MEDIUM-TERM REVIEW

2008-2015

JOHN FITZ GERALD

ADELE BERGIN

THOMAS CONEFREY

SEÁN DIFFNEY

DAVID DUFFY

IDE KEARNEY

SEÁN LYONS

LAURA MALAGUZZI VALERI

KAREN MAYOR

RICHARD TOL

MAY 2008 NUMBER 11

Copies of this paper may be obtained from The Economic and Social Research Institute (Limited Company No. 18269).
Registered Office: Whitaker Square, Sir John Rogerson's Quay, Dublin 2.
www.esri.ie

Price €100

Authors

John Fitz Gerald and Richard Tol are Research Professors, Ide Kearney is a Research Associate, Seán Lyons is a Higher Research Officer, David Duffy is a Research Officer, Adele Bergin is a Research Analyst, Laura Malaguzzi Valeri is a Post-Doctoral Fellow, Thomas Conefrey, Seán Diffney and Karen Mayor are Research Assistants with The Economic and Social Research Institute.

MEDIUM-TERM REVIEW

2008-2015

JOHN FITZ GERALD

ADELE BERGIN

THOMAS CONEFREY

SEÁN DIFFNEY

DAVID DUFFY

IDE KEARNEY

SEÁN LYONS

LAURA MALAGUZZI VALERI

KAREN MAYOR

RICHARD TOL

MAY 2008 NUMBER 11

ISBN 0 7070 0265 6

ISSN 0790-9470

ACKNOWLEDGEMENTS

Work on this year's *Medium-Term Review* has been a lengthy process, which involved many experts both from within and outside of The Economic and Social Research Institute (ESRI). In preparing the *Review* for publication the authors have drawn heavily on the expertise of the Director and staff of the ESRI.

The authors, and their research, have benefited hugely from the invaluable assistance of the Central Statistics Office (CSO). The CSO has been a key partner in this long-standing research programme. Over successive *Reviews* the range and quality of the data for economic modelling available from the CSO has dramatically improved. With such a wide range of information now available, the advice and timely assistance of the experts in the CSO is more than ever important in making good use of this very fine resource. This advice and assistance was very freely given in preparing this *Review*.

Over the last six months, the authors have been in contact with several leading institutions and experts from various fields of the economy. Such meetings, as always, proved to be more than useful. In particular we would like to thank the Department of Finance, the Department of the Environment & Local Government, the Department of Communications, Energy & Natural Resources, the Department of Transport, the Environmental Protection Agency (EPA), Teagasc, Forfás, the ESB, BGE, EirGrid, ICTU and IBEC, John McCartney, Austin Hughes, Marian Finnegan, John Beggs, Brian O'Gallachóir and the other individuals who offered us useful advice.

The research on the environment was undertaken as part of a programme of work funded by the EPA. The research on energy was undertaken as part of a programme of work funded by the Department of Communications, Energy & Natural Resources, the ESB, BGE, EirGrid, the CER, SEI, and Viridian.

Once again the National Institute of Economic and Social Research, London, proved to be invaluable in offering advice and in allowing us access to their global econometric model, *NiGEM* which enabled us to formulate the *External Environment* section of this year's *Review*, as well as allowing us to carry out various shocks in the model.

The work on the housing sector benefited from research in the ESRI by Bettina Drepper. The last word of thanks goes to Regina Moore, Mary Cleary and Deirdre Whitaker all of the ESRI, because without their professionalism, expertise and attention to detail, publication would simply not have been possible.

Finally, the authors themselves are solely responsible for the analysis, views and conclusions reached throughout the *Review*.

CONTENTS

EXECUTIVE SUMMARY

Introduction

Despite the very real difficulties that are currently being encountered, the essential message of this *Review* is that the economy will eventually rebound, and return to its medium-term growth path. The analysis in the *Review* suggests that the Irish economy is resilient in the face of adverse circumstances. When we wrote the last *Medium-Term Review* in December 2005 we were more concerned that a misplaced sense of economic invincibility had taken hold in Ireland and we sought to draw attention to the very real dangers facing the economy at that time. Unfortunately, some of these problems have now come to pass (along with some we did not envisage). However, if properly managed the slowdown that is occurring in the economy today should pass and the economy should recover fully in the early years of the next decade.

While our understanding of the key factors driving the economy has evolved over recent years, our view of its likely medium-term growth rate has not. The forecast for the growth in GNP over the period 2007-2015 is identical to what it was when we published the last *Review* in December 2005, an average of around 3¾ a year.[1] This expectation is based on a detailed examination of the potential growth in productivity and the likely development in the labour force. Our analysis suggests that, even if the current downturn were to be more severe than anticipated, the economy would eventually recover more vigorously to realise the medium-term growth rate. This resilience is crucially dependent on the assumption that appropriate policies are pursued.

GNP is a crude measure of well-being and a number of other factors will be important if the standard of living, broadly defined, is to continue rising. Important among these issues are the delivery of a public and a private infrastructure suitable for a rich economy in the 21st century, the provision of high-quality public services and the protection of the environment. An innovation in this *Review* is the inclusion of detailed environmental forecasts that contribute to our understanding of the sustainability of development in Ireland.

The Behaviour of the Economy

The Irish economy has entered into a new phase of development and structural change is affecting how it behaves in response to developments in the world economy (Chapter 2). Business and financial services are in the process of "taking over the baton" from the manufacturing sector as the key channel through which growth in world trade is transmitted to the Irish economy. While this analysis indicates that the manufacturing sector still

[1] The housing shock in the 2005 *Review*, which included a US slowdown, is compared to the *Benchmark* forecast in this publication.

remains very important to the economy, net expansion of employment in the sector will only occur in the high tech industries where the technology involves skilled workers in the production process. Ireland's recent performance shows that its comparative advantage on world markets is shifting towards the production and export of business and financial services.[2] Major employment growth in the future is expected to occur in this sector, which is among the most human capital intensive in the economy.

There are other changes under way in the labour market where the characteristics of migration have changed. Whereas in the past there was emigration, with a large potential supply of mobile Irish labour that moved backwards and forwards from the UK, the rest of the EU or even the US, today there is net immigration, with the bulk of the mobile workers being foreigners. In addition, the rapid growth of the economy in recent years means that public infrastructure and housing are in short supply, raising the cost of living in Ireland. These changes make the supply of labour less sensitive to wage rates affecting the labour market in two important ways:

1. Unlike the 1980s and early 1990s when there was spare capacity, in the future, if the economy is growing rapidly, any domestic stimulus to the economy from fiscal policy would tend to raise domestic wages and prices, tending to crowd out the domestic tradable sector.

2. In the past, most of the incidence of reductions in labour taxes ultimately accrued to employers, leading them to increase output and employment. By contrast, today a significant part of any cut in labour taxation would accrue to employees, so that the positive impact on competitiveness and employment would be more limited than in the past. We, nonetheless find that a shift from labour to environmental taxation has a positive effect on growth and employment.

Background Assumptions

The global forecast underlying this *Review* anticipates that the problems in the US economy, which began in the housing sector and now encompass the financial sector, will result in a major slowdown in that economy this year. However, it is anticipated that a recovery will begin next year, returning the US to its trend growth path by 2010 or 2011. For the Euro Area the slowdown is expected to be milder this year and, consequently, the recovery in 2009 and 2010 will be less pronounced. This external environment is particularly unfavourable for Ireland due to exchange rate changes, which reduce Irish competitiveness on world markets.

The structure of the population remains very favourable for the next twenty years, with Ireland's dependency rate being considerably lower than that of our EU neighbours. There will be a very substantial increase in the supply of skilled labour out to 2020. While the growth in aggregate labour supply from domestic sources (natural increase and increased female labour force participation) is slowing, there will continue to be significant net

[2] The business and financial sector includes banking and insurance, real estate, IT services, R&D, professional and personal services and other market services not included elsewhere. Obviously only some of these sub-sectors are fully tradable.

immigration. However, this forecast anticipates that the inflow will be much smaller than in the current decade.

A broadly neutral fiscal policy is assumed over the forecast horizon with the share of current expenditure and taxation in GNP remaining relatively unchanged out to 2015. It is assumed that the National Development Plan will be implemented as planned and that, after the current Plan is completed, further major investment will be needed out to around 2020. Thereafter, with the necessary infrastructure in place, government capital expenditure should fall to levels more normal in a developed EU economy. As a result, the state's debt, net of financial assets, will disappear after 2020.

In line with the increased priority being attached to environmental policy, we assume that a carbon tax will be introduced in 2010 at the market price of carbon. It is assumed that the resulting revenue will be used to keep labour taxes lower than they would otherwise be.

Forecast

Summary details of the *Benchmark* forecast are shown in Table 1 for five-year periods out to 2020.[3] This Table shows a gradual slowdown in the average rate of growth of GNP from 2000 through to 2020. However, the rate of increase in income per head (GNP per head) is expected to remain broadly unchanged. The growth in labour productivity, measured by GNP per worker, was particularly low in the first half of this decade due to the

Table 1: Forecast Summary, *Benchmark*

	1995-2000	2000-2005	2005-2010	2010-2015	2015-2020
	Average Annual Growth, %				
GNP	8.6	4.4	4.1	3.8	3.5
GNP per head	7.5	2.6	2.4	2.6	2.4
GNP per worker	3.5	1.2	2.0	2.5	2.4
Non-Agricultural Wage Rates	5.9	6.0	4.2	4.3	4.8
Consumption Deflator	3.4	3.3	2.4	2.8	3.2
Employment, April	5.0	3.2	2.0	1.2	1.1
Labour Force, April	3.4	3.0	2.6	0.9	0.9
Energy use	6.2	3.2	1.9	1.6	1.7
Greenhouse gas emissions	3.1	0.4	0.0	0.1	1.0
For end Year:	**2000**	**2005**	**2010**	**2015**	**2020**
Net Immigration, thousands	26	55	10	15	15
Unemployment rate, ILO Basis %	4.3	4.2	6.6	5.3	4.4
Balance of Payments, % of GNP	-0.3	-4.2	-5.6	-0.6	3.0
General Government Balance, % of GNP	5.1	1.2	-1.4	1.2	3.8
Debt/GNP Ratio[4]	34.0	25.5	21.0	21.1	5.8
Housing Completions, thousands	49.8	81.0	46.8	48.6	47.1

[3] Detailed year-by-year numbers are set out in Appendix 3.
[4] The National Pension Reserve Fund has been netted off the debt.

exceptional level of investment in housing, which had low or negative productivity growth. With building having a much smaller weight in future, the rate of productivity growth is expected to average around 2½ per cent a year in the next decade.

The increase in wage rates, while slower than in the boom years, will continue at a significant pace reflecting above average productivity growth in Ireland relative to the EU. The rate of inflation in consumer prices, measured by the consumption deflator, will remain low.

The unemployment rate is rising quite rapidly at the moment and we expect that the future return to full employment will lag the economic recovery. As a result of the higher unemployment and increased competition within the EU for immigrants from the New Member States, net immigration will continue at a very much reduced rate than in the recent past.

Population growth and the relatively small number of dwellings per adult in Ireland (relative to the EU-15) mean that there will be a continued need for more dwellings out to 2020. This demographic pressure will place a floor on the housing market in the medium term.

The Environment

Over the last fifteen years the pressures on the environment have risen much more slowly than the rate of economic growth – there has been a substantial decoupling between economic growth and environmental pressures. This has occurred partly because of technological progress and the modernisation of the power generation sector, but mostly because growth was concentrated in the environment-friendly services sectors. Based on the forecast for the economy, the new ESRI environment model, *ISus*, shows a further decoupling between economic growth, energy use, emissions to air, and waste. In some cases – sulphur dioxide, ammonia, hazardous and other waste, and carbon dioxide from electricity – there is even a reduction in environmental pressure. However, these trends are not sufficient to meet the stated targets of environmental policy.

In the areas of waste and climate change – perhaps the most significant environmental challenges for Ireland – the trends are in the opposite direction of the declared policy targets, even though the *Benchmark* scenario assumes an acceleration of policy implementation.

The projected price level in the EU Emissions Trading System is likely to drive change in electricity generation, resulting in a fall in carbon dioxide emissions from power generation by 2020. Ireland will also easily meet the EU renewables target in power generation. However, the assumed carbon tax would not be high enough to induce a major reduction in emissions elsewhere before 2020.

For waste, there is a similar discrepancy between the stated ambitions of government and the actual policies in place. The amount of waste arising will continue to increase as the population grows and gets richer. Although the share of waste that is recycled will be higher in future, there is an upward trend in the amount of waste to be incinerated and disposed of in landfills.

In sum, although we expect that the rate of progress in environmental protection will accelerate, there will remain a substantial gap between the ambitions of policy makers and reality – particularly for climate change and waste – unless new policy initiatives are put in place.

Alternative Scenarios

Because of the uncertainty that surrounds all forecasting exercises, this *Review* examines three scenarios. The first two scenarios focus on how competitiveness on world markets affects the Irish economy. They provide possible upper and lower bounds for our medium-term forecasts. The high growth scenario examines what the economy would look like if growth were an average of 0.7 per cent a year above the *Benchmark* forecast because of enhanced competitiveness. The "wasted opportunity" scenario considers the possibility that a serious loss of competitiveness could see the economy under-perform by an average of 0.7 per cent a year. The results suggest that there are significant downside risks over the medium term if policy does not promote competitiveness, broadly defined.

A third scenario looks at the possibility that the current slowdown in the world economy could be sharper and deeper than in the *Benchmark*. This scenario suggests that a severe liquidity crisis in the US could lead to a more serious recession there, with serious short-term consequences for Ireland. In such an event the Irish government deficit could mushroom, posing serious problems for policymakers. However, what this scenario also shows is that, if the problems in Ireland were appropriately managed, the US recession would not do long-term damage to the Irish economy. In the medium term, when the global economy recovered, the rate of growth in Ireland would accelerate to return the economy to its medium-term growth path.

Medium-Term Challenges

The changing behaviour of the economy holds significant implications for fiscal policy. While not immediately relevant, because of the current economic downturn, in the future it will be important to tighten fiscal policy when the economy is growing rapidly, resulting in substantial surpluses in the "good times" (i.e., adopt a counter-cyclical policy). This will leave scope to loosen fiscal policy in the "tough times". If such a policy had been adopted consistently since the end of the 1990s there would have been more scope today to insulate the economy from the current downturn. Fiscal policy has a greater impact now than in the past and, with EMU membership, it is the only effective tool open to the government to manage the housing market.

While governments can smooth the cycle through appropriate use of fiscal policy, this policy is not the appropriate instrument to influence productivity growth and living standards in the long term. Instead, structural policy, including investment in public infrastructure, is the appropriate policy instrument that governments can use for such longer-term goals. Efficient delivery of the National Development Plan and of other public services will be very important for future growth in living standards.

The shift from dependence on growth in the manufacturing sector to growth in business and financial services as the driver of the economy has important implications for industrial policy and for policy on R&D and

human capital. We have extensive experience in facilitating new manufacturing firms to set up in Ireland. However, in the future most of the additional jobs will be in the business and financial sector. The supply of labour with appropriate skills for the services sector will be important for future growth. This will involve not only ensuring an adequate output of graduates but it will also be necessary to ensure that Ireland is an attractive location for the skilled workers in the sector, be they Irish or foreign. Thus ensuring a good urban infrastructure, high quality health care and education and a clean environment may be of substantial indirect benefit to the sector through its potential effects on labour supply.

Research on investment priorities suggests that the implementation of policies to ensure efficient use of the infrastructure is at least as important as the physical investment itself. Enhanced competition in the production of public services together with improved regulation where competition is not feasible and where network benefits need to be exploited (e.g. public transport) will be important In particular, there is a need for policy on physical planning to focus on developing sustainable urban centres that are good to live in. This not only involves investment but it also requires an appropriate regulatory response to move towards much denser development. If good value is to be obtained from the huge investment in infrastructure, and if we are to develop sustainable urban centres, it will be important to move fairly rapidly towards some system of congestion charging, as is happening in other EU countries. Given the EU's plans for reducing emissions of greenhouse gases, and given its proposed limits for Ireland, the current trend towards dispersed development and long distance commuting is simply not sustainable on environmental grounds.

While the end is not quite in sight in the race to deliver an adequate public infrastructure, the major investments are likely to be completed around 2020. After that the funds that will be released as public investment is wound down will need to be reallocated to dealing with the "greying" of Ireland.

This *Review* suggests that the fundamentals of the Irish economy are sound. Even if the immediate future may prove quite difficult, the resilience of the economy is such that, if properly managed, it is likely to return to healthy economic growth in the medium term.

1. INTRODUCTION

1.1 Background

When we wrote the last *Medium-Term Review* in December 2005 we were concerned that a sense of economic invincibility had taken hold in Ireland and that the very real dangers facing the economy at that time were being ignored. While in that *Review* we did not want to overdo the sense of foreboding, mindful of the fate of Cassandra,[5] still wanted to alert readers to our concerns. For this *Review* the task is rather different. Some of the potential difficulties that concerned us in 2005 have now come to pass (along with some we did not envisage). In addition, there is widespread concern about the immediate future prospects for the world economy. However, our essential message in this *Review* is upbeat, recognising that there is a danger that Irish society could be transfixed by the current very real difficulties, missing the opportunity to plan and prepare for a better future in the next decade.

This focus on medium-term prospects is not intended to obscure the serious immediate problems facing the economy. However, the conclusion of this *Review* is that, whatever the severity of the immediate economic difficulties, if appropriately managed the current downturn will not do lasting damage to the economy's long-term growth potential. As a result, when the economy exits from its current difficulties we anticipate a return to steady growth. While this medium-term growth in GNP will be somewhat slower than we have been accustomed to – around 3.5 per cent a year – it will, if delivered, represent a very satisfactory performance. Of course GNP is a crude measure of well-being and a number of other factors will be important if the standard of living, broadly defined, is to continue rising. Among these important issues is the delivery of an infrastructure, public and private, suitable for a rich economy in the 21st century. Alongside this is the need to provide high quality public services efficiently. There will also need to be investment in protecting and developing our environment. An innovation in this *Review* is the inclusion of detailed environmental forecasts.

Setting Ireland in an international context, we must recognise that when Ireland had a standard of living well below that of our EU neighbours, there was a lot of room to outperform them. Now that we are richer than most other EU countries, outperforming our neighbours becomes much more problematic. The *Benchmark* forecast in Chapter 4 suggests that the Irish economy, if properly managed, can continue to make marginal improvements in living standards relative to our neighbours out to 2015.

[5]In Greek mythology Cassandra was fated to forecast the future with accuracy and always to be ignored.

To some extent this superior prospective performance will be facilitated by a broadly favourable demographic profile that is not available to other EU members. Because this bonus will not last indefinitely, some of it should be used to prepare for the challenges of an ageing population that will affect Ireland in the second quarter of this century.

This *Review* analyses some important changes in the underlying behaviour of the economy that have become apparent in recent years. These changes have been incorporated in a revised version of the *HERMES* macro-economic model that is used to prepare our forecasts. For the first time the *Review* uses a new sustainable development model, *ISus*, to extend the coverage of the forecasts to examine the likely pressures on key environmental variables.

In Greek mythology *HERMES* was the messenger of the gods and one of his tasks was to bring dreams to mortals. We feel that the medium-term forecasts for economic growth in this *Review* are not merely "dreams" but, with appropriate public policies, they can be turned into a reality over the coming decade.

1.2 Outline of the *Review*

In recent years the Irish economy has undergone significant changes, which affect the way it operates. The working of the labour market has altered and the services sector is playing an increasing role in transmitting increases in world trade into demand for Irish output. For this reason we have overhauled the *HERMES* macro-economic model to capture the changing processes which drive growth in Ireland. The alterations in behaviour and how we have captured them in the revised model are discussed in Chapter 2. The understanding gained from this analysis has been very important in developing our medium-term forecasts for the Irish economy.

In Chapter 3 we consider a range of background assumptions which drive our forecasts. First, we have developed a forecast for the major world economies based on the January 2008 *National Institute Economic Review*, and the IMF's January 2008 forecast.[6] This *Benchmark* forecast sees the US economy undergoing a major slowdown this year and next and then recovering. More recent forecasts suggest a more severe downturn and this possibility is considered in a separate scenario described in Chapter 6. The *Benchmark* scenario sees the major world economies recovering in 2010 and returning to trend growth in subsequent years. The second set of assumptions is derived from the ESRI's demographic model. These relate to future population structure, labour force, household formation and educational attainment. The third set of assumptions relate to the public finances.

Chapter 4 sets out our *Benchmark* forecast, which has been developed using the *HERMES* model based on the assumptions set out in Chapter 3. The figures for 2008 and 2009 are taken from the Spring *Quarterly Economic*

[6]Forecasts have changed since January involving downward revisions in growth projections. The possibility that the world economy, especially the US, could perform significantly worse than we have assumed in our *Benchmark* forecast is considered in the third scenario in Chapter 6.

Commentary. This forecast includes numbers year by year out to 2015 for the major economic aggregates and for five-year average growth rates thereafter out to 2025.[7]

Chapter 5 of this *Review* produces the first set of forecasts using the ESRI's new *ISus* sustainable development research model.[8] This model relates pressures on the Irish environment to key economic aggregates – for example how economic growth affects the quantity of greenhouse gas emissions. The model has been used in conjunction with the *HERMES* model to produce detailed energy and environmental forecasts for Ireland out to 2025. These forecasts are consistent with the *Benchmark* economic forecast outlined in Chapter 4. This is the most ambitious exercise of its kind undertaken in Ireland and it throws new light on the sustainability implications of the economic growth forecasts.

Because forecasts are inevitably uncertain, Chapter 6 examines three scenarios around the *Benchmark* forecast. The first and second scenarios examine the possibility that the Irish economy grows on average by between one half and one percentage point a year more or less than in the *Benchmark* forecast. These scenarios can be used to stress test policies to ensure that they are likely to prove robust in the face of an uncertain future.

The third scenario considers what the implications would be of a more severe and long-drawn out recession in the US relative to that assumed in Chapters 3 and 4.

Our conclusions are set out in Chapter 7. These conclusions draw out some of the key implications of the analysis contained in the *Review* for public policy. The discussion suggests that, while there are dangers for future development inherent in the forecasts, prudent policy could minimise these risks and help ensure that the Irish economy realises its considerable potential to produce a further increase in living standards.

The forecasting record of past *Reviews* is analysed in Appendix 1. This shows than past publications have had a reasonable track record in forecasting the average medium-term growth rate. However, they have been less successful in predicting turning points. The *Benchmark* forecast for the 2008-2015 period in this *Review* is almost identical to the housing shock scenario in the last *Review*. Two and a half years' additional data have not changed our view as to the medium-term growth potential of the economy. However, the timing of the growth in the economy in this *Review* is rather different than in the last. As a result of this analysis we put much more emphasis in this *Review* on the five-year average growth rates than on the forecasts for individual years.

[7]More details of the numbers are available on CD from ESRI. Details, including the price, are available from admin@esri.ie

[8]This model has been developed as part of a programme of research at the Institute funded by the Environmental Protection Agency (EPA).

1.3 Methodology

The forecast presented in this *Review*, and the analysis underlying the range of different scenarios, has been developed with the assistance of five different economic models. In developing our forecast for the world economy and the external environment for the Irish economy we have used the *NiGEM* world model of the National Institute of Economic and Social Research in the United Kingdom. This model allows us to simulate different options on how the US economy will adjust to its current problems and how these different options are likely to affect the rest of the world. The benefit of such a model is that it allows "what if" experiments to explore the sensitivity of forecasts to changes in assumptions. This model has proved an essential tool in preparing a consistent set of forecasts for the major world economies of relevance to Ireland.

In analysing changes in the population structure that are taking place we have used the ESRI's demographic model. This model uses very detailed data from successive CSO *Labour Force Surveys* and *Quarterly National Household Surveys* on labour force status, broken down by level of education, age and sex. The model is driven by the educational attainment of the population. In the model individuals, as they reach the age of 20 years, are assigned a level of education based on current trends. This level of education has a major impact on their labour force behaviour. The model is used to project births, deaths, the population, the labour force, the number of households, and the human capital of the work force. The level of migration is taken from the *HERMES* macroeconomic model. The demographic model differs from that used by the CSO in that educational attainment drives labour force participation.

The *HERMES* macroeconomic model has been used for two decades in preparing successive *Medium-Term Reviews*. Major changes were made in 2002 to incorporate a sub-model of energy demand and greenhouse gas emissions from energy use (Fitz Gerald, Hore and Kearney, 2002).[9] We have re-estimated the latest version of *HERMES* using data from the CSO *National Income and Expenditure, 2006*. The forecasts for 2008 and 2009 are based on the Spring *Quarterly Economic Commentary*. Appendix 1 of the *Medium-Term Review: 2003-2010* provided a description of the key mechanisms in that model. As discussed in Chapter 2, this latest version of the model takes account of the major changes in the behaviour of the Irish economy that have recently been identified.

Finally, a new model relating economic activity to energy use and environmental pressures has been developed – *ISus* (O'Doherty, Mayor and Tol, 2007). This model is designed to take the forecasts from *HERMES* and use them to predict likely environmental pressures. These pressures include emissions to air, especially greenhouse gas emissions, solid waste, and water. The *ISus* model has been used in Chapter 6 to produce forecasts of energy demand and environmental pressures out to 2025 based on the macro-economic forecasts in Chapter 4. When forecasting energy use in electricity generation the *ISus* and *HERMES* models are supplemented by a model of the electricity sector (McCarthy, 2005).

[9]Development of this sub-model was supported by research grants from the Environmental Protection Agency (EPA) and Sustainable Energy Ireland (SEI).

As discussed in Appendix 1, our forecasting record, while better than average, is still not perfect. As a result, in preparing the forecasts we have examined a number of scenarios reflecting the range of uncertainty that surrounds our estimate of the potential output growth of the Irish economy. While any forecast involves many assumptions that rely on the authors' judgement, these models are essential tools in ensuring the coherence of the forecast published in this *Review*. They force a high degree of consistency on those using them. In addition, the models, taken together, are an indispensable tool for undertaking the kind of sensitivity testing we have used extensively in this *Review*, and in developing sets of scenarios that are internally consistent.

2. THE BEHAVIOUR OF THE IRISH ECONOMY

2.1 Introduction

To the outside world the recent history of Ireland is viewed as something of an economic miracle. From a relatively low standard of living within the EU-15 in the early 1990s, over the course of a little more than a decade the standard of living rose to take Ireland to the top of the scale in recent years. This achievement naturally provokes interest in whether Ireland has found the "elixir of eternal growth" and what the secret of the success actually is. In particular, can that prescription, which worked so well for Ireland, be applied elsewhere with equally advantageous results?

The answer from recent research is that there is no secret ingredient that can be prescribed for other economies. While there are some exceptional elements to the Irish experience, which are elucidated later in this chapter, the main lesson of research is that Ireland pursued very unwise economic policies with exceptional consistency in the forty years after Independence and it was not until the 1990s that Ireland reaped a reward for very belated policy reforms, implementing changes that had occurred a quarter of a century earlier in most of Ireland's EU neighbours.

This issue of Ireland's recent economic success has already been addressed in an extensive literature. The first phase of exceptional growth in the economy, from the early years of the 1990s through to the early years of this decade, has been extensively analysed (*MTR* 1997 and 1999, Fitz Gerald, 2000, Honohan and Walsh, 2002, O'Gráda, 2002). These papers suggest that to a significant extent this growth represented a catch up by the Irish economy to the standard of living of its neighbours in North-Western Europe, a catch up which had been delayed for many years by past policy failures. However, the analysis also indicated that the rapid growth owed a significant amount to demographic particularities, to the way Ireland connected with the globalisation process, FDI and corporation tax, (Barry, 2002), and to investment in human capital (Bergin and Kearney, 2007). The analysis in these papers differs as to the emphasis placed on these different factors but agrees about the range of factors involved.

This chapter, rather than replaying an old film, considers a new script on how recent developments in the economy suggest a different phase of development over the coming decade. This new phase of development is unlikely to see growth on the scale of the late 1990s. However, in the light of the changing structure of the economy apparent in recent years, there remains the prospect that the Irish economy will experience continued growth for some years to come at rates somewhat above the long-term trend for the EU-15. While on the basis of income per head Ireland comes

across as one of the rich countries in the EU, this may not be the best measure of welfare, as discussed in Section 2.2.

This chapter considers the evidence that the economy has entered a rather different phase of development. The evidence for a change in behaviour comes from a range of sources. In many cases sub-models of important processes have been estimated and included in the *HERMES* macro-economic model used in the rest of this *Review*. These sub-models are briefly discussed in Appendix 2.

Section 2.3 examines some of the key trends apparent in the recent data for the economy. Section 2.4 considers the growing importance of the market services sector, in particular that of business and financial services. Section 2.5 examines changes in productivity and in the terms of trade in recent years and considers how recent trends may affect development out to 2020. It also considers how investment in human capital may affect future trends in productivity.

The last decade has also seen a radical change in the behaviour of the labour market. This change has been concentrated on the factors affecting the supply of labour, and its elasticity with respect to real after tax wages. The changing shape of the supply curve of labour, and the change in the factors affecting wage formation in Ireland, have important policy implications. These are discussed in Section 2.6. The housing market and the factors driving it are discussed in Section 2.7. Section 2.8 summarises the implications of this analysis for the Irish economy in the medium term.

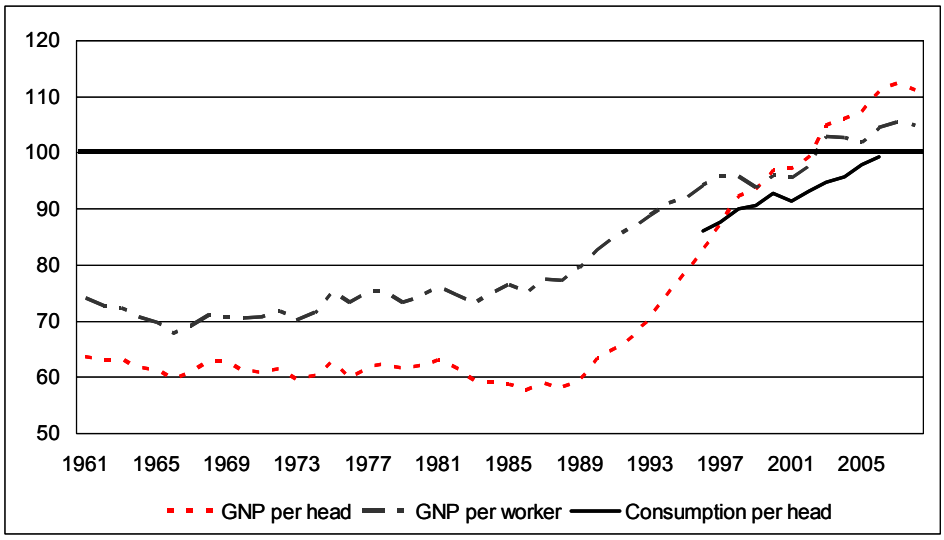
2.2 Measuring Living Standards

There are many different ways of measuring living standards. Probably the best income based measure is Gross National Disposable Income (GNDI), which takes account, *inter alia*, of EU transfers and, more important, changes in the terms of trade (the purchasing power of Irish exports relative to imports). However, when comparing living standards across countries the most common approach is to compare GDP per head or per person employed, adjusted for the cost of living. In the case of Ireland GDP is not the appropriate measure because of the large amount of profits repatriated abroad by foreign firms, which are not available for domestic consumption. For that reason here we use GNP for Ireland instead of GDP. For other EU countries GNP is very similar to GDP.

By the conventional measure of living standards Ireland is now one of the richest countries in the EU. Figure 2.1 shows the trend in GNP per capita relative to the EU-15 over more than four decades.[10] This graph shows that, measured in terms of GNP per head, there was very limited change in Ireland's relative position between 1960 and 1990. However, from 1990 onwards there was very rapid convergence, taking Ireland to an income per head, adjusted for purchasing power, which is 10 per cent above the average for the EU-15 today.

[10] The figures for Ireland are for GNP per capita. Those for the rest of the EU are GDP per capita. However, for nearly all countries in the EU other than Ireland GDP and GNP are very similar in magnitude.

Figure 2.1: Relative Standard of Living, Ireland v EU-15, in PPS, EU-15=100



Source: EU Commission: *European Economy*, and ESRI databank.

As shown in Figure 2.1 there was somewhat steadier progress in terms of convergence in productivity levels – GNP per person employed. Ireland today has a level of GNP per person employed that is about 5 per cent above the average for the EU-15, a significantly smaller gap than for income per head. The difference between these two measures reflects the very favourable trend in the dependency ratio in Ireland since 1990. This is discussed in more detail in Chapter 3.

Figure 2.1 also shows consumption per head for Ireland for the period 1995-2006. This suggests that Ireland is only today reaching the average EU-15 level of consumption. This is a more appropriate measure of current standard of living than the income per head measure. The gap between this measure and the measure of income reflects the fact that Ireland has a much lower endowment of public infrastructure than most of the rest of the EU-15. As a result it has to invest much more to catch up, leaving less resources available for current consumption, private or public.

The poorer endowment of infrastructure is true of both private infrastructure (housing) and public infrastructure (such as transport, educational and health infrastructure). The result is that Ireland, to catch up, has had an investment to GNP ratio of 30 per cent or more between 2005 and 2007 and the ratio is likely to remain high for some time to come, in spite of the slowdown in the housing sector. The norm for developed countries tends to be around 20 per cent. Thus, while income may be above average, that advantage is being dedicated to catching up on the endowment of infrastructure; hence it is not available for current consumption. As discussed in Chapter 4, it will be some time before the gap in infrastructure is made good and investment will fall back to a more normal relationship to income. There is no simple measure that allows one to value the services derived from a good road and public transport system but it is clear that it does impact on welfare. What this means is that, if one takes into account the benefits which flow to society from having a good infrastructure, then the Irish standard of living has probably still not attained that of countries such as France and Germany.

2.3 The Changing Structure of the Economy

The channels through which changes in world economic activity have been transmitted to the Irish economy have altered over time. Half a century ago the primary channel was through agricultural exports. More recently the manufacturing sector has been the conduit through which the growth in world trade has impacted on the economy. However, since the turn of the century the services sector has grown rapidly in importance as a link between domestic economic activity and world trade.

In the latest version of the *HERMES* model activity in both the manufacturing sector and the tradable market services sector is modelled as a function of world growth and Ireland's share of world output is a function of Ireland's competitiveness on the world market, broadly defined (Bradley and Fitz Gerald, 1988 and Bradley, Fitz Gerald and Kearney, 1993). The research results, described in Appendix 2, indicate that this model, which for many years has been used to model Irish manufacturing sector output, now applies equally to the rapidly growing trade in services. Initially, the key point of contact between the production sector of the Irish economy and the outside world was through agricultural exports. In the early 1960s agricultural exports accounted for over 40 per cent of all exports but only 12 per cent of GNP (Table 2.1). These exports underwent limited processing in Ireland and the terms of trade for such exports were generally unfavourable.

From the late 1950s onwards there was an increasing consciousness among policymakers that future economic prosperity would depend on developing a vibrant manufacturing sector to take over gradually from agriculture as the driving force of growth. The approach that Ireland adopted to opening up its economy belatedly to the globalisation process from 1960 onwards was unusual (Honohan and Walsh, 2002). Considerable reliance was placed on the attraction of foreign firms to Ireland to help modernise the manufacturing sector. A key element in this policy was the effective exemption of profits on all export sales from corporation tax.

While the change in the corporate tax regime was made in the late 1950s, it was really only with the reduction in the protective barriers to trade with Ireland's trading partners that this policy began to bear fruit. The first reduction in tariff barriers began in the early 1960s and the process culminated in membership of the EU in 1973.[11] By 1980 agricultural exports still accounted for just over a quarter of exports while industrial exports had by then risen to account for almost 60 per cent of the total and 28 per cent of GNP.

Between 1980 and 2000 the manufacturing sector grew dramatically in size so that by 2000 industrial exports accounted for just under three-quarters of all exports and amounted to 85 per cent of the value of GNP. Over this period the growth in the manufacturing sector was clearly the major channel through which the growth in world trade (and output) was transmitted to the Irish economy.

[11] For a few sectors (e.g. motor vehicle assembly) the barriers were not fully phased out till the end of the 1970s. Of course the Single European Market in 1992 was very important for Ireland in removing non-tariff barriers within the EU.

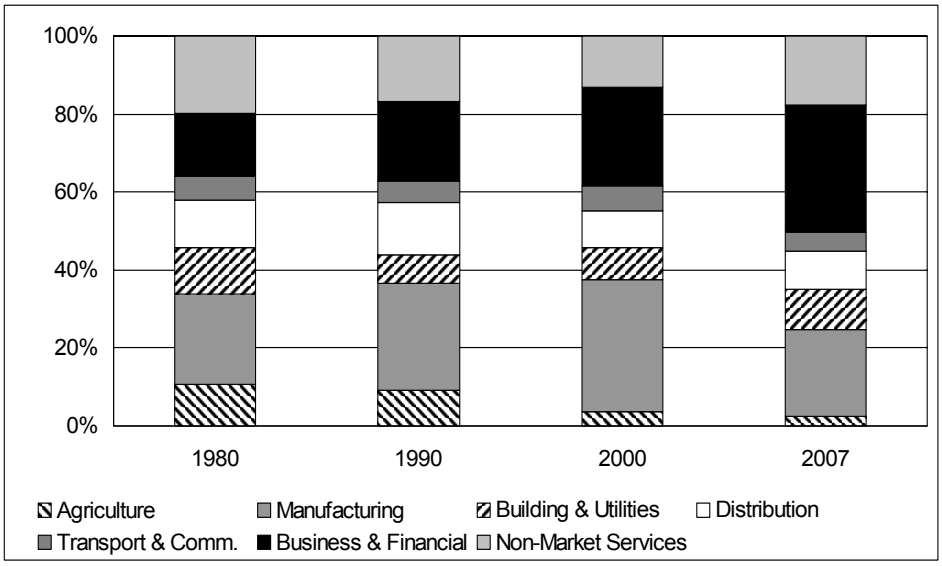
Table 2.1: Exports Share of the Economy, Value, %

	Share of	1960	1980	2000	2007
Agricultural	Exports	40.9	26.1	4.3	3.7
	GNP	12.1	12.2	5.0	3.5
Industrial	Exports	29.4	59.5	73.8	52.9
	GNP	8.7	27.9	85.2	49.4
Services	Exports	29.8	14.5	21.9	43.4
	GNP	8.9	6.8	25.3	40.5

However, from the late 1990s onwards there has been a dramatic rise in the role of the market services sector. By 2000 exports of services already accounted for 22 per cent of exports, amounting to 25 per cent of GNP. By 2007 this had risen to over 40 per cent of both exports and GNP. Clearly, this is now a major channel through which world economic growth is transmitted to the Irish economy. As discussed in Chapter 4, this channel is likely to continue growing in importance over the coming decade, gradually replacing the manufacturing sector as the key channel for the transmission of world growth to the economy.

This change in the pattern of exports over time has also been reflected in a change in the pattern of output in the economy (Figure 2.2). Twenty-five years ago the agricultural sector was still a significant contributor to output in Ireland accounting for over 10 per cent of GDP (and agricultural exports were 12 per cent of GNP). Manufacturing accounted for just under a quarter of output, somewhat greater than would be the contribution in most of the more developed world economies at that time. However, the last quarter century has seen a transformation in the structure of the economy. Today, agriculture accounts for only 2 per cent of output and manufacturing, which grew rapidly in importance in the 1990s to account for a third of output in 2000, had by 2007 fallen back to its position in 1980, accounting for 22 per cent of GDP.

Figure 2.2: Share of GDP by Productive Sector



It is the business and financial sector,[12] which has grown continuously in importance as reflected in its share of GDP over the period, so that today it accounts for about a third of the output of the economy. Within that sector, the financial services sub-sector itself now accounts for 10 per cent of total GDP. New data from the Central Statistics Office (CSO) show for the first time gross output by the services sector for the years 2002 and 2003 (the GDP figures above are based on value added – wages and profits). While not directly comparable, the ratio of exports of other services (excluding tourism) to the gross output of the business and financial services sector in 2003 was over 70 per cent, up from 60 per cent in 2002. While this exaggerates the share of the output of the sector which is exported, as a significant part of services exports comes from other sectors, it is still an indication of the globalisation of the sector in recent years and its crucial importance as a link between Ireland and the world economy.

One surprise in these data is the relatively small share of value added accounted for directly by the building and construction sector – approximately 10 per cent of GDP. This contrasts with the share of gross output of the construction sector, which accounted for just under 20 per cent of GDP in 2007. It reflects the fact that there are substantial inputs, largely from domestic sources, which are used in the sector, so that the footprint of building and construction spreads to many other sectors in the economy – especially business and financial services and manufacturing. Finally, the production of non-market services (the public sector) accounted for 18 per cent of GDP in 2007, up from 13 per cent in 2000, but still below its share of 20 per cent in 1980.

