefits from the state, risk of malaria and the ISO[10] environmental and quality standards.

3. *Labour Regulations* are made up of the cost of overtime, firing costs, labour force participation, minimum wage and age requirements and legal requirements placed on the employers. These indicators are sourced from Botero *et al.* (2004) and essentially represent the labour laws used in their paper.

4. The *Citizen Rights* group is a more general grouping of the basic right of citizens. It is taken from Botero *et al.* (2004), Djankov *et al.* (2002) and Glaeser *et al.* (2004). The group is composed of expropriation risk, civil rights, corruption levels in the government, court formalisation and property rights.

5. *Political Government* measures are taken from Botero *et al.* (2004) and Glaeser *et al.* (2004). Political government measures the quality of a country's government and consists of the political breakdown of the government, legislature process competition, government effectiveness, executive constraints and the level of democracy.

6. *School enrolment* measures secondary level school participation. It is taken from the World Bank Indicators as a proxy for the role of education in a country. The skills gained from this education have already been accounted for in the human capital ratio derived from the Barro-Lee tables.

[10] International Organisation for Standardisation

Table 2.1: Household Budget Survey Responses

	1988	1995	2000	2005
Publication Date	October 1989	October 1996	January 2002	March 2008
Field Work	Feb-87 to Apr-88	May-94 to Jul-95	Jun-99 to Jul-00	Oct-04 to Dec-05
Census of Population	1986	1991	1996	2002
Initial Sample	13,810	14,873	16,038	16,635
Uninhabited$^{\psi}$	972	1,441	1,984	1,966
Effective Sample	12,838	13,432	14,054	14,651
State Responses	7,705	7,877	7,644	6,884
Response Rate	60%	59%	55%	47%
Sample Size	7,691	7,839	7,634	6,834

Note: ψ Uninhabited households represent addresses selected that are vacant, demolished, boarded-up, boarding houses, institutions, etc.

Table 2.2: HBS National Expenditure & Disposable Income by location

	1988	1995	2000	2005
Average Weekly Expenditure (€)				
State	475.28	547.33	687.00	787.12
Urban	497.03	576.35	728.39	819.11
Rural	438.57	497.70	612.75	681.42
Average Weekly Disposable Income (€)				
State	428.15	494.96	655.94	842.98
Urban	441.40	513.94	696.50	871.43
Rural	405.80	462.48	618.49	796.77
Growth Rate of Disposable Income (%)				
State		15.60	32.52	28.52
Urban		16.43	35.52	25.12
Rural		13.97	33.73	28.83
Growth in Expenditure (%)				
State		15.16	25.52	14.57
Urban		15.96	26.38	12.45
Rural		13.48	23.12	11.21
Expenditure to Disposable Income (%)				
State	111.01	110.58	104.74	93.37
Urban	112.60	112.14	104.58	94.00
Rural	108.08	107.62	99.07	85.52

Note: Data has been converted to Euro and rebased to 2005 levels.

Table 2.3: HBS Distribution of Household Expenditure (%)

	1988	1995	2000	2005
Food	25.22	22.70	20.37	25.15
Services	21.91	24.39	25.70	40.49
Transport	13.58	14.35	16.43	21.63
Housing	8.81	9.81	9.59	16.65
Alcohol & Tobacco	7.99	7.65	7.63	8.31
Fuel & Light	6.28	4.97	3.75	5.40
Clothing & Footwear	6.74	6.39	6.08	7.52
Miscellaneous Goods	3.47	3.81	3.30	4.19
Durable Goods	3.92	3.62	4.65	6.26
Non-Durable Goods	2.08	2.33	2.49	3.07
Total	100	100	100	100

Note: This gives the percentage of expenditure spent by product

Table 2.4: HBS Household Weekly Disposable Income by Deciles (€)

Deciles	1988	1995	2000	2005	Growth Rate (%)
1st Poorest	97.74	110.16	126.32	158.99	62.67
2nd	160.14	172.49	207.41	224.65	40.28
3rd	218.87	234.98	296.60	359.12	64.08
4th	274.35	304.98	394.56	488.30	77.98
5th	330.07	377.75	503.02	628.31	90.36
6th	395.69	463.56	613.52	779.53	97.01
7th	477.74	564.62	734.61	950.84	99.03
8th	573.22	674.89	884.08	1,167.54	103.68
9th	705.78	825.03	1,100.47	1,420.76	101.30
10th Richest	1,048.31	1,220.73	1,698.96	2,232.01	112.92
State Average	428.15	494.95	655.94	842.98	96.89

Note: Data has been converted to Euro and rebased to 2005 levels

Table 2.5: HBS Household Expenditure by Livelihood

	1988	1995	2000	2005
Average Weekly Expenditure				
Self-Employed	555.77	618.71	811.30	912.05
Employee/C.E.S.	616.39	741.61	885.25	1,017.88
Out of work	339.75	398.13	493.10	553.00
Retired	334.08	352.70	400.38	456.09
Other	284.40	320.39	408.88	534.50
State Average	475.28	547.31	687.00	787.12
Average Weekly Disposable Income				
Self-Employed	509.82	586.87	786.72	1,012.39
Employee/C.E.S.	559.26	592.96	847.51	1,118.39
Out of work	277.50	321.02	395.30	455.83
Retired	303.38	336.02	397.76	483.25
Other	255.73	285.23	380.14	515.58
State Average	428.15	494.96	655.94	842.98
Ratio Expenditure to Disposable Income (%)				
Self-Employed	109.01	105.43	103.12	90.09
Employee/C.E.S.	110.22	125.07	104.45	91.01
Out of work	122.43	124.02	124.74	121.32
Retired	110.12	104.96	100.66	94.38
Other	111.21	112.33	107.56	103.67
State Average	111.01	110.58	104.74	93.37

Note: Data has been converted to Euro and rebased to 2005 levels

Table 2.6: HBS Data Definitions

Variable	Definition
Household Characteristics	
Mortg-age	Number of Year in Residence for Commercial Mortgage Providers (hdr258)
Origmort	The original mortgage value; no adjustment made for remortgage/top-up/equity release (t2243)
Prinoutst	The amount of principal outstanding on the primary residence when the household is surveyed (t638)
lnsch	Education level attained is transferred into years of schooling and logs taken (hdr342)
lnchild	Number of dependent children (#0-9); (hdr242)
Persons	Number of persons in the household (#1-25); (hdr3)
Rooms	Number of Rooms in the building (#1-98); (hdr55)
Savings	SSIA and weekly savings (t434+t1456)
Income Variables	
lnDI	Log Disposable Income, generated as the log of total household disposable income (t498)
Dinvestinc	Domestic investment income - building soc, stock & shares, Irish Govt Bond & other investments (t445 to t448)
Finvestinc	Foreign investment income - building soc, stock & shares, other foreign investments (t1130 to t1132)
Otherinc	Room-to-let, agricultural land, interest on SSIA, income other properties (t449+t450+t1957+t1968)
Totaddinc	Sum of dinvestinc, finvestinc plus otherinc
Stockshares	Sum of income generated from domestic & foreign stock & shares (t446+t1130)
Invest	Investment income from domestic & foreign sources excluding stocks&shares
Debt Variables	
Rent	Weekly rent paid by households to private or local authority landlords (t229+t230)
MRP	Mortgage repayment - Interest only, principle & interest and mortgage subsidiary loan(t235+t235+t236)
MRPB	Mortgage repayment burden is the percentage of DI spent on mortgage repayments
Perloan	Amount Repaid Bank, Employer, Credit Union & Other personal loans (t598 to t601)
Hirepur	Amount Repaid on Household, Clothing, Vehicle and Other goods by Hire Purchase (t427 to t431)
Cardpayment	Amount Repaid on Credit and Store Card Repayments (t1019+t1386)
Totrepay	Sum of repayments made on Hire Purchase, Loans and Cards
Totdebt	Sum of repayments made for totrepay plus mrp (only effects mortgaged households)

Note: All data sourced from the HBS STATA files; HBS codes in brackets

Table 2.7: HBS Summary Statistics

	2005		2000		1995		1988	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Household Characteristics								
Mortgage age	9.90	8.80	12.30	10.48	11.93	9.58	11.88	10.84
Orig. Mortgage	37,268	74,247	18,422	23,139	17,593	15,173	11,974	8,853
Outstanding debt	29,882	67,955	32,675	548.77	24,027	25,668	n.a.	n.a.
lnsch	2.51	0.28	2.44	0.29	2.37	0.28	2.46	0.20
lnchild	0.63	0.50	0.69	0.51	0.74	0.54	0.82	0.56
Persons	3.14	1.58	3.10	1.71	3.17	1.88	3.51	2.04
Rooms	5.96	1.40	5.70	1.14	5.49	1.52	5.41	1.52
Savings	44.42	67.86	14.20	34.69	8.98	18.44	11.13	107.20
Income Variables								
Disposable income	6.53	0.76	10.64	0.76	9.98	0.74	8.51	0.72
Domestic invest inc	6.47	54.06	5.01	38.44	5.10	21.50	5.59	13.49
Foreign invest inc	0.46	16.90	0.53	17.19	n.a.	n.a.	n.a.	n.a.
Other income	18.57	73.27	7.13	47.57	4.48	19.54	3.71	15.61
Total additional inc	25.50	95.41	12.67	65.62	9.58	29.93	9.30	21.59
Stock & shares	4.13	51.64	2.77	30.04	2.12	17.75	1.57	9.40
Investments	2.80	18.10	2.24	23.73	2.98	10.53	4.02	8.44
Debt Repayment Variables (€)								
Rent	116.20	99.12	87.17	74.25	52.96	32.04	29.43	14.47
Mortgage	43.42	80.57	36.69	53.50	35.06	31.74	29.28	24.47
Mortgage burden (%)	5.87	10.76	6.33	31.11	11.90	44.04	6.65	23.76
Personal loan	40.63	67.26	34.86	68.26	23.55	27.71	16.93	16.47
Hire purchase	6.46	24.55	7.87	23.16	4.70	10.14	4.11	727.37
Card payment	18.07	111.09	79.33	10.75	n.a.	n.a.	n.a.	n.a.
Total repayment	65.17	139.77	42.73	72.81	28.25	29.97	21.04	18.17
Total debt	108.59	162.49	92.10	120.40	61.40	45.69	45.91	30.42

Note: Monetary variables have been converted to Euro and rebased
Variables are given in weekly 2005 Price level Euros unless otherwise indicated

Table 2.8: HBS Financial Products Data

Variable	Definition
Insurance Products	
homeins	Sum of housing related insurance both contents and dwellings (t238+t237)
motorins	Sum of motor related insurance products (t333+t334+t335)
incins	Income Protection insurance (t1421)
mortins	Mortgage Protection Insurance (t381)
healthins	Amount spent on health insurance with VHI & BUPA (t379)
lifeins	Amount spent on Life assurance (t382)
otherins	Other insurance products purchased (t384)
pencontib	Sum of personal Pension, PRSA & AVC contributions (t380+t1994+t1457)
empcontib	Sum of employers Pension & PRSA contributions (t1425+t1445)
Saving & Investment Products	
hdr323	No. Stocks & Shares held by the household
hdr324	No. Government Loans held by the household
hdr325	No. Building Society Accounts held by the household
hdr326	No. Commercial Bank Savings Accounts held by the household
hdr328	No. Post Office Saving Investment held by the household
hdr329	No. Other Investments held by the household
hdr335	No. Current Accounts held by the household
hdr340a	No. Laser cards held by the household
hdr340	No. Other cards held by the household
Unsecured Credit	
hdr330	No. of Bank loans held by the household
hdr331	No. Employeer loans held by the household
hdr332	No. Credit Union loans held by the household
hdr333	No. Other loans held by the household
hdr334	No. Hire Purchase & Credit Sales contracts held by the household
hdr337	No. Visa cards held by the household
hdr338	No. with Access cards held by the household
hdr339	No. American Express cards held by the household

Note: All data sourced from the HBS STATA files

Table 2.9: HBS Financial Products Summary Statistics

	2005		2000		1995		1988	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Insurance Products								
Home Insurance	7.29	6.65	4.63	4.11	3.96	3.94	3.002	1.83
Motor Insurance	15.01	15.51	13.87	12.92	10.93	10.23	8.642	7.80
Income Protection	0.67	4.98	1.63	4.32	n.a.	n.a.	n.a.	n.a.
Mortgage Protection	2.96	6.86	9.48	13.25	1.19	2.56	0.313	0.55
Health Insurance (VHI/BUPA)	11.69	22.47	11.33	22.03	6.32	6.85	4.520	3.88
Life Insurance	8.36	17.10	n.a.	n.a.	10.47	11.25	9.971	10.59
Other Insurance	1.93	11.59	2.04	8.11	2.22	5.57	1.256	2.46
Total Pension Contrib	27.44	78.88	12.95	26.93	8.53	12.75	7.263	8.22
Saving & Investment Products								
Stocks & Shares	0.167	0.431	0.194	0.481	0.061	0.26	0.048	0.23
Government loans	0.002	0.048	0.001	0.036	0.004	0.06	0.009	0.09
Building Society investments	0.067	0.280	0.068	0.274	0.071	0.29	0.128	0.38
Comm. Bank savings	0.235	0.551	0.136	0.418	0.140	0.40	0.304	0.58
Post Office saving	0.057	0.256	0.057	0.256	0.061	0.26	0.102	0.33
Other Investments	0.015	0.125	0.125	0.434	0.098	0.35	0.188	0.46
Current Account	1.296	0.971	0.992	0.881	0.669	0.75	0.636	0.72
Laser cards	0.134	0.418	0.383	0.665	n.a.	n.a.	n.a.	n.a.
Other cards	0.134	0.418	0.042	0.225	0.009	0.09	0.009	0.10
Unsecured Credit								
Bank loans	0.513	0.858	0.366	0.717	0.251	0.58	0.247	0.57
Employer loans	0.002	0.040	0.002	0.050	0.008	0.11	0.024	0.18
Credit Union loans	0.288	0.582	0.319	0.608	0.259	0.53	0.184	0.47
Other loans	0.025	0.187	0.040	0.215	0.033	0.20	0.029	0.19
Hire & credit schemes	0.139	0.445	0.200	0.517	0.227	0.58	0.213	0.51
Visa cards	0.623	0.779	0.472	0.719	0.239	0.51	0.128	0.38
Access cards	0.093	0.345	0.107	0.370	0.130	0.39	0.097	0.33
American Express cards	0.012	0.115	0.011	0.114	0.010	0.11	0.014	0.13

Note: Monetary variables have been converted to Euro and rebased to 2005 levels, given in weekly values

Table 2.10: Pension Related Variable Sources

	Years	Unit	Source
Government Contributions	2001-2010	€bln	NPRF
Fund Value Year-End	2001-2010	€bln	NPRF
Cumulative Contributions	2001-2010	€bln	NPRF
Pension Assets	1989-2009	€mln	IAPF
Pension Assets % GDP	1989-2009	% GDP	IAPF
Pension Asset Growth	1989-2009	%	IAPF
Defined Benefit Pension S/D	2001-2010	€mln	Attain
ISEQ Returns Growth	1989-2009	%	ISEQ
Occupational Pension Coverage	2002-2009	volume	CSO
Population Forecasts	2006-2041	thousands	CSO
Dependency Ratios	1926-2041	%	CSO
Public Pension Expenditure	2004-2050	% GDP	EC
Occupational Pensions	2004-2010	volume	IPB

Table 2.11: Central Bank of Ireland Data

	Years	Description & Source
psc	1992-2009	Private Sector Credit (PSC); sum of household loans, financing, housing & credit cards
housing	1992-2009	Household Debt Relating to Housing
otherloans	1992-2009	Other Household Loans
credcard	1992-2009	Outstanding Credit Card Debt
investfin	1992-2009	Households Other Finance for Investment Purposes
nonmortcrd	1992-2009	Sum of PSC Not Related to Residential Housing (author's calculations)
pscdi	1992-2009	PSC % DI (CBI, CSO, author's calculations)
pscgdp	1992-2009	PSC % Gross Domestic Product (CSO & author's calculations)
pscgnp	1992-2009	PSC % Gross National Product (CSO & author's calculations)
housingpscdi	1992-2009	PSC Housing % DI (authors calculations)
investfipscdi	1992-2009	PSC Investment Financing % DI (author's calculations)
otherpscdi	1992-2009	PSC Other loans % DI (authors calculations)
credcrdpscdi	1998-2009	PSC Outstanding Credit Card Debt % DI (author's calculations)
varstock	1999-2009	Percentage of Household on Variable Interest Rate Mortgages
fixstock	1999-2009	Percentage of Households on Fixed Interest Rate Mortgages
nintrate	1970-2005	Nominal Interest Rate
rintrate	1970-2005	Real Interest Rate (author's calculations)

Table 2.12: Additional Aggregate Level Variables by Source

	Years	Description & Source
Department of Environment		
ravemortg	1970-2009	Real Average Mortgage Amounts (author's calculations)
ravehp	1970-2009	Real Average House Prices (authors calculations)
ltv	1970-2009	Loan-to-Value; as Annual Average Mortgages to House Prices (author's calculations)
mortdi	1970-2009	Average Mortgage % DI (author's calculations)
hpdi	1970-2009	House Price % DI (author's calculations)
Central Statistics Office		
rdi	1970-2009	Real Disposable Income (DI) (forecasts from CBI)
infrate	1970-2005	Annual Inflation Rate
rents	1976-2009	Average Monthly Rents, based on CPI Rental Index (author's calculations)
gdppc	1970-2005	Gross Domestic Product Per Capita (forecasts from CBI)
savings	1970-2009	Annual Households Savings (forecasts from CBI)
savdi	1970-2009	Annual Saving Rate % of DI (author's calculations)
CPI	1970-2009	Annual Consumer Price Index based 2006=100; this was rebased to 2005
PE	1970-2005	Price Earnings Ratio of House Price to Potential Rental Income (author's calculations)

Table 2.13: Summary Statistics of Aggregated Data

	Mean	Std. Dev.		Mean	Std. Dev.
Central Bank of Ireland (CBI)			*Department of Environment (DOE)*		
psc	69,241	59,566	ravemortg	97,516	67,339
housing	57,653	52,065	ravehp	140,696	80,223
otherloans	8,388	5,243	ltv	67.05	8.31
credcard	1,248	1,137	mortdi	2.02	0.42
investfin	2,132	1,803	hpdi	3.00	0.40
nonmortcrd	11,769	7,984			
pscdi	96.93	51.34	*Central Statistics Office (CSO)*		
pscgdp	52.09	25.21	rdi	45,387	21,397
pscgnp	61.23	30.86	savdi	8.60	3.18
housingpscdi	79.34	45.88	infrate	7.42	6.07
investfipscdi	3.09	1.53	rents	345.72	140.23
otherpscdi	12.87	3.33	gdppc	16,019	7,702
credcrdpscdi	1.62	1.26	savings	2,301	1,782
varstock	77.80	6.32	cpi		
fixstock	22.20	6.32	PE		
nintrate	9.76	3.70			
rintrate	2.34	4.89			

Table 2.14: Countries by Regions for TFP

Europe		Australasia	
Austria	AUT	Australia	AUS
Belgium	BEL	China	CHN
Switzerland	CHE	Hong Kong	HKG
Denmark	DNK	India	IND
Spain	ESP	Indonesia	IDN
Finland	FIN	Japan	JPN
France	FRA	Korea, Rep	KOR
U.K.	GBR	Malaysia	MYS
Greece	GRC	New Zealand	NZ
Ireland	IRL	Philippines	PHL
Italy	ITA	Sri Lanka	LKA
Netherlands	NLD	Thailand	THA
Norway	NOR		
Portugal	PRT		
Sweden	SWE		
Romania	ROM		
Turkey	TUR		
The Americas		Africa & Middle	East
Argentina	ARG	Egypt	EGY
Bolivia	BOL	Ghana	GHA
Brazil	BRA	Israel	ISR
Canada	CAN	Jordan	JOR
Chile	CHE	Kenya	KEN
Colombia	COL	Mali	MLI
Dominican Rep.	DOM	Mozambique	MOZ
Ecuador	ECU	Malawi	MWI
Jamacia	JAM	Pakistan	PAK
Mexico	MEX	Senegal	SEN
Panama	PAN	South Africa	ZAF
Peru	PER	Uganda	UGA
Uruguray	URY	Zambia	ZMB
Venezuela	VEN	Zimbabwe	ZWE

Note: The countries used in Chapter 6 were determined by the availability of Barro-Lee educational attainment data and Shleifer's institutions variables

Table 2.15: Penn World Tables (PWT) Variables

Variable	Unit	Definition
pop	000'S	Population
xrat	US=1	Exchange Rate
cgdp	$ current	Real Gross Domestic Product per capita (current prices)
cc	%	Consumption share of CGDP
ci	%	Investment share of CGDP
cg	%	Government share of CGDP
p	US=100	Price Level of GDP (current prices)
pc	ppp/xrate	Price Level of Consumption (current prices)
pg	ppp/xrate	Price Level of Government (current prices)
pi	ppp/xrate	Price Level of Investment (current prices)
openc	%	Openness (current prices)
cgnp	%	Ratio of GNP to GDP (current price)
csave	%	Current Savings
rgdpl	$ constant	Real GDP per capita (constant prices: Laspeyres)
rgdpch	$ chain	Real GDP per capita (constant prices: Chain series)
rgdpeqa	$ eq. Adult	Real GDP chain per equivalent adult
rgdpwok	$ worker	Real GDP chain per worker
rgdptt	$ terms of trade	Real Domestic Income (RGDPL adj. for Terms of Trade changes)
openk	%	Openness (constant prices)
kc	%	Consumption share of RGDPL
kg	%	Government share of RGDPL
ki	%	Investment share of RGDPL

Table 2.16: Shleifer's Institutions Variables

Variable	Definition and Source
Political Government	
Government effectiveness	This variable measures the quality of public service provision. Glaeser et.al.(2004)
Executive constraints	A measure of the extent of institutionalized constraints on the decision making powers of chief executives. Botero et.al.(2004)
Citizens Rights	
Expropriation risk	Risk of "outright confiscation and forced nationalization" of property. Glaeser et.al.(2004)
Corruption	Corruption perception index for 1999. Djankov et.al.(2002)
Civil Rights	Combination of two measurements Civil right index from Djankov et.al.(2002) and Botero et.al.(2004)
Property Rights	Property rights of citizens. Djankov et.al.(2002)
Court Index	Combination of two court formalism index - collection of bounced cheque and eviction non-paying tenants. Botero et.al(2004)
Labour Regulations	
Alternative contract Index	Measures the existence and cost of alternatives to the standard contract. Botero et.al.(2004)
Male(Female) Participation	Male(Female) participation rate as a percentage of the total male(female) population aged 15 to 64. Botero et.al (2004)
Minimum Age	Measures the age at which a child can be employed in an apprenticeship or in a full-time, non-farm, non-hazardous, non-night time job outside of the family business. Botero et.al.(2004)
Minimum Wage	Measure the minimum mandatory wage. Botero et.al.(2004)
Labour Index	Measures the protection of labor and employment laws as the average of:(1) Alternative employment contracts; (2) Cost of increasing hours worked: (3) Cost of firing workers; and (4) Dismissal procedures. Botero et.al (2004)
Health Benefits	
Response	Responsiveness of the health system. Djankov et.al (2002)
ISO ave	Combination of ISO environmental and quality standards. Djankov et.al (2002)
Sick index	Measures the level of sickness and health benefit. Botero et.al (2004)
Population at risk of malaria	Percentage of the population at risk of malaria transmission in 1994. Glaeser et.al.(2004)
% Population in temperate zone	Percentage of a country's population in Koeppen-Geiger temperate zone in 1995. Glaeser et.al. (2004)
Social Benefits	
Industrial Index	Measures the protection of collective relations laws as the average of: (1) Labor union power and (2) Collective disputes. Botero et.al (2004)
Social security index	Measures social security benefits as the average of: (1) Old age, disability and death benefits; (2) Sickness and health benefits; and (3) Unemployment benefits. Botero et.al.(2004)

Note: Definitions are taken from Shleifer's referenced papers

Chapter 3

Irish Pension System Policy Review

3.1 Introduction

Barr and Diamond (2008 pp. 32) state that "the primary objective of pensions is economic security in old age through consumption smoothing, insurance, poverty relief, and redistribution". There are two dimensions to this statement: first, the individual can choose to smooth their own consumption and invest in an insurance policy (i.e., a pension plan). Second, the Government must take responsibility for those who do not have the means to provide for themselves. It must protect these individuals against poverty in old-age, while distributing these societal costs across all tax payers. This is not an easy task to fulfil and many different approaches have been implemented globally in an attempt to achieve this balance.

This chapter examines the Irish pension system which is comprised of three tiers; the State Pension, occupational pensions and personal pensions. The State Pension is available to members of society who have paid full social insurance stamps and are over 65 years of age. The State Pension may then be supplemented with an occupational pension and/or a personal pension. The occupational pension may be a defined benefit or defined contribution scheme, while personal pensions are defined contribution schemes only. Individuals with occupational pensions can make additional pension provisions using Additional Voluntary Contributions (AVCs) through the personal pension category.

Occupational pensions were traditionally defined benefit schemes, used to attract labour. However, increased life expectancy, salary increases and new accounting requirements have led to significant increases in the cost of defined benefit schemes. The Irish Pensions Board estimated that 75 per cent of defined benefit pensions were in deficit at the end of 2009, while Mercer estimated that the aggregate deficit of ISEQ companies' pension schemes was €4.6 billion at year-end 2010. Companies are required to submit proposals to the Irish Pensions Board outlining how they plan to correct these deficits. In the current environment of credit restrictions this may be a difficult task to achieve given that company profits are likely to be low and there is a risk that defined benefit pension deficits will add additional pressures to companies' funding and cash flow positions.

The long-term outlook for the Irish State Pension and public sector pensions are not much better. An ageing population, increasing emigration and a rising Exchequer deficit all indicate that the future cost of the national pension system is likely to grow. In an attempt to spread the burden of the ageing population the Government established the National Pension Reserve Fund (NPRF) in 2010. Unfortunately, the recent investment of this fund in the banking sector is likely to prevent the NPRF achieving its goal. Other proposals to address total pension coverage have been suggested by the Department of Social Protection's (2010a) National Pensions Framework Group; this includes an auto-enrolment scheme which would result in fewer individuals being solely dependent on the State Pension. This scheme's activation is subject to favourable economic conditions and therefore may not be implemented due to the financial crisis. Notwithstanding the potential pension funding gap facing the Government, Ireland's current demographic situation is better than its European counterparts indicating that there is still time to prepare for the future.

There is a large volume of policy related pension reports and documents which examine the Irish pension system. A selection of national reports include: NPRF (2010), the National Pensions Framework, Whelan (2001/2005/2007), Irish Pension Boards (2010) and the Irish Association of Pension Funds (IAPF) (2000-2011). International reports that reference Ireland include: Committee of European Insurance and Occupational Pen-

sion Supervision (CEIOPS) (2009 and 2010) financial stability reports, and the OECDs (2009) Private Pension Outlook. Each report tends to examine one element of the pension system at a time. The main contribution of this chapter is that it gives an overview of the Irish pension system as a whole and outlines its shortcomings. The overwhelming complexity of the pension system is found to be its biggest drawback.

The remainder of the chapter is organised as follows. Section 2 reviews the Irish pension system, outlining the public pension system, occupational pension coverage and the method by which pensions are drawn down by private pension holders. Section 3 presents the financial dilemma facing the Irish Government due to increased old age dependency ratios. It also examines the appropriateness of the NPRF as a response measure. Section 4 reviews occupational pension coverage and assets, highlighting the additional strain on companies which offer defined benefit pension schemes. The section identifies the funding shortfalls in both defined benefit and defined contribution schemes. Section 5 analyses the effect of budgetary changes on pension schemes. It also examines policy recommendations that may be implemented in order to improve pension coverage, equality and general understanding of retirement provisioning. Finally, Section 6 concludes. A glossary of all pension-related terminology is provided in the Appendix.

3.2 The Irish Pension System

3.2.1 Pension System Review

Ireland has a *Three-Tier Pension System*; the State Pension, occupational pensions and personal pensions. Figure 3.1 depicts the structure of the Irish pension system. **Tier 1** is the **State Pension**, which is available to every member of society, with the exception of public sector employees hired prior to 1995 who pay a reduced Pay Related Social Insurance (PRSI) stamp. The system provides both contributory (for those who have paid a full PRSI stamp) and non-contributory pension benefits (for those who have not paid any PRSI or have an insufficient number of contributions made). Individuals are means tested to receive non-contributory pensions. The State Pension is administered through the Department of Social Protection; this is to ensure

that no one is excluded from the system, as social welfare payments and unemployment benefits are also administered through the same department.

In 2010 the Government announced a plan to roll out a three phase increase in the retirement age to claim the State Pension, increasing it from 65 to 68 by 2028. Phase I will increase the retirement age to 66 in 2014, affecting those currently over the age of 55. Phase II increases the retirement age to 67 in 2021, affecting those aged between 50 and 55, with the final phase coming into effect in 2028 resulting in any person currently under the age of 49 working until they are 68. This retirement age increase only affects an individual's State Pension; private pension funds have not been required to increase their retirement age.

In 2009, the State Pension provided pensioners with a pension equal to 35 per cent of national average weekly wage (or €230.30 per week). A retired household claiming the State Pension with an *adult dependent*[1] will receive an additional €206.30 per week, increasing their household retirement income to €436.60 per week. The basic State Pension may then be supplemented with additional pension provisions made in either Tiers 2 and/or 3.

Tier 2 represents **Occupational Pensions**, which covers both private and public sector employee pensions that are provided by their respective employers. **Tier 2a** is the *Public Sector's Statutory Pension Scheme* for State employees. These are defined benefit schemes typically funded through the Exchequer, though some State and semi-State bodies have independent pension funds, for example, Bord na Mona, ESB and the Central Bank. **Tier 2b** relates to *private sector occupational pensions* which can be either defined benefit or defined contribution schemes.[2] If a company does not operate an occupational pension scheme for staff they are obliged by law to operate

[1] An adult dependent is an individual who never paid PRSI (i.e., never formally participated in the work force, including voluntary work and home-makers, etc.) and possesses no additional means such as property or inheritance, but lives with an individual who is entitled to the State Pension.

[2] The principal difference between defined benefit and defined contribution schemes is that defined benefit schemes are occupational pensions that guarantee the pensioner a set annual payment on retirement relating to their final salary. A defined contribution scheme is based on contributions made by both the employee and employer during the member's working life. The final pension value is not guaranteed but is subject to the performance of the invested funds.

a group Personal Retirement Savings Account (PRSA). Both the employer and the employee can contribute to the PRSA, although the employer is not obliged to do so. An increasing number of employers are opting for this type of scheme as unlike the defined benefit and defined contribution schemes, PRSAs are not established under trust and so the employer has no trustee responsibilities.

Finally, Tier 3 represents **Personal Pensions**. These schemes include Personal Retirement Savings Account (PRSAs), Personal Pension Plans (PPPs) and Additional Voluntary Contributions (AVCs) plans. By definition these funds are defined contribution schemes, as they are fully dependent on the investment returns earned from contributions made. Personal pensions were initially established so that the self-employed or those who worked in non-pensionable employment (e.g., doctors, consultants, etc.) could make retirement provisions. Traditionally self-employed individuals would have opted for PPPs but more recently have tended to join PRSAs as there are strict guidelines set out by the Government in relation to commission and management charges. These plans are also available to everyone who wishes to supplement their occupational and State Pensions with additional provisions.

For the remainder of the chapter, personal and occupational pensions will be referred to as *private pensions* in order to help distinguish them from the State Pension. Public sector pensions are included as occupational pensions.

3.2.2 Private Pension Coverage in Ireland

In 1998 the Irish Pension Board proposed that private pension coverage in Ireland should be increased to 70 per cent for workers over the age of 30. The Central Statistics Office's (CSO) Quarterly National Household Surveys (QNHS) Special Pension Modules[3] most recent pension coverage survey indicates that 51 per cent of 20 to 69 year olds held private pensions in addition to their State Pension entitlements (Table 3.1) in 2009. There has been a fall in private pension coverage across all categories between 2008

[3]Special Pension Modules are available for 2002Q1, 2004Q1, 2005Q1 & Q4, 2007Q1, 2008Q1 and 2009Q4

and 2009.

Table 3.1 also provides a breakdown of pension coverage by employment sector, this is the total coverage of both personal and occupational pensions in each sector. It shows that five sectors have pension coverage of 30 per cent or less. These include: agriculture, forestry and fishing (24 per cent), wholesale and retail trade (30 per cent); accommodation and food (17 per cent); administration (29 per cent) and other Nace activities (27 per cent). The highest pension coverage occurs in the public administration and defence sector (93 per cent) and the financial, insurance and retail sector (83 per cent). This is most likely due to the high level of State employment and financial awareness, respectively.

The distribution of the type of pension held varies significantly across each sector, for example, of those with pensions in the agricultural sector 79 per cent hold personal pensions. On the other hand, the public administration sector only has 3 per cent personal pension cover, while education and health have 5 per cent and 7 per cent, respectively.

3.2.3 Pension Structure on Retirement

In 2010, retired individuals without private pension plans (i.e. completely dependent on the State Pension for their retirement) received an annual income of €11,960, while those who had a dependent adult received €22,703 for the year. Individuals earning the minimum wage receive €8.65 per hour or €346 per week, assuming a 40 hour week (€18,000 p.a.). According to the CSO Earning and Labour Cost estimates,[4] the average weekly wage in 2010 was approximately €690 per week (€35,886 p.a.). This indicates that individuals earning either minimum wage or the average wage would suffer a decline in income on retirement if they did not make additional pension provisions. However, households with a dependent adult earning the minimum wage could see an increase in retirement income depending on the social benefits received before retirement.

It is therefore important that individuals make additional pension provisions to supplement their State Pension in retirement. There are a number

[4]This is a new CSO survey on Earnings Hours and Employment Costs (EHECS) covering all sectors of the economy other than agriculture, forestry and fishing introduced from Q1 2008

of ways in which individuals can achieve this, as discussed above. Assuming an individual has made private pension provisions, upon reaching the Normal Pension Date (NPD[5]) they are entitled to take a certain amount of their fund tax-free. The tax-free lump sum payable depends on the service completed at the NPD. If an individual has worked continuously for 20 years a maximum lump-sum equal to one and a half times ($120/80^{ths}$) final salary can be drawn. If less than 20 years continuous service has been completed, the individual is entitled to a tax-free lump-sum in accordance with the Revenue Commissions augmented scale given in Table 3.2. Proprietary Directors (i.e., those owning at least 5 per cent of the voting rights of a company) are entitled to take up to 25 per cent of their pension fund tax-free. However, this was revised in the 2010 Budget as discussed in Section 5.

The treatment of the balance in the fund varies depending on the type of scheme held by the individual.[6] If the individual has an occupational defined benefit scheme then their fund manager must purchase an annuity[7] on their behalf. However, companies that have sufficiently large scheme have the option to pay their retired staff directly from their fund. This is an insurance product that guarantees the purchasers an annual income for the rest of their life. The annuity rate quoted by insurance companies is associated with long-term interest rate expectations. The annuity rate is subject to a number of factors, these include (though not limited to):

- The Actuarial Mortality Tables - dictated by age and sex of the applicant;
- Annuity type - single or joint life policy;
- Guarantees desired upon death - transfer to spouse or continue payments for a predetermined number of years;
- Wether income will be escalated and if so by what percent;

[5]The NPD is the date when a member can normally start to get their pension benefits. It will usually be the date that they reach normal pension age.

[6]The information in this section was obtained from personal correspondence with pension consultants.

[7]A life annuity is a financial contract in the form of an insurance product according to which a seller (issuer) makes a series of future payments to a buyer (annuitant) in exchange for the immediate payment of a lump sum (single-payment annuity) or a series of regular payments (regular-payment annuity), prior to the onset of the annuity.

- Long-term interest rate expectations; and
- Assumed growth of the fund.

Actuaries calculate individual annuity rates for each customer based on the above factors, these rates are usually between 3.5 and 5 per cent. The individual then transfers the balance of their fund (less their lump-sum) to the insurance company, who holds all transferred funds in an annuity book. The annuity book is constantly monitored and future annuity rates can be adjusted based on how well or poorly investment are performing. Annuity funds are usually invested in low risk long-term assets such as gilts, bonds and cash. Insurance companies offer different annuity rates and have different investment strategies. If the pensioner lives longer than expected the insurance company loses money on the annuity and vice versa if the pensioner lives for a shorter period of time. The break even threshold for insurance companies varies per person subject to the factors outlined above.

According to industry consultants, companies that have sufficiently large pension funds like Cement Roadstone Holding (CRH) and Universities [e.g., Trinity College Dublin (TCD)] before their fund was transferred to the NPRF were able to pay their defined benefit pension obligations directly from their accumulated funds, as long as they offer the same pension the individual would obtain in the open market.

In 1999, the Government introduced Approved Retirement Funds (ARFs). These can be used instead of purchasing annuities. This option was initially only available to individuals with personal pension plans (PPPs), Proprietary Directors and those with Additional Voluntary Contributions (AVCs). In the 2010 Budget this option was extended to include members in defined contribution schemes. These individual still have the option to purchase an annuity and are in fact required to do so if their total fund value is below the threshold that will guarantee them an annual retirement income of €18,000 (inclusive of the individual State Pension of €11,960 p.a.).

The benefit of the ARF system is that it provides more flexibility to the owner. The owner is free to decided how much to drawn in a given year and the fund can also be transferred to the members spouse upon death and upon the death of the spouse the balance can be passed to children in a

tax effective manner. However, the principal drawback of ARFs is that it is up to individuals to control their funds, therefore the fund could run out if not managed in an efficient way. To address this problem, individuals who own ARFs are required to place a once-off lump-sum of €119,800 into an Approved Minimum Retirement Fund (AMRF). This fund can only be accessed once the pensioner reaches 75 years of age to ensure sufficient income is available after this later life stage. However, any income earned on this fund may be drawn at any time subject to tax.

Once an ARF is established funds must be drawn after the individual reaches 60 years of age regardless of whether they are working or not. ARF holders must also withdraw a minimum of 5 per cent (this was increased from 3 per cent in the 2010 budget) of the fund each year, upon which they are taxed regardless of whether monies are withdrawal or not. Currently there are relatively few ARFs in place; however, opening ARFs to defined contribution scheme members is likely to increase its numbers in the future.

3.3 Government Pensions Dilemma

3.3.1 State Pension Funding Gap

As the State pays both the State Pension and the Public Sector Pension (Figure 3.1) there are multiple levels to their pension obligations. The Department of Social Protection (2010c) revealed that in 2009 €4,569 million (2.8 per cent of GDP) was needed to fund the State Pension for 378,746 recipients. This included both contributory and non-contributory means-tested benefits. The State Pension is traditionally funded through contributions made by individuals, employers and the Exchequer.

Employer and employee PRSI contributions are paid directly into the Social Insurance Fund (SIF) as part of the Pay-As-You-Go (PAYG) pension system. Essentially, this means that those currently employed directly pay the current State Pensions through their PRSI contributions to the SIF each year. Subsequently, when current PRSI employees retire, their State pensions are paid by future workers and so on.

Since 1996 the volume of PRSI contributions made by individuals and employers to the SIF has been so large that no Exchequer contributions

have been needed. However, the SIF surplus was exhausted in 2010, requiring an additional €1.55 billion from the Exchequer to meet the needs of contributory pension payments. Means-tested non-contributory pension payments are funded though the welfare system and not the SIF. The SIF is expected to need an increasing amount of funding from the Exchequer in future, as the ratio of pensioners to workers increases overtime and insufficient PRSI contributions are made in the future to meet future contributory State Pension obligations.

In addition, the Government must also pay Public Sector Statutory Pensions (occupational pensions). The Department of Finance's (2010a) Pay and Pensions Bill Report indicates that the public sector pensions were €2,235 million (1.3 per cent of GDP) for approximately 100,000 recipients and their dependents. In 1988 270,300 were employed in the public sector, by 2009 this had increased to 360,900; therefore the absolute number of public pensions has increased, along with life expectancy levels implying that the future cost of public sector pensions will increase significantly over time. It should be noted that public sector employees contribute to their occupational pensions through the pension levy and monthly wage deductions; these contributions are supplemented by Exchequer funds to fund the public sector pension. However, there are a number of State organisations that do not receive their pension from the Exchequer as they have their own fully funded independent pension funds. These include Bord na Mona, ESB and the Central Bank to name a few.

The combination of these figures implies that the total pension bill came to just over 4.1 per cent of GDP in 2009. Table 3.3 reveals forecasts made by the European Commission, which were analysed in Salomaki (2006), which suggests that by 2050 the total public pension bill will increase to 11 per cent of GDP. However, when compared with other European countries, Ireland's expected future costs are still below the European average. Considering that these forecasts were made before the financial crisis, the macroeconomic conditions (e.g., economic growth and labour market activity) will be somewhat over-estimated. Labour market participation is expected to be lower as significant emigration has occurred. As a result, economic growth also will be less with a lower GDP, implying that the pension bill as a percentage of

GDP could be larger than forecast.

For the PAYG system to be sustainable, future workers must be able to meet the demands of those in retirement. Figure 3.2 illustrates CSO Population and Labour Force Projections (2008b) of what the Irish population distribution might look like in 2041, and compares the distribution with 2005 levels. These figures were estimated by the CSO in 2006 before the financial crisis, when macroeconomic forecasts were generally more favourable. It was assumed that there would be zero net migration[8] and that fertility rates would decline to 1.65 by 2016, remaining constant at that level. These assumptions are likely to be incorrect, as many individuals have emigrated due to the significant increase in unemployment caused by the financial crisis. However, it helps to illustrate that there will be an increase in the number of persons over the age of 50, thus dramatically increasing the old age dependency ratios in the future.

The old age dependency ratio is defined as the number of pensioners being supported by those employed; this ratio must be manageable for the system to function smoothly. Figure 3.3 shows forecasted CSO (2008b) dependency ratios[9] in Ireland. Since 1926, there has been a steady decline in the ratio of young dependents (i.e., those too young to work), with the ratio of elderly dependents increasing over the same period. Projections indicate that by 2041 there will be one dependent elderly person for every two workers (36.3 per cent) compared to a ratio of one for every five workers (15.9 per cent) in 2006. As the number of young dependents has also been falling, over time there may not be sufficient numbers entering the workforce to sustain future pensioners. This may be especially true if 1980s emigration levels return to Ireland, increasing the elderly dependency ratios even more dramatically than forecasted. This will add additional strain to the already developing pension funding gap. High unemployment caused by the financial crisis has also resulted in a reduction in employer and employee PRSI contributions to the SIF. However, when compared with Europe the Irish population is still relatively young and has time to adjust the pension

[8]The zero net migration scenario M0, expects the level of net migration would remain constant at 2005 levels.

[9]These forecasts are based on the assumptions that (1) fertility will remain constant at the 2006 level of 1.9 and (2) net migration will level off at +10,000 p.a. in 2021.

system to make it more sustainable.