Within manufacturing there has also been a major change in structure over the period (Figure 2.3). Clothing, which accounted for 17 per cent of gross output in 1960 has now effectively disappeared as a sector. Food, drink and tobacco, which accounted for just under 50 per cent of gross output as late as 1975 now accounts for just 20 per cent. The three sectors which have grown very substantially in share are chemicals, including pharmaceuticals; paper and publishing, which includes reproduction of computer media,[13] and machinery and equipment which includes computers, instrument engineering etc.

In the case of machinery and equipment, the growth in share was particularly rapid between 1975 and 1990. Further growth to 2005 has taken it to over 31 per cent of gross output of manufacturing. The growth in chemicals has been particularly large since 1990, accounting for 27 per cent of gross output by 2005. The rapid growth in the paper and publishing sector is even more recent. By 2005 it accounted for 13 per cent of output, the bulk of it being in the reproduction of computer media category. This means that the three more "high-tech" sectors now account for over 70 per

[12] The Business and Financial sector includes banking and insurance, real estate, computer services, R&D, professional services and other market services not included elsewhere. Distribution includes retailing and wholesaling. The coverage of Transport and Communications is self-explanatory.

[13] The measured output of this manufacturing sector may be affected by changes in the classification of firms. For example, as firms move to distributing IT services over the internet and as the nature of the services evolve, the firms may be reclassified into the Business Services sector.

cent of manufacturing output. With food and drink still accounting for 20 per cent, it means that the rest of manufacturing now makes a very small contribution to total output.

Figure 2.3: Structure of Manufacturing, Percentage of Gross Output

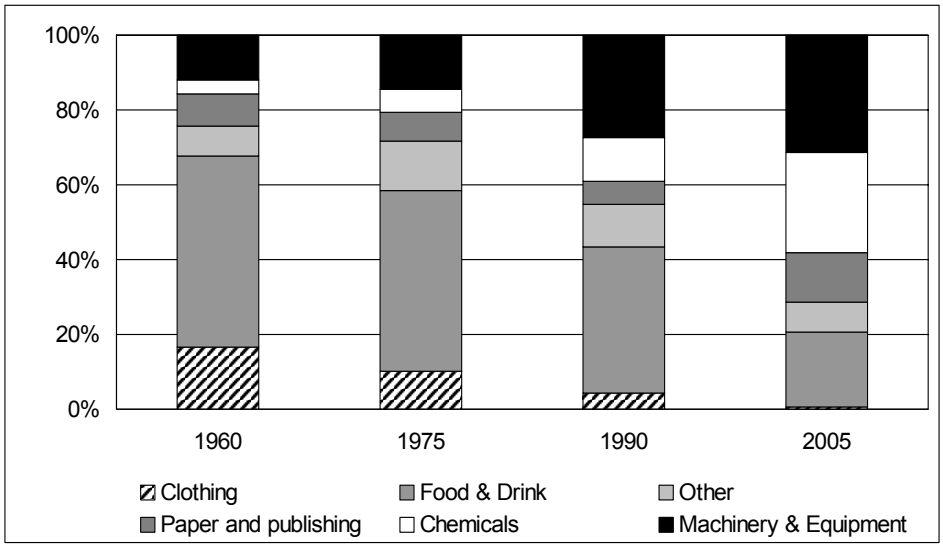
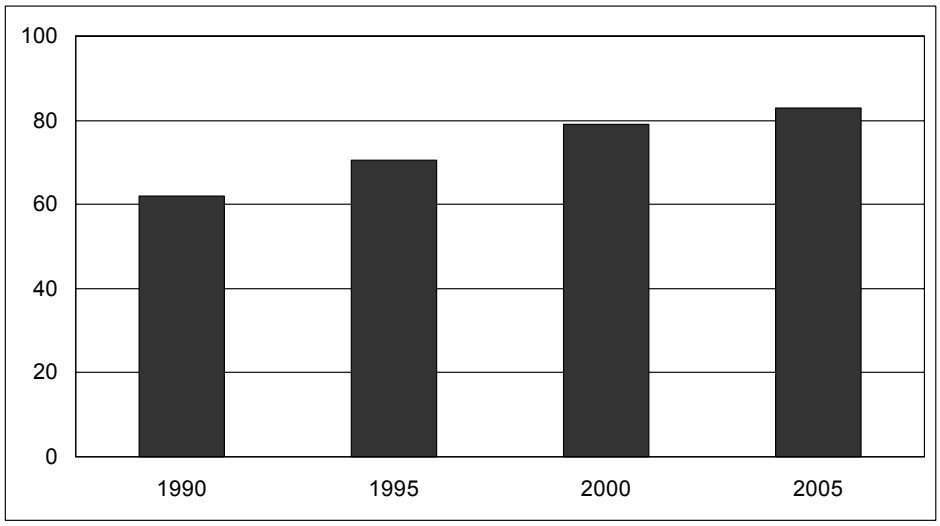


Figure 2.4: Share of Manufacturing Output Exported, %



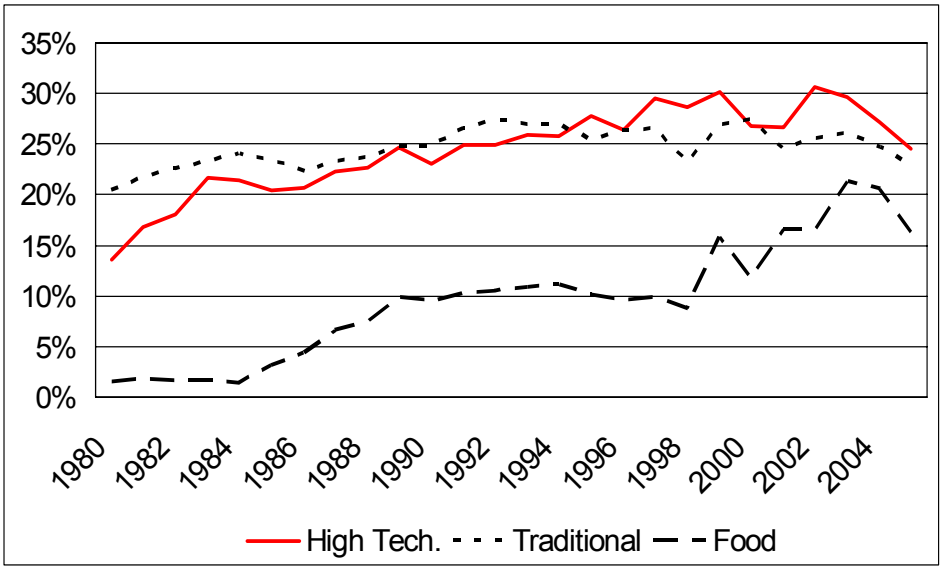
An important feature of the manufacturing sector today is the very high proportion of its output that is exported (Figure 2.4). With the proportion now exceeding 80 per cent, it means that fluctuations in domestic demand have a very limited impact on the output of the sector. Also, because such a high proportion of the output of the sector is destined for the EU market, it is fluctuations in demand within that much wider market that drives day-to-day fluctuations in the output of the sector in Ireland. This contrasts with the market services sector, which still produces the majority of its output for the domestic market, though also serving an ever-increasing export demand.

The low rate of corporation tax applicable in Ireland has obviously attracted firms that are highly profitable to Ireland and facilitated domestic firms that also fall into this category. It has also incentivised multinational

firms to attribute as much of their profits as legitimately possible to their Irish operations. The result has been a high observed rate of profit in manufacturing in recent years.

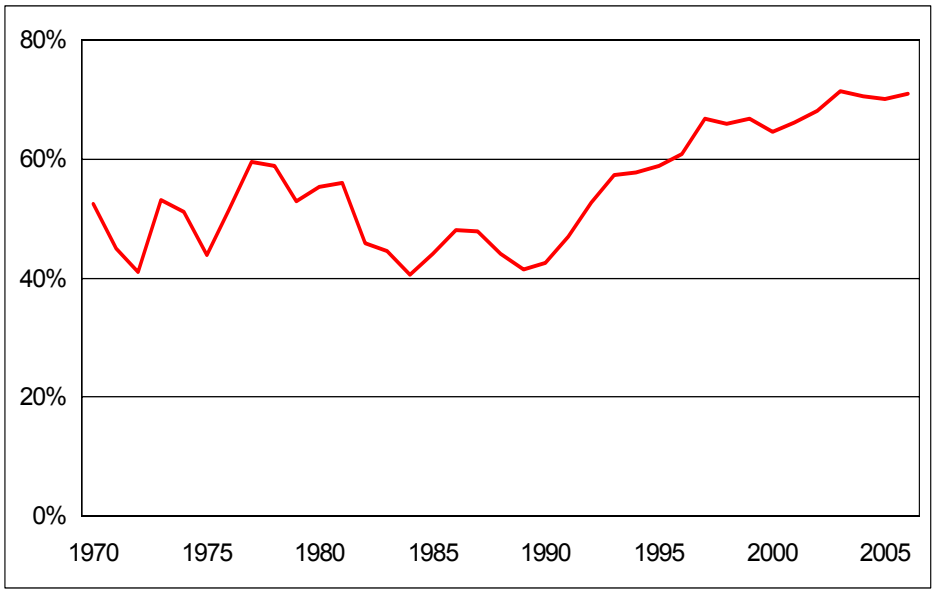
Figure 2.5 shows the operating surplus (profit) rate for the three sub-sectors of manufacturing since 1980. This figure shows that, while there were major differences in profit rate twenty-five years ago, the profit rates have tended to converge over time to their current level. Over the course of the 1980s the profit rate in the traditional and high-tech sectors tended to drift upwards stabilising in the 1990s at between 25 per cent and 30 per cent of gross output. The most recent years for which data are available suggest some downturn to a rate of around 25 per cent, possibly reflecting rapidly rising costs in Ireland and a more competitive external environment. For food processing the rate of profit was exceptionally low in the 1980s, reflecting the fact that the sector was dominated by farmer-owned co-operatives that sought to maximise input prices (paid to farmers) rather than profits. However, the change in the structure of the sector in the 1980s and the 1990s has seen it achieve profit rates of around 20 per cent in recent years, the kind of behaviour observed for other manufacturing sectors.

Figure 2.5: Profit Rate, Manufacturing



In 1989 the favourable corporate tax regime applicable to the manufacturing sector was extended to the International Financial Services Centre (IFSC) in Dublin. From 1994 a common low rate of corporation tax applying to all other sectors was progressively introduced and by 2003 it was fully implemented at 12.5 per cent. This common rate also applies to all new firms in the sectors covered by the previous 10 per cent rate. The effect was to extend the attraction of Ireland for highly profitable business to a much wider range of firms supplying the world market and also to extend the range of firms that could benefit from transfer pricing. The result has been an increase in the share of profits in value added in the financial services sector (Figure 2.6).

Figure 2.6: Profit Share of Value Added, Financial Services



A substantial share of the profits earned in the Irish economy, especially in manufacturing and business and financial services, are the property of owners who are resident outside Ireland, in particular, foreign multinational firms. However, this also applies to many of the largest firms, such as banks, the majority of whose shareholders are resident outside Ireland. The profits, whether paid as dividends or retained in the firms are considered the income of these foreign residents and deducted from GDP to arrive at GNP. The diversification geographically in financial portfolios also means that there is a substantial, though smaller inflow of profits into Ireland to those residents who own assets abroad.

Profit repatriations from the business and financial sector are now of a similar magnitude to those from the manufacturing sector. This has to be taken into account in considering the impact of growth in the business and financial sector on the wider economy. The latest version of the *HERMES* macro-economic model incorporates such an adjustment.

2.4 Market Services – New Driver of Growth

The external environment in which the Irish economy operates has changed markedly over the last fifteen years. The rise of China, India, and more recently Brazil, as major players in world trade has brought about changes throughout the world economy. These newly emerging industrial economies have a huge potential supply of unskilled and semi-skilled labour available to work in manufacturing.

With these emerging industrial powers supplying an ever-increasing share of the world's manufactured goods, the terms of trade in these goods have changed. Prices of many traditional manufactured goods have fallen in relative terms, shifting the comparative advantage of the more developed economies towards higher-technology manufactured goods and traded services that require a high-skilled labour input. It is not that China and India do not have a substantial and increasing supply of skilled labour. Rather it is their continuing **relative** scarcity in this key input that means

that their economies have a comparative advantage in producing less-skill intensive manufactured goods.

Developments in information technology and transport have also had their effects. These innovations have made goods and services, which had previously been non-traded, into very fast-growing areas of trade. In the services sector, especially financial services, globalisation and the reduction in non-tariff barriers, combined with developments in information technology, have produced an integrated financial system spanning most developed economies. Some of the most rapidly growing areas, such as financial services, use English as their language of communication, which confers an advantage on the Irish economy.

In addition to the changing pattern of world supply the pattern of world demand has also been changing. As incomes have risen in the developed world and the relative price of goods has fallen, demand has shifted towards services, especially towards new products and services related to the revolution in information technology. These goods and services, the production of which requires a major input of skilled labour, are in ever-increasing demand.

This changing global context means that Ireland's comparative advantage is also shifting. Obviously, the speed with which change takes place in Ireland is partially determined by developments in Irish competitiveness. However, it is also affected in a more positive way by developments in education, R&D, and information technology, which develop niches where the Irish economy may find new opportunities. As a result of the changes in the global trading environment the baton of economic growth is passing from manufacturing to the business and financial services sector of the Irish economy. This reflects long-term changes in Ireland's comparative advantage in the global economy. In recent years the loss of competitiveness relative to our EU partners has taken its toll on Irish manufacturing. This sector has to compete in a global market and the specialised advantages of the Irish economy (e.g. the tax regime) are increasingly outweighed by the rise in other costs. While some parts of this sector are human-capital intensive, it is less dependent on such skills than the business and financial sector. The closure of much of lower skilled manufacturing, as a result of the loss of competitiveness, is more than offsetting the effects of a growth in the most skill-intensive sectors. This is reflected in the decline in employment in the sector in recent years and also in the changed composition of manufacturing output as reflected in Figure 2.3.

As discussed later in Section 2.5, the past investment in human capital will continue to add to the productivity of the Irish work force for some time to come. In particular, it is paying off in the rapid growth in the output of the business and financial services sector. The success of the sector relies on the availability of an adequate supply of skilled labour at a reasonable price, together with the natural advantage of the English language, the flexibility of the labour market, and the low rate of corporation tax (see Appendix 2). These characteristics of the economy underpin Ireland's advantage as a source of supply for such services to the global market. Under these circumstances it is not surprising that Ireland is specialising into the sector, reflecting the relative abundance of this key factor of production, skilled labour. The OECD data on revealed

comparative advantage indicate that Ireland has a comparative advantage in the supply of financial services, computer and IT services and other business services.[14]

Developments in the world economy impact on Ireland through a range of different channels. These channels include financial markets, world trade, and labour mobility. Here we concentrate on the transmission of changes in world activity directly to the Irish economy through trade. Domestic competitiveness relative to the rest of the world determines what share of world output is produced in Ireland.

The latest version of *HERMES* has a new sub-model of the business and financial sector that reflects the factors driving the sector. As explained in Appendix 2, this model first explains exports of services (excluding tourism) in terms of the growth in world activity, the rate of corporation tax payable by the sector, and the cost of Irish output relative to that of competitors (competitiveness). Then the output of the sector is modelled as being driven by exports and by domestic demand as well as by Irish competitiveness. The model indicates that, while foreign demand accounted for less than 10 per cent of the output of the sector a decade ago, it now accounts directly for around 30 per cent of output. This model also indicates that the move to a common low rate of corporation tax had a major impact on the output of the sector over the period 1995-2005. However, that effect is now completed and, while underpinning existing output, it is not likely to contribute to further growth in the sector.

The sub-model of the manufacturing sector is also described in Appendix 2. As with market services, Ireland's share of world output of manufactured goods is a function of Ireland's competitiveness (Bradley and Fitz Gerald, 1988 and Bradley, Fitz Gerald and Kearney, 1993). Thus the growth in the sector is driven by the growth in world output and by Ireland's competitiveness as a location for manufacturing.

A third, though much less important channel through which changes in world activity impact on the Irish economy is tourism. As with the other sectors trading on a world market, tourism exports are sensitive to the growth in world activity and to competitiveness.

Thus, there are three main sectors through which the growth in world trade directly affects the Irish economy – manufacturing, business and financial services and tourism. Using the *HERMES* model it is possible to decompose the effects of the growth in world trade to determine the relative importance of these three channels. Table 2.2 shows the impact on certain key variables through the three different channels and the combined effect of all three. These effects are presented for two cases, one where the positive shock to world activity occurs in 1990, before the boom in services exports really began, and one where it occurs in 2006, the latest date for which we have the necessary published data. Comparing the results from these two shocks illustrates the changing importance over time of the different channels through which world growth is transmitted to the Irish economy.

[14] See: http://stats.oecd.org/wbos/Index.aspx?DatasetCode=TIS

Table 2.2: Effects of a 1 Per Cent Increase in World Activity Through Different Channels

Stimulus in 2006, effects shown for 2010

Channel:	Combined	Tourism	Manufacturing	Business Services
Effect in % points on:				
GNP	1.32	0.16	0.79	0.44
Manufacturing output	2.51	0.00	2.96	0.00
Business services output	1.59	0.16	0.32	1.37
Total employment	0.57	0.09	0.42	0.35
Business services exports	3.68	0.00	0.00	4.80
Tourism exports	2.21	2.41	0.00	0.00

Stimulus in 1990, effects shown for 1994

Channel:	Combined	Tourism	Manufacturing	Business Services
Effect in % points on:				
GNP	0.85	0.16	0.55	0.10
Manufacturing output	1.93	0.00	2.20	0.00
Business services output	0.77	0.17	0.32	0.29
Total employment	1.94	0.00	2.46	0.00
Business services exports	0.50	0.15	0.28	0.24
Tourism exports	0.59	0.09	0.64	0.05

In this case the stimulus is assumed to amount to 1 per cent of world activity in either 1990 or 2006, sustained indefinitely. The effect on the Irish economy is measured for 1994 and 2010, the fifth year of the change, allowing time for production to adjust to the increase in demand. The combined effect of all three channels is shown in the first column of the table. For 2010 they sum to less than the sum of the parts because the rise in domestic activity through each of the channels raises the demand for labour leading to increased wage rates. To a limited extent this rise in wage rates offsets the benefits of the increase in foreign demand for Irish output.

The combined effects (through all channels) of growth in world demand on the Irish economy in 1990 were substantially less than they would be today. In the case of the shock beginning in 1990, in the fifth year, 1994, the effect would have been to raise GNP by 0.85 percentage points above what it otherwise would have been, compared to an addition of 1.32 percentage points in 2010 for a shock beginning in 2006. This substantial increase in the impact of world growth on Ireland is due to the changing structure of the economy. It is now more integrated into the global economy and the internationalisation of business services has contributed an important additional link between the Irish economy and the world market for traded goods and services.

The results for 2010 suggest that manufacturing is still the most important channel through which world demand drives Irish GNP. For a stimulus in 2006 manufacturing would have accounted for 57 per cent of the ultimate increase in Irish GNP (Table 2.3). However, a significant part

of the increase in Irish output would actually occur in business services, providing services as an input to domestic manufacturing.

Table 2.3: Share of GNP Growth from Different Channels

	Tourism	Manufacturing	Business Services
2010	11.5	56.8	31.7
1994	19.8	67.9	12.3

Today, almost one-third of the effect on the Irish economy of an increase in world output would be transmitted to GNP directly through the business and financial services sector (Table 2.3).[15] In this case (and the case of tourism exports) there is no real effect on domestic manufacturing as such a high proportion of manufacturing output is now exported – it is not used elsewhere in the services sector. Finally, the increase in tourism exports, as a result of higher world output (driving foreign demand for holidays in Ireland), would account for just over 10 per cent of the ultimate impact of an increase in world output on Irish GNP.

The results for the 1990 shock are very different from those for the 2006 shock. In the case of the earlier shock, by 1994, some 68 per cent of the effect would have come through manufacturing with only 12 per cent through business and financial services. In the earlier period tourism was also more important, accounting for 20 per cent of the impact of growth in world activity on the Irish economy. What this illustrates is the major increase in importance of the business and financial services sector as a crucial link between the Irish economy and world growth. The sector, which was largely providing for a domestic market in 1990, is now a major exporter. The rise in services exports (excluding tourism) has been a very recent phenomenon and has taken place at a very rapid pace. This trend is likely to continue in the forecast period, as discussed in Chapter 4.

This change has major importance in understanding what drives growth in the Irish economy. Until very recently all the emphasis was put on attracting manufacturing to Ireland, very often owned by foreign multinationals. However, for the future new factories will be less common and the major impetus to growth will come from expansion of the business and financial services sector. This has implications for a range of policy areas, including "industrial policy" and regional policy. In planning for the years ahead, while manufacturing will remain important for the foreseeable future, the major growth in activity is likely to occur in business and financial services. Public policy will need to plan for the infrastructural needs of the Irish and foreign firms that will provide this future growth. These needs will be rather different from those of traditional manufacturing plants. Regional policy will need to take account of the fact that business and financial services jobs tend to be concentrated in large urban centres. With this sector providing the major growth in employment in the future, it emphasises the importance of the National Spatial Strategy's approach of concentrating on a few key "gateways".

[15] All of these results leave out the transmission to Ireland of the effects of changes in world output through the financial markets, migration etc.

While Ireland clearly has enjoyed a competitive advantage in the business and financial services sector in world markets over the last decade, this advantage is in no way guaranteed. The *HERMES* model indicates that business services exports and output are very sensitive to Ireland's competitiveness (Appendix 2). This is illustrated in Table 2.4, which shows the impact of a one percentage point improvement in Ireland's competitiveness relative to the rest of the world, assumed to begin in 2006, and sustained for twenty years. Wages in Ireland are held constant (as are import prices). To capture the full long-run effects of competitiveness changes the effects on the key variables are shown for 2025. The results indicate that the supply response for both tourism and business services exports is similar lying in the range 1.29 to 1.35.

Table 2.4: Effects of a 1 Per Cent Improvement in Competitiveness

Stimulus in 2006 effects in 2025

	Effect in Percentage Points on:
GNP	0.83
Manufacturing output	1.08
Business services output	0.72
Total employment	0.45
Business services exports	1.29
Tourism exports	1.35

Manufacturing output shows a supply elasticity of just over unity when faced with a one percentage point improvement in competitiveness. When the combined effects on the three sectors exposed to international competition are taken into account, the effect of the improvement in competitiveness on GNP is around 0.85 percentage points by the end of the period.

While Ireland is specialising into certain sectors where it has special advantages, there are other developed countries with similar advantages. As a result, these model results suggest that competitiveness relative to our neighbours is very important, not just for manufacturing, but also for business services. This conclusion is also broadly consistent with the results using a much simpler model of the Irish economy in Bergin and Kearney (2007).

The detailed results, not shown here, suggest that the response to changes in competitiveness is somewhat slower than to changes in world demand. Firms can adjust their output in the short-term in existing plants in response to changes in world demand. However, relocating production to more competitive locations requires major investment. Such decisions on relocation, either to Ireland or from Ireland, are not made on the spur of the moment. Once made it generally takes quite a number of years before the new production centre is operating at capacity.

2.5 Productivity, Human Capital and the Terms of Trade

The manufacturing sector has seen very high rates of productivity increase over a prolonged period. This reflects the heavy weighting of the high-tech sub-sector in manufacturing. The nature of the product of this sector means that technical innovation is particularly rapid resulting in substantial cost reductions each year. Table 2.5 shows the five-year average growth in labour productivity for the three sub-sectors of the manufacturing sector used in the *HERMES* model, as well as for market services.

Table 2.5: Labour Productivity, 5 Year Averages, Per Cent

		1980-85	1985-90	1990-95	1995-00	2000-05
Manufacturing						
	Traditional	5.2	6.0	4.8	4.5	4.8
	Food Processing	7.4	7.9	5.9	2.9	7.0
	High-Tech.	14.2	8.3	8.3	14.5	9.3
	Total	6.9	6.4	5.8	8.3	7.7
Market services						
	Business & Financial	-1.8	6.5	-1.6	6.7	0.3
	Distribution	2.3	-1.3	-1.0	0.6	2.9
	Transport & Communications	3.0	6.9	4.0	4.6	3.5
	Total	1.5	1.7	-0.1	3.0	2.5

The exceptionally high rate of productivity increase was not confined to what we have here defined as the high-tech sector – chemicals and engineering.[16] In addition, what is here defined as the "traditional" sector includes paper and publishing, which has within it the "reproduction of computer media" category, which is properly a high-tech business. The high rate of productivity increase owes much to the gradual replacement of low productivity firms by firms in niches with much higher productivity (Haller, 2007). The result of this transformation is a continuing very high rate of productivity increase in manufacturing. This is not just a phenomenon of the 1990s but has been sustained over a very long period, as shown in Table 2.5, and it has been accompanied by a major change in the structure of the sector.

The existence of very high rates of productivity growth in the manufacturing sector has, of course, meant that the very high rate of growth in output has been accompanied by a moderate, though nonetheless significant, increase in employment. However, if the industry matures and experiences slower growth in output in the future the continuation of such a high rate of productivity increase will involve a contraction in the employment of the sector. This appears to have happened in the most recent years, with a substantial fall in employment since its peak in 2001.

[16] Because of problems in availability of suitable national accounts data it is not possible to use a more precise definition – for example, pharmaceuticals, computers, instrument engineering.

This very high rate of productivity increase in the sector internationally has meant that the price of the output of the sector has fallen fairly steadily in recent years. Today, the price index for the output of the sector is 5 per cent below its 2000 level, in spite of an average rise in the GDP deflator over that period of around 3.5 per cent a year. With the bulk of manufacturing output exported (over 80 per cent), to buy the investment and consumption goods that make up the rest of GDP, ever higher volumes of manufactured goods have to be produced and exported. Table 2.5 also shows the measured rate of productivity increase in the market services sector and its sub-sectors over the same period. The trend growth in productivity is dramatically lower than in the manufacturing sector. The one exception is the transport and communications sector.

The latest version of *HERMES* identifies a change in trend in the transport and communications sector in the second half of the 1980s, with labour productivity stepping up in gear around that time. This acceleration in the rate of productivity increase was due to major structural change – the advent of competition in air transport and inter-urban buses, as well as major change in the telecommunications sector. Globally the move to containerisation and liberalisation have also made for a more efficient industry. The result of the accelerated rate of increase in labour productivity is that the rate of inflation in the price of output of that sector has been substantially moderated, making the tradable sector of the economy more competitive and resulting in savings for consumers.

The distribution sector has shown rather slow growth in productivity over the same period. Studies of the EU and the US suggest that one of the key reasons for higher productivity in the US than in the EU-15 over the last decade and a half has been the growth in productivity in the distribution sector in the US (van Ark, O'Mahony and Timmer, 2008). The limited progress in this sector in Ireland may mean that there is scope for more progress in the coming decade in this sector.[17] The key sub-sector in market services, which is growing rapidly and is increasingly competing on a world market, is business and financial services. Table 2.5 suggests a rather uneven progress in productivity in that sector over the last twenty-five years, with an average growth in productivity over the full period of only 0.7 per cent a year, lower than for any other sector considered here. In spite of the very slow growth in the productivity of the sector, output and employment have grown continuously and, as explained earlier, its share of GDP has expanded greatly. A very substantial part of the output of the sector is now exported and its success in international markets has occurred in spite of the slow growth in measured productivity.

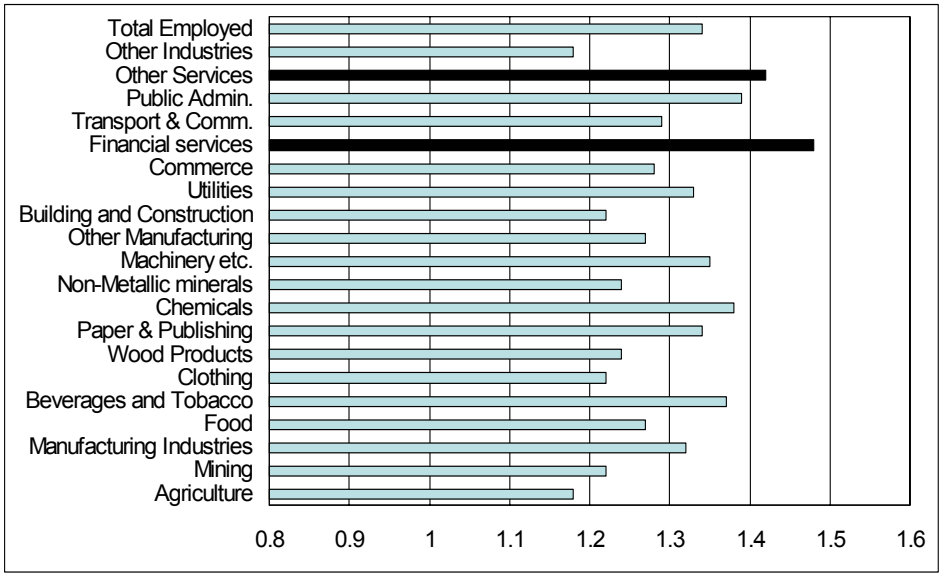
While measured labour productivity may have grown slowly in this sector, there are many problems in measurement. Unlike in manufacturing, where the number of units of output produced each year in a plant is generally identifiable, much of the output of the business and financial sector is not amenable to such quantification. There are also major problems in dealing with improvements in quality of service provided by the sector. While methods have been developed to deal with this issue of

[17] It may also be due to differences in taste. In the US consumers may prefer to buy their goods in large hypermarkets whereas in the EU for some products consumers may prefer more individualised products in smaller shops (Fitz Gerald and Knipper, 1990).

quality improvement in manufacturing, for example, in the computer hardware sector, progress by statistical authorities in the business services sector is much slower. What this means is that measured output may underestimate the true increase in the volume of output, and hence in productivity.

If output and productivity are underestimated this will be manifested in a high rate of inflation in the output price of the sector.[18] Over the twenty-five years between 1980 and 2005 the deflator for the GDP arising in the business and financial sector rose by on average over 8 per cent a year. For all of the services sector, including non-market services, the increase was around 6.7 per cent a year and for manufacturing it was under 2 per cent a year. The fact that the sector can command a continuing price premium for its output could be due to a number of factors, including a continuing unforeseen increase in demand, a trend rise in the price of one of its key inputs, namely skilled labour, and technical change, resulting in quality improvements not captured in the price indices. A problem in measuring the "true" price would be consistent with an underestimate of output. Even if the output of the business and financial sector is not underestimated, its success in dramatically increasing its exports in a global market indicates that, to date, it has remained competitive in spite of a rapid rise in prices. This is reflected in the OECD measures of revealed comparative advantage.

Figure 2.7: Index of Level of Education of Work Force, by Sector, 2002



The sector is very human capital intensive – the work force has a high average level of education. Figure 2.7 shows an index of the average level of education of the work force by sector from the *2002 Census*.[19] The two categories relevant to the business and financial sector are highlighted in

[18] The output deflator for the sector is obtained by dividing the value of output by the measure of volume.

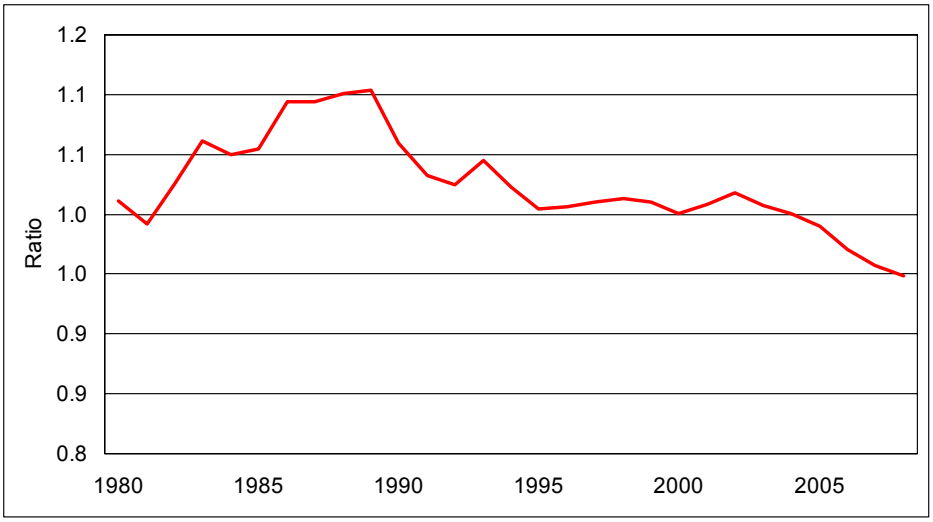
[19] The index treats someone with primary education alone as having an index of unity. The weights reflect the relative returns, in terms of earnings, to each level of education where the returns are measured relative to the income of those with primary education alone.

the figure. In a world where goods and services with a high human capital content are experiencing a rapid growth in demand, producers face a demand curve that is not very price elastic.

As the sector increasingly becomes the engine of growth in the economy, taking over from manufacturing, the measured productivity increase for the economy as a whole will tend to fall. However, as discussed below this may exaggerate the slowdown in the purchasing power of Irish incomes.

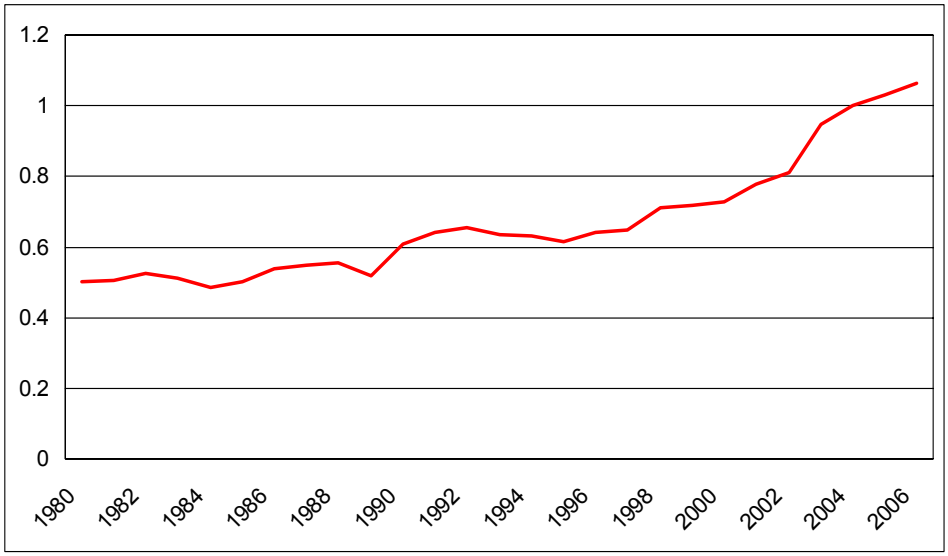
The effect of the high rate of productivity increase in manufacturing has been that the price of exports from the sector has risen very slowly over time (reflecting the low rate of inflation in output prices). The goods and services that Ireland imports tend to be less high-tech and their prices have risen more rapidly than export prices over time. Thus, as shown in Figure 2.8, the terms of trade have moved against Ireland fairly consistently since the late 1980s. Each year, in order to buy even the same volume of imports as the previous year, a larger volume of high-tech exports has to be sold because of the change in the relative prices. This means that the rate of growth in GDP and GNP, driven by the growth in manufacturing, exaggerates the true growth in living standards in Ireland. As explained above, Gross National Disposable Income (GNDI) is a more appropriate welfare measure as it takes account of the change in purchasing power due to fluctuations in the terms of trade.

Figure 2.8: Terms of Trade, Ireland



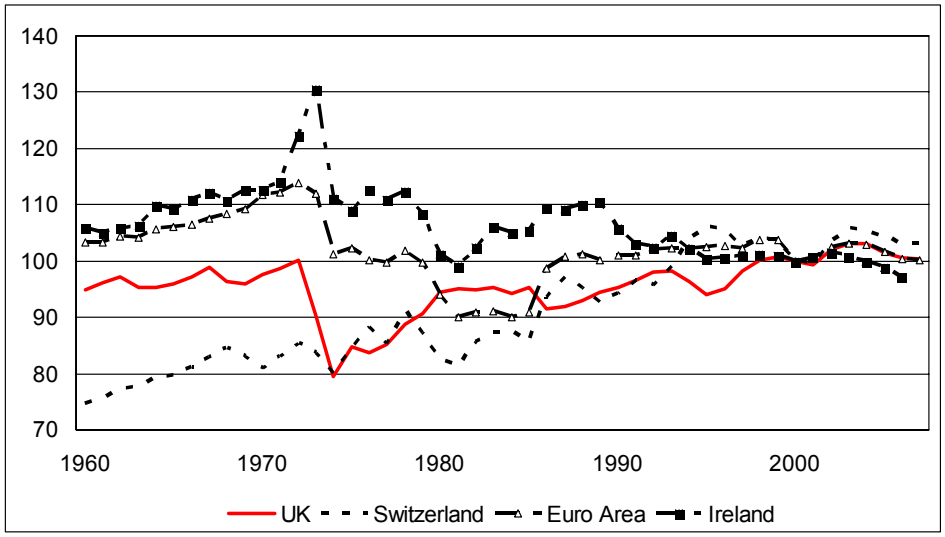
However, as services exports increase in importance in the economy there is likely to be a reversal in the trend deterioration in the terms of trade. In the next decade the very rapid growth in the export of services will come to dominate Irish exports (see Chapter 4). Assuming that the past trend for the price of exports of services to rise relative to that of merchandise goods continues (Figure 2.9), as services exports come to dominate total exports the result will be a reversal of the trend deterioration in the terms of trade. This will be reflected in GNDI growing more rapidly than GNP. Of course if the problem is an underestimation of the output of the business and financial sector then measured GNP would grow more rapidly and the terms of trade would not improve. Either way GNDI will be the appropriate measure of the improvement in welfare.

Figure 2.9: Relative Price of Services and Merchandise Exports, Ratio



Two other European countries where a substantial proportion of total exports is accounted for by business and financial services, are the UK and Switzerland. As shown in Figure 2.10, since the mid-1980s they have both experienced a significant improvement in their terms of trade, whereas for the Euro Area there was relatively little change over the same period. It is likely that the experience of these two countries, the UK and Switzerland, will be a more appropriate guide to Ireland's position over the coming decade as, like them, Ireland becomes ever more reliant on exports of services.

Figure 2.10: Terms of Trade, UK, Switzerland, Ireland and Euro Area, 2000=100



There remains one factor which is likely to give rise to a somewhat more rapid growth in productivity in Ireland than in its neighbours over the coming ten or fifteen years. That is the differential effect of investment in education.

Over the last twenty years there has been major investment in education in Ireland. While free second-level education was first introduced in 1967, the substantial rise in participation only really began in the 1980s, especially in the participation rate at third level. The upgrading of the education system in Ireland has occurred much later than in many of Ireland's northern European neighbours. For example, in the UK the 1944 *Education Act* presaged a major increase in educational participation in post-war years. Similar developments occurred in the late 1940s and the 1950s in countries such as Germany, Sweden and the Netherlands.

As a result, the productivity enhancing effects of investment in education was felt much earlier in countries such as Germany and the Netherlands than in Ireland. For Germany the major benefit of its post-war investment in education occurred in the 1970s (Koman and Marin, 1997). One way of measuring the change in the investment in human capital in a range of countries since the 1950s is to compare the average educational attainment of the population in each country aged 25-29 years with that of the population aged 55-59 years. Figure 2.11 shows the ratio of the human capital index for the two cohorts across a range of countries.[20] This shows that there has been little additional upgrading of human capital over the last thirty years in countries such as Germany, Denmark and the Netherlands. Thus the impact of rising educational attainment on these economies has already been fully accounted for. It is those countries that have invested more recently that have not yet fully reaped the benefits of this investment. This goes some way to explain the superior growth performance of Ireland, Spain and Portugal in recent years.