The ageing population issue has sparked significant debate in the national newspapers about whether the State Pension should be pre-funded or not. In 2001 the Irish Government established the NPRF, in order to meet its future obligations to both State and public sector pensions.

3.3.2 National Pension Reserve Fund (NPRF)

The NPRF (2010) is controlled and managed by the National Pensions Reserve Fund Commission. The Commission's functions include the determination and implementation of the Fund's investment strategy in accordance with its statutory investment policy. This policy requires that the NPRF be invested so as to secure the optimal total financial return within a level of risk that is deemed to be acceptable by the Commission.

The Commission's Mission Statement adopted in 2001 is:

"to meet as much as possible, within prudent risk parameters to be agreed by the Commission, of the cost to the Exchequer of social welfare and public service pensions to be paid from the year 2025 until the year 2055, as provided for in the National Pensions Reserve Fund Act, 2000"

It is expected that in 2025 the costs of the State's total pension bill will increase dramatically, due to the ageing population. No money can be drawn from the NPRF before 2025 and, from then on, drawdowns will continue until at least 2055, under rules laid down by the Minister for Finance. It is believed that by spreading the Exchequer's increasing pension burden over a lengthy period, the NPRF will facilitate long-term sustainability in the pension system. The Government, therefore, has created a hybrid PAYG and pre-funded system to meet its future pension requirements. This system will accumulate additional funds between 2001 and 2025 in order to fill the expected future shortfall between PRSI contributions and pension obligations.

The NPRF is funded through a commitment by the Government to invest one per cent of GNP every year between 2001 and 2025. There was also an initial injection of €7.5 billion in 2001 to establish the fund. By end 2010 the Exchequer had contributed a total of €19.78 billion to the NPRF (Figure 3.4), and the funds total valued was €24.4 billion, implying that nearly €5

billion had been earned from the investments made. The Fund's assets are divided between the Discretionary Fund (which are funds managed by the Commission's strategists) and the Directed Portfolio (directed investments by the Department of Finance for bank recapitalisation); in December 2010 these stood at €14.9 billion and €9.5 billion, respectively.

Quarterly returns on the NPRF's investments are presented in Figure 3.5. The Discretionary Portfolio's assets have been divided into Equities, Financial Assets (cash, bonds and currency holdings) and Alternative Assets (property, infrastructure, commodities, etc.). The Directed Portfolio's investment in the Bank Recapitalisation scheme is also identified. Figure 3.5 illustrates how the Fund's assets have been redistributed since the onset of the financial crisis, with a significant portion of investments being directed towards the Irish banking sector. Figures 3.4 and 3.5 show a significant decline in the value of the Fund in 2008 derived from financial market volatility during the recent crisis. However, the NPRF Commission stress that the Fund is a long-term investment, and as such, short-term fluctuations should not overly influence the general investment strategy. Returns on the Discretionary portfolio were 11.1 per cent in 2010, while the Directed portfolio returns were -7.9 per cent.

Investments in the Directed Portfolio are not controlled by the NPRF commission and are reported separately from other investments. In 2009, €7 billion was invested in AIB and Bank of Ireland. This investment was funded by €3 billion from the Exchequer (which fulfilled the Government's NPRFs required contribution of one per cent of GNP per annum for 2009 and 2010) and €4 billion from the NPRF. An additional investment in AIB of €3.7 billion meant that at end December 2010 the bank recapitalisation balance stood at €9.5 billion and accounted for 38.9 per cent of the NPRF's total assets.

The NPRF has "a supplementary objective to outperform the cost of five-year Government debt over rolling five year periods at a 75 per cent probability level". This target was relatively easy to achieve when the Exchequer was in surplus and the debt/GDP ratio was low. The NPRF Commission has therefore decided "that the costs of borrowing should now be formally recognised in its investment objective and explicitly factored into

the level of risk it is satisfied to take with regard to the NPRF". Figures released from the National Treasury Management Agency (NTMA) place the cost of serving the Exchequer debt of €148.6 billion at €4.8 billion per annum in 2010.

Due to the high cost of servicing the national debt, the NPRF will provide an additional €17.5 billion to the EU-IMF programme as part of the State's contribution to the recovery plan in 2011. The NPRF will provide €10 billion of this with the rest being sourced from other domestic cash resources; these funds will be split between financing the needs of the State and supporting the banking sector. As a result the remaining value of assets in the Discretionary Portfolio will be approximately €4.9 billion. This portfolio is due to be invested in infrastructural assets and water metering services as set out in The National Recovery Plan 2011-2014. The entire Fund will essentially be depleted as it is unlikely that the banking sector will be able to repay these debts in the future. Unfortunately the dilemma of an ageing population is still outstanding and looming ever closer each year, without any obvious solution.

The existence of the NPRF has always been controversial and some commentators believe that it should never have been established in the first place. In a discussion on the Irish Economy Blog, Karl Whelan suggests that the money would be better served generating economic growth and prosperity, which would encourage a positive net flow of migration to Ireland and may result in a lower pensioner dependency ratio. Colm McCarthy comments that the NPRF should be wound down. He argues that increased life expectancy is not a population crisis but rather a policy issue created by an inflexible pension system.[10] The following section outlines the issue of pre-funded versus PAYG national pension systems.

3.3.3 To Fund or not to Fund State Pensions

The increase in life expectancy and changing population demographics has led global experts (such as the World Bank and the OECD) to the consensus that a totally unfunded national pension system is not a viable long-term

[10]These comments can be found at http://www.irisheconomy.ie/index.php/2009/07/28/national-pensions-reserve-fund-an-bord-snip-nua/

option. Globally, national pension schemes have been in deficit due to poor fiscal planning, limited tax collection and unrealistic commitments made by Governments. This has resulted in a significant volume of debate since the 1990s as to whether or not State Pensions should be pre-funded. This debate revolves around the potential funding gap between the income tax generated by the future labour force and the pension expenditure required to support an ageing population (Figure 3.2). To date, no consensus has been reached.

The World Bank suggests that countries should move to a "multipillar" system where: Pillar I, is a defined benefit state pension funded through a PAYG system, Pillar II, is a mandatory privately funded defined contribution scheme, and Pillar III, is a voluntary privately funded defined contribution scheme. For Ireland, this would mean that in addition to the State Pension, individuals would have to make additional provisions in the event that they do not already have a private pension plan in place. The Government would then allocate tax breaks in relation to mandatory contributions and could, over time, disband the State contributory pension if desired (leaving the means tested non-contributory pension in place). The auto-enrolment scheme proposed by the National Pensions Framework Group would be similar to the World Banks Pillar II recommendations.

Feldstein (1996) argues that there are real gains to society if national pension systems are restructured from PAYG to pre-funded systems. Feldstein claims that the returns on assets (earned by the funded system) exceed any potential wage-bill growth needed to fund the PAYG system.

Disney *et al.* (1999) review a range of policy options examining some of the actual reform strategies implemented by various countries. Specifically, the authors examine switching from a PAYG unfunded social system to a funded defined contribution system. They find that pre-funded programmes are dynamically more efficient than unfunded systems. However, it is necessary to offer a gradual voluntary transfer to individuals so as to encourage them to switch from unfunded to pre-funded systems. The authors also find that most countries have not adopted the World Bank's approach to switching, instead choosing to implement top-up private pension accounts with reforms to the PAYG system (e.g., Sweden) or by allowing a voluntary

switching for older members of the labour force (e.g., the UK).

Whelan (2005) reviews the Irish pension system in the context of national pension policy, specifically examining the idea of compulsory saving schemes for pensions. He finds that even allowing for a significant increase in the old-age dependency ratio, the estimated cost of maintaining the current system will still be lower than the European average in 2050.

Table 3.3 shows the European Commission's projections of the cost of public pensions as percentage of GDP across Europe.[11] In 2004, Ireland's public pension expenditure[12] was the lowest across the listed countries. While there are differences in the structure of each country's system, the principle reason for Ireland's lower costs is its significantly younger population relative to mainland Europe.

Whelan (2007) compares a compulsory personal pension savings account (invested at low risk to ensure a minimum final pension) to a sustainable PAYG approach. He finds that both approaches give similar returns before administration costs. However, once administration costs are accounted for, he finds that sustainable PAYG systems are expected to generate 20 per cent higher pensions than alternative systems based on the same contribution level.

A sustainable PAYG system is, however, primarily based on a stationary population. The key concern is that Ireland's population has not only increased rapidly, it has also aged; this occurred in conjunction with high levels of economic growth, income tax decline and increases in the State Pensions. As a result most individuals receive more from their State Pensions than they pay into the system.

Whelan (2007) emphasizes the fact that the population would need to increase indefinitely to sustain such a system. He illustrates that during times of labour force growth it would be more appropriate to invest the additional contributions made by the larger number of workers in assets for future pension demands rather than paying out higher pensions to the current pensioners. The surplus funds could then be drawn on to meet pension

[11] Estimates were made in 2006 before the onset of the financial crisis, implying that these figures may be underestimated as GDP growth and migration movements are unlikely to match the assumptions made at the time.

[12] This includes both the State Pension and Public Sector Pension paid by the Exchequer.

obligations when the working population begins to decline and a funding gap emerges. Whelan concludes that the PAYG system needs to be refined to incorporate some pre-funding and that it must become more like a financial contract, clearly outlining contributions and benefits for individuals.

It was thought that establishing the NPRF would be the most efficient way to bridge the gap in national pension requirements after 2025. However, the financial crisis has meant that the Government has used most of the NPRF to support the banking sector. The logic behind this investment is simple: if it costs the Government more to borrow funds to support the country than the NPRF can generate from investing its funds, then it makes sense for the Government to borrow less and invest its own savings. The problem stems from the fact that it is thought that the banking sector will never be able to repay the investment. In addition the bank shares now held by the NPRF are unlikely to pay sufficient dividends to fill the pension funding gap in the future. This implies that the NPRF will most likely be severely underfunded to meet its objectives. Therefore the Government will still need to source additional funding from abroad to support pensioners in the future.

3.4 Funding of Private Pension Schemes

3.4.1 Occupational Pension Fund Assets

Many companies offer an *Occupational Pension Scheme* as a means of distinguishing themselves from other employers. Traditionally, these companies offered defined benefit pension schemes. Increased life expectancy and salaries have significantly increased the cost of providing defined benefit pensions in recent years. As a consequence many companies have closed their defined benefit schemes to new members since the turn of the century, offering instead defined contribution schemes or hybrid schemes that combine elements of both defined benefit and defined contribution pensions. Developments such as this imply that individuals need to take greater responsibility for their own retirement income. The problem with this is that many individuals will not be aware of the need to make pension provisions until it is too late to generate a sufficiently large fund for their retirement.

The recent crisis has identified the shortcomings of such an approach, as most defined benefit schemes remain underfunded even with restructuring.

Data collected by the Irish Pensions Board (IPB)[13] presented in Table 3.4 show that while the number of defined benefit schemes has declined since 2000, their membership increased steadily until 2009. This indicates that new employees continue to join schemes that remained open to them. The drop off in defined benefit membership in 2010 is most likely due to the closure of approximately 200 schemes due to restructuring and company insolvencies. The IPB estimated that 75 per cent of defined benefit schemes were in deficit by the end of 2009.

On the other hand, the number of defined contribution schemes was increasing prior to the crisis; however, since 2007 they have declined in both membership and number. This is also most likely due to the increase in company insolvencies and redundancies caused by the crisis. However, it could also be due to individuals choosing to stop contributions in the short-term due to financial strain as a result of reduced income as a result of reduced hours and wage cuts.

Table 3.4 also shows that the percentage of employed persons that were covered by an occupational pension scheme[14] was increasing before the financial crisis. The continued increase in the percentage of workers with pensions during the crisis was not only due to additional members joining their employers' schemes; but also due to the fact that a large number of those made redundant in the early stages of the financial crisis were involved in the construction sector which has very low occupational pension coverage and as such would not have been included in the IPBs data.

The Irish Association of Pension Funds[15] (IAPF) carries out an annual survey of all investment management firms and of large pension schemes

[13]IPB was established as a regulatory body with three functions: first, it protects the interests of pension scheme members, second, it promotes the development of efficient national pension structures and third, it monitors and collects pension schemes' data.

[14]Personal Pension Plans (PPPs) held by the self-employed persons are not included in this occupational pensions data.

[15]The Irish Association of Pension Funds was established in 1973 and conducts an annual survey in relation to occupational pension assets. They represent over 340 corporate members, representing 200,000 employees or approximately 25 per cent of occupational pensions. The body also engages with the National Pensions Board and the Department of Social Protection on behalf of its members and it is also represented at a European level through membership of the European Federation of Retirement Provisions (EFRP).

that have in-house asset management. The collated results from the Asset Allocation Surveys (from 1987 to 2008) and the Pension Investment Surveys (2009 to 2011) are given in Table 3.5.

Data from the survey indicate that prior to the financial crisis, pension funds held a high volume of equities (66 per cent) in 2007, followed by bonds (18 per cent) which had become less popular over time. In 2008, there was a significant shift in the distribution of assets as fund managers reduced equity holdings in favour of cash, bonds and other low-risk investments. In 2010, the distribution of assets returned to trend with equities accounting for 58.5 per cent of assets held. Bond holdings fell although they remained relatively high at nearly 27 per cent in 2010. The total value of Irish pension funds increased continuously in the lead up to the crisis. However, the assets suffered a 26 per cent drop in value (€23 billion) in 2008, although much of this loss was subsequently recovered during 2009 and 2010.

When compared internationally, Irish pension scheme holdings are similar to that of the UK; however, when compared with continental European schemes there are clear difference in investment strategies. Mercer consulting (2010) conducted a survey of more than 1,000 clients' pension plans from 11 countries in Europe. The asset breakdown by country is given in Table 3.6; while it does not represent the entire pensions market in each country it is interesting for general comparisons.

Figure 3.6 displays the growth rates of total pension assets from the IAPF survey. Total pension assets were valued at approximately 16 per cent of GDP in 1989. This increased to 43 per cent of GDP in 1999 and peaked at nearly 50 per cent of GDP before the crisis. Subsequently, assets fell to 37 per cent of GDP in 2008; this 13 per cent decline is not as significant as other measures owing to the fact that GDP also fell during the crisis. Figure 3.6 also shows the growth rate of both pension fund asset and ISEQ returns. Given the high quantity of equities held by Irish pension funds (Table 3.5), movements in the growth rates of both series are quite similar. The recent divergence in these growth rates is mainly due to the shift in asset allocations away from equities in 2008. Notwithstanding the fall in total occupational pension funds to €63.5 billion (-23 per cent) in 2008, pension funds recoved during 2009 and 2010 to €72.2 billion and €75.5 billion, respectively.

The UK and Ireland invest more heavily in equities with exposures of between 50 and 60 per cent, respectively. Exposure to equity markets in the rest of Europe remains low even with the recent recovery in the market. In Germany the equity share is particularly low at only 3 per cent but this is due to local restrictions on the equity exposure in German. Spain, the Netherlands and Germany invest primarily in bonds with exposures ranging from 68 to 85 per cent. The low level of property holdings in Spain reflect the recent property price crash they experienced.

Mercer also notes that, companies with a higher proportion of pensioners in the schemes tend to have a more conservative investment strategy than younger more active schemes. Companies whose pension plan has been closed to new entrants tend to invest, on average, an additional 10 percentage points in bonds in recognition of their lower risk tolerance.

Pension funds are considered a long-term investment, and, therefore, younger members in defined contribution schemes who may have experienced losses due to the financial crisis have time to rebuild the value of their fund. Unfortunately, it is those closest to retirement who are most at risk of realising the fall in investment returns. Twenty-one per cent of 55 to 69 year olds depend on a personal pension plan for their retirement income, limiting the amount of time available to them to recover lost investments. Individuals in this situation may have to consider postponing their retirement or continue to work part-time in order to supplement their income.

3.4.2 Defined Benefit Scheme Deficits

Another mounting issue for the pensions industry in Ireland relates to "defined benefit" schemes. These are exclusively occupational schemes for employees, whereby the employer guarantees a fixed pension upon retirement for each employee. The employer is responsible for these liabilities. Generally speaking, defined benefit schemes are provided by large companies such as Cement Roadstone Holding, Glanbia, Kerry Goup, AIB, Bank of Ireland, etc. Increased life expectancy has significantly increased the cost of defined benefit pension schemes for companies.

Standard accounting requirements for pension fund declaration within company accounts were changed from the Statement of Standard Account-

ing Practices (SSAP) to the International Financial Reporting Standards (IFRS), as discussed in Attain (2008a, 2008b). Since 2001 companies have been required to report their net pension position on their balance sheets. All companies must disclose this position regardless of whether their pension plan is a defined benefit or defined contribution scheme. However, the method by which the final Profit and Loss (P&L) figure is calculated varies according to the type of scheme that the company offers. As discussed in Mills (2006) defined benefit schemes must make a number of assumptions based on future pension obligations. These include:

- *Current service cost:* the cost of providing an additional year's pension for staff of that year.
- *Interest on liabilities:* recognizing the fact that liabilities are a year closer than the previous year's balance sheet.
- *Expected return on assets:* recognizing expected returns on pension assets for the year.
- *Past service:* including the cost of any additional accrued benefits arising from activities during the year.
- *Cost of curtailments/settlements:* this can occur when a material change arises in either the benefits or the number of staff qualifying for the pension scheme.
- *Deficit/surpluses write off:* where liabilities exceed assets (or vice versa) by an amount which is greater than 10 per cent; a company can either take the full surplus/deficit to balance sheet reserves or else write off the excess over 10 per cent through the P & L over a maximum period of the average time to retirement of the scheme members.

The actuary must also make a number of assumptions in relation to the discount rate on liabilities, the expected return on plan assets, future salary increases and future pension increases (typically inflation related). This new accounting practice prevents companies from smoothing their pension fund balance over the term of the member's policy, meaning that stock market

fluctuations which affect their net pension position will ultimately have a knock-on effect on their P&L accounts.

Data collected by Attain Consultants[16], from 24 ISEQ[17] quoted company accounts indicate that defined benefit pension schemes have been in deficit for the majority of the last 10 years (Figure 3.7). Initially deficits were the result of sharp falls in asset prices, reduced corporate bond yields, improved life expectancy and new accounting practices. During both 2004 and 2005, asset prices improved; however, low corporate bond yields drove deficits higher, due to the higher cost of funding pensions with new bond holdings. Continued improvements in stock market and bond yields meant that pension scheme deficits began to recover during both 2006 and 2007.

However in 2008, the global financial crisis had a significant affect on the ISEQ year on year growth rate which fell by 66 per cent that year. Due to the over-dependence of Irish pension funds on the ISEQ (as shown in Figure 3.6) defined benefit pension deficits rose dramatically to €5.1 billion. Throughout 2009, there was a significant recovery in global stock markets. The ISEQ year-on-year return increased by nearly 27 per cent in 2009; however, the continued uncertainty surrounding the Irish banking sector during 2010 has meant that ISEQ returns subsequently fall to -3 per cent last year. This stock market volatility has meant that the all deficits in the ISEQ listed companies' pension schemes remain high. Provisional data, from Mercer LLC, indicates that by the end of 2010 the aggregate pension deficit of the ISEQ companies' stood at approximately €4.6 billion.

Defined benefit schemes are a complex liability; this is because they are not governed in a similar fashion to guaranteed liabilities that have a fixed payment date and value. The long-term dimension of pension funding, in addition to the company's right to wind-up its pension scheme at anytime implies that there is a greater amount of flexibility in this type of product. Many companies will not risk industrial relation disputes if at all possible;

[16]Attain Consultants is an Irish firm that specialise in pension and financial planning for its clients. In addition it supplies HR consultancy and employee training programs. (www.attain.ie)

[17]Companies analysed include: Allied Irish Bank (AIB), Anglo Irish Bank, Bank of Ireland (BOI), C&C, CRH, DCC, Elan, FBD, Fyffes, Glanbia, Grafton, Greencore, IAWS, IFG, Independent (INM), Irish Life and Permanent (ILP), Irish Continental, Kerry Group, Kingspan, McInerney, Origin Enterprises, Readymix, Smurfit Kappa Group (SKG) and United Drug.

therefore, defined benefit pension schemes can create a continuous funding problem for employers. This can in turn generate additional strain on a company's funding and cash flow position. This is especially true in the current environment, where assets and liabilities are diverging further, increasing the funding risk. This could potentially affect performance and/or profitability of the company.

All pension funds must submit an annual review of their scheme to the Irish Pensions Board. The Board estimated that approximately 75 per cent of defined benefit schemes were in deficit at the end of 2009. The Board requested that all schemes submit plans by end 2010, outlining how they propose to correct their pension fund's deficit. Typically, the Pensions Board allows companies to correct deficits over a ten year period; however, this may be too short a timeframe for many companies due to current market conditions and the size of their pension's deficits. Credit flows are already considerably constrained in the current environment, implying that additional pension-related restructuring and funding may not be possible for many companies. This may be especially difficult for financial institutions such as banks and insurance companies as they will be affected by new pension-related capital requirements being imposed within the Basel III framework.

In a situation where the company is insolvent, the pension fund must be wound up. If the company has a defined benefit pension scheme which is also in deficit, there may be insufficient funds to purchase the required annuities for its employees. In an attempt to alleviate the cost of purchasing annuities in such cases, the Government established the Pensions Insolvency Payments Scheme (PIPS) outlined in the Department of Finance (2010b). Under this scheme, the National Treasury Management Agency (NTMA) effectively supplies a State annuity that is cheaper than those from insurance companies (essentially cutting out the middle man). Companies that are insolvent pay a lump sum to the Exchequer to cover the cost of providing pensions to their members in the future.

PIPS will not provide post-retirement increases; however, it makes available an investment facility that links the return on the pension fund's investment to the ten year rate on fully secured Government bonds. This is

expected to provide a better return than might otherwise be the case for the pension funds in question. PIPS will operate on a pilot basis for three years after which it will be reviewed. The Government's initial assessment suggested that between 200 and 300 companies with defined benefit pension plans would qualify for the scheme. However, to qualify for the scheme both the employer and the fund must be insolvent.

3.4.3 Defined Contribution Scheme Funding Shortfalls

Personal and occupational defined contribution schemes have also suffered significant pension fund losses. However, unlike defined benefit schemes, these losses will be absorbed by the individual rather than their employer. According to the European Commission's (2010) country profile from the joint report on pensions, Irish pension funds lost an average 35 per cent of value due to the dramatic fall in stock markets during the financial crisis. As discussed individuals with defined contribution schemes who are close to retirement are the most exposed to these stock market declines because they do not have time to recoup the losses.

Analysis conducted by Price Waterhouse Cooper (PWC) on the UK pension funds' market revealed that average fund returns have been so poor that fixed interest savings accounts outperformed them. For example, an individual who invested 10 per cent of salary over the past 20 years (1990-2010) would have earned on average a growth rate of less than 4 per cent per annum, which was only marginally above the inflation rate at the time, and less than returns on a savings account. Those who began investing in 2000 would have seen their pension funds fall below the amount they had contributed over the 10 year period.

However, pension funds are accumulated over 30 or 40 years, which is usually a sufficiently long time to compensate for market fluctuations. O'Murchu *et al.* (2009) show that pension fund returns declined by an average of 20 per cent in OECD countries in 2008. Ireland experienced the largest fall of 32 per cent compared to 23 per cent in the USA and 14 per cent in the UK. These declines in addition to the significant increase in unemployment imply that it may be quite some time before these lost earnings are recuperated.

These low-level returns make it difficult for the Government to incentivise individuals to invest in pension plans. In a situation where high interest savings accounts generate superior returns (which are guaranteed), people may decide to invest in savings accounts rather than in pension plans. The key problem is that individuals are rarely disciplined enough to establish personal savings accounts that are not touched until retirement. Ideally, pension funds should be determined by the individual's risk appetite. This would mean funds belonging to risk averse members would contain less risky assets, and potentially generate lower returns than those willing to take more risk.

The recent move away from defined benefit schemes means that individuals need to have a greater understanding of the consequences of stock market movements on their asset portfolio value. Increased responsibility will only succeed in generating sufficient pension provisions if individuals' general understanding of financial issues improves. If the Government is to meet its target of private pension coverage of 70 per cent, then investment in educational programmes in both schools and the work place is needed urgently. The current National Pension Awareness Plan being carried out by the Irish Pensions Board needs to be expanded beyond employer and trade union conferences, to actual lectures and awareness days in schools and offices.

3.5 Pension Policy Changes and Recommendations

Private pension investment by individuals has been incentivised by previous Irish Governments through the creation of tax breaks on pension contributions and returns made by the respective fund. However, it has become increasingly evident that such policies have been primarily beneficial to high income earners, who probably would have invested in a private pension without these incentives. Therefore, the problem is, and always has been, that lower income earners are not sufficiently aware of the need to have additional provisions made for retirement.

The primary objective of a national pension strategy is to reduce poverty among older persons in the population through consumption smoothing

techniques. Those not earning sufficient income to participate in consumption smoothing can avail of the State Pension to achieve a basic standard of living in retirement. However, for most individuals the State Pension will mean a fall in their standard of living as it will be below the level of income earned before retirement. In fact, the Irish Pensions Board estimate that eight out of every ten people without a private pension plan do not believe the State Pension will meet their retirement needs. This highlights the need for households to take more responsibility for their own lifetime consumption smoothing. Unfortunately, individuals find it difficult to deal with their own mortality, resulting in a certain amount of complacency regarding retirement planning as found by O'Donnell and Keeney (2010) in the 2009 Financial Capability Study (FCS).

3.5.1 Pension Policy Changes

Over the last decade changes to national taxation policy have incentivised high income earners to contribute to pension funds as they could avail of reduced tax payments in the form of: higher thresholds for tax-free retirement lump-sums, PRSI ceilings and tax breaks on pension contributions. The recent financial crisis has meant that many of these incentives have been revised due to lower tax receipts for the Government. For example, the recent abolition of the PRSI ceiling means that, for the first time high income earners will pay PRSI on all of their income rather than up to a threshold (i.e., €75,000 in 2010). Table 3.7[18] outlines some of the budget policy changes that have affected pension funds since 2005. The table illustrates that before the recent financial crisis, incentives were not designed for the benefit of lower income earners. This section reviews major policy changes to pension planning since the financial crisis, analysing the consequences of such changes in relation to private pensions, public sector pensions and also the State Pension.

The most significant **private pension** revisions suggested by the National Pension Framework include: an auto-enrolment opt-out scheme, changes

[18]This Table was compiled from a number of sources, including, (1) New Ireland Assurance's (2006-2010) Technical Summary's of Annual Budgets, (2) the Department of Finance's (2010c) Summary of 2011 Budget Measures and (3) KPMGs (2011) Finance Bill 2011 Headline Report.

to tax relief on pension contributions, streamlining how retirement benefits are drawn and attempting to simplify and increase the overall transparency of the system. However, not all of these suggestions have been implemented.

The proposed changes that were crystallised in the 2011 Finance Bill that affect private pensions are shown in Table 3.7. Industry experts are concerned that these changes will disincentives individuals from investing in private pension plans, increasing reliance on State Pensions. Bigley (2011) highlights the fact that the new legislation limits the amount that can be contributed to pensions in a tax effective manner, directly affecting the size of the pension fund that can be accumulate and how it can be drawn down in retirement.

Tax relief on pension contributions is actually postponed taxation because when the individual retires they will have to pay tax on their pension income. The incentive arises for high-income earners who avoid paying the higher rate of tax on their pension contributions and then pay the lower rate of tax on their retirement income (subject to their pension income level). However, the upper limit for tax relief on pension contributions has been decreased significantly from €254,000 in 2006 to €115,000 in 2011, implying that individuals will pay tax twice on any funds in excess of this new threshold.

In addition to this, the Standard Fund Threshold (SFT), which is the maximum pension fund allowed for tax purposed, has been reduced from €5.4 million to €2.3 million. If an individual's fund already exceeds the new threshold than the member has 6 months from Budget day to apply for a higher Personal Fund Threshold (PFT). However, if the capital value in the individual's fund exceeds their SFT or PFT when it matures, the excess will be subject to a tax charge of 41 per cent in addition to any other tax charges that apply to the pension or annuity when drawn. According to Bigley (2011), this will equate to a penal rate of approximately 70 per cent on the excess.

The tax-free lump sum was traditionally set at 25 per cent of the SFT (previously €5.4 million) equal to a maximum value of €1.25 million. However, the 2010 Budget reduced the tax-free lump sum to €200,000, with remainder of the new 25 per cent threshold (i.e., the next €375,000) being

taxed at the standard rate of 20 per cent. Any funds drawn, exceeding €575,000, will be subject to the marginal rate of tax, the Universal Social Charge (USC) and PRSI where applicable.

For individuals with ARFs, the mandatory investment in their AMRFs has been increased from €63,500 to €119,800 since 2010. The minimum required rate of withdrawal from ARFs has been increased from 3 to 5 per cent of the individuals ARF fund. The pensioner will be taxed on income of 5 per cent of the ARF fund regardless of whether the funds are withdrawn or not. The option of an ARF has been made available to all members of defined contribution schemes, generating more flexibility and equality within private pension plans. While these changes significantly affect some pension holders and employers, the vast majority of individuals will never reach the required thresholds, which means the new legislation ensures greater equality within the overall system.

A number of changes have been made to **Public Sector Pensions** in accordance with the National Pensions Framework's recommendations. A new standardised scheme is to be introduced for all new entrants to the public sector. The new scheme will increase the minimum retirement age from 65 to 66 years with a maximum retirement age of 70 years. In addition pensions will no longer be based on an employee's final salary but instead on a career average salary which will significantly reduce the final pension package for each member. Employee pension contributions were also increased through the introduction of the pension levy.

The **State Pension** has also been amended incorporating recommendations made by the National Pension Framework group. These changes are designed to make the State Pension more efficient and sustainable in the long-run. An individual claiming a contributory pension is required to have paid 520 PRSI contributions rather than the previous 260 PRSI contributions (for those who reached 66 by April 2012). PRSI contributions are made weekly, implying that a recipient of the contributory State Pension must have worked in the State for a minimum of 10 years in order to qualify. If the individual does not qualify they will be means tested for the non-contributory State Pension. The level of pension paid will be directly proportional to the number of PRSI contributions made, with the maximum

pension being paid only to those individuals with a minimum of 30 years'. Given the ten year contribution requirement, this implies the minimum pension will be one-third the maximum pension. In addition to these changes the age of retirement will be increased in stages from 65 to 68 by 2029 as discussed above.

3.5.2 Additional Recommendations

Considering that the primary objective of pension legislation is to ensure a reasonable standard of living in retirement, any policy that creates a tax haven for high-income earners could be abolished. In addition, one of the main reasons why many households do not have retirement plans in place is due to their perceived complexity. Industry experts consulted during this research believe that a standardised and simplified pension system is required in Ireland.

The National Pension Framework Group also proposed that an auto-enrolment programme be introduced in 2014, for individuals over 22 years of age who are not already contributing to a private pension plan. It is proposed that individuals who do not have private pension plans at that stage are to be automatically enrolled into this scheme. While, individuals would be able to opt-out at any stage, it is proposed they would be automatically re-enrolled every two years. This style of opt out scheme would force households to prepare for their retirement and prevents complacency by removing the daunting task of establishing a personal pension. It would also eliminate some of the complexity surrounding pension funds.

The scheme will be set up in a similar manner to PRSAs and will be funded through contributions made by the individual, the employer and the State. The employer contributes €1 for every €2 contributed by the individual, and the Government contributes an additional €1 (for every €3 already contributed), which is equivalent to 33 per cent tax relief. The plan is expected to increase private pension coverage, especially in households where financial literacy and awareness is low. This will ensure that the Government reaches its 70 per cent pension coverage target. Under this scheme an individual earning €30,000 will receive a pension equal to 58 per cent of their salary during retirement, plus their State Pension. However,

this proposal is subject to economic conditions improving and therefore has not yet been finalised in a Finance Bill.

Another area where industry experts have indicated reform should occur is in relation to transferability. Individuals moving employment who have a defined benefit scheme in place have three options as to how to manage their fund. First, the fund can be left where it is as a deferred pension which is guaranteed and will be paid out on retirement. Second, the funds can be transferred to another approved defined benefit pension plan. Third, it can be transferred to a Pension Retirement Bond (PRB) which is performance related and not guaranteed. Defined contribution schemes face the same options but can only be transferred between defined contribution schemes. However, individuals with PPPs, PRSAs or AVCs cannot transfer funds to defined contribution or defined benefit schemes. PPPs are non-transferable even within these personal pension options. While individuals are entitled to claim their pension from multiple sources, it can make retirement provisioning difficult and frustrating for many people.

An industry expert believes that the entire system should be simplified making it easier for individuals to understand how much they should contribute and what they will receive in retirement. This could be achieved by abolishing defined benefit schemes, developing recommended funding rates based on age, establishing a single personal account for each individual in the State that is contributed to by the individual and their employer, to which all existing pension provisions could be transferred. Finally, for individuals to have a reasonable standard of living in retirement it is suggested that 20 per cent of salary be contributed to a pension fund, with individual and employer contributions becoming mandatory. The consequence of this could be lower take home pay; however, this would in turn reduce disposable income levels and the general cost of living in Ireland.

Fine Gael (2011) outlines the election campaign proposals for new pension policy. They promised that "no political pensions will be paid to sitting TDs and no retired politician will get a political pension until the national retirement age" (pp 8). They also committed to "fundamentally reforming the pension system" (pp 24) where there will be complete coverage, with more support for lower earners and great equality between public and pri-

vate retirement arrangements. They expect to achieve this by capping tax relief on pension incomes for all residents in the State (including politicians) at €60,000, which is less than the recent reduction in the SFT. This further reduction in the SFT to €1.3 million and its application to both public and private sector pensions improves equality in the system. Individuals will be able to accumulate additional pensions if desired; however, this will have to be done using after tax income. They also propose allowing defined contribution pension savers access funds to meet business and personal responsibilities.

These are only a few of the options available to reform the Irish pension system. Nevertheless, it illustrates various inequalities within the system that need to be addressed. High-income households tend to provide for their retirement through traditional pension plans and alternative investments. It is important to address the low participation levels of low-income earners, who are more likely to struggle financially during retirement.

3.6 Conclusions

The aim of this chapter is to provide a general review of the Irish pension system. It outlines how the three-tier pension system is structured and the different types of pensions available to individuals. The long-term funding outlook for both the public and private pension schemes are also examined, along with recent policy changes implemented as a result of the financial crisis and additional potential reforms.

In relation to the State and public pension system, it is evident that a funding gap has emerged between tax receipts and future pension obligations due to Ireland's ageing population. In an attempt to address this issue, the Government established the National Pensions Reserve Fund (NPRF) in 2001, in order to partially pre-fund future pension obligations. Additional measures undertaken in the 2010 Budget and National Pension Framework proposals illustrate how the pension system's sustainability and equality can be improved further. These Budgetary measures and proposals include, though are not limited to: abolishing the PRSI ceiling, reducing the retirement tax-free lump sum, reducing capital gains tax, increasing the national

retirement age, and the proposed introduction of an auto-enrolment pension system.

A combination of these factors would ensure a more viable and sustainable system than is currently in place in Ireland. The NPRF was designed to bridge the pension funding gap facing the Government. However, the recent transfer of NPRF funds to the banking sector implies that this initiative is unlikely to achieve its objectives. Therefore the future State Pension and public pension funding gap will need to be bridged through a combination of ordinary shares (in a substandard banking sector) and future Government borrowings.

The auto-enrolment scheme is designed to introduce a mandatory element to the national pension system, as suggested by the World Bank. The system is designed to increase overall private pension coverage of the labour force to 70 per cent, and is due to be introduced in 2014. However, given that the proposal was subject to favourable economic conditions, commentators from the pension industry expect this proposal to be shelved.

Private pension funding pressure arises from occupational defined benefit pension schemes which are currently underfunded. These schemes guarantee the employees a fixed annual pension on retirement. However, increased life expectancy, salary increases and lower returns on investments have meant that approximately 75 per cent of defined benefit pension schemes are in deficit in 2009. By year-end 2010, companies were due to submit detailed proposals outlining how they intended to correct these deficits to the Irish Pensions Board. Restructuring may include increased contributions from employees and employers, the closure of these schemes to new entrants and switching to defined contribution schemes to meet pension targets. Many commentators in the pensions industry do not believe that these measures will be sufficient.

Policy changes introduced in the 2010 budget have the capacity to alleviate some of the pressure associated with defined benefit schemes. This is due to the fact that the maximum value of an individual's pension fund has been reduced from €5.4 million to €2.3 million. This may require some individuals with defined benefit pensions to re-negotiate their employment contracts, as their pension income will be reduced if their fund was due to

be above the new threshold. Individuals with defined contribution pensions may simply cease contributing to their pension plan once the new threshold is reached and invest in alternative saving options. However, caution is required as the threshold applies to the final value of the fund on retirement and, therefore, any earnings on the fund that push it over the threshold will be taxed at an effective rate of 70 per cent.

This chapter concludes that significant reform is needed in order to achieve a fair and balanced system for the Irish public and that the outstanding pension funding gap needs to be addressed as soon as possible so that there is sufficient time to accumulate the necessary funds to meet future public pension obligations.

Appendix A

Description of Pension Schemes

- *Occupational Pension:* A pension provided for by one's employer where both the individual and/or the employer may contribute, though neither are required to do so, these can be defined contribution or defined benefit schemes.

- *Personal Pension:* Is a pension established by an individual independently of occupation or other factors. This can only be a defined contribution pension

- *Social Pension:* A pension paid solely on the basis of age and citizenship, without regard to work or contribution records.

Description of Pension Plans

- *Defined-benefit plan:* A pension plan with a guarantee by the insurer or pension agency that a benefit based on a prescribed formula will be paid. Such plans can be fully funded or unfunded.

- *Defined-contribution plan:* A pension plan in which the periodic contribution is prescribed and the benefit depends on the contribution plus the investment return on accumulated contributions. Typically, such plans are fully funded.

- *Personal Pension Plan (PPPs):* These plans defined contribution plans which are suitable for those who have earning from self employment or from non-pensionable employment. This includes doctors, dentists' & accountants in practices, sole traders and those in non-pensionable employment.

- *Personal Retirement Saving Account (PRSA):* These plans are also defined contribution plans and are not available to those with occupational schemes, they are established for individuals who do not have an alternative private pension. If a company does not provide an occupational plan they are obliged to offer their employees the option

of a PRSA. PRSAs are available to employees, self-employed, home-makers, part-time workers or contracted staff.

Glossary of Pension Terms

- *Annuity:* This is a contract for annual payment made between the owner of a pension fund usually with an insurance company. The insurance company agrees to pay a fix sum for the remainder of the individuals' life, the amount paid is subject to the final value in the fund and the annuity rate applied, usually between 3.5 and 5 per cent.

- *Approved Retirement Fund (ARF):* In 1999 Minister McCreevy introduced the ARF system Proprietary Directors (i.e., hold 5 per cent voting rights) and those with AVCs had the option not to purchase an annuity. This allowed individuals to manage their own funds (through their fund manager) withdrawing funds as required, subject to the marginal rate of tax. More flexibility was given to a member where upon death funds could be transferred to children in a tax effective manner.

- *Approved Minimum Retirement Fund (AMRF):* As of the 2010 Budget individuals holding ARFs are required to put €119,800 into this AMARF. It can only be accessed when pensioners reach 75 years of age; however, any income earned on this money may be drawn prior to this subject to tax. The purpose of this fund is to ensure that there are sufficient funds available to the individual from 75 onwards.

- *Full Funding:* The accumulation of pension reserves that total 100 per cent of the present value of all pension liabilities owed to current members.

- *Indexation:* Increases in benefits by reference to an index, usually of growth in prices, although in some cases growth in average earnings. Public Sector Pensions are indexed linked to wage increases for those currently fulfilling their pre-retirement posts.

- *Legal retirement age:* The normal retirement age written into pension statutes, the Irish Government has indicated that this age will increase from 65 to 68 by 2028.

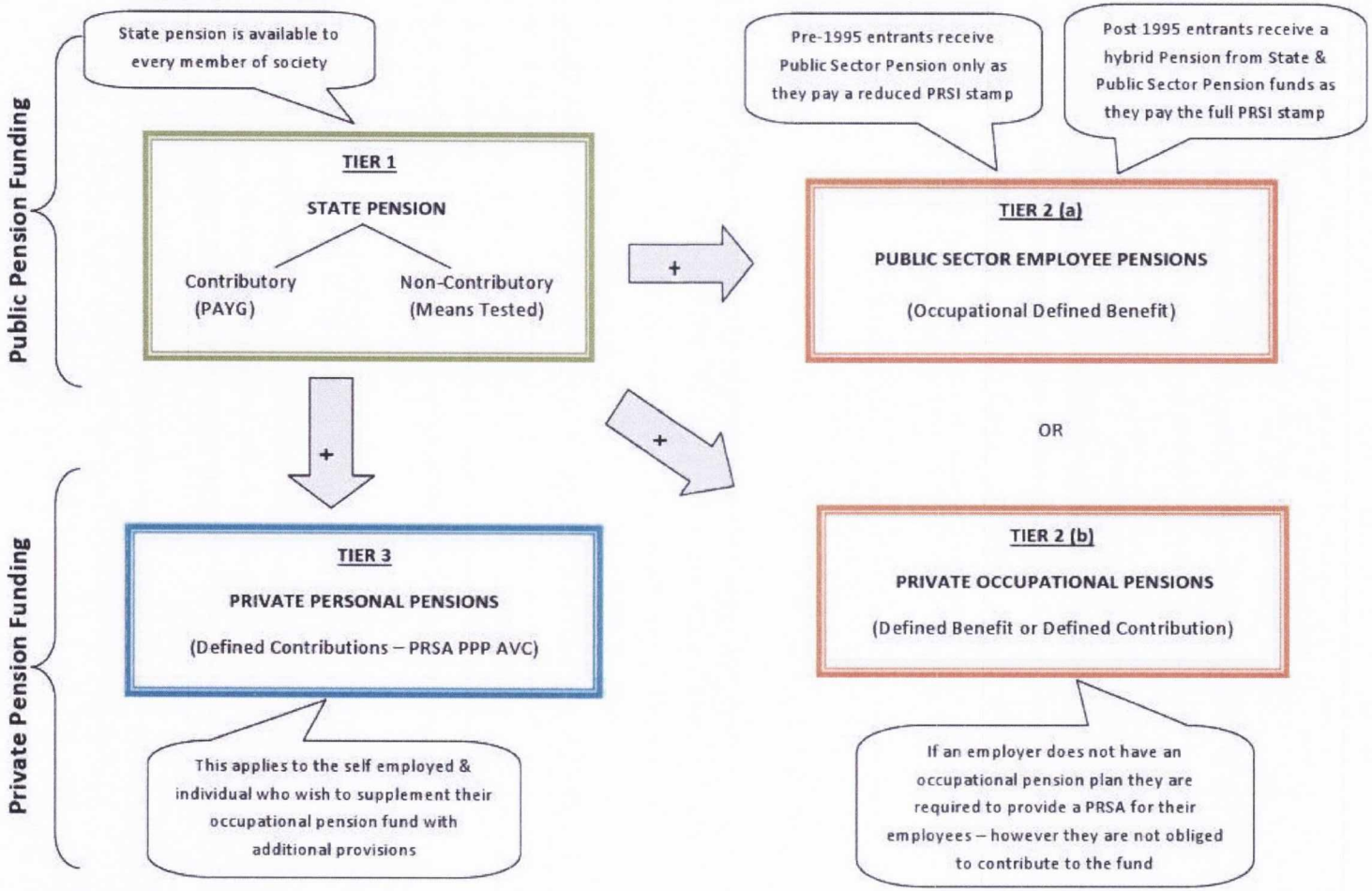
- *Tax-Free Lump-Sum:* This is a once off tax free sum of money an individual can withdraw from their fund on retirement subject to terms and conditions in the individuals pension plan.

- *Means-tested benefit:* A benefit that is paid only if the recipient's income falls below a certain level.

- *Old-age dependency rate:* The ratio of older persons to working-age individuals. The old-age dependency rate is defined as the number of persons older than age 65 divided by the number of person's age 15 to 64.

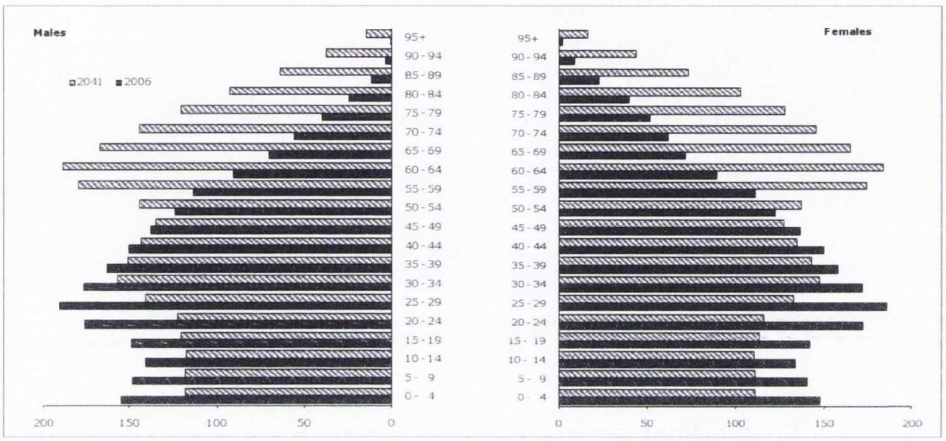
- *Pay-As-You-Go (PAYG) system:* A method of financing in which current outlays on pension benefits are paid out of the current revenues from an earmarked payroll tax.

Figure 3.1: Ireland's Three-Tier Pension System



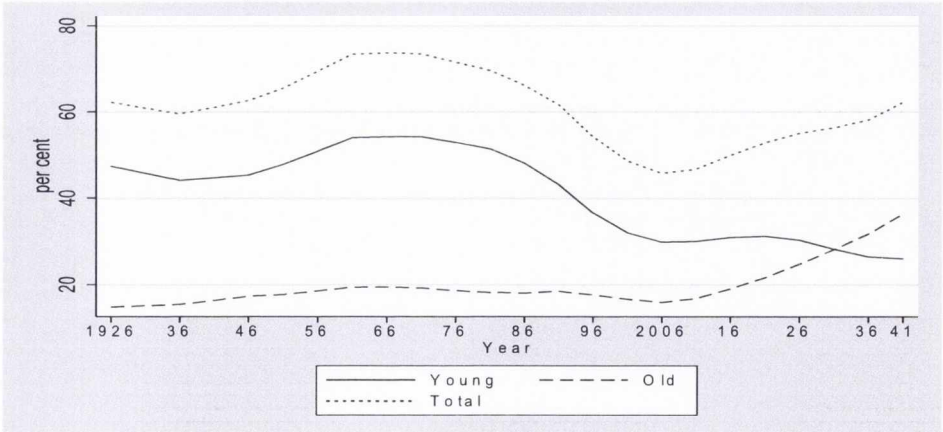
Note: Within the Irish pension system every member of society receives a **State** pension (Tier 1) (with the exception of public sector employees employed pre-1995) this is then supplemented with the individual's **occupational** (Tier 2a or 2b) and or a **personal** pension (Tier 3) as shown above. The State is responsible for funding both the State Pension and Public sector employee's pensions from taxes and employee contributions, while employers and individuals contribute to private pensions.

Figure 3.2: CSO Population Forecasts



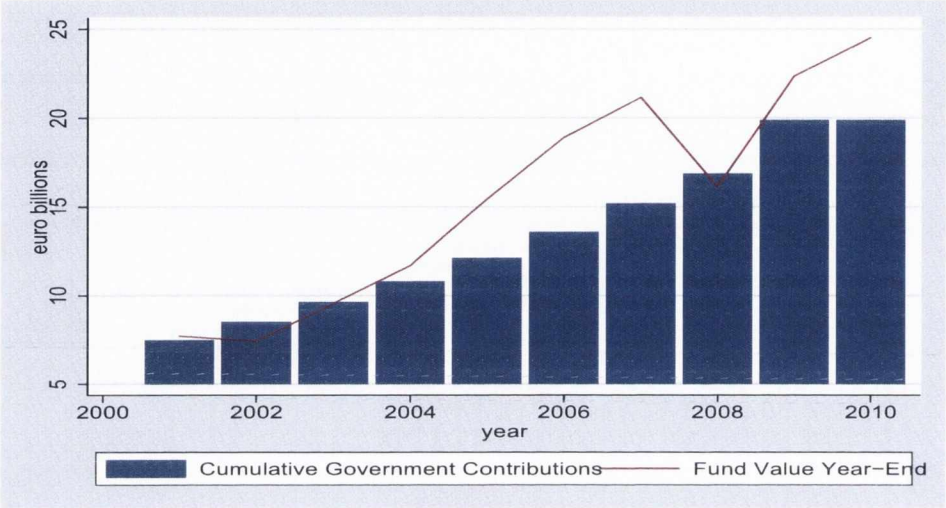
Source: CSO, Population & Labour Force Projections 2011-2041.
Note: Forecast assumptions: (1) zero net migration(M0) & (2) fertility rates decrease to 1.65 by 2016 (F2)

Figure 3.3: Ireland's Dependency Ratios



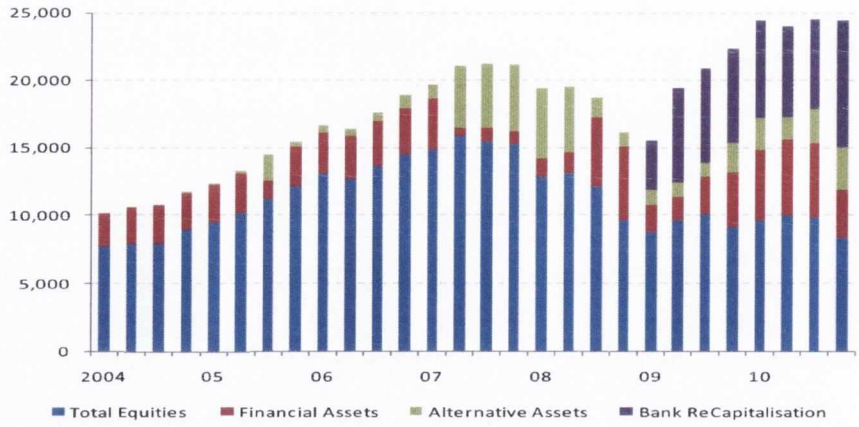
Source: CSO, Population & Labour Force Projections 2011-2041.
Note: Forecast assumptions: (1) migration levels off in 2021 at +10,000 p.a. (M2)& (2) fertility rates remain constant at 2006 level at 1.9 (F1)

Figure 3.4: Government Contributions & NPRF Value



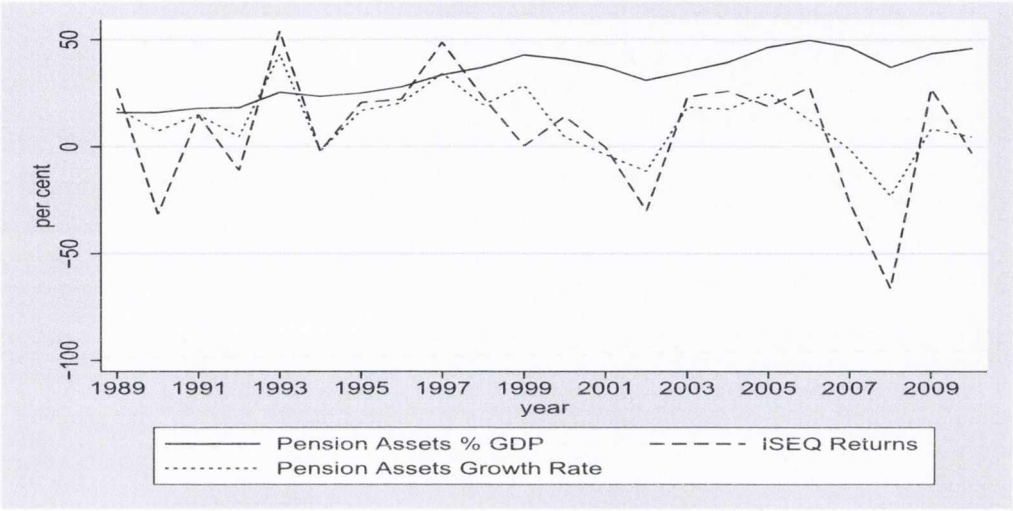
Source: NPRF and author's calculations

Figure 3.5: NPRF Asset Performance



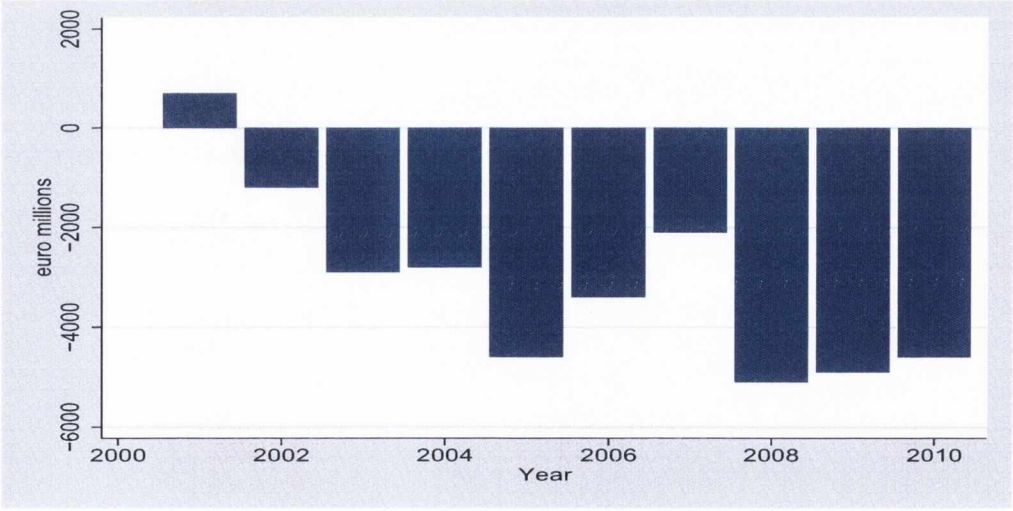
Source: NPRF and author's calculations
Note: These Figures are unaudited. Asset allocation is based on amounts allocated to each investment manager and includes residual cash and other nets assets held by them.

Figure 3.6: Occupational Pensions Funds Value



Source: IAPF Pension Investment Survey, and author's Calculations

Figure 3.7: Pension Deficit/Surplus for ISEQ plc's



Source: Attain Consulting & Mercer estimations for 2010.

Table 3.1: Pensions Coverage in Ireland (%)

	2002	2004	2005	2007	2008	2009
Total State Cover	52	52	55	52	54	51
Male	57	56	58	55	56	53
Female	45	47	51	50	50	49
Age Group						
20-24	25	23	28	23	28	19
25-34	50	51	53	50	49	49
35-44	61	62	65	62	61	58
45-54	60	60	64	63	65	60
55-69	50	55	53	53	55	49
NACE Codes						
A: Agri, forestry & fishing		37	36	36	39	24
B-E: Industry		61	66	60	62	58
F : Construction		42	46	45	45	44
G : Wholesale & Retail		35	39	39	37	30
H : Transport & Storage		60	61	55	57	55
I: Accomodation & Food		21	24	20	22	17
J: Information & Communication		61	67	62	63	58
K-L : Financial Insurance & Real Estate		78	78	77	78	83
M: Professional, Research & Admin.		56	60	56	57	61
N: Admin & Support		30	37	36	36	29
L : Public Admin. & Defence		91	93	93	93	93
M : Education		67	72	74	73	75
N : Health		61	63	60	60	57
O-Q: Other services		34	34	29	32	27

Source: CSO, QNHS, Pensions Update

Table 3.2: Maximum Lump Sum Benefits

Years Service	Eightieths of Final Remuneration
9	30
10	36
11	42
12	48
13	54
14	63
15	72
16	81
17	90
18	99
19	108
20	120 Max

Source: Revenue Commission, Practice Notes
Note: Lump Sum Benefits greater than 3/80th of final remuneration for each year of service may be given on retirement at Normal Pension Date in accordance with the table above. This is provided that the aggregate of the value of non-pension retirement benefits in respect of service with the current employer and any retained benefits does not exceed 1.5 times final remuneration.

Table 3.3: EC Projections of Public Pension Expenditure % of GDP

Country	2004	2010	2015	2020	2025	2030	2040	2050
Belgium	10.4	10.4	11	12.1	13.4	14.7	15.7	15.5
Denmark	9.5	10.1	10.8	11.3	12	12.8	13.5	12.8
Finland	10.7	11.2	12	12.9	13.5	14	13.8	13.7
France	12.8	12.9	13.2	13.7	14	14.3	15	14.8
Germany	11.4	10.5	10.5	11	11.6	12.3	12.8	13.1
Ireland	4.7	5.2	5.9	6.5	7.2	7.9	9.3	11.1
Italy	14.2	10	13.8	14	14.4	15	15.9	14.7
Luxembourg	10	9.8	10.9	11.9	13.7	15	17	17.4
Portugal	11.1	11.9	12.6	14.1	15	16	18.8	20.8
Spain	8.6	8.9	8.8	9.3	10.4	11.8	15.2	15.7
UK	6.6	6.6	6.7	6.9	7.3	7.9	8.4	8.6
EU10	10.9	9.8	9.2	9.5	9.7	9.8	10.6	11.1
EU25	10.6	10.3	10.4	10.7	11.3	11.9	12.8	12.8

Source: European Commission Data table from Salomaki (2006).
Note: These estimate were made before the financial crisis and are therefore likely to be revision up as GDP in the Euro are will be lower than forecasted at the time of estimation.

Table 3.4: Breakdown of Occupational Pension Schemes

	Defined Benefit		*Defined Contribution*		Total	Pensioned
	Schemes	Members	Schemes	Members	Employed	Employees (%)
2000	2,027	449,111	84,321	214,871	1,713,800	38.7
2001	1,956	455,627	95,976	180,690	1,762,600	36.1
2002	1,901	471,841	105,863	237,491	1,777,200	39.9
2003	1,693	483,031	110,972	241,302	1,826,100	39.7
2004	1,583	500,633	86,486	225,772	1,899,500	38.2
2005	1,478	499,885	82,841	234,814	1,995,100	36.8
2006	1,411	522,645	92,075	255,008	2,076,900	37.4
2007	1,319	555,244	98,483	269,465	2,138,800	38.6
2008	1,442	577,011	90,424	272,197	2,054,600	41.3
2009	1,307	586,488	82,939	266,909	1,887,700	45.2
2010	1,108	550,229	75,183	259,732	1,823,200	44.4

Source: Irish Pensions Board Annual Reports & CSO Labour Statistics

Table 3.5: IAPF Asset Management Breakdown of Pension Schemes (%)

	2003	2004	2005	2006	2007	2008	2009	2010
Asset Class Weights (%)								
Equities	63	63.1	65	63.4	66.3	47.8	61.5	58.9
Cash	3.8	4.7	4.5	5.5	3.8	11.4	8.35	7.2
Property	8.7	7.4	8	9	9.1	8.1	4.35	4.4
Bonds	23.5	23.5	21.5	19.7	18.5	25.6	23.7	27
Other	1	1.2	0.8	2.4	2.3	7.1	2.05	2.5
Value(€bln)	55.5	62.3	77.9	87.7	86.6	63.5	72.2	75.5

Source: IAPF Asset Management Survey (2003-2008); Pension Investment Survey(2009-2010)

Table 3.6: EU Pension Fund Asset Allocations (%)

	Equity	Bonds	Property	Other
Ireland	59	32	4	5
UK	50	41	2	7
Belgium	48	45	3	4
Sweden	39	47	4	10
Switzerland	35	43	15	7
Spain	30	68	1	1
Portugal	23	62	6	9
Netherlands	23	70	4	3
France	22	66	4	8
Norway	15	47	17	21
Germany	3	85	7	5
EU excl UK	43	49	4	4

Source: Mercer Asset Allocation Survey 2010Q1

Table 3.7: Budgetary Changes to Pension Regime

Date of Budget Year Effected	01.12.2004 2005	07.12.2005 2006	06.12.2006 2007	19.12.2007 2008	14.10.2008 2009	07.04.2009 Emergency	09.12.2009 2010	07.12.2010 2011
State Pension (weekly)	179	193	209	223	223	230	230	230
Minimum Wage$^{\psi}$ (weekly)	280	306	306	346	346	346	346	306
Est. Average Wage (weekly)	534	557	575	687	706	705	687	-
PRSI Ceiling	44,180	46,600	48,800	50,700	52,000	75,036	75,036	abolished
SFT/PFT*		5m	5m	5m	5.4m	5.4m	5.4m	2.3m
Tax-Free Lump Sum		1.25m	1.25m	1.25m	1.25m	1.25m	1.25m	200,000
Tax relief on Pension Contribution Earnings Cap		254,000		275,239	150,000	150,000	150,000	115,000
Health Levy (%)	-	2.0	2.0 - 2.5	2.0 - 2.5	2.0 - 2.5	4.0 - 5.0	4.0 - 5.0	abolished
Income Levy (%)	-	-	-	-	1.0 -2.0	2.0 - 6.0	2.0 - 6.0	abolished
Universal Social Charge (%)	-	-	-	-	-	-	-	2.0 - 7.0
Capital Gains Tax (%)	20	20	20	20	22	25	25	25

Source: Annual Budget Reviews
Note: $^{\psi}$ Minimum wage assumes a 40 hrs week; *SFT/PFT refer to Standard/Personal Fund Threshold

Chapter 4

Irish Households' Pension Decisions

This chapter examines factors which affect the probability of households investing in private pensions. This is done by identifying the households which participate in a private pension scheme, and by examining the factors which affect the amount they contribute. This type of analysis is important as it gives policymakers the necessary information to development a more efficient and sustainable pension regime. International research indicates that variables such as age, gender, education, employment and personal experience all affect whether or not an individual will invest in a private pension scheme.

So why is pension planning important? An individual retiring at the current retirement age of 65 would be expected to live for at least another 20 to 25 years. The purpose of a pension is to fund these retirement years. The standard economic theory of wealth accumulation indicates that consumption decisions are made in a life-cycle framework. Therefore consumption-smoothing activities result in savings and investments being made in preparation for consumption during an individual's retirement. However, few individuals really understand or care about their pension provisions until it is too late to do anything about it. The problem is that employers are moving away from the traditional defined benefit pension schemes towards defined contribution pension schemes which places more responsibility on the individual as they are no longer guaranteed a specific income in retirement.

O'Donnell and Keeney (2010) analyse a Financial Capability Survey (FCS) carried out in Ireland by the Financial Regulator. The purpose of the FCS is to determine whether or not households have increased their understanding of financial products and if they play a greater role in their own financial planning. The survey was split into four areas, managing money, planning ahead, choosing products and staying informed. The survey finds that only 4 per cent of non-retired respondents knew the actual value of the basic weekly State Pension.[1] However, when told that it was 35 per cent of the average industrial wage (€11,960 p.a.), 76 per cent felt that this would not be sufficient to meet their needs in retirement. Nevertheless, only 37 per cent of these non-retired respondents made additional pension provisions to supplement their State Pension.

Similarly an Irish Pensions Board survey estimates that 80 per cent of individuals feel that the State Pension is insufficient to meet their retirement needs. However, according to the latest Quarterly National Household Survey (QNHS) from the CSO, only 51 per cent of employed 20 to 65 year olds were covered by a private pension scheme in 2009. The lack of pension awareness seriously hinders the Government's target of 70 per cent private pension coverage for individuals between the age of 30 and 65.

Financial awareness is defined as understanding basic financial terminology used in organisations, and being able to construct and/or maintain simple financial records. This is becoming an increasingly important measure of individuals' ability to interact and navigate though the wide variety of financial products available to them. It also measures how prepared individual's are for complex transactions such as purchasing a property (i.e., understanding the consequence of a variable interest rates) and planning for their retirement (i.e., understanding that the value of the final fund can be subject to contributions and returns on assets). Unfortunately, financial awareness is usually quite low on average across countries. In fact pension specific awareness is so poor in Ireland that the CSO does not ask whether individuals with a pension plan have a defined contribution or defined benefit scheme because the majority did not know the answer.

[1]Non-retired respondents were asked the value of the State Pension, answers between €220 and €240 were considered correct. Therefore, only 47 of 1,301 respondents were correct, with 542 answering that they didn't know the value

Households in the Household Budget Survey (HBS) dataset are assessed with respect to their interaction with financial products (e.g., current accounts, credit cards, hire/purchase agreement, investments, etc.) which gives an indication of financial awareness. State-only pension holders interact with these products less than those with private pension funds. While households with private pension plans appear to interact with more complex financial products such as personal loans, stocks and shares and other investments. These findings support international research that financial awareness/literacy increases the probability of a household owning complex financial products and engaging in a private pension scheme.

By applying a Heckman two-stage model to the HBS data, this chapter investigates first the decision to invest in a private pension, and second the factors that affect the amount households invest. The results indicate that personal characteristics such as disposable income, age and schooling are the primary factors driving both pension participation in and contribution to, private pension funds. In addition a household's prudence level is examined while controlling for personal characteristics. Prudence is a proxy for risk aversion based on the number of insurance products held by the households; the results indicate that it is positive and significant in both stages of the model. A financial awareness proxy was also generated based on the number of financial products held (excluding insurance products), however, it only has a very small effect on the probability of having a pension. This chapter also finds that households employed in the public sector are more likely to participate in a pension plan than those in the private sector, though this does not influence the amount contributed. The results also show that even when property and finance related variables are included in the model personal characteristics remain the most significant explanatory variables

A number of reviews have been carried out on the Irish pension system, however, very little micro-level analysis has been undertaken. O'Donnell (2011) uses the FCS to examine the determinants of risk attitudes and their role in pension and investment decisions in Ireland and the UK. She finds that in Ireland socio-economic factors such as education and marital status out-weight the risk variable in relation to pensions and investments, though this is not the case in the UK sample. This chapter takes the first step in

assessing factors that affect households' attitudes to pension participation and the amount they subsequently contribute. This type of analysis could provide policymakers with information about households that could be used in pension related policy decisions.

This chapter is laid out as follows. Section 2 discusses the current literature on retirement planning and household financial literacy. Section 3 outlines the relevant data, reviewing summary statistics from the HBS. Section 4 describes the model used in the analysis and the corresponding results. Finally, Section 5 presents the conclusions.

4.1 Literature Review

Pension plans are complicated and the majority of people who have pensions are not aware of how they function or what their final retirement income will be. This is especially true under a defined contribution scheme, because the final value of the pension fund depends on a wide variety of elements as discussed in Chapter 3. To fully understand the consequence of salary increases, inflation, stock market fluctuations, etc., on pension funds values, individuals must have a high level of financial literacy. The literature indicates that individuals with higher levels of financial literacy are more likely to make retirement provisions, therefore it is important to discuss financial literacy in conjunction with pension decisions.

Financial literacy refers to skills and knowledge that enable an individual to understand financial terminology, allowing them to make informed decisions. For example, a financially literate household will understand that when they sign a variable interest rate mortgage contract their repayments will be affected by any changes in the interest rates. Forward planning is an important element of financial literacy, as the understanding of personal responsibility for retirement significantly affects whether a household dedicates sufficient resources to support itself later in life. In addition, financial awareness can help to prevent costly mistakes made by the general public in relation to assessing and choosing financial services, especially pensions.

Lusardi (2003) examines the extent to which American households with the head or principal earner close to retirement are prepared for their re-

tirement (i.e., in the age cohort of 50-61 years). Lusardi finds that a large number of households have not thought about retirement, and that the lack of planning resulted in low wealth holdings, with portfolios that are less likely to contain high-return assets, such as stocks. Lusardi also reveals that education and personal experiences (such as a parent being ill before death, or having informed older siblings) increases the likelihood that a household will plan for retirement.

Lusardi and Mitchell (2006) take this research further, developing their own purpose-built survey for household planning and financial literacy. The survey indicates that while 31 per cent of adults in their 50s tried to devise a retirement saving plan, only 66 per cent of these succeeded, representing only 19 per cent of the entire sample. The authors find that individuals who plan for their retirement tend to rely on more formal methods of planning (i.e., retirement calculators, retirement seminars, and financial experts). The findings also show that those who had higher financial literacy were more likely to invest in more complex assets, such as stocks and shares. Lusardi and Mitchell conclude that financial illiteracy in the USA needs to be addressed before retirement planning improves.

Lusardi and Mitchell (2007a) use data from the Rand American Life Panel to examine previous financial training. This study incorporates more sophisticated questions to measure financial literacy. This allows Lusardi and Mitchell to create a financial literacy index based on their responses. They found that, for every measure, in every subsample, the financial literacy index was a key determinant of retirement planning. Lusardi and Mitchell note that financial literacy was higher where respondents were exposed to economics in school or company-based financial education programs. The authors believe that the value of financial education is vital for policymakers to understand, so that changes can be made to educational programs in an environment where individuals must take increasingly more responsibility for their own retirement planning.

The effect of housing wealth on households' retirement planning is discussed by Lusardi and Mitchell (2007b). They note that "Baby Boomers" in 2004 have higher levels of net worth than households of the same age (51-56) from the 1992 sample and that this net worth is primarily derived

from housing wealth. Lusardi and Mitchell find that the distribution of wealth between the two samples changed and that the poorer households of the Baby Boomer sample are worse off than their 1992 counterparts. The authors find that households that plan are wealthier than non-planners even after controlling for socio-demographic factors. Additional analysis reveals that being a wealthier household does not increase the probability of being a planner, concluding that there is no reverse causality between these factors.

O'Donnell and Keeney (2009) analyse the Financial Capability Study[2] (FCS) conducted by the Financial Regulator in Ireland. They find that pension cover in Ireland was quite poor, as only 32 per cent of non-retired respondents had occupational or personal pension plans at the time of the survey. However, when told the value of the State pension 76 per cent claimed that it would not be sufficient to give them the standard of living they expected in retirement. The survey data also indicate that the decision to make personal pension provision varied across age cohort, with 46 per cent of 30-39 year olds, 51 per cent of 40-49 years old, 46 per cent of 50-59 year olds, and 37 per cent of 60-69 year olds making additional provisions for retirement, to supplement the State Pension. The authors also find that the principal reason for not having any additional pension provisions were affordability, indifference[3] and not having been employed for enough years.

In addition O'Donnell and Keeney discuss the process of choosing financial products and the type of products typically held by respondents. These vary from standard products such as current accounts and credit cards to more complex options such as mortgages, gilts and stocks and shares. The study also analyses other products including insurance and unsecured credit. Participants were asked where they sourced their information on financial products. The results reveal that many people prioritised non-professional information. Respondents who held financial and insurance products indicated a tendency for automatic renewal of a policy rather than shopping around. However, the study finds that while only a minority bought products that they did not need or understand most people tended to learn from

[2]The Financial Capability Study is a purpose-designed, representative study of over 1,500 individuals, carried out by the Irish Financial Regulator in 2008.

[3]Indifference refers to respondents who answered: (1) have not thought about it or (2) have not gotten around to it.

experience, making increasingly competent decisions as they increased the scope of their financial portfolio.

McQuinn and O'Donnell (2010) draw on the FCS and a similar UK survey to examine the determinants of risk attitudes. The authors believe that understanding and identifying factors that influence risk attitudes has become increasingly important over time. This is primarily due to responsibility for future financial security falling increasing on the individual rather than employers and also to the increased volume and complexity of financial products available. The authors use a probit model to examine some of the underlying characteristics affecting risk attitudes. The results indicate that people from ethnic backgrounds (i.e., not white-Irish or white-British in the respective samples) appear to be more risk averse, while married people and males tend to have a significant preference for risk.

O'Donnell (2011) applies a probit model to FCS data to examine individuals risk attitudes in relation to pensions and other investments for the UK and Ireland. She finds that personal characteristics are the principal factors affecting the probability of having pensions. She also finds that for Ireland the risk variable is only significant if all personal characteristics are removed from the regression, while in the UK risk variable remains positive and significant even when socio-economic factors are controlled for.

4.2 The Heckman Model

This section examines the type of household that chooses to invest in private pension plans and the factors that affect the amount they subsequently invest in their pension. However, pension planning is only observed if official pension fund contributions are made by the household. This implies that the sample is censored at zero, because households that have alternative pension arrangements will not be observed in the data, which create a selection bias. Using an Ordinary Least Squares (OLS) model in this situation would return biased results because correlation will exist between the dependent variable (pension contributions) and the error term which will contain the unobserved alternative pension plans.

Heckman (1976) developed a two-stage model to adjust for this selection

bias, allowing both the decision to participate and size of responses to be estimated independently using a combined maximum likelihood function. The first stage is a probit[4] choice model, while the second stage runs an OLS estimate subject to the constraints set out in the first stage.

In this analysis Stage I identifies the variables that affect participation in a pension scheme. Subject to this participation, Stage II analyses the factors that affect the amount contributed to a pension plan. The idea of the Heckman selection model is that the outcome in the second stage is only observed subject to the certain criterion being satisfied in the first stage. Therefore to control for sample selection bias in stage II, it is recommended that at least one variable that determines the discrete choice in stage I, is excluded from Stage II. In this case there are two variables that determine participation but not the amount contributed, disposable income squared and a public sector employment dummy.

The Heckman model can be represented as follows:

Stage I: Selection Equation (Probit)

$$z_i = w_i'\alpha + \nu_i \tag{4.1}$$

where z_i satisfies:

$$z_i = \begin{cases} 1 & \text{if } y_i^* > 0 \\ 0 & otherwise \end{cases}$$

where z_i is the dependent dummy variable for having a pension (addpen); y_i^* is the unobserved latent variable of pension planning; w_i' is the vector of explanatory variables for selection/stage one; α is the vector of coefficients, and ν_i is the error term.

Using the parameters estimated in the Stage I probit regression, the Heckman model generates an Inverse Mills Ratio (IMR[5]), or the estimated

[4]The Probit Model is discussed in detail in Chapter 5

[5]The Inverse Mills Ratio was developed by John P. Mills; it is the ratio of the probability density function (pdf) over the cumulative distribution function (cdf). In STATA, lambda is the product of rho (correlation coefficient) and sigma (adjusted standard errors). The IMR must be generated from a probit model instead of a logit in the first stage due to the fact that the probit assumes that the error terms follows a standard normal distribution curve, which the logit does not.

selection coefficient (λ), which accounts for the fact that the selection is not random. The IMR is then used to determine the selection effect from Stage I. This is then included in Stage II as an additional explanatory variable (λ). The second stage subsequently examines the effects of the independent variables on the outcome using OLS. The dependent variable in the outcome/second stage (y_i) is only observed if y_i^* exceeds a particular threshold in the first stage.

Stage II: Outcome Equation (OLS)

$$y_i = x_i'\beta + \lambda_i + \mu_i \tag{4.2}$$

where:

$$y_i = \begin{cases} y_i^* & \text{if } y_i^* > 0 \\ 0 & otherwise \end{cases}$$

where y_i is the dependent variable in the outcome equation (pencontrib); x_i' is the vector of covariates for unit i in the outcome equation; β is the vector of coefficients for the outcome equation, λ_i is the IMR selection coefficient and μ_i is the random error term for unit i.

The correlation between the residuals in both stages (ν_i and μ_i) is given by ρ. When ρ is positive, residuals are positively correlated in both stages, i.e., both stages are working in the same direction. When ρ is negative, the residuals are negatively correlated and working in opposite directions over the two stages. If the residuals are uncorrelated (i.e., $\rho = 0$) then selection into stage II is random, and a Heckman model is not necessary.

The Heckman model's maximum log-likelihood function can be defined as:

$$ln\mathcal{L} = \sum_{0} ln\left(1 - \Phi\left(w_i'\alpha\right)\right) + \sum_{+} ln\left[\Phi\left(\frac{w_i'\alpha + \frac{\rho}{\sigma}\left(y_i - x_i'\beta\right)\right)}{\sqrt{1-\rho^2}}\right)\frac{1}{\sigma}\varphi\left(\frac{y_i - x_i'\beta)}{\sigma}\right)\Bigg] \tag{4.3}$$

where Φ denotes the standard normal cumulative distribution function.

Given that explanatory variables appear in both stages of the Heckman model, their interpretation must be considered with great care. In this case, the coefficient in the second stage relates to the effect of an explanatory variable on the amount contributed to private pension funds subject to the household choosing to contribute in the first stage. A number of variables will affect both the decision to contribute and the amount contributed, implying that their summed effect cannot be identified in a Heckman model.[6] However, as the purpose of this research is to examine the individual effects of each variable on the two decisions discussed, this specific shortcoming is not relevant within this chapter's analysis.

4.3 The Data

The primary data source for this chapter is the Household Budget Survey (HBS[7]), which is carried out by the Central Statistics Office (CSO) approximately every five years. The main purpose of the HBS is to determine in detail household expenditure patterns. These expenditure patterns are then used to update the weighting basis of the national Consumer Price Index (CPI). However, the HBS provides a significant quantity of additional household information which can be used for micro level analysis beyond its inflation-related objectives. This chapter focuses specifically on households' weekly pension contribution patterns.

Pension related variables available from the HBS include: contributions made to occupational pension plans, Additional Voluntary Contributions (AVCs) and Personal Retirement Savings Accounts (PRSA) broken down by both individual and/or employers' contributions.[8] The dependent variable (pencontrib) used in Stage II of the heckman models is the sum of these

[6]To interpret an explanatory variable's marginal effect, it would have to be calculated using the delta model or the nonparametric bootstrap as discussed in Vance (2006). This calculation would allow for cross-model comparison of the total effect of a variable on the amount contributed. However, this is not necessary for the analysis in this chapter as the individual stage effects of the explanatory variable are desired.

[7]The 2004/05 Household Budget Survey is discussed in Chapter 2

[8]Of those who have pensions in the HBS, 76.5 per cent reported no employer contributions, this could be because their employer does not contribute or the household may not have known how much their employer contribute. Only 18 per cent reported both household and employer contributions to their pension funds. While 5.5 per cent reported that only their employer contributed to their private pension.

variables for each household, while the dependent variable in Stage I is a dummy variable equal to one if pension contributions are made and equal to zero otherwise.

Additional variables generated for this analysis include a public sector dummy variable, household prudence and financial awareness. The public sector variable is derived from the head of households Nace Rev2 code. Households that work in the defence and public administration, education and health sectors are assumed to be public sector employees. If the household head is unemployed their sector is determined by the last employment position held.

Household prudence is a proxy for risk aversion, which is generated by counting the number of insurance products hold by each household. The seven insurance products include, home (dwelling and/or content cover), motor, health, income protection, mortgage protection, other insurance policies and life assurance (as listed in Table 4.2). The count ranges from zero to seven. A risk averse household will hold some if not all of the insurance products listed. A risk-loving household will tend not to hold any insurance products.

Household financial awareness is a proxy for financial literacy levels. It is based on the number of financial products held by the household, excluding the seven insurance products used in prudence (also listed in Table 4.2). These include stocks and shares, loans, credit and laser cards, hire purchase agreements and saving accounts. The data are based on the number of these products held; this implies that a household with three visa cards is more financially aware than a household with only one. The index ranges from zero to 26. While this is not a perfect measure of household financial literacy it gives an indication of how much households interact in the financial arena.

The final amendment made to the data was to exclude households that are over 65 years of age, along with any household under this threshold claiming retirement benefits. Households are identified as being over 65 based on the principal earners age, if an individual in the household is under this age and not head of the household it would imply that their income is below that of the pension income being received. This reduces the sample size from 6,834 to 5,227 households.

However, there are a number of limitations with the HBS data. It estimates that 44 per cent of households in the sample made contributions to private pensions in the 2005 survey. However, Quarterly National Household Survey data indicate that 55 per cent of individuals had private pensions in 2005Q4. The reason for the discrepancy is that the HBS does not ask if an individual has a pension within the household; it only collects total observed household pension contributions made in the past 12 months.

The consequence of this is that some households' pension planning will be unobserved due to reporting errors while other households' pension planning will be unobserved due to their decision to stop contributing to a pension or because they choose not to have a pension at all. Examples of this kind of omitted planning include: (1) Illness or unemployment, where a household stops contributing to their pension due to financial strain though a fund is in place. (2) The tax efficient pension fund threshold may have been reached so the household chooses to stop contributions. (3) Alternative retirement provisions such as other personal investments or buy-to-let properties may have been made so they choose not to invest in a formal pension fund at all. (4) Self-employed households may choose not to have a pension as they prefer to invest the profits from their business in other assets, including the business. (5) Some households may not have a pension as they expect to inherit sufficient funds. (6) Households' attitudes to risk may be such that they have no interest in preparing for the future. (7) Households may not be able to afford a pension even if they desire to have one. None of these pension related decisions can be observed in the data, creating selection bias in the data, which drive the need to apply a Heckman model rather than simply using OLS.

4.4 Results

4.4.1 Summary of HBS Pension Statistics

Who Contributes To a Private Pension?

Table 4.1 displays the breakdown of pension contributions by household characteristics. Weekly and annual average contributions are presented, along with the estimated total accumulated value of the pension fund when

it matures. The total accumulated fund value assumes 40 years of contributions and an annual growth rate of 2 per cent on the fund. The final column gives the annual retirement income that an individual will receive for the rest of their life based on a standard annuity rate of 5 per cent. However, as discussed in Chapter 3 individuals (excluding those with defined benefit schemes) also have the option of investing in an Approved Retirement Fund (ARF) instead of purchasing an annuity.

Pension participation by sub-groups is also examined in Table 4.1. Range of sub-groups examined include, gender, marital status, employment, location and age. The data indicate that 44 per cent of non-retired households in the sample have private pension funds, contributing on average €4,128 per annum to their fund. After 40 years of contributions, this would provide the average contributing household with a pension fund valued at approximately €254,300. Based on a 5 per cent annuity rate, this fund would provide an individual with an annual pensionable income of €12,717 (in addition to the annual State Pension) for rest of their life. However, as this is an aggregated figure it is vital to examine the allocation of these contributions.

The HBS data show that 48.8 per cent of households with a male head of household participate in private pension schemes. They contribute an average of €4,255 per year to their pension fund, receiving an additional pension income of €13,108 per year. However, households with a female head of household not only participate less (28.4 per cent) but also contribute less per annum (€3,854), receiving a lower final pension (€11,871) than their male counterparts. Women's longer life expectancy will affect the annuity rate that they are given which would further reduce their final pension.

Considering the sample in terms of marital status, Table 4.1 reveals that married households have the highest participation rate in this category, at 50 per cent. This above average participation rate may be due to an individual's need to believe that their spouse will be provided for upon death. However, they contribute the least in this category (€3,723 p.a.). The low levels of contribution could be due to additional expenditures incurred with family life. Single households contribute more to their pension fund, albeit with fewer single people actually participating in a private pension scheme.

In contrast, divorcees contribute the most to their retirement fund (€7,248

p.a.). However, just 23 per cent of divorcees actually participate in a pension scheme. The sample excludes Old Age Pensioners (OAPs), yet there are still a number of widows in the sample of which only 16 per cent contribute to a private pension fund. The widows that do participate contribute more than average to their pension fund, indicating that being widowed prior to retirement may force the survivor to restructure their finances in order to ensure that sufficient provisions are in place for their retirement. This supports findings by Lusardi (2003) that life experiences affect pension contributions.

Of those households where the head was employed during the HBS sample, 45 per cent contributed an average of €4,130 per annum to their private pension fund in 2004/2005. This is close to the Irish Pensions Board's (IPB) 2004 figure of 39 per cent of employed individuals that participated in a private pension. When urban and rural households are compared, the data not only indicate that significantly more households in urban areas participate in private pension plans, but also that they invest more in their pension fund.

Pension contributions were also examined by household tenure. More than half of all mortgaged households make pension provisions, contributing around €4,280 per annum. This should generate a supplementary pension income of €13,183 per year during the individual's retirement. Households that own their home outright contribute and participate less than mortgaged households. On the other hand, private renters contributed most to their pension funds, but in a similar fashion to divorcees they participate significantly less than other tenure categories. The term "other housing" includes households that live rent free, rent from a local authority or are engaged in tenant purchase schemes. As expected the participation and contribution rates by these households are low at 12.9 per cent and €1,493 per annum, respectively.

Finally, Table 4.1 displays pension participation and contributions by age. As expected it shows that younger households not only participate least but that they also contribute the lowest amount to their pension funds. The purpose of a pension is to smooth consumption over an individual's life time: as already indicated the distribution shows that the amount contributed increases with age and income as an individual acquires greater

work experience. The total private pension fund column in Table 4.1 gives an indication of how much is accumulated if an individual follows the age-related contribution distribution.

The average accumulated amount at the end of each ten year period is illustrated in the "Total Private Pension Fund" column. The final figure of €313,200 represents what is available to an individual if they contributed for the 50 years presented. This provides an additional retirement income of €15,660 per year for 20 years upon retirement at 65 years of age. However, the majority of households do not begin to contribute to their pension until their mid-twenties. This will reduce the fund not only by €31,390 less contributions but also by lost earnings those contributions would have generated, resulting in a smaller total final fund of €235,790 (€77,411 less).

It is worth noting, however, that while growth of 2 per cent has been applied to these investment, the value of a fund can increase or decrease over the course of the investment. However, a pension fund is a long term investment and over its life-time it will tend to generate this type of return, notwithstanding the recent declines in pension funds as a result of the recent financial crisis.

Financial Awareness: Interaction with other products

The restricted HBS sample of non-retired respondents indicates that 56.2 per cent of households will depend entirely on the State Pension for their retirement income. This highlights the need for the improvement of individual's awareness and understanding of their retirement requirements. To this end, household awareness of other financial products by pension category (i.e., State-only or private pension policy holders) are examined in order to establish what kind of individual participates in a private pension scheme. Table 4.2 outlines the interaction between various pension categories and other financial products. The products are split into three financial categories: savings and investments, unsecured credit and insurance.