Figure 2.11: Investment in Human Capital, 2002

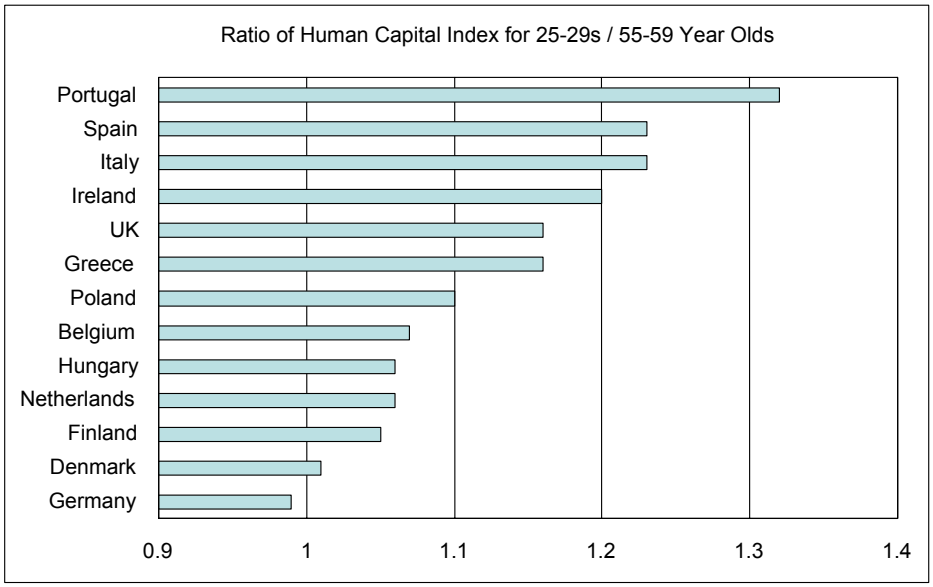
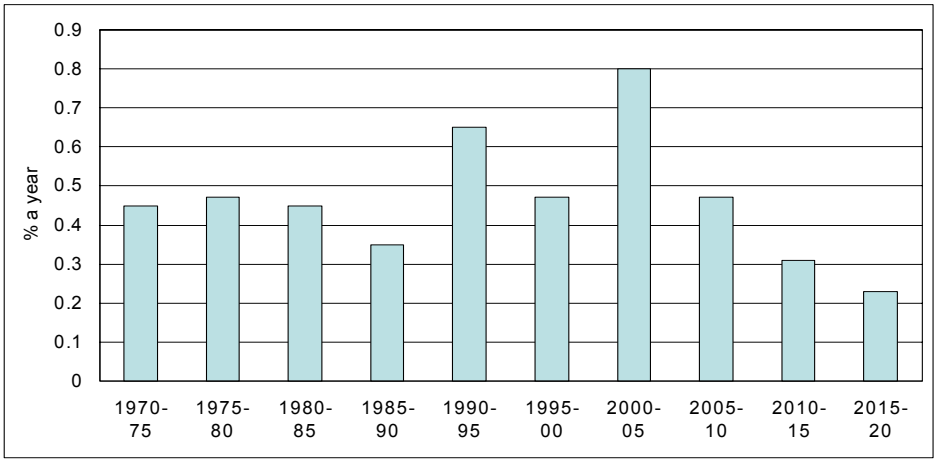


Figure 2.12 shows the average annual growth in the human capital index for Ireland for five-year periods since 1970. It shows that the biggest

[20] For details on methodology see Fitz Gerald (2006). This index weights those with each of four levels of education (completed) by the estimated returns to the individual from that level of education. Primary education has a weighting of one. The weights for Ireland are taken from Fitz Gerald, McCarthy, Morgenroth and O'Connell (2003). Primary education has a weight of 1, Junior Certificate, 1.11, Leaving Certificate 1.27 and Third Level 1.68.

impact on the growth in productivity, and hence in the economy, was between 1990 and 2005. However, it will still be significant, though slowing, for the next twenty years. This reflects the fact that the upgrading of the educational system is relatively recent in Ireland. While this growth in the index does not necessarily translate into a similar increase in productivity, it does provide a useful guide to the potential long-term effects of the investment in education and training.[21]

Figure 2.12: Growth in Human Capital Index



The increase in the human capital of the population can affect the economy in a number of different ways. Participation rates are higher for those with good education, reflecting their superior productivity and earning power. This is particularly true for women. Also those with better levels of education are much less likely to experience unemployment. Thus increases in human capital will affect participation rates positively and unemployment rates negatively. Finally, increases in human capital will positively affect the productivity of individuals.[22] (In a market economy with a flexible labour market the earnings of individuals will reflect their marginal product.)

Recent research by Bergin and Kearney (2007) examines the impact of the increase in human capital on the Irish economy in recent decades. Their research indicates that the rise in human capital played a pivotal role in increasing output and productivity, slowing the growth in wage dispersion between high-skilled and low-skilled workers, and in boosting employment. They find that had Ireland failed to invest in human capital over the twenty year period examined in the paper, GNP per capita would have been over 20 percentage points lower than it actually was. In their numerical simulations the growth in output per head is decomposed into the contributions from employment, participation and productivity. The results suggest that, with unemployed resources, the biggest benefit to the Irish economy in the 1990s from human capital accumulation was in terms of employment. It turned those who had poor employment prospects because

[21] The quality of education is clearly very important. This makes international comparisons difficult but it also poses problems when comparing trends within a country over long periods.

[22] Obviously higher levels of educational participation reduces labour force participation in the younger age groups.

of their limited education into individuals with a good education sought after by employers.

With the economy now at (or close to) full-employment the biggest benefit in the future is likely to come from rising labour force participation. However, they did not model in detail the potential productivity enhancing effects of investment in human capital. Previous work by Durkan, Fitzgerald and Harmon (1999) suggested that the productivity enhancing effects would be substantial.

Finally, there is some micro-economic evidence which suggests additional human capital effects from the mobility of the Irish labour force in the past. Barrett and O'Connell (2001) show that those Irish who worked abroad and returned could expect to earn substantially more (c. 10 per cent) as a result of the increase in their human capital from their more varied work experience. With around 30 per cent of all those in Ireland with third level education (and over 20 per cent of the adult population of working age) being returned emigrants this would suggest quite a substantial long-term impact. However, further studies will be needed to fully identify both the private returns to labour mobility, and the related experience gained, and also the likely social returns. However, on the basis of the evidence to date it would suggest that for at least another decade Ireland will continue to experience a potential advantage relative to many of its EU competitors, in terms of higher labour productivity arising from human capital effects.

2.6 The Labour Market

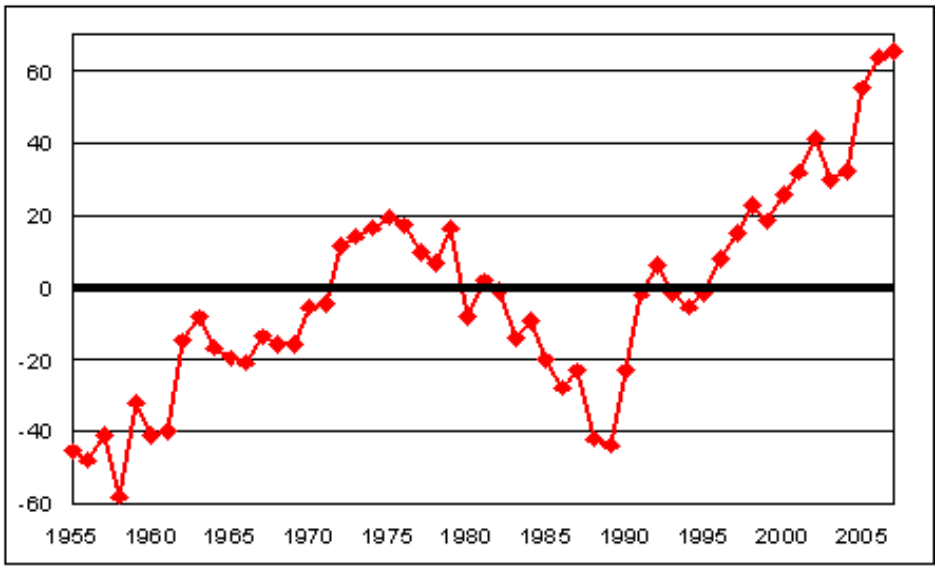
For two centuries there has been free movement of labour between the United Kingdom and Ireland. In addition, over much of that period, Irish labour also had access to other attractive labour markets, such as that of the United States. The result of this free movement was extensive emigration from Ireland over a very long period. This free flow of labour out of Ireland made it part of a much larger British Isles labour market so that the supply of labour was affected by factors in that wider market. This had implications for the economy as a whole and, in particular, it affected wage formation in Ireland (O'Rourke, 1995).

Figure 2.13 shows the pattern of net emigration over the last half century. For most of this long period the free movement of labour generally involved emigration from Ireland. While there was always some return of former emigrants, until the 1970s these flows were swamped by the movement outwards, giving rise to substantial net emigration (Fahey, Fitz Gerald and Maître, 1998). Over most of this period there was very little inflow of foreign citizens into Ireland. The first sign of a change in pattern occurred in the 1970s. This change was partly due to the disturbances in Northern Ireland, which led to some movement of population south of the border. In addition, for the first time, there was a significant flow of returning emigrants who had left in the 1950s or the 1960s.

With the advent of difficult economic conditions in the 1980s, associated with low growth and rising tax rates, there was a return to net emigration. The highest level of net emigration was experienced in 1989. With the rapid growth in the economy since 1994 there was again a reversal in the flow of labour. Initially, there was a major return of emigrants,

primarily those who had left in the 1980s. This resulted in substantial net immigration over the second-half of the 1990s. However, for the first time there was also significant immigration of non-Irish citizens. With the enlargement of the EU in 2004 creating a much larger pool of labour, there was a further step up in net immigration into Ireland, with the bulk of the net inflow being foreign citizens rather than returning emigrants.

Figure 2.13: Net Immigration into Ireland, 000s



Going back to the 1960s, the behaviour of net migration has been explained using a model where the flow of net emigrants is driven by differences in the unemployment rates in the origin (Ireland) and destination (UK) labour markets (a specification based on Harris and Todaro, 1970). This model explaining migration behaviour has been re-estimated on quite a number of occasions (Walsh, 1968, Keenan, 1981, Honohan, 1984 and 1992 and Bradley *et al.*, 1993). With each successive re-estimation it proved robust, continuing to explain migration behaviour over a long period.

As shown in Appendix 2, the flow of migration was explained by the difference between the expected returns to living in Ireland relative to the UK. This is a function of the expected real after tax wage rate and of the probability of being unemployed/employed in the two countries. As indicated in the Appendix, this specification implies an infinitely elastic supply of labour in the long run; provided the gap between the circumstances in the two labour markets continues unchanged the net flow of migrants will continue indefinitely. If the relative attractiveness of the Irish labour market remains unchanged, in today's circumstances this would mean that an infinite inflow of immigrants would continue to come. Such an inflow would only be choked off if the rise in the supply of labour affected domestic wage rates or unemployment rates, or else if there was a change in the labour market circumstances in the countries of origin.

This approach was realistic in the 1950s through to the early 1990s, when the bulk of migrants were going from Ireland to the UK or *vice versa*. Up to the mid-1980s they were also largely unskilled and more likely to suffer from spells of unemployment than skilled workers, hence the

importance of differential rates of unemployment. However, over the course of the 1980s the educational attainment of the emigrants changed dramatically (Fahey, Fitz Gerald and Maître, 1998). With the shift towards emigration of skilled labour the difference in the real after tax wage rate in the origin and the receiving labour markets could be expected to be more important.

In more recent times the move to immigration of foreigners (generally skilled, Barrett and McCarthy, 2007), rather than returning emigrants, could be expected to change the factors driving the movement of labour. While in the late 1990s many of these immigrants came from the UK, in recent years their origin has shifted, with many of these immigrants coming from the new EU member states. This could be expected to change the factors affecting the international movement of labour (e.g. substituting Polish wage rates for UK wage rates). One would expect that, with a change in the alternative labour market to Ireland (in this case the origin of the movement of labour), different variables would appear in any model explaining migration.

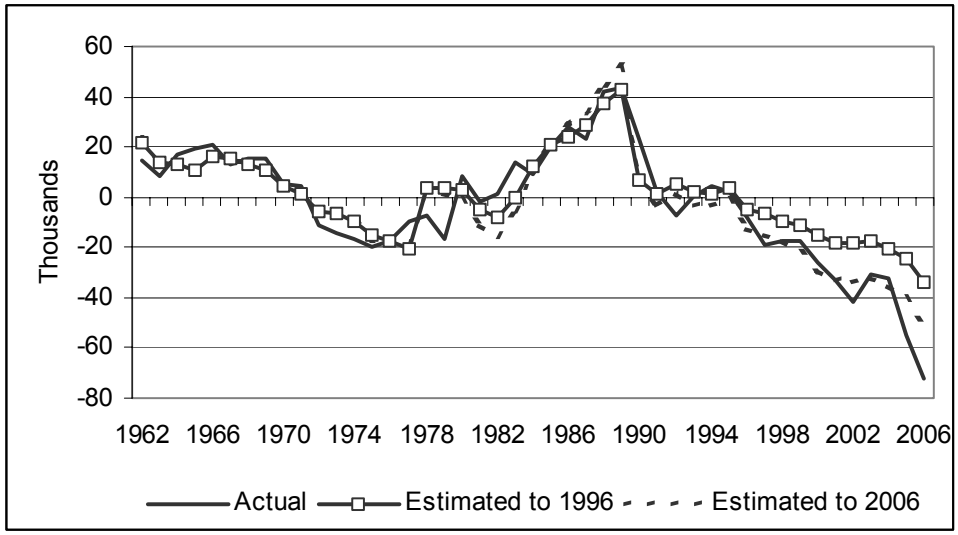
In addition, the cost of moving from the new origin countries to Ireland is likely to be different than it was for those coming from the UK or for returning emigrants. While a century ago an important element of the cost of moving was the cost of transport, today the major cost will be the loss of contact with family, friends and networks. Also the information requirements needed to live and work successfully in a new location are significant.[23] While modern technology can ease the transition, language obstacles remain severe. Obviously, these factors will constitute costs for foreigners coming to Ireland while, for Irish people returning, they will constitute benefits. Hence, the shift in the composition of migrants will affect the cost of moving and migration behaviour.

Having reliably explained migration behaviour over three or four decades, this change in behaviour has caused the old model of migration to breakdown, as illustrated in Figure 2.14. This figure shows the estimates of migration from the traditional migration equation when it was estimated over different time periods (to 1996, to 2006 and the actual net emigration, NMA). When estimated up to 1996 the model massively underestimates immigration in subsequent years. When estimated over the full period it still underestimates migration in the most recent years by a substantial amount, while providing a much worse fit for the period to 1996. Underlying the instability of this equation is the change in the factors driving migration and labour supply since the mid-1990s.

As discussed above, the traditional model of migration implies an infinite elasticity of labour supply in the long run. However, a number of factors have changed this elasticity of labour supply:

[23] For example, how you access the property market; how can you establish a credit reputation.

Figure 2.14: Estimates of Immigration with Different Models



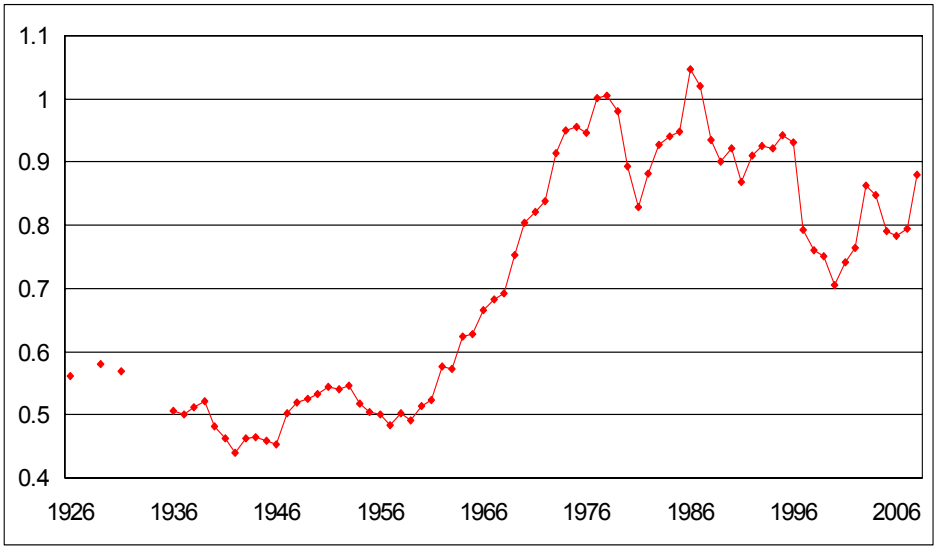
1. The fact that the origin of the immigrants has changed should result in a change in the alternative labour market related variables (unemployment rate or real after tax wage rates) that should appear in the model. In practise this did not prove feasible.[24] However, the UK variables may still be relevant if the foreign immigrants are choosing between the Irish and the UK labour markets. This is not implausible in the case of immigrants from the new member states as the inflow into the UK from these countries has been even larger than that into Ireland in absolute terms (Barrell, Fitz Gerald and Riley, 2007).

2. The Irish labour market is much smaller than that of the UK and large inflows result in rising costs of living because the stock of infrastructure, both private and public, is fixed in the short run. Duffy, Fitz Gerald and Kearney (2006) show that the bigger the inflow of people to be housed, the bigger the demand for housing and the higher the cost of accommodation. (This is reflected in Chapters 4 and 5 in the discussion of the impact of migration on demand for housing in the forecast period.) This increase in demand affects the cost of living in Ireland, adversely affecting the country's attractiveness for foreign labour, tending to moderate the inflow. In addition, Barrell, Fitz Gerald and Riley (2007) show that, because the stock of public infrastructure (e.g. public transport) is fixed in the short term, increases in the population and labour supply result in a decline in labour productivity (because of the rising congestion costs that such a limitation on public infrastructure implies).

[24] The rapidly shifting origin of the immigrants combined with the wide range of countries of origin means that it is not possible to identify suitable variables for home country wage rates or unemployment to use in an annual time series model.

For forty years between 1926 and 1966 Irish wage rates ranged around 50 and 60 per cent of those in the UK (Figure 2.15). This was in spite of very substantial movement of labour from Ireland to the UK. However, from the mid-1960s onwards the wage rate in Ireland converged rapidly on that in the UK stabilising at just under 90 per cent of the UK rate between 1970 and 2005. Curtis and Fitz Gerald (1996) and Fitz Gerald (1999) modelled the reduced form of the labour market using a wage equation which took account of the fact that UK labour costs affected both the demand and the supply of labour in Ireland. This also suggested that the fluctuations around the long-term trend, manifested in Figure 2.15, were partly due to fluctuations in the bilateral exchange rate.

Figure 2.15: Irish Labour Costs Relative to UK



While this model satisfactorily explained the behaviour of wage rates up to the mid-1990s, when periodically re-estimated with more recent data it has suggested changes in underlying behaviour. It is a reduced form model of the labour market and the implied labour supply elasticity can be derived from the estimation results. As shown in Table 2.6, when estimated with data that ended in 1990 or 1994, before significant net immigration was observed, it implied a very high elasticity of labour supply. However, as more recent data are added the implied supply elasticity has fallen. This is fully consistent with the results shown above for the migration equation. This evidence confirms that the supply of labour is no longer infinitely elastic. Instead the labour supply curve slopes upwards with significant implications for labour market behaviour. As additional data are added the measured elasticity of supply falls. In the *HERMES* model there is a structural model of labour supply (Appendix 2) which provides an independent and more robust estimate of the elasticity of labour supply and that is also shown for comparison in Table 2.6.

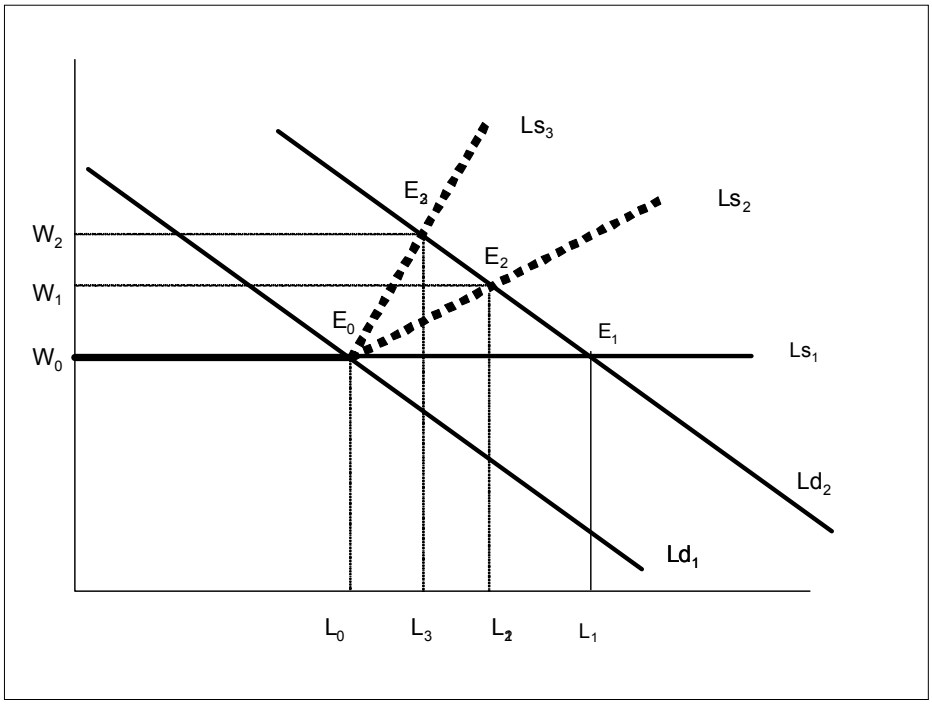
Figure 2.16 provides a stylised model illustrating the implications of the change in the shape of the supply curve for the economy. In the past the labour supply curve (Ls_1) was horizontal with an infinite elasticity of labour supply in the long run through migration. Under these circumstances, if the labour demand curve shifted outwards from Ld_1 to Ld_2, for example due to expansionary fiscal policy, employment would rise from L_0 to L_1, with no change in the wage rate W_0. However, as supply becomes more inelastic,

Table 2.6: Estimation of Wage Rate Equation, Implied Labour Supply Elasticity

	Estimation Period	Labour Supply Elasticity
Curtis and Fitz Gerald (1996)	1962-90	3.62
Fitz Gerald (1999)	1980-94	4.4
Fitz Gerald and Hore (2002)	1983-98	2.67
Model re-estimated using latest data	1974-2005	2.23
HERMES 2008 structural model		0.66

with the supply curve shifting upwards to Ls_2 or even Ls_3, the outward shift in the demand for labour to Ld_2 leads to a rise in wage rates to W_1 or even to W_2.[25] As a result, total employment only rises to L_2 or L_3. This means that rising domestic demand for labour, with no change in the supply curve, will see rising wage rates. Until the early 1990s, with a very elastic supply, shocks to domestic demand, for example, from an expansionary fiscal policy or a building boom, just resulted in an inflow of labour. However, today such a stimulus would have significant inflationary effects. The rise in wage rates that would occur would tend to crowd out the tradable sector of the economy, which has to compete on global markets.

Figure 2.16: Response to Labour Demand Shifts with Changes in Slope of Labour Supply Curve

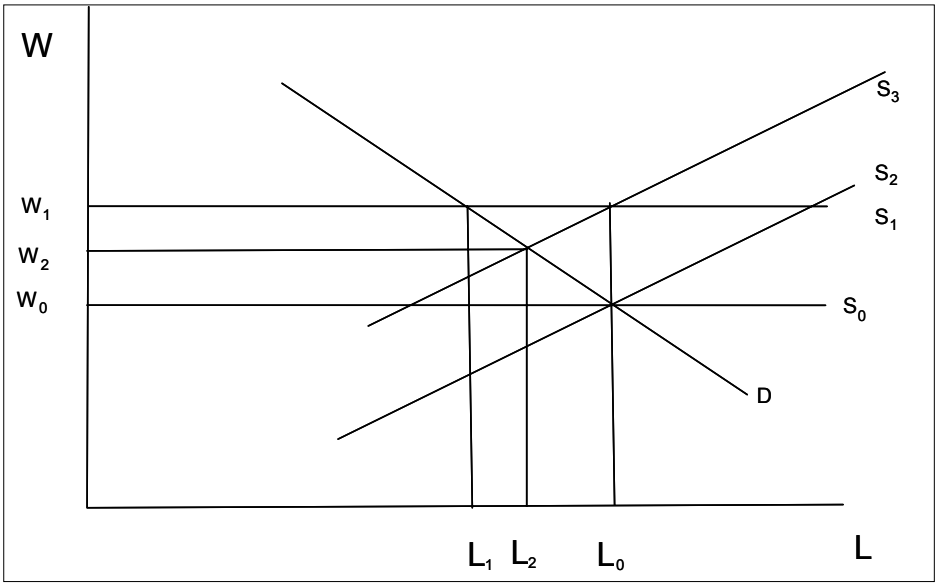


A second implication of this change in labour market behaviour is illustrated in Figure 2.17. When the elasticity of labour supply was infinite (S_0) any change in the tax on labour affected wage rates directly – all of the incidence of an increase in labour taxes fell on employers, as did all the benefits of tax cuts. For example, if a tax was imposed which shifted the

[25] Without enlargement of the EU the supply curve would have been even more inelastic.

wage rate from W_0 to W_1 then, with an infinitely elastic supply curve, the supply curve would be shifted up to S_1. With a fixed demand curve, D, employees would still get W_0 but employment would fall from L_0 to L_1. Employers would pay the cost of labour including all the tax, W_1. Under these circumstances, the trade-off agreed in the first partnership agreement in 1987, involving lower taxes on labour in return for wage moderation, reflected the realities of the labour market at the time. Even without a partnership agreement the labour market would eventually have delivered such an improvement in competitiveness in return for a reduction in taxes on labour.

Figure 2.17: Incidence of Taxation with Changes in Slope of Labour Supply Curve



However, since the late 1990s, with the change in the shape of the supply curve of labour (Figure 2.17) to S_2, the incidence of labour taxation is changed. With the same increase in tax the supply curve is then shifted to S_3. The new wage rate is set where the supply curve S_3 intersects with the demand curve D – at a wage rate of W_2. The increase in wage rates from W_0 to W_2 is less than the increase in labour taxes – from W_0 to W_1. This means that some of the incidence of the tax falls on employees – the after tax wage falls. As a result, the fall in employment to L_2 is less than it would have been in the past with an infinite elasticity of labour supply.

This has very significant implications for the operation of fiscal policy. For example, this means that the potentially positive effects on employment of the introduction of a carbon tax, with the revenue used to cut taxes on labour, are not as positive as they would have been in the past (Fitz Gerald and McCoy, 1992). Today some of the reduction in the tax on labour would accrue to employees whereas in the past the vast bulk would have gone to employers and into generating additional employment. (Nonetheless, the *HERMES* model indicates that for realistic levels of carbon tax, with the revenue recycled through lower labour taxes, there would be a positive effect on competitiveness, output and employment.)

While all the evidence points to a change in the response of labour supply in the Irish economy, the fact that it has occurred so recently makes it difficult to estimate just how inelastic it actually is using the reduced form

wage equation. This problem arises from the short data sample – it is essentially a decade since there was a significant change in migration behaviour in the mid-1990s. However, using a structural model of migration and labour supply the *HERMES* model does produce an independent estimate of the elasticity of labour supply.

Appendix 2 discusses the approach that has been taken in the latest version of the *HERMES* model used in preparing our forecasts. This model takes account of both the responsiveness of labour supply through migration and the responsiveness of labour force participation to changes in wage rates. While in the 1990s female labour force participation was very responsive to wage rate changes, the percentage change in labour supply for a given percentage change in wages today is lower because such a high proportion of the female population of working age is already in the labour force. When combined, these factors result in a long-run elasticity of labour supply with respect to domestic wage rates of 0.66 per cent. While this elasticity is less than the infinite elasticity of labour supply of the past, it is still quite elastic by international standards, reflecting the continuing openness of the Irish labour market.[26] Also it is considered more robust than the elasticity estimated from the reduced form model, shown in Table 2.6.

In the *HERMES* model the demand for labour in each of seven sectors of the economy is modelled as a component of a factor demand system for each of those sectors. (The demand for labour in agriculture and non-market services is treated as exogenous.) When taken together these equations suggest a long-run elasticity of labour demand of -0.4 per cent. While the elasticity of labour supply has fallen compared to the 1980s and the early 1990s, the model and recent experience also suggests that labour supply in the short term is actually more responsive to changing labour market circumstances than in the past

The slowdown in the influx of new immigrants (as reflected in the PPS numbers) has been combined with a fairly similar pattern of outflow of short-stay immigrants. The result has been a substantial reduction in net immigration and a corresponding major slowdown in the increase in labour supply. In the past where those losing their jobs were Irish they would have taken some time searching for domestic jobs before leaving. The foreigners in the labour force seem to be much more responsive to changes in labour market circumstances, especially unemployment. Barrett and McCarthy (2007) indicate that immigrants had a lower propensity to depend on welfare payments than domestic residents. With job opportunities elsewhere, in both the UK and in the booming economies of the New Member States, foreigners are responding as much to the pull of these job opportunities outside Ireland as to the loss of opportunities in Ireland.

[26] While the *HERMES* model assumes that labour is homogeneous, this is obviously an oversimplification. As discussed earlier very significant differences exist in the productivity of labour depending on educational attainment. Also there will be more job-specific human capital that makes labour less mobile between sectors. Bergin and Kearney (2007) estimate a model with two kinds of labour, those with at least a Leaving Certificate and those without one. The results of this specialised model are used to inform the forecasts presented in Chapter 4.

The changes in the labour market discussed in this section have major policy implications:

The incidence of labour taxes is changed. This means that the kind of trade-offs between wage rates and labour taxes which were exploited by governments in the late 1980s and early 1990s will no longer be as effective in improving competitiveness and increasing employment. It also means that, should it become necessary to increase rates of labour tax by a small amount at some date in the future, for such limited changes the negative competitiveness effects would be smaller in magnitude than they would have been in the 1980s or early 1990s.

While the Irish labour market has long been unusual in the apparent absence of a Philips curve involving a trade-off between unemployment and inflation, things are changing. This change in behaviour indicates that crowding out[27] of the domestic tradable sector by fiscal policy is potentially important. (This concern about potential crowding out was discussed in Morgenroth and Fitz Gerald, 2006, in the context of the appropriate size of the National Development Plan.) It means that wage rates are affected by fiscal policy and that in the future an unduly expansive budgetary position would have negative long-term consequences for competitiveness, output and employment. It also reflects the fact that by not using fiscal policy to moderate the housing boom in recent years, significant damage was done to the competitiveness of the tradable sector.

While the evidence suggests that labour supply is now less responsive in the long run to changes in wage rates, the opposite is true in the short run. Many of the foreign workers in Ireland are only here for a short time anyway.[28] A reduction in net immigration is rapidly achieved as the inflow falls with news of deteriorating labour market conditions, while the outflow continues at the previous rate. This rapid adjustment to changing labour market circumstances appears to be happening already with those losing jobs in building and construction. This short run responsiveness of labour supply has facilitated the adjustment of the economy in 2007 and 2008 to lower levels of activity, without having as adverse an effect on unemployment as had been anticipated in the last *Review*.

2.7 The Housing Market

One of the stories that has come to prominence over the past decade is how the housing sector has grown in size and importance for the Irish economy. This sub-sector is an important component of the ESRI macro model (Appendix 2).[29] New house prices are modelled based on the level of per capita income, per capita housing stock, the percentage of the population in the main household formation age group 25 to 34 years, and the user cost of housing. A dummy variable is also included for 2003, which suggests that house prices were higher than the model would

[27] Crowding out means that the expansion of one sector in the economy raises overall prices and wages, hence reducing the competitiveness and output of other sectors.

[28] See the analysis by the CSO of the pattern of employment of those workers from the New Member States (NMS) with PPS numbers CSO: 2008, *Foreign Nationals: PPSN Allocations and Employment 2002-2006*.

[29] Based on work by Murphy (2005). The ESRI housing model is described in Duffy (2002). Extensive research has also been carried out by the Central Bank, see inter alia McQuinn (2004), McQuinn and O'Reilly (2007) and Addison-Smyth, McQuinn and O'Reilly (2008).

normally have predicted by around 10 per cent in 2005.[30] This was followed by nominal growth in house prices of around 13 per cent in 2006. The recent slowdown in the property market will have removed some of the overvaluation.

The coefficient for the change in income suggests quite a rapid pass through of short-run changes to prices. Per capita real income is also highly significant with an elasticity greater than one. Thus rising standards of living have a strong effect in increasing the demand for housing, leading to a more than proportionate increase in new house prices. This is consistent with the results of Miles and Pillonca (2007). Their analysis finds that Irish house prices rose by 173 per cent between 1997 and 2006. Of this increase 108 percentage points was accounted for by increases in real income per capita.

A key driver of any housing market is demographic influences and in this regard the experience of Ireland is in contrast to that of many other European countries. The *2006 Census* recorded the population at 4.2 million, up by 8.2 per cent in the four years since the previous Census, and nearly a third of the population was aged between 25 and 44 years, the key household formation age groups. Combined with changes in population it is also the rate of household formation that is an important influence on housing demand. Household formation patterns are driven by older people living longer and living alone, couples separating or divorcing, young, single people leaving the family home and living independently, and single parent families. Between 1997 and 2006 the number of households rose by 25 per cent, to nearly 1.5 million. At the same time as the population has been growing there is also a decline in the average size of households. While it is the case that housing supply has risen substantially in recent years, the stock of dwellings per 1,000 population in Ireland is still below that of many other European countries. The housing stock per capita variable can be considered as capturing a "scarcity" effect – given a rapid growth in the population and the inevitably slower growth in the stock of houses, the consequent housing scarcity quickly puts upward pressure on house prices. In addition to this scarcity effect, changing demographics, which increase the proportion of the population in the house-buying age group, has put upward pressure on house prices. The average household size has decreased from 3.2 persons in 1997 to 2.9 persons in 2006. Although the number of persons per household in Ireland has been declining, it also remains above European levels and some further decline is anticipated.

Analysis of the *2006 Census* shows that headship rates (the proportion of each age group who are heads of households) increases with age in the 25-39 year age group. For example, a much higher proportion of those who are aged 30-35 are in independent households than is the case for 25-29 year olds. As the bulge in the population moves up through the age bands over time the number of households also tends to increase. Data from the UK Census shows that Irish headship rates are lower than those in the UK

[30] This is in keeping with the approach of Murphy (2005). Murphy includes dummy variables for 1997 and 2003 that "pick-up the combined effects of financial liberalisation, policy interventions since 1998 and speculative frenzy effects." His results are similar to the number reported above.

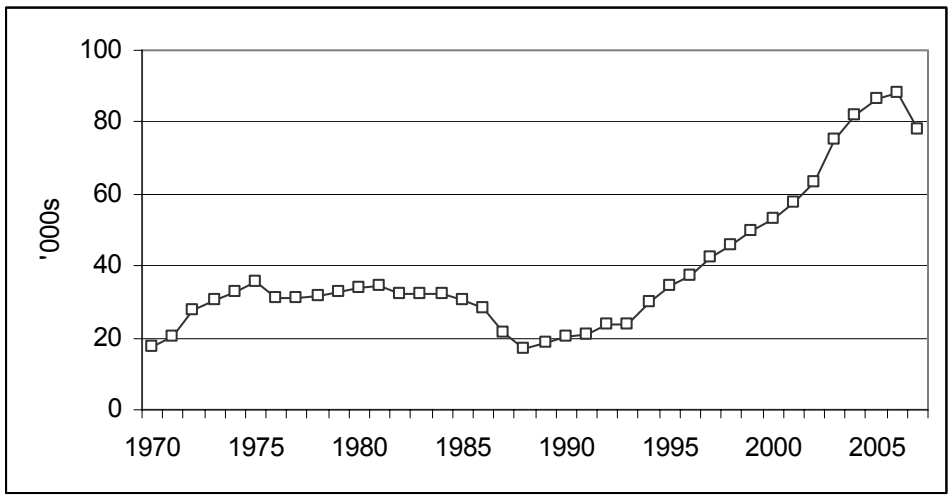
at comparable ages. If Irish headship rates were to rise towards UK levels this would represent an increase in this source of demand for dwellings.

One of the main contributions to the growth in population in recent years has come from the high level of immigration to Ireland. Following years of emigration there is now a sustained net inflow of people into the country. The net inflow of people has increased substantially in recent years as migrants are attracted to the Irish economic success story and movement between countries became easier with the entry into the EU of the New Member States (NMS) in 2004. The net inflow reached 67,300 in 2007 down from 71,800 in 2006. Some two-thirds of the net inflow in 2007 were nationals of the 10 new EU member states. From a property market perspective, the majority of immigrants are in the key household formation age groups between 25 and 44 years old. In the year to April 2006, 53.7 per cent of immigrants were aged between 25-44 years.

Duffy (2007), shows that, while there are significant differences in tenure between Irish and foreigners of the same age, there is not a major difference in headship rates. As a result, the housing demand forecasts from the *Medium-Term Review* are based on the assumption of identical headship rates for both Irish and foreigners.

The supply of new houses is also modelled. The results from this equation show that short-run changes in house prices have a significant effect in boosting housing completions. In the long run completions are particularly influenced by the mark-up of house prices over costs. This mark-up, or profitability measure, indicates that if house prices increase relative to the cost of building then profitability rises and this increases the rate of house completions. The level of housing completions in Ireland in recent years reached record levels and has far exceeded the supply response in other European countries.

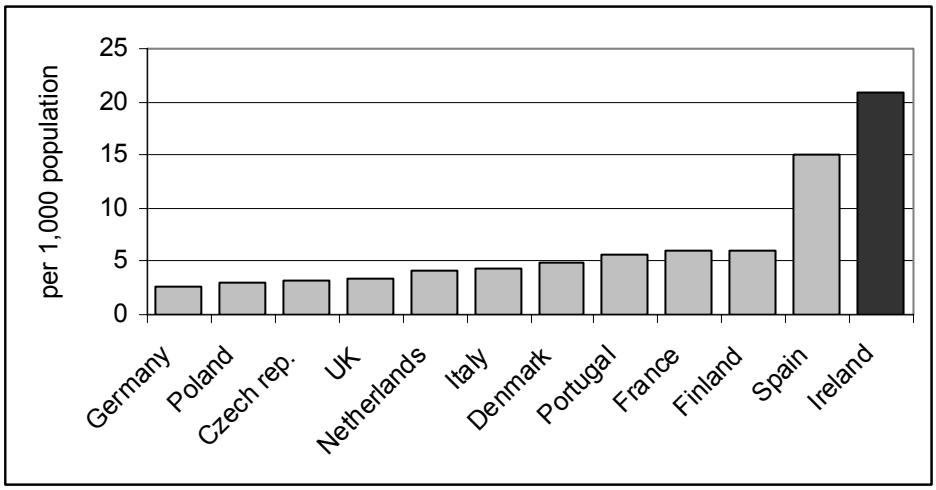
Figure 2.18: Housing Completions, Ireland, 1970-2007



However, at the same time as this supply response occurred there has also been a large increase in the proportion of dwellings classified as holiday homes or second dwellings. The total stock of permanent houses at the time of the Census was 1.77 million. Of these approximately 175,000 units were vacant houses, a further 41,600 were vacant flats and 49,800

were holiday homes. Based on these estimates the vacancy rate stands at around 15 per cent of the housing stock, a very high figure. Because of their location away from the major centres of employment growth, many of these vacant dwellings may not be useful in meeting future housing needs. Like many asset markets the housing market can experience peaks and troughs. A major policy challenge is how to deal with such volatility. Intervention is complicated by the fact that policies need to take account of both the owner-occupant and rental sectors of the market. Traditionally one of the main policy instruments for housing market control has been interest rate adjustment.

Figure 2.19: Housing Completions, Per 1,000 Population



As a regional economy within EMU Ireland no longer has independent control of interest rates as a control mechanism for the Irish housing market. Indeed, Faust, Rogers and Wright (2001) suggest that interest rates in Ireland would probably have risen to 10 per cent or more in the late 1990s if Ireland had not been a member of EMU.[31] In the absence of independent interest rates, the burden of managing fluctuations falls to fiscal policy. Traditionally, fiscal policy in Ireland has been supportive of homeownership. For example, the OECD (2008a) identifies Ireland's housing tax system as "one of the most favourable in the OECD." It recommends that the tax breaks favouring homeownership, such as mortgage interest relief should be reduced and ultimately phased out to be replaced by a property tax.[32] This recommendation is in line with that of the *Commission on Taxation*, which reported in the early 1980s.

The need to manage the housing market using fiscal policy was identified in Fitz Gerald (2001). The British Treasury, in considering what the UK would have to do if it joined EMU also recognised the need for a more active management of the housing market using fiscal policy (HM Treasury, 2003). Current circumstances in Ireland mean that this is not an issue. Housing demand and prices are falling and there is little that policy can do to manage this process. However, over the coming decade when the

[31] For a discussion of the experience of EMU in Ireland that deals with such issues as monetary policy and the housing market see Fitz Gerald (2006).
[32] The IMF (2007) have also suggested that the area of property taxation be modernised.

housing market recovers the need to prevent a future bubble could require a more active fiscal policy stance.