Table 4.2 indicates that fewer households in the "State-only" category engage with financial products compared with those with private pensions. There is likely to be a contagion effect whereby households using financial products increase both their exposure to, and their understanding of, addi-

tional products such as pension and investment schemes, via interaction with a broker or bank manager. This supports Lusardi and Mitchell's (2006/07) finding that financial illiteracy increases the probability of not engaging with financial products and failing to plan for retirement.

Table 4.2 illustrates that 76 per cent of State-only pension holders have current accounts compared with 92 per cent of private pension plan holders. Laser card ownership statistics are similar to those of current accounts, owing to the fact that most banks issue a combined ATM and laser facility card. Other bank account related holdings such as Visa, Access and American Express cards are also higher in households where private pension participation occurs. Households possessing private pension funds also appear to have a higher level of personal loans, stocks and shares and credit card facilities. This indicates that households investing in pension funds are more financially literate and actively participate in the credit system, using a multitude of payment methods.

In addition, private pension households appear to be more risk averse, with 61 per cent of these households holding life assurance policies compared with 44 per cent for State-only pension holders. While 53 per cent of private pension holders invest in mortgage protection insurance, only 29 per cent of State-only pension holders purchase the same product. Mortgage protection insurance tends to be purchased as part of a mortgage contract, and only 21 per cent of mortgaged households do not hold this product. However, just 48 per cent of mortgaged households have both mortgage protection and private pensions, indicating that having a mortgage does not necessarily imply that a household will have made pension provisions.

Private pension policy holders' participation rate is higher for the various insurance products compared with the lower participation rate of State-only households. This could be due to the fact that these households do not have a need for the products, e.g., they do not own a car or a property that needs to be insured. The relatively high coverage for both car and home insurance is probably due to legal requirements to hold motor insurance, and mortgage providers' requirements for dwelling insurance on a mortgaged property. Nevertheless, the majority of households that do not have either product fall into the State-only category, indicating that they are likely to

be in lower income deciles.

Table 4.2 also highlights the fact that there are a number of products that are used less frequently by both household types. These include: Government bonds, employer loans, other (i.e., non-traditional) loans and endowment loans. The reduced uptake of these products could be due to prevailing market conditions (during the survey period) which improved households' access to credit through formal lending channels, reducing the demand for other credit lines.

Endowment mortgages[9] became less favourable after low stock market returns during the 1990s, meaning that many policies failed to cover the principle of the mortgage, resulting in many households having to extend or restructure their mortgages at a late stage. In addition, life assurance policies used for the endowment mortgage stopped being tax deductable[10] in April 1992, increasing the overall cost of endowment mortgages.

Other products that have relatively low representation include stocks and shares, savings accounts and other insurance. However, this could also be due to the relative ease with which households could acquire formal credit at the time of surveying. Unfortunately, time series analysis is not possible across previous HBS years as only limited pension data were collected before 2004.[11] The interaction with most financial products is lower for State-only pension households, suggesting that awareness of products and responsibility for one's own retirement is limited for these households. It is reasonable to assume that these households were never exposed to, or made aware of, the need to have a pension plan. This highlights the need for some sort of schooling or employment based seminars in relation to retirement requirements before these households can realistically make their own pension provisions.

[9] Endowment mortgages are designed to function as an interest only repayment for the life the mortgage, where the mortgagee also pays into a life insurance policy which in theory would at least generate enough returns to cover the original principle amount.

[10] Allowing life assurance policies to be tax deductable implies that households were indirectly getting tax relief on the mortgage principle which was not available for households with ordinary mortgage contracts.

[11] Earlier questionnaire does not include PRSA, AVC or employers contributions to pensions, which significantly reduces the sample.

Pension Contributions and Income

The Financial Capability Study revealed that almost 25 per cent of the sample could not afford to invest in a private pension plan. It also found that 77 per cent of respondents did not know the value of the State pension. However, once told 66 per cent of all respondents felt that the State Pension would not be sufficient to give them the standard of living they desired in retirement, though 37 per cent of these had private pension plans. This indicates that household awareness and affordability may be significant factors in retirement planning and financial product interaction.

The general rule of thumb applied by the pension industry in structuring pension plans recommends that individuals contribute approximately 20 per cent of their salary per annum. This will generate a pension income of approximately two-thirds of an individual's salary on retirement. The rationale for this high contribution rate is two-fold. First, individuals tend to leave pension related decisions until they are relatively old which shortens the time for accumulating sufficient funds. Second, individuals tend to expect a similar standard of living in retirement as during their working life which would not be possible without high contribution ratios. This highlights the need for getting pension provisions established as soon as possible. Table 4.3 provides a breakdown of the ratio of pension contributions to income for non-retired households surveyed in the 2005 HBS.

Table 4.3 provides ratios by gross income and disposable income. Given that pension contributions are tax deductable (up to a certain threshold), gross income can be considered the most accurate measure. The table shows that approximately 56 per cent of non-retired households contribute nothing to a pension scheme and that nearly 40 per cent of non-retired households have total pension contributions of less than 10 per cent of their disposable income (inclusive of employer contributions). Nearly 4 per cent of non-retired households contribute between 10 and 20 per cent of their salary, with less than one per cent contributing more than 20 per cent, indicating that many households fall well short of the industry recommendation of 20 per cent per annum.

Households in higher income groups are thought to contribute more to

their pensions than those in lower income groups. While this may typically be the case, Table 4.4 illustrates that, as a share of disposable income, high income households contribute a similar proportion of income to those in lower income deciles. The distribution of average pension contributions as a percentage of disposable income reveals that across all income deciles, households contribute between 4 and 7 per cent of their earned income. However, unless a household lies within the top two deciles, their supplementary income will not be sufficient to generate a retirement income equal to the average wage (€35,700) nor do they satisfy the criterion of pension income equalling two-thirds of salary recommended by the pension industry.

Table 4.5 illustrates private pension coverage by sector. As expected, pension coverage is high in sectors where the Government employment is dominant, i.e., public administration and defence (76%), education (64%) and health (62%). The financial and professional sectors along with the highly-unionized transport, storage and communication sectors also have high pension coverage rates (61%, 51% and 51%, respectively). Sectors where many households are self-employed such as agriculture, forestry, fishing and construction all have lower pension coverage rates.

Personal contributions are provided as a percentage of disposable income. It shows that personal contributions vary from 3.7 per cent to 9.1 per cent of disposable income across sectors. The professional, research and administration sectors contribute the largest share of disposable income to their pension at 9 per cent, followed by the financial sector at 8 per cent of disposable income.

Employers' contributions vary considerably. As expected, sectors where workers are predominantly self-employed have the lowest employer contributions. The sectors within NACE Rev2 codes A to F all tend to have individual contractors working on specific short-term contracts, so employers would tend not to provide an occupational pension in these sectors. Contracted workers would therefore have to have their own Personal Pension Plan (PPP). The financial and professional sectors have the highest employer contributions, primarily due to many large companies continuing to provide defined benefit pension plans which have costs that are too high for small and medium size employers to provide.

The following section uses econometric techniques to identify and explain the effects of specific explanatory variables on private pension fund participation and contributions. The purpose of this analysis is to identify the type of households that need to be targeted with respect to future pension policy changes.

4.4.2 Heckman Regression Results

Three separate model specifications are estimated in this chapter, with each regression building on the previous one. The first specification focuses on *personal characteristics* such as disposable income, sex, marital status, children, employment and a proxy for household prudence. The second specification examines *property-related* variables to establish if either being a home owner or the size of one's home affects the probability of possessing a private pension fund, and if so, whether it affects the amount contributed. The third regression includes additional *financial* variables to the specification, including a proxy for financial awareness, personal loans, savings and other investments.

In each Heckman specification the dependent variable in Stage I is a binary variable (addpen), equal to one if the household contributes to any pension beyond the State Pension and zero otherwise. This accounts for contributions made by both the household and their employer. The results given represent the marginal effect of a unit change in the explanatory variable on the probability of having a pension.

There are two identification variables used to determine participation in a pension scheme in Stage I, which have no affect on the amount contributed in Stage II, they are disposable income squared and a public sector employment dummy.[12] Disposable income squared represents the threshold at which households have sufficient disposable income not to invest in a pension scheme. This is not correlated with the amount subsequently contributed to a pension because contribution is only observed if participation occurs. In the event that a household reaches this threshold they are unlikely to alter contributions to the pension funds already established. The second

[12]Alternative specifications have been tested; however, disposable income squared and the public sector employment dummy proved to be the best indicators.

variable that determines participation but not the amount contributed is a public sector dummy. It shows that the probability of participating in a pension fund is affected by employment in the public sector, however, it does not affect the amount that is subsequently contributed.

The dependent variable in Stage II is the log of contributions (pencontrib) made by the household and the respective employer. The log is taken of contributing households, with the remaining households retaining their zero value. Households that are over 65 years of age are excluded from the sample in addition to any household under this threshold claiming retirement benefits. In each regression the estimated selection coefficient (λ) is significant indicating that the Heckman model is the appropriate model for estimation.

Table 4.6 displays results from the first model specification, ***personal characteristics***. The first column reports the findings from an OLS regression, the purpose of which is to demonstrate the need to use the Heckman model. It illustrates that while the same variables are significant, the OLS model does not account for the multiple decision making process and selection bias involved in holding a private pension fund.[13] The positive significant effect of the lambda coefficient (the estimated selection coefficient) indicates that selection into the second stage of the model is subject to conditions in Stage I.

The second and third columns of Table 4.6, give the results from the first and second stage of the Heckman model. Stage I results indicate that a unit change in *disposable income* increases the probability of participation in a pension scheme by 2.2 per cent. *Disposable income squared* represents the point at which households have sufficient income to choose not to make formal retirement provisions. Having disposable income above this threshold reduces the probability of a household having a pension of 0.14 per cent. An additional *year of schooling*[14] increases the probability of having a pension of 0.2 per cent. Having a *male* head of household increases the probability of having a pension of 0.04 per cent.

[13]Independent probit model estimations were also carried out; these were only marginally different from the results found in Stage I of the Heckman model.

[14]Number of years spent in education: variable range from zero years for no formal schooling to 18 years for higher university degrees.

Being *married* and having *dependent children* reduces the probability of participation by 0.05 and 0.04 per cent, respectively. These negative relationships may arise from the additional costs incurred by being a married household with dependent children. Households may choose to sacrifice their retirement funds for higher current consumption. The probability of having a pension varies with *age*, however, a unit change in relation to age is the movement from one age cohort to the next.

Instead of using an employment variable a *public sector* dummy was generated as the identification variable in Stage I. It shows that the marginal effect of switching from private to public employment increases the probability of pension participation increases by 0.13 per cent. However, once in a pension scheme households in public sector pensions do not contribute statistically different amounts and so it can be omitted from Stage II. Finally a unit change in *Prudence*, a proxy for risk aversion that counts the number of insurance products held by each household, increases the probability of having a private pension by 0.08 per cent.

The final column in Table 4.6 shows the effect different variables have on the amount contributed to a pension fund. It should be noted that once a pension fund is established most households are unlikely to choose to invest more or less than the original value recommended. That is, most households contribute a fixed percentage of salary, this is determined either by their employer or their pension broker. Therefore as income increases their contributions will increase even though there was no direct decision made to increase their pension contributions.

The variables that have the most significant effect on the amount contributed to a pension are disposable income, years of schooling and age. The amount contributed significantly increases as households get older. In addition, the more prudent the household the more they contribute to their pension fund. Both being married and having dependent children, continue to have negative effects on the amount contributed; this supports the theory that these personal characteristic have financial consequences.

Table 4.7 incorporates ***property-related*** variables while continuing to control for personal characteristics. Household *tenure* illustrates the fact

that the marginal effect of switching to being a homeowner[15] increases the probability of having a private pension by 0.08 per cent. This could be due to spill-over effects from interacting with insurance brokers when purchasing other insurance products, such as dwelling and content insurance on one's home, and life assurance policies which are linked to mortgages. It also has a positive effect on the amount contributed to a pension this could be because owner-occupiers view both property and pensions as a form of saving for the future.

The other property-related variable added to the regression specification is the *number of rooms* in the property, this is used as a proxy for the size of the property. It has a negative effect on both the probability of holding a private pension and also the amount contributed. It is possible that the larger the house the less likely the household can afford a pension, due to a large number of occupants and/or the cost of running a larger property. Alternatively it may be the case that larger properties are in fact a proxy for wealth and the wealthier the household the less likely they are to have a private pension as they may have alternative financial assets at their disposal for retirement purposes. The inclusion of tenure and number of rooms reduces the effect of age and prudence in both stages of the model. This is probably due to the fact that these property-related variables indicate a certain stage in the life-cycle which is correlated with age and prudence. That is, the older the household the more likely they are to have purchased a home and to have made some sort of retirement provisions.

Table 4.8 incorporates ***financial factors*** into the model specification controlling for both personal and property related variables. *Financial awareness*, a proxy for households interaction with or use of financial products, increases the households probability of participating in a pension fund by 0.02 per cent. Given that this variable is deemed to be highly significant in international literature, this low effect is possibly due to weak correlation between the financial products used and actual financial literacy. This is because it is not necessary to understand compound interest to hold a visa card. However, financial awareness is significant at the one per cent level and its inclusion in the model increased λ from 0.12 to 0.13 per cent, high-

[15]These are both mortgaged households and those that own outright.

lighting that this variable is picking up part of the selection bias, albeit at a weak level.

As expected, *savings* and *loans* (as a percentage of disposable income) not only have opposite effects but they also effect a different stages in the model. Savings have a small but positive effect on the probability of investing in a pension, while loans have a negative effect on pension fund contributions. An *investment* dummy variable is also included, where investment equals one if the household received additional income from the following sources: building society/bank investment income, SSIA interest, stocks and shares, Government bonds, other investment income (either foreign or domestic) and income sourced from property letting. Holding alternative investment classes increases the probability of having a pension by 0.11 per cent and increases the amount contributed by 0.06 per cent. The inclusion of financial variables in the model reduces the effect of age; however, this is also likely to be due to the correlation between age and interaction with financial products.

The analysis indicates that personal characteristics, especially disposable income and years of schooling, have the most significant effect on both the probability of participating in a pension fund and the amount that is contributed to the fund. It also indicates that households' level of risk aversion (proxied by the number of insurance products they hold) has a significant and positive effect in both stages of the model. Being employed by the public sector is also a consistent predictor of having a pension fund.

The model was also estimated using the Nace Rev2 codes by sector (as broken down in Table 4.5). The results indicated that the Construction, Accommodation & Food and Other services sectors had no effect on the probability of having a pension, this is not surprising as these sectors have the lowest pension coverage in the sample, in fact the hotel and restaurant sector actually had a negative effect on pension participation. Including the Nace codes also shows that the defence and administration sector had the highest probability of pension participation (0.39 per cent) followed by health (0.31 per cent) and then education (0.27 per cent), which is to be expected given the high level of public sector employment in these sectors. The inclusion of the Nace code variable had no quantitative effect on the

other variables in the specification.

4.5 Conclusions

A pressing need exists to address the pension system in Ireland. This need presents itself not just because of the significant losses on investments related to pension schemes during the financial crisis but also due to Ireland's ageing population, implying that the current system will not be able to sustain Ireland's ageing population. At present, nearly 50 per cent of the workforce relies completely on the State Pension for their entire retirement income. Under the current "pay as you go" (PAYG) system individuals in the labour force today fund the pensions of those currently retired, under the assumption that when they retire in the future their pension will be provided for by the labour force at the time. However, this old-age dependency ratio is increasing as Ireland's demographics change. As individuals from the baby-boom generation enter retirement the dependency rate will increase rapidly, meaning fewer people paying into the pension system to support the growing retirement population.

Financial pressures on the Government to meet the needs of pensioners in the future are expected to increase significantly over time. This problem is not specific to Ireland: the Financial Times recently reported the fact that by 2060 there will be only two people of working age for every person over 65 in the EU, falling from four people in 2008. As discussed in Chapter 3, the CSO indicates that Irelands' old persons' dependency ratios will increase from 15.9 per cent in 2006 to 36.3 per cent in 2041. However, this is likely to be even higher as the CSO estimates do not take account of the recent financial crisis and the subsequent emigration that has occurred. For these reasons it is critical that individuals take a higher level of responsibility for their own retirement income to ensure their retirement remuneration meets expectations.

This chapter uses a Heckman two-stage model to examine the factors that affect households' participate in, and the value contributed to, private pension plans. The results reveal, in accordance with international literature, that personal characteristics (i.e., age, sex, education, and em-

ployment) are the primary factors that affect households' decision to make pension provisions, they also have a subsequent impact on the value contributed. Even when households' risk levels and financial activities are controlled for personal characteristics (with the exception of age) remain the primary drivers for both participation and contribution levels in private pensions. However, the inclusion of a financial awareness proxy did improve the quality of the estimated selection coefficient (λ).

These conclusions are important as they could assist both Government and policymakers to make informed decisions when developing the appropriate macroeconomic pension policy for the country. If the political objective of a national pension programme is to create a system that aims to eliminate poverty in old age, it should provide a fair system that prevents high-income earners becoming wealthier through tax avoidance. Identifying the type of households that do not invest in private pension funds may enable policy makers to adjust regulations in order to improve the overall quality and fairness of the pension system. It also provides the tools needed by policy makers in order for them to promote education and understanding, regarding individuals' need to make personal pension provision.

Data from the HBS in 2005 indicate that 56.2 per cent of households in Ireland had no pension provisions. In 2009, the CSO QNHS found that 49 per cent of individuals had no private pension plan in place. Allowing for the improved situation, there is nevertheless a continuing need for the Government to raise households' understanding of pensions and the consequences of not having made pension provisions. One method to achieve this goal is to implement various financial awareness programmes in schools, colleges and places of work. Lusardi and Mitchell (2007a) found that pension provisions in America were higher for those exposed to economics in school or the work place. This type of forward planning could be easily implemented in Ireland and would represent a worthwhile investment considering Ireland's ageing population.

Table 4.1: Private Pension Holders, Average Contributions & Generated Pension

	Contributors (%)	Average Contributions Weekly (€)	Average Contributions Annual (€)	Total Pension Fund$^{\varphi}$ (€)	5% Annuity Rate Pension$^{\gamma}$ (€)
Sample (excl. OAPs)	43.8	79.39	4,128	254,343	12,717
of which					
Personal contributions	-	57.15	2,972	183,093	9,155
Employer contributions	-	22.24	1,156	71,251	3,563
Male	48.8	81.83	4,255	262,161	13,108
Female	36.2	74.11	3,854	237,428	11,871
Married	48.0	71.60	3,723	229,386	11,469
Divorced	26.2	139.38	7,248	446,519	22,326
Widowed	16.1	88.35	4,594	283,049	14,152
Single	30.8	77.26	4,018	247,519	12,376
Employed	45.0	79.42	4,130	254,440	12,722
Unemployed	0.7	21.42	1,114	68,624	3,431
Urban	44.8	87.86	4,569	281,479	14,074
Rural	20.9	58.60	3,047	187,738	9,387
Own-Outright	41.5	75.76	3,940	242,714	12,136
Mortgaged	57.6	82.30	4,280	263,666	13,183
Private Renter	23.1	89.24	4,640	285,900	14,295
Other housing	12.9	28.71	1,493	91,979	4,599
Average Contributions by Age Cohort$^{\psi}$				*Cumulative*	
15-24 years	14.0	60.36	3,139	35,059	
25-34 years	42.7	68.11	3,542	82,296	
35-44 years	50.3	75.65	3,934	144,256	
45-54 years	47.4	85.23	4,432	220,392	
55-64 years	34.0	91.90	4,779	313,201	15,660

Source: CSO, HBS 2005

Note: φ Total Private Pension Fund value assumes 40 years of service and 2% growth p.a. on the fund; γ This is the annual pension income received for the rest of one's life; ψ Age related contributions are cumulative over time generating a total pension fund according to the distribution. Average values include Employee & Employer Contributions; OAPs are excluded from the sample.

Table 4.2: Financial Products Held by Pension Category (%)

	Only State Pension	State & Private Pension
Pension Share (excl. OAPs)	56.20	43.80
Savings & Investments		
Stocks & Shares	9.97	22.38
Government loans	0.07	0.35
Building Society investments	3.47	8.65
Commercial Bank savings	14.05	22.51
Post Office saving	3.67	6.51
Other Investments	0.92	2.23
Current Account	76.35	92.22
Laser cards	80.67	95.76
Other cards	9.87	15.17
Secured & Unsecured Credit		
Mortgage	30.32	57.74
Bank loans	32.77	51.92
Employer loans	0.14	0.26
Credit Union loans	25.55	28.58
Other loans	2.52	2.80
Hire & credit schemes	13.27	13.33
Visa cards	38.96	64.60
Access cards	5.14	11.93
American Express cards	0.75	1.97
Insurance Products		
Income Protection	0.78	10.31
Life Insurance	43.55	60.97
Mortgage Protection	28.55	52.62
Endowment Mortgage	2.04	4.50
House Contents Cover	65.77	91.17
Dwelling Insurance	65.36	90.21
Health Insurance (VHI/BUPA)	35.01	68.84
Motor Insurance	81.29	95.19
Other Insurance	11.81	19.93

Source: CSO, HBS 2005
Note: Table gives the percentage product interaction by pension category

Table 4.3: HBS Private Pension Contributions to Income Ratios

% of Income	Gross Income	Disposable Income
zero	56.23	56.23
1 to 10 %	39.45	37.11
10 to 20 %	3.94	5.64
20 to 25 %	0.17	0.61
26 to 50 %	0.17	0.31
50 % or more	0.04	0.06

Source: CSO, HBS 2005

Table 4.4: Private Pension Holders Contributions by Income Quintile

Quintile	1 (poorest)	2	3	4	5 (richest)
% Contributing per Quintile	30.9	35.9	45.8	51.4	54.8
Individual Contrib (%DI)	4.79	4.44	4.19	4.32	4.46
Employer Contrib (%DI)	0.64	1.44	0.98	1.14	2.17
Contributions p.a. (Total)	3,338	3,370	3,112	3,616	6,401
Final Pension Fund Value	205,630	207,656	191,752	222,804	394,340
Pension Income p.a.	10,282	10,383	9,588	11,140	19,717

Source: CSO HBS 2005
Note: Quintiles from the 2004 HBS; Fund is assumed to grow at 2% per annum and an annuity rate of 5%

Table 4.5: Private Pension Coverage Persons Aged 15-65 Years by NACE Rev2

NACE Rev2	Sector	Pension Coverage (%)	Disposable Income (€)	Annual Contributions (€) by Employers	Personal	Total	Personal Contrib. % DI
A	Agri, Forestry & Fishing	35.5	73,228	56	2,689	2,744	3.75
B-E	Industry	30.5	64,520	1427	2,833	4,260	6.60
F	Construction	39.4	64,404	677	2,127	2,804	4.35
G	Wholesale & Retail Trade	43.0	60,989	784	2,090	2,873	4.71
I	Accommodation & Food	28.4	58,721	544	1,880	2,424	4.13
H/J	Transport, Storage, Inform. & Comm.	50.6	66,876	1318	2,820	4,137	6.19
K/L	Financial, Insurance & Real Estate	60.9	84,432	3387	3,349	6,735	7.98
M/N	Professional, Research & Admin.	50.8	72,504	2928	3,718	6,646	9.17
O	Defence & Public Admin.	76.0	65,832	647	2,618	3,265	4.96
P	Education	64.4	69,657	679	4,638	5,317	7.63
Q	Health	62.0	64,624	500	3,411	3,911	6.05
R-U	Other NACE activities	31.8	59,375	1463	2,521	3,984	6.71

Source: CSO HBS 2005, Contributors Only Sample and author's calculations

Table 4.6: Heckman Model I: Personal Characteristics

	OLS Check		Stage I: Probit		Stage II: Outcome	
	Coefficient	Robust SE	dy/dx	Robust SE	Coefficient	Robust SE
Log Disposable Income	-0.83*	0.20	2.21*	0.48	0.48*	0.03
Log Disposable Income Squared	0.10*	0.02	-0.14*	0.02		
Log of Schooling Years	0.41*	0.05	0.16*	0.04	0.56*	0.04
Male$^{\varphi}$	0.06*	0.02	0.04*	0.02	0.02	0.02
Dependent Children	-0.05*	0.01	-0.04*	0.02	-0.28*	0.01
Married$^{\varphi}$	-0.09*	0.03	-0.05***	0.01	-0.12*	0.03
Age (Omitted = 15-24 years)						
25-34 years	0.16*	0.06	0.13**	0.06	0.17	0.09
35-44 years	0.25*	0.06	0.19*	0.06	0.20**	0.09
45-54 years	0.22*	0.06	0.16*	0.06	0.21**	0.09
55-64 years	0.19*	0.06	0.12***	0.06	0.25*	0.09
Public Sector$^{\varphi}$	0.18*	0.03	0.13*	0.03		
Prudence	0.10*	0.01	0.08*	0.01	0.03*	0.01
Constant	0.20	0.65			-3.50*	0.23
Lambda					0.12*	
Log pseudo-likelihood					-3720.65	
N (obs)	5123				5123	

Note: (1) Dependent variable in Stage I = addpen dummy & in Stage II = log of private pension contributions. (2) Stage I probit results are the marginal effects of a unit change in the explanatory variable on the probability of having a pension. (3) φ refers to dummy variables. (4) *significant at 1% level; ** significant at 5% level; *** significant at 10%level. (5) OLS R^2 is 32%

Table 4.7: Heckman Model II: Personal & Housing Characteristics

	Stage I: Probit		Stage II: Outcome	
	dy/dx	Robust SE	Coefficient	Robust SE
Log Disposable Income	2.18*	0.48	0.49*	0.03
Log Disposable Income Squared	-0.14*	0.03		
Log of Schooling Years	0.17*	0.04	0.57*	0.04
Male$^{\varphi}$	0.05*	0.02	0.03	0.02
Dependent Children	-0.03*	0.01	-0.02*	0.01
Married$^{\varphi}$	-0.04***	0.02	-0.12*	0.03
Age (Omitted = 15-24 years)				
25-34 years	0.11***	0.06	0.09	0.09
35-44 years	0.17*	0.06	0.17**	0.09
45-54 years	0.14**	0.06	0.18**	0.09
55-64 years	0.11***	0.06	0.23*	0.09
Public Sector$^{\varphi}$	0.13*	0.02		
Prudence	0.07*	0.01	0.02*	0.01
Property Variables				
Owner-Occupier$^{\varphi}$	0.08*	0.03	0.06***	0.04
Number of rooms	-0.16**	0.04	-0.09**	0.04
Constant			-3.47*	0.23
Lambda			0.12*	
Log pseudo-likelihood			-3707.42	
N (obs)			5123	

Note: (1) Dependent variable in Stage I = addpen dummy & in Stage II = log of private pension contributions. (2) Stage I probit results are the marginal effects of a unit change in the explanatory variable on the probability of having a pension. (3) φ refers to dummy variables. (4) *significant at 1% level; ** significant at 5% level; *** significant at 10%level.

Table 4.8: Heckman Model III: Personal, Housing & Financial Characteristics

	Stage I: Probit		Stage II: Outcome	
	dy/dx	Robust SE	Coefficient	Robust SE
Log Disposable Income	2.09*	0.45	0.49*	0.03
Log Disposable Income Squared	-0.13*	0.03		
Log of Schooling Years	0.15*	0.04	0.55*	0.04
Male$^{\varphi}$	0.05*	0.02	0.02	0.02
Dependent Children	-0.02*	0.01	-0.02*	0.01
Married$^{\varphi}$	-0.04***	0.02	-0.12*	0.03
Age (Omitted = 15-24 years)				
25-34 years	0.12***	0.06	0.09	0.09
35-44 years	0.17**	0.06	0.16**	0.09
45-54 years	0.13**	0.06	0.17**	0.09
55-64 years	0.10	0.07	0.22**	0.09
Public Sector$^{\varphi}$	0.13*	0.02		
Prudent	0.07*	0.01	0.02*	0.01
Property Variables				
Owner-Occupier$^{\varphi}$	0.08*	0.03	0.05	0.04
Number of rooms	-0.19*	0.04	-0.09**	0.04
Financial Variables				
Financial Awarness	0.02*	0.003		
Loans % Disposable Income	0.0001	0.001	-0.002**	0.00
Savings % Disposable Income	0.002**	0.001	0.001	0.00
Investments$^{\varphi}$	0.11*	0.02	0.06*	0.02
Constant			-3.36*	0.23
Lambda			0.13*	
Log pseudolikelihood			-3669.25	
N (obs)			5123	

Note: (1) Dependent variable in Stage I = addpen dummy & in Stage II = log of private pension contributions. (2) Stage I probit results are the marginal effects of a unit change in the explanatory variable on the probability of having a pension. (3) φ refers to dummy variables. (4) *significant at 1% level; ** significant at 5% level; *** significant at 10%level.

Chapter 5

Household Tenure Trends & Mortgage Repayment Burdens

5.1 Introduction

The aim of this chapter is to analyse financial trends in the Irish household sector between 1970 and 2009. The need to monitor household finances stems from households' involvement in the financial sector as a borrower and lender. The recent financial crisis emphasised how spill-overs from the banking sector into the real economy can cause problems for households. This chapter examines household tenure trends and the factors that influence households' decisions to purchase property, even if it makes them highly indebted. The chapter can be viewed in two parts, first the decision to own a home and second the consequence of that decision in relation to households' mortgage repayment burden.

Developments in Government policy and financial market liberalisation made significant volumes of credit available to households which was ultimately invested in property. Residential mortgage data indicate that during this period of financial market liberalisation, local authorities and insurance companies reduced their share in the market as commercial banks became more active. This increased competition resulted in lower interest rates and new financial products such as Tracker and 100 per cent mortgages being introduced.

Sharpe ratio analysis identifies returns on investments as an additional

factor influencing households' demand for property. It shows that in the period between 1987 and 2005, residential buy-to-let property generated the highest average annual returns, followed by commercial buy-to-let property and equities. Owner-occupied capital gains generated one of the lowest returns on investment. However, once the level of risk associated with each investment is accounted for, owner-occupied returns on investment come in second behind residential buy-to-let investments. This indicates that property remained the best investment choice, given that the interest rates over this period were historically low and the property boom occurred in this period. However, when the period is extended into the financial crisis to the end-2009, the Sharpe ratio still indicates that property is the best investment choice, which could affect households' decision to be owner-occupiers.

Aggregated household sector credit (HSC) grew on average by 17 per cent per annum over the past decade, predominantly due to increases in property-related lending. Household credit increased from less than 50 per cent of disposable income in 1992 to nearly 200 per cent by 2009, of which property-related lending accounted for 161 per cent of lending in 2009. Sectoral level analysis carried out by Cussen and Phelan (2010) indicates that between 2002 and 2007 total household net worth increased by 80 per cent (to €640 billion), with a subsequent fall of 31 per cent (to €439.59) in 2010 quarter two. The problem with aggregated data is that as a whole the sector looks financially sound even with the recent decline (which was primarily due to falling house prices). Unfortunately it does not facilitate analysis of individual household indebtedness or if the households with the largest outstanding mortgage debt are also those most at risk of default.

Micro level analysis can provide more insight into the examination of household data. Analysis is carried out on data from four Household Budget Surveys (HBS) carried out in 1988, 1995, 2000 and 2005 from the Central Statistics Office (CSO).[1] The data allow for the identification of household demographics and financial characteristics over time and peer group. Household tenure trends are explored over the four samples identifying personal, macroeconomic and financial characteristics involved in the probability of being an owner-occupier using a probit model. It is found that while there

[1]The Household Budget Survey is discussed in detail in Chapter 2

have been changes in household tenure trends over time, the fundamental elements involved in the decision to own a home have remained relatively constant. The changes that did occur during this period are as a result of social and demographic changes in Ireland since the 1980s.

The sample is restricted to mortgaged households to study changes in mortgage repayments with respect to disposable income over time. The surveys are supplemented with estimated data for 2007 and 2009. This analysis shows how exposed all owner-occupiers are to fluctuations in interest rates and unemployment, irrespective of whether they are in negative equity. Notwithstanding the fact that data on mortgages drawn post-2005 and individual household wealth (i.e., the stock of saving and investments) are not available, estimated 2009 data indicate significant financial strain in the household sector should unemployment levels remain high.

The layout of this chapter is as follows. Section 2 discusses the relevant literature. Section 3 examines the domestic environment in Ireland between 1970 and 2005, focusing on changes in the residential mortgage market brought about by Government policy and financial deregulation. It also examines household tenure over time, alternative investment decisions and household indebtedness at a macroeconomic level. Section 4 analyses the probability of a household owning a home using a probit choice model. Section 5 identifies households' repayment burden trends across the different survey years and stress-tests the effects of unemployment and interest rate increases on estimated mortgage repayment burdens in 2007 and 2009 for households surveyed in 2005. Finally, Section 6 concludes.

5.2 Literature Review

The literature review can be divided into two sections. The first section covers papers that relate to factors affecting home-ownership decisions, while the second highlights the consequence of mortgage repayment burdens due to over-indebtedness. As the literature in this area is vast, a limited number of papers are discussed to outline the issues at hand.

Factors Effecting Home-Ownership

Somerville (2007) examines the reason for Ireland's relatively high level of property owner-occupation compared with other European countries between 1946 and 2002. Using national population Census data he finds that tenure patterns have a strong life-cycle dimension, with the proportion of owner occupiers rising with age. He also finds that historical factors relating to land tenure and landlord and tenant legislation are contributing factors in the Irish need to be owner-occupiers and, therefore, explains some of the underlying causes of Irish indebtedness.

Duffy (2007) looks at immigrant household tenure in Ireland using a probit model. He finds that the principal explanatory variables of ownership are age, education attainment, family cycle, employment and the sex of the head of household.

Sefton (2007) uses British Panel Household Survey (BPHS) data to examine changes in household tenure. He finds that leaving home, marriage, children, widowhood and retirement are the principal factors affecting tenure changes. Other factors investigated which were found to have explanatory power include: location, employment status, age and sex of household head and household type.

Numerous commentators have examined household tenure over the household's life-cycle. Attanasio *et al.* (2005) find that home ownership varies depending on the individual's stage in the life-cycle and educational attainment. They find that home ownership is associated with greater labour market participation, where households choose to service their greater debt repayment now so that in retirement increased consumption and leisure can be facilitated through capital release.

Painter and Lee (2009) indicate that household tenure transition in older households is not directly related to their age. They report that the most important factors influencing transition in these households are poor health and widowhood, though the effect is not immediate. Divorce, however, is the only consistent predictor of tenure transition. They find that beyond the demographic factors that affect tenure transition geographic proximity to and the financial wealth of one's children is also significant. The closer elderly households are to their children the less likely they are to change tenure or downsize; they believe this is due to the security generated by the

closeness of family. While the wealthier their children are the more likely the household will engage in equity release, this is possibly due to the fact that it is not needed for inheritance. They conclude that financial factors are less important than demographic and family factors.

Given that property is both a consumption and investment good, it is necessary to examine the cost difference between renting and purchasing a home. As discussed in Fahey (2004) rent is a payment for housing services, while mortgage repayments have both an interest and capital repayment component. The interest element is comparable to rent as it is the cost incurred for borrowing the finance behind the investment, with the capital repayment relating to asset accumulation or savings. While it costs more to purchase a home than to rent one in absolute terms, they find that financial pressures are more severe for private renters than mortgagees when examined from an affordability perspective. Even though mortgaged households are still exposed to high levels of debt repayment burdens, he finds that on average these are lower than those experienced in the private rental sector. This implies that households may choose to purchase a home as it is more affordable than renting.

Households' Indebtedness and Mortgage Repayment Burdens

Since the onset of the 2007 financial crisis households' indebtedness and housing affordability have become a focal point for policy makers. What caused house prices to increase? How will housing debt be serviced throughout the recession? Specifically for Ireland, what will the long-term effect of negative equity be on the housing market? While many of these questions are outside the scope of this chapter it is important to consider households' indebtedness and its effect on the real economy.

Debelle (2004) discusses the significance of household debt for the macro economy across European countries. He finds that most of the increase in borrowing can be attributed to two factors: first, the decrease in credit rationing from deregulation in the 1980s; and second the dramatic fall in both real and nominal interest rates. Both these factors contributed to the significant easing of liquidity constraints that households faced, increasing household sector borrowings. As a result households became more exposed

to interest rate movements as the share of variable rate mortgages increased, and in many European countries households engaged in equity release increasing financial pressures on the sector. They conclude that the principal macroeconomic risks from a highly indebted household sector are increased repayment burdens due to increased unemployment and interest rates.

Cox *et al.* (2002) examine financial pressures in the UK household sector using the British Household Panel survey (BHPS). They use three measures of household stress: debt-income ratios, debt-service burdens and debt to asset relationships. They note that while the debt-income ratios of mortgaged households increased in the late 1990s, unsecured debt-income ratios increased significantly more in this period. They find that those with the highest levels of mortgage and unsecured debt tend to have the highest income and wealth levels. They suggest that the increase in household sector indebtedness was accompanied by increases in both assets and liabilities for all households as opposed to some households accumulating liabilities while others gained assets. However, they conclude that the distribution of household debt may be more vulnerable than the overall aggregate measure suggests.

Evidence from a study in Austria, by Beer and Schurz (2007), also finds that higher income earners have the largest levels of debt. However, they note that these households were usually not the most burdened. Evidence from a logit model indicates that for housing and consumption loans, the age of the household head positively affects the levels of debt. They discover that higher income earners have more potential to self-fund and therefore engage in less borrowing; however, in relation to consumer credit, income seemed to be less relevant. With regard to age they find that there was a significant decrease in loans for household over 65 years, while the majority of loans fell into the 35 to 45 age group.

Kearns (2003) investigates mortgage arrears in the 1990s using two household budget surveys (1995 and 2002). He finds that mortgage lending growth during this period was high both by historical and international standards. He notes that the criteria for determining the value of a mortgage (i.e., income multiplies, property values and repayment burdens) are unlikely to insulate a household from falling into arrears should they suffer an adverse

income or interest rate shock. Kearns indicates that in the 1990s households with relatively high mortgage repayment burdens were more likely to fall into arrears. Other factors affecting the probability of arrears included unemployment, other debt repayments and having other non-mortgage arrears. He concludes that increased indebtedness, due to relaxed lending criteria and an increased appetite for household debt, may increase the number of mortgage arrears should unemployment increase.

Hogan and O'Sullivan (2003) find no evidence that there has been an increase in the marginal propensity to consume due to the increase in housing wealth in Ireland. They find that between 1970 and 2002 the rise in personal income can explain all of the increase in consumption, indicating that Irish households did not consider the increase in housing wealth to be a permanent fixture during that period. This increase in household consumption was also facilitated by an increase in the supply of unsecured credit, such as personal loans and credit card debt by financial institutions. They suggest that if households have not borrowed against housing wealth to boost consumption it implies that a sharp correction in house prices would have a limited effect on aggregate consumption, resulting in limited recessionary effects on the economy as a whole.

Subsequent research by Addison-Smyth *et al.* (2009) confirms that fundamental changes in the global and domestic economy can account for the majority of Ireland's house price increases until 2003: this supports Hogan and O'Sullivan's conclusions. However, since that period they find that significant divergence occurred between actual and fundamental house price levels. They conclude that the excess availability of credit was a key factor explaining this divergence. Their results suggest that excess credit alone accounted for an average of 11 per cent of annual house-price growth between 2004 and 2008, with this rate increasing to nearly 20 per cent of house-price growth towards the end of the period.

Over the past decade equity-release was embraced on a larger scale in the UK than in Ireland. Aoki *et al.* (2002) find that house prices are not a source of fundamental shocks, but are part of the transmission mechanism by which changes in short-term interest rates affect consumption, the output gap, and hence inflation. They also find that households in the UK have

become less constrained by credit due to the increase in competition in the banking sector. Households have access to more credit, and as banks developed their retail credit expertise, households which had not previously qualified for credit became able to borrow. There has been a large increase in the number of new entrants to the market for credit cards and unsecured loans. Within the mortgage market there has not only been an increase in the type of mortgage products, but also a greater ease with which households may withdraw housing equity to finance consumption.

Keeney and O'Donnell (2009) reviewed a survey conducted by the Financial Regulator regarding financial capability in Ireland. The findings indicated that 37 per cent of consumers have at least some degree of difficulty keeping up with bills and credit commitments in the six months before the survey. The report also shows that 13 per cent of the population experienced financial difficulties during the last five years (i.e., three or more months behind payments with regular commitments). For those aged between 21 and 35 this rises to 20 per cent, indicating that a large number of households are under pressure to fulfil their debt obligations. It is therefore important to determine the number of households at the margin and to establish whether their indebtedness could affect the overall financial stability of the system.

The analysis carried out in this chapter specifically builds on techniques used by Cox *et al.* (2002) in relation to household indebtedness exposures, Duffy (2007) for tenure modelling using probit models, and Kearns (2004) for mortgage burdens using the household budget survey.

5.3 The Domestic Environment in Ireland

The purpose of this section is to review how household tenure trends have changed over time. It examines a number of different economic and social factors that influenced households' decisions to purchase a home. These factors include: educational attainment, restructuring of the residential mortgage market through property related tax incentives introduced by the Government, financial market liberalisation and the social perception that house prices would continue to increase justifying residential property investment.

The subsequent high level of household indebtedness is also discussed in this section.

5.3.1 Household Tenure Trends

The distribution of household tenure in Ireland is summarised in Figure 5.1. The data are a combination of Census of Population housing statistics (1981, 1991, 2002 and 2006) and Household Budget Survey (HBS) data.[2] Over the period between 1981 and 2006, the number of households in Ireland increased by 63 per cent (or 566,242 households). Over this period the distribution of households across tenure category (e.g., mortgaged, rented, or homes owned outright) changed significantly. In 1981, 40 per cent of households owned their homes outright; by 2006 this had fallen to 34 per cent. A possible reason for this decrease may be the increase in the length of mortgage terms and the recent trend of top-up/remortgaging for equity release. Mortgaged households increased from 26 per cent to 39 per cent. The consequence of these increases is that the number of households renting or in a tenant purchase scheme (TPS) fell from 33.6 per cent in 1981 to 27 per cent in 2006.

The HBS data in Table 5.1 indicate that over the course of the four HBS samples, households increasingly choose to use the Associated or retail banks[3] as their mortgage provider. Building societies maintained a relatively constant share of the market over time illustrating their ability to change and compete with new entrants in the market place. Local authorities' share of the mortgage market fell significantly from 38.4 per cent in 1988 to 7.5 per cent in 2005, mainly influenced by Government policy changes. Insurance companies had a relatively low share of the market in 1988 (3.6 per cent) and by 2005 they have essentially exited the market (0.4 per cent).

Over this period disposable income increased significantly, helping to explain why many households chose to own a home. Table 5.2 displays household weekly disposable income by employment type. All employment types experienced significant increases in their disposable income over the

[2]Both the Census of Population and the Household Budget Survey are discussed in Chapter 2.

[3]Associated Banks refer to Bank of Ireland, the Allied Irish Bank, Ulster Bank and the National Irish Bank, because they provided a clearing system for all other Irish banks.

course of the HBS samples. The largest increase of 136 per cent was enjoyed by lower professionals and non-manual workers who saw their average weekly wage increase from €367 in 1988 to €867 in 2005. Self-employed individuals and farmers experienced the lowest increase, albeit at a high level of 76 per cent. The lowest paid section of the economy, unskilled manual and other non-specified gainfully employed households saw disposable income increase by 110 per cent from a weekly average of €197 in 1988, to €412 in 2005. This increase in disposable income should be viewed in the context of massive economic growth and development in Ireland over the period, with massive increases in the both the cost and standard of living. Fundamental growth and investment significantly improved the economy resulting in the much needed convergence with our European counterparts.

Table 5.3 gives the breakdown of *owned outright* and the restricted *mortgaged* tenure categories by age, allowing comparisons to be made between peer groups across time. The first section shows that households over the age of 75 increased their share of outright owned housing stock from 14 to 18 per cent between 1988 and 2005. It is thought that better health standards in elderly households, longer life expectancy and increased wealth of their children means that elderly households maintain ownership of their home for longer. The 45 to 64 year olds also experienced an increase in outright ownership of their housing stock. The decline in outright ownership for all other age groups could be due to prolonged repayment periods caused by longer mortgage terms, top-ups, remortgaging and equity release, resulting in outright ownership occurring later in life. Another factor that could explain why households are taking longer to pay off their mortgages is that increased house prices have meant that longer mortgage terms are needed to maintain a lower repayment burden.

As discussed in the literature Attanasio *et al.* (2005) find that home-ownership falls off in old age due to the desire to service debt during earlier life-cycle stages and to increase consumption and leisure in later years. However, HBS data suggest that in Ireland older households have been retaining their homes. As discussed in Patiner and Lee (2009) this is possibly due to higher wealth holdings of their children and the reduced need for financial assistance from elderly parents to acquire properties for themselves.

The second section of Table 5.3 illustrates the distribution of mortgaged households by age. It indicates that households aged between 35 and 44 years have the largest stock of mortgages compared with other age groups in 2005; however, when compared with previous generations at that age, their share of household stock has increased from 37 per cent to 41 per cent. As disposable income and family dynamics change in early middle-age households tend to move into the owner-occupier category [Somerville (2007)]. In Ireland this shift from renting traditionally occurred in the 25 to 34 age bracket; however, this age group decreased its share of the mortgage market from over 36 per cent in 1988 to 23.5 per cent in 2005. This is possibly due to young first-time-buyers being priced out of the market in the boom years, when compared with previous generations of 25 to 34 year olds.

Another factor that may have caused a delay in purchasing property could be higher educational achievements, meaning that it is slightly later in life that potential buyers are in a position to purchase. Table 5.4 shows the *educational attainment* of mortgaged households by age cohort in 1995 and 2005. It indicates that there was a significant increase in the level of educational achievements attained by households. For example, 28.6 per cent of 25 to 34 year olds held a higher level degree in 2005 compared with 13 per cent a decade earlier. While education increases potential earnings, it also changes the consumption patterns in the life-cycle.

5.3.2 Changes in the Residential Mortgage Market

When examining changes in household tenure trends, it is necessary to consider the recent economic history of the country. Changes made in the Irish mortgage market over the past twenty years resulted in a significant increase in supply and demand for property as primary residence and buy-to-let investments. These changes occurred through a combination of domestic and international financial market deregulation and liberalisation, which increased the supply of cheap credit. A number of Government taxation policies were introduced incentivising households to invest in property.

Financial Sector Changes (1974-2007)

The composition of the Irish mortgage market changed significantly after 1974; prior to this, only building societies, local authorities and assurance companies provided mortgages. Figure 5.2 displays the Department of the Environment, Heritage and Local Government's (DoEHLG) distribution of annual residential mortgages by provider type. It shows that Associated/retail banks provided just 0.3 per cent of mortgage loans paid in 1975; however, by 1988 this share had increased to 16.2 per cent. Retail banks continued to expand their share of mortgages paid throughout the 1990s, peaking at 84 per cent in 2007.

Financial liberalisation significantly increased the supply and demand for credit in Ireland. As discussed in Browne *et al.* (2003) and Kelly and Everett (2004), this liberalisation occurred during the 1980s and 1990s when steps were taken to remove credit, capital and interest rate controls. Developments in the Irish financial market reflected international financial environment changes made during the establishment of the European Monetary System (EMS). The steps taken in Ireland included (but not limited to) the following,

- abolishing formal guidelines on private sector lending in 1984,
- reducing primary liquidity ratios from 10 per cent in 1979 to 2 per cent in 1999,
- removing restrictions on interest rates and increasing competition in the retail banking market since 1985,
- access to international funding markets increased, allowing domestic banks access more credit and extend the supply of credit beyond domestic deposits,
- removing all exchange rate controls by 1993 and joining the Euro also increased access to credit, reducing the associated exchange rate risk, and
- allowing financial institutions to set their own lending and deposit rates generated a more competitive market.

These steps not only increased the supply and reduced the cost of credit for the private sector (i.e., households and non-financial corporations), but deregulation also opened the Irish credit market to foreign institutions, which further increased competition in the financial sector. In addition to changes on the supply side, demand for credit from the private sector increased as many believed that joining EMU would rapidly reduce interest rates and keep them at a level below what they would have otherwise been. Capital liberalisation in the financial sector allowed institutions respond to increased household demand for funding, fuelling the growth rate of household sector credit and house prices.

The increased competition in the market resulted in the development of new innovative products by financial institutions. These include: internet banking, reduced transaction costs, near elimination of cheques, the introduction of ATM and debit cards. Changes were also made to credit facilities, which include: increased loan-to-value ratios, increased mortgage to salary ratios (from an approximately three-time to six-time disposable income), 100 per cent mortgages and tracker mortgages (introduced in 2005 and 2007, respectively). The belief that property appreciation would continue meant that financial institutions were prepared to take greater risks than before. This was because if a customer defaulted the growth in value of the house would ensure limited losses would be incurred. As a result of these factors, household that previously would not have qualified for a mortgage, were given access to credit creating a highly indebted and vulnerable segment of society.

Government Taxation Policies

The most significant underlying factor affecting how much a household will borrow to purchase a home is the interest rate charged. As discussed the introduction of the ERM and the EMS (predecessors or the euro in the 1990s) led to lower interest rates. However, this was not the only factor to encourage households to invest in property.

Barham (2004) reviews the effects of Government taxation policy on the cost of capital in housing. He examines both direct taxation on property and tax incentives introduced in Ireland between 1976 and 2003. He shows that

Governments tend to focus on private home ownership with many policies being specifically designed to encourage this investment decision. Tax incentives, such as mortgage interest relief, first-time-buyers (FTB) grants, zero capital gains tax on the sale of primary residence and the abolition of property taxes, were all designed to increase households' demand for property in this period.

On the flip side, the Government generated a substantial amount of revenue from stamp duty paid on the purchase of residential property. Stamp duty receipts increased from €60 million in 1980 to a peak of €3.7 billion in 2006. Stamp duty rates were first introduced in 1892 (0.5 per cent) but it was not until the late 1960s and early 1970s that a banded system was introduced. While this was a significant source of revenue for the Government it did not discourage home ownership. The highest rate was 9 per cent; however, those purchasing within the national average house price bracket paid between three and four per cent stamp duty over the past two decades. As many FTBs were being priced out of the market the Government reduced the stamp duty rate for FTBs in 2000, and subsequently abolished it in 2007. Since the early 1990s the removal of property taxes and a general decline in income taxes (mainly due to the large increase in stamp duty and capital gains taxes generated in the boom years) further encouraged households to invest in property. In an attempt to stimulate the property market after the financial crisis, the Government announced a new stamp duty policy in the December 2010 budget. A flat stamp duty rate of one per cent is applied to any monies paid up to the value of €1 million, and any amount paid over this threshold is taxed at two per cent; this will be applied to all purchases regardless of buyer status. The next section examines returns on property compared with alternative investment options available to households using the Sharpe Ratio.

5.3.3 Sharpe Ratio Analysis of Investment Options

The combination of Government policies and financial liberalisation increased competition, innovation and prices in the mortgage market. FTBs were eager to enter the mortgage market and those that already owned property were incentivised to buy larger homes and/or to invest in buy-to-let prop-

erties. When a household decides to purchase a home they must consider three distinct factors: first, how much will the mortgage cost compared with renting an alternative property? Second, how much will the property appreciate over the course of tenure generating capital gains for the investor? And finally, is there an opportunity cost of investing in property over alternative investment options (i.e., stocks and shares, high return deposit accounts, Government bonds, etc.)? This section examines the returns on alternative investments compared with residential property investment.

Figure 5.3 shows the annual rate of return on residential and commercial property, equities and 10-year Government bonds. Equities are clearly the most volatile investment option facing households, however, they did provide the highest returns during the mid 1990s. Returns on property and Government bonds are clearly more stable. However, just analysing the returns on an asset is misleading, as it does not account for the associated risk involved with each asset.

The Sharpe Ratio,[4] which is a relatively simple financial measurement, can be used to characterise how well the return of an asset compensates the investor for the risks taken. The higher the Sharpe Ratio the better the performance of the asset. The Sharpe Ratio measures the excess return per unit of risk in an investment asset and is defined as:

$$S_i = \frac{[E(r_i) - r_f]}{\sigma_i} \tag{5.1}$$

where S_i is the Sharpe Ratio, $E(r_i)$ is the mean of the random return on investment r_i, r_f is the best available rate of return of a risk-free security and $\sigma(i)$ is the standard deviation of r_i.

There are two forms of returns, capital gains and income earned. In the case of residential and commercial property, capital gains are valued as the annual growth rate of prices. Additional income earned is generated from letting the property (i.e., rents). Returns on equities can be viewed in a similar manner, where dividends can be compared with property rents and capital gains arising from an increase in the value of the stock. It is assumed that there is no gearing required for the investor and as such there are no

[4]The Sharpe Ratio was derived by William F. Sharpe in Sharpe (1966). Due to its simplicity it is one of the most referenced risk/return measures in finance.

interest rate implications on mortgages or other loans for funding.

Table 5.5 gives the portfolio performance over two periods from 1989 to 2005 (the final year of the HBS sample) and 1989 to 2009. This provides additional insight into the financial situation of households due to the crisis. In this instance the 10-year Irish Government bonds yield is the risk-free security, which is an updated replication of Woods (2007).

In the sample 1989 to 2005 the highest returns were generated by residential buy-to-let properties, with an average annual return of nearly 20 per cent. Commercial buy-to-let returned the next best annual average of 16.6 per cent over the period, followed by returns on equities including dividends at 16 per cent. Returns for owner-occupiers (i.e., potential capital gains) had one of the lowest returns in the sample at 10.5 per cent. When the associated risk (or variance) is calculated it shows that equities carry significantly more risk that other investment options. This is followed by commercial property investments, with the associated risk on residential property remaining relatively low. It is important to include this risk factor when calculating households' investment decisions, as it can help explain why households invest in one asset over another. The results from the Sharpe ratio indicate that once risk has been accounted for residential property investment becomes the best option. Analysis of the larger 1989 to 2009 sample shows a significant fall in returns for all asset types with the exception of 10-year Government bonds. Residential BTL properties still had a relatively healthy return and the highest Sharpe Ratio albeit at a lower level than before the crisis.

While future growth will determine returns generated on any investment, past returns drive households to invest, but additional costs incurred from the investments must also be considered. For example, any income earned on a rental property (be it commercial or residential) is subject to income tax, along with a capital gains tax on any profit generated in the eventual sale of the property/asset; neither of these costs is applied to primary residences. However, interest charges must also be considered in relation to mortgaged properties versus other assets which may be bought with savings. These simple calculations do not account of interest rate fluctuation that will occur over the mortgage term.

Figure 5.4 compares the price earnings (PE) ratio of residential house prices to rental income with real interest rates from 1998 to 2010. It shows that as real interest rates declined the returns on property increased. The average PE ratio of property over this period was 18 per cent, increasing from 12 per cent in 1998 to a peak of 24.3 per cent in 2006Q2. Real interest rates increased significantly from 2009Q1 due to the contraction in the real economy and negative inflation rates; this affected the PE ratio which fell below the period average to 17 per cent in 2009Q4. The combination of high returns on property investments, Government incentives and the belief that one may be priced out of the housing market spurred many households to continue purchasing over-valued properties during the boom, creating a highly indebted household sector. The following section discusses trends in household's indebtedness over the period.

5.3.4 Household Indebtedness

As a consequence of political and financial policy, including entry to the Euro Monetary Union, Household Sector Credit (HSC) increased by approximately 17.6 per cent per annum over the past decade. Figure 5.5 shows that HSC increased significantly, as a percentage of both Gross Domestic Product (GDP) and Gross National Product (GNP), from around 30 per cent in 1992 to over 100 per cent by 2008.

Property related lending accounted for approximately 80 per cent of HSC credit growth per annum over this period. Between 1993 and 2009 property related lending grow on average 18 per cent per annum; however, until 2003 this growth was primarily driven by fundamental changes in the economy. Increased disposable income, demographic changes and economic growth were among the factors fuelling this growth. Since the crisis began in 2007, the continued increase in HSC as a percentage of GDP and GNP has been driven by falling GDP and GNP levels.

Figure 5.6 displays the relationship between real average household disposable income, average real mortgage values and national average real house prices since 1970. It is quite clear from this chart that there has been a significant divergence between average disposable income and house prices. However, the relationship between average mortgage values and house prices

has remained relatively constant over time. Even with the huge increase in house prices most potential buyers still manage to provide significant deposits; this could be due to the increased number of double income households since 1995 or support from other family members. Notwithstanding the additional disposable income generated by a second income, house prices and mortgages were significantly higher relative to disposable income in 2009 than pre-1995. These higher house prices continued to be affordable due to extended mortgage terms, lower interest rates, higher loan-to-value (LTV) ratios and the introduction of 100 per cent mortgages.

HSC can be broken down into housing-related lending (including extensions & renovations), finance for investment purposes (e.g., buy-to-let properties, education, etc.), credit-card debt and other personal loans (e.g., holiday or car loans). In 2009 HSC fell by 2.9 per cent from €169,047 million in 2008 to €167,729 million. Housing-related lending accounted for 88.6 per cent of this, with the remaining 13.3 per cent being attributed to other credit. To examine the real burden of household debt, credit is displayed as percentage of disposable income in Figure 5.7. It shows that in 1992 property-related lending accounted for just 31.8 per cent of disposable income; however, by 2009 it reached 161 per cent. Other personal loans doubled from around 9 per cent in 1992 to 18 per cent in 2009, while finance for investment remained relatively constant averaging about 2.5 per cent per annum over time, except for a spike of 6.4 per cent in 2007. Outstanding credit card debt[5] (i.e., debt that is not paid off in full each month), increased from 1.5 per cent in 1998 to 3.2 per cent in 2009, indicating an increased dependence on short-term credit since the start of the recession.

As discussed in Section 5.3.2, deregulation and liberalisation of the banking sector along with joining the EMU significantly reduced retail interest rates in the 1980s and 1990s. This improved households' access to cheap credit, resulting in the accumulation of larger quantities of debt than ever before. Central Bank data indicated that at year end-2009 the stock of residential mortgages on variable rate contracts was 86 per cent compared with 62 per cent in 1999 (Figure 5.8). In addition to this, 84 per cent of new mortgage business opting for variable contracts in the same period. Households

[5]Credit card debt was collected as a component of other personal loans until 1998

are therefore more exposed to interest rate fluctuations as their mortgage repayments are immediately affected by any interest rates changes made by the ECB or their mortgage provider.

This interest rate risk may have been somewhat mitigated by the introduction of tracker mortgages in 2006. While no official tracker mortgage data are available, it is thought that they account for a large portion of the banking sectors loan book as they proved to be very popular with many households remortgaging to take advantage of these favourable long term rates. Tracker mortgage rates are set at a constant level above the ECB base rate, implying that when the ECB lowered interest rates many households experienced a fall in their mortgage repayment burden. From a banking sector perspective, tracker mortgages have been a loss-making product since the onset of the crisis, given that banks wholesale funding rates have risen significantly above the ECB base interest rate. To compensate for these losses retail banks have increased their fixed and standard variable interest rates affecting mortgage repayment burdens for households not on trackers.

When analysing the financial stability of the household sector it is important to assess household indebtedness against the net-worth position of the sector. Cussen *et al.* (2008) estimate the level of Irish household wealth in 2006 was €641 billion (Figure 5.9). This wealth value is the combination of the household sectors financial assets and liabilities worth approximately €306 billion and €176 billion, respectively,[6] and an estimated dwelling[7] stock value of €571 billion. Cussen and Phelan (2010) revised this analysis to estimate the effect of the economic crisis on households' net wealth. They find that from 2007 the combination of falling house prices and stock market volatility contributed to a decline in the household sectors' net worth. By

[6]Data source: CSO's, Financial Sectoral Accounts; financial assets are both domestic and foreign assets.

[7]Cussen, Kelly and Phelan (2008) estimated housing assets based on the volume and value of the housing stock. Data on the size of the housing stock were derived from annual house completions calculated by the DoEHLG. Two key adjustments were made to these data. First, an estimate of annual depreciation was incorporated and secondly 15,000 houses were deducted from 2007 completions to account for houses built but not sold. Data on the value of housing assets were obtained from the Permanent TSB/ESRI house price index. In accordance with national accounting, end-year prices were used for new and existing housing to estimate the value of the housing stock in a given year, whereas the annual average price for new housing was used to estimate transactions in housing in a given year.

2010Q2 household net worth fell by 31 per cent to €439 billion or 2003 levels of which financial asset and liabilities were €286.8 billion and €198 billion, respectively, with the largest decline occurring in housing assets.

High levels of household sector wealth usually correspond with high levels of indebtedness. Figure 5.10 shows ECB data for Ireland's household sector indebtedness compared with other Euro Area countries in December 2009. Ireland has the highest lending for house purchases at 68 per cent of GDP, followed by the Netherlands (65 per cent). However, this must be taken in the context of the high level of home ownership in Ireland compared with other western European countries. Irish households appear to purchase a home as soon as they can afford it, regardless of the economic environment around them.

Table 5.6 gives a cross-country comparison of home ownership across western Europe. In 2004 Ireland had the second highest ownership rate at 79 per cent, behind Spain, by 2008 this had fallen to 77 per cent, possibly due to the increased number of repossessions and property sales due to the financial crisis. The EU-SILC data used for 2008 indicate that Eastern European countries tend to have home ownership of between 86 and 96 per cent as a consequence of policies implemented during the dissolution of the Former Soviet Bloc. Slovakia, Lithuania and Romania have 89, 91 and 96 per cent ownership, with mortgaged households accounting for 7 per cent or less of owner-occupiers in these countries.

5.4 The Model

5.4.1 Probit Choice Model

Given that households continue to invest in owner-occupied properties, it is necessary to examine what factors affects the probability of owning a home? This section builds on previous research by using the household budget survey of weekly expenditure and applies Binary Choice Models to analyse a household's decision to own a home. It also explores whether the factors affecting that decision have changed over the course of the four Household Budget Surveys discussed in Chapter 2. These models are used to analysis either/or scenarios; they are necessary because using Ordinary

Least Squares (OLS) regressions with a binary dependent variable (i.e., Y=1 or Y=0) is not possible as the assumption of homoscedasticity is violated.

There are two models in this area, the Probit[8] and Logit[9] models. The principal difference between the models is that the probit model assumes the cumulative distribution function (cdf) is a standard normal distribution (Φ), while in the logit model the cdf follows a logistic distribution[10] (Λ). Given the similarities between the two models only the probit model will be discussed in detail; however for robustness all estimates are run as both probit and logit models.

The decision of the ith household to own a home or not depends on an unobservable latent variable Y_i^* which is determined by a vector of explanatory variables (X) such as: age, income, saving, double or single-income or single-parent household, financial knowledge and/or awareness, and the level of household indebtedness. The larger the value of Y_i^* the higher the probability of the household owning a home. Given that Y_i^* is unobservable, it is necessary to assume a new binary variable y_i where $y_i = 1$ if the household is an owner-occupier and $y_i = 0$ if not. The model can be written in the form:

$$Y_i^* = x_i^{'}\beta + \epsilon_i \tag{5.2}$$

where Y_i^* is the unobservable decision/utility to own a home, β is the vector of coefficients and ϵ_i is the error term. The probability function of the event occurring can take the form:

$$Pr(Y = 1|X) = \Phi(X^{'}\beta) \tag{5.3}$$

subject to:

$$y = \begin{cases} y_i^* & \text{if } y_i^* > 0 \\ 0 & \text{if } y_i^* < 0 \end{cases}$$

[8]The Probit Model was introduced by Chester Bliss in 1934; Ronald Fisher proposed a fast method for computing maximum likelihood estimates (MLE) for Probit models in the same article.

[9]The Logit Model was introduced by Joseph Berkson in 1944, the term was coined based on the similarities to the Probit Model

[10]The Logit Model's cumulative distribution function (cdf) is: $\Lambda(X^{'}\beta) = \frac{exp(X^{'}\beta)}{1+exp(X^{'}\beta)}$

where, Pr denotes the probability, Y_i is the observed dummy variable of home ownership (subject to Y_i^* being positive), β is the vector of coefficients, $X^{'}$ is the vector of N independent variables, the β parameters are estimated by maximum likelihood and Φ is the standard normal cdf distribution for the probit model. The model is estimated using a Maximum Likelihood Estimation (MLE) where the joint log-likelihood function for the model is:

$$ln\mathcal{L}(\beta) = \sum_{i=1}^{n} \Big(y_i ln\Phi(x_i^{'}\beta) + (1 - y_i) ln(1 - \Phi(x_i^{'}\beta)) \Big) \tag{5.4}$$

The probit model measures the probability of the event occurring. Results for these models can be difficult to interpret and explain given that the coefficients relate to a change in the dependent variables' z-scores. The results are therefore presented as the predicted probabilities or the marginal effect[11] (or slope) of the event occurring from a unit change in an explanatory variable.

The marginal effects are interpreted as the effect of a one-unit change in the explanatory variable on the dependent variable. For example, a one unit increase in disposable income will increase the likelihood of a household owning a home by x per cent, subject to all other things being equal. Each explanatory variable's effect is independent of movements in other variables. In the case of dummy variables,[12] β measures the estimated change in probability of a discrete change in the dummy from 0 to 1. Positive signs on coefficients indicate that the variable will increase the probability of the event occurring, in this case home ownership.

5.4.2 Regression Specifications

Four binary regressions are explored in this chapter. Each specification builds on the previous one, where the first relates to personal characteristics

[11] As discussed in Anderson & Newell (2003), the marginal effects for *continuous variables* are equal to: $\frac{\partial E[y|X]}{\partial X} = f(\beta^{'} X)\beta$. When continuous variables are normalised to equal zero, $\beta^{'} X$ becomes c, an estimated constant term. As c becomes more positive, $F(c) \rightarrow 1$; while $f(c) \rightarrow 0$, and the marginal effects approach zero.

[12] For a dummy variable the marginal effect refers to the discrete change of the dummy from zero to 1. The *discrete probability* effect of a dummy variable is defined as: $E[y|d = 1] - E[y|d = 0] = F(c + d) - F(c)$ where d is the estimated parameter for the dummy variable. Given that c is in both terms of this equation the net effect of the dummy variable approaches zero, regardless of whether c becomes increasingly positive or negative.

of the household, (i.e., age, education, employment, income, etc.) and the second includes house-related characteristics such as location and size of the property and the third corrects for year-specific variables in the year the property was occupied. In the final specification the sample is restricted to new occupants only (i.e., those in residence for one year or less at time of surveying). It is assumed that their financial circumstances have not changed within that period; therefore the effect of financial characteristics on the decision to rent or purchase a home can be assessed over time.

Probit Model I: Personal Characteristics

$$\begin{aligned} y_i &= \beta_1 lnDI_i + \beta_2 lnsch_i + \beta_3 male_i + \beta_4 married_i \\ &+\beta_5 lnpersons_i + \beta_6 dblinc_i + \beta_7 age_i + \beta_8 emptype_i \end{aligned} \tag{5.5}$$

where y_i is the dependent variable equal to 1 if the household owns their home and zero otherwise, $lnDI_i$ is the log of disposable income for each household, $lnsch_i$ is the log of years of schooling for the ith household, $male_i$ is a dummy variable equalling one if the head is male, $married_i$ is a dummy variable for married households, $lnpersons_i$ is the log of the number of persons in the household, $dblinc_i$ is a dummy variable for a double income household, Age_i is age of the household head and $emptype_i$ define the head of household's employment by labour type (i.e., professional, skilled, unskilled, etc.)

Probit Model II: Personal and House Related Characteristics

$$y_i = \beta_1 lnDI_i + ... + \beta_{10} townsize_i + \beta_{11} rooms_i \tag{5.6}$$

where the additional variables are $townsize_i$, which identifies the households in relation to the size of the population in their local area and $rooms_i$, indicates the size of the property.

Probit Model III: Personal, Housing and Year Specific Characteristics

$$y_i = \beta_1 lnDI_i ..... + \beta_{11} yrocc_i + \beta_{12} aveDI_j + \beta_{13} aveHP_j + \beta_{14} aveRent_j + \beta_{15} nIR_j \tag{5.7}$$

where the additional variables are $yrocc_i$, the year the household occupied the property as rented or owner-occupied, $aveDI_j$, the national average disposable income in the year occupied j, $aveHP_j$, the national average house price in the year occupied j, $aveRent_j$, the national average rental in the year occupied j, and nIR_j, the nominal interest rate in the year occupied j. Working status was excluded from this specification as it was no longer significant. Average national savings rates, loan to value ratios and price-earnings ratios were all tested in this specification but they where found to be insignificant.

Probit Model IV: Financial Characteristics of new residents

$$y_i = \beta_1 lnDI_i + ... + \beta_{14} totsavings_i + beta_{15} loans_i + \beta_{16} havess_i \quad (5.8)$$

where the included financial variables are $totsavings_i$, the weekly amount each household saves, $loans_i$, personal household loan repayments and $havess_i$, a dummy variable for having stock and shares. Employment type is dropped from this specification as it becomes insignificant. Each specification is estimated for the four Household Budget Surveys, allowing for analysis within a survey year as well as over time.

5.4.3 Probit Model Results

This section gives the results of the four regression specifications described above. The dependent variable is a dummy variable equal to one if the house is owner-occupied (i.e., owned outright or with mortgage) and equal to zero otherwise. The results are given as the marginal effect of a one-unit change in the explanatory variable on the probability of ownership.

Equation 5.5 captures personal characteristics that affect a household's decision to purchase a home. Table 5.7 give the results of this specification across all four household budget surveys. The log of *disposable income* is positive and significant in all years, however, while the marginal effect of a unit change in disposable income declined in 1995 and 2000 it recovered its effect on determining home ownership in 2005. The log of *schooling* has also had a decreasing affect over time, traditionally higher education levels

increased the probability of home ownership; however, it would appear that affordability has improved across all education levels.

Demographic and social changes over the past twenty years such as divorce, marrying later, and an increase in female labour force participation are assumed to be factors explaining the declining effects of head of household *sex*, *marriage*, and *number persons* in the household on the probability of home ownership. The relatively consistent effects of being a *double income* household also correspond with these socio-economic changes.

The *age* of the head of household has a positive and significant effect on the probability of ownership. In 1988 and 1995 households in the 35 to 44 age bracket had the highest probability of ownership; however, in 2000 and 2005 these have been overtaken by the 45 to 54 age cohort, which will roughly represent the same households who have aged over the surveys. Over time the effect has become marginally less significant in the 25 to 34 and over 65 age cohorts. This is probably because the age of first-time-buyers has increased due to higher educational attainments and increased house prices. The fall in older age cohort probability of ownership could be due to increased availability of retirement homes, where older relations choose to leave their home, so their children can sell or live in it. In each specification age is found to be statistically significant at the one per cent level but due to space restriction it is only reported in the Table 5.7.

The *employment type* of the household head has a positive and significant effect on the probability of home ownership. The omitted group include unskilled-manual labourers, agricultural workers, and all other gainfully employed households not specified as defined by the CSO for the population census. Households are determined by the occupation of the head of household; however, if they are unemployed or retired they are classified by their former occupation, ensuring that the entire sample is accounted for. The probability of ownership increases with each employment type relative to the omitted variable. The highest marginal effects occurred when the household was self-employed.

Equation 5.6 builds on the personal characteristics discussed above by including property-related variables to explain home ownership; results are given in Table 5.8. *Population density* has a negative effect on the proba-

bility of ownership in most years: that is living in Dublin, another city or large town will reduce the probability of home ownership. This is possibly due to a higher demand for property, increasing house prices in these areas, thus reducing affordability for many households. An alternative cause for lower probability of ownership in Dublin could be due to the availability of more rental units than in smaller cities and towns.

The other property-specific variable added to the specification is *number of rooms*, which proxies for the size of the property. Traditionally larger properties tended to be owned-occupier family homes. However, as many divorcees and first-time-buyers invested in smaller apartments and starter homes, the effect of property size on home ownership has fallen over time, though it remains significant at the one per cent level in each HBS year. The inclusion of these variables had little effect on the existing variables in the regression but the pseudo R^2 indicates an improvement in the specification.

Equation 5.7 includes year-specific macroeconomic variables for the year that the household occupied the property. These variables include national averages for disposable income, house prices, rental values and mortgage interest rates. Table 5.9 gives the results (controlling for the age of the household head), which show that *mortgage interest rates* became less significant over time which corresponds with lower interest rates and the liberalisation of the banking sector since the 1980s. *National house price* averages have very little effect on the probability of a household owning a property; this is probably due to personal affordability as the national average house price will not directly affect a household's decision. However, lower average prices may increase the size or value of what a household can afford. In addition social and family pressures to get onto the property ladder in recent years are likely to overrule some of these effects. A household's fear that they will not be able to afford a home later on could result in irrational consumption behaviour.

Average disposable income has a negative effect on the probability of ownership, which is possibly due to the effect that increasing disposable income levels have on house prices. Higher average disposable income at a sectoral level increases the amount households can borrow nationally and therefore the amount households have available to bid on property. *Rental*

yields have had significant effects in all samples, indicating that the higher the cost of renting the higher the probability of households choosing to repay a mortgage rather than effectively repaying someone else's mortgage by renting.

The final probit regression (Equation 5.8) restricts the data to new occupants, both renters and mortgagees. It is assumed that a new occupant has been in residence for one year or less, and that their financial situation has not varied over that time. This enables one to analyse the factors that affect the actual *decision* to purchase instead of simply the probability of ownership. The results given in Table 5.10 indicate that personal characteristics such as age, gender, marital status and the number of persons in the household unit are consistently the most significant factors in a person's decision to purchase a home.

Financial variables such as disposable income, savings and personal loans do not appear to have as significant an impact on new occupants as expected. This could be due to the household's perception of the housing market; if the household is desperate to get onto the housing ladder, regardless of the financial pressure it generated, it would explain why rational financial factors are less significant. Location only becomes significant in the 2004/05 sample which again could be an indicator of the oversupply of property during the boom. For robustness all regressions were estimated using a logit model discussed in the model section, and as expected results were not found to be statistically different from those in the probit model.

These results indicate that the probability of owning a home is primarily due to personal and family factors as indicated in much of the literature. While reductions in interest rates have improved households' access to affordable credit and therefore increased ability to purchase a home, they have also increased house prices and mortgage terms. The question that must then be asked is: have these households who chose to purchase without regard to their financial constraints over-stretched themselves? The following section explores household repayment burdens across the four household budget surveys and estimates what kind of financial stress households who were surveyed in 2005 may have faced in 2009.

5.5 Household Mortgage Repayment Burden

The purpose of this section is to examine changes in the mortgage repayment burden of owner-occupiers since they were surveyed in 2005. It is important because the increase in both the volume and value of residential mortgages along with the share of the market held by commercial lenders indicates that the Irish mortgage market has become more important to the Irish economy than was previously the case. Accordingly, it is necessary to examine households' mortgage repayment burdens and their changing dynamics over the last 20 years.

5.5.1 Estimation of 2007 and 2009 Data

This section of analysis is restricted to *mortgaged* households with commercial mortgage providers (i.e., building societies and other retail credit institutions) the data are also restricted to mortgages withdrawn no later than 1970.[13] Considering that HBS data are only available until 2005, it was necessary to estimate the 2007 and 2009 data. This was achieved as follows:

- Households are assumed to be on variable mortgage interest rates with mortgage contracts that have not changed since 2005 (i.e., households have not re-mortgaged, or made any additional lump sum repayments and have not moved house, etc.).
- Central Bank data for quarterly mortgage interest rates are used to isolate the interest component of households' mortgage repayments in the 2005 HBS.
- The remaining element is the principal repaid each month and it is assumed that between 2005 and the two estimated years the principal repayment amount remained constant.[14]

[13]These restrictions reduce the sample size to 1,363 in 1988; 1,753 in 1995; 2,035 in 2000 and 2,255 in 2004. This restriction is applied as mortgage data are not available prior to 1988

[14]When interest rates are increased households mortgage repayments increase; however, to adjust the burden the principal portion of the payment is decreased while the interest portion increases. The consequence of the constant principal repayment assumption means that the actual amount of principal repaid will be less than the assumed amount if interest

- The principal is then multiplied by the number of months between the time surveyed and the two estimated years to calculate the amount of principal repaid. The 2007 and 2009 principal outstanding figure can then be generated by taking the two estimated principal repayment amounts from the 2005 principal outstanding value. If this results in a negative principal outstanding than the household is assumed to have fully repaid its mortgage and the mortgage burden is set to zero.

- The December interest rates for 2007 (5.09 per cent) and 2009 (2.68 per cent) are applied to the new figure for principal outstanding to estimate the new interest element of the mortgage. This is added back to the original monthly principal component to estimate the household's mortgage repayments for 2007 and 2009, respectively.

- According to Central Bank of Ireland estimates, average disposable income increased by 13.95 per cent between 2005 and 2007. It estimated that between 2005 and 2009 it increased by 11.42 per cent (which includes crisis-related falls in income). Therefore each surveyed household's disposable income is increased by these two rates to generate 2007 and 2009 individual household's disposable income level for each year.

- The new mortgage repayment burdens are then estimated by placing the new mortgage repayment figures over the estimated disposable incomes for 2007 and 2009.

There are a number of caveats in relation to these estimated data which need to be highlighted. For example, there is no way to account for promotions or increased salary due to time in a company, nor can wage cuts, reductions in working hours or redundancy be calculated. Notwithstanding these shortcomings, the mortgage repayment burdens for 2007 and 2009 are recalculated as a percentage of their respective disposable income figures.

rates are increased. However, given the constant interest rates experienced over the time period in question, the overestimated principle paid would be less than 3 per cent year-on-year. Given the low impact such additional repayments will have on households this assumption is considered acceptable.

The 2005 HBS sample represents the total mortgage market population of 431,235 mortgaged households in Ireland. However, the estimated 2007 and 2009 data account for less of the market because Department of the Environment[15] figures show that 70,459 FTBs entered the market in 2006 and 2007, with an additional 31,682 FTBs in 2008 and 2009. This implies that the sample represents approximately 86 per cent of the 2007 mortgage market and 81 per cent of it in 2009. However, as these calculations do not account for any outflows (i.e., mortgages repaid, repossessions, emigration, deaths, etc) and therefore the figures are underestimated. The following section examines changes in mortgage repayment burdens in relation to the level of burden and years in residence.

5.5.2 Results of Estimated Data

According to the ECB FSR (2005) household lending accounted for approximately 35 per cent of the total euro lending stock in 2004, with household sector debt-to-GDP ratio increasing to 57 per cent in the euro area. However, this increase in household indebtedness was off-set by a combination of lower interest rates, increased loan-to-value ratios and longer mortgage terms of 30 to 35 years. This resulted in a relatively constant monthly mortgage repayment of approximately 11 per cent of household disposable income between 2000 and 2004. The ECB estimates that the sectors total debt to financial assets was 30 per cent in 2004, with a total debt repayment burden averaging about 12 per cent of disposable income.

Typically a household is assumed to be heavily indebted if its mortgage repayment exceeds 40 per cent of disposable income. Table 5.11 illustrates changes in the distribution of mortgage repayments by *level of burden.*[16] The first four columns are based on the equivalent survey year, while the fifth and sixth columns give the estimated figures for 2007 and 2009 as outlined above. Evidence from the survey years indicates that actual repayment burdens (measured as weekly mortgage repayments as a percentage of weekly

[15]These First-Time-Buyer mortgages do not include local authority tenant purchase agreements

[16]Indebtedness percentiles can be interpreted as follows: the first 20th percentile represents the average mortgage repayment burden of the least burdened households, with burden increasing up to the 90th percentile giving the average repayment burden for the most indebted 10 per cent of households.

disposable income) have generally declined between 1988 and 2005.

In 1988, when interest rates were over 11 per cent, 20 per cent of households had a mortgage repayment burden of less than 7.8 per cent of their household disposable income, with the most indebted 10 per cent of households spending approximately 31.5 per cent of disposable income on their mortgage repayments. However, by 2005 with interest rates at the significantly lower level of 3.45 per cent, household burdens had fallen to 5.7 per cent and 26.5 per cent for the least and most burden households, respectively. Average households spent 16 per cent of disposable income on mortgage repayments in 1988 and just 11 per cent during 2005.

The estimated mortgage repayment burden for 2007 remains relatively unchanged, though there were minor increases in burden estimated even though interest rates increased from 3.45 per cent to 5.09 per cent. These constant improvements were predominately due to relatively low interest rates compared with the earlier samples, rising disposable income and the fact that these households will have repaid some of the principal on their mortgage since they were surveyed in 2005. Between 2007 and 2009 disposable income fell, which should have increased mortgage repayment burdens; however, the reduction in ECB interest rates, implemented to increase the flow of credit in Europe during the financial crisis, have meant that the repayment burden for households actually fell in 2009 below 2005 levels. Therefore, of the mortgaged households surveyed in 2005, the median repayment burden fell below nine per cent of disposable income in 2009.

Mortgage repayment burdens can also be examined by *number of years in residence*. This is important because there are two elements that affect the level of household indebtedness during the contract. First, the household's debt to income ratio, and second, the household's ratio of mortgage repayment to income (burden). Should a household have constant income and interest rates over the course of the mortgage then the debt to income ratio will fall as the principal is repaid, while their mortgage repayment burden will remain constant as repayment is distributed over the course of the mortgage term. This is not a realistic scenario as both income and interest rates fluctuate over the course of a household's life-cycle. Earnings will increase with inflation along with increases generated from improvements

in the individual's experience/skill easing the monthly mortgage repayment burdens and debt to income ratios over time. This indicates that the most indebted households should be those with the youngest mortgages.

Table 5.12 shows the 2005 cross-sectional distribution of the repayment burdens by the number of years in residence. Households in their first year of a mortgage had a repayment burden of over 25 per cent, however, the average repayment burden between the sixth and tenth years was 12 per cent of disposable income, falling to less than 10 per cent for the remainder of the mortgage. As a result the impact of an interest rate increase will be larger for more recently mortgaged households than for those close to the end of their term.

5.5.3 Stress Testing Households Mortgage Repayment Burdens

The financial crisis which began in 2007 affected households in a number of ways. Disposable income decreased, interest rates decreased, unemployment increased and the Government imposed levies and additional taxes on all earners. Notwithstanding the discussed limitations of the estimated 2009 data, it is still interesting to determine the effect of changes in the economic environment on these households.

The stress-testing methods utilised in this section are similar to those in McCarthy and McQuinn (2010). They examined household mortgage burdens under unemployment and interest rate shocks, using data from the 2007 Survey on Income and Living Conditions (SILC). The two unemployment income scenarios stress-tested are achieved by reducing disposable income by 50 per cent and 75 per cent, respectively. They find that the proportion of households in the top mortgage repayment-to-income deciles increases by almost 16 per cent under the first income reduction scenario and 30 per cent in the second more extreme situation. In this case households in the median deciles spend 50 per cent of their income on their mortgage repayments, allowing them to track the movement of households from deciles to deciles. This section will build on their work using estimated data to stress-test 2009 mortgage repayment burdens for households who where owner-occupiers during the 2005 household budget survey.

Increase in Unemployment

When the 2005 HBS was being conducted, unemployment was approximately 4.5 per cent. By 2009 unemployment had risen dramatically to 12 per cent, with 2010 forecasts stabilising around 14 per cent. Therefore before any shock can be applied to mortgaged household unemployment[17], increases must be taken into account. This was done by randomly selecting 820 heads of households in the sample for redundancy, together with the 145 already unemployed; this represents a 12 per cent unemployment rate. Other household earners' income is assumed to remain unchanged from the estimated 2009 values; therefore a double-income household will have additional income available to combine with the unemployment subsistence from the State to fulfil financial commitments. Table 5.13 displays the distribution of newly unemployed households by tenure.

The loss of employment by the head of household will reduce the household's disposable income. There are three possible income scenarios estimated for the households where unemployment has occurred;

- The first scenario replaces the head of household's disposable income with the basic job seeker's allowance's of €204.30 per week in 2009.
- The second scenario replaces the earned income with €326.15, which is equal to the average disposable income of a household where the head is unemployed in the HBS.
- The final scenario involves a percentage fall in household income of 59 per cent. This figure is chosen because in the 2005 HBS, households where the head is unemployed earned an average disposable income of €16,959 or 59 per cent of the average employed head of household income of €39,100.

[17]Even though the employment category of the household head is available by NACE Rev2 code unemployment cannot be applied by sector. This is because between 2005 and 2009 some sectors experienced so much employment growth (after survey was conducted) that even with the significant level of redundancies' that occurred between 2007 and 2009 employment levels in these sectors were still higher than 2005 levels. Too many assumption would be needed to increase the entire sample and employment in specific sectors, therefore unemployment was randomly applied by STATA using unique-uncorrelated household reference numbers.

Table 5.14 displays the mortgage repayment burden of households in 2005 who were randomly selected for redundancy by years in residence. Column I represents their repayment burden in 2005 when they were sampled; column II, their estimated repayment burden in 2009 had they remained employed; column III, IV and V give their mortgage repayment burden under each unemployment scenario in 2009 as discussed above. Wage increases and lower interest rates explain why the repayment burden will have eased between 2005 and 2009, if the household remained employed. However, of the three unemployment scenarios, the third scenario of an income drop of 59 per cent had the most significant effect on households' mortgage burden.

New occupants on the basic job seeker's allowance (Scenario 1), would see their repayment burden increase from 27 per cent in 2005 to 38 per cent of income in 2009. Households in residence for more than 20 years would suffer an increase in their burden from less than 2 per cent to nearly 13 per cent in the same time frame. Households that claim additional benefits (i.e., children's allowance and all other social benefits) would experience a less severe increase in their mortgage repayment burden. Unemployment income Scenario 2 uses the average disposable income for an unemployed household which is over €100 a week more than the basic job seeker's allowance. As a result the mortgage repayment burden in Scenario 2 varies from nearly 9 per cent to 28 per cent of disposable income.