2.8 Conclusions

The analysis set out in this chapter has important implications for the medium-term forecast for the economy set out in later chapters. First, a key driver of growth in the future is likely to be the business and financial services sector. Policy will need to consider how best the needs of this sector can be met through structural policies. What are likely to be the infrastructure needs of the sector in the future? What kind of R&D policy can best support the sector? What are likely to be the human capital needs of the sector?

There have been major changes in how the labour market operates. In the long run the supply of labour is likely to be less responsive to wages than it was in the past. This means that the incidence of taxation will be less on business and more on the labour force compared to the past. It also means that the impact on employment will be lower than in the 1980s and the early 1990s. The change in labour market behaviour means that fiscal policy will have an enhanced role in managing domestic inflationary pressures, Inappropriate fiscal policy in the future could crowd out the tradable sector by harming competitiveness causing lasting damage to the productive potential of the economy.

While it is unlikely to be an issue for some time to come, it would be appropriate to consider today, in a dispassionate way, how the housing sector can be managed in the future to avoid unnecessary disruption from possible excessive inflation in house prices.

3. BACKGROUND ECONOMIC ENVIRONMENT AND ASSUMPTIONS

3.1 Introduction

This chapter begins by outlining our assumptions for the external environment. Developments in the world economy impact on Ireland through a wide range of channels. Obviously, for a country where trade in goods and services amounts to one- and three-quarters times the value of GNP, what happens to world trade is of vital importance. With monetary policy determined externally and a very big exposure to exchange rate fluctuations what happens on financial markets is also crucial. Developments in labour markets elsewhere in the EU have for many years been important as drivers of labour mobility and migration. To understand the varied impact of all these different external variables it is necessary to develop a detailed forecast for the world economy, especially the regions of that economy that impact most directly on Ireland.

Since the publication of the last *Medium-Term Review,* the global economic outlook has deteriorated over the near term, with an increased risk of a prolonged setback to the world economy as a result of the continuing turbulence in financial markets. However, while the short-term situation will be difficult, the international outlook for the medium term remains broadly favourable.

In this chapter we present medium-term forecasts for the three major economic blocs that drive the Irish economy: the US, the Euro Area and the UK and then we draw out the implications of this environment for the Irish economy. In preparing the forecasts we have used a number of different sources (especially the *National Institute Economic Review*, January 2008 and the *World Economic Outlook* of the IMF, January and April 2008). We used the National Institute of Economic and Social Research (NIESR) January 2008 forecast as an input to the medium-term forecast for the major world economies. This forecast was modified to take account of

additional information available to us from a range of different sources.[33] In carrying out these modifications and in examining alternative assumptions we have used the NIESR Global Econometric Model (*NiGEM*).[34]

The changing demographic structure of the economy also plays a key role in determining the future productive capacity of the economy. In Section 3.3 we present our demographic projections out to 2025. The favourable demographic factors that made the boom of the late 1990s possible, especially the growth in high-skilled labour supply, will continue to have a positive impact on Ireland's potential growth rate, but at a more modest rate than before. The growth in labour supply could average over 2.5 per cent a year to the end of the decade before slowing to around 1 per cent per year over the longer term. In terms of the composition of labour supply, we anticipate that the availability of low-skilled labour from domestic sources will fall and the lion's share of the increase in the labour force will be among those with a third level education.

Finally, Section 3.4 presents our underlying assumptions on the public finances. This section examines the likely structure of the public sector over the next twenty years, in the context of the current infrastructural deficit and the likely ageing of the population beyond 2025.

3.2 External Environment

As discussed in Chapter 2, the structure of the world economy is changing rapidly as globalisation brings rapid economic development to key centres of world population, such as China, India and Brazil. These newly developing economies have an abundant supply of unskilled or semi-skilled labour. Their comparative advantage is thus in manufacturing sectors which have a high unskilled or semi-skilled labour content. The advent of these economies as major locations for the production of manufactured goods is, in turn, changing the comparative advantage of the other major economic regions in the world. These changes are taking place rapidly.

For Ireland the three main regions that are currently of direct importance are the US, the EU and the UK. While these three regions are today dominant, over the coming fifteen or twenty years the new regions of the world economy will develop in importance as markets for the goods and, especially, the services produced in Ireland. With economic development some will also emerge as new competitors. Thus while competitiveness today is measured relative to our current trading partners, new competitors will emerge by the end of the forecast period.

[33] We adjusted the NIESR January 2008 forecast to take account of the fact that short-term growth prospects for the US had deteriorated since the beginning of the year. These adjustments were partly informed by the IMF January forecasts. We use the International Energy Agency forecast of the oil price. This translates into the nominal price of oil, in terms of dollars per barrel, $70.5 in 2007 to $73.9 in 2012. Thereafter, the oil price is expected to rise to $90.5 by 2020 and $110.3 in 2025.

[34] We are very grateful to Ray Barrell and Dawn Holland of NIESR for their assistance in using the *NiGEM* model. The forecast itself remains the sole responsibility of the authors.

UNITED STATES

Short-term growth prospects in the United States are weak and there are fears that the current turbulence in financial markets could push the US further into recession.[35] However, in our *Benchmark* forecast this downturn in activity is expected to be short lived, and a rebound in economic activity is expected in 2010. Thereafter, annual growth is expected to remain in the region of 2 to 2.5 per cent.

Since mid-2007, the US economy has been affected by financial problems, initially in the sub-prime mortgage lending market, which have now spread to other areas of the economy. This has involved an increase in the inter-bank rate spread over the central bank rate because lending banks are uncertain about the exposure of borrowing banks to risky assets. This uncertainty has stemmed, at least initially, from the scale of defaults in the US sub-prime mortgage market. The assets associated with these mortgages have been stripped and split so that it is not always clear to outsiders who is liable to make losses. The rise in inter-bank rates reflects short-term liquidity problems, as banks cannot easily borrow to cover the fluctuations in their assets and liabilities flows. As the problem intensified, global financial markets became more volatile. As exposures become clear, these liquidity problems may be relatively short lived, and our *Benchmark* forecast is based on this assumption.

The Federal Reserve has intervened aggressively and cut its target rate by 3 percentage points over the past twelve months with the target rate currently standing at 2.0 per cent. Despite this intervention, inter-bank rates have risen and the supply of credit has been tightened. The correction in the US housing market is continuing, with house prices remaining flat or falling in 2007, depending on the measure used, and housing starts data showing a dramatic fall in the early part of this year. The length of the slowdown in the US depends crucially on future developments in both the housing and financial markets. The most recent IMF report argues that the US economy is usually quick to respond to downturns in activity and that recessions are typically followed by vigorous recoveries, as sharp adjustments generally resolve imbalances and the effects of expansionary fiscal and monetary policies take hold. We expect further easing in monetary and fiscal policy in the near term in an attempt to contain the current slowdown. Our *Benchmark* forecast is based on the assumption that the credit squeeze, currently evident in the international economy, will be short lived. The possibility that the credit squeeze could be more prolonged constitutes a significant downside risk to our *Benchmark* forecast and we consider this scenario in Chapter 6.

Medium-term growth prospects are more favourable. Real GDP growth in the US is forecast to average 2.4 per cent between 2010 and 2015 before moderating to average around 2 per cent per annum out to 2025 (Table 3.1). The inflation rate, as measured by the consumer expenditure deflator, is expected to average 2.8 per cent between 2010 and 2020. On the basis of our exchange rate assumptions, and the forecast recovery in activity at the

[35] Technically our *Benchmark* forecast assumes that the US is in recession this year – output falls in two consecutive quarters.

beginning of the next decade, we expect official interest rates to increase gradually over the medium term.

Table 3.1: Forecasts for the US Economy

	2007	2008	2009	2010	2011	2012	2013	2014	2015
					Per Cent				
Real GDP Growth	2.2	1.5	1.9	3.7	3.0	2.4	2.2	2.1	2.1
Inflation*	2.5	3.3	1.7	0.7	2.1	2.7	2.9	3.0	3.0
Short-term interest Rate+	5.3	3.0	0.9	1.5	3.1	4.3	4.8	5.1	5.3
Exchange Rate ($ per €)	1.37	1.51	1.50	1.45	1.43	1.42	1.41	1.41	1.41
Fiscal Deficit (as a % of GDP)	-3.0	-4.0	-3.9	-3.0	-2.9	-2.6	-2.4	-2.2	-2.1

	1995-2000	2000-2005	2005-2010	2010-2015	2015-2020	2020-2025
			Annual Average Per Cent Change			
Real GDP Growth	4.1	2.3	2.4	2.4	2.0	2.1
			Annual Average			
Inflation*	1.8	2.2	2.2	2.8	2.8	2.5
Short-term interest Rate+	5.7	3.0	3.2	4.0	5.4	5.3
Exchange Rate ($ per €)	1.13	1.04	1.38	1.42	1.41	1.42
Fiscal Deficit (as a % of GDP)	-0.5	-2.6	-3.4	-2.5	-2.1	-2.2

*Consumer Expenditure Deflator.
+ 3 month inter-bank rate.

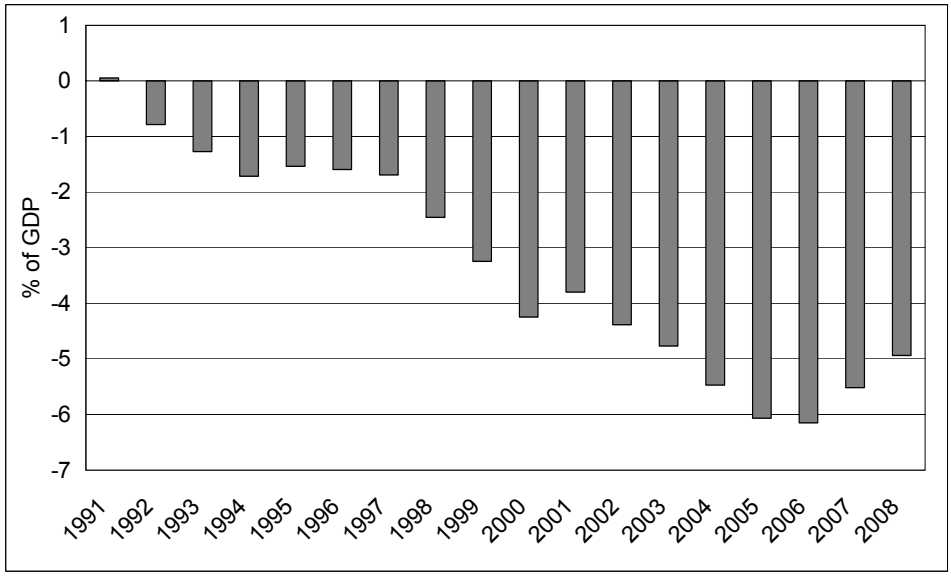
In previous *Medium-Term Reviews*, we have focused on the sustainability of the large and increasing current account deficit in the US and the effects that a gradual or sudden adjustment in the US economy could have on Ireland. The US current account deficit had deteriorated considerably since the late 1990s and in 2006 the deficit stood at 6.2 per cent of GDP (see Figure 3.1). The unprecedented magnitude of the deficit and the growing net indebtedness of the US fuelled concerns about its sustainability and fears that a correction had to come at some point.[36] The recent slowdown in the US housing market, the depreciation of the dollar and the fallout from what is happening in the financial markets have led to some improvement in the current account position of the US and we expect to see some further improvement in the short term. However, with the expected recovery in the US around 2010, pressure on the current account could return.

EURO AREA

Growth in the Euro Area is expected to slow in the short term in the face of the effects of a strong currency and turmoil in international financial markets. Much of the slowdown will be seen in weaker export volume growth in the Euro Area. Demand from the US and UK, which accounted for around 30 per cent of extra-Euro Area exports in 2007, is expected to slacken in the short term so trade with other non-Euro Area countries and intra-Euro Area trade are expected to make a larger contribution to export growth in the short term. The euro has appreciated strongly against the

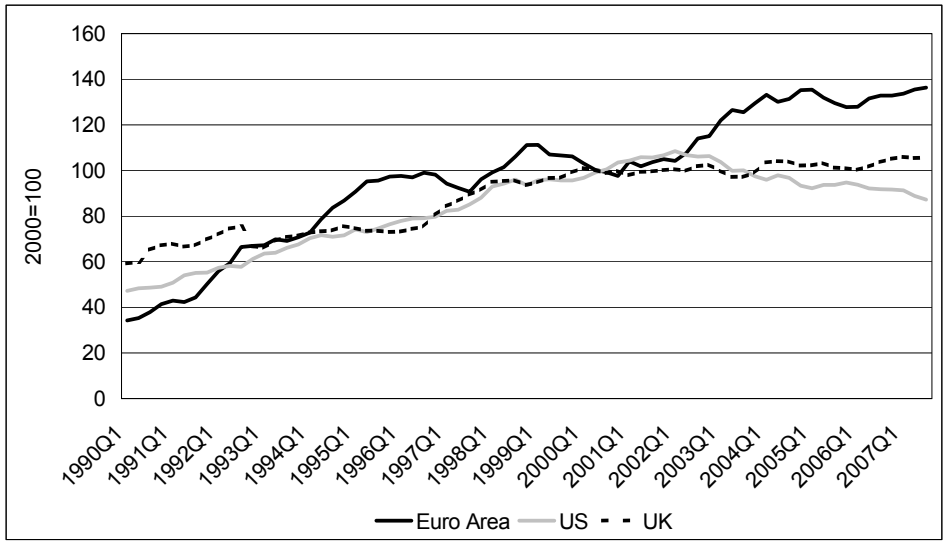
[36] See, for example, Obstfeld and Rogoff (2005) and Blanchard, Giovazzi and Sa (2005) and IMF *World Economic Outlook*, September 2005.

Figure 3.1: US Current Account Deficit



currencies of its main trading partners and this contributed to losses in export market shares for many of the Euro Area economies, with the notable exception of Germany, which has been gaining export market share in recent years. Figure 3.2 shows the effective (trade-weighted) exchange rate for the Euro Area and also for the US and the UK. From the graph we can see that the Euro Area effective exchange rate has risen by over 5 per cent in the past two years. In addition to the effects on competitiveness of a strong currency, the slowdown in the US and UK is likely to further dampen external demand in the Euro Area.

Figure 3.2: Effective Exchange Rates, 2000=100



Source: NIESR Database.

However, we anticipate that the slowdown will be short lived and the outlook for activity in the medium term is more positive. The public finances of the Euro Area are in a reasonably healthy position. The fiscal deficit of the Euro Area peaked at over 3 per cent of Euro Area GDP in 2003 and has been coming down steadily since then with the overall fiscal deficit standing at 0.8 per cent of GDP in 2007. This leaves national

governments with the option of adopting more expansionary fiscal policies in the short term to help contain any slowdown in activity, while remaining within the guidelines of the *Stability and Growth Pact.*

Table 3.2: Forecasts for the Euro Area Economy

	2007	2008	2009	2010	2011	2012	2013	2014	2015
	Per Cent								
Real GDP Growth	2.7	1.8	2.0	2.2	2.2	2.1	2.0	2.0	2.0
Inflation*	1.9	2.1	1.6	1.6	1.8	1.8	2.0	2.1	2.1
Short-term interest Rate+	4.3	4.5	4.0	3.9	4.3	4.7	5.0	5.1	5.2
Exchange Rate ($ per €)	1.37	1.51	1.50	1.45	1.43	1.42	1.41	1.41	1.41
Fiscal Deficit (as a % of GDP)	-0.8	-1.0	-0.9	-0.9	-1.0	-0.9	-1.0	-1.1	-1.2

	1995-2000	2000-2005	2005-2010	2010-2015	2015-2020	2020-2025
	Annual Average Per Cent Change					
Real GDP Growth	2.7	1.4	2.3	2.1	2.1	1.9
	Annual Average					
Inflation*	1.8	2.1	1.9	2.0	2.4	2.9
Short-term interest Rate+	4.6	3.1	3.6	4.7	5.3	5.3
Exchange Rate ($ per €)	1.13	1.04	1.38	1.42	1.41	1.42
Fiscal Deficit (as a % of GDP)	-2.6	-2.1	-1.3	-1.0	-1.3	-1.4

*Consumer Expenditure Deflator.
+ 3 month inter-bank rate.

The European Central Bank (ECB) had been gradually increasing interest rates since the end of 2005, in line with the improved economic conditions in the Euro Area and rising inflationary pressures, with the main refi rate currently standing at 4 per cent. Despite mounting short term inflationary pressures, we anticipate that the ECB will loosen monetary policy over the short-term in an attempt to reduce fears of a credit crunch, increase liquidity in credit markets and to encourage investment growth which has been hampered by rising borrowing costs. Over the medium term, we expect interest rates to rise gradually and to average 4.9 per cent between 2010 and 2015 and 5.3 per cent between 2015 and 2025. However, for companies and households some of this rise in official interest rates will be offset by a fall in risk premia.

Despite the slowdown expected in the short term, we anticipate a rebound in activity beginning in 2009 and our forecast is for growth in the Euro Area to average 2.1 per cent between 2010 and 2020 and a somewhat more modest rate of 1.9 per cent between 2020 and 2025.

UNITED KINGDOM

The UK economy continues to be an important trading partner for the Irish economy, although the share of Irish exports going to the UK has declined. Over the past number of years, the UK economy has performed well, with annual growth averaging 2.5 per cent between 2000 and 2005. Growth is expected to moderate somewhat in the short term, due to the slowdown in the housing market and turmoil in the financial markets. However, a pick-up in activity is expected in 2009 and we expect growth to average 2.7 per cent between 2010 and 2015. Growth over the next

number of years will be aided by the gradual weakening of sterling against the euro and, in the medium term, we expect that sterling will stabilise at a rate of £0.77 per euro.

Table 3.3: Forecasts for the UK Economy

	2007	2008	2009	2010	2011	2012	2013	2014	2015
					Per Cent				
Real GDP Growth	3.1	1.8	2.2	2.7	2.7	2.7	2.6	2.6	2.7
Inflation*	2.5	2.9	2.0	2.2	2.3	2.4	2.9	3.0	2.6
Short-term interest Rate+	6.0	5.2	4.2	4.6	4.8	4.9	5.0	5.1	5.2
Exchange Rate (Stg. per €)	0.68	0.76	0.76	0.77	0.77	0.77	0.77	0.77	0.77
Fiscal Deficit (as a % of GDP)	-3.1	-2.9	-2.3	-2.0	-1.7	-1.4	-1.1	-1.0	-1.0

	1995-2000	2000-2005	2005-2010	2010-2015	2015-2020	2020-2025
	Annual Average Per Cent Change					
Real GDP Growth	3.2	2.5	2.6	2.7	2.8	2.6
	Annual Average					
Inflation*	2.2	2.0	2.4	2.7	3.0	3.4
Short-term interest Rate+	6.4	4.7	4.9	4.9	5.3	5.3
Exchange Rate (Stg per €)	0.71	0.65	0.72	0.77	0.77	0.77
Fiscal Deficit (as a % of GDP)	-1.5	-1.5	-2.7	-1.4	-1.1	-1.1

*Consumer Expenditure Deflator.
+ 3 month inter-bank rate.

UK inflation, as measured by the consumer expenditure deflator, is expected to average 2.7 per cent between 2010 and 2015. In response to current difficulties, The Monetary Policy Committee (MPC) of the Bank of England may cut interest rates in the short run, although we expect interest rates to gradually rise over the medium to longer term.

CONTEXT FOR IRELAND

In the short term the Irish economy faces an uncertain international environment. The risk of a marked slowdown to the world economy has risen as a result of the developments in the financial markets. Growth in the US, UK and Euro Area is expected to slow considerably in the short term. Our *Benchmark* forecast assumes that recent turbulence in financial markets is short-lived and there will be a rebound in activity in the international economy around 2010 with growth rates returning to close to potential. In Chapter 6, we consider the effects on the Irish economy of a longer and more pronounced financial crisis.

With growth in our main trading partners forecast to remain relatively muted in the short term, the trading environment for Ireland will deteriorate. Our forecast for the dollar/euro exchange rate incorporates a depreciation of the euro in the near term and we expect the exchange rate to average around $1.50 per euro for the next two years. Thereafter, the exchange rate is forecast to fall slightly and to stabilise at around $1.41 per euro over the forecast horizon. At the same time, sterling is expected to depreciate over the short term but even out at rates of around £0.77 per euro over the medium term. Ireland has a greater than average exposure to

non-Euro Area trade and so is likely to experience continued price competitiveness pressures over the medium term.

Interest rates in Ireland are determined externally by the ECB and will, therefore, reflect the situation in the Euro Area rather than domestic conditions. This effectively removes monetary policy as a mechanism for stabilising the Irish economy if the Irish business cycle is different from that of the larger Euro Area economies. The forecast recovery in the Euro Area will see interest rates gradually rise in the next decade.

We have not described our forecast for the rest of the world, most notably China and India. These economies are likely to continue growing rapidly, accounting for an increasing share of foreign trade and global growth. It is in the medium to long term that they will rise in importance as markets and potential competitors for goods and services.

Overall, the international context for Ireland will be difficult in the short term, but it is set to improve in the next decade. Provided the domestic productive base can remain competitive, the international environment for Ireland contained within this *Review* is broadly favourable.

3.3 Demographic Structure and Labour Supply

One of the key drivers of the transformation of the Irish economy in the last decade was the expanding labour force. The labour market was affected by a series of factors that dramatically increased the supply of labour. These factors, which included a very favourable demographic profile, rising female labour force participation rates, and a dramatic increase in net immigration, accounted for around half of the growth in GNP per capita between 1995 and 2000. The factors that will determine the potential supply of labour over the medium term are a key element in determining the potential growth rate of the economy.

BIRTH RATE

Following the post-Second World War baby boom, the birth rate remained uniquely high in Ireland until 1980 while it fell much earlier elsewhere in Europe. Since 1980, the birth rate had been declining rapidly. While there has been a small increase in the birth rate since the mid-1990s, we expect it to stabilise at its current level over the medium term. The falling birth rate since the 1980s means that there is, and there will continue to be, a large decline in the natural increase in the labour force. This is in contrast to the effect that the high birth rates of the 1960s and 1970s had on labour supply.

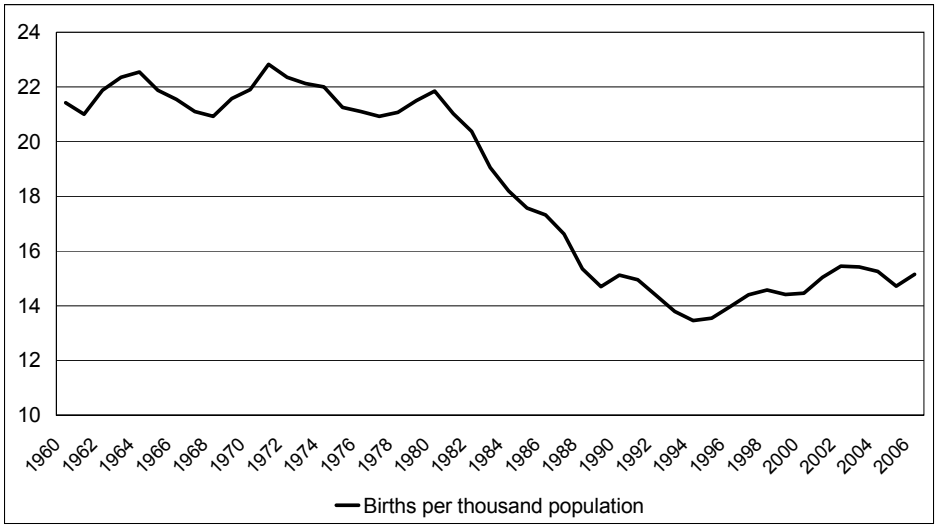
The *Total Fertility Replacement* (TFR)[37] rate is currently at 1.9 in Ireland and we project the overall rate unchanged over the forecast horizon.[38] However, we incorporate different patterns of fertility for women according to their age. The birth rate for women under the age of 35 years has been declining in recent years and there has been an increase in the birth rate for women over the age of 35 years. We expect this pattern to

[37] This measure represents the number of children that a representative woman will have over her lifetime.

[38] This is the same as assumption F1 in the latest CSO *Population and Labour Force Projections.*

continue in the short term and then to stabilise. The fact that women are having children later in life has implications for female labour force participation and may partially explain why participation rates for younger Irish women are high in comparison to the OECD average.

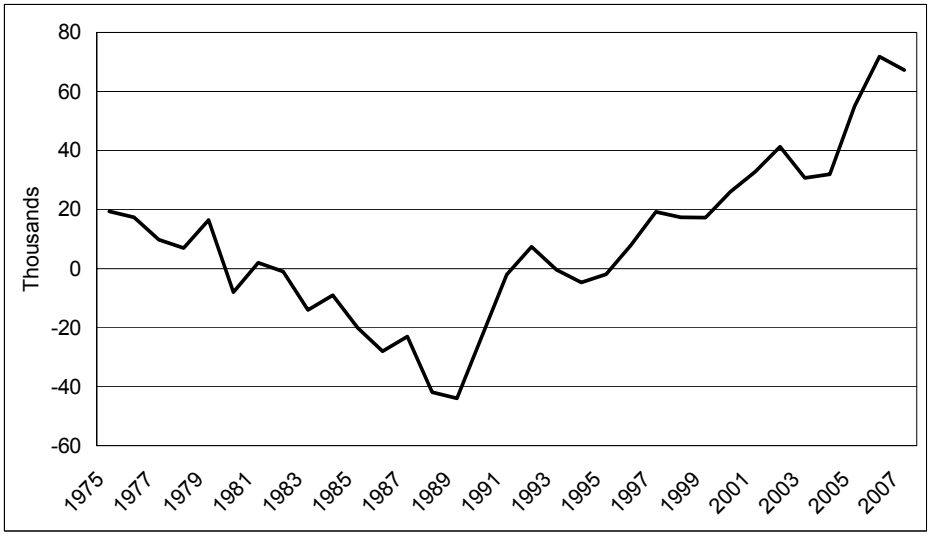
Figure 3.3: Birth Rate



MIGRATION

Migration has long played a key role in driving changes in the population structure and the labour force in Ireland. Migration flows tend to be quite volatile (Figure 3.4) and are sensitive to economic conditions, both domestically and in the source countries for immigrants or the destination countries for emigrants. In the latter part of the 1990s, strong economic growth and a tighter labour market encouraged large inflows into the country. Initially many of them were returning Irish whereas in more recent years foreign nationals make up around 80 per cent of gross inflows.

Figure 3.4: Net Immigration



Barrett, Bergin and Duffy (2006) examined the characteristics of immigrants who had arrived in the ten years up to 2003 and compared them to Irish nationals. They find that immigrants into Ireland have high levels of education – over 40 per cent of immigrants have degrees compared to 16.7 per cent of Irish nationals. Although immigrants into Ireland have higher levels of education relative to the native population, the research shows that these skills are not being fully employed.[39]

As growth in the economy slows, Ireland will become less attractive for immigrants in the future. We anticipate that the effects of EU enlargement had a once off effect on the EU and Irish labour markets and that, once the pent up pressures have been accommodated, the ongoing movement of population within the EU will be more limited. We expect continued net immigration over the forecast horizon but at a much reduced pace compared to what we have seen so far this decade. Our projection is for net immigration to slow to around 10,000 per annum by 2010 before rising to around 15,000 per annum from 2015 on.[40] The magnitude of the inflow depends on the growth trajectory of the economy. However, there is some uncertainty about the likely evolution of migration. As mentioned above, in recent years the bulk of immigrants are foreigners and the sensitivity and speed of response of these flows to changes in Ireland's relative standard of living may be different to that of the immigrants of the late 1990s – the returning Irish.

POPULATION STRUCTURE

Ireland's demographic structure is somewhat unusual in comparison to other EU countries. The high birth rate until the 1980s means that there is now a large cohort of people of working age (Figure 3.5). Today the 25-29 cohort is much larger than any other and the cohort of teenagers is much smaller. In addition, the high level of emigration in Ireland up to the 1960s means that many of the people born in Ireland who are now in their sixties and seventies emigrated, reducing the numbers in the older cohorts of the population, thereby reducing the old age dependency ratio. However, by 2025 the structure of the population will look rather different as the current population ages. Today, the average age of the population is 35.2, a year older than it was in 1999. By 2020 the average age will have risen to 37.7 and by 2025 it will be 39.1. Over the time horizon covered by this *Review* the population structure remains broadly favourable; however, the process of population ageing becomes more apparent as we look farther out.

[39] Barrett *et al.* (2006) document how the distribution of immigrants and natives across occupations is similar, despite the large difference in educational attainment between the two groups. This under-utilisation persists even after controlling for characteristics such as age and education.

[40] Our migration projections assume an unchanged policy with free movement of population within the EU and restrictions on immigration of unskilled labour into Ireland (and the EU) from outside the EU.

Figure 3.5: Population Structure, 2008

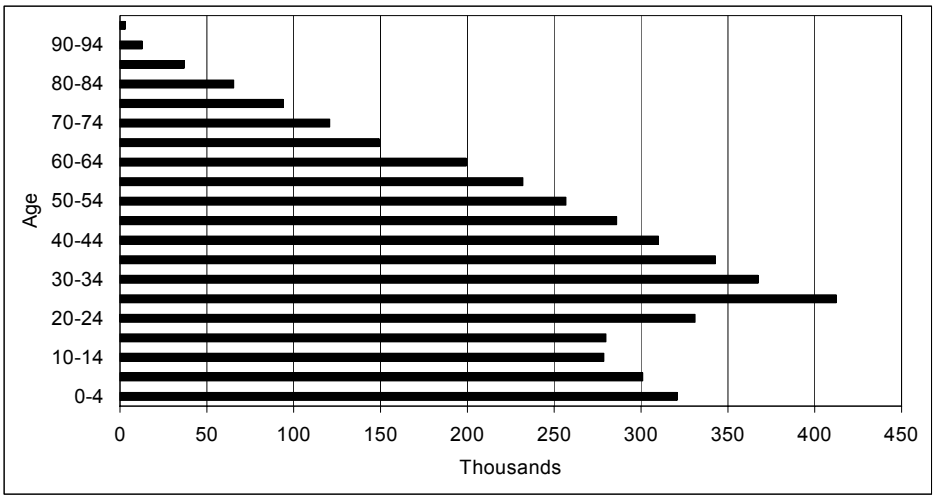
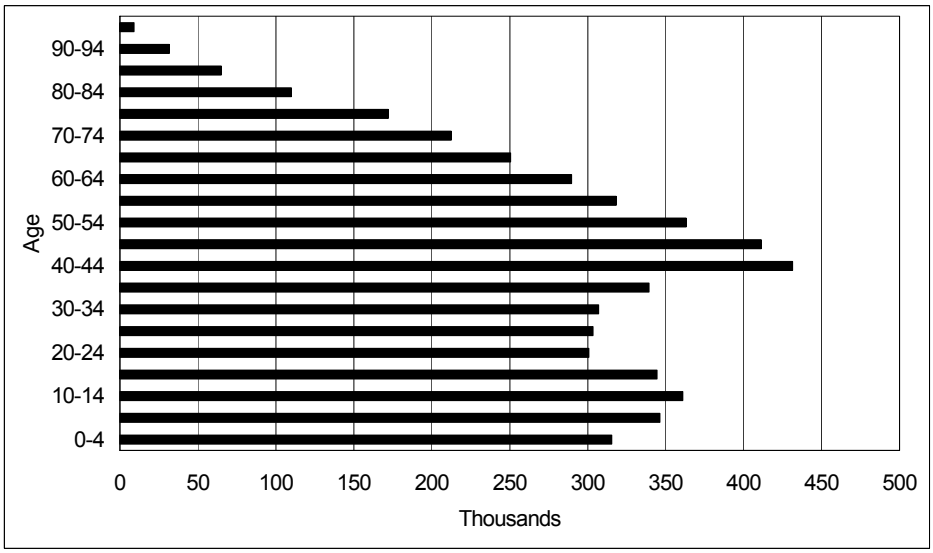


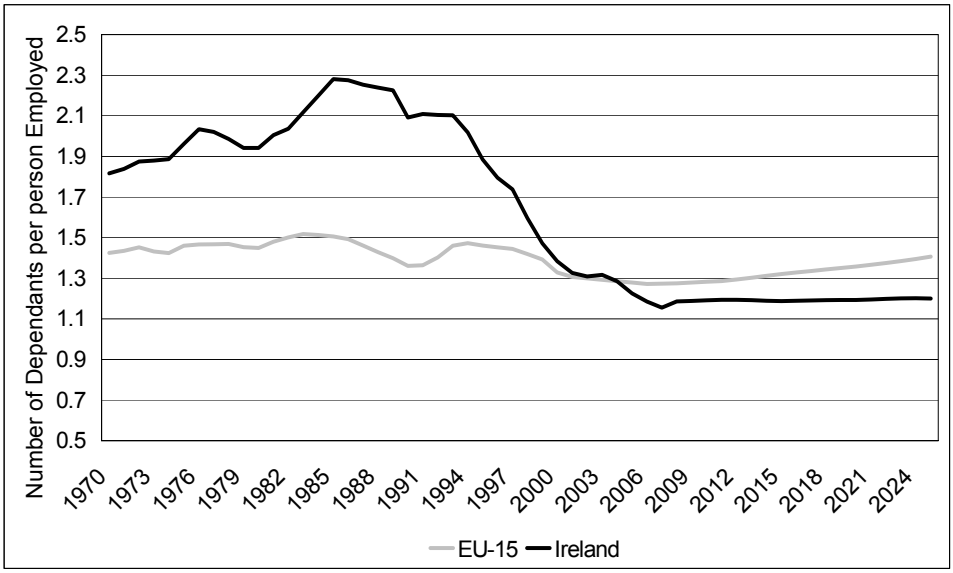
Figure 3.6: Population Structure, 2025



The economic dependency ratio is defined here as the ratio of those who are not working in the population, including children and pensioners, to those who are working. This measure is not only affected by the changing age structure of the population but also by other changes, such as employment rates and the age that people start work and retire. The economic dependency ratio can be used as a measure of a country's capacity to produce the resources needed to maintain the population's living standards. Generally speaking, the lower the dependency ratio the more money individual workers have available to spend out of their own income. In the 1970s and 1980s the Irish economic dependency rate was well above the average for the EU-15. A combination of the high levels of emigration in the 1950s (reducing the number of older people in the country today), the fall in the birth rate and a rising employment rate in the 1990s led to a sharp decline in the dependency rate in Ireland in the 1990s (Figure 3.7). This led to convergence with the EU-15 dependency ratio around 2004. Over the forecast horizon, we expect the Irish dependency rate to stabilise at just below 1.2, remaining below the European average. The dependency rate for the EU-15 countries is expected to deteriorate in

the next few years, as the process of population ageing is more prevalent in other EU countries. This presents the Irish economy with an opportunity to prepare for the longer-term problem of population ageing, which will have an increasing impact on the demographic structure of the country and on labour supply from the 2020s on. Other studies have shown that there will be significant age-related pressures on the public finances after 2025. [41]

Figure 3.7: Economic Dependency Ratio



Source: EU-15 dependency ratio constructed from Eurostat Data, own estimates for Ireland.

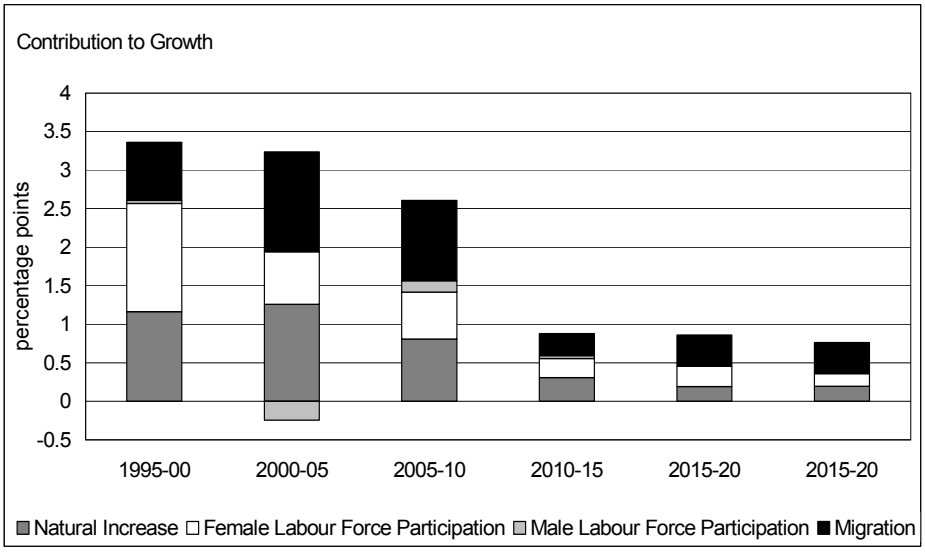
LABOUR SUPPLY

The three key elements that determine labour supply are the natural increase in the population – the difference between the numbers retiring and the numbers of young people entering the labour market; the change in participation rates in the labour force, driven primarily by changes in female participation rates and the continued rising educational attainment of the population; and migration. Rising educational attainment increases the supply of labour for those over 25 years. Their potential earnings are enhanced by increased education and, hence, their participation rate is higher. This is particularly important in driving rising female labour force participation. However, for those under 25 years it reduces participation as young adults remain longer in the educational system.

Figure 3.8 decomposes the growth in labour supply attributable to each of these factors. Looking forward, growth in labour supply is expected to be significantly lower than over the past 15 years, with annual average growth of just under 1 per cent expected over the medium term.

[41] See Barrett, A., A. Bergin and Y. McCarthy (2007) and Barrett, A. and A. Bergin (2006).

Figure 3.8: Decomposition of the Growth in Labour Supply



The high birth rate in the past meant that the contribution to labour supply growth from the natural increase in the population was substantial, accounting for over 1 percentage point of labour supply growth in the 1995-2000 and 2000-2005 periods. The fall in the birth rate since the 1980s means that the contribution from the natural increase in the population to labour supply growth is more limited (and declining) since 2000.

The changing educational attainment of the population is shown in Figure 3.9. The rising educational attainment of the labour force can influence the economy through several distinct channels: it has a positive effect on participation in the labour market; it can reduce the probability of becoming unemployed and it can increase the productivity of workers. Over the ten year period 1997 to 2007, we can see the rise in the educational attainment of the population due to the increasing participation rates in education, in particular in third level education. We expect there will be a continued upgrading of the human capital of the population over the medium term and this will have a positive impact on participation rates as those with higher levels of education are more likely to participate in the labour market.[42] This effect is much more marked for women.

The impact of the changing educational attainment of the population on labour supply is shown in Figure 3.10.[43] The graph shows that there will be a continued strong increase in the supply of high-skilled labour (those with at least Leaving Certificate education) while the supply of less skilled labour (those with Junior Certificate education or less) will continue to fall.

[42] The effect of increased participation in third level education can increase the age of labour market entry so we could see decline in participation rates for those aged 15-19 years.

[43] This projection of high and low-skilled labour implicitly assumes that migrants have the same educational distribution as nationals.