The final income scenario decreases a household's income by 59 per cent; this scenario presents the most significant increases in mortgage repayment burdens. Here new occupants could see their mortgage repayments increase to over 55 per cent of income with those in residence over 20 years spending nearly 13 per cent of income on their mortgage. Unfortunately, it is also the most likely scenario as the second household earner is also likely to have suffered some sort of income reduction over the past year, through reduced hours, wage cuts and tax increases. The probability of these households falling into arrears is relatively higher than other households suffering from income losses.

There are, however, a number of assistance and forbearance programmes in operation to facilitate some level of stability for households in distress. For example, the Department of Social Protection (2010b) offers Mortgage

Interest Supplement (MIS) for households who have suffered a temporary loss of income. This scheme pays a portion of the household's interest repayments during the period of reduced income to prevent households falling into arrears. All financial institutions offer some form of forbearance schemes to ease the financial strain for their clients (i.e., switching to interest only mortgages, payment holidays or deferred interest payments). In addition financial institutions are prohibited from taking legal action against a household's primary residence until they have been in arrears for at least 24 months. These actions may imply that the estimated figures in Table 5.14 will not be the actual mortgage repayments made if the household engages in one of these schemes.

The probability of falling into arrears and/or defaulting under any of the three income scenarios increases the longer a household remains unemployed. There is likely to be an initial savings stock that could be used to supplement income in the short-term; however, as savings are depleted and interest rates are increased the burden may become too much for many households.

Effects of Interest Rate Changes

Interest rates are expected to increase over the coming years as the ECB focuses on monetary tightening to prevent inflation occurring in the Euro Area. The prolonged period of low interest rates designed to increase the flow of credit during the boom and the subsequent recession are both coming to an end. Four increased interest rate scenarios are applied to the estimated 2009 data; 4.75 per cent, 5.75 per cent, 6.75 per cent and 7.75 per cent.

As discussed above, the mortgage repayment burdens for 2007 and 2009 were calculated using Central Bank data on mortgage interest rates[18] of 5.09 per cent and 2.68 per cent, respectively. Table 5.15 displays the effect of the four separate interest rate hikes. Panel A examines the interest rate shocks only, while Panel B, C and D show the interest rate increases in conjunction with the three unemployment income scenarios outlined above.

The results in Panel A indicate that interest rates would need to increase to around 6.75 per cent before households that owned property in 2005

[18]Rates are for December 2007 and 2009, from Table B2.2 monthly statistic release, housing loans with a greater than 5 year original maturity

would be under severe financial pressure from their mortgage repayments. The median repayment burden would range from 10.7 per cent to 13 per cent under these interest rate changes, while the most indebted would pay between 25 and 35 per cent of their disposable income on their mortgage repayments. This indicates that households which remain employed should be able to service their mortgage even if interest rates increase.

However, these estimates do not account for the 12 per cent unemployment level experienced in the economy in 2009. Panels B, C and D examine these interest rate increases in conjunction with the head of household's disposable income falling under the three income scenarios outlined above. Income reductions to the basic job seekers' allowance of €203.30 per week, (Panel B) indicate that the most indebted household's mortgage repayment burdens in these scenarios would vary between 28.6 per cent to 36.9 per cent, with the median households paying between 11 and 14 per cent of income.

Panel C considers the second unemployment-income scenario, where the head of household's income dropped to €326.15 per week. These households fare better than Scenario 1, but the most indebted households are still spending between 27 per cent and 38 per cent of their disposable income on their mortgage repayments. Finally, Panel D analyses the results from the third unemployment scenario, where household income is reduced by 59 per cent. As discussed above, this scenario is the most severe. The most indebted households would have their mortgage repayments increased to levels between 30 per cent and 40 per cent of their disposable income depending on the interest rate hike experienced.

5.5.4 Additional Financial Concerns

The financial strain experienced by households due to unemployment and potential interest rate increases, shown in the two preceding sections, indicates a very vulnerable household sector. Limitations with these estimations include: the lack of information on the stock of household wealth (i.e., stock of saving and investment), its falling representation of the mortgage population over time (approximately 80 per cent of mortgaged households

in 2009[19]) and its inability to capture the most distressed households who would have bought post-2005. The excluded 20 per cent of the mortgage market is the most likely to be in negative equity due to a number of factors such as: the recent fall in house-prices to below 2004 levels, the introduction of more generous loan-to-value ratios and higher loan to salary multiples. Households that find themselves in these circumstances will have excessive mortgage repayments relative to their declining disposable income. As a result the outlook for the household sector gives rise for concern.

Additional pressures placed on households include changes in the tax system and the introduction of health[20] and income[21] levies in 2009. These were subsequently combined and renamed the Universal Social Charge (USC) in the 2010 Budget. This new tax will be charged on gross annual income of more than €4,000. All income above this threshold up to €10,036 will be charged at 2 per cent, while additional earnings between €10,037 to €16,016 will pay 4 per cent, with any income over this level being subject to 7 per cent taxation. These changes have left many households worse off as the threshold for exemption has been lowered and medical card holders are not excluded from the USC.

While these measures were necessary for the Government to try to control its spiralling deficits as a result of increased expenditure and declining property-related tax revenues (e.g., stamp duty and capital gains taxes), they add significant pressure to households that are already financially strained. The result of these additional pressures on households will increase the number of households falling into arrears on their mortgages, which will ultimately result in default and repossession.

Central Bank data[22] indicate that 7.4 per cent (44,508) of primary resi-

[19]Between 2005 and 2009 approximately 90,000 FTB entered the market, with an unknown number of household outflows through repossession, emigration or death

[20]The health levy was incorporated into the PRSI payment system. Initially, employed persons paid the additional 2 per cent health levy on income from €26,000 to €100,100 and 2.5 per cent over this level. The levy was revised in the May 2009 emergency budget to 4 per cent on earning from €26,000 to €75,036 and 5 per cent on additional earnings.

[21]The income levy was introduced in January 2009 and revised in the emergency budget. Every employed person must pay 2 per cent of their gross annual income if they earn between €15,000 and €75,037. A levy of 4 per cent was charged on additional income earned to €174,980, and 6 per cent on subsequent money earned over €175,000.

[22]Limitations of the Financial Regulator data include: first, data are only collected for own-occupied primary residence excluding pressure experienced by households which have

dential mortgage accounts were in arrears in December 2010 compared with 4.5 per cent (28,603) in December 2009. The data also indicate that 59,229 mortgage accounts had been restructured by the end of 2010; 24,014 of these had subsequently fallen into arrears for a second time. This implies that even with significant reductions in their mortgage repayments these households were still unable to meet their mortgage obligations. This is most likely due to the fact that many of these households have experienced some level of unemployment during the crisis and have had no way to source the additional income needed to service these debts.

With house prices continuing to fall both households and mortgage providers are reluctant to engage in repossession proceedings. This is because many of these properties are in negative equity and repossession will ultimately realise these losses. However, Central Bank data report that by the end of 2010, 585 residential properties had been repossessed compared with 397 by the end of 2009. If unemployment is not reversed in the near future the number of residential repossessions will continue to increase through 2011.

5.6 Conclusions

This chapter explores household tenure trends across age, education and over the course of four household budget surveys (1988, 1995, 2000 and 2005). It finds that while there has been an increase in the percentage of households who own their home outright, the fundamental personal characteristics affecting the decision to own one's home have not changed significantly in that time. Changes that did occur can be explained by social and demographic developments in Irish society over the period. For example, the probability of owning a home as a lone parent has increased since 1988, while the sex of the household head has become less significant.

In addition to social and demographic changes in Irish society, the liberalisation of the financial sector and Government policies incentivising home ownership have also contributed to changes in tenure trends. Older age

second properties or investment properties. Second, any household that has experienced arrears but have engaged forbearance or restructuring of their mortgage are excluded from the sample.

groups were more indebted in 2005 than in earlier samples, indicating that households are indebted for longer, due to equity release from their homes and longer mortgage terms as a result of higher house prices. Probit model results indicate that the probability of owning a home is primarily driven by personal and family factors. Reductions in interest rates have improved households' access to credit and therefore increased ability to purchase a home; however, this has increased households debt to income levels.

Given the increasingly high levels of household indebtedness in Ireland, mortgage repayment burdens (weekly mortgage repayment amount as a percentage of disposable income) are examined over time. Results indicate that mortgage repayment burdens did not significantly increase when house prices rose, for a number of reasons. These include, a significant increase in average household disposable income, increased mortgage terms from 25 to 35 years and historically low interest rates making borrowing money cheaper.

Projections of the burden of mortgage repayments were made for 2009, using owner-occupier data from the 2005 HBS. If the macroeconomic environment were stable, then these households should have been in a relatively healthy financial position as they will have paid a minimum of four years worth of principal on their mortgages and unlikely to be in negative equity as house prices in 2009 had only fallen to 2004 levels. This is assuming that the surveyed households had not engaged in top-up or other mortgage contract changes.

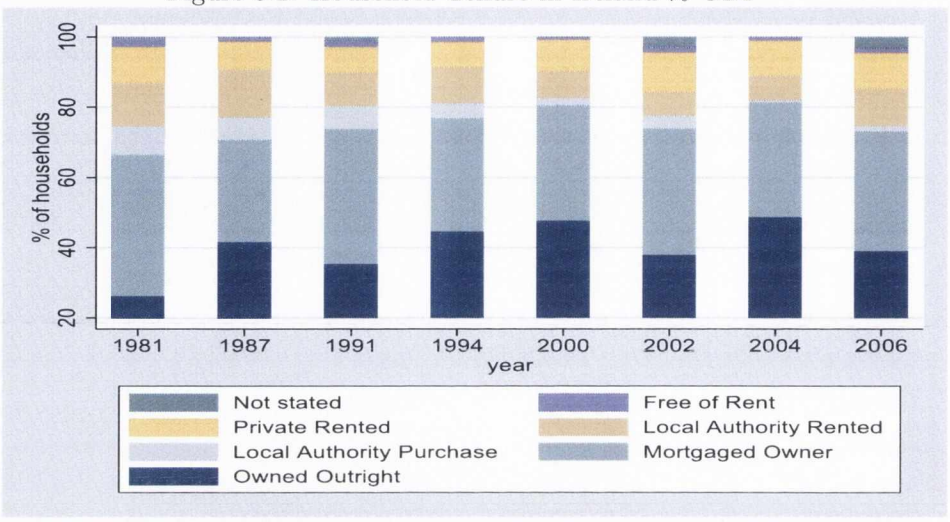
However, given that the macroeconomic environment deteriorated unemployment and interest rate shocks must be applied to mortgage repayment burdens. These shocks result in mortgage repayment burdens increasing to over 65 per cent of disposable income for some households. While many households have savings and investments that would enable them to meet their increased mortgage repayments in the short-term, high levels of long-term unemployment would result in a significant increase in the number of non-performing residential loans and ultimately increased repossessions.

It should be noted that this research does not account for 20 per cent of mortgaged households that entered the market since the 2005 HBS or the estimated 300,000 that may be in negative equity, nor does it consider households that acquired 100 per cent mortgages. Even with these limita-

tions in identifying the most vulnerable households this chapter finds that households who owned pre-2005 may not be as financially sound as once thought. The conclusions drawn from this research is that the household sector will remain exposed and financially unstable as long as unemployment remains high.

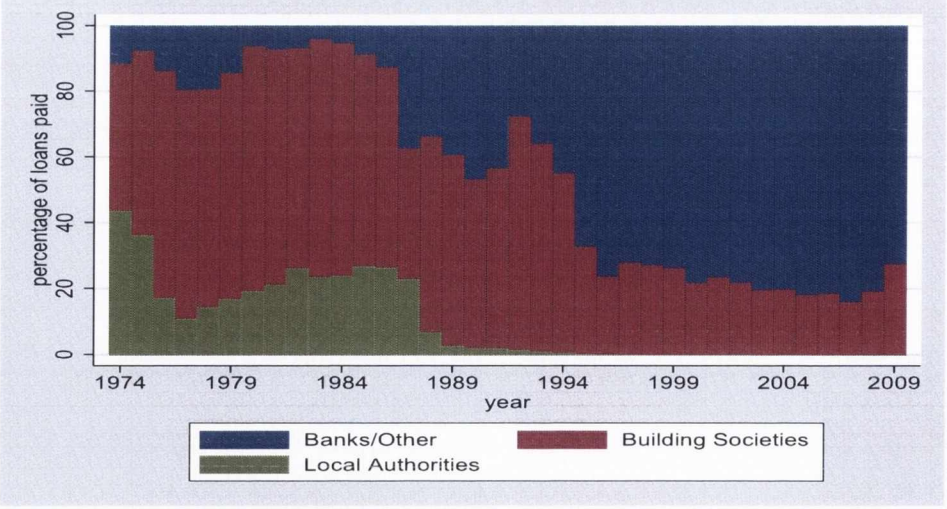
The financial risk arising from having a highly indebted household sector is that increases in unemployment and interest rates directly affect their ability to service their debt. As a result this increases the probability of arrears and defaults. Ordinarily, the banking sector will have sufficient bad-debt provisions in place to absorb any loss from defaults or losses made on the repossession of a property. However, the dramatic fall in house prices has meant that many properties are in negative equity (i.e., the property is worth less than their outstanding mortgage amount) implying that if repossession occurs the sale of the property will not cover the outstanding costs. In this scenario, the homeowner is fundamentally responsible for repaying the difference between the outstanding mortgage and the sale price received for the property to their mortgage provider; however, in many cases this is not feasible as household members have been made redundant, increasing the number of personal bankruptcies and bad debts in the financial sector.

Figure 5.1: Household Tenure in Ireland % GDP



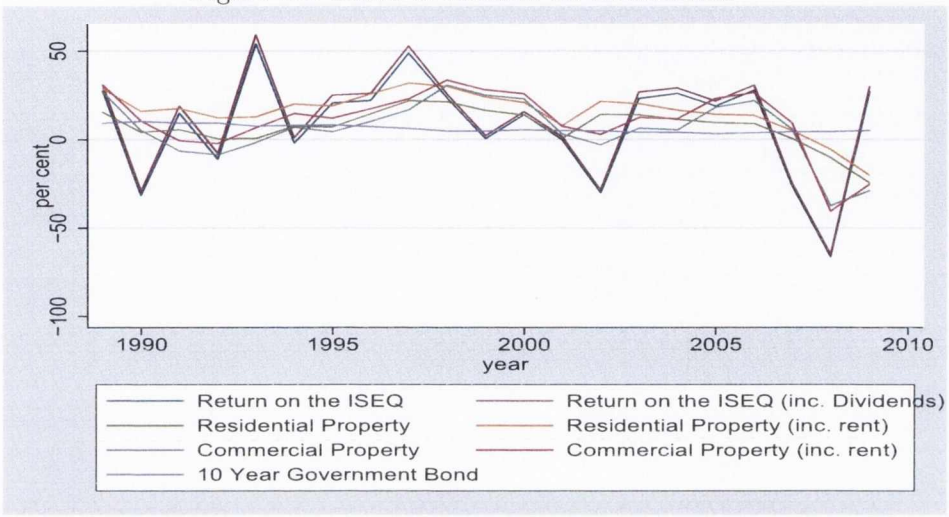
Source: CSO, Census (1981, 1991, 2002 & 2006) & HBS data (1988, 1995, 2000, 2005)

Figure 5.2: Distribution of Residential Mortgage Market



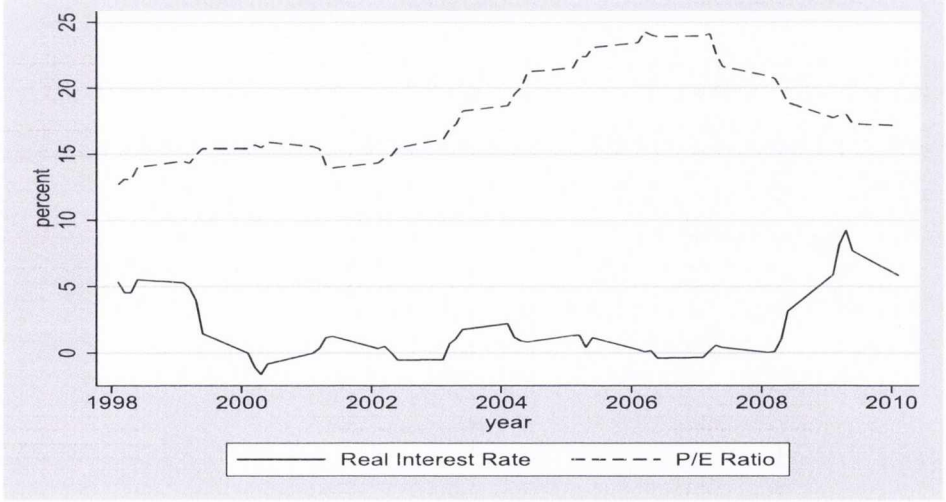
Source: Department of Environment, Heritage, and Local Government (DoEHLG)

Figure 5.3: Rates of Returns on Investments



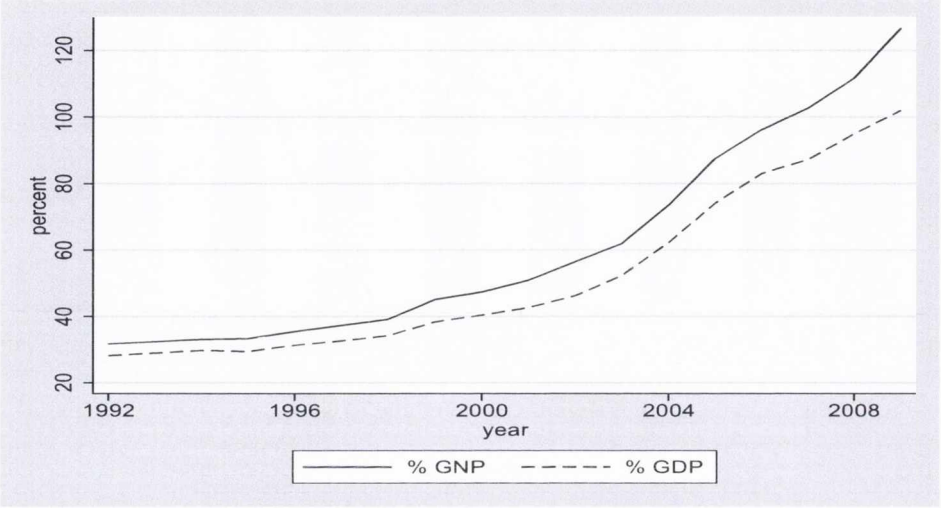
Source: Irish Stock Exchange, DoEHLG, SCS/IPD & CBI, author's calulations

Figure 5.4: Housings Price Earnings Ratio & Real Interest Rates



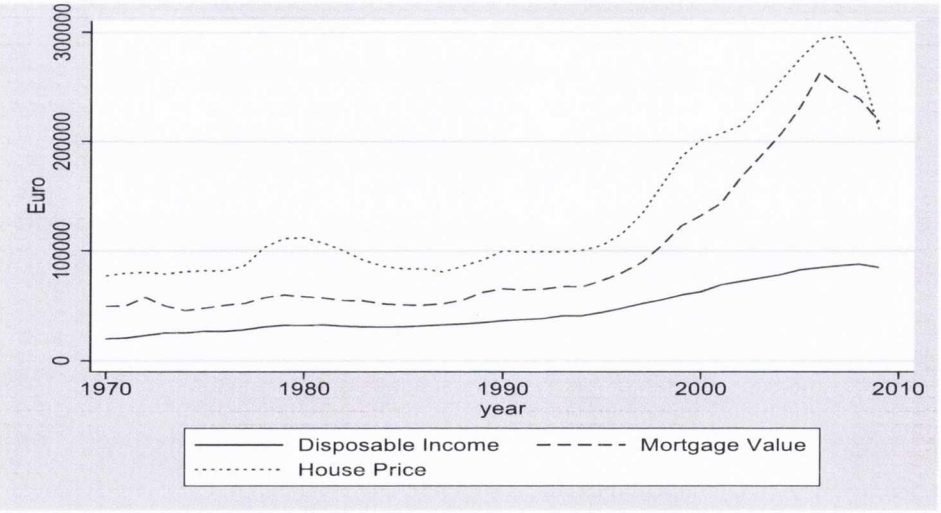
Source: CBI, DoEHLG & CSO, author's calculations
Note: The Price Earnings Ratio is house prices: annual rents

Figure 5.5: Household Sector Credit % of GNP and GDP



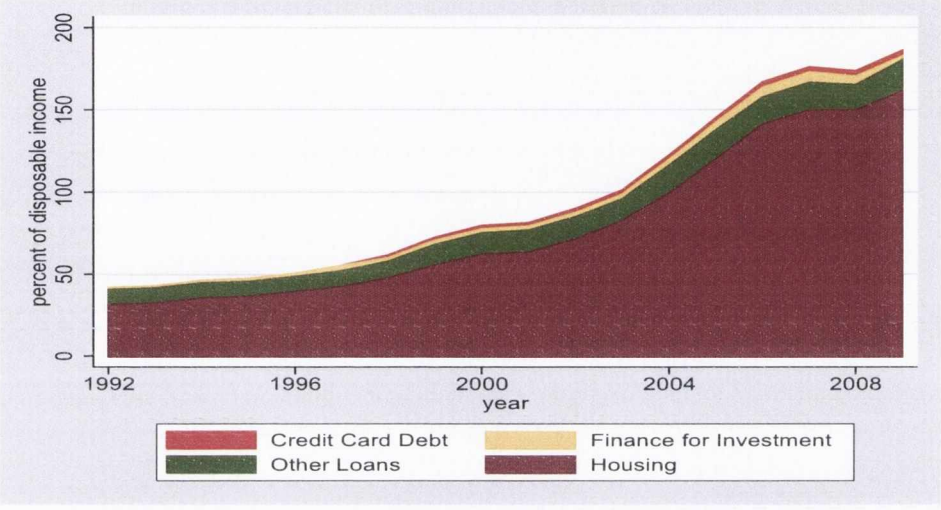
Source: CBI & CSO
Note: Credit includes securitisations

Figure 5.6: Macroeconomic National Averages 1970 to 2009 (Real)



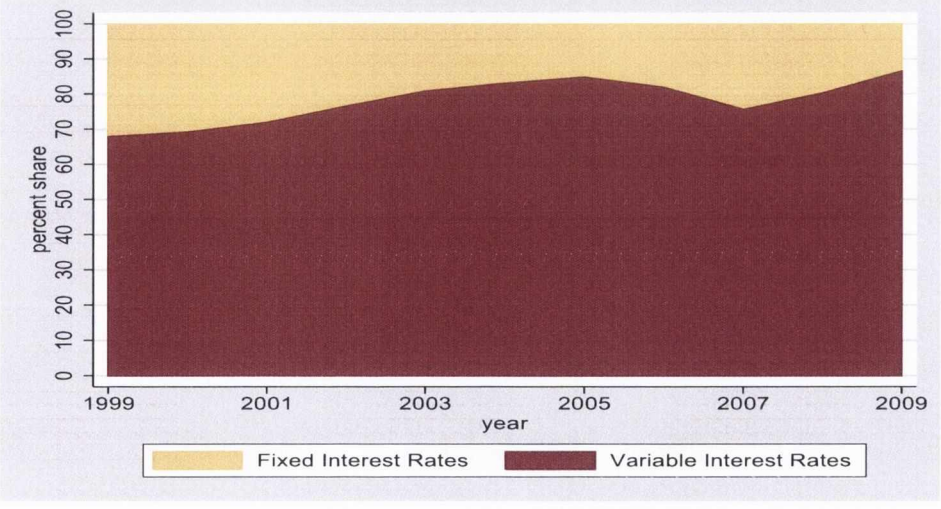
Source: CBI, DoEHLG & CSO

Figure 5.7: Distribution of Household Sector Credit % Disposable Income



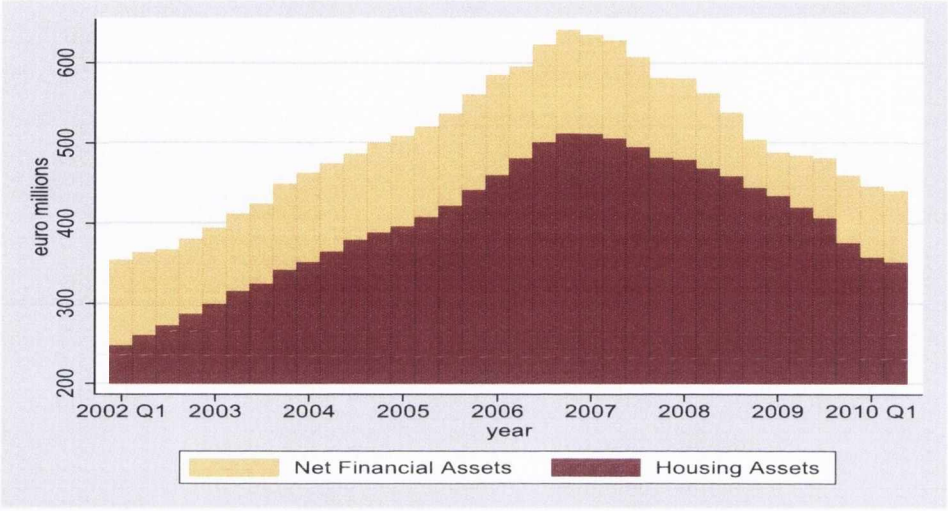
Source: CBI & CSO

Figure 5.8: Breakdown of Mortgage Interest Stock



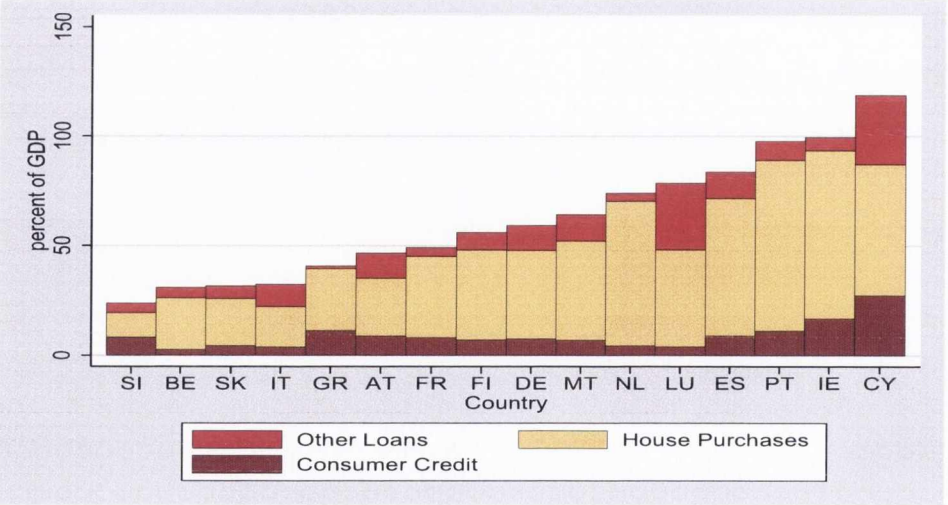
Source: CBI

Figure 5.9: Household Worth



Source: Cussan & Phelan (2010)

Figure 5.10: International Household Lending % GDP



Source: ECB, author's calculations

Table 5.1: Distribution of Mortgaged Households

	1988	%	1995	%	2000	%	2005	%
Mortgaged	282,580	29.0	336,408	32.3	402,675	32.7	471,767	32.6
of which:								
- Building Society	118,009	41.8	152,179	45.2	202,245	50.2	205,615	43.6
- Other Credit Institutions	45,743	16.2	76,319	22.7	119,730	29.7	228,955	48.5
- Insurance Companies	10,219	3.6	9,481	2.8	7,272	1.8	2,033	0.4
- Local Authority	108,609	38.4	98,429	29.3	73,427	18.2	35,163	7.5
- Not Classified	0		146		0		0	
Total Households	975,886		1,039,978		1,229,892		1,448,826	

Source: CSO, HBS 1988, 1995, 2000, 2005

Table 5.2: Household Weekly Disposable Income by Employment Type

	1988 €	1995 €	2000 €	2005 €	increase %
Higher Professional & Mangagement	576.63	680.60	762.58	1,217.14	111
Lower Professional & Non Manual	367.32	436.48	621.18	867.74	136
Self-Employed & Farmers	481.07	548.10	547.40	846.76	76
Manual & Semi Skilled	343.85	409.63	468.98	682.67	99
Unskilled & Others	196.89	211.01	258.56	412.63	110

Source: CSO, HBS 1988, 1995, 2000, 2005
Note: Disposable Income has been inflated to 2005 levels and converted to Euro

Table 5.3: Breakdown of Owned Outright & Mortgaged by age of Household Head(%)

	1988	1995	2000	2005
Households Owned Outright				
15-24	0.36	0.34	0.12	0.21
25-34	5.13	3.61	2.24	1.61
35-44	13.01	13.60	10.73	8.71
45-54	18.00	20.44	21.87	20.65
55-64	23.10	20.46	24.44	25.95
65-74	26.59	24.92	23.80	24.85
75+	13.81	16.63	16.79	18.02
Total	406,294	462,728	586,717	704,645
Mortgaged Households				
15-24	1.06	0.67	0.85	1.02
25-34	36.21	27.55	21.40	23.51
35-44	37.06	43.02	43.95	41.09
45-54	18.23	21.69	24.80	25.26
55-64	6.15	5.82	7.45	7.84
65-74	1.09	1.08	1.16	1.08
75+	0.20	0.22	0.38	0.20
Total	163,751	228,457	321,975	434,570

Source: CSO, HBS 1988, 1995, 2000, 2005
Note: Mortgages obtained from Local Authorities and Insurance Companies are not included

Table 5.4: Highest educational level achieved by head of household with a mortgage (%)

	Age HoH	Primary School	Inter/Junior Certificate	Leaving Certificate	Sub Degree	Primary Degree	Higher Degree	Total
2005	15-24 years	-	1.2	1.7	0.4	0.3	0.9	4,124
	25-34 years	7.6	13.9	24.3	27.8	29.9	28.6	101,704
	35-44 years	16.3	39.6	44.6	45.2	39.5	42.8	178,188
	45-54 years	38.0	34.9	23.4	20.0	22.7	20.2	108,621
	55-64 years	29.9	8.6	4.9	5.7	7.6	7.1	33,044
	65-74 years	6.4	1.3	1.0	1.0	-	0.4	4,704
	75+ years	1.9	0.6	-	-	-	-	849
	Total	21,139	80,821	132,058	73,009	69,118	55,089	431,235
1995	15-24 years	-	1.1	0.9	0.5	-	-	1,522
	25-34 years	13.7	29.3	31.8	27.7	27.1	13.5	62,320
	35-44 years	29.9	40.7	44.5	50.4	43.1	48.3	97,690
	45-54 years	38.8	24.3	17.4	15.2	22.0	25.1	49,312
	55-64 years	14.6	3.6	4.3	5.2	7.0	11.5	13,298
	65-74 years	2.6	0.7	0.8	1.1	0.8	1.7	2,336
	75+ years	-	-	-	-	-	-	395
	Total	18,566	58,615	80,735	26,338	28,894	13,726	226,874

Source: CSO, HBS 1988, 1995, 2000, 2005

Table 5.5: Sharpe Ratio Comparisons of Alternative Investments

	Residential Property		Equities		Commercial Property		Government
	Capital Gains[a]	incl. Rent[b]	Capital Gains	incl. Dividends	Capital Gains	incl. Rent	10-year Bonds
1989-2005							
Average Annual Return (%)	10.48	19.95	12.84	15.94	9.52	16.58	6.59
Variance (Associated Risk)	46.29	43.40	542.65	576.64	142.40	150.95	4.89
Sharpe Ratio	0.084	0.308	0.012	0.016	0.021	0.073	-
1989-2009							
Average Annual Return (%)	7.28	15.82	8.60	11.52	5.86	10.85	6.17
Variance (Associated Risk)	113.86	142.32	825.32	871.20	292.47	318.74	4.73
Sharpe Ratio	0.010	0.068	0.003	0.006	-0.001	0.015	-

Source: Irish Stock Exchange, DoEHLG, SCS/IPD & CBI, authors calulations
Note: (*a*) represents Owner-Occupancy; (*b*) represents buy-to-let investors

Table 5.6: Homeownership Rates in Europe (%)

	1990	2002	2004	2008
Spain	78	84	82	83
Ireland	79	77	79	77
Portugal	67	75	75	74
Greece	76	74	74	76
Italy	68	71	73	72
United Kingdom	65	69	69	72
Belgium	67	68	68	73
Finland	72	64	63	73
France	54	55	57	62
Netherlands	45	53	56	67
Austria	55	52	51	58

Source: Housing Statistics in the European Union (2005/06); EU-SILC 2008

Table 5.7: Probit Model I: Personal Characteristics

	1988		1995		2000		2005	
	dF/dx	R.SE	dF/dx	R.SE	dF/dx	R.SE	dF/dx	R.SE
Log Disposable Income	0.116*	0.01	0.076*	0.01	0.057*	0.01	0.108*	0.01
Log of Schooling Years	0.173*	0.03	0.149*	0.02	0.095*	0.02	0.081*	0.02
Male	0.062*	0.02	0.045*	0.01	0.027*	0.01	0.018***	0.01
Married	0.089*	0.02	0.026***	0.02	0.040*	0.01	0.096*	0.02
Log Person in Household	-0.073*	0.01	0.026**	0.01	0.007	0.01	-0.045*	0.01
Double Income	0.073*	0.01	0.097*	0.01	0.084*	0.01	0.078*	0.01
Omitted Age under 25s								
25-34 years	0.226*	0.01	0.162*	0.01	0.129*	0.01	0.150*	0.01
35-44 years	0.287*	0.01	0.251*	0.01	0.223*	0.01	0.253*	0.02
45-54 years	0.27*	0.01	0.249*	0.01	0.238*	0.01	0.266*	0.01
55-64 years	0.272*	0.01	0.228*	0.01	0.215*	0.01	0.227*	0.01
65-74 years	0.286*	0.01	0.244*	0.01	0.212*	0.01	0.182*	0.01
75+ years	0.237*	0.01	0.210*	0.01	0.178*	0.01	0.150*	0.01
Omitted Other Employment)								
Manager/ Higher Professional	0.026	0.02	0.015	0.02	0.032**	0.01	0.078*	0.01
Lower Professional/ Non-manual	0.035*	0.01	0.057*	0.01	0.027**	0.01	0.066*	0.01
Skilled/Semi-Skilled	0.030**	0.01	0.048*	0.01	0.026**	0.01	0.060*	0.01
Self-Employed/Farmers	0.169*	0.01	0.146*	0.01	0.101*	0.01	0.127*	0.01
Predicted Probability at mean	0.812		0.857		0.885		0.817	
Number Obs	7634		7612		7527		5639	
Pseudo R2	0.169		0.214		0.205		0.253	
Log Likelihood	-3398.98		-2925		-2609.37		-2003.44	

Note: Dependent variable is the dummy own=1 if household is an owner-occupier & own=0 otherwise. Other employment includes agricultural worker, other gainfully occupied and unknowns. Unemployed or retired households are defined by their previous occupation. *significant at 1% level; ** significant at 5% level; *** significant at 10%level

Table 5.8: Probit Model II: Personal & House Related Characteristics

	1988		1995		2000		2005	
	dF/dx	R.SE	dF/dx	R.SE	dF/dx	R.SE	dF/dx	R.SE
Log Disposable Income	0.101*	0.01	0.056*	0.01	0.037*	0.01	0.065*	0.01
Log of Schooling Years	0.065**	0.03	0.046**	0.02	0.034**	0.02	0.026	0.02
Male	0.041*	0.02	0.038*	0.01	0.027*	0.01	0.010	0.01
Married	0.081*	0.02	0.019	0.01	0.039*	0.01	0.076*	0.02
Log Person in Household	-0.131*	0.01	-0.047*	0.01	-0.052*	0.01	-0.095*	0.01
Double Income	0.058*	0.01	0.080*	0.01	0.076*	0.01	0.053*	0.01
Omitted Other Employment								
Manager/ Higher Professional	0.008	0.02	0.144	0.02	0.030**	0.01	0.061*	0.01
Lower Professional/ Non-manual	0.054*	0.01	0.067*	0.01	0.032*	0.01	0.064*	0.01
Skilled/Semi-Skilled	0.041*	0.01	0.053*	0.01	0.031*	0.01	0.049*	0.01
Self-Employed/Farmers	0.107*	0.01	0.103*	0.01	0.074*	0.01	0.083*	0.01
Omitted Small towns (< 3,000)								
Rural	0.173*	0.02	0.068*	0.02	0.014	0.02	0.028	0.02
Dublin Metropolitan Area	0.022	0.02	-0.071*	0.02	-0.036	0.03	-0.055*	0.02
LargeTowns (> 20,000)	0.011	0.02	-0.079*	0.03	-0.073*	0.03	-0.093*	0.03
Mid-Towns (3,000 -20,000)	0.045**	0.02	-0.027	0.02	-0.044***	0.03	-0.077*	0.02
Number of Rooms	0.439*	0.02	0.369*	0.02	0.295*	0.02	0.378*	0.02
Predicted Probability at mean	0.832		0.878		0.899		0.901	
Number Obs	7634		7612		7527		5639	
Pseudo R2	0.284		0.323		0.285		0.356	
Log Likelihood	-2926.16		-2517.92		-2346.8		-1729.3	

Note: Dependent variable is the dummy own=1 if household is an owner-occupier & own=0 otherwise. Regression controls for Age which remain significant at 1% level. Other employment includes agricultural worker, other gainfully occupied and unknowns. Unemployed or retired households are defined by their previous occupation. *significant at 1% level; ** significant at 5% level; *** significant at 10%level

Table 5.9: Probit Model III: Personal, House & Year Specific Characteristics

	1988		1995		2000		2005	
	dF/dx	R.SE	dF/dx	R.SE	dF/dx	R.SE	dF/dx	R.SE
Log Disposable Income	0.161*	0.02	0.085*	0.01	0.037*	0.01	0.071*	0.01
Log of Schooling Years	0.172*	0.05	0.155*	0.03	0.098*	0.02	0.072*	0.02
Male	0.050**	0.03	0.043*	0.02	0.026**	0.01	0.023*	0.01
Married	0.296*	0.04	0.067*	0.02	0.086*	0.02	0.076*	0.02
Log Person in Household	-0.271*	0.02	-0.088*	0.02	-0.087*	0.01	-0.115*	0.01
Double Income	0.058*	0.02	0.097*	0.01	0.090*	0.01	0.051*	0.01
Omitted Other Employment)								
Manager/ Higher Professional	0.055***	0.03	0.043***	0.03	0.060*	0.01	0.061*	0.01
Lower Professional/ Non-manual	0.097*	0.02	0.111*	0.04	0.055*	0.01	0.058*	0.01
Skilled/Semi-Skilled	0.079*	0.02	0.092*	0.02	0.058*	0.01	0.042*	0.01
Self-Employed/Farmers	0.144*	0.02	0.118*	0.03	0.082*	0.01	0.071*	0.01
Omitted Small towns (< 3,000)								
Rural	0.241*	0.02	0.089*	0.03	-0.023	0.03	0.028***	0.01
Dublin Metropolitan Area	0.085*	0.03	-0.056***	0.03	-0.078**	0.04	-0.066*	0.02
LargeTowns (> 20,000)	0.070**	0.03	-0.059***	0.04	-0.127*	0.05	-0.092*	0.03
Mid-Towns (3,000 -20,000)	0.065**	0.03	0.006	0.03	-0.084**	0.04	-0.065*	0.02
Number of Rooms	0.545*	0.05	0.421*	0.04	0.313*	0.02	0.322*	0.02
Number of Years in Residence	-0.056*	0.02	0.020***	0.01	-0.002	0.01	-0.002	0.00
Year Specific Macro Variables)								
National Average DI	0.028	0.04	-0.058*	0.01	-0.003	0.01	-0.009*	0.00
National Average House Price	0.0002**	0.01	0.010*	0.00	-0.003*	0.00	0.001	0.00
National Averagea Rental	-1.069	1.30	0.864	0.52	0.809*	0.30	0.710*	0.13
Mortgage Interest Rates	0.012**	0.01	-0.007	0.00	0.003	0.00	0.002	0.00
Predicted Probability at mean	0.753		0.838		0.890		0.918	
Number Obs	4628		5306		5701		5639	
Pseudo R2	0.372		0.396		0.363		0.422	
Log Likelihood	-1795.34		-1779.98		-1754.37		-1550.4	

Note: Dependent variable is the dummy own=1 if household is an owner-occupier & own=0 otherwise. Other employment includes agricultural worker, other gainfully occupied and unknowns. Unemployed or retired households are defined by their previous occupation. Regression Controls for Age which remain significant at 1% level; * significant at 1% level; ** significant at 5% level; *** significant at 10%level

Table 5.10: Probit Model IV: New Occupant Restriction

	1988		1995		2000		2005	
	dF/dx	R.SE	dF/dx	R.SE	dF/dx	R.SE	dF/dx	R.SE
Log Disposable Income	0.191*	0.04	0.056	0.05	0.036	0.05	0.179*	0.05
Log of Schooling Years	-0.219**	0.11	-0.106	0.10	-0.04	0.11	-0.055	0.12
Male	0.110**	0.05	0.108**	0.05	-0.033	0.05	-0.039	0.05
Married	0.256*	0.06	0.117***	0.07	0.179*	0.06	0.138**	0.06
Log Person in Household	-0.123**	0.06	-0.061	0.06	-0.180*	0.06	-0.307*	0.06
Double Income	-0.002	0.05	0.194*	0.08	0.223*	0.06	0.239*	0.06
Omitted Under 25s								
25-34 years	0.116***	0.06	0.218*	0.08	0.192*	0.08	0.221*	0.07
35-44 years	0.185**	0.08	0.406*	0.11	0.420*	0.08	0.317*	0.07
45-54 years	0.090	0.12	0.560*	0.12	0.374*	0.10	0.334*	0.08
55-64 years	0.283***	0.18	0.310***	0.18	0.556*	0.07	0.493*	0.05
65-74 years	0.270	0.18	0.526*	0.14	0.396*	0.11	0.458*	0.06
75+ years	0.115	0.26	0.251	0.29	0.434***	0.18	0.397**	0.12
Omitted Small towns (< 3,000))								
Rural	0.331*	0.12	0.203	0.16	0.237	0.17	0.058	0.10
Dublin Metropolitan Area	0.118	0.10	0.027	0.12	0.247	0.18	-0.216**	0.09
LargeTowns (> 20,000)	0.032	0.10	0.062	0.15	0.064	0.19	-0.283*	0.09
Mid-Towns (3,000 -20,000)	-0.057	0.09	0.051	0.13	0.045	0.18	-0.248*	0.08
Number of Rooms	0.378*	0.09	0.392*	0.08	0.612*	0.11	0.716*	0.11
Average House Prices	-	-	-	-	-	-	-0.005*	0.00
Total Weekly Savings	0.000	0.00	0.000	0.00	0	0.00	0.001	0.00
Personal Loans	0.000	0.00	0.000	0.00	0	0.00	-0.0002	0.00
Stocks & Shares Dummy	-	-	0.107	0.14	-0.001	0.08	0.173**	0.08
Predicted Probability at mean	0.235		0.213		0.374		0.470	
Number Obs	539		444		583		719	
Pseudo R2	0.360		0.366		0.274		0.316	
Log Likelihood	-223.73		-178.82		-287.50		-340.22	

Note: Dependent variable is the dummy own=1 if household is an owner-occupier & own=0 otherwise. Employment status is not significant for new occupants and is not included in the final specification. *significant at 1% level; ** significant at 5% level; *** significant at 10%level

Table 5.11: Mortgage Repayments as a percentage of Disposable Income

Percentile by Burden	1988 (11.6%)	1995 (7.53%)	2000 (5.23%)	2005 (3.45%)	2007* (5.09%)	2009* (2.68%)
20th (least)	7.81	9.11	7.10	5.70	5.69	4.83
40th	13.48	12.86	10.59	9.21	9.25	7.34
Median	16.08	15.20	12.36	11.12	11.23	8.75
60th	18.74	16.98	14.34	13.29	13.39	10.32
80th	25.40	22.82	19.98	20.22	20.86	15.35
90th (most)	31.51	28.79	25.57	26.57	27.22	19.92

Source: CSO, HBS 1988, 1995, 2000, 2005
Note: Figures in brackets are the average interest rate during each survey period. The interest rates used are the standard variable mortgage rates for Credit Institutions from Table B2.1 Central Bank Monthly Statistics, quarterly average of the House Purchase Loans. * 2007 and 2009 are estimated figures based on the 2005 HBS they do not include any new purchases since 2005

Table 5.12: Distribution of Mortgage Burdens by Years in Residence (2005)

Number of Years	Number of Households	Burden % of Disposable Income	Burden % of total income
less than one year	22,741	25.08	24.34
one year	31,645	22.54	20.92
2-5 Years	128,035	18.05	17.40
6-10 Years	107,250	12.08	11.77
11-20 Years	113,910	8.82	8.64
21-35 Years	22,479	8.51	8.31
36+ Years	3,179	9.26	9.17
Total	429,238		

Source: CSO, HBS 2005

Table 5.13: Household Tenure by Unemployment (%)

	2005	2009*
Owns Outright	1.57	11.70
Rent and TPS	27.25	84.41
Mortgage	4.50	41.09
of which:		
Building Society	0.78	9.30
HFA and Other Sources	0.32	18.92
Total Unemployment	2.26	12.09

Note: TPS are Tenant Purchase Scheme & HFA are Housing Finance Agency
* 2009 estimated data

Table 5.14: Unemployed Households' Mortgage Repayment Burden by Years in Residence (%)

			Unemployment Income 2009		
	2005	2009*	Scenario 1	Scenario 2	Scenario 3
less than one year	27.02	23.17	38.33	27.94	56.51
one year	17.41	13.84	28.86	26.17	35.74
2 to 5 years	15.71	14.65	35.50	21.65	33.77
6 to 10 years	9.84	9.60	23.12	16.47	23.41
11 to 20 years	3.03	6.00	12.95	9.61	14.63
21 to 35 years	1.42	5.30	12.51	8.54	12.92

Note: Table represents mortgaged households that were randomly made unemployed.
*Estimated 2009 burden if that household was not made unemployed;
Scenario 1, income falls to basic job seekers allowance of €204.30;
Scenario 2, income falls to unemployed households average of €326.15;
Scenario 3, household income is reduced by 59 per cent

Table 5.15: Interest Rate Effects on Mortgage Repayment Burdens 2009

	(4.75%)	(5.75%)	(6.75%)	(7.75%)
A: Interest Rate Increase Only				
20th Percentile	5.45	5.75	6.04	6.25
40th Percentile	8.89	9.55	10.05	10.56
Median	10.72	11.51	12.34	13.17
60th Percentile	12.78	14.02	15.14	16.31
80th Percentile	19.88	22.15	24.16	26.20
90th Percentile	25.81	28.96	32.23	35.96
B: Interest rate & Unemployment Scenario 1				
20th Percentile	5.74	6.00	6.25	6.51
40th Percentile	9.25	9.85	10.56	11.17
Median	11.08	12.00	12.94	13.80
60th Percentile	13.47	14.63	15.89	17.09
80th Percentile	21.14	23.74	26.42	28.71
90th Percentile	28.65	31.12	35.73	36.97
C: Interest rate & Unemployment Scenario 2				
20th Percentile	5.69	5.95	6.21	6.44
40th Percentile	9.18	9.77	10.37	11.00
Median	11.01	11.76	12.69	13.67
60th Percentile	13.26	14.42	15.59	16.79
80th Percentile	10.67	23.13	25.25	27.69
90th Percentile	27.36	30.94	34.11	37.95
D: Interest rate & Unemployment Scenario 3				
20th Percentile	5.77	6.10	6.33	6.62
40th Percentile	9.38	10.01	10.80	11.44
Median	11.26	12.38	13.28	14.20
60th Percentile	13.70	14.87	16.25	17.47
80th Percentile	21.80	24.29	27.03	29.51
90th Percentile	30.70	34.05	37.93	40.65

Note : Scenario 1, income falls to basic job seekers allowance of €204.30; Scenario 2, income falls to unemployed households average of €326.15; Scenario 3, household income is reduced by 59 per cent

Chapter 6

Institutions and Total Factor Productivity Convergence

6.1 Introduction

Much of the recent literature on economic growth has discussed the impact that institutions can have on economic efficiency. For instance, Hall and Jones (1999) and Acemoglu *et al.* (2001) have emphasised institutional differences as perhaps the key factors explaining why some countries are rich while others are poor. The existing literature, however, contains very little evidence on the exact form of the linkages between institutions and improvements in efficiency. This chapter addresses this issue by examining the relationships between growth in Total Factor Productivity (TFP) and various measures of institutions in a large cross-country panel dataset.

One channel through which institutions are likely to affect TFP growth is through their influence on a country's ability to absorb or adapt superior technologies in use elsewhere. That the ability to adapt technologies may play a key role in determining a country's position in the world income distribution has been emphasised in various theoretical analyses based on learning models such as Bernard and Jones (1996) and Acemoglu (2009). This chapter provides a first empirical assessment of the role that institutions play in affecting economic growth through this learning channel. It also examines the extent to which institutions influence those components of TFP growth that are unrelated to learning.

The key findings in the chapter are that there is some evidence that TFP

in poorer countries tends to catch-up with TFP in the leading countries, i.e., there is some evidence for unconditional catching up. In addition, we find evidence that institutions have an effect on TFP growth, both through their effects on the speed of learning and also through direct effects. That said the empirical fits produced by these models are relatively poor. In addition, we find that country-specific intercept terms—random unexplained differences in growth across countries—explain far more of the variation in TFP growth than do institutional variables. This finding of a limited role for institutions may be a function of the weakness of the institutional proxies used here. However, the chapter uses a far wider and more comprehensive set of institutional variables than previous studies, building on work in studies such as Glaeser and Shleifer (2002) and Djankov *et al.* (2002).

The contents of this chapter are as follows. Section 2 reviews current literature on growth theories. Section 3 outlines the model used in the analysis. Section 4 describes the methodology and data. Section 5 presents the results and, Section 6 contains the conclusions and summary.

6.2 Literature Review

Growth theory was born from the desire to know why some countries are richer than others, which has been an issue pre-Adam Smith but he was the first to really address it in his book "The Wealth of Nations". He argues that the government should not attempt to boost the growth rate because the 'invisible hand' would lead the economy. This follows from Smith's theory that if people are rational and choose to maximise their returns, markets would take care of the rest independent of government. Malthus and Ricardo both had the pessimistic view that there would be so much population growth that the planet would not be able to sustain it and eventually it would result in stagnation. This of course was not the case as technology and international trade allowed for more efficient food production, which brought about competitive advantage for different nations.

Landes (1990) reviews the development of growth theory. He puts forward the theory that there is a predetermined level of growth that any

country can obtain because its land is a fixed commodity. All other factors of production can be bought and sold; therefore, they are not the cause of inequality in the world. The size of a country is only important in absolute term; this is why GDP is measured in per capita figures, allowing land to be left out of the production function.

Landes goes on to examine the effect of the 19^{th} and 20^{th} centuries on global economics. The 19^{th} century created huge competition within Europe where a number of countries challenged the might of the British Empire in a game of "follow the leader". By the end of the 19^{th} century, the international division of labour had been modified by the diffusion of new technologies across the western world after the industrial revolution. Britain was no longer the "Workshop" of the world; this term had been expanded to include Europe and the United States. Unfortunately, the rest of the world wwas not included in this industrial revolution and was left behind, increasing the inequality between nations.

The 20^{th} century saw many countries gain independence after World War II. It also saw a lot of technology filter through the world, resulting in the creation of emerging markets. These countries began to compete on the global market. It was thought at the time that once these countries set up good policies, both political and economic, they would see rapid growth and they would catch up. They had the advantage of being the 'Followers'. This meant that they could learn from the mistakes of other developed nations, enabling them to implement better policies, more quickly, resulting in convergence. This however has not been the case. Countries may be richer than they were but there is still a very large gap between rich and poor countries.

Third World Countries however tend to be ex-colonies with accidental boundaries with tribal and ethnic hostilities; this does not create an easy base for 'good' economic and political policies. As Landes argues, it takes time to create an effective, functional bureaucracy. To create national pride, identity and purpose takes time, and nations that want rapid catch-up risk creating an inefficient state. These new nations need to take more time to develop themselves and their institutions before they can attempt to compete with the rates of growth seen in the western world. There is a vast

literature on growth theories, but these can be divided into two sections, neo-classical theories and endogenous growth theories, theory specification taken from Barro and Martin (2004) unless otherwise stated.

6.2.1 Neo-Classical Growth Theory

Cobb-Douglas Production Function

The Cobb-Douglas Production Function is often used in growth theory to represent the relationship of output to inputs. In 1928 Paul Douglas and Charles Cobb developed the theory and tested it using statistical evidence. The basic production function is:

$$Y = K^{\alpha} (AL)^{\beta} \qquad 0 < \alpha, \beta > 1 \tag{6.1}$$

Where Y is output, L is labour input, K is capital input, A is the labour augmented technical progress and α & β are output elasticities of capital and labour, respectively.

When $\alpha + \beta = 1$, the production function has constant returns to scale, if L and K are increased by $x\%$, then Y will increase by the same percentage. If $\alpha + \beta < 1$ returns to scale are decreasing, and if $\alpha + \beta > 1$ then returns to scale are increasing.

The Solow Model

The most famous neo-classical growth theorist is Robert Solow. He developed the Solow Model of Economic Growth in 1956. Solow (1956) explores growth as a result of the changes in the factors of production, beginning with the production function:

$$Y = F(K, AL) \tag{6.2}$$

where Y is output, K is capital, L is the amount of labour and A is the productivity of labour determined by the availability of technology. The main assumption is that there are diminishing marginal returns to capital and labour separately, and constant returns to scale for both factors combined. As the stock of capital increases, the benefit to production from each additional unit of capital will fall. The share of capital income to total income

showed that buildings and machinery are relatively minor ingredients for growth and that labour and technology were the principal drivers. Solow estimated that the capital accounted for about one-third of total output in the USA, while wages or income per worker made up the rest. If an economy tries to grow by increasing investment in capital stocks and not labour then diminishing marginal returns will mean that eventually growth will fall. If capital stock per person grows at a constant rate, eventually the growth rate of output per person would drop to zero.

Important predictions in this model are:

- First, the savings rate (s) does not affect the steady state growth rate of income. Saving diverts money from consumption today for investment in capital goods tomorrow, but as capital investment is not a source of growth then the long-run rate of growth is unchanged. A high saving economy will have higher income, but due to diminishing marginal returns the growth rate will return to zero. Therefore it affects the *levels* at which the steady state occurs but not its growth *rate*.

- Second, population growth (n) will have the opposite effect to savings. The higher population growth is, the lower the steady state level of income per capita, however, again it can only affect the *levels* of the growth not the *rate* of growth.

- Third, technological progress (A) is the only factor that affects the *rate* of growth in the economy. The Solow Residual measures technological change and is the only factor that can make a limited labour force more productive. New technologies stave off diminishing marginal returns as each individual can become more productive for equal time and effort. The only way that output per worker can be increased indefinitely is through labour-saving technology. A weakness of the model is that the technological growth rate (g) is assumed to be exogenous. This implies that the economy has no long run control over its growth rate.

Convergence

The idea of convergence was first developed in 1952. It was proposed that, under certain circumstances, "backward" countries would tend to grow faster than richer countries in order to close the gap between the two groups. An important cause of convergence might be technological transfer, but there is evidence that some countries converge while others do not. For example, the hypothesis works very well when explaining growth rates in OECD countries but it fails to explain differences across the world as a whole, proving that poor countries are not closing the gap as initially hoped.

The Solow model helps to explain these findings, by considering the idea of "conditional convergence". This predicts that convergence will occur if countries have the same fundamental factors or steady state. Conditional convergence does not mean that countries will converge to similar levels of per capita income; it only means that countries that are below their own steady state will grow faster than those closer to their steady state. Economists have looked at various panels of country data to see if the conditional convergence proposed by Solow is supported by the data.

Barro and Sala-i-Martin (1992) focused on the idea of "convergence clubs", that is, countries with similar conditions and similar steady-state levels will converge. With this framework they looked at regional areas, such as states in the US, Japanese prefectures, European regions and OCED members. They concluded that convergence does occur in the sense that economies tend to grow faster in per capita terms when they are further below the steady-state position. Over longer samples they found that poorer states in the US tended to grow faster in per capita terms than rich states, even when they held constant any variables other than initial per capita income or product. In the standard neoclassical growth model, with exogenous technological progress and a closed economy, convergence is predicted. However, they had to assume underlying parameters for preferences and technology that depart substantially from the benchmark case. If technologies are the same then the introduction of a global capital market tends to speed up the convergence rate for output.

In subsequent research, Mankiw, Romer and Weil (1992) found that

savings and population could explain more than half of the cross-country variation in income per capita, and that their growth rates affect income as Solow predicted. However, they argued that the predictions of the Solow Model do not accurately report the magnitude of the effects of savings and population. They believe that the accumulation of physical capital and population growth have greater impacts on income when accumulation of human capital is accounted for; this is because higher savings and lower population growth rates lead to higher income.

Their results show that human capital was correlated with savings and population growth, which implies that when it is omitted the results are biased. They believe that their augmented Solow Model could explain 80 per cent of international differences in income per capita, whereas the basic model explains just over half of the difference. They conclude that physical capital accumulation and population growth both have larger impacts on income than the basic model predicts. They also find that economies that are out of their steady state, but who have similar technologies, rates of accumulation and population growth should converge to a similar income per capita in the steady state. However, this convergence is slower than the basic Solow model predicts.

Mankiw (1995) summarises his theories of growth and discussed three aspects of the Solow model:

- *The magnitude of the international difference*: If all economies were in their steady state the model predicts that different countries should have different levels of income per person, depending on the determinants of the steady state.

$$sy^* = (n + g + \delta)\, k^* \tag{6.3}$$

  Using the standard estimates that the capital share of production, α, is equal to one-third, this implies that $(1 - \alpha)$ is one half. Therefore, differences in the rate of saving will lead to differences in income that are proportionately half as large, i.e., if one country's savings rate is four times that of another country, its steady state income will be twice as large. This shows that the model can only explain some of

the income variation of cross-country difference but not the current multiples of ten.

- *The rate of convergence*: Mankiw argues that convergence is only evident in certain samples, i.e., within the states of the US and among OECD member countries. However, the neoclassical model predicts that countries converge not to each other but to their own steady state, which is determined by its population growth and savings rates. This conditional convergence is evident in most studies. The Solow model predicts the rate of the convergence is twice as fast as that found in Mankiw's results.

- *The rate of return on capital*: If poor countries are poor because they have small capital stocks, then the marginal product of capital should be high. Higher profit rates and higher real interest rates in poor countries should therefore be observed, so capital should flow from rich to poor countries. This is not the case as investment in emerging markets is still relatively low. Investors consider the return on an investment before they invest. This is usually larger in poorer countries than wealthier ones. Jaume Ventura (1997) developed a model of interdependent economies, where the rate of return differentials explains the differences in growth rates over time, while the savings rate explains the difference in growth rates across countries. The size of these return differentials between countries depends on the production function within each country. The larger the elasticity of substitution between capital and labour the smaller the return differential there is for capital. The elasticity of substitution depends not only on each industry's technology but also on its ability to move resources among industries. International trade converts an excess production of capital-intensive goods into exports, instead of falling prices, or altering the return on either capital or labour. The implication of this factor-price-equalisation theorem for growth theory is that trade increases the economy's ability to substitute capital for labour, pushing the effective elasticity of substitution in each economy towards infinity. However, the results for the traditional Cobb-Douglas production func-

tion, where the elasticity of substitution is one, predict much higher return differentials than seen in reality and do not allow for higher elasticity of substitution.

Lucas (1990) discusses the issue of rates of return on capital in different countries. He looks at the two-country neoclassical model of production, with homogenous capital and labour inputs. He finds that if there is a difference in production per worker between the two countries it must be due to the different levels of capital per worker.

Using a simple Cobb-Douglas production function, with a constant returns technology, he was able to show that if the United States has production per person 15 times that of India then India's marginal returns to capital would be 58 times that of the United States. With such large differentials between magnitudes in rich and poor countries, there should be no investment in wealthy economies. This, of course, is not the case and, while there is some capital flow from rich to poor countries, it is not nearly as high as it should be. Lucas discusses three possible explanations as to why, given the large return differentials, capital flows are so small:

- *Differences in Human Capital*: In the Neoclassical model, it is assumed that the labour input per person is equal in both countries. This is an unrealistic assumption and when it is accounted for the return differential dramatically falls. This is done by reinterpreting y as income per effective worker rather than per worker. The ratio of y in the United States to India falls to 3 from 15, implying that the rate of return becomes 5 rather than 58. This is a more realistic value but still quite large.

- *External Benefits of Human Capital*: Lucas then assumes that the economy's technology level is the average level of its workers' human capital raised to a power. So the production function takes the form $y = Ax^{\beta}h^{\gamma}$, where y is income per effective worker, x is capital per effective worker, and h is human capital per worker. Lucas then interprets the h^{γ} as an external effect of human capital from knowledge or technology. The parameter equals the value by which a worker's

productivity will increase, when the quality of those around him increases. He admits that this may not be the most accurate assumption but when he adds this to his model the return differential is reduced to unity. He does note that it is assumed that the entire stock of a country's human capital is produced within that country and knowledge spill-overs across countries are assumed to be zero. Without being able to ascertain the scope of external effects across borders it is impossible to test this theory properly.

- *Capital Market Imperfections*: Lucas' third explanation is "Political Risk'. This is where country A initially sends capital goods to country B and then the capital flow switches from B to A in the form of interest or repatriated profits. For this to be a competitive equilibrium there must be an effective enforcement mechanism in the international borrowing market. Otherwise country B would take the capital investment from country A but never repay it. Country A would anticipate this problem and would never lend to country B. He concludes that monopoly power over trade in capital goods was an important factor during the colonial era and that there is no reason to assume that this stopped once that era ended.

McQuinn and Whelan (2006, 2007a) return to the debate on convergence and present evidence supporting the basic Solow model with exogenous technology. Using the Cobb-Douglas Production Function:

$$Y_t = K_t^{\alpha} \left(A_t L_t\right)^{1-\alpha} \tag{6.4}$$

The usual decomposition of the production function is:

$$\frac{Y_t}{L_t} = \left(\frac{K_t}{L_t}\right)^{\alpha} A_t^{1-\alpha} \tag{6.5}$$

In this form there are direct and indirect effects from technology on the output labour ratio. The direct effect comes from the growth of A, while the indirect effect comes from the effect this technological growth has on K. In this format the effect of technology cannot be isolated. To overcome this problem McQuinn and Whelan re-write the production function as:

$$\frac{Y_t}{L_t} = A_t \left(X_t\right)^{\frac{\alpha}{1-\alpha}} \tag{6.6}$$

where $X_t = K_t/Y_t$ is endogenous. McQuinn and Whelan show that the dynamics of output per worker can be shown by taking logs so that:

$$y_t = a_t + \frac{\alpha}{1-\alpha} x_t \tag{6.7}$$

where the dynamics are:

$$\dot{y} = g + \frac{\alpha}{1-\alpha} \dot{x}. \tag{6.8}$$

The steady state path for output per worker is the level of output per worker consistent with the capital-output ratio being equal to its steady state level:

$$y_t^* = a_t + \frac{\alpha}{1-\alpha} x_t^*. \tag{6.9}$$

Due to diminishing marginal productivity of capital and labour, the growth rate of K and AL must be the same along the steady state growth path. As these growth rates are given by $s(Y/K) - d$ and $(g + n)$, respectively, the formula for the steady state capital-output ratio X^* is:

$$X^* = \frac{s}{g + n + \delta}. \tag{6.10}$$

McQuinn and Whelan re-write this in "error-correction" form as:

$$\dot{X}_t = \lambda \left(X^* - X_t \right) \tag{6.11}$$

where the convergence speed is determined by:

$$\lambda = (1 - \alpha)(g + n + \delta) \tag{6.12}$$

Through the substitution of x^* the dynamics of output per worker can be expressed as:

$$\dot{y}_t = g + \lambda \left(y_t^* - y_t \right). \tag{6.13}$$

The convergence speed, λ, of the capital-output ratio is also the conditional convergence speed of output per worker. The capital-output ratio is determined by the gap between the output and its steady state level, whereas the output per worker equation is determined by technological progress as well as the gap between y_t and y^*. This new methodology allows them to look at conditional convergence without the econometric problems that surround the traditional growth regressions, relating to specifying a particular time series model for A.

McQuinn and Whelan's empirical work shows convergence speeds towards X^*'s steady state of around 7 per cent per year. This is higher than that of Solow and contradicts the results of Mankiw, Romer and Weil who claim that Solow over-estimates the convergence rates. That said, there are still limitations in the Solow model. These include its failure to explain how or why technological progress occurs. This failing has led to the development of endogenous growth theory, which endogenizes technological progress and/or knowledge accumulation.

6.2.2 Endogenous Growth Theory

Variation between the two theories

Endogenous growth theory was developed in the 1980s. In this theory, the "production" of new technologies and human capital is of crucial importance. Firms and individuals have an incentive to invent in order to exploit an advantage over their competitors, thereby improving their own productivity. Some of the knowledge associated with the innovation "spills over" into other economic areas, increasing these areas' ability to innovate. A virtuous cycle arises through this mechanism.

In contrast to the older neoclassical growth theory, endogenous growth theory argues that policy measures can have an impact on the long-run growth rate of an economy. The neoclassical model implies that changes in the savings rate will not affect economic growth, but they will increase income levels. According to the neoclassical model, if saving rates change, the growth rate of output will adjust so that it will be at the same level as before the change in savings rates. On the other hand, endogenous growth theory assumes a constant marginal product of capital, which implies that higher savings levels will lead to a higher growth rate.

The effect of an increase in savings on the savings and investment gap differs from the neo-classical model because in the endogenous model the savings curve is straight rather than curved. Since the gap determines the rate of growth in the capital-labour ratio, the endogenous growth model predicts that high income will lead to high savings and high savings will lead to higher growth rates. There are two basic types of endogenous growth theory, the AK model and the Romer Model.

The AK Model

Sergio Rebelo first discussed the AK models in 1990; they differ from the Solow model by abolishing the assumption of diminishing marginal returns to capital accumulation. This has a dramatic effect on the models predictions for the sources of growth. The basic AK model only examines A and K but this proves to be too simplistic because there is no mention of the most important factor of production labour. Therefore, discussion starts with an extended production function which incorporates labour:

$$Y = AK^{\alpha}H^{1-\alpha} \tag{6.14}$$

where Y is output, K is physical capital, H is human capital and A is technology. In this model, labour input is determined by the stock of human capital, H. This can be accumulated through education, which means that both types of capital (H and K) can be accumulated. The steady state levels depend positively on the savings rate and negatively on the depreciation rate, neither of which is relevant in the long run of the Solow model. The steady state growth rate is given as:

$$As_K^{\alpha}s_H^{1-\alpha} - \delta \tag{6.15}$$

As both H and K can be accumulated saving can therefore be split into two sections, the savings rate for human capital (s_H) and for physical capital (s_K) accumulation. The expression for the steady state growth rate reveals that the level of technology has an effect on the growth rate. It should be noted that in this model, labour is defined differently from Solow; it becomes a measure of the skill of the work force rather than just of the size of the labour force. This human capital can be accumulated through investment in education and training. The more education achieved in a country the higher the level of human capital.

The Romer Model

The Romer model approaches endogenous growth from a different angle. Romer views technology as primarily due to research and development (R&D) that leads to invention. In this model labour is divided between $L = L_y + L_A$;

where L_y is the allocation of labour to the production of output/goods and L_A is the number of workers engaged in developing ideas or R&D. The production function for the change in the number of capital goods is:

$$\dot{A} = L_A^{\lambda} A^{\phi} \tag{6.16}$$

where $\dot{A}$ is the growth rate of technology. The parameter λ determines the productivity of labour in R&D activity, while ϕ measures the extent to which new technology builds upon the old. When $\phi < 1$ it implies that there are a limited number of inventions in the world and that the stock of potential inventions is falling, but when $\phi > 1$ it implies that each invention is building on the knowledge that is already available. The production function is:

$$Y = AK^{\alpha} L_y^{1-\alpha} \tag{6.17}$$

Taking logs and differentiating the output function gives the growth rate of technology along the steady state path as:

$$g_A = \frac{\lambda n}{1 - \phi} \tag{6.18}$$

This growth rate depends on three important factors:

- *The growth of population* (n). The higher n, the faster the economy increases in knowledge and therefore increases the growth rate of production. This is the opposite of Solow's conclusions which show that increases in the growth rate of population decrease growth rate out of the steady state.

- *The productivity of R&D parameter* (λ). This affects growth both in and out of the steady state, because the productivity of labour in R&D will affect the growth rate of technology (gA). There is a temporary effect out of the steady state, which moves it towards the new steady state level, but there is also a long-run effect on the steady state growth rate of output.

- *The building of knowledge effect* (ϕ). More knowledge in a society increases the rate of current inventions, which results in an increase in (gA).

The Romer Model has an additional assumption, which is important; it states that the technology invented is not restricted to the country that invented it. Rather, products invented end up around the world affecting every other country's growth as well. This implies that it is not a growth model for an individual country but rather a long-run model of global economic growth. It indicates that the ability of citizens in one country to learn and adopt knowledge and technology from another has an effect on the level of output per worker.

6.2.3 Analysis and Extensions of Growth Models

Comparisons of the two models

Barro (1991) uses various growth theories to investigate cross-country growth rates between 1960 and 1985. He finds that, given the initial level of GDP per capita in 1960, the growth rate is significant and positively related to the starting amount of human capital. Thus poor countries tend to catch up with rich countries if the poor countries have high human capital per person, in relation to their level of per capita GDP, but not otherwise.

Barro concludes that high fertility rates tend to occur in countries with low human capital and low ratios of physical investment to GDP. Per capita growth and the ratio of private investment to GDP are negatively related to the ratio of government consumption expenditure to GDP. This could be that government consumption introduces distortions, such as high tax rates, etc.

Bernard and Jones (1996) expand on the Solow model and investigate technology and convergence; they find that capital accumulation is an important factor in differentiating growth rates. They examine innovation sharing and the ability to adopt new technologies. For example, two economies with the same K, L and A will produce different quantities of output if α is different. They therefore conclude that steady state convergence is more an exception rather than the rule. Countries that are good adopters of technology do better than those that cannot implement new knowledge as easily. By examining convergence, at a sectoral level, rather than the aggregated level they investigate how much convergence is due to technology versus capital-labour ratios because of the differences in composition of the sec-

tors. They show that the manufacturing sector has vastly different levels of convergence than those at the national level. This is a very interesting result due to the vast amounts of investment in R&D that has occurred in the manufacturing sector, and when so much emphasis has been placed on R&D as an explanatory variable for the rate of convergence.

Crafts (1999) reviews economic growth in the twentieth century, he compares neo-classical theory and endogenous growth theory. He believes that the most straightforward reason why fast growth comes to an end is that it is based on an investment boom that runs into diminishing returns and/or involves an episode of catch-up growth, at the end of which productivity growth will naturally slow down. He suggests that the underlying problem in the long-run is that governments fail to adopt adequate institutions and policies to facilitate reform in the economy. This can lead to economies' catch-up falling short.

Crafts reviews the argument that long-run time-series evidence is the key to evaluating the endogenous growth hypothesis. He stresses that the failure of OECD growth rates to accelerate in recent decades appears to contradict the predictions of endogenous growth models that increased investment in human capital and R&D will permanently raise the growth rate. This does not mean that the endogenous growth hypothesis can be rejected; it is just that the scale effects underlying endogenous growth may be absent.

He shows that if there are diminishing returns to research, then increases in the share of national income devoted to R&D will raise the level of GDP per person and will have a transitory but not a permanent positive effect on the growth rate, which in the long-run will be determined by the exogenous natural rate. This brings the problem back to the Augmented-Solow model of the world.

He concludes that growth theory is right to use long-run time-series but that it needs to recognise the importance of changes in technology. He believes that policy-makers need to embrace the importance of institutional change in maintaining productivity growth in the long run, especially in terms of catch-up growth where the dynamics of an economy are constantly changing.

Expanding Technology beyond R&D

Charles Jones (2002) describes output per worker in the steady state as being determined by the rate of investment in private inputs like physical and human capital, the growth rate of the labour force and the productivity of these inputs. The western world is richer because it not only invests more in these inputs but also uses them more productively than poorer countries. The essential point that he makes is that the growth rate of A is not only determined by investment in research and development, but it is dependent on any other variable that will increase the total factor productivity (TFP) of a worker. This is where social infrastructures such as laws, government policies and institutions play an important role. A country will be richer if these social infrastructures encourage investment, production and prosperity. However diversion dramatically reduces the wealth of a nation. Actions such as corruption, bribery and expropriation can reduce the standard of living in a country as they reduce the incentive to invest.

Influence of Social/Cultural Development

Robert Hall and Charles Jones (1999) claim that success in achieving high levels of output per worker is due to a common set of determinants. These include institutions that support production over diversion (defined below), an economy that is open to international trade, freedom for private ownership to exist at some level, where international languages are spoken to increase the ability to trade and that the country is located in a temperate climate far from the equator. This is done using the Cobb-Douglas Production Function as the basic framework.

They then explore the development of social infrastructure hypothesising that differences in capital accumulation, productivity and therefore output per worker are fundamentally related to differences in social infrastructure across countries. They define social infrastructure as institutions and government policies that determine the economic environment within which individuals accumulate skills and firms accumulate capital and produce output. Social infrastructure that is favourable to high levels of output per worker provides an environment that supports productive activities and en-

courages accumulation of capital.

They then introduce the idea of diversion, i.e., thievery, squatting and mafia. This diversion undertaken by private agents reduces growth. Regulations and laws may protect against diversion but they can also be the primary agent of diversion in an economy when governments or their officials are corrupt. Policies that are favourable to productive activities produce more output per worker but there has to be a powerful deterrent to reduce the risk of diversion. This is best implemented on an economy wide basis through legal and policing systems.

Large variation in output per worker across countries is partially explained by difference in physical capital and educational attainment. Differences in social infrastructure across countries cause large differences in capital accumulation, educational attainment and productivity and therefore large differences in income across countries. The extent to which different countries have adopted different social infrastructure is partially explained by the influence of Western Europe in the past.

Influence of Institutions and Origins

Acemoglu *et al.* (2001) looked at this issue of institutions and origins; they present some robust and interesting results. They investigate the role of mortality in colonies more than 100 years ago and its effect on the creation of economic institutions and long-run growth. If the conditions were favourable the Europeans settled in the region and brought with them their culture and economic institutions thus affecting the subsequent development of that region. Acemoglu *et al.* find a very strong relationship between the historical mortality risk faced by Europeans and the current extent to which property rights are enforced.

Using European mortality as an instrument for the current enforcement of property rights, they show that most of the gap between rich and poor countries today is due to differences in economic institutions. They discovered that there was a correlation between latitude and income per capita, but this was only in an historical sense as the creation of institutions occurred where the Europeans settled; that tended to be in more temperate climates, as they were not immune to tropical disease. However, when they controlled

for the effect of economic institutions on GDP per capita, geographical variables (i.e., latitude, land-locked regions, current disease environment, etc) have no explanatory power for current prosperity.

Another issue was the effect of the colonist's culture on the regions they settled in. They report that once economic institutions were accounted for, there were no significant effects from culture, colonial power or the proportion of the populations of various religions on income per capita. They concluded that the data did not support the theory that geography, religion or culture of the coloniser had a significant effect on institutions.

In Acemoglu *et al.* (2004) they take this thought one step further when they examine why the institutions varied so much across colonies. They discuss four different theories as to why institutions vary across countries:

- First, the *Social Conflict View*: this arises when all groups want to get their own way. Different groups or individuals will prefer different institutions and they allocate resources differently depending on their own interests, having a direct impact on the political system.

- The second view, *Efficient Institutions*, is based on the Coase Theorem. Coase (1960) argues that if the current economic institutions benefited a certain group while negatively affecting another, these two groups could negotiate to change the institutions. Effective negotiation will increase the surplus wealth of the country, which can be bargained over to determine how it is divided between them. This theory views political institutions or power as irrelevant; it may matter for the distribution but not for efficiency itself.

- The third theory of institutions, the *Ideology View*, is quite close to that of the efficient institutions view but societies may choose different institutions because they or their leaders disagree about what would be good for the society. The models developed on this view show that even if different societies have different beliefs about what is socially efficient, they could still rationally choose economic institutions.

- Finally, the *Incidental Institutions View* explores the historical accidents at critical junctures that determine the institutions. Moore's

(1966) theory is that democracy emerged when there was a strong, politically assertive, commercial middle class, and when agriculture had been commercialised so that there were no feudal labour relations in the countryside. He believed that fascism arose when the middle classes were weak and entered into a political coalition with the landlords. Communist revolution occurred when the middle class was non-existent, agriculture was not commercialised, and rural labour was repressed through feudal regulations. This puts agricultural development at the core of the development of institutions. However, the development of agriculture was not chosen with the intention to develop these institutions, making them an unintended accident.

Papers found on Andrei Shleifer's website[1] examine institutions and their effects on growth in great detail. Two papers investigate the issue of where institutions come from and what effects have they had on growth. The first paper, Glaeser and Shleifer (2002), concludes that most countries in the world have inherited their legal systems from their occupiers and colonisers, rather than developing them indigenously. They conclude that civil law could be used as a control instrument of a bad government, as it can have adverse effects for the security of property rights. The differences between common and civil law can be traced back to the relatively more peaceful England that developed trials by independent juries while France relied on state imposed judges to resolve disputes. The differences between these two legal systems can have an effect on social and economic outcomes.

Glaeser *et al.* (2004) conclude that to determine a link between institutions and economic growth is extremely difficult. Their results support the theory that the greater the human and social capital of a community, the more attractive the institutional opportunities. This implied that while human capital is more influential with respect to growth than institutions, the institutions themselves do promote growth in their own right. Institutions are determined by efficiency, history and politics. They discovered that the data did not support the view that security of property and eco-

[1]Datasets which have been complied by Andrei Shleifer are used in a number of co-authored papers found on his website, however, his co-authors change often and it is not immediately obvious that the institution related literature involves Shleifer's work.

nomic development, democratisation and constraints in government must come first. Rather the poor countries can get out of poverty through good policies (often implemented by good dictators), and then once out of poverty the institutional improvements occur, not before.

Additional studies move on from the creation and development of institutions to look at how the polices of current institutions affect productivity and growth. Djankov *et al.* (2002) focus on the levels of regulation of entry for start-up firms. The countries with heavier regulation of entry have higher corruption and larger unofficial economies, but not better quality of public or private goods. They conclude that while regulation benefits politicians and bureaucrats it is not necessarily in the best interest of the general public.

Botero *et al.*(2004) consider the influence of the origins of the legal system and politics on the amount of labour regulation there is in an economy and the affect this has on the growth rate of that country. They found the legal origin has a larger effect on labour regulation then politics of the ruling party. They concluded that a more regulated market tends to have lower labour force participation and higher unemployment, especially in the younger age bracket.

6.3 Model

6.3.1 Model Assumptions

The model used in this chapter is a standard model of technology transfer. There are a number of variations of this type of model. Nelson and Phelps's (1966) model looks at the effect that educated people have on innovation, and how education can speed the process of technology diffusion. Bernard and Jones's (1996) version of the model is based on technology diffusion in the manufacturing sector of the USA. The model we use in this chapter is a slightly different version of the model presented in Acemoglu (2009).

This version of the model examines the gap in technology growth levels in countries across the world. It is assumed that there is a lead country and all other countries follow the leader. The leader has technology level A, which grows at rate g. All other countries have technology levels B_{it},

where $B_{it} < A_t$. The model assumes that the lead country's technology growth rate is exogenous while the following countries' technology growth is endogenous. In continuous time these technology levels grow at a rate of:

$$\dot{B}_i(t) = \lambda_i \left(A(t) - B_i(t)\right) \tag{6.19}$$

where $(A(t) - B_i(t))$ is the technology or productivity gap between the lead country and the follower. The parameter λ_i measures the fraction of the gap that can be closed due to country $i's$ convergence speed through absorbing knowledge and new technology from the advanced country. The larger the gap the more the following country has to learn and therefore the more convergence needed.

6.3.2 Steady State Solution

In the steady state solution of this model, technology in all countries grows at the same rate, therefore the growth rate of $B_i(t)$ is given by:

$$\frac{\dot{B}_i(t)}{B_i(t)} = \lambda_i \left(\frac{A(t) - B_i(t)}{B_i(t)}\right) \tag{6.20}$$

In the steady state, the growth rate of the follower must equal the growth rate in the lead country, g.

$$\lambda_i \left(\frac{A(t) - B_i(t)}{B_i(t)}\right) = g \tag{6.21}$$

So,

$$A(t) - B_i(t) = \frac{g}{\lambda_i} B_i(t) \tag{6.22}$$

which can be rearranged to:

$$B_i(t) = \frac{A(t)}{1 + \frac{g}{\lambda_i}} \tag{6.23}$$

or, alternatively;

$$B_i(t) = \frac{\lambda_i}{g + \lambda_i} A(t) \tag{6.24}$$

The fundamental part of this model is that following countries can never actually catch-up because:

$$\frac{\lambda_i}{g + \lambda_i} < 1 \tag{6.25}$$

The following country always has technology levels less than the leader and can only experience growth in technology if there is a gap between their level of technology and the leaders. That is, as long as the lead country grows at rate g, the followers can acquire new technologies from them. Therefore in the steady state they must have lower technology levels than the leader.

6.3.3 Convergence to the Steady State Path

By solving Equation 6.19 it can be shown that the steady state equilibrium is relevant if convergence occurs. It is expressed below with all $B_i(t)$ terms on the left hand side

$$\dot{B}_i(t) + \lambda_i B_i(t) = \lambda_i A(t) \tag{6.26}$$

Given that $\frac{\dot{A}(t)}{A(t)} = g$, its solution is $A(t) = A(0)e^{gt}$ therefore the differential equation can be re-written in the form

$$\dot{B}_i(t) + \lambda_i B_i(t) = \lambda_i A(0)e^{gt} \tag{6.27}$$

The General solution of this differential equation is:

$$B_i(t) = \frac{\lambda_i}{g + \lambda_i} A_0 e^{gt} + D_2 e^{-\lambda t} \tag{6.28}$$

or, alternatively:

$$B_i(t) = \frac{\lambda_i}{g + \lambda_i} A_t + D_2 e^{-\lambda t} \tag{6.29}$$

Given that $e^{-\lambda_i t}$ tends toward zero as time goes on, the solution converges to the first term, which is growing at rate g, as required in the steady state.

This shows that even if there is TFP growth in poor countries and they close some of the gap with rich countries they will never actually catch-up because $\frac{\lambda_i}{g+\lambda_i}$ is less than one. The leader will always be growing at rate g, this implies that the follower will always have technology levels below that of the leader. The model also shows that it is not the countries' ability to invent new capital goods that is the key to growth but instead their ability to absorb and learn technology from advanced countries. Therefore, the higher the absorption speed of the follower countries, the faster they will converge on the leader.

6.3.4 Determinants of Technological Convergence λ

The model also makes predictions about the relationship between the rates of technological convergence, λ_i, and the country's places in the long-run world income distribution. The faster the speed of learning, the higher the country's long run level of income will be. If a country can increase its λ_i via education or science-related policies its position in the steady state distribution of income may move upwards with the economy then going through a phase of rapid growth.

The next issue to address is what causes differences in TFP across countries and what drives the pace of technological convergence in poorer countries? Hall and Jones (1999), Acemoglu *et al.* (2001) and Glaeser *et al.* (2004) are among many that address these issues. They all seem to agree that institutional and social infrastructures are the keys to explaining productivity and growth differences across countries.

6.4 Data and Methodology

6.4.1 Data

There are three data sources used in this chapter, Penn World Tables (PWT), Barro-Lee Tables and Shleifer's Institutions data. The PWTs provide data on countries' national accounts, in a consistent and comparable template, from which 58 countries are drawn. The Barro-Lee Tables give the number of years of schooling achieved by individuals by country (between 1960 and 2000) which is used to estimate human capital and therefore determines the period used. The institutions data is sourced from work carried out by Andrei Shleifer; these data provide country-specific information with regard to how a country functions. Institution variables include, but are not limited to, the type of social and health benefits available, labour regulations, corruption, political regimes and civil rights that exist in a country. All data sources are discussed in detail in Chapter 2.

6.4.2 Assumptions for K, I and δ

The first variable that had to be calculated was capital as it is not a primary data source in the Penn World Tables. Before it could be generated assump-

tions needed to be made regarding depreciation and initial conditions. The depreciation assumptions (δ) follow those of McQuinn and Whelan (2007b). They claim that depreciation is around 6 per cent per annum. They come to this conclusion by assuming that there are different rates of capital depreciation for each type of capital input.

$$Y_t = S_t^{\gamma} E_t^{\alpha-\gamma} (A_t L_t)^{1-\alpha} \tag{6.30}$$

where S_t is physical structures and E_t is equipment. They show that this equation can only be obtained in this case if the weights used to calculate the "aggregate depreciation rate" reflect the contribution of each asset to production. That would be $\frac{\gamma}{\alpha}$ and $\frac{\alpha-\gamma}{\alpha}$ in this example. Empirical calculations from Whelan (2003) report Cobb-Douglas exponents of 0.145 for equipment and 0.165 for physical structures, where value weights point to physical structures being more important. An equally-weighted average of 2 per cent depreciation rate on dwellings and 10 per cent depreciation rate for equipment, point to an overall depreciation rate of 6 per cent.