Figure 3.9: Population by Educational Attainment, Percentage of Total

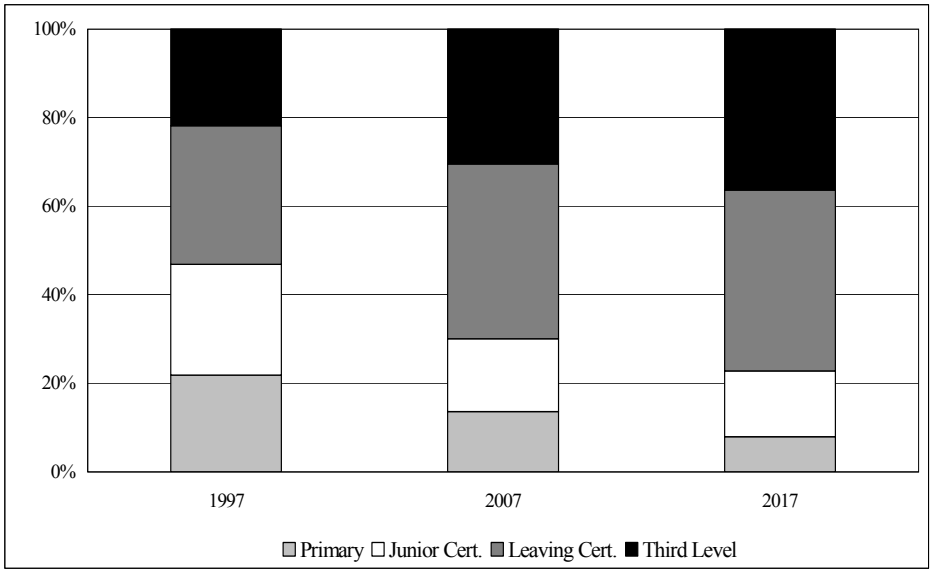
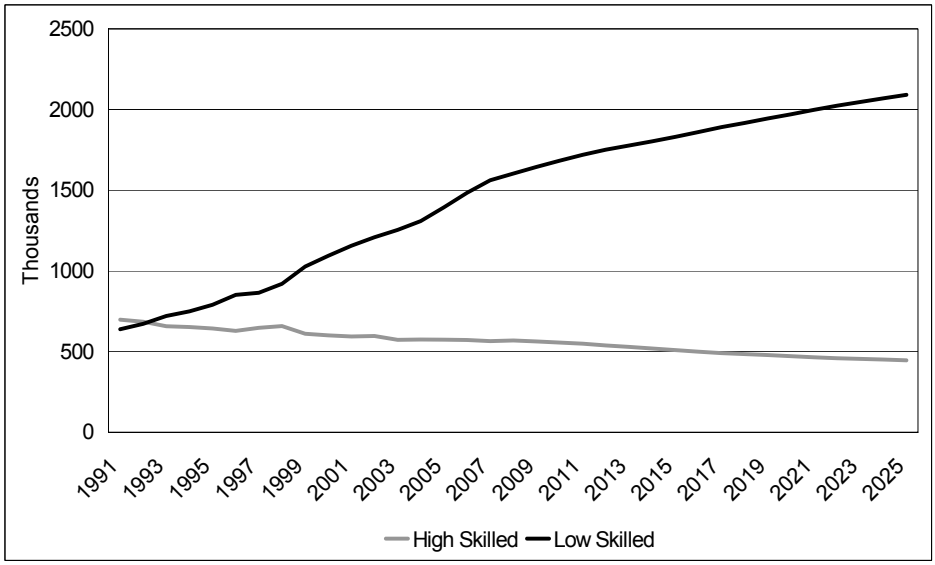
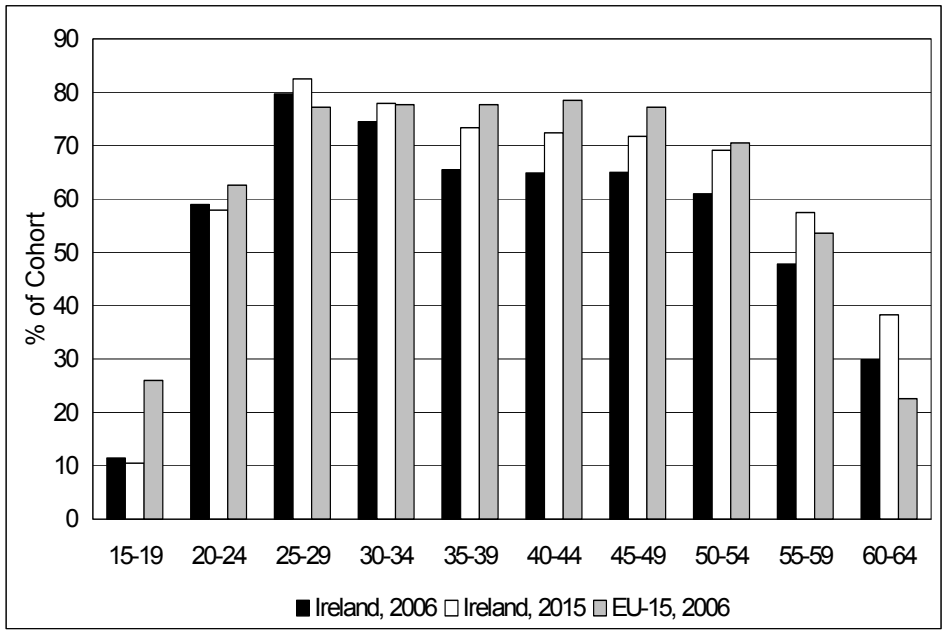


Figure 3.10: Supply of High-Skilled and Low-Skilled Labour



In the 1980s Ireland's female participation rates were among the lowest in the EU. However, a combination of changing cultural factors, rising educational attainment and more favourable labour market conditions led to a dramatic increase in participation rates in the 1990s. Figure 3.11 shows the current female participation rates by age for Ireland and the EU and our projections for the rates in Ireland in 2015. Although participation rates in Ireland for women under 35 years are comparable to the EU average, participation rates are significantly lower for older women. In projecting female participation rates, we have assumed only limited increases in the education specific participation rates for women under the age of 35, because of the high rates already achieved. However, as those with high participation rates in the younger age groups age we anticipate significant increases among older age groups in later years. Overall, further increases in female participation rates will continue to be an important source of labour supply growth, although making less of a contribution than in the past.

Figure 3.11: Female Labour Force Participation: Ireland and the EU



3.4 The Public Finances

In preparing our *Benchmark* forecast we have assumed a broadly "neutral" fiscal policy stance on the income side of the government accounts, with essentially indexation of tax rates and bands. This would represent a tightening of fiscal policy relative to the experience since 2000.

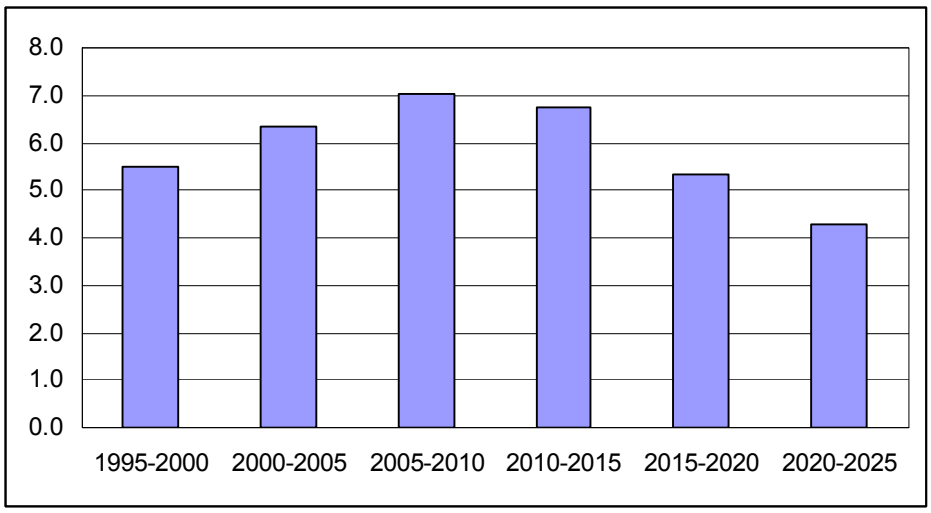
Our *Benchmark* forecast suggests that beyond 2020 the public finances could move into strong surplus if such a neutral fiscal policy were adopted. These numbers imply that the government could be a net saver by 2025. However, it is important to remember that by 2025 the fiscal gains from a falling dependency ratio will be eroding and the government will be facing an increased demand for expenditure on pensions. Therefore, it seems prudent to build up such savings once the massive infrastructural investment programme currently underway begins to wind down beyond 2020. These savings can help fund the demand for pensions, which will begin to burgeon as the population ages beyond 2025.[44]

On the capital expenditure side we have applied the increase in expenditure published in *Budget 2008*[45] for the years 2008-2012. These numbers include spending under the NDP and Transport 21. As can be seen from Figure 3.12, the current and planned level of capital expenditure is historically very high, and should reach a peak of 7 per cent of GNP in the period 2005-2010. Between 2012 and 2020 we assume that this high level of capital expenditure will be maintained, with growth averaging 2.4 per cent per annum out to 2020. This level of public investment is urgently required to tackle the deficit in public infrastructure in Ireland. Beyond 2020 we assume that this high level of investment will have served to bridge the infrastructural deficit so that government capital expenditure will fall in real terms, with its share in total GNP falling to more typical levels.

[44] Barrett, A. and A. Bergin (2006).

[45] Table 1: Multi-Annual Capital Investment Framework 2008-2012.

Figure 3.12: Government Capital Expenditure/GNP Ratio



On the current expenditure side we have assumed that the increase in the volume of expenditure by public authorities on goods and services remains below the rate of growth of GNP – around 2.5 per cent a year. This will still allow for a significant volume increase in publicly provided services. We assume there will be a steady increase in public sector employment over the forecast period relating to these improved services. Rates of personal transfers are assumed to be fully indexed to average wage rates. Adjustments are made for the changing demographic balance and for the forecast change in unemployment. Finally, national debt interest payments will gradually disappear over the coming decade, as the national debt is eventually repaid. (Here we net off the government's financial assets in the National Pension Reserve Fund.)

In relation to tax rates, the average income tax rate is assumed to increase marginally in 2010-2012 to help fund the widening deficit currently arising, thereafter it is held constant. Finally, we have assumed that a carbon tax is introduced beginning in 2010; this is priced initially at €20 per tonne of carbon dioxide in 2010 rising steadily to reach €83 per tonne in nominal terms in 2025. We assume a similar tax is introduced elsewhere in the EU limiting the negative competitiveness effects. This assumed rate of tax is similar to the forecast price of tradable emissions permits for carbon, which we have assumed will be auctioned from 2013 onwards. This would mean that the price per tonne of carbon will be similar for all economic agents across the EU, ensuring that the reduction in EU carbon emissions is achieved at least cost. The implications of this carbon tax for the macroeconomy are discussed in Chapter 4 and the implications for carbon emissions in Chapter 5.

4. THE *BENCHMARK* FORECAST

4.1 Introduction

In this chapter we set out in detail the *Benchmark* forecast for the Irish economy to 2015, together with indicative forecasts out to 2025. Our analysis suggests that the very rapid growth rates recorded over the past ten years will not be repeated in the coming decades. Nevertheless, we expect that the Irish economy has the potential to grow strongly in the next decade, and should continue to exceed the EU-15 average growth rate out to 2020. We expect that the current slowdown in the economy will persist into 2009, leading to a significant increase in the unemployment rate. Thereafter, as described in detail in Chapter 3, our International Forecast expects an improvement in world economic conditions. If this happens, then the Irish economy has the potential to grow at an average rate of 3.5 per cent out to 2020, slowing to 3 per cent thereafter. This is underpinned by a rate of productivity growth[46] averaging up to 2.5 per cent in the next decade, with labour force growth adding a further 0.9 per cent per annum and increases in the employment rate adding 0.3 per cent per annum in the years 2010-2015, slowing to 0.2 per cent in the latter half of the decade.[47] Beyond 2020 we expect productivity growth to slow to approximately 2 per cent per annum, with further labour force growth and increases in the employment rate adding respectively 0.8 per cent and 0.1 per cent per annum to the overall growth rate.

The *Benchmark* forecast is discussed in depth in Sections 4.2 through to 4.6. Our forecast data are based on the *National Income and Expenditure (NIE) 2006* national accounts, together with the Spring *Quarterly Economic Commentary* forecasts for 2008 and 2009. The ESRI's medium-term macroeconomic model *HERMES* was used to produce the detailed forecasts of the economy for the years 2010-2025. In preparing these forecasts we use the demographic assumptions, public finance assumptions and assumptions on world economic conditions discussed in Chapter 3.

Section 4.2 provides a summary of our forecasts for the key macroeconomic aggregates together with an overview of the factors underpinning the forecast growth profile. Section 4.3 looks at the crucial supply side of the economy, the driving force behind the growth process. Given the supply side, we then move on to look at incomes, expenditure and prices in Section 4.4, clearly of importance in terms of the likely future

[46]Measured as GNP per worker. This measure is explored more fully in Section 4.2.
[47]Throughout the *Review* employment numbers quoted are on a principal economic status (PES) basis.

implications of growth for living standards. Section 4.5 then considers the labour market with forecasts for employment and unemployment. Section 4.6 discusses the balance of payments, the public finances and savings. The likely implications of our forecast for the housing market are analysed in Section 4.7. Finally, the track record of previous editions of the *Review* is reviewed in Appendix 1.

4.2 Overview

Table 4.1 shows some key figures from the *Benchmark* forecast. More detailed tables are available in Appendix 3. Following two years of relatively low growth in 2008 and 2009, we expect that growth will recover in 2010. This is predicated on an assumption that the world economy, and hence world demand for Irish exports, will have recovered from the current slowdown by 2010. Nevertheless, our forecast figures indicate that average growth rates will moderate from those recorded in recent years. For the years 2010-2015 we expect GNP growth of 3.8 per cent, slowing to 3.5 per cent in the second half of the decade and to 3.0 per cent in the years 2020-2025. This pattern is consistent with growth in the potential output of the economy being around 3.5 per cent a year over the coming decade, falling to around 3 per cent a year after 2020. It is probable that this growth will be partly fuelled by strong growth in the population, so that GNP per capita will grow a full percentage point less than aggregate GNP in those years. The increasing importance of services exports in total exports, discussed below, should see a terms of trade gain from 2014 onwards so that GNDI per head is expected to average 2.6 per cent a year between 2015-2025.

Given the slowdown in the house-building sector, currently ongoing, we expect the investment to GNP ratio to fall from current levels over the forecast horizon. In the years 2005-2010 it is expected to average 28.1 per cent, this is expected to fall steadily over the forecast period. In the years 2010-2020 it is expected to remain relatively high by international standards due to the extensive programme of government investment under the NDP in those years. Beyond 2020 it is forecast to fall to 21 per cent of GNP. And notably, despite the current slowdown in house-building, our estimate of the demographic factors underpinning the rate of household formation suggests that the demand for housing in Ireland over the medium term will remain relatively strong, with almost 48,000 housing units per year required in the period 2010-2020, falling to 45,000 beyond 2020.

The slowdown in the economy in the years 2008 and 2009 leads to a rise in unemployment and the unemployment rate. Numbers unemployed are forecast to peak in 2011, and beyond that the labour market should gradually clear. After 2015 the unemployment rate is expected to average 4.5 per cent of the labour force. Over the forecast period net immigration flows are expected to slow significantly from the exceptionally high levels of recent years, averaging 11,000 per annum in the period 2010-2015, rising to 15,000 per annum beyond that. The strong performance of the labour market from 2015 onwards should lead to a gradual rise in the real wage out to 2025.

A consequence of our *Benchmark* forecast is that beyond 2020 the public finances move into strong surplus. With the general government running a surplus from 2014 onwards, this means that the government becomes a net

saver by 2022. Beyond 2022 the general government continues to accumulate net savings. These savings include the provision for pensions and other age-related expenditures that await the economy beyond 2025 when age-related fiscal pressures will begin to rise (Barrett and Bergin, 2005).

Table 4.1: *Benchmark* Forecast, Growth in Major Aggregates

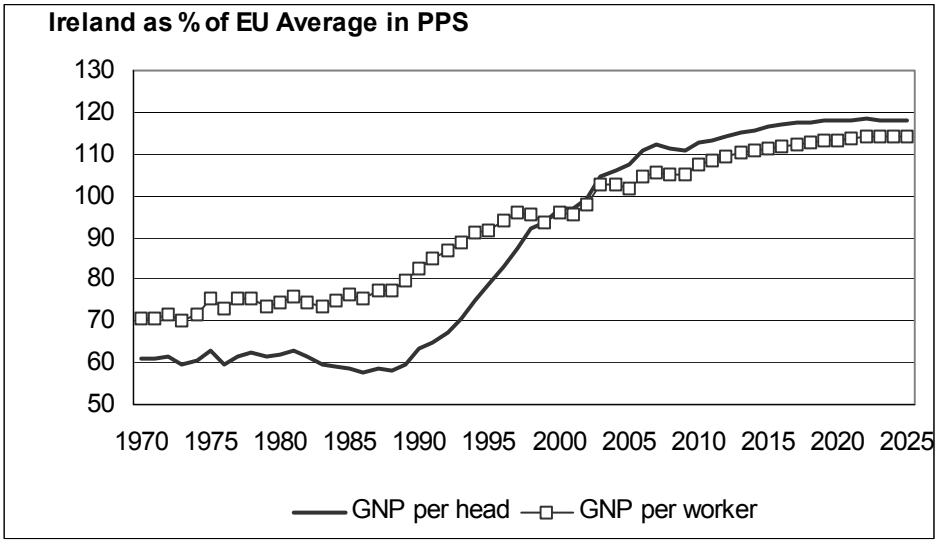
	2007	2008	2009	2010	2011	2012	2013	2014	2015
					% Growth Rate				
GDP	4.9	1.8	3.1	4.6	3.7	3.7	3.6	3.5	3.5
GNP	4.5	1.6	2.9	5.1	3.7	3.9	3.8	3.6	3.7
GNP per head	2.1	0.2	1.7	3.9	2.5	2.8	2.7	2.5	2.4
GNDI per head	0.6	-0.9	1.0	2.1	1.4	2.2	2.6	2.7	2.8
Investment/GNP ratio	29.5	27.1	26.5	26.7	25.0	25.0	24.7	24.1	23.5
Consumption deflator	3.5	2.3	1.7	2.7	2.7	2.7	2.9	3.0	2.9
Employment % change	3.7	0.0	1.1	1.0	1.0	1.2	1.2	1.3	1.3
Real after tax wage	0.9	2.1	1.9	0.0	1.1	0.9	1.3	1.4	1.6
					% of GNP				
Balance of Payments surplus	-5.4	-4.9	-4.8	-5.6	-3.7	-3.0	-2.3	-1.4	-0.6
Net Government Debt	20.7	20.0	19.2	21.0	22.4	23.3	23.5	22.7	21.1
General Government Balance	0.6	-1.4	-2.4	-1.4	-1.2	-0.9	-0.5	0.4	1.2
					% of Labour Force (ILO basis)				
Unemployment Rate	4.5	5.9	6.2	6.6	6.9	6.7	6.2	5.7	5.3
					In Thousands				
Net immigration	67	20	11	10	10	10	10	10	15
House completions	78	50	45	47	48	48	48	49	49
FIVE-YEAR AVERAGES	**1985-1990**	**1990-1995**	**1995-2000**	**2000-2005**	**2005-2010**	**2010-2015**	**2015-2020**	**2020-2025**	
					Average Annual % Growth				
GDP	3.3	4.4	9.4	5.3	4.0	3.6	3.3	2.7	
GNP	2.8	4.2	8.6	4.4	4.1	3.8	3.5	3.0	
GNP per head	3.0	3.7	7.5	2.6	2.4	2.6	2.4	2.1	
GNDI per head	3.3	2.9	7.2	2.2	0.9	2.3	2.6	2.6	
Investment/GNP ratio	18.9	18.5	24.8	27.8	28.1	24.5	22.7	21.0	
Consumption deflator	3.5	3.0	3.4	3.3	2.4	2.8	3.2	3.5	
Employment % change	1.0	1.9	5.0	3.2	2.0	1.2	1.1	0.9	
Real after tax wage	1.4	1.4	2.2	3.0	1.4	1.3	1.6	2.5	
					% of GNP				
Balance of Payments surplus	-1.8	2.0	1.7	-0.8	-5.1	-2.2	1.0	3.9	
Net Government Debt	113.0	91.4	53.6	26.0	20.6	22.6	12.6	-5.5	
General Government Balance	-4.1	-2.8	2.4	0.7	-0.2	-0.2	2.9	4.6	
% of Labour Force (ILO basis)									
Unemployment Rate	11.4	9.6	8.0	4.2	5.5	6.2	4.8	4.3	
					In Thousands				
Net immigration	-31.9	-0.3	17.6	38.4	36.1	11.0	15.0	15.0	
House completions	22.0	24.2	42.2	67.4	62.6	48.3	47.6	45.5	

The Irish economy began a remarkably rapid period of convergence with its EU partners in 1990, as discussed in Chapter 2. Between 1995 and 2006 the Irish economy doubled in size as measured by GNP. This growth performance led to full convergence between Ireland and the EU average[48]

[48]The EU average here refers to the EU-15 member states.

in terms of GNP per capita by 2005, as shown in Figure 4.1. In our *Benchmark* forecast we expect output growth rates to continue to exceed the EU average out to 2020 so that GNP per capita, which for the thirty years between 1970 and 1990 hovered around 60 per cent of the EU average, is expected to come close to 120 per cent of the EU average in the period 2020-2025.

Figure 4.1: GNP Per Head Relative to EU Average[49]

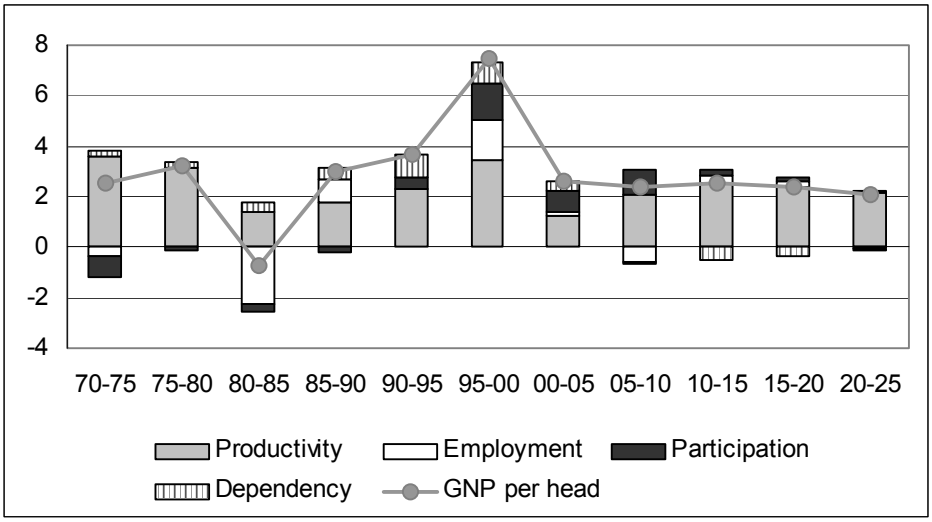


The picture is broadly similar when measured as GNP per worker, national productivity broadly defined (see Figure 4.1). However the rate of convergence is not so pronounced, as Irish productivity levels were closer to the EU average in the period 1970-1990 and have grown at a slower pace than total GNP since then. The difference between productivity growth and total growth is the rate of economic dependency. As discussed in Chapter 3, there has been a sustained and steady decline in the Irish economic dependency rate since the mid-1980s, driven by rising employment, rising participation rates and a fall in youth dependency. These demographic gains are likely to plateau by 2010 so that further growth in GNP per head will be largely driven by productivity growth.

This can be seen more clearly in Figure 4.2 which decomposes the growth in GNP per capita (the solid line) into productivity (the grey bar in the graph) and economic dependency, where the latter is further decomposed into employment, participation and age dependency. As can be seen from this graph, over half the growth in GNP per capita between 1985 and 2005 was due to the reduction in the rate of economic dependency. Beyond 2010 this demographic advantage is largely spent: while there are some further limited increases in labour force participation and employment rates, these are offset by an increase in the age dependency rate. Over the forecast period the rate of economic dependency remains low, as discussed in Chapter 3, but it stops actually contributing to growth.

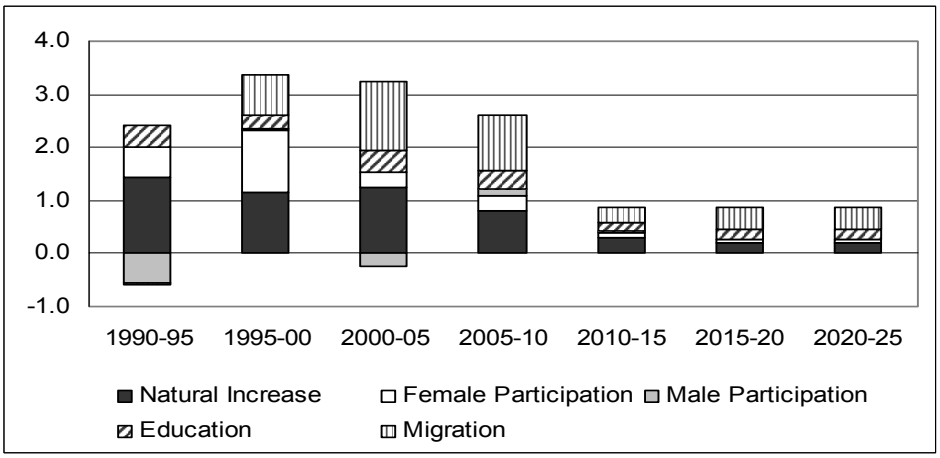
[49]GDP and employment forecasts from NIESR, population forecasts from Eurostat.

Figure 4.2: Decomposition of GNP Per Capita Growth Rate



The ending of the demographic dividend (when a very high proportion of the population are in the working age groups) means that over our forecast horizon GNP per capita growth will be equal to the rate of productivity growth. However, we expect growth in total GNP to be over one percentage point higher than productivity growth (see Figure 4.5 below). This is largely because labour supply growth is expected to add approximately 0.9 per cent to the annual growth rate in total GNP over the forecast period 2010-2025. This growth in labour supply, shown in Figure 4.3, is due to increases in the population of working age (natural increase), together with further increases in the rate of female labour participation and continued net immigration. The graph separately identifies the estimated contribution of rising educational levels[50] on the growth in the labour force: this "education" effect is driven by a rise in female participation rates associated with rising education levels.

Figure 4.3: Decomposition of Growth in Labour Supply



Our *Benchmark* forecast expects a recovery in the average rate of productivity growth in the period 2010-2020 relative to the current decade.

[50]These are estimated in the ESRI demographic model.

While this may seem surprising given that we expect the economy to move from higher productivity manufacturing activity to lower productivity services, this is in fact consistent with an economy gradually moving to lower rates of productivity growth. This is due to two separate effects:

- First there is a compositional effect attributable to productivity rates in the building sector. Between 1995 and 2010 the building sector recorded negative measured productivity growth which, given its growing importance in those years, served to reduce the overall productivity growth rate. Table 4.2 calculates the growth in GDP per worker excluding the building sector. The building sector knocked over 0.6 per cent from annual productivity growth in the period 2000-2005 and an estimated 0.4 per cent per annum in the period 2005-2010. Over the forecast period we expect productivity levels in the building sector to improve in the aftermath of the decline in the house-building sector. As can be seen from the table this increases the overall productivity growth rate in the industrial sector (which here includes building and construction).

- Second there is an effect due to measures of output. Using GDP at factor cost, which is the measure consistent with sectoral output figures, the *Benchmark* forecast productivity growth rates are consistent with a maturing economy, with productivity growth falling from 2.4 per cent per annum in the first half of the next decade to 2.2 per cent in the latter half, and to 1.7 per cent in the period 2020-2025. However, over the forecast period the gap between GDP and GNP narrows so that productivity growth as measured using GNP per worker (Figure 4.2) is higher.

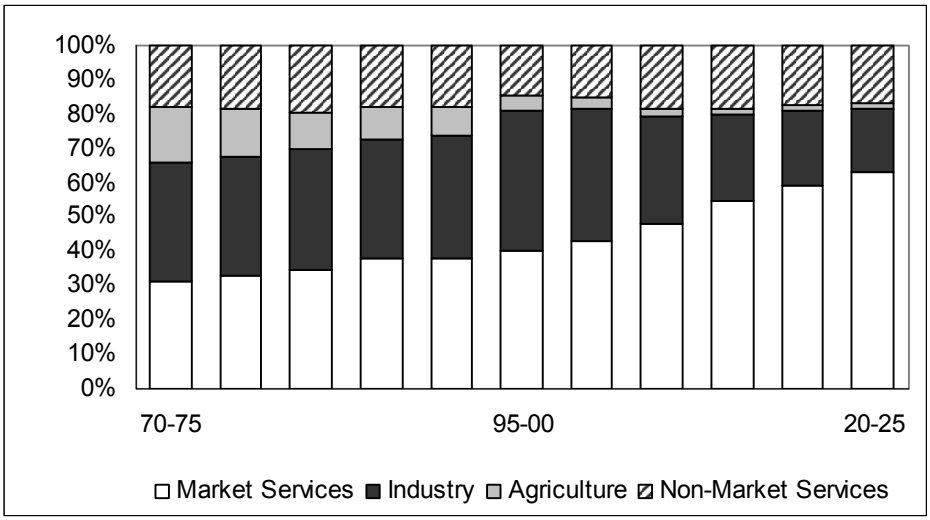
Table 4.2: Value Added Per Worker: Average Annual Growth Rates

	70-75	75-80	80-85	85-90	90-95	95-00	00-05	05-10	10-15	15-20	20-25
Industry of which:	1.4	4.6	7.4	5.6	5.8	5.6	2.5	2.2	3.7	4.3	4.2
Building	1.2	4.2	4.6	1.9	1.8	-3.2	-2.3	-2.8	0.8	1.9	1.0
Market Services	3.5	2.7	1.5	1.7	-0.1	3.0	2.5	2.8	2.5	1.8	1.5
GDP at Factor Cost	4.3	3.8	3.2	2.6	2.3	4.1	2.2	2.0	2.4	2.2	1.7
GDP at Factor Cost Excluding Building	4.5	3.7	3.2	2.7	2.3	4.8	2.8	2.4	2.4	2.1	1.7
GNP	3.6	3.1	1.4	1.8	2.3	3.5	1.2	2.0	2.5	2.4	2.1

Underlying our forecast is a marked shift in the composition of the economy towards market services. Figure 4.4 shows the shares of agriculture, industry and market services in value added. The move from manufacturing to market services as the engine of growth is the central story at the heart of this *Benchmark* forecast. We expect market services to account for over 60 per cent of value added by 2025, continuing a trend that began in the late 1990s. Since the end of the 1990s exports of services have begun to play an increasingly important role in the growth of the services sector as discussed in Chapter 2. As is typical of economies which have reached a high level of real income, the Irish economy is currently in the process of transition from a specialisation in low-cost manufacturing

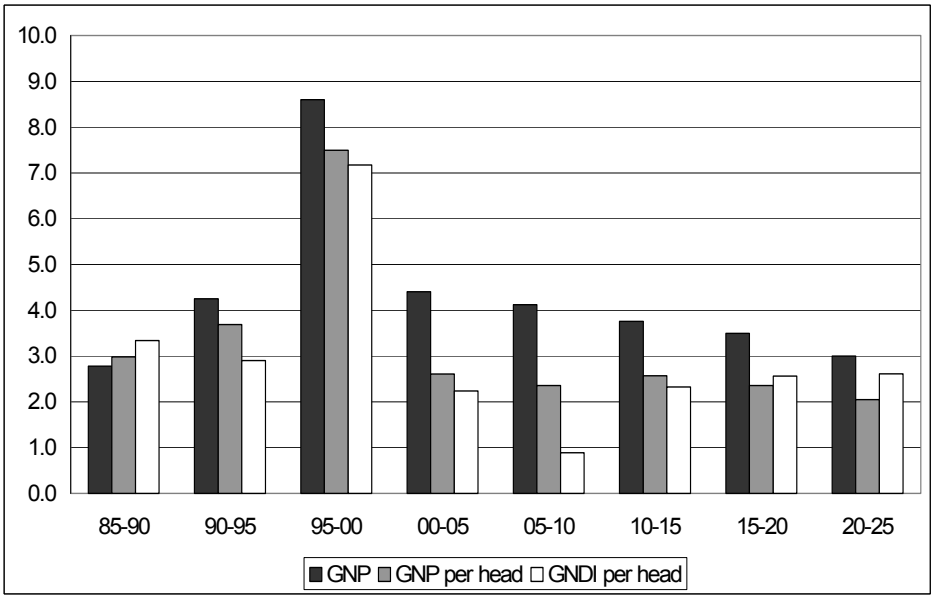
activities towards a specialisation into niche areas of high-tech manufacturing and high value-added internationally traded services.[51]

Figure 4.4: Value-Added Shares by Broad Economic Sector



As discussed in Chapter 2 services exports have become more important in total exports and we expect that trend to continue. One consequence of this is that over the forecast horizon there is likely to be an improvement in the terms of trade, since services exports prices tend to exceed import prices and the price of manufactured exports. Our forecasts suggest that by 2014 the trend deterioration in the terms of trade recorded since the mid-1980s will end and, thereafter, the growing dominance of services exports in total exports will ensure terms of trade gains out to 2025. This is reflected in GNDI growing more rapidly than GNP as shown in Figure 4.5.

Figure 4.5: Growth in GDP and GNDI, Annual Averages



[51]In some cases firms may be reclassified from manufacturing to services.

4.3 The Supply Side

The determination of the economy's potential growth path and the real income and living standards of its citizens is dependent on the development of the supply side of the economy. The supply side of the economy consists of both the tradable and non-tradable sectors. The tradable sectors of the economy refer to those sectors exposed to the competitive world trading environment. The remaining sectors of the economy (utilities, building, some of market services, public services) make up the non-traded sector. Given the extreme openness of the Irish economy, the tradable sector represents the main source of sustainable growth for the economy. As discussed in Chapter 2, output in the tradable sector is determined by two factors: the state of the world economy and the level of Irish cost competitiveness relative to its trading partners. Therefore, for any given level of world demand, it is critical to the level of output produced by the tradable sector that Ireland maintain its competitiveness on world markets. Any loss of competitiveness will result in Ireland losing market share and will give rise to a slower growth rate relative to the rest of the world. Ireland's cost competitiveness is also affected by developments in the non-tradable sector. Output in the non-tradable sector is driven mainly by domestic demand. However, prices and wages in the non-tradable sector affect the cost of production in the tradable sector. The manufacturing sector is a large consumer of services inputs some of which are sourced from the non-tradable sector, though many of them are imported. If prices rise in the services sector and these services are used as inputs in the tradable sector, then a loss of competitiveness may accrue to the tradable sector.

As discussed in Chapter 2, a significant change to the latest version of the *HERMES* model used to produce this *Review* concerns the way in which the business and financial services sector is modelled. Previously, this sector (and most of the market services sector) was included in the non-tradable sector and was, therefore, assumed not to be exposed to international trade. Changes in the world economy and Ireland's international cost competitiveness affected primarily the tradable manufacturing sector. In the light of the growing share of exports from the business and financial services sector in total exports, the modelling of this sector has now changed so that the output of the sector is treated as tradable and hence driven by world activity and competitiveness. This change means that, unlike in the past, changes in world growth and Ireland's international competitiveness affect the Irish economy through both the manufacturing and the business and financial services sectors.

As detailed in Chapter 2, the supply side of the Irish economy continues to experience significant structural change. Mirroring a pattern experienced in many developed countries, the agriculture sector, once the backbone of the economy, diminished dramatically in importance from the 1970s to be replaced by manufacturing as the main source of exports during the 1990s. As a result the knock-on effects of the recent rise in global food prices for the Irish economy are likely to be small. Most recently, the services sector has emerged as the key driver of growth in the Irish economy, with services exports set to account for 60 per cent of total exports by 2015.

While undergoing this significant structural change, the supply side of the economy continued to perform strongly up to the turn of the century. A sharp slowdown in 2001 and 2002 was followed by a recovery in the

2005 to 2007 period. We anticipate a substantial slowdown in economic activity for 2008 and 2009, due both to a slowdown in the international economy and the current slowdown in the pace of house completions. Based on a recovery in international activity we expect a leaner Irish economy to rebound at the end of the decade with GNP growth of 3.8 per cent forecast for the years 2010 to 2015.

Table 4.3: Percentage Change in Output, GDP at Factor Cost at Constant 2004 Prices

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Agriculture	-6.8	-10.0	1.0	1.0	2.1	0.4	0.0	0.5	0.8	0.8
Industry	4.5	3.9	-0.9	1.7	5.2	2.4	2.9	2.4	2.0	2.0
Manufacturing	3.9	5.7	2.6	2.9	4.8	3.3	2.7	2.5	2.5	2.6
Utilities	12.6	7.5	4.0	3.6	11.0	4.5	4.3	1.9	1.6	1.2
Building	5.3	-1.6	-12.3	-2.7	5.6	-1.6	3.5	1.9	0.0	0.0
Market Services	6.6	6.4	3.6	4.8	5.0	5.8	5.1	5.0	4.9	4.8
Distribution	4.3	5.0	2.0	1.9	2.6	2.5	2.5	2.5	2.5	2.5
Transport & Communications	5.2	5.0	2.0	2.0	2.9	3.4	3.7	3.9	4.0	4.1
Business and financial	7.7	7.2	4.4	6.2	6.0	7.1	6.1	5.9	5.7	5.5
Non-Market Services	7.0	4.2	2.9	2.9	2.0	2.0	2.0	2.0	2.0	2.0
Health & Education	8.1	4.7	3.4	3.4	2.0	2.0	2.0	2.0	2.0	2.0
Public Administration	3.0	2.5	1.0	1.0	1.9	1.9	1.9	1.9	1.9	1.9
GDP at Factor Cost	5.4	4.8	1.9	3.4	5.0	3.9	3.8	3.6	3.4	3.4
Taxes on Expenditure	6.5	5.5	1.5	1.4	2.3	2.0	2.8	3.5	3.8	4.0
Subsidies	-4.1	3.0	3.0	3.0	2.0	0.6	0.6	1.1	1.2	1.3
GDP at Market Prices	5.8	4.9	1.8	3.1	4.6	3.7	3.7	3.6	3.5	3.5
Net Factor Income	1.7	6.9	2.7	4.4	2.3	3.7	2.3	2.4	2.7	2.7
GNP at Market Prices	6.6	4.5	1.6	2.9	5.1	3.7	3.9	3.8	3.6	3.7

Five year annual averages	**1990-1995**	**1995-2000**	**2000-2005**	**2005-2010**	**2010-2015**	**2015-2020**	**2020-2025**
Agriculture	-1.3	2.2	2.8	-2.7	0.5	0.6	0.6
Industry	7.6	12.0	5.1	2.9	2.3	2.5	1.6
Manufacturing	9.4	12.2	4.8	3.9	2.7	2.7	1.8
Utilities	5.0	15.9	10.8	7.7	2.7	0.5	-0.4
Building	3.6	10.9	5.4	-1.4	0.8	1.9	1.0
Market Services	3.1	9.7	6.0	5.3	5.1	4.3	3.3
Distribution	0.2	11.4	3.1	3.2	2.5	2.5	2.5
Transport & Communications	6.4	10.5	6.7	3.4	3.8	4.0	3.6
Business and financial	3.8	8.9	7.0	6.3	6.0	4.8	3.5
Non-Market Services	2.4	4.0	5.3	3.8	2.0	1.5	2.0
Health & Education	3.3	4.7	6.1	4.3	2.0	1.5	2.0
Public Administration	0.4	1.8	2.6	1.9	1.9	1.4	1.9
GDP at Factor Cost	4.2	9.3	5.5	4.1	3.6	3.2	2.6
Taxes on Expenditure	2.5	8.6	4.3	3.4	3.2	3.4	3.6
Subsidies	-6.0	0.9	2.8	1.3	1.0	1.0	0.9
GDP at Market Prices	4.4	9.4	5.3	4.0	3.6	3.3	2.7
Net Factor Income	6.2	16.1	11.1	3.6	2.8	2.2	1.0
GNP at Market Prices	4.2	8.6	4.4	4.1	3.8	3.5	3.0

INDUSTRY

The ESRI macroeconomic model makes a distinction between the tradable and non-tradable parts of the industrial sector. The tradable sector consists of manufacturing industry, which in turn is comprised of the traditional, food processing and high-technology industries. The non-tradable sector is

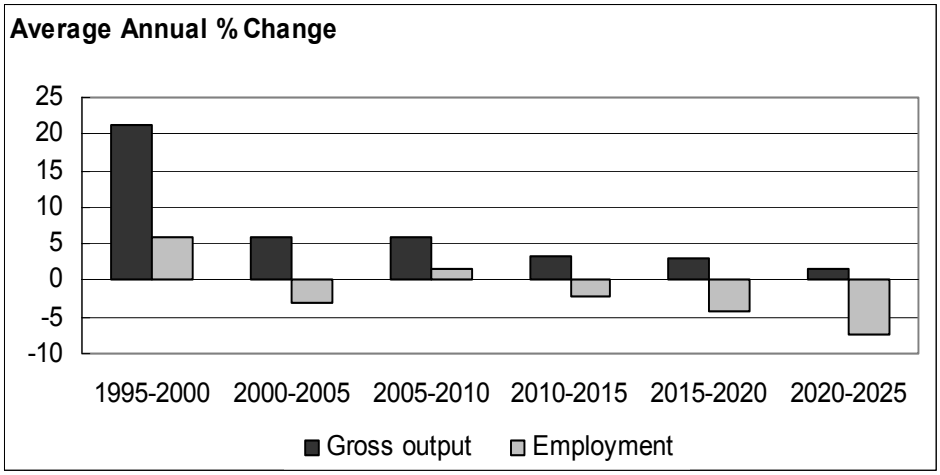
made up of the building and utilities industries. While the graphs and tables in this chapter show annual average growth rates out to 2025, attention in the text is concentrated on our forecasts out to 2015, given the natural uncertainty that surrounds any such estimates.

MANUFACTURING

The rapid growth of the manufacturing sector in the 1990s owed much of its success to the large inflow of foreign direct investment (FDI) particularly from the United States. For the period 1995 to 2005, the sector experienced average annual output growth of 12 per cent. Much of the dramatic increase in output and employment in the manufacturing sector was accounted for by the exceptional growth of the high-technology sector. Fuelled by significant productivity gains and high levels of investment, annual average output in the high-technology sector increased by over 21 per cent in the period 1995 to 2000. The traditional and food processing industries recorded annual average output growth for the same period of 3.2 and 5 per cent respectively.

Since the beginning of this decade the manufacturing sector has experienced a significantly slower pace of growth with annual average growth of 3.3 per cent expected for the period 2008 to 2012. We also estimate that the rate of decrease in employment in the sector will accelerate to an annual average of -2.4 per cent for the years 2010 to 2015 and -3.7 per cent for the period 2015-2020. For much of the 1990s the manufacturing sector was characterised by a divergence between the growth paths of output and employment, with employment growing at a much slower rate than output. This trend was indicative of a high rate of labour saving technical progress in the manufacturing sector.

Figure 4.6: Output and Employment in the High-Tech Sector

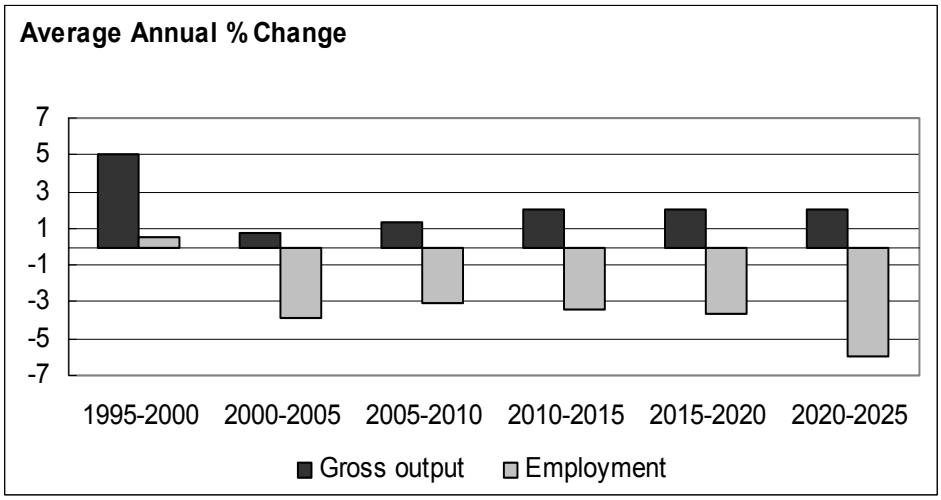


The global downturn experienced by the high-tech sector in the 2001-2002 period brought the era of double digit output growth in the manufacturing sector to an abrupt end. Furthermore, the appreciation of the euro and the negative effect of Ireland's loss of competitiveness have all served to place significant downward pressure on output growth in the manufacturing sector. For the period 2000 to 2005, annual average output growth in the high-tech sector fell back to 5.9 per cent. We expect this downward trend to continue with annual average output growth of 4.6 per

cent forecast for the period 2008 to 2012. For the period 2010 to 2015, growth in the high-tech sector is estimated to fall back further to 3.2 per cent. The unprecedented growth in the high-tech sector in the mid-1990s was driven by rapid growth in investment and productivity and both of these are expected to moderate over the course of the next decade. It is anticipated that investment by high-technology industries will increase by an annual average of 3.4 per cent for the period 2005 to 2010 and by 4.6 per cent for the period 2010 to 2015. This follows annual average investment growth of 13.2 per cent for the period 1995 to 2000. Productivity growth is also expected to ease significantly, having reached almost 15 per cent per annum for the period 1995 to 2000. It is expected that productivity will grow by an annual average of 4.0 per cent for 2005 to 2010 and 5.4 per cent for 2010 to 2015.

As with output, employment in the high-tech sector peaked towards the end of the last decade with annual average employment growth of 6.1 per cent recorded for the period 1995 to 2000. This trend of robust employment growth was reversed in the years 2000 to 2005, which saw a small contraction in the numbers employed in the sector. Despite a slight recovery in this sector in 2006 and 2007, its medium-term employment prospects remain weak. Employment is forecast to remain flat during the period 2005 to 2010 with a more pronounced contraction of -2.2 per cent in annual average employment in the sector expected for the period 2010 to 2015. Because of it accounts for so large a share of manufacturing employment this contraction in high-tech employment will be the main cause of the anticipated contraction of employment in the total manufacturing sector over the first half of the next decade.

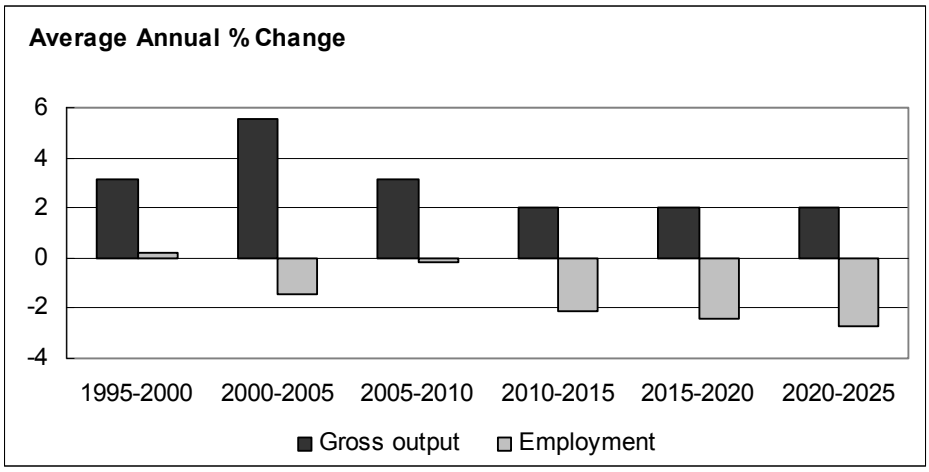
Figure 4.7: Output and Employment in the Traditional Manufacturing Sector



Output growth in the traditional manufacturing industries performed solidly during the 1990s although their rate of expansion was dwarfed by the exceptional growth of the high-tech sector. Factors such as the erosion of Ireland's international cost competitiveness and the appreciation of the euro, which have had a negative effect on the manufacturing sector as a whole, have been particularly detrimental to the traditional sector and are expected to contribute to the ongoing decline in employment in that sector. In addition, the rise of low cost manufacturing in Eastern Europe as well as

in China and India means that the future prospects for the traditional manufacturing sector in Ireland remain weak. The one exception will be the paper and publishing sector, which includes the reproduction of computer media. Output growth in the traditional sector will remain sluggish at 1.3 per cent for the period 2005 to 2010 and 2 per cent for 2010 to 2015. Employment in the traditional sector has contracted since the early 1980s and we estimate that the rate of decline will accelerate over the course of the next decade. The numbers employed in the sector are forecast to fall by 17,000 between 2005 and 2010 with a further fall in employment of 12,000 in the sector by 2015.

Figure 4.8: Output and Employment in the Food Processing Sector



The dependence of the food processing business on the agricultural sector for a large, though declining, share of its inputs means that the fortunes of the two sectors have long been intertwined. Significant rationalisation and restructuring in the food processing sector from the 1980s gave rise to strong output growth in the sector during the 1995 to 2000 period. In the mid-1990s the Irish food processing industry benefited from a strong competitive position relative to its EU trading partners, particularly in the dairy industry where the operations of Irish multinational companies gave rise to improved efficiency in the industry. Notwithstanding the recent rise in global food prices, it is unlikely that the strong output growth recorded by the food processing sector in the mid 1990s will be repeated. Annual average output growth in the 2005 to 2010 period is expected to decline to 3.2 per cent from 5.5 per cent in the years 2000 to 2005 due in part to the contraction in output recorded in the sector in 2005. It is forecast that output growth in the sector will weaken further in the period 2010 to 2015 to an annual average rate of just 2 per cent.

Productivity growth in the food processing sector is expected to continue to decline from the heights recorded in the 1995 to 2000 period.[52] Annual average productivity growth of 3.4 per cent is estimated for the sector for the 2005 to 2010 period with higher productivity growth of 4.2 per cent forecast for 2010 to 2015. Ongoing productivity growth, allied to lower output growth, is expected to reduce employment in the sector further. Employment levels are forecast to contract by an annual average

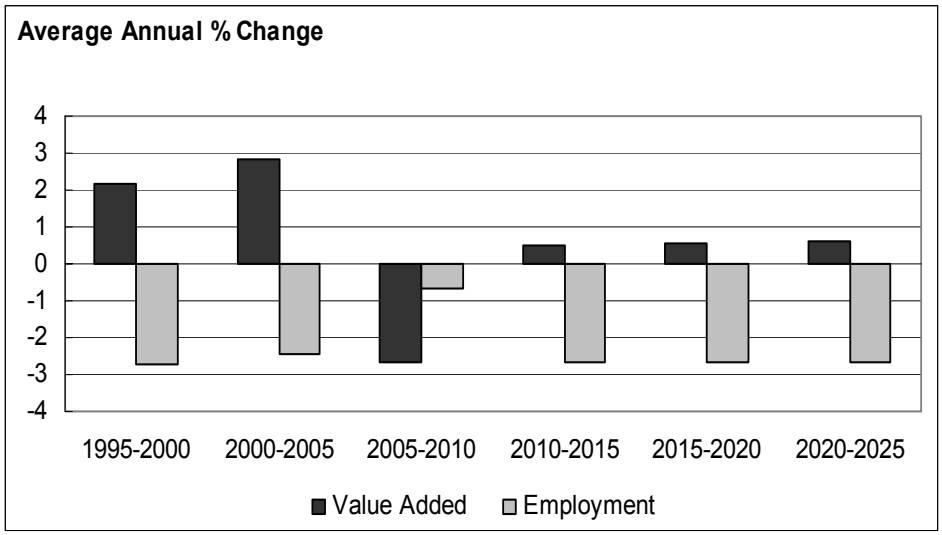
[52]The high rate of productivity increase in the 1990s owed much to the restructuring of the sector moving from farmer owned co-ops to private limited companies.

rate of 2.2 per cent in the period 2010 to 2015. As a result we estimate that 44,000 people will be employed in the sector by 2015.

AGRICULTURE

The well documented path of Ireland's economic development, involving first a shift from agriculture to manufacturing and then from manufacturing to services, is one that is common to many developed countries. The decline of the agricultural sector is illustrated by its ever-shrinking share of Ireland's GNP and employment. In the early 1980s, farming accounted for around 9 per cent of GNP and employed 209,000 people. By 2006, agriculture comprised less than 3 per cent of GNP and employment had fallen to 111,000.

Figure 4.9: Output and Employment in Agriculture



The prospects for output and employment in the agricultural sector remain weak, though the increased attention to environmental policy could see some shift in the focus of output. We forecast positive growth in value added to resume in 2010, following a contraction over the period 2005 to 2010.[53] From 2010 to the end of the forecast period, average value added will grow very slowly at less than 1 per cent per annum. The trend of falling employment in the agricultural sector is forecast to continue over the medium term with employment contracting by an annual average of around 2.5 per cent for the remainder of the forecast period.

The recent buoyancy of world commodity prices has given rise to speculation of a possible revival in Ireland's agricultural sector. However, as outlined, over the forecast horizon agriculture's overall contribution to the Irish economy is expected to decline further, a trend that is unlikely to be reversed despite this recent increase in global food prices. Nonetheless, certain sectors remain well placed to take advantage of higher food prices. In particular, Ireland enjoys a comparative advantage in milk production arising from its grass-based system. The consolidation currently underway in the dairy sector, likely to be expedited by expected future reform of the

[53]We are grateful to Teagasc for their assistance in preparing our forecasts. However, the authors remain responsible for the final numbers.

milk quota regime, should allow for the emergence of an efficient internationally competitive dairy industry in Ireland. The extent to which recent price developments are structural rather than transitory in nature will determine whether there is a sustainable future for other sectors such as beef and grain, which after successive CAP reforms are increasingly exposed to the competitive world trading environment. Also the move towards growing energy crops could see some change in the pattern of output in the period to 2025. Higher output prices should see a continuation of the recent trend of lower output volumes but higher output in value terms over the forecast horizon.

In the medium term, income support will increasingly be linked towards the remuneration of farmers for the multifunctional benefits of agriculture. These include the provision of public goods, such as the preservation of the countryside, the maintenance of rural communities, the preservation of biodiversity and the production of biomass and other sources of renewable energy. Diversification into these areas is likely to represent an important source of income for farmers in the years ahead.

BUILDING

Here we consider the growth in GDP arising in the building and construction sector. This differs significantly from the gross output of the sector which is frequently discussed in terms of its share in GNP. The difference, of course, lies in the large amount of inputs used in the sector many of which are sourced in Ireland. An outstanding feature of Ireland's recent economic experience has been the exceptional growth in output and employment in the building sector. For the period 1995 to 2000, output in the sector grew by an annual average of almost 13 per cent. While output growth moderated significantly to 7.1 per cent during the period 2000 to 2005, this rate of growth still exceeded that recorded in many other sectors of the economy. A number of factors combined to fuel this rapid growth in the building sector. Strong economic growth accompanied by rising disposable income, in addition to a strong demographic profile and high levels of inward migration, caused the demand for new housing to soar. At the same time the expansion in the services and industrial sectors increased the demand for commercial and industrial properties.

Another contributory factor to the boom in the building sector was the high level of investment in roads and public transport undertaken by government under the National Development Plan (NDP). Capacity constraints and labour shortages in the building sector resulted in excess demand and rapidly increasing prices. The price deflator for gross output in the building sector rose by an annual average of 10.7 per cent for the years 1995 to 2000 and by 7.5 per cent for 2000 to 2005.

We anticipate that as overall economic growth retreats from the high levels achieved in the last decade and as the level of house building returns to more sustainable levels, output growth in the building sector will ease over the forecast horizon. We forecast a small contraction in annual average output for the years 2005 to 2010 as the level of demand in the residential sector normalises and activity in the commercial market slows down. Output growth will remain flat for the period 2010 to 2015 before rising to an annual average of almost 2 per cent for the period 2015 to 2020 as a result of continued demand for housing and investment in

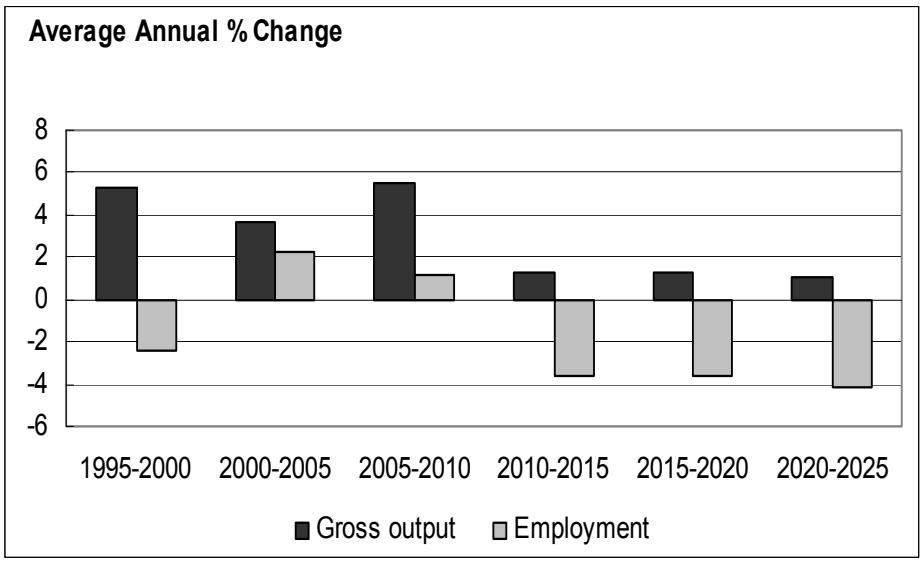
infrastructure. Beyond 2020 the level of government capital investment is expected to fall with the completion of major projects under the NDP and Transport 21.

The labour intensive nature of the building sector has meant a strong correlation between output and employment trends in the sector. The exceptional output growth during the period 1995 to 2000 was translated into annual employment growth averaging over 14 per cent for the same period. By 2007, there were 278,000 people employed in the building sector, 181,000 more than in 1997. In line with the contraction in output forecast for the years 2005 to 2010, employment growth is also expected to remain flat, growing by 1.5 per cent per annum as the high rates of employment growth recorded in 2005 and 2006 is offset by weaker growth for the remainder of the decade. As discussed earlier in this chapter, productivity in the sector was negative over the period since 1995. This is likely to change in the post-2010 period with the change in the composition of the output of the sector towards non-housing construction where productivity growth is higher.

UTILITIES

Growth in the utilities sector (electricity, gas and water supply) is driven by the demand for energy in the rest of the economy (see Chapter 5) and hence tends to be linked closely to the growth path of other sectors of the economy. We forecast that output growth in utilities will slow down significantly over the forecast horizon as growth in the economy and the commercial sector eases. Annual average growth will measure 5.5 per cent in the period 2005 to 2010 before falling back to just over 1 per cent for the remainder of the forecast horizon. Output growth in the utilities sector will continue to rely on the expansion of the commercial sector.

Figure 4.10: Output and Employment in the Utilities Sector



It is anticipated that strong output growth in the utilities sector for the period 2005 to 2010 will be matched by only a slight increase in employment of over 1 per cent. As a result of ongoing restructuring and falling output growth, we expect a sharp reduction in the numbers

employed in the utilities sector over the forecast horizon. The pace of reduction in utilities sector employment is expected to accelerate over the medium term.

MARKET SERVICES

Market services are split three ways in the current version of the ESRI *HERMES* model: distribution (wholesale and retail), transport and communications and business and financial services (professional, financial, personal). In the past the output of this sector was considered non-tradable and was determined solely by a weighted measure of final domestic demand. However, due to deregulation and technological advancements, large parts of this sector have been increasingly exposed to international competition.

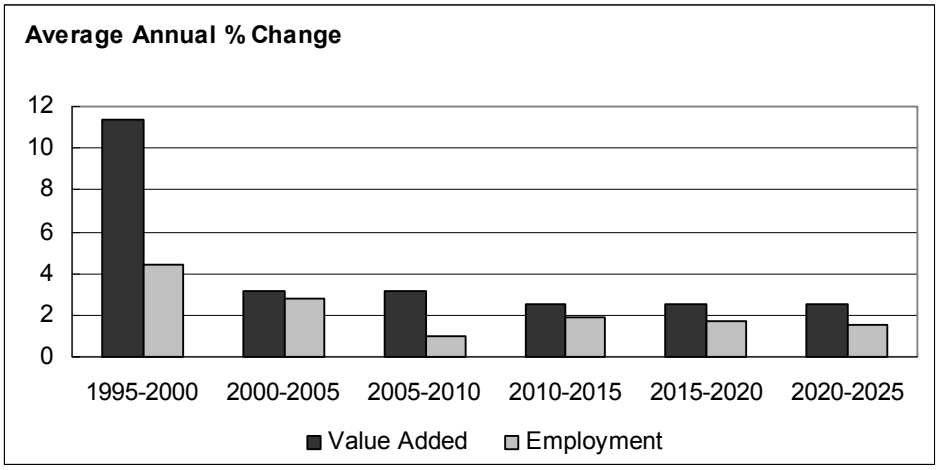
The market services sector has experienced robust growth since the mid-1990s with demand for exports from the sector now a key driver of growth in the Irish economy. Output growth in market services averaged 6.0 per cent between 2000 and 2005. We expect this strong rate of output growth to continue over the medium term, averaging 4.9 per cent over the years 2008 to 2012 before easing slightly for the rest of the forecast horizon. Given the labour intensive nature of the market services sector, the strong growth in output has been accompanied by a corresponding growth in employment. Employment growth will average 2.4 per cent for the period 2005 to 2010 before falling back slightly over the remainder of the forecast horizon. By 2015, we estimate that there will be over 1 million people at work in the market services sector, representing over 50 per cent of total employment, thereby making it the dominant sector of the economy.[54] We expect the numbers at work in the sector to increase further out to the end of the forecast period as Ireland shifts definitively towards a service driven economy. The three market services sectors are now examined in turn.

DISTRIBUTION

The level of domestic demand in the economy, in particular the level of consumption, determines output in the distribution sector. The key driver of personal consumption is the level of disposable income. The demographic profile of the population also influences output growth in the distribution sector. As well as rising disposable incomes, Ireland has experienced increased labour force participation, falling dependency rates and increased levels of immigration. These factors have changed the consumption pattern of the population leading to a change in the demand for different types of goods and services, many of which tend to have higher margins and demand more specialised customer service thereby providing opportunities for increased employment. Technological advances has increased the efficiency of operations in the distribution sector and reduced the number of wholesalers while the supply of output from the sector has also changed due primarily to the growth in internet shopping.

[54]In this respect, Ireland will be following a path common to most countries at our stage of development.

Figure 4.11: Value Added and Employment Growth, Distribution



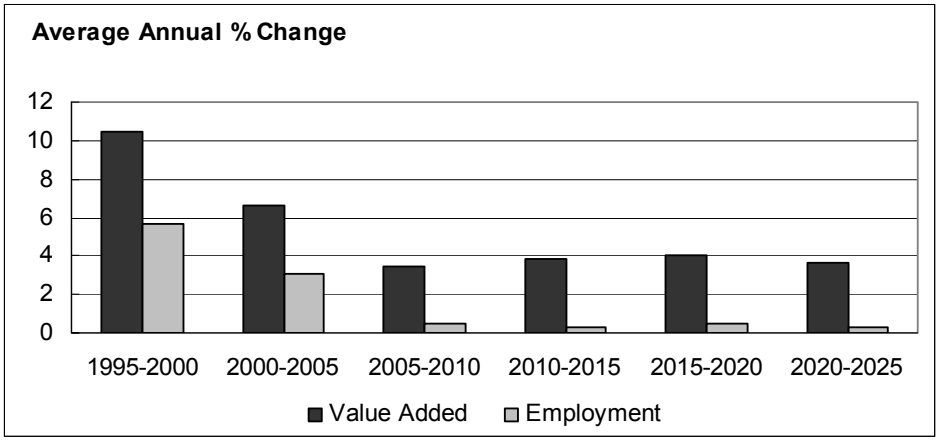
Following exceptional double-digit average growth over the period 1995 to 2000, growth in the distribution sector slowed for the years 2000 to 2005. A further moderation to an annual growth rate of 2.3 per cent for the period 2008 to 2012 is expected after the strong annual growth of almost 5 per cent recorded for the years 2005-2007. In line with the predicted levelling off in economic growth after 2010, we expect growth in the distribution sector to stabalise at 2.5 per cent over the course of the forecast horizon. The numbers employed in the distribution sector reached 266,000 in 2005 and we anticipate that the numbers employed in the sector will continue to rise over the forecast horizon, although at a slower pace than in recent years. Annual average employment growth of 1.9 per cent is expected for the period 2010 to 2015 and will remain flat for the rest of the forecast period.

TRANSPORT AND COMMUNICATIONS

As with distribution, output growth in the transport and communications sector is primarily driven by domestic demand. Despite regulatory reform in the sector, a significant degree of government intervention remains, especially in the transport area. The process of liberalisation has resulted in a step upwards in the rate of growth in labour productivity and an increasingly competitive environment in this sector, which has fuelled higher output and employment growth after years of stagnation. The scope for further regulatory reform, a continuing high level of government investment and the development of new technologies means that there remains potential for further growth in this sector.

The extremely high growth rates recorded during the years 1995 to 2000 are unlikely to be repeated over the forecast horizon. Nonetheless, we forecast strong output growth in the sector. As a result of the strong growth rates recorded for the 2005 to 2007 period, we anticipate that annual growth will average 3.9 per cent for the period 2005 to 2010 and 3.8 per cent for 2010 to 2015. We expect that programmes such as the National Development Plan and Transport 21 will contribute to the high levels of investment in this sector being maintained out as far as the middle of the next decade. Lower investment in the capital stock after that period will see output growth easing to 3.6 per cent for the final years of the forecast period.

Figure 4.12: Value Added and Employment Growth, Transport and Communications

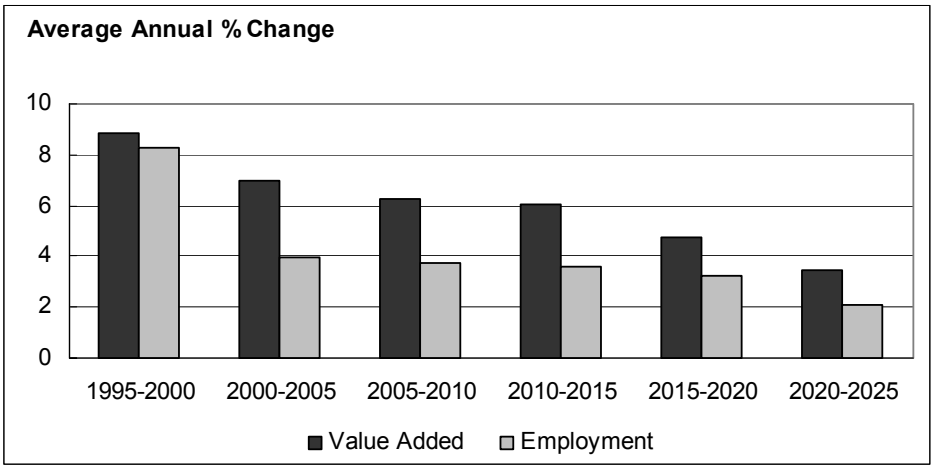


Further rationalisation in the transport and communications sector means that employment is forecast to show very little growth over the forecast horizon. Employment growth is expected to remain almost flat for the years 2005 to 2010 only growing at an annual average rate of just 0.5 per cent. Growth is forecast to remain equally sluggish for the remainder of the forecast period, growing by an annual average rate of 0.3 per cent over the last five years of the forecast.

BUSINESS AND FINANCIAL SERVICES

This sector comprises both personal and professional services as well as the financial sector. Personal services consist of hotels, pubs, restaurants, motor repairs, hairdressers etc., while professional services include banking, insurance, legal services, consultancy and other professions. The sector also includes IT services and research and development. A prominent theme in this *Review* is the expectation that business and financial services will account for a growing share of Ireland's economic growth in the coming years. While in the past this sector was treated as non-tradable with output driven directly by domestic demand, this is no longer the case, as today the sector is exposed to competitive pressures from outside Ireland. The business and financial services sector is now responsible for a significant part of the growing exports of services from the economy. As discussed in detail in Chapter 2, this development has necessitated a change in the way in which the business and financial services sector is modelled, with output from the sector now treated as tradable and, therefore, determined by world activity and competitiveness.

Figure 4.13: Output and Employment in the Business and Financial Services Sector



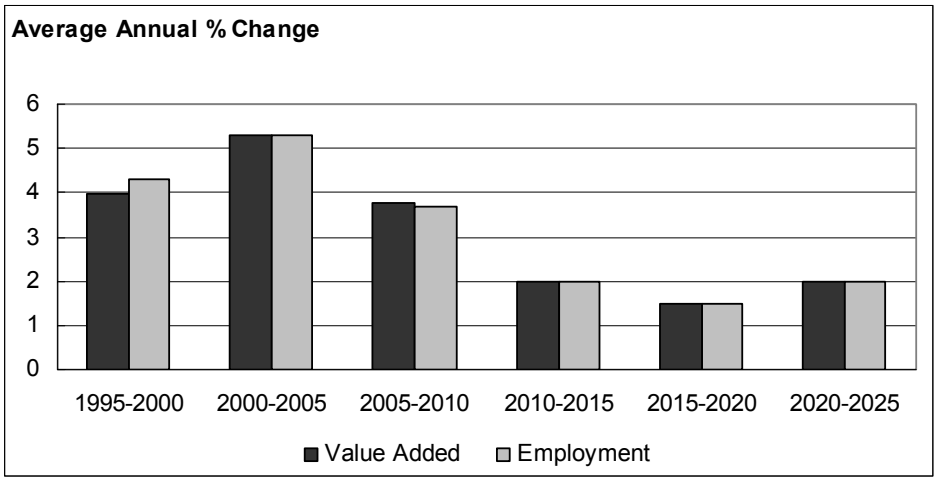
Annual output growth in the this sector averaged almost 7 per cent over the years 2000 to 2005 and we expect this rate of growth to moderate only marginally out to the middle of the next decade. Despite lower output growth in this sector in the next decade, Ireland will continue to experience rising living standards due to the improvement in the terms of trade arising from the anticipated increase in the price of services. Growth for the period 2015 to 2020 is forecast to average 4.8 per cent, with slightly slower growth of 3.5 per cent expected for the remainder of the forecast period. These growth rates mean that the business and financial services sector will be the fastest growing sector of the economy in terms of value added.

The sector is forecast to account for an ever-increasing share of total employment in the economy. By 2007 there were 228,000 more people working in the sector than in 1995, with employment in the sector accounting for 53 per cent of total employment in the market services sector. We expect modest annual average growth in employment in the business and financial services sector over the forecast horizon of around 3.5 per cent per annum. By 2025 we estimate that employment in the sector alone will have reached 754,000, representing over 30 per cent of total employment in the economy and almost twice the number employed in industry.

NON-MARKET SERVICES

The non-market services sector is modelled under two separate headings: health and education, and public administration and defence. Due to the public good characteristics of these services, their provision is generally the responsibility of government. The output of the non-market services sector is determined by the government's demand for public services. This in turn is determined by the country's demographic profile and the budgetary position.

Figure 4.14: Output and Employment in the Non-Market Services Sector



The non-market services sector experienced rapid value-added output growth in the 2000 to 2005 period in excess of 5 per cent. We expect this rate of growth to ease over the forecast horizon due to budgetary considerations, averaging 2 per cent annually for the years 2010 to 2015 and 1.5 per cent for the next five years. The level of investment in the sector under the NDP is expected to grow by around 2 per cent per annum slowing from a rate of over 12 per cent for the years 2005 to 2010 when the NDP was being ramped up. Output growth in the health and education sector is expected to remain slightly higher than in public administration and defence.

The exceptionally rapid growth in current expenditure over the last decade was manifested in rapid growth in the numbers employed in health, education and public administration. Employment in these sectors grew by an annual average of 5.3 per cent over the years 2000 to 2005. By 2007 there were 476,000 people employed in these sectors, 208,000 more than in 1995. As the growth in current public spending slows to more sustainable levels over the next decade, we expect employment growth in the non-market services sector to ease over the forecast horizon. As Lane (2007) has argued, more efficient delivery of public services could allow for a reduction in the growth of the public sector payroll, easing labour cost pressures in the private sector, contributing to an improvement in competitiveness and a rebalancing of the economy toward the export sector. Annual average employment growth is estimated to measure 2.0 per cent over the period 2010 to 2015. By the end of the forecast period, it is expected that non-market services will account for around 28 per cent of total employment.

4.4 Income, Expenditure and Prices

The period 2000 to 2005 saw some recovery in agricultural incomes, which grew by an annual average of 3.4 per cent, having fallen in the previous 5-year period. As has already been outlined, employment in the agricultural sector is expected to continue its decline over the forecast period. It seems likely that income growth in this sector will be much more moderate in the current period, averaging just 0.3 per cent per annum between 2005 and 2010. Income growth is expected to improve between 2010 and 2015 to an annual average of 3.9 per cent.

In contrast to the volatility in agricultural incomes, non-agricultural incomes have grown rapidly over the past number of years. Between 2000 and 2005 this growth averaged 9.8 per cent per annum, reflecting strong employment growth. It is likely that employment growth will be slower in the future. Thus, growth in non-agricultural incomes over the next decade will be more moderate, albeit still reasonably strong. In the current period, 2005-2010, income growth of 6.5 per cent per annum is expected, boosted in part by strong growth in 2006 and 2007. Some moderation to an annual average growth of 5.8 per cent is forecast between 2010 and 2015.

The start of the decade saw strong growth in transfer incomes, averaging 12.9 per cent a year between 2000 and 2005 (some of which was due to special compensation schemes). Low unemployment levels, a young population reducing the dependency ratio and low interest rates contributed to a slower growth rate of 6.9 per cent per annum between 2005 and 2010. A further moderation to an annual average of 5.8 per cent is anticipated between 2010 and 2015.

Annual average growth in personal taxes is expected to stabilise at around 7.3 per cent over the period 2005 to 2015. This compares with annual growth of 11 per cent between 1995 and 2000. Again the figure for 2005 to 2010 is underpinned by strong growth in 2006 and 2007. Although growth in personal incomes will be slower than in the past disposable income will continue to grow quite strongly over the forecast period. Since 2003 growth in personal consumption has exceeded that of personal incomes, leading to a decline in the personal savings rate. This trend is expected to end with the savings rate remaining relatively stable over the forecast period.

CONSUMPTION

The late 1990s was a period of rapid economic growth, which was also reflected in strong growth in personal consumption, averaging 7.9 per cent per annum between 1995 and 2000. Growth continued between 2000 and 2005 at an annual average of 4.8 per cent. The increases were in part being driven by income growth and employment creation as well as low interest rates and rising house prices. Many of these factors continued to support personal consumption growth in the early part of the current five-year period and so annual growth of 4.2 per cent is expected between 2005 and 2010. However, support from these drivers has diminished recently and a substantial improvement is not anticipated over the forecast period. Thus, personal consumption growth is expected to moderate to an annual average of 3.1 per cent between 2010 and 2015.

Public consumption, current government spending on goods and services, grew by an annual average of 4.7 per cent between 2000 and 2005. We expect growth in public consumption to remain broadly stable at an annual average of 4.8 per cent between 2005 and 2010, before slowing to an average growth rate of 2.6 per cent a year between 2010 and 2015.

Table 4.4: Personal Income and Personal Expenditure, Percentage Change

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Agricultural Incomes	-5.7	2.0	2.0	2.0	1.3	5.9	4.5	3.5	2.8	2.8
Non-Average Wage Income	9.8	9.0	4.0	4.7	5.2	5.6	5.5	5.7	6.0	6.1
Transfer Income	-0.5	15.4	7.0	7.5	5.5	6.5	5.9	5.6	5.5	5.7
Other Personal Income	8.3	4.3	8.3	3.5	-3.9	13.0	11.9	11.7	11.3	10.9
Non-Ag. Profits etc.	5.0	4.6	2.9	5.5	1.6	5.7	6.2	6.7	6.9	7.1
National Debt Interest	7.8	-14.0	16.0	11.5	5.8	11.8	16.4	9.6	10.7	6.7
Net Factor Income	-0.8	5.8	4.7	6.2	2.8	4.9	4.0	4.5	5.0	5.0
Other Private Income	10.1	1.6	1.4	5.7	0.9	6.9	8.9	8.8	8.7	8.8
Personal Income	7.2	9.1	5.1	4.9	3.8	6.7	6.5	6.5	6.7	6.7
Taxes on Personal Income	9.2	10.6	3.5	4.1	9.4	8.5	8.2	6.4	6.7	6.8
Personal Disposable Income	6.7	8.8	5.5	5.1	2.5	6.3	6.0	6.6	6.7	6.7
Personal Consumption	7.9	10.2	5.3	5.0	5.4	4.8	5.4	6.3	6.7	6.9
Personal Savings	-6.1	-9.8	7.6	7.7	-40.2	46.1	17.3	10.6	6.0	3.2
% of disposable income										
Tax ratio (% pers. Income)	19.4	19.6	19.3	19.2	20.2	20.5	20.9	20.8	20.9	20.9
Savings ratio (% pers. Income)	7.3	6.1	6.2	6.3	3.7	5.1	5.6	5.8	5.8	5.6

	Average Growth Rates					
	1995-2000	2000-2005	2005-2010	2010-2015	2015-2020	2020-2025
Agricultural Incomes	-0.8	3.4	0.3	3.9	3.2	3.2
Non-Ag. Wage Income	12.0	9.8	6.5	5.8	6.1	6.8
Transfer Income	6.7	12.9	6.8	5.8	6.1	6.7
Other Personal Income	11.9	3.9	4.0	11.7	9.1	7.3
Non-Ag. Profits etc.	18.9	7.8	3.9	6.5	6.8	6.2
National Debt Interest	-6.3	-4.8	4.9	11.0	-4.7	-181.9
Net Factor Income	20.3	10.7	3.7	4.7	4.8	4.4
Other Private Income	14.5	4.8	3.9	8.5	7.7	6.5
Personal Income	10.4	9.0	6.0	6.6	6.6	6.8
Taxes on Personal Income	11.0	7.4	7.3	7.3	6.6	5.3
Personal Disposable Income	10.2	9.4	5.7	6.5	6.5	7.2
Personal Consumption	11.6	8.2	6.8	6.0	6.4	7.0
Personal Savings	-10.8	32.4	-10.1	15.7	8.1	9.3

Table 4.5: Expenditure on GNP, Constant 1995 Prices, Percentage Change

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Personal Consumption	5.7	6.5	3.0	3.2	2.7	2.0	2.6	3.3	3.6	3.9
Public Consumption	5.3	5.0	4.0	3.5	6.1	3.0	2.5	2.5	2.5	2.5
Fixed Investment	2.9	1.9	-6.9	-0.3	5.9	-3.3	3.1	2.4	1.2	1.2
Building	5.5	-1.3	-11.9	-2.6	5.6	-1.6	3.5	1.9	0.0	0.0
Machinery	-5.2	13.0	8.0	5.2	6.8	-7.1	2.4	3.6	3.9	4.0
Total Exports	4.4	6.6	5.4	5.7	6.6	6.2	6.3	5.8	5.5	5.3
Total Imports	4.3	6.1	4.0	5.2	6.7	3.4	5.9	5.6	5.3	5.2
Gross Domestic Product	5.8	4.9	1.8	3.1	4.6	3.7	3.7	3.6	3.5	3.5
Net Factor Income	1.7	6.9	2.7	4.4	2.3	3.7	2.3	2.4	2.7	2.7
Gross National Product	6.6	4.5	1.6	2.9	5.1	3.7	3.9	3.8	3.6	3.7
GNDI	4.2	2.9	0.5	2.2	3.3	2.6	3.4	3.7	3.8	4.0

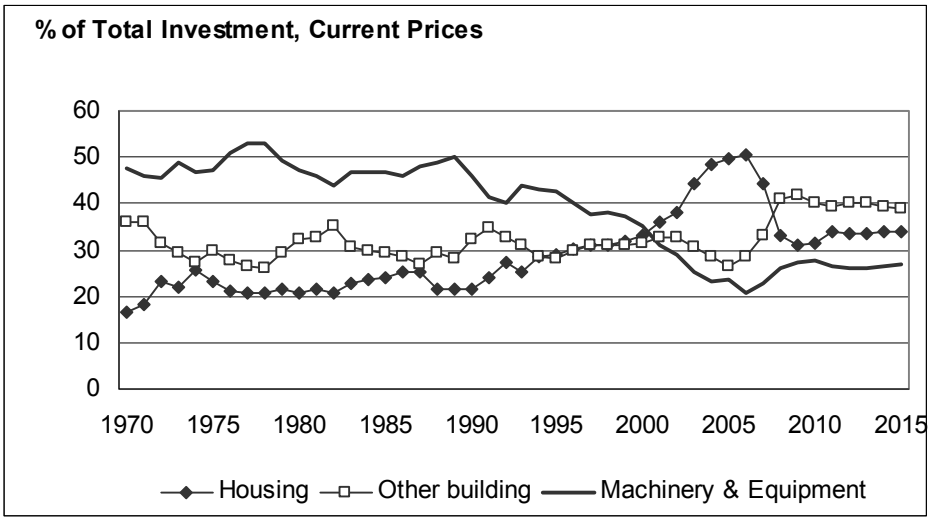
	Average Growth Rates					
	1995-2000	2000-2005	2005-2010	2010-2015	2015-2020	2020-2025
Personal Consumption	7.9	4.8	4.2	3.1	3.2	3.4
Public Consumption	5.7	4.7	4.8	2.6	2.6	2.4
Fixed Investment	13.5	6.0	0.6	0.9	2.4	1.5
Building	12.8	7.1	-1.2	0.8	1.9	1.0
Machinery	15.1	3.0	5.4	1.3	3.6	2.5
Total Exports	17.7	5.3	5.8	5.8	4.7	4.1
Total Imports	18.1	4.8	5.2	5.1	4.7	4.5
Gross Domestic Product	9.4	5.3	4.0	3.6	3.3	2.7
Net Factor Income	16.1	11.1	3.6	2.8	2.2	1.0
Gross National Product	8.6	4.4	4.1	3.8	3.5	3.0
GNDI	8.3	4.0	2.6	3.5	3.7	3.6

INVESTMENT

Having grown by an annual average of 13.5 per cent between 1995 and 2005, growth in the volume of overall investment slowed to 6 per cent per annum between 2000 and 2005. In the past number of years the main growth driver of overall investment has been residential construction. As is outlined in the *Housing* section of this chapter, the number of dwellings completed increased substantially to nearly 90,000 units in 2006. The volume of house completions grew by an annual average of 10.2 per cent per annum between 2000 and 2005. The slowdown in the housing market has resulted in a substantial decline in completion levels and so the activity is forecast to decline by an annual average of 8.5 per cent between 2005 and 2010. Much of this expected decline occurs between 2007 and 2009. The slowdown in housing investment means that investment in machinery and equipment is forecast to be stronger than building investment over the forecast period. However, the slower pace of economic growth will result in growth in investment being lower than experienced during the boom of the late 1990s. Investment in building is expected to contract by an annual average of 1.2 per cent in the current 5-year period as the housing market adjusts. A return to moderate growth of 0.8 per cent per annum is forecast

during the period 2010 to 2015 and a further improvement to an annual average of 1.9 per cent between 2015 and 2020.[55] In contrast to the current decline in building, investment in machinery and equipment is estimated to grow at 5.4 per cent per annum between 2005 and 2010. A moderation to an annual average of 1.3 per cent is forecast for the period 2010 to 2015 before an upturn in growth to 3.6 per cent a year between 2015 and 2020.

Figure 4.15: Subsectors as a Percentage of Total Investment



The impact of the decline in the volume of housing investment is forecast to reduce the growth in overall investment to 0.6 per cent per annum between 2005 and 2010. However, Ireland continues to experience infrastructure constraints and so the proportion of investment accounted for by other building is forecast to increase. The changing contribution of the different subsectors to overall investment will take place against a backdrop of a moderate decline in the share of GNP accounted for by investment. As a percentage of GNP investment rose from 17.3 per cent in 1993 to 31 per cent in 2005. The average investment to GNP ratio between 2000 and 2005 was 28 per cent and is likely to attain the same figure between 2005 and 2010. While some moderation is expected, this ratio is expected to average 24 per cent between 2010 and 2015 and 23 per cent between 2015 and 2020 (Figure 4.16).

EXTERNAL TRADE

Having grown at a very strong pace in the late 1990s, the annual average growth rate for the volume of total exports declined to 5.3 per cent between 2000 and 2005 (Figure 4.17). Much of this slowdown in growth reflects the changing nature of the Irish economy and the weak international environment. Between 2005 and 2010 exports are expected to grow by an annual average of 5.7 per cent. A moderate increase in the growth rate for exports to 5.8 per cent per annum is forecast for the period 2010-15. Economic growth in the main international markets is forecast to improve between 2010 and 2015.

[55]The model generated annual figures for 2010 to 2012 are much too uneven and should probably be smoothed.

Figure 4.16: Investment as a Share of GNP

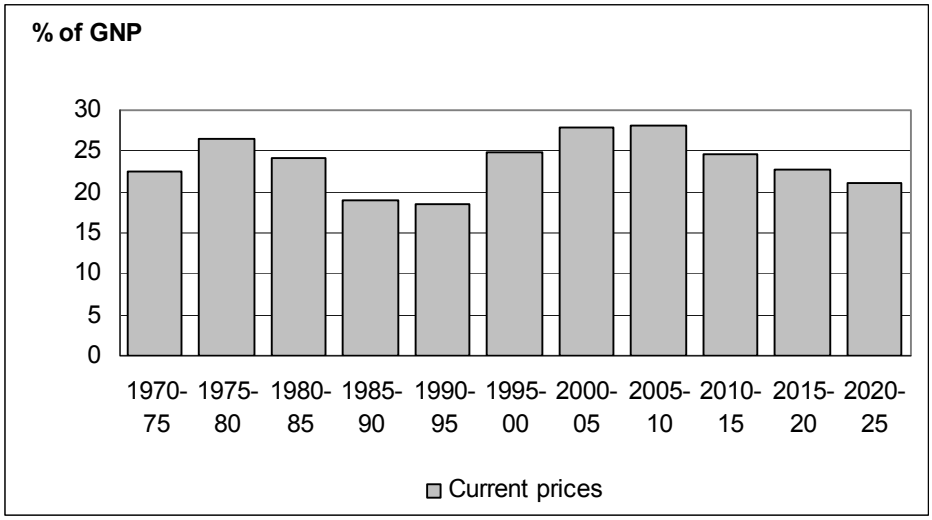


Table: 4.6. Foreign Trade, Constant 2004 Prices, Percentage Change

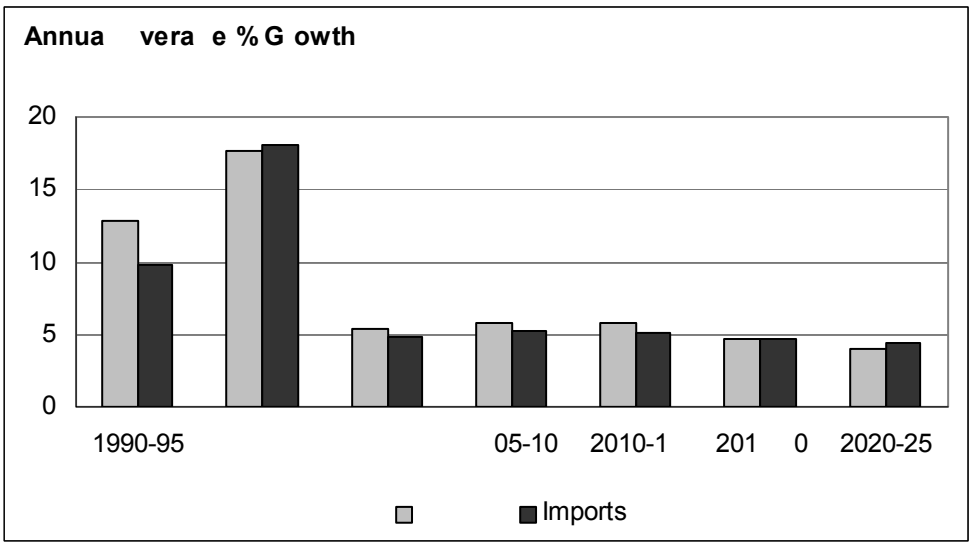
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
EXPORTS										
Agriculture	5.0	5.0	5.0	5.0	-3.6	0.0	-0.2	-0.2	-0.4	-0.6
Industry	0.7	3.4	2.4	2.5	5.3	3.6	2.8	2.6	2.6	2.7
Merchandise	0.9	3.5	2.6	2.6	4.8	3.4	2.6	2.5	2.5	2.5
Tourism	8.0	5.3	5.6	6.1	-8.5	0.6	3.9	5.1	5.5	5.7
Other Services	10.7	12.0	9.8	10.3	10.3	10.1	10.9	9.5	8.7	8.0
Services	10.5	11.5	9.5	10.0	9.1	9.6	10.5	9.3	8.6	7.9
Exports - Total Goods and Services	4.4	6.6	5.4	5.7	6.6	6.2	6.3	5.8	5.5	5.3
IMPORTS										
Imports - Total Goods and Services	4.3	6.1	4.0	5.2	6.7	3.4	5.9	5.6	5.3	5.2

	Average Growth Rates					
	1995-2000	2000-2005	2005-2010	2010-2015	2015-2020	2020-2025
EXPORTS						
Agriculture	0.8	1.3	3.3	-0.3	-1.0	-2.1
Industry	16.7	2.7	2.8	2.9	2.8	1.7
Merchandise	15.2	2.6	2.9	2.7	2.6	1.6
Tourism	7.6	2.7	3.1	4.2	6.2	6.1
Other Services	30.7	12.3	10.6	9.4	6.5	5.8
Services	26.2	11.3	10.1	9.2	6.4	5.8
Exports - Total Goods and Services	17.7	5.3	5.8	5.8	4.7	4.1
IMPORTS						
Imports - Total Goods and Services	18.1	4.8	5.2	5.1	4.7	4.5

Reflecting the changing structure of the Irish economy, outlined in Chapter 2, the main driver of export growth over the forecast period is expected to be service exports. Exports of services are forecast to grow by an annual average of 10.1 per cent between 2005 and 2010 and by 9.2 per cent in the period 2010-15. These growth rates mainly reflect the performance of non-tourism services exports, which are forecast to increase by 10.6 per cent per annum between 2005 and 2010 and by 9.5 per cent between 2010 and 2015. In contrast exports by the tourism sector are forecast to grow at more modest rates. Over the period 2005-10 tourism exports are forecast to increase by an annual average of 3.1 per cent.

Our forecasts suggest that the volume of import growth will move in line with growth in the overall economy and export volumes. Following a period of very strong growth in the late 1990s when import growth averaged 18.1 per cent per annum growth was more subdued between 2000 and 2005 when the annual average rate declined to a more moderate 4.8 per cent. While substantially lower than the previous 5-year period it reflects more moderate growth in output. A slight rebound in import activity is expected in the current period when growth will average 5.2 per cent a year. Growth in import volumes is forecast to remain stable at this rate between 2010 and 2015 before moderating to an annual average of 4.7 per cent between 2015 and 2020.

Figure 4.17: Import and Export Growth



NET FACTOR INCOME

In contrast to many other European countries, a substantial difference can exist between Irish GDP and GNP, the key measure of economic growth. Although GDP is used mainly for international comparisons, GNP provides a better indication of Ireland's income level. The reason for the difference between the two measures has been the large factor income flows leaving the economy. Net factor income consists of repatriated profits, "other" factor income flows and national debt interest payments.

Traditionally, the largest of these has been profit repatriations as a result of the success of Irish industrial policy in attracting foreign multinationals. In recent years the gap between the two measures of economic growth has

been narrower than was previously the case. Between 2000 and 2005 it is estimated that net factor flows had a negative effect on GNP, reducing the growth rate by 1.9 percentage points per annum (Table 4.7). In the current period the reduction is estimated at 0.7 percentage points, with a further fall in the impact to an annual average of 0.5 percentage points between 2010 and 2015. On the basis of these forecasts the ratio of GNP to GDP is expected to average 85 per cent between 2005 and 2010. Some narrowing of the gap is anticipated over the forecast period with the ratio moving to 86.5 per cent by 2015.

Table 4.7: Contribution of Net Factor Flows to GNP Growth, Percentage Points of GNP

	1995-2000	2000-2005	2005-2010	2010-2015	2015-2020	2020-2025
National Debt Interest	0.2	0.0	0.0	-0.1	0.1	0.1
Profits etc. Outflows	-2.6	-1.0	-1.3	-0.6	-0.6	3.9
Other Factor Income	0.5	-0.8	0.6	0.2	0.1	-0.6
Net Factor Income	-1.9	-1.9	-0.7	-0.5	-0.4	-0.2

GROSS NATIONAL PRODUCT

The start of the decade saw a continuation of the strong growth rates experienced by the Irish economy in the late 1990s. However, more difficult conditions in the external environment resulted in annual average growth slowing to 4.4 per cent per annum between 2000 and 2005. Between 2005 and 2010 a further moderation in the economic growth rate is forecast, to an annual average of 4.1 per cent. In line with the move towards a more pace of expansion for a mature economy, growth is expected to average 3.8 per cent per annum between 2010 and 2015 and 3.5 per cent a year between 2015 and 2020.

GROSS NATIONAL DISPOSABLE INCOME

Gross National Disposable Income (GNDI) provides a more complete indication of living standards, by adjusting GNP to take account of net transfers from abroad and changes in the terms of trade. As is shown in Figure 4.18, growth in GNDI is expected to average 2.6 per cent per annum between 2005 and 2010 compared with growth rates of around 4 per cent for GDP and GNP. The difference results primarily from adverse movements in the terms of trade. However, for the remainder of the forecast period the move to becoming a net contributor to the EU and the terms of trade adjustment will not have as substantial an impact and so growth rates of the three measures of activity and living standards will move much more closely together than is the case at present.

Figure 4.18: GDP, GNP and GNDI Growth

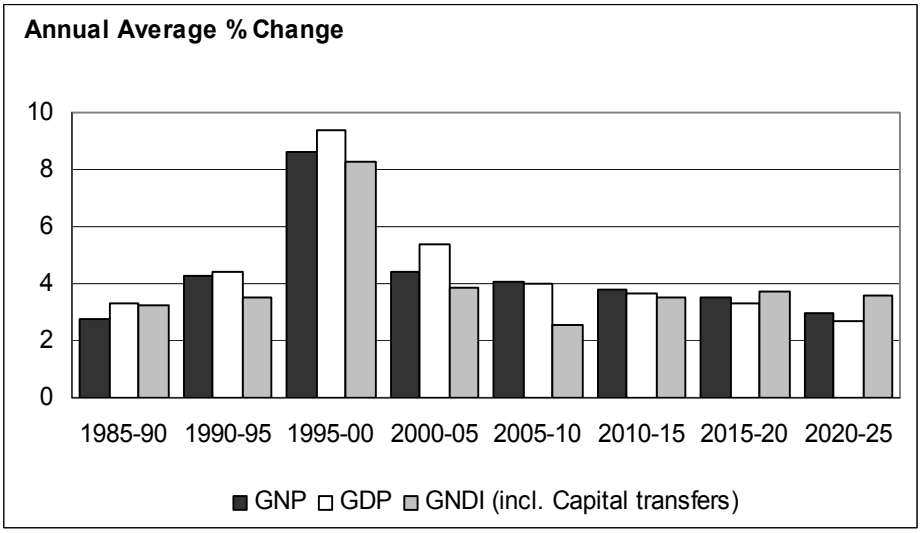


Table 4.8: Prices and Wages, Percentage Change

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Personal Consumption	2.1	3.5	2.3	1.7	2.7	2.7	2.7	2.9	3.0	2.9
Public Consumption	3.6	6.2	5.3	4.8	-1.0	2.8	2.7	2.8	3.0	3.1
Fixed Investment	6.5	0.0	2.2	2.9	-0.2	2.2	2.7	2.9	3.0	2.9
Building	7.2	1.2	3.2	3.7	-1.3	2.6	3.2	3.3	3.5	3.4
Machinery	2.1	-1.5	1.5	1.5	1.4	1.6	1.8	1.9	1.9	1.9
Total Exports	1.4	-0.2	0.8	1.0	0.4	1.1	1.6	2.0	2.2	2.3
Imports-Energy	21.3	2.0	9.4	-9.6	-1.1	0.9	2.5	3.4	3.2	3.2
Imports-Non-Energy	3.5	1.2	1.7	1.5	1.9	1.9	1.9	1.9	1.9	1.9
Agri. Output gross	-6.8	-10.0	1.0	1.0	2.1	0.4	0.0	0.5	0.8	0.8
Manu. Output gross	3.9	5.7	2.6	2.9	4.8	3.3	2.7	2.5	2.5	2.6
Average annual earnings % change										
Non agricultural	4.8	4.8	4.0	3.5	4.0	4.3	4.1	4.2	4.5	4.6

	Average Growth Rates					
	1995-2000	2000-2005	2005-2010	2010-2015	2015-2020	2020-2025
Personal Consumption	3.4	3.3	2.4	2.8	3.2	3.5
Public Consumption	4.7	6.8	3.7	2.9	3.2	4.0
Fixed Investment	7.4	5.1	2.3	2.7	3.1	3.4
Building	10.7	7.5	2.7	3.2	3.5	3.6
Machinery	1.9	-0.3	1.0	1.8	2.3	2.7
Total Exports	2.4	-0.2	0.7	1.8	2.6	3.3
Imports-Energy	8.8	3.7	3.9	2.6	3.2	3.0
Imports-Non-Energy	2.3	-0.1	2.0	1.9	2.4	2.8
Agri. Output gross	2.2	2.8	-2.7	0.5	0.6	0.6
Manu. Output gross	12.2	4.8	3.9	2.7	2.7	1.8
Average annual earnings % change						
Non agricultural	5.9	6.0	4.2	4.3	4.8	5.7

PRICES AND WAGES

As a small open economy Irish price movements are the result of both domestic and external forces. Despite the strength of economic activity between 2000 and 2005 inflationary pressures within the Irish economy remained low with the change in prices averaging 3.3 per cent per annum. However, it should be noted that the *Medium-Term Review* forecasts inflation based on the consumer expenditure deflator rather than using the more commonly cited consumer price index. The appreciation of the euro against both the dollar and sterling, as well as competition from low cost economies, is likely to ensure that goods inflation will remain low. However, service sector inflation seems likely to be higher over the forecast period, although more moderate than the rates experienced in the late 1990s. Our *Benchmark* forecast is for personal consumption price growth to average 2.4 per cent per annum in the current period, 2005-10. On the back of a return to stronger growth between 2010 and 2015 we anticipate that the personal consumption deflator will increase at an annual average of 2.8 per cent. We forecast that the deflator for government consumption will increase more rapidly than consumer prices, averaging 3.7 per cent between 2005 and 2010. Thereafter, it is forecast that the growth rate for the government price deflator will move in line with the deflator for personal consumption.

Between 2000 and 2005 the Irish labour market experienced strong employment growth and low unemployment levels. One consequence was that non-agricultural wage rates rose by an annual average of nearly 6 per cent. With slower growth in the economy and an increase in the unemployment rate we estimate that the growth in non-agricultural wages will average 4.2 per cent per annum in the period 2005-10 and will grow by 4.3 per cent a year between 2010 and 2015. How growth in wages in real terms, adjusted for inflation, compares to productivity growth will be important for Ireland's competitiveness as a small open economy. Productivity growth in terms of GNP per person employed at 1.2 per annum between 2000 and 2005 was lower than growth in real wages, which increased by 2.4 per cent. This situation is reversed in the current period and over the period 2010-15 productivity growth is forecast to average 2.5 per cent and growth in real wages is forecast to be 1.6 per cent.

4.5 The Labour Market

The Irish labour market has undergone a significant transformation over the past 15 years. During that time, the economy moved from unemployment rates in excess of 12 per cent to virtually full employment, the size of the labour force increased by almost 50 per cent to over 2 million for the first time and the economy experienced significant flows of inward migration after decades of emigration. This rapid employment growth, combined with high levels of productivity growth, underpinned the strong rates of economic growth recorded since the mid-1990s.

The transformation of Ireland's labour market gained considerable momentum during the years 1995 to 2000. During this period, annual employment growth averaged 5 per cent with the result that total employment grew by 342,000 to reach 1,590,000 by 2000. While slowing slightly, this impressive employment performance was largely maintained for the period 2000 to 2005, with annual employment growth averaging 3.2 per cent for the period. We expect employment growth to moderate over

the forecast horizon. In line with the anticipated lower level of overall economic activity, annual employment growth is expected to average 2.8 per cent for the period 2008 to 2012 following the robust employment growth experienced for the years 2005 to 2007 (Table 4.9). The rate of employment growth is forecast to decline further, averaging 1.2 per cent for the period 2010 to 2015 and around 1 per cent for the last ten years of the forecast.

Table 4.9: Employment and the Labour Force, Percentage Change

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Agriculture	0.9	-0.5	-0.5	-0.5	-2.7	-2.7	-2.7	-2.7	-2.7	-2.7
Industry	2.6	3.9	-3.5	-1.2	1.4	-1.1	-1.3	-1.4	-1.3	-1.4
Traditional Manufacturing	-1.4	-4.1	-3.3	-3.8	-8.0	-3.8	-3.8	-4.0	-2.7	-2.9
Food Processing	2.3	2.3	0.0	0.0	0.0	-2.1	-2.1	-2.1	-2.2	-2.2
High Technology	-2.8	2.3	0.0	0.0	9.6	-1.2	-1.9	-2.2	-2.6	-2.9
Manufacturing	-1.5	0.2	-1.1	-1.2	2.6	-2.1	-2.4	-2.7	-2.6	-2.8
Utilities	-13.0	23.8	0.0	0.0	-1.4	-3.8	-3.6	-3.4	-3.6	-3.6
Building	8.1	7.0	-6.0	-1.3	0.3	0.0	0.0	0.0	0.0	0.0
Market Services	4.7	4.5	0.6	1.7	0.6	2.3	2.6	2.7	2.7	2.7
Distribution	6.2	1.6	1.0	1.0	-4.5	0.9	2.1	2.2	2.2	2.1
Transport & Communications	2.7	1.3	0.0	0.0	-1.4	-0.3	0.2	0.4	0.5	0.5
Business and Financial	4.2	7.3	0.5	2.6	4.3	3.8	3.5	3.5	3.5	3.5
Non-Market Services	7.5	3.3	2.9	2.9	2.0	2.0	2.0	2.0	2.0	2.0
Health & Education	6.7	4.7	3.4	3.4	2.0	2.0	2.0	2.0	2.0	2.0
Public Administration	9.9	-1.0	1.4	1.4	2.0	2.0	2.0	2.0	2.0	2.0
Total	4.5	3.7	0.0	1.1	1.0	1.0	1.2	1.2	1.3	1.3
Labour Force	4.5	3.7	1.9	1.6	1.5	1.3	0.9	0.7	0.7	0.8
Unemployment rate ILO	4.3	4.5	5.9	6.2	6.6	6.9	6.7	6.2	5.7	5.3
Net Immigration (000)	-71.8	-67.3	-20.3	-11.2	-10.0	-10.0	-10.0	-10.0	-10.0	-15.0

The high level of job creation in the economy since the mid-1990s has rectified Ireland's chronic unemployment problem. The numbers unemployed fell by 105,000 between 1995 and 2000 to leave the unemployment rate standing at 4.3 per cent in 2000. Since 2000, the economy has largely maintained this position of full employment, while at the same time experiencing record levels of inward migration. Due to the rapid slowdown in the construction sector, only partly compensated for by increased employment in the services sector, we expect the unemployment rate to increase for the remainder of the current decade, reaching 6.9 per cent by 2011. As economic growth recovers in 2010 and the economy develops along a more sustainable growth path, we anticipate that the unemployment rate will fall gradually from 2012 to average 4.3 per cent annually for the last five years of the forecast.

Table 4.10: Employment and The Labour Force, Percentage Change

Five Year Annual Averages	1990-1995	1995-2000	2000-2005	2005-2010	2010-2015	2015-2020	2020-2025
Agriculture	-3.3	-2.7	-2.4	-0.7	-2.7	-2.7	-2.7
Industry	1.7	6.0	2.6	0.6	-1.3	-1.8	-2.5
Traditional Manufacturing	-0.2	0.0	-2.1	-4.1	-3.5	-3.6	-5.9
Food Processing	3.8	1.1	0.4	0.9	-2.1	-2.4	-2.7
High Technology	2.8	6.1	-0.6	1.7	-2.2	-4.3	-7.5
Manufacturing	1.7	2.9	-1.0	-0.2	-2.5	-3.7	-6.1
Utilities	1.6	-2.5	2.3	1.2	-3.6	-3.7	-4.2
Building	1.8	14.6	7.9	1.5	0.0	0.0	0.0
Market Services	3.2	6.4	3.4	2.4	2.6	2.5	1.8
Distribution	1.8	4.4	2.8	1.0	1.9	1.7	1.5
Transport & Communications	2.2	5.6	3.0	0.5	0.2	0.5	0.3
Other Market Services	4.9	8.3	3.9	3.8	3.6	3.2	2.1
Non-Market Services	3.3	4.3	5.3	3.7	2.0	1.5	2.0
Health & Education	3.7	5.1	5.3	4.0	2.0	1.5	2.0
Public Administration	2.3	2.1	5.1	2.7	2.0	1.5	2.0
Total	1.9	5.0	3.2	2.0	1.2	1.1	0.9
Labour Force	1.9	3.4	3.0	2.6	0.9	0.9	0.8
Unemployment Rate ILO	9.6	8.0	4.2	5.5	6.2	4.8	4.3

The expected development in overall employment growth and the unemployment rate over the forecast horizon mask significant changes which are forecast in the composition of employment, driven by the changing structure of the Irish economy. The sectors of the economy that have experienced rapid output growth, including building, high-tech manufacturing and the services sector, fuelled the rapid levels of employment growth witnessed over the last decade. Table 4.9 summarises the details of our employment forecasts. Total employment is predicted to increase by 165,000 between 2008 and 2015. Of this increase in employment, 85 per cent will be in the services sector which will increase its share of total employment in the economy to 46 per cent by 2015. Previous *Reviews* have drawn attention to the unsustainable nature of the growth in employment recorded in the construction sector since the mid-1990s. As the residential market reverts to a sustainable level of house building and the level of government investment in the sector slows, we expect construction sector employment to contract by 17,000 between 2007 and 2009 and to remain flat thereafter.

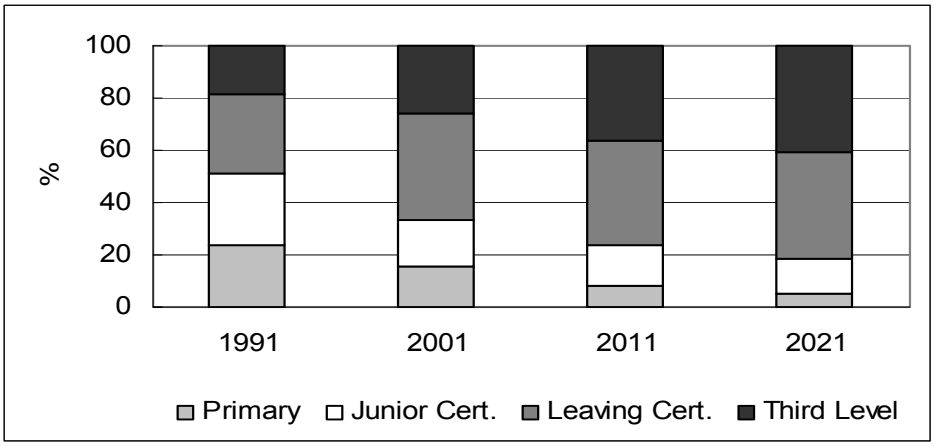
Overall, employment in the industrial sector is expected to decline over the forecast horizon. The high-technology sector, the engine of employment growth in the late 1990s, is expected to experience a slight contraction in the numbers at work between 2008 and 2015 as the industry matures, and lesser skilled jobs in the sector shift to lower cost economies. We expect the recent decline in the numbers at work in the traditional manufacturing and food processing sectors to continue over the forecast horizon. It is estimated that the numbers at work in these two sectors will

be 50 per cent lower than their 2007 levels by the end of the forecast period. The long established trend of shrinking employment in the agriculture sector is also forecast to continue. The numbers employed in agriculture are expected to decline by 17,000 in the medium term from 110,000 in 2007 to 93,000 in 2015.

It is clear, therefore, that the Irish economy will not be relying on the industrial sector as the source of employment growth in the years ahead. Instead, as noted earlier, the market services sector will become the dominant sector of the economy in terms of employment. Employment growth in the market services sector is expected to continue to outperform that achieved in other sectors of the economy over the forecast horizon. Within the market services sector, we estimate that employment growth in business and financial services will be higher than in distribution or transport and communications. Employment in the business and financial services sector alone is expected to reach 579,000 by 2015, 65,000 more than will be employed in industry. Employment growth in the non-market services sector is expected to remain steady at around 2 per cent over the forecast horizon. By 2015, 26 per cent of total employment will be in the non-market services sector.

By 2015, the market services and non-market services sectors combined will account for 72 per cent of total employment. These activities are human capital intensive and require a high-skilled labour force. In contrast, as the numbers employed in agriculture, traditional manufacturing, food processing and building decline over the forecast horizon, the level of low-skilled employment is expected to fall.

Figure 4.19: Labour Force by Educational Attainment



Thus one of the important consequences of the shift to a services driven economy will be the increase in the demand for skilled labour. Figure 4.19 shows the forecast change in the level of educational attainment of the labour force. The proportion of the labour force with primary education is expected to continue its gradual decline to stand at just 4.9 per cent by 2021. In contrast, the numbers with Leaving Certificate and third level qualifications are expected to increase over the forecast period. By 2021, 41 per cent of the labour force will hold a third level qualification, up from 18 per cent in 1991.

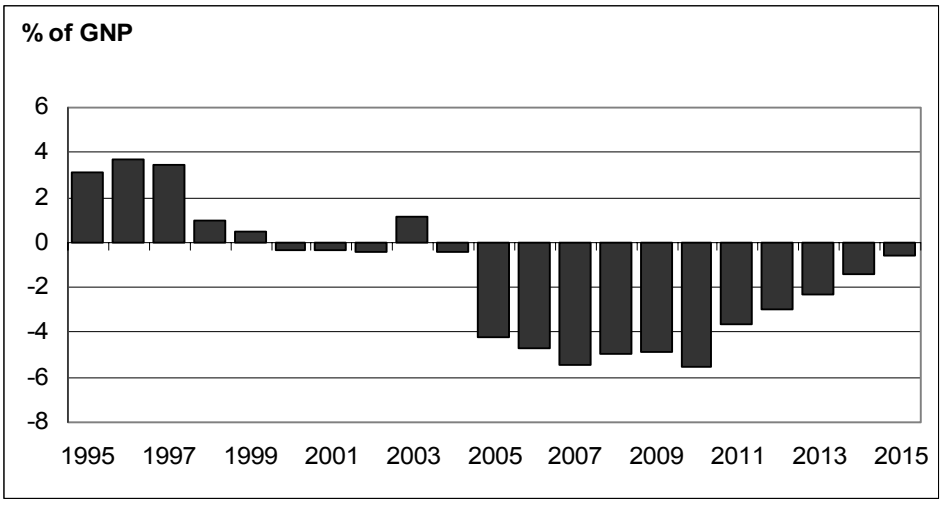
Since the late 1990s, robust economic growth and high wage rates have attracted significant inward migration to Ireland. The importance of migration to labour force growth is shown in Figure 4.3. The majority of this immigration has been high skilled with immigrants having a higher level of educational attainment than the native population (Barrett *et al.*, 2006). The effect of this immigration has been to ease labour shortages in key sectors of the economy and dampen wage inflation. This resulted in excess demand for unskilled labour which reduced wage dispersion between skilled and unskilled labour and helped lower unemployment (Barrett, Fitz Gerald, and Nolan, 2002). The current slowdown in the economy is expected to reduce net immigration over the medium term. Predicated on a recovery in economic activity from the beginning of the next decade, a resumption of the skilled immigration of the type received to date will be important in ensuring that the forecast demand for skilled labour in Ireland's services driven economy is satisfied.

4.6 The Balance of Payments, Public Finances and Savings

THE BALANCE OF PAYMENTS

The strength of the Irish economy resulted in the current account of the balance of payments averaging a surplus equivalent to 1.9 per cent of GNP between 1995 and 2000. However, this surplus was reversed in 2000 and for much of the period 2000-2005 the Irish economy recorded a deficit, albeit small, on the current account. However, the deficit increased substantially in 2005 reflecting a sharp decline in other factor income. The deficit on the current account is expected to average 4.8 per cent per annum between 2005 and 2010 before improving to an annual average of 2.6 per cent between 2010 and 2015 (Figure 4.20).

Figure 4.20: Balance of Payments Current Account as a Percentage of GNP



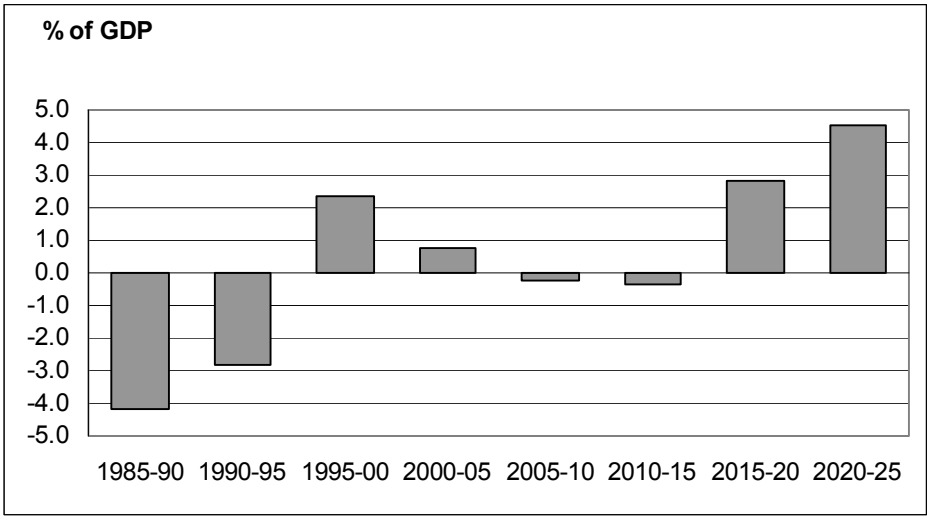
PUBLIC FINANCES

The surplus experienced by the Irish public finances was much lower in the first half of this decade than was the case in the latter half of the 1990s. The current period has seen the public finances move back into deficit, albeit to a much smaller extent than in the 1980s. Our projections for the

public finances are broadly positive. On the back of slower economic growth and reduced activity levels in the housing market we forecast a widening of the deficit between 2010 and 2015, moving from an annual average of 0.2 per cent of GNP between 2005 and 2010 to an average of 0.3 per cent of GDP in the period 2010-15. On the basis of these annual averages the decline appears modest but on an annual basis the impact of the slowdown in economic activity is more visible. The general government deficit is forecast to be 2 per cent of GDP in 2009. With a recovery in the economy in 2010 the pressures would ease somewhat. However, it is also assumed that fiscal policy is tightened in 2010 in order to eliminate this deficit under normal growth conditions. This would still leave a small deficit out to 2014 with the public finances moving into increasing surplus thereafter.

As part of the tightening of fiscal policy in 2010, it is assumed that a carbon tax is introduced impacting those sectors of the economy not affected by emissions trading (See Box 4.1). In addition, it is assumed that the revenue from auctioning all permits accrues to the government from 2013 onwards. The rate of carbon tax is discussed in Chapter 5. By 2013 the revenue from this source would amount to 0.6 per cent of GNP. It is assumed that changes in taxation on personal income between now and 2011 will raise the proportion of personal income paid in taxation by 1.5 percentage points by 2011. On the expenditure side it is assumed that the rate of growth in employment in the public sector is cut from around 3 per cent in 2009 to 2 per cent in the years to 2015 (and to 1.5 per cent to 2020). The average growth in public employment in the 2005-2010 period is forecast at 3.7 per cent. This represents a substantial tightening in the stance of public policy reflecting the forecast slower trend growth in output in the next decade.

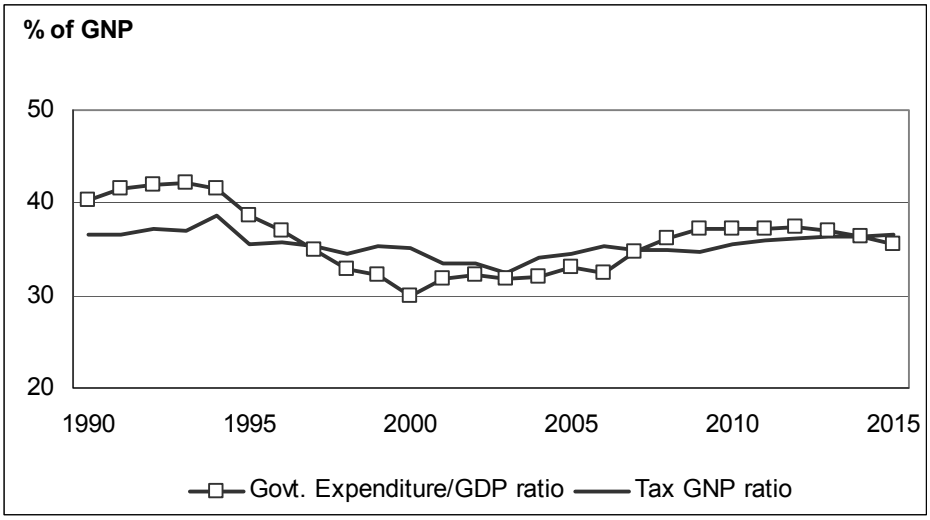
Figure 4.21: Government Budget Balance, as a Percentage of GDP



It is assumed that the bulk of the infrastructural investment is completed by 2020, five years after the date assumed in the last *Medium-Term Review*. Under the assumptions set out above, as shown in Figure 4.22, government expenditure as a share of GNP is assumed to peak in 2010 and fall slowly thereafter. However, the decline is moderate reflecting an increased public preference for public consumption, especially in the area of health. Some of the costs of the provision of public services will be met

by increased charges. It is assumed that from 2010 to 2013 there will be a gradual introduction of charges for parking, use of urban road space, disposal of waste, water charges etc. rising to 1 per cent of GNP in 2012.

Figure 4.22: Government Expenditure and Taxation as a Percentage of GNP



Box 4.1: The Macroeconomic Effects of the Carbon Tax

Previous studies have shown that, for realistic levels of carbon tax, where the bulk of the revenue is recycled through a reduction in taxes on labour, the impact on GNP is mildly favourable (Fitz Gerald and McCoy, 1992 and Fitz Gerald, Hore and Kearney, 2002). Even with the changed behaviour of the labour market and its effects on the incidence of taxation, we still find that the carbon tax (cum revenue recycling) assumed in the *Benchmark* forecast would be likely to marginally increase the rate of growth in the medium term.

On the assumption that all the revenue from the carbon tax (and from the auctioning of permits) is used to reduce the average rate of personal taxation, there is no net effect on the government's finances. The reduction in direct taxes, and the consequent moderating impact on labour costs for firms, would more than offset the effects of the higher price of carbon, and hence energy, on the competitiveness of both the manufacturing and the market services sector. This would see output in 2020 rise by a cumulative 0.8 per cent in manufacturing and a cumulative 1.6 per cent in business and financial services relative to the *Benchmark* forecast. While positive, these effects are small. There would, of course, be more negative consequences for more carbon intensive sectors. However, the HERMES model shows that the negative effects on such firms would be more than offset by the positive effects for the vast bulk of the business sector that is competing on the global market. This reflects the decline in the carbon intensity of the Irish economy in recent years, discussed in Chapter 5. It also highlights again the importance of labour costs as a fundamental driver of the competitiveness of the Irish economy.

The combined effect of the carbon tax and the reduction in labour taxes would be to raise the level of GNP in 2020 by 1¼ per cent, with very little further impact thereafter. Total employment would increase by almost the same amount.

SAVINGS

The latter half of the 1990s saw the personal savings ratio fall so that by 2000 the ratio was at a low of 3.2 per cent of personal disposable income. However, the savings ratio recovered sharply in 2001 to 7.8 per cent. Having averaged 8.2 per cent between 2000 and 2005 the personal savings ratio is expected to average 6.1 per cent per annum between 2005 and 2010. On the basis of the economic and labour market forecasts outlined in this chapter, we do not expect this to change significantly. The personal savings ratio is forecast to average just over 6 per cent per annum between 2010-15 and 2015-20.

An important issue for the future is the level of consumer debt. Official statistics show strong growth in private sector credit and there has also been a substantial rise in the level of gross indebtedness of the Irish household sector. In recent years there has been a dramatic increase in gross indebtedness, primarily due to increased borrowing for housing purposes. Household debt increased from 68.9 per cent of personal disposable income in 2000 to 145.3 per cent in 2007. While this is high by historic levels in Ireland, it is not substantially out of line with debt-to-income ratios in other developed economies like the UK or the US. However, the increase in debt levels does mean that Irish households are exposed to any sharp rise in interest rates or income falls. These figures represent gross debt and so do not adjust for assets or savings by the personal sector. Although housing was the main contributing factor behind higher indebtedness, rising property values are also responsible for a substantial increase in household assets.

As shown in Box 4.2, in spite of the huge increase in gross borrowing by households, their net financial asset position actually improved between 2001 and 2006. To this improvement in their net financial position must be added the massive increase in their physical asset position through the acquisition of many new dwellings. This suggests that the household sector as a whole is in a very strong financial position in Ireland, rather different from the popular picture.

These data reflect the fact that for many older households the combination of their housing wealth and the accumulated value of their financial assets, especially in the form of pension funds, leaves them in a very strong financial position. It is younger households, who face heavy debts as a counterpart to their acquisition of new dwellings, who face a more difficult environment. However, even for such households, with interest rates remaining relatively low and with their continued employment, the burden of debt will be readily supported, and will tend to fall over time.

Box 4.2: Net Worth of Irish Households[56]

Much of the focus in recent years has been on the indebtedness of the household sector, particularly given the growth in private sector credit and borrowing for housing purposes. Another perspective is provided by CSO institutional accounts data. These data provide a more comprehensive picture by presenting a household balance sheet, which shows household assets as well as household debt.

The financial liabilities of the Irish household sector are on a sharply rising trend. By 2006, these liabilities had increased by 181 per cent since 2001 to €176.3 billion. It is worth pointing out that the increase is in the context of very strong economic growth, with strong growth in employment and after tax incomes. A major contribution of the CSO sectoral accounts data is that they allow us to look at both sides of the balance sheet of Irish households. Over the same period, 2001-06, the financial assets of Irish households rose by 71 per cent to €308.2 billion.

Financial Balance Sheet, Household Sector, 2001-06

	2001	2002	2003	2004	2005	2006
Financial Assets	180.4	185.5	214.9	240.1	277.0	308.2
Financial Liabilities	62.8	75.4	89.7	112.3	146.0	176.3
Net Financial Assets	117.7	110.1	125.2	127.9	131.0	131.9

Source: CSO, *Institutional Sector Accounts, Financial 2001-2006*.

A breakdown showing the composition of financial assets indicates that households now have large holdings of currency and deposits, which account for approximately 30 per cent of household financial assets. Insurance policies and pension fund assets account for about 43 per cent. The balance is accounted for by shares and other equity assets. The majority of household liabilities are in the form of loans, predominantly long-term loans. If account is taken of housing assets then the picture is one of a substantial increase in the net asset position of the Irish household sector. Thus, much of the increase in liabilities has been used by households to accumulate housing assets. Even allowing for the current decline in house prices, the net financial position of Irish households remains positive.

[56]For a detailed analysis see Kelly, J., M. Cussen and G. Phelan, 2007. "The Net Worth of Irish Households – An Update," CBFSAI *Quarterly Bulletin 3*.

Figure 4.23: Personal Savings Ratio, as a Percentage of Disposable Income

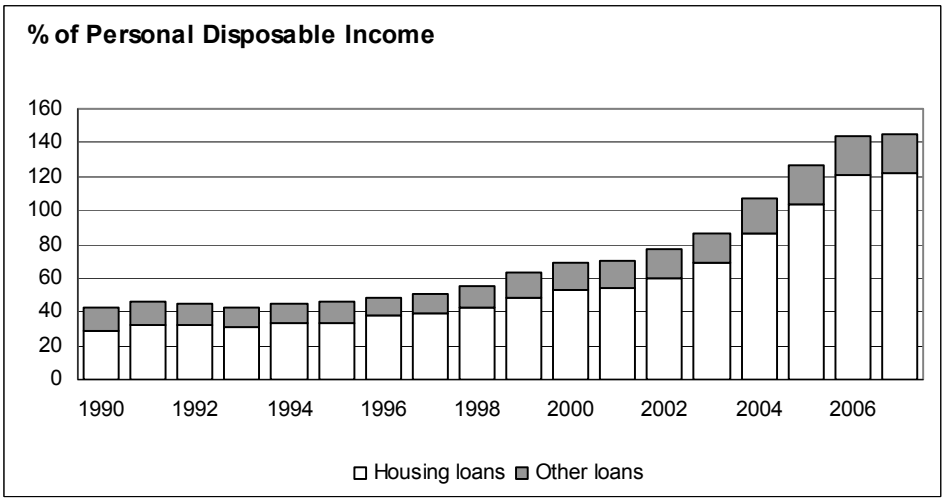
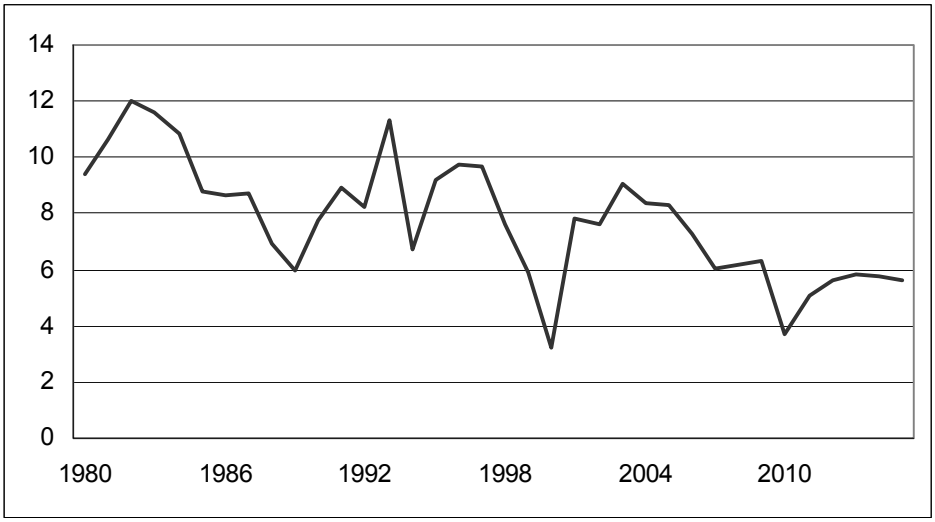


Figure 4.24: Household Gross Debt



4.7 The Housing Market

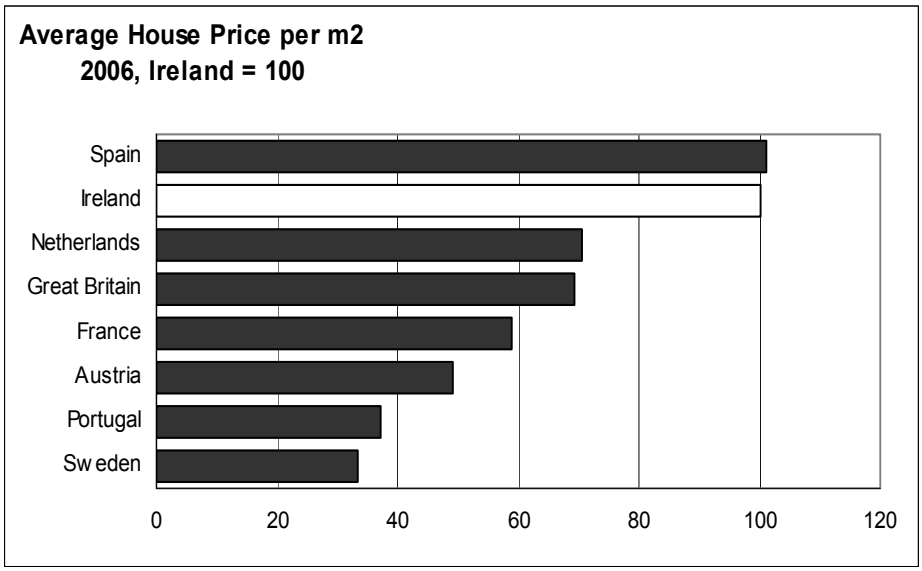
The fortunes of the Irish housing market have changed substantially since the last *Medium-Term Review*. Having risen dramatically in the late 1990s house prices continued to appreciate in the first half of this decade. The scale of the increases and the length of the boom in the housing market prompted concerns about the sustainability of the housing market and its vulnerability to a shock. Ireland has one of the highest proportions of owner-occupiers in the EU. The recent Census shows the proportion of private households in Ireland that are owner-occupied stands at 77 per cent, down slightly from the 79.8 per cent recorded in *Census 2002*.

More recently house prices have declined steadily and at the beginning of 2008 were estimated to be down by around 9 per cent compared with the same period in 2007. The performance of the Irish housing market is against the backdrop of an economy that has also grown very strongly in recent years. Although the economy is slowing, at present it seems likely

that most of the economic drivers of the housing market will remain positive over the next few years. The forecasts for the economy suggest that house price growth will be much more moderate than that seen over the past 10 years. Between 2005 and 2010 house prices are expected to grow by an annual average of 3.2 per cent and by an average of 3 per cent per annum over the rest of the forecast period. However, the comparison shown in Figure 4.25 indicates that the lower growth rate in Irish house prices will be from a much higher price level than many other European countries.

Current and expected personal income are important factors determining the demand for housing. Between 1995 and 2000 annual average growth in house prices was much higher than growth in disposable personal income per head and, although the gap narrowed, this differential remained in place between 2000 and 2005. As a result, the ratio of personal disposable income per head to new house prices showed a deterioration in affordability over that period. However, the forecasts in this *Medium-Term Review* indicate that in the current period, 2005-10, annual average growth rates in these two variables will be much more closely matched. The recent decline in house prices coupled with continued income growth suggests an improvement in affordability. Our view is that once the current housing market correction has occurred house prices will grow by much more moderate rates than those experienced between 1995 and 2005 and so further improvements in affordability are forecast.

Figure 4.25: Average House Price Per m^2, 2006, Ireland = 100



Source: ERA Europe.

Entry to EMU resulted in a sharp downward adjustment in Irish interest rates. However, the rise in house prices has been such that this did not result in improvements to the affordability of homeownership. Despite this, the demand for housing remained strong. One explanation is provided by the trend in the user cost of housing. The user cost of housing, or the rate of return, provides a measure of the cost of owning a house and aims to take account of the role played by capital appreciation, taxation, indebtedness and expectations. A basic calculation approximates user cost based on the mortgage interest rate minus the change in house prices. This

shows that the user cost of housing has fallen since 1992 and is estimated to be negative between 1996 and 2006 because of the growth in house prices. Houses, although highly priced, remained attractive because of low real interest rates and expected capital gains, resulting in housing being a very profitable investment. However, recent falls in house prices and the expectation that future house price growth will be low means that this will not support housing demand to the same extent over the next few years. The steady increase in interest rates has been a factor behind the current slowdown in the housing market. Having kept interest rates steady for around two years the European Central Bank (ECB) began to increase interest rates in December 2005. This was followed by a series of interest rate increases during 2006 and into 2007. The effect of this has been to add 2 percentage points to official interest rates compared to where they were, with a knock on impact on mortgage rates. Such a steady increase in interest rates has had a negative impact on affordability, particularly for recent entrants into homeownership.

Figure 4.26: House Price to Personal Disposable Income Per Head Ratio

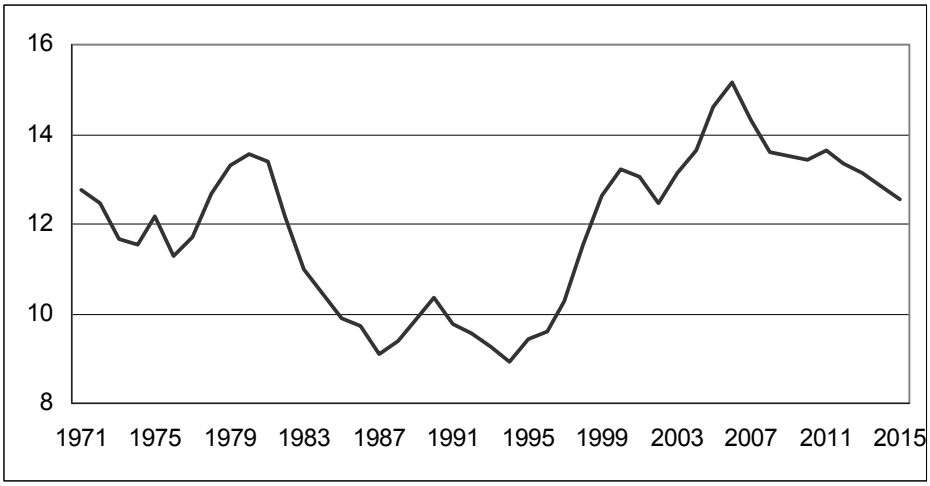


Figure 4.27: User Cost of New Houses, 1972-2015

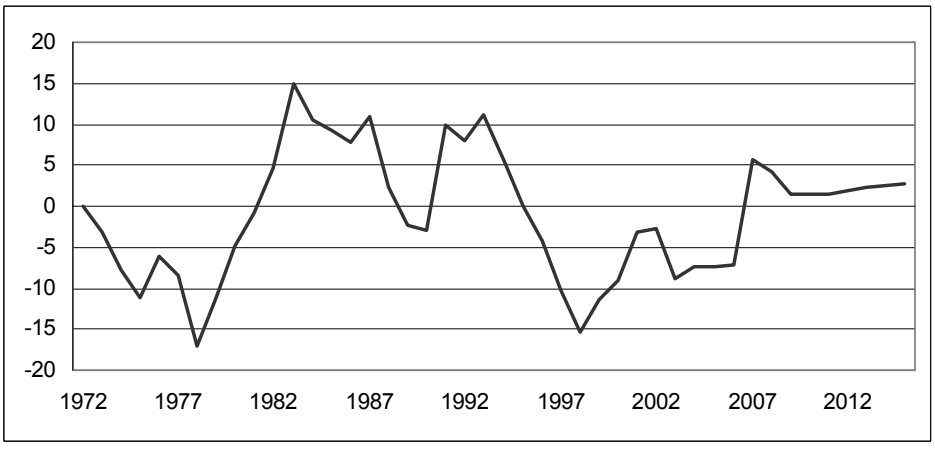


Table 4.11: Decomposition of Housing Demand, Thousands, Annual Averages

	1991-1996	1997-2002	2003-2006	2007-2011	2012-2016
Population Growth	16.5	20.0	19.8	22.2	22.8
Change in Headship	3.1	0.9	8.2	8.2	7.9
Migration	0.0	5.9	17.5	9.0	5.3
Vacant	0.1	6.4	19.7	7.1	5.6
Obsolescence	4.9	11.6	13.4	7.0	7.0
Dwellings Built	27.0	48.0	80.0	53.5	48.6

Table 4.11 shows a breakdown of housing needs into five main categories – the change due to population growth (rising number of adults), the change in headship (proportion of each age group who are heads of households), the change due to net migration, the change due to the demand for second dwellings and the change due to the replacement of obsolescent stock. Population growth, excluding the effects of migration, has been the main factor underpinning housing demand and this is expected to remain the case, contributing an annual average of over 22,000 units per annum to housing needs. The housing market boom prevented some young adults forming independent households and resulted in the rise in headship contributing less than 1,000 units per annum between 1997 and 2002. However, the expectation that house price increases would continue and would be higher than the cost of borrowing encouraged many adults to form independent households and as a result the rise in headship increased the demand for housing units by 8,200 per annum between 2003 and 2006. The number of units needed to meet this component of demand is expected to average around 8,000 units per annum over the remainder of the forecast period. The implied rise in headship in the forecast period will be supported by the anticipated fall in the real cost of dwellings over the same period. Net migration to Ireland rose substantially following the accession of the New Member States to the EU. This is reflected in the growth of the estimate of the number of housing units required to meet demand from this factor, an annual average of 17,500 units between 2003 and 2006. On the basis of the levels of migration assumed as part of this forecast (a net inflow averaging 15,000 per annum) there will be a need for 9,000 dwellings a year between 2007 and 2011 and 5,300 dwelling per annum in the period 2012-16. Rising standards of living have also increased the demand for second dwellings, i.e., holiday homes. The most recent Census records 49,789 dwellings as holiday homes. When vacant dwellings are included the Census records a vacancy rate of 15 per cent of the housing stock. The forecasts in this chapter anticipate that income growth is to slow and so we expect that the demand for second dwellings will make a lower contribution to housing demand over the period, averaging 7,100 units per annum between 2007 and 2011 and 5,600 units a year between 2012 and 2016. With regard to the replacement of obsolescent stock we conservatively estimate that this will add 7,000 units per annum to housing demand over the forecast period. This would represent a return to the levels of replacement stock required during the 1980s and 1990s.

Box 4.3: The Housing Tenure of Immigrants in Ireland

Microdata from the CSO *Quarterly National Household Survey* allow us to examine headship rates and housing tenure for both Irish nationals and immigrants resident in Ireland. Immigrants are defined as individuals who describe themselves as born outside the Republic of Ireland and are not Irish nationals. Those who say that they were born in Ireland and describe themselves as Irish nationals are the "native" population. To be included an individual must be aged 20 years or over. In order to ensure sufficient responses are available the microdata for 1993 and 1994, 2003 and 2004, and 2005 and 2006 are merged.

Table 4.3.1 shows that headship rates (proportion of each age group who are heads of households) are lower for immigrants in the later period for those in the 25-54 year age groups than they were in the mid-1990s. However, they are surprisingly close to those for natives, indicating that the flow of immigration added substantially to the demand for dwellings.

Table 4.3.1: Headship Rates, Percentage of Age Cohort Who Are "Heads of Households"

	Native			Immigrant		
	1995[1]	2004[2]	2006[3]	1995[1]	2004[2]	2006[3]
Years	%	%	%	%	%	%
20-24	14.4	16.6	17.0	31.9	33.4	33.0
25-34	39.3	40.1	40.5	47.3	44.5	41.1
35-44	50.8	51.5	51.7	53.1	52.4	48.7
45-54	54.1	52.5	53.0	54.2	54.1	49.8
55-59	56.7	54.4	54.1	64.7	57.2	62.2
60-64	60.8	55.9	56.9	55.9	58.5	57.3
65+	68.6	66.2	56.6	67.2	64.1	64.7

[1] *Labour Force Survey 1993 and 1994.*
[2] *QNHS 2003 and 2004.*
[3] *QNHS 2005 and 2006.*

When examining housing tenure we use those who identify themselves as household heads. The data shows that the homeownership rate amongst immigrants has fallen from 46.3 in 2004 to 36.7 in 2006. This decline has occurred at a time when native homeownership rates have remained broadly stable at around 83 per cent. The data do not directly allow us to ascertain what has caused the decline. However, we can explore if there have been changes in the composition of migrants in Ireland since 2004 and the opening of the EU to the New Member States (NMS).

NMS immigrants now account for nearly 22 per cent of immigrant household heads. These immigrants tend to be younger, 76 per cent are aged under 34 years old compared with 38.3 per cent of other immigrants. Just under 38 per cent of NMS immigrants have a third level qualification, compared to just under 50 per cent of other immigrants. Of NMS immigrants 56 per cent indicate that they are single compared to 31.6 per cent of other immigrants. Nearly all NMS immigrants (99.5 per cent) indicate that they have been in Ireland for less than 10 years. In contrast 69.4 per cent of other immigrants are resident less than 10 years. Detailed year of arrival data shows that 66 per cent of NMS immigrants arrived in Ireland since 2004 compared to 16.3 per cent of other immigrants.

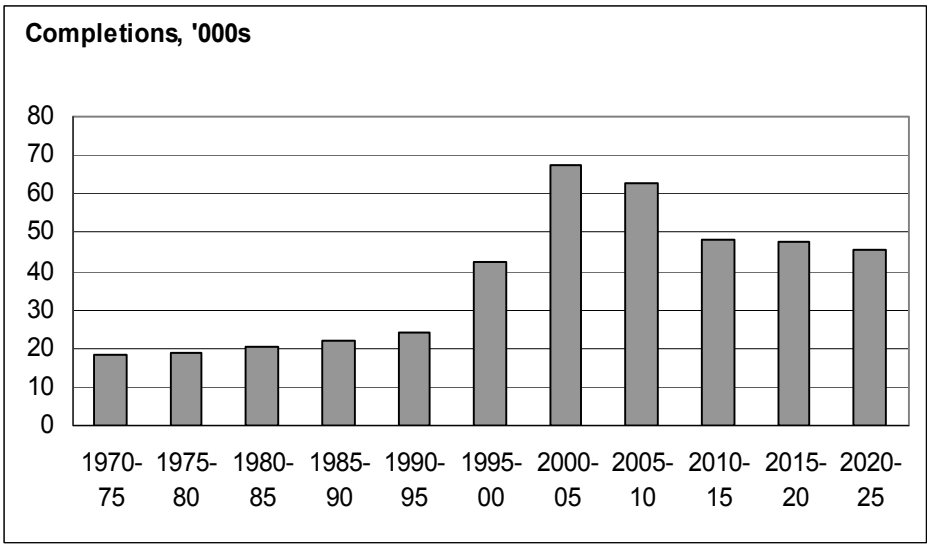
A contributing factor to the decline in homeownership is the changing mix of immigrants to Ireland. Many immigrants now in Ireland have only recently arrived and may not have decided on their long-term plans or

made a long-term decision about housing tenure. Other reasons may exist as to why immigrants have a lower homeownership rate than natives and these are outlined in Duffy (2007). They include preferences and may also include difficulties accessing financial services and affordability constraints.

A factor that may become more important in the current financial environment is the availability of credit and mortgages to individuals and households. If banks have to raise interest rates or tighten lending conditions in the face of funding constraints this will have a negative impact on the supply of credit.

The housing sub-model also forecasts housing completions, with one of the main drivers being the change in new house prices. In recent years there has been a large increase in the number of housing units completed as developers responded to the boom in the housing market. On the basis of a forecast slowdown in economic growth and slower house price growth the level of housing completions is expected to moderate. However, as illustrated in Table 4.11 the economy has an underlying need for an annual average of around 50,000 units per annum in the period to 2016.

Figure 4.28: New House Completions



5. ENERGY, ENVIRONMENT AND TRANSPORT

5.1 Introduction

Energy has always been a part of the ESRI forecasts for the economy, although it has received more or less attention depending on public perceptions and economic circumstances. The extension of the modelling and forecasting of fossil fuel use to carbon dioxide emissions is more recent (Fitz Gerald *et al.*, 2002). In the previous *Medium-Term Review*, we introduced a detailed treatment of the power generation sector. In the current *Review*, we extend previous forecasts in three areas. First, we include greenhouse gases other than carbon dioxide. In fact, we have modelled many emissions to air, but are able to show only selected results in this chapter. Second, we provide more detail on the transport sector. Third, we forecast waste and its disposition.

There are two reasons for the expanded treatment of the environment. The first is that environmental care and particularly greenhouse gas emission reduction is high on the political agenda and important in the Irish mind – in sharp contrast to previous years. The public profile of climate change was stimulated by the release of the *Stern Review on the Economics of Climate Change* (Stern *et al.*, 2006; cf. Yohe and Tol, 2007), the publication of the *Fourth Assessment Report* of the *Intergovernmental Panel on Climate Change*,[58] the success of the Oscar-winning movie *An Inconvenient Truth*, and the Nobel Peace Prize shared by Albert Gore and the IPCC.

Following the 2007 election, the Green Party entered into government. This increased the political profile of environmental issues. The emphasis is again on climate change, with substantial emission reductions advocated in the Programme for Government. The European Union has also announced ambitious plans for greenhouse gas emission reduction – and in the current proposals Ireland faces the strictest targets of all Member States. The EU National Emissions Ceilings Directive already imposes targets for emissions of sulphur, oxides of nitrogen, ammonia, and volatile organic compounds. Some of these targets may be difficult to meet. The EU Landfill Directive sets tough targets for waste.

The second reason to pay increased attention to environmental issues is that the plans and policies for environmental protection are couched in terms of specific targets or limits on emissions. If these targets or limits are

[58] http://www.ipcc.ch/

to be achieved, policies will need to be implemented that would potentially affect the rate and pattern of economic growth. Chapter 4 shows that this is the case. The tax on carbon dioxide emissions allows for income taxes to be below what they otherwise would have been. This increases the competitiveness of the Irish economy, and thus leads to higher employment and faster economic growth. Other policies may have a different impact on economic activity.

This chapter presents forecasts of energy use; power generation; transport, greenhouse gas and sulphur dioxide emissions; and waste. These forecasts necessarily make assumptions about future policy. In the set of models used in this exercise, we can only implement changes based on policy instruments. We cannot impose policy targets. For climate and energy, we assume:

- that there will be a domestic carbon tax;
- that this tax will cover all carbon dioxide emissions that are not already regulated by the EU Emissions Trading Scheme (ETS);[59]
- that the carbon tax will equal the projected permit price (Table 5.1); and
- that a similar tax will be levied in other EU countries, so that there are no effects on the competitiveness of Irish firms and farms relative to the rest of Europe.

For waste, we assume that prices of collection, recycling and disposal remain constant in real terms, incineration capacity expands as currently planned, and that incentives will eventually be put in place to ensure that waste will be incinerated.

To date, Irish policymakers have emphasised the formulation of targets for environmental protection rather than developing and implementing policies for emission reduction. The setting of goals is a necessary first step, but objectives will not be met without the use of instruments that change the actual behaviour of people and companies.

We decided to include a domestic carbon tax in the *Benchmark* forecast for several reasons. A carbon tax is anticipated in the Programme for Government, and the Commission on Taxation is studying a carbon tax at the time of writing. There is virtual consensus amongst economists that a carbon tax is the most appropriate policy instrument to reduce greenhouse gas emissions. The cheapest way to meet any emissions target is to price all emissions at the margin at the same rate. Besides economic efficiency, uniform carbon prices also adhere to the basic notion of fairness to treat like cases alike. More specifically, everybody pays the same amount per tonne of carbon. Uniform emission pricing can be achieved by taxes, subsidies, or tradable permits. Subsidies reduce emissions as much as taxes or tradable permits in the short run, but subsidies lead to higher emissions in the long run. For stock pollutants like greenhouse gas emissions, the impact of the uncertainty about the costs and the benefits of the policy

[59] This tax covers only carbon dioxide emissions and not other greenhouse gas emissions such as methane and halocarbons. Agricultural emissions are, therefore, essentially not affected by the tax.

intervention is much more favourable for taxes than it is for permits (Weitzman, 1974). A carbon tax is, therefore, the instrument of choice for reducing greenhouse gas emissions.

However, the European Union has created an Emissions Trading System (ETS), and Ireland is participating in it. The ETS covers carbon dioxide emissions from power generation, cement production, the pulp and paper industry, and aluminium production.[60] That is, the price of carbon is not uniform. For example, it is currently €23.18/tCO_2 for electricity and 0 for transport.[61] If transport and other sectors were included in the ETS, a uniform carbon price would arise automatically – but it is unlikely the European Union will decide to do this during the forecast period of the current *Medium-Term Review*. An alternative way to create a uniform carbon price is to set the domestic carbon tax equal to the ETS permit price.[62] In order to prevent double regulation, sectors that are covered by the ETS should be exempted from the carbon tax.[63]

5.2 Energy Demand

Table 5.1 summarises the main assumptions on energy prices for 2012, 2020 and 2025. Our assumptions on energy prices are derived from the International Energy Agency's forecasts. Together with the level of economic activity and technical progress, these drive the demand for energy.

Table 5.1: Energy Price Assumptions

	2007	2012	2020	2025
Oil price $ a barrel, nominal	70.5	73.9	90.5	110.3
Coal price € a barrel, nominal	51.5	52.0	66.9	77.7
Exchange rate $/€	1.37	1.42	1.42	1.42
Carbon price (2004 €/tCO_2), real	0.12*	20.8	38.2	49.0
Carbon tax (2004 €/l petrol), real	0	0.05	0.09	0.11
Average annual per cent change		**2007-2012**	**2012-2020**	**2020-2025**
Oil price, nominal growth in €		0.2	3.2	3.0
Coal price, nominal growth in €		1.2	1.7	1.5
Inflation rate		2.0	2.0	2.0
Oil and gas price, real growth		-1.8	1.2	1.0
Coal price, real growth		-0.8	-0.3	-0.5
Peat price real growth		0.0	0.0	0.0

* The price of carbon fell steadily through 2007, from 5.53 €/tCO_2 on January 2 to 0.02 €/tCO_2 on December 28; the price quoted here is for the middle of the year http://www.eex.com/

[60] Aviation will be added in 2012.

[61] April 30, 2008; http://www.eex.com/

[62] Note the carbon price in the ETS has been volatile while taxes are typically fixed for the budget period. One solution would be to change the carbon tax every year, and set the carbon tax equal to the futures price of carbon at the time that the budget is announced.

[63] A domestic carbon tax on emissions regulated under the ETS would reduce emissions in Ireland, but would increase emissions elsewhere in Europe by the same amount. The costs of compliance would increase both in Ireland and elsewhere (Tol, 2007).

On the basis of our assumptions, demand for energy is expected to continue to grow in the medium term, albeit at a slower rate than during the past fifteen years (Tables 5.2 and 5.3). Total Final Energy Use is expected to rise above 17.7 million Tonnes of Oil Equivalent (TOE) by 2025, an increase of almost 35 per cent over the 2005 level. Average annual increases will be between 1.6 per cent and 1.9 per cent for each five-year period out to 2025. The transport sector sees the strongest growth in energy use. We expect an increase of almost 60 per cent between 2005 and 2025. We also expect to see strong growth in the energy use of household and services sectors rising to 47 per cent and 43 per cent above their respective 2005 levels. Industry is the only sector where we expect to see a decline, of 2 per cent by 2025. Oil will remain the country's dominant energy source. Its share of final energy use is not expected to deviate much from the 65 per cent observed for 2005. Thus it will make up the bulk of increases in absolute terms. However, the greatest relative increase should be observed for gas consumption, where we forecast 75 per cent growth over its 2005 level by 2025.

Table 5.2: Final Energy Use by Sector, Thousand TOE

		Average Annual Growth Rates						
	2005 Level	**1990-1995**	**1995-2000**	**2000-2005**	**2005-2010**	**2010-2015**	**2015-2020**	**2020-2025**
Household	2,954	-0.4	2.6	3.2	2.5	1.7	1.7	1.8
Industry	2,641	2.8	5.2	0.8	-0.3	-0.4	0.0	0.2
Services	1,702	1.6	4.6	4.5	3.9	0.8	1.4	1.2
Agriculture	339	6.2	-1.4	1.4	-0.4	1.0	1.0	1.0
Transport	5,031	3.4	11.3	4.3	2.1	2.7	2.5	2.1
Total	**12,668**	**2.0**	**6.2**	**3.2**	**1.9**	**1.6**	**1.7**	**1.6**

Table 5.3: Final Energy Use by Fuel, Thousand TOE

		Average Annual Growth Rates						
	2005 Level	**1990-1995**	**1995-2000**	**2000-2005**	**2005-2010**	**2010-2015**	**2015-2020**	**2020-2025**
Coal	435	-18	4.6	1.8	-8.9	-5.2	-4.6	-4.3
Oil	8,196	4.4	7.5	3.0	1.5	2.0	1.9	1.7
Gas	1,485	7.0	8.6	4.3	4.4	1.9	2.4	2.7
Peat	274	-4.2	-13.1	-2.0	-1.3	-4.9	-4.9	-4.8
Renewables	184	-3.1	5.1	9.3	0.2	-0.1	-0.1	-0.1
Electricity	2,094	4.6	6.4	3.7	3.9	1.4	1.4	1.1
Total	**12,668**	**2.0**	**6.2**	**3.2**	**1.9**	**1.6**	**1.7**	**1.6**

Final energy use in the services sector has grown at an average annual rate of about 4.5 per cent since 1995, but increases in energy consumption in the sector will see a marked slowdown after 2010. Increases in household consumption will also moderate after 2010, settling to a level of average annual increases in line with overall final energy use. In recent years the industrial, services and household sectors have consumed roughly similar quantities of electricity. However, the share of electricity consumed by services is expected to reach 41 per cent by 2015 compared to

household use of 30 per cent and industrial use of just 26 per cent. A similar pattern for gas consumption will mean that the services sector should overtake industry as the second largest consumer of gas (after households) late in the next decade. Final energy use in agriculture is forecast to decline at a rate of 0.4 per cent between 2005 and 2010. However, for the remainder of the forecast period it is expected to grow at an average annual rate of 1.0 per cent.

Oil will continue to be the dominant fuel in transport, while electricity, the only alternative, will remain only a minor contributor, making up less than 0.1 per cent of total final energy use. However, oil use in services will decline rapidly over the forecast period. In industry, oil use will decline during 2005-2010 after which it will show small increases. Oil will remain the main fuel used in agriculture, but electricity will see its share increase from 16 per cent in 2005 to 22 per cent in 2025. The use of both coal and peat will steadily decline over the forecast period, with both reaching a share of just 0.7 per cent of total final energy use by 2025. Apart from electricity generation, the use of renewables will change little between 2005 and 2025, assuming that there is no significant adoption of bio-heat.

5.3 Power Generation

A new all-island electricity market, including both the Republic of Ireland and Northern Ireland, started in November 2007. It compensates electricity generators directly for the fuel and carbon costs of the electricity they produce. It also incentivises generators through the use of capacity payments, which are designed to help cover their capital costs and encourage an efficient use of available generating plants.[64] Electricity generation is a large consumer of primary energy in Ireland. Demand for electricity is also growing rapidly; new investments are needed to meet this demand and replace older infrastructure.

MAIN ASSUMPTIONS

Table 5.4 shows the assumed commissioning and decommissioning of plants out to 2025. The commissioning and decommissioning schedule out to 2013/2014 is based on:

- EirGrid's 2008-2014 Generation Adequacy Requirement (GAR);
- The System Operator of Northern Ireland (SONI) Seven Year Statement 2007-2013 (SYS);
- The June 2007 Asset Strategy Agreement between ESB and CER;
- An additional 500 MW interconnector running from Wales to the Republic of Ireland in 2012.

Additional thermal plants are needed in 2020 and 2025 in order to maintain the reliability of electricity supply. Specifically we assume that an extra 400MW Combined-Cycle Gas Turbine (CCGT) will be commissioned by 2014 and another one by 2020, and that two 200MW Open-Cycle Gas Turbines (OCGT) will come online by 2020 (one of which will be in Northern Ireland). We also assume that Moneypoint will

[64]More information on the single electricity market can be found at www.allislandmarket.com.

be closed by 2025, to be replaced by a new conventional 1,000MW coal-powered plant, and that a further 500MW interconnector will be in place by 2025, bringing the total capacity of interconnection with Great Britain to 1,400MW. We further assume that Great Britain will be able to export electricity to Ireland when needed.[65] With respect to renewables, we follow the central scenarios of the 2007 Grid Study and assume that wind generation capacity on the All-Island system will increase from about 1,000MW available at the beginning of 2008 to 4,000MW by 2020 and 4,700MW by 2025. We also assume that starting in 2012 about 10 per cent of the energy produced by peat plants will come from burning biomass, but that peat plants lose their "must run" status.

Table 5.4: Commissioning/Decommissioning Schedule for All-Island Market

Plant Name	Capacity (MW)	Commissioning Date	Decommissioning Date
Poolbeg 3	242		2007
Great Island	216		2008
Poolbeg 1&2	219		2009
Marina	27		2009
Tarbert	590		2009/2010
Ballylumford (NI)	340		2013
Kilroot (NI)	390		2019
Aghada	270		2019
Moneypoint	845		2024
Aghada (CCGT)	431	2010	
Whitegate (CCGT)	445	2011	
Interconnector	500	2012	
Quinn (CCGT)	400	2014	
Incinerator	60	2014	
Kilroot (CCGT) (NI)	430	2020	
OCGT (NI)	200	2020	
OCGT	200	2020	
CCGT	400	2020	
Coal (w/o CCS)	1000	2025	
Interconnector	500	2025	
Total shut down			3139
Total new capacity		3566	
Total new interconnector		1000	

Using these assumptions and the model described in Box 5.1, we calculated the fuel mix for power generation for 2012, 2020, and 2025, given the existing technology. The results are shown in Table 5.5.

[65] Specifically, we assume that generation capacity in Great Britain will grow at the same rate as electricity demand.

Box 5.1: Electricity Model

The model of the electricity generation market used in this *Medium-Term Review* reflects the new All-Island Market for wholesale electricity. This market started in November 2007 and includes both the Republic of Ireland and Northern Ireland.

A demand curve based on actual 2007 consumption determines the amount of electricity that is needed in each half hour of the year. *HERMES* estimates the rate of increase of demand for future years linking it to general economic growth.

The model is an optimal dispatch model. It details all the plants generating electricity in Ireland, their size, the type of fuel they use with its associated carbon content, their yearly availability and how efficient they are at converting fuel into electricity. It then determines the least costly schedule of generating plants needed to match electricity consumption for each half-hour of the year.

To determine the cost of electricity for the interconnector (and therefore determine if there are imports or exports to Great Britain), a simulation of the British system is also set up. We simplify the British wholesale electricity market and design a dispatch model for Great Britain that is similar to the one for Ireland, albeit less detailed. Generating plants that use the same type of fuel (e.g. coal or natural gas) are aggregated into a few large plants.

The simulations provide an estimate of which plants run and which fuels are used in the Republic of Ireland, the carbon dioxide associated with electricity production, and the level of Irish electricity trade. For a more detailed discussion of the model, see McCarthy (2005).

Electricity demand is forecast to continue to grow significantly up to 2025. By 2020 it will be 30 per cent higher than in 2005, and 37 per cent higher by 2025. As described above, most of the net increase in the electricity generation capacity will be powered by wind. Thanks to this large increase in wind, renewables reach 37 per cent of electricity generated by 2025, as shown in Table 5.5. Ireland thus meets this particular EU target without any difficulty. The very limited amount of biomass reflects the fact that it is used as a co-firing fuel in peat plants. Since peat plants do not have priority dispatch in this scenario, they run very little, therefore keeping the amount of biomass low as well.

The share of coal generation decreases as Moneypoint ages and becomes less competitive, especially when it is faced with increasing costs of carbon. The addition of an efficient new plant in 2025 drives the share of coal generation back up.

The large amount of wind mainly removes the need for additional natural gas generation, which would otherwise grow at a much faster rate. However, it might not be realistic to assume that large amounts of wind can be seamlessly accommodated on the electricity system. See Box 5.2 for more details. Finally, the increased size of electricity interconnection to Great Britain allows for significant imports of electricity over time, as well as limited exports. Net imports from Northern Ireland and Great Britain account for 14 per cent of total electricity consumption in 2012. In later years, net imports decrease, but still account for 8 per cent of total consumption in 2020 and 2025. If investment in power generation in Great

Britain does not keep up with demand growth, Ireland may become a net exporter of electricity – and prices and emissions would be higher than indicated in Tables 5.5 and 5.7.

Table 5.5: Power Generation

	2005	2012	2020	2025
Peak electricity demand (MW)	4,823	5,627	6,235	6,620
Real carbon price per tonne, 2004€	17.6[66]	20.8	38.2	49.0
Cost of carbon/KWh 2004 €	0.09	0.09	0.16	0.21
Imports (KTOE)	176	397	253	304
Exports (KTOE)	0	5	24	68
Fuel Used in Power Generation				
Coal (%)	27.8	24.6	9.9	22.8
Oil (%)	15.2	0.0	0.0	0.0
Gas (%)	40.1	46.8	56.0	40.3
Peat (%)	10.0	0.08	0.06	0.02
Landfill gas (%)	0.5	1.2	2.7	2.6
Hydro (%)	1.1	2.1	1.8	1.7
Wind (%)	1.9	25.2	29.5	32.6
Biomass (%)	0.0	0.01	0.01	0.0
Total (%)	100	100	100	100

Box 5.2: When Wind Power Might be Curtailed

Wind is a variable source of energy. It sometimes blows strongly and sometimes not at all. When this is coupled with the fact that storage of electricity is not economic, it means that the System Operator has to call on conventional plants to produce electricity when the wind slackens, but curtail conventional plants when the wind blows. This is not always possible. Conventional plants (such as coal-fuelled or gas-fuelled base-load plants, designed to run 24 hours a day) take several hours to warm up and be ready for production. Therefore a realistic scenario will see the occasional curtailment of wind energy, in order to keep conventional plants running and maintain the reliability of the electricity system.

To see what the effects might be on the share of renewables and on carbon dioxide emissions, we ran a scenario where base-load gas plants and coal plants run at least at their minimal stable capacity during the whole day. This means that wind is curtailed at times of low electricity consumption. Under this scenario, the generation share of renewable electricity in 2020 and 2025 reduces to 30 per cent (from 34 per cent) and 31 per cent (from 37 per cent) respectively and emissions from the electricity system increase by 17 per cent in 2020 and 16 per cent in 2025 relative to the *Benchmark* forecast.

[66] The price of carbon was very volatile in 2005, ranging from about €7/tonne to €30/tonne. We have taken an average price for the year, equal to €18/tonne of carbon (and deflated to 2004 prices).

Table 5.5 reports the cost of carbon per KiloWatt hour (KWh), which increases from €0.009/KWh in 2005 to €0.021/KWh in 2025. This compares to the current unit rate of €0.132/KWh for the domestic standard tariff (CER, 2007). In addition to the cost of fuel and carbon, electricity prices also cover the cost of power plants, the cost of transmission and distribution of electricity and the cost of retail to final consumers. The new power plants will add to the cost of electricity. The All Island Grid Study (Ecofys, 2008) suggests that the investment in renewable generation capacity (mostly wind-powered plants) will be of the order of €7 billion. To this we have to add the cost of the new thermal-generated plants. Finally, the electricity transmission network will need to be reinforced to accommodate the new plants and this will cost at least €1 billion (Ecofys, 2008). It is evident, therefore, that the price of electricity will rise.

EMISSIONS FROM ELECTRICITY GENERATION

The carbon emissions from electricity generation can be found in Table 5.7. Emissions in this sector started decreasing during the 2000-2005 period and are set to continue to fall until the advent of the new coal plant in 2025. As mentioned above, the coal plant in this scenario is a traditional coal plant. At a real price of carbon of €49/tonne it might be profitable to build a coal plant with carbon capture and storage instead.[67] This would undoubtedly be much more expensive, but it could save the economy between 5 and 6 million tonnes of CO_2 in 2025. Much will depend on the speed with which this new technology (carbon capture) is developed and the expected long-run price of carbon. Obviously, in making the decision on a replacement for Moneypoint, the assessment of the best option will depend very much on the expected price of carbon over the lifetime of the plant (out to 2050 and beyond).

The decrease