Given the assumed depreciation rate, the time series for capital stock (K) can be created using the perpetual inventory method below.

$$K_t = K_{t-1} (1 - \delta) + I_{t-1} \tag{6.31}$$

where I_{t-1} is the unobserved invested value. The problem is that initial capital, K_{t-1}, cannot be observed. To deal with this issue we follow the calculation from McQuinn and Whelan (2007b). They estimate the initial capital stock by making an "informed guess" based on the ratio of the first observed investment value (I_t) to capital, which is given by:

$$\frac{I_t}{K_{t-1}} = \frac{\Delta K_t}{K_{t-1}} + \delta \tag{6.32}$$

and thus,

$$K_{t-1} = \frac{I_t}{\frac{\Delta K_t}{K_{t-1}} + \delta} \tag{6.33}$$

where $\frac{\Delta K_t}{K_{t-1}}$ is the average growth rate of investment over a ten year period. It is used as a proxy for the growth rate of capital. When they tested this method they found that their estimated capital stock for 2000 had a

correlation of 0.99 with later series that were almost completely based on data rather than the initial assumptions. In this chapter the first available ten years are used. Once this initial value has been generated it was entered into Equation 6.32, which then determined the entire series of capital stock. Additional variables generated from the PWT are defined in Table 6.1.

6.4.3 Creating Institution Rankings

The variables within each of the institutional groups are highly correlated with each other. This multicollinearity problem implies that the estimated coefficients will not be very reliable as they will be prone to changes as other variables are added or withdrawn from the regression. In order to overcome this problem a Borda ranking system was used. The Borda Count was first developed by Jean-Charles Chevalier de Borda in 1770. It is an electoral scheme that provides a method to rank-order scoring. This type of ranking system has been used by economists such as Sen (1977) and Benjamin (2002) to analyse social choice and well-being, respectively.

The Borda rank was created by ranking each country's score for a particular variable within the institutional groupings relative to the other countries in the study. In other words the best performing country in a particular category will obtain a score of 1 and the worst performing country gets a score of 58. This process is repeated for every variable in each group.

Once all the variable rankings are obtained, it is then necessary to sum the ranks for each institutional grouping. This provides us with one number for each of the institutional groups, which indicates their effectiveness in a particular country relative to the other countries in the study. The sum of the ranks contains the essential information given by the original variables without imposing any serial correlation problems for our modelling.

6.4.4 Total Factor Productivity (TFP)

Using the absorption and convergence models discussed above this chapter examines the convergence speeds of technology growth. The TFP gap is the difference between the leader's TFP growth and the follower's, rather than the steady state difference above. It is determined by calculating TFP for each country over time using Hall and Jones's decomposition of output per

worker. This is done using the Cobb-Douglas production function:

$$Y_i = K_i^{\alpha}(A_i H_i)^{1-\alpha} \tag{6.34}$$

where α is a production function parameter, which is equal to the share of capital income in national output. H_i is human capital, which is used rather than labour. It is derived as

$$H_i = e^{\phi E_i} L_i \tag{6.35}$$

Hall and Jones assume that L_i is homogeneous within a country and that each unit of labour has been trained with E_i years of schooling. This chapter uses the Barro-Lee tables of average years of schooling for this variable E in the estimations. In this specification ϕE reflects the efficiency of a unit of labour with E years of schooling relative to one with no schooling.

This production function can be written in terms of output per worker

$$y_i = k_i^{\frac{\alpha}{1-\alpha}} h_i A_i \tag{6.36}$$

where $k_i \equiv K/Y$ is the capital-output ratio, $y \equiv Y/L$ is output per worker and $h \equiv H/L$ is human capital per worker. This can be re-written to give the TFP or A_i value:

$$TFP_i = \frac{y_i}{k_i^{\frac{\alpha}{1-\alpha}} h_i} \tag{6.37}$$

Figure 6.1 shows the effect of accounting for human capital on TFP. The broken lines show that the TFP or the residual is lower when h_i is used instead of L_i given that more of the output per worker has been explained.

In these calculations the standard value of $\alpha = 1/3$ is used, as done in Hall and Jones (1999) and McQuinn and Whelan (2006). However, the results were similar when alternative values, such as $\alpha = 0.4$ were used, as done in Easterly and Levine (2001).

Table 6.2 shows the ratio of output per worker to that of the leader, for a selection of countries. The leader is the USA and it covers the entire sample. The sample is split into high, middle and low income countries and the Table shows that output per worker has been catching up in some countries, e.g., Ireland, Hong Kong and China. It also shows that some countries such as Italy, Mexico, Argentina, Japan and Kenya started to converge in the

1970s and 1980s but then diverged again in the 1990s. These countries are compared with the USA values in the same year, and therefore USA growth needs to be considered. Over the sample the US experienced output per worker growth averaging 1.4 per cent per year. This implies that when a country converged with the US during this period, output per worker needed to be growing in excess of 1.4 per cent.

Tables 6.3 and 6.4 show the break-down of the productivity calculations for 2000 as ratios to the USA. The 58 countries are divided up into regional groupings: Europe, Australasia, the Americas, Africa and the Middle East. It can be seen that in the more developed countries TFP contributes more to output per worker growth-rates than in less developed countries. This would imply that developed countries invest sufficiently in labour and capital, and that their growth comes from how productively and efficiently this investment is used.

Hall and Jones concluded that differences in productivity (A or TFP) play a key role in the generation of output per worker differences across countries. They find that their measure of productivity is highly correlated with human capital accumulation and moderately correlated with the capital-output ratio. It is from this perspective that we examine what really affects productivity and explore what merit there is in learning-type models explaining the differences across countries.

6.4.5 Regression Specifications

There are six different specifications of the model tested in this section. They all represent variations of the learning model and the effect of institutions on TFP growth. The sample leaders used are the USA and an average of OECD members, i.e., all countries in the sample learn from these two leaders. While the USA does not always have the highest absolute TFP levels, it is still used as the global leader because it has managed to maintain consistent output per worker growth for much longer periods than any other country.

Given that unconditional convergence is low, and not all countries will converge on the USA or even on the OECD average, the sample is broken into regions which have their own local leaders. The regions are Australasia, Europe, The Americas and the rest of the world which is made up of Africa

and the Middle East (see Table 2.14 in the Data Chapter). In none of the regions is there a single leader for the entire sample; the leaders change sporadically depending on who has the highest TFP levels in any given year. This incorporates the random disturbance term, $\epsilon_i(t)$, which allows the leader to change. The entire sample is then estimated allowing each country to learn from its regional leader, without causing sampling errors by running each of the regions separately.

The regression specifications will be discussed in discrete time as that is the format of the data. The first regression tests the pure learning effect on TFP growth as described in Equation 6.19. This is done by using the productivity gap between each country and the leader:

$$\Delta \log \hat{TFP}_{it} = \lambda_i \left(\hat{GAP}_{it} \right) + \epsilon_{it} \tag{6.38}$$

where the gap is defined as the difference between each country's estimated TFP and the leader's TFP:

$$\hat{GAP} \equiv \left(\log TFP_{t-1}^{usa} - \log TFP_{i,t-1} \right) \tag{6.39}$$

The fraction of the gap that is closed each year is measured by the parameter λ_i. Each country's convergence speed is due to their ability to absorb and implement new technology and knowledge from the lead country. The error term is ϵ_{it}. The gap can be lagged because the following country can only acquire technology from the previous periods. This is to incorporate R&D patents in the advanced country.

The rest of the regressions include institutions; the purpose of this is to determine the direct and indirect effects that institutions have on TFP growth. For example, if a following country were to implement a new health system that was learned about from the leader, there would be two different channels of influence. The direct effect is the benefit of the new system itself, while the indirect effect measures how much the gap is reduced and how much convergence occurred through learning and implanting this new system.

The second regression tests the indirect effect of institutions on TFP growth through the gap. The effect on the gap is measured by creating interaction variables, i.e., multiplying institutions by the gap. This test

measures whether or not the institutions matter for learning speeds and convergence.

$$\Delta \log T\hat{F}P_{it} = \beta_1 \left(G\hat{A}P_{it}\right) + \beta_2 \left(INST_{it} * G\hat{A}P_{it}\right) + \epsilon_{it} \tag{6.40}$$

where INST is a combination of institution indicators that measure government, citizens rights, trade, health, social and labour behaviour in a country. In this case λ_i becomes a function of the gap and the interaction variables.

$$\lambda_i = (\beta_1 + \beta_2 * INST_{it}) \tag{6.41}$$

The lower the λ_i the more slowly the country converges toward the leader of a given gap. This implies that the indirect effect of institutions should be negative, because if they are reducing the gap they are creating convergence, where λ_i determines the speed of that convergence.

The third regression includes country-specific factors as well as the indirect institution effect. This is to determine how much TFP growth should be assigned to country-specific factors that cannot be measured. The purpose of this regression is to determine if the difference in global TFP growth is based on domestic differences or if they are explained by learning alone.

$$\Delta \log T\hat{F}P_{it} = \beta_1 \left(G\hat{A}P_{it}\right) + \beta_2 \left(INST_{it} * G\hat{A}P_{it}\right) + \beta_3 \left(DUMMY_i\right) + \epsilon_{it} \tag{6.42}$$

It is important to return to the direct effect that institutions have on TFP growth as new policies and systems can have a significant influence on society. The fourth regression tests this direct effect, independently of the gap:

$$\Delta \log T\hat{F}P_{it} = \beta_1 \left(G\hat{A}P_{it}\right) + \beta_2 \left(INST_{it}\right) + \epsilon_{it} \tag{6.43}$$

The fifth regression examines the combined direct and indirect effects of institutions on TFP growth. If they are not correlated the effect should be the sum of the direct and indirect effect. This will not be the case as there is correlation between the variables and this makes it difficult to attribute definite effects.

$$\Delta \log T\hat{F}P_{it} = \beta_1 \left(G\hat{A}P_{it}\right) + \beta_2 \left(INST_{it} * G\hat{A}P_{it}\right) + \beta_3 \left(INST_{it}\right) + \epsilon_{it} \tag{6.44}$$

To compensate for this correlation, joint significance tests are run to determine if all of the variables are significant as a group rather than just looking at the individual institution's effects.

Given that both the direct and indirect effects are potentially affected by country-specific factors it is important to test for this effect independently of other factors. The final regression therefore tests for the county specific effect on its own:

$$\Delta \log \hat{TFP}_{it} = \beta_1 \left(\hat{GAP}_{it} \right) + \beta_2 \left(DUMMY_i \right) + \epsilon_{it} \tag{6.45}$$

This will give an indication of how much TFP growth is due to internal factors in each country. These are things that would be difficult to replicate. While this chapter does not analyse any country specifically we can use Ireland as an example to explain the intuition behind this regression.

It is unlikely that other countries will be able to have the same growth rates for as long as Ireland because there were so many things that created its TFP growth. There were demographic changes, returns on previous investment in education, joining the European Union and attracting large quantities of FDI, etc. All of these factors could be replicated but the chances of them all coming together at the same time and having the same effect in another country is very slim. So how much of the Celtic Tiger was due to luck, domestic circumstance or implementation of better institutions? This chapter will attempt to determine these answers at a global rather than a country level.

6.5 Results

6.5.1 Summary Statistics

This section examines the relationship between the institution variables and the gap in TFP compared with the leader. The two global leaders used in this chapter are the USA and an average of OECD member's TFP. Regional leaders changed over the course of the sample so there is no specific leader for any given region. This allows the leader in each respective region to change with all local countries learning from that year's local leader. The coefficient of the TFP gap is λ, which measures the fraction of the gap that

is closed each year due to learning. It is therefore the convergence speed for the following country over the entire sample.

Figure 6.2 shows a selection of countries TFP gaps with the USA and how they have changed over time. The developed countries used are Canada, Finland, Ireland and the UK. Since the 1980s, Canada and Finland seem to have become less productive in relation to the USA. Ireland became more productive in the 1990s, while the UK has been performing consistently better than the USA since the early 1970s. The speed at which these countries closed this gap, λ, was approximately 0.04 over the course of the sample.

The absolute gap between the Latin American countries and the USA has also been small but there is some evidence of divergence since the early 1980s. This Panel indicates that Argentina and Mexico were both more productive then the USA until the mid 1980s, i.e., they were more efficient in their use of resources; however, after 1980 they began to lose this relative efficiency. In other words, Latin America was not able to increase its productivity levels as rapidly as the USA. Argentina and Brazil convergence speeds are 0.11 and 0.10, respectively, with Chile and Mexico at 0.06 and 0.03; unfortunately, these learning speeds do not appear to have had the expected theoretical effects of catch-up.

The size of the absolute gaps in Asia and Africa are quite similar and much larger then Latin America and the developed countries. In Asia a large portion of that gap has been closed in recent years. China for example has halved its gap with the USA, with the rest of Asia increasing their productivity levels by about 0.5. India, China and Korea had convergence speeds of 0.01, with Japan's converging at a rate of 0.10.

Africa's TFP levels have been relatively consistent with the USA over time. This does not mean that there has been no TFP growth in Africa, but that whatever growth has been over shadowed by growth in the USA TFP. The convergence speeds in these four African countries have also been very low, all less than 0.006.

6.5.2 Regression Results

Table 6.5 shows results from Equation 6.38 in the model. It measures the pure effect of learning on TFP growth over five year intervals. The five year

time scale is standard in the literature and it is used to minimise disturbances in the data, that is, it focuses on longer term trends ignoring short term fluctuations such as the business cycle. Given that TFP is a residual the R^2 tends to be quite low.

In the global economy analysis, the TFP gap between the USA and all the other countries has a coefficient of 5.4 per cent on TFP growth. The five-year TFP growth rate used implies that every five years global learning speeds are about 5.4 per cent. This indicates that all countries in the sample are learning at this speed, however, this pure learning effect is weaker for OECD averages and local leaders.

The next regression tests Equation 6.40 and the results are displayed in Table 6.6. It tests whether institutions matter for the speed of learning. The coefficient of the gap (λ) measures the speed of convergence through learning. By interacting the institution variables with the gap the indirect effect of these institutions on TFP can be seen as they work through learning, i.e., the λ defined in Equation 6.41. The R^2 shows that adding the institution variables to the regression only increases the fit of the model by 2 per cent.

Given that Table 6.5 claims that each country is learning at 5.4 per cent it is interesting to see how vastly different the learning speeds are once institutions are added. For example, Australia, Austria, Denmark, Belgium, Sweden and Canada all have learning rates greater than 13 per cent as shown by A in Table 6.3. This implies that they are learning at least twice as much as expected without institutions. On the other hand Mali, Senegal, Zambia and Mozambique all have learning speeds less than 1 per cent (Table 6.4). This indicates that there is a huge variation across countries in the quality of institutions and their effect on each country's ability to learn.

It can also be seen that the interacted institutions do not have significant coefficients, which is most likely due to the correlation between them. This is not surprising, given that the probability of a country only having one good institution indicator is very slim. Therefore exclusion tests were run on the interacted variables and these tests showed that the variables are jointly significant at the 1 per cent level. These tests shows that institutions clearly affect the speed of learning which facilitates the catch-up shown in Table 6.5.

The next step was to determine how much of this convergence is due to the direct effect of institutions on TFP growth and how much due to the gap. Table 6.7 shows the results from Equation 6.43 which indicate that there is a significant direct effect on TFP growth by institutions that is not related to the country's ability to learn. The R^2 are slightly better; in the case of the USA it increases to 11 per cent, while the OECD and Local Leader regressions only increase to 9 per cent. However, these figures may be misleading because Tables 6.6 and 6.7 only examine one aspect of the effects of institutions at a time, that is either the direct or indirect effects.

To address this issue Table 6.8 shows both the direct and indirect effect of institutions on TFP growth. It finds that they both are important though it is difficult to determine which one is the most influential. This is because the correlation between the variables changes some of the signs and significance levels when direct and indirect effects are combined. After conditioning on the direct effect, there seems to be less evidence that institutions matter for learning speeds.

Equations 6.42 and 6.45 add country-specific dummy effects to the regression which have a significant effect on the R^2 as shown by the joint significant test displayed in Table 6.9. Country-specific factors alone account for an R^2 ranging between 21 and 28 across regional and global levels. This indicates that there are systematic country differences in TFP that do not seem to have anything to do with institutions. However, once interacted institutions are added to the dummy variables, as in Equation 31, the value of R^2 increase, to a range of 24 to 31.

6.5.3 Implication of Results

There are a number of reasons for these weak results. First, TFP is a residual and by its very nature is difficult to explain. Second, the institutions data are not time varying in their own right, although this is not a major issue given that implementing new institutions take time to have a significant effect. Third, the regions used are very broad and while there may be learning at a micro level it does not appear to be transferred to this regional level. That is a country may be more inclined to learn from a close neighbour or their dominant trading partner rather than the regional or global TFP leaders.

Also given the strength of the country-specific factors in explaining TFP growth, it should be noted that institutions are very difficult to measure and that Acemoglu *et al.* (2001) and Glaeser *et al.* (2004) stated this in their respective research.

For robustness these regressions were run using Gross National Product (GNP) rather than GDP and hours worked rather than labour as discussed above in the human capital estimations. The purpose of using GNP is to test what effect Foreign Direct Investment (FDI) has on TFP growth. There was practically no difference at a global level as would be expected given that global GDP equals global GNP. However, there was only a very small difference in regional markets which would suggest that GNP only really makes a difference at a country level, although the impact of FDI is beyond the scope of this chapter.

Substituting hours worked into the regressions could only be done for the 17 European countries in the dataset. The data were taken from the Groningen Growth and Development Centre but there was not enough coverage of the other regions to analyse them. The overall growth rates were left relatively unchanged although one or two countries changed position in their global ordering.

6.6 Conclusions

The purpose of this chapter is to examine the direct and indirect effects of institutions on Total Factor Productivity (TFP) growth. It uses a basic absorption model which measures a following country's ability to absorb knowledge and technology from the lead country.

In this chapter there are two global leaders, the USA and an average of OECD member countries. There are also four regions analysed: Australasia, Europe, The Americas and the ROW (which includes the Middle-East and Africa). There are no outright leaders in the regions so the leaders are allowed to vary over time. This indicates that it is possible for followers to overtake leaders depending on which country is more productive at any particular point in time. The regional leader regression is run over the entire sample with each country learning from its local leader, which prevents

sampling errors.

The gap between the respective leaders and followers is generated using TFP levels. The larger the gap the further behind the follower is and the more convergence it needs to catch-up. The coefficient on the gap, λ_i, measures the fraction of the gap that is closed given its absorption ability.

The results show that despite the absence of unconditional convergence in the overall sample data, there appears to be some evidence that there is a tendency for poorer countries to catch-up with wealthier ones. The rate of this catch-up can be influenced by the quality of the country's institutions. There is both a direct and indirect effect from institutions. The direct effect on TFP growth comes from the policies set by these institutions, while the indirect effect is administered through the gap between the leader and the follower, however, these effects are still relatively small.

The most interesting finding of this research is that country-specific factors, which are not picked up by the institution variables used, have the highest explanatory power of all. This demonstrates that there is still a large random element in cross country TFP growth rates and convergence rates.

Table 6.1: Generated Variables Created from the PWT

Variable	Unit	Definition	Equation
Y	$ chain	Total Domestic Output; RGDPCH by Population	$\frac{pop*1000*rgdpch}{1{,}000{,}000}$
trgdpl	$ constant	Total Domestic Output; RGDPL by Population	$\frac{pop*1000*rgdpl}{1{,}000{,}000}$
L	000's	Labour Force	$\frac{trgdpl*1{,}000{,}000)/rgdpwok}{1000}$
INVST	$ constant	Investment	$(\frac{ki}{100}) * trgdpl$
cgnp2	$ current	Gross National Product (current Prices)	$\frac{cgdp*cgnp}{100}$
deflator	-	Deflator used in GDP chain linking base yr 2000	$\frac{cgdp}{rgdpch}$
rgnpch	$ chain	Real Gross National Product (chain series)	$\frac{cgnp}{deflator}$
trgnpch	$ chain	Total National Output; RGNPCH by population	$\frac{pop*1000*rgnpch}{1{,}000{,}000}$

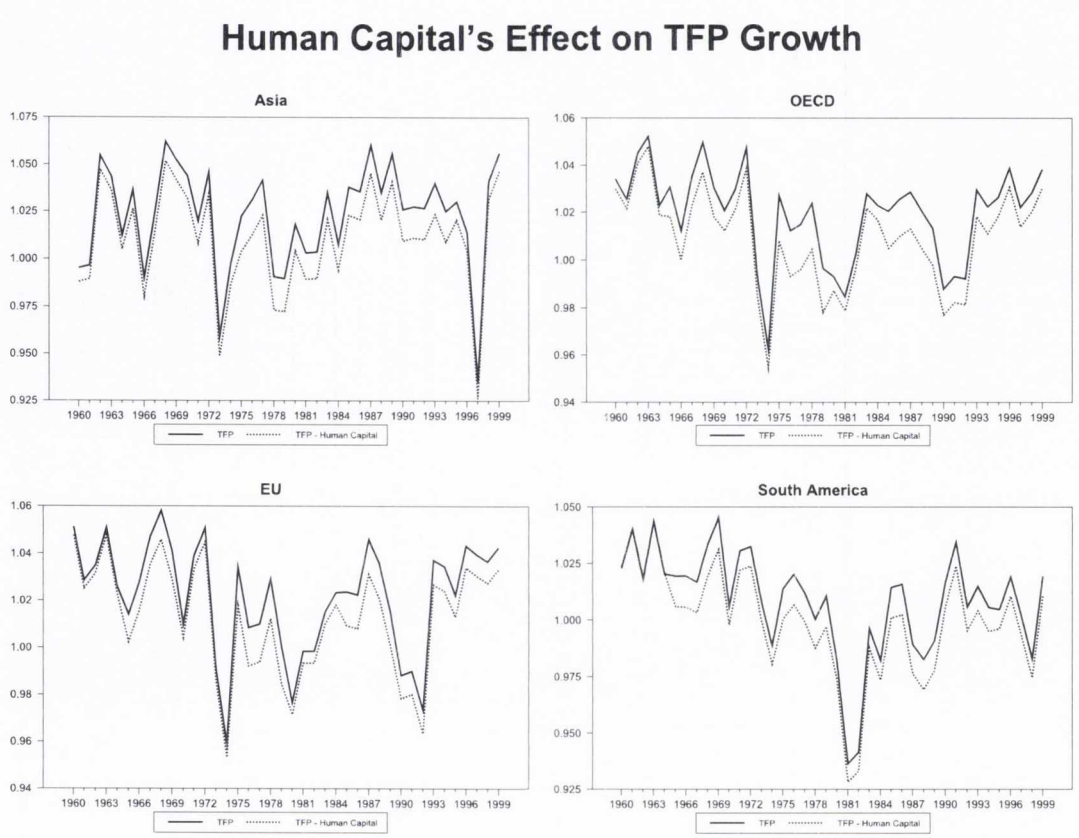


Figure 6.1: Human Capital's Effect on TFP Growth

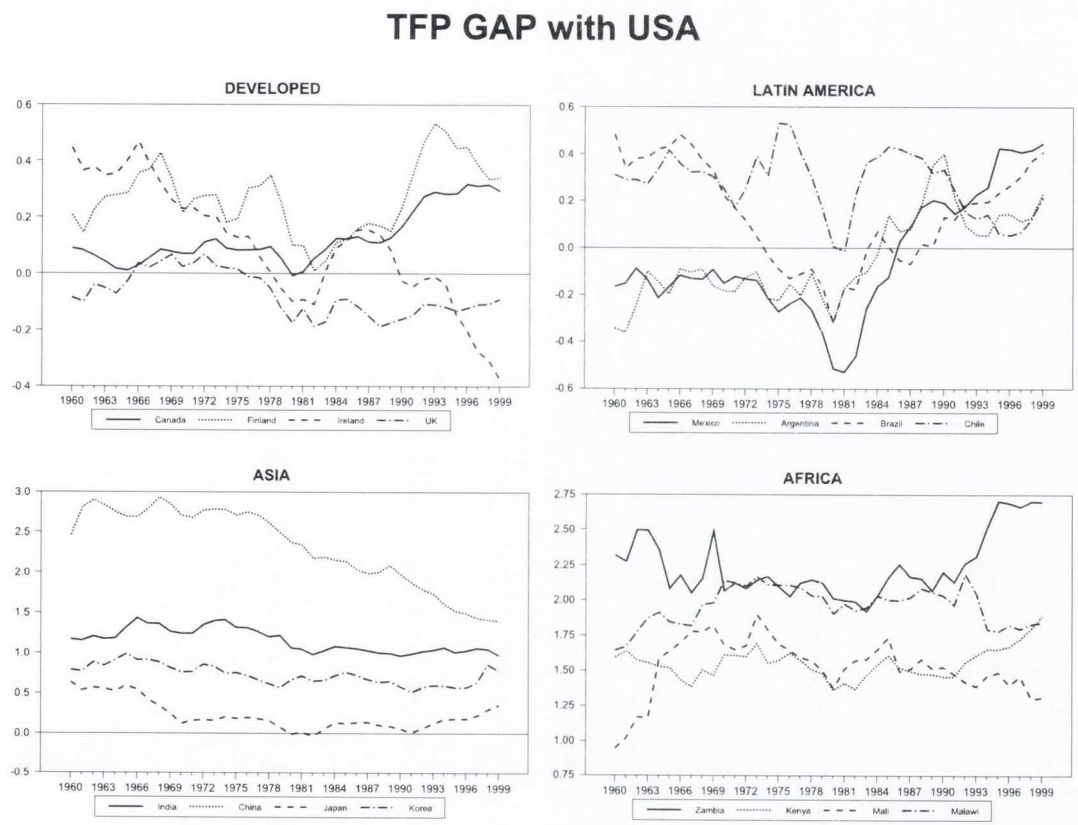


Figure 6.2: TFP GAP with USA

Table 6.2: Output per Worker: Ratios To U.S. Values

	1960	1970	1980	1990	2000
USA	1.000	1.000	1.000	1.000	1.000
Ireland	0.426	0.498	0.641	0.668	0.881
France	0.622	0.766	0.879	0.907	0.824
Italy	0.536	0.722	0.880	0.841	0.758
UK	0.700	0.681	0.723	0.742	0.734
Canada	0.886	0.848	0.844	0.763	0.743
Hong Kong	0.264	0.409	0.605	0.802	0.750
Japan	0.304	0.542	0.708	0.773	0.664
Argentina	0.624	0.610	0.635	0.407	0.417
Mexico	0.385	0.423	0.494	0.346	0.293
Brazil	0.243	0.274	0.380	0.286	0.231
Romania	0.070	0.107	0.256	0.228	0.163
China	0.026	0.024	0.031	0.053	0.100
India	0.060	0.064	0.069	0.083	0.090
Zimbabwe	0.146	0.153	0.162	0.141	0.109
Kenya	0.071	0.057	0.060	0.053	0.037

Table 6.3: Contribution to Output per Worker 2000: Ratios to USA

	YL	HL	$KY^{\frac{\alpha}{1-\alpha}}$	A
Europe				
Austria	0.871	1.013	0.630	1.365
Belgium	0.893	1.012	0.624	1.413
Switzerland	0.810	1.027	0.779	1.011
Denmark	0.752	1.009	0.749	0.995
Spain	0.661	1.008	0.512	1.283
Finland	0.674	1.018	0.754	0.878
France	0.824	1.010	0.595	1.372
U.K.	0.734	0.998	0.678	1.085
Greece	0.478	1.010	0.606	0.782
Ireland	0.881	0.989	0.649	1.374
Italy	0.758	1.012	0.495	1.514
Netherlands	0.845	1.009	0.668	1.254
Norway	0.953	1.012	0.949	0.991
Portugal	0.507	1.004	0.374	1.351
Sweden	0.694	1.009	0.888	0.775
Romania	0.163	1.010	0.693	0.232
Turkey	0.182	0.985	0.369	0.501
Australasia				
Australia	0.754	1.009	0.798	0.936
China	0.100	0.992	0.418	0.241
Hong Kong	0.750	1.005	0.689	1.083
India	0.090	0.961	0.367	0.255
Indonesia	0.116	0.988	0.364	0.323
Japan	0.664	1.028	0.712	0.907
Korea, Rep	0.456	1.018	0.787	0.570
Malaysia	0.401	0.996	0.557	0.722
New Zealand	0.611	1.008	0.907	0.669
Philippines	0.138	0.979	0.538	0.261
Sri Lanka	0.134	0.971	0.438	0.314
Thailand	0.162	1.020	0.439	0.362
U.S.A.	1.000	1.000	1.000	1.000

Table 6.4: Contribution to Output per Worker 2000: Ratios to USA

	YL	HL	$KY^{\frac{\alpha}{1-\alpha}}$	A
The Americas				
Argentina	0.417	0.994	0.604	0.695
Bolivia	0.107	0.970	0.407	0.272
Brazil	0.231	0.997	0.357	0.648
Canada	0.743	1.008	0.896	0.822
Chile	0.417	0.993	0.558	0.753
Colombia	0.210	0.978	0.379	0.565
Dominican Rep.	0.224	0.965	0.387	0.599
Ecuador	0.164	1.005	0.464	0.353
Jamacia	0.135	1.001	0.390	0.346
Mexico	0.293	0.993	0.477	0.617
Panama	0.280	0.991	0.558	0.506
Peru	0.166	1.000	0.517	0.320
Uruguray	0.356	0.986	0.512	0.705
Venezuela	0.267	0.996	0.411	0.653
Africa-Middle East				
Egypt	0.178	0.941	0.381	0.496
Ghana	0.042	0.945	0.331	0.135
Israel	0.773	1.005	0.667	1.154
Jordan	0.182	0.985	0.520	0.356
Kenya	0.037	0.971	0.331	0.114
Mali	0.032	0.952	0.214	0.156
Mozambique	0.031	0.920	0.227	0.149
Malawi	0.026	0.949	0.274	0.100
Pakistan	0.100	0.971	0.269	0.384
Senegal	0.053	0.940	0.261	0.215
South Africa	0.295	0.962	0.556	0.551
Uganda	0.032	0.902	0.288	0.124
Zambia	0.031	1.006	0.401	0.076
Zimbabwe	0.109	0.984	0.372	0.297
U.S.A.	1.000	1.000	1.000	1.000

Table 6.5: Pure Learning Effect on TFP Growth

Dependent Variable: Five Year TFP Growth			
	USA	*OECD Average*	*Local Leader*
Five Yr GAP	0.054***	0.046***	0.034***
	(0.00)	(0.00)	(0.00)
Observations	2542	2542	2542
R^2	0.049	0.038	0.031

Notes: Linear robust regression (Equation 6.38). Figures in brackets are standard errors. *significant at 1% level; ** significant at 5% level; *** significant at 10%level

Table 6.6: Interacted Institutions Effect on TFP Growth

Dependent Variable: Five Year TFP Growth			
	USA	*OECD Average*	*Local Leaders*
Five Yr GAP	-0.205	-0.254	-0.366
	(0.58)	(0.52)	(0.37)
Citizens Rights*GAP	0.034	0.053**	0.053**
	(0.02)	(0.02)	(0.02)
Health Benefits*GAP	-0.101***	-0.110***	-0.045
	(0.03)	(0.03)	(0.02)
Labour Regulation*GAP	0.173	0.187	0.201*
	(0.16)	(0.15)	(0.11)
Labour Regulation Sq*GAP	-0.165	-0.185	-0.236*
	(0.19)	(0.19)	(0.13)
Political Government*GAP	0.036**	0.030*	0.009
	(0.01)	(0.01)	(0.01)
School Enrollment*GAP	0.001***	0.000***	0.000***
	(0.00)	(0.00)	(0.00)
Social Benefits*GAP	0.046	0.048	0.019
	(0.03)	(0.03)	(0.02)
Observations	2542	2542	2542
R^2	0.07	0.06	0.06

Notes: Linear robust regression (Equation 6.40). Figures in brackets are standard errors. *significant at 1% level; ** significant at 5% level; *** significant at 10%level

Table 6.7: Institutions Effect on TFP Growth

Dependent Variable: Five Year TFP Growth			
	USA	*OECD Average*	*Local Leaders*
Five Yr GAP	0.102***	0.093***	0.083***
	(0.00)	(0.00)	(0.01)
Citizens Rights	0.080***	0.078***	0.073***
	(0.01)	(0.01)	(0.01)
Health Benefits	-0.075***	-0.072***	-0.073***
	(0.01)	(0.01)	(0.01)
Labour Regulation	0.104	0.110	0.137
	(0.10)	(0.10)	(0.10)
Labour Regulation Sq	-0.102	-0.118	-0.168
	(0.11)	(0.11)	(0.11)
Political Government	0.009	0.009	0.015**
	(0.00)	(0.00)	(0.00)
School Enrollment	0.001***	0.001***	0.001***
	(0.00)	(0.00)	(0.00)
Social Benefits	-0.031**	-0.032**	-0.035**
	(0.01)	(0.01)	(0.01)
Observations	2542	2542	2542
R^2	0.11	0.09	0.09

Notes: Linear robust regression (Equation 6.43). Figures in brackets are standard errors. *significant at 1% level; ** significant at 5% level; *** significant at 10%level

Table 6.8: Interaction and Institutional Effects on TFP Growth

Dependent Variable: Five Year TFP Growth			
	USA	*OECD Average*	*Local Leaders*
Five Yr GAP	-0.048	-0.212	-0.355
	(0.55)	(0.50)	(0.36)
Citizens Rights*GAP	-0.049	-0.037	-0.009
	(0.03)	(0.02)	(0.02)
Health Benefits*GAP	-0.038	-0.044	-0.011
	(0.04)	(0.04)	(0.04)
Labour Regulation*GAP	0.509***	0.616***	0.551**
	(0.17)	(0.18)	(0.17)
Labour Regulation Sq*GAP	-0.409**	-0.529**	-0.512**
	(0.20)	(0.21)	(0.20)
Political Government*GAP	0.034*	0.040**	0.002
	(0.01)	(0.01)	(0.02)
School Enrollment*GAP	-0.000	-0.000*	0.000
	(0.00)	(0.00)	(0.00)
Social Benefits*GAP	0.056	0.060*	0.052
	(0.03)	(0.03)	(0.03)
Citizens Rights	0.118***	0.118***	0.101***
	(0.01)	(0.01)	(0.02)
Health Benefits	-0.077***	-0.068**	-0.077***
	(0.01)	(0.01)	(0.02)
Labour Regulation	-0.191*	-0.252**	-0.327**
	(0.11)	(0.12)	(0.15)
Labour Regulation Sq	0.1473	0.185	0.272
	(0.12)	(0.13)	(0.16)
Political Government	0.006	0.003	0.013
	(0.00)	(0.00)	(0.01)
School Enrollment	0.001***	0.001***	0.001***
	(0.00)	(0.00)	(0.00)
Social Benefits	-0.056***	-0.061***	-0.045**
	(0.01)	(0.01)	(0.01)
Observations	2543	2542	2542
R^2	0.12	0.10	0.10

Notes: Linear robust regression (Equation 6.44). Figures in brackets are standard errors. *significant at 1% level; ** significant at 5% level; *** significant at 10%level

Table 6.9: Joint Significance test on Institution Variables Global Leaders

Dependent Variable: Five Year TFP Growth				
USA				
	Equ.	R^2	Chi-Squared	Significance
Interaction Institutions	29	0.07	42.97	0.000
Interaction Institutions with Dummies	31	0.31	62.87	0.000
Institutional Levels	32	0.11	156.38	0.000
Levels and Interaction Institutions	33	0.12	198.56	0.000
Country-specific Dummies	34	0.28	793.92	0.000
OECD Average				
	Equ.	R^2	Chi-Squared	Significance
Interaction Institutions	29	0.06	42.65	0.000
Interaction Institutions with Dummies	31	0.25	39.62	0.000
Institutional Levels	32	0.09	136.76	0.000
Levels and Interaction Institutions	33	0.11	181.51	0.000
Country-specific Dummies	34	0.23	675.10	0.000
Local Leader				
	Equ.	R^2	Chi-Squared	Significance
Interaction Institutions	29	0.06	51.09	0.000
Interaction Institutions with Dummies	31	0.24	54.00	0.000
Institutional Levels	32	0.09	131.42	0.000
Levels and Interaction Institutions	33	0.10	163.39	0.000
Country-specific Dummies	34	0.21	561.82	0.000

Chapter 7

Conclusions

This thesis examines three distinct economic issues. First, an examination of the Irish pension system and household pension participation is carried out. Second, household indebtedness in relation to tenure choices is explored. Third, a study of institutional effects on total factor productivity convergence between countries is undertaken. This thesis has led to a number of working papers that are published or forthcoming on the Central Bank of Ireland website as outlined in the Summary.

Pension Related Analysis

Chapter 3 and Chapter 4 examine the Irish pension system and households' pension related decisions, respectively. Chapter 3 examines how the pension system works and also the various options available to individuals. The chapter highlights current policy issues that need to be addressed before the national pension system can be considered sustainable. Chapter 4 analyses micro level household data in order to determine the factors that affect households' decision to invest in a pension and also how much these households choose to contribute to their respective pension schemes.

The findings in Chapter 3 reveal that Ireland is potentially facing a pension crisis on a number of fronts. First, the Government is facing a significant pension funding gap, as future PRSI contributions are unlikely to be sufficiently large to meet future State Pension obligations due to Ireland's ageing population and increased life expectancy. The Government is also faced with an increasing Public Sector Pension bill, due to increased

public sector employment, increasing public sector salaries and longer life expectancies. Second, companies offering defined benefit pension schemes are also being affected by higher salaries and increased life expectancies. However, changes in accounting standards and poor stock market returns have meant that providing defined benefit pension schemes has placed more pressure on companies than ever before. Third, individuals with defined contribution pension schemes have suffered significant losses on their retirement funds due to the significantly decreased returns on international stock markets. Individuals close to retirement are the most exposed to these losses as they may not have sufficient time to rebuild their retirement portfolio.

Notwithstanding these individuals, the primary problem currently impacting the pension industry is that nearly 50 per cent of workers have no private pension cover whatsoever. Individuals with no private pension depend entirely on the State Pension for their retirement needs, even though many of these individuals are aware that the State Pension is not sufficient to meet their desired standard of living upon retirement. Chapter 3 highlights that, while a number of initiatives have been enacted in order to address the pension policy problem in Ireland, a great deal more needs to be done over the coming years to adequately mitigate the problem. Recent budgetary changes should to help address the problem, these changes include some standardisation across pension entitlements and the creation of the National Pension Reserve Fund to partially pre-fund the State and Public Sector pensions. However, an area of key concern that still needs to be addressed with a great deal more rigour is pension coverage. Private pension coverage is important as it is necessary to supplement households State Pension entitlements to maintain their desired standard of living. In addition if the State Pension becomes too costly for the Government benefits may be reduced in the long run, increasing the need for individuals to take control of their own retirement planning. The National Pension Framework Group proposed an auto-enrolment scheme that would significantly address this problem, subject to Irish economic conditions improving. An auto-enrolment scheme would significantly improve pension coverage in Ireland and would ultimately relieve some of the pressure on the State in the future.

Chapter 4 applies the Heckman model to micro level household data in

order to determine the factors that affect households' decisions to participate in a pension scheme and subsequently the amount contributed to the pension scheme. Central Statistics Office household budget survey data are used. The data provide pension contributions made by both households and their employers during the survey year. The primary benefit of a Heckman model is that it allows both the decision to participate in a pension and the amount contributed to be analysed separately. The results in this chapter are similar to those in key international literature; it finds that personal characteristics such as age, sex, education and employment are the principal factors influencing in households' pension related decisions. When property and financial related variables are controlled for, personal characteristics remain the key determinants in both stages of the model. The ability to determine the factors affecting households' decision to participate in a pension scheme are important for policy makers as it facilitates more focused policy initiatives to increase pension coverage within the State.

Pension related work in progress includes an analysis of corporate exposures to defined benefit pension scheme deficits. In addition to this there may be scope to incorporate a pension related section into a "micro level household survey" currently being discussed by the Financial Stability Department in the Central Bank of Ireland; this proposed element is heavily derived from the finding within this thesis.

Household Tenure and Indebtedness

Chapter 5 examines household tenure trends in Ireland from 1980 to 2005. The findings reveal that the distribution of household tenure has changed as a result of social and demographic developments in Ireland. Additionally, financial market liberalisation, European Monetary Union membership and national housing policy have all played a significant role in higher property ownership and increased indebtedness in the State. A probit model is applied to the CSO Household Budget Survey (1988, 1994, 2000 and 2005) data in order to determine the factors that affect the probability of home ownership. The findings indicate that the principal factors driving home ownership are personal and family related variables. Low interest rates enabled households to service large mortgages, having less of an effect on the probability of home

ownership over the period of examination. This finding may be derived from the fact that households erroneously believed interest rates would remain low over a long-term horizon.

Owing to increased household indebtedness, this chapter applies both an interest rate and unemployment shock to households holding a mortgage in the 2005 HBS survey. Projections towards 2007 and 2009 levels are made for these households before the respective stress-tests are applied. The findings of the stress tests reveal that households which purchased prior to 2005 (who have not changed their mortgage contracts) were able to absorb interest rate increases. However, prolonged unemployment shocks resulted in mortgage repayment burdens exceeding 65 per cent of disposable income. Notwithstanding the fact that household savings are likely to exist (allowing these households to supplement their income), it is likely that residential mortgage defaults will significantly increase if the recent growth in unemployment does not abate.

In relation to household indebtedness, further analysis focusing on the various policy options for highly distressed households is in progress. Specifically, it involves designing new innovative policy options that would allow distressed households to keep their homes, while at the same time reducing the risk of moral hazards. Such policy options are discussed in Browne, Kennedy and McGuinness(2011).[1] Furthermore, analysis relating to both Mortgage Principal Forgiveness and Tracker Mortgages is currently underway within the Central Bank of Ireland.

Institutions and Total Factor Productivity Convergence

Chapter 6 examines the direct and indirect effects of institutions on Total Factor Productivity growth. Institutions relate to a number of different country structures. These can include: government policies, health systems, corruption levels, education standards and labour regulation. This research analyses the effect of a country's ability to learn and absorb new institutional models on economic growth. To do this the *gap* between the lead country and the follower is determined based on each countries technology level,

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A. Two global leaders are assigned in this chapter, the United States and an average of OECD member countries. There are also regional leaders within the four regions analysed, regional leaders vary over time as no one country maintains the highest technology level A for the entire period. The coefficient on the gap between the leader and followers technology level A measures the fraction of the gap that is closed given absorption ability. The results indicate that there is some evidence that poorer countries will catch-up with wealthier ones, and that the rate of this catch-up can be affected by quality of a countries institutions. However, the country specific dummy variables still appear to have the highest explanatory power indicating that there is still a large random element to cross country TFP convergence and growth.

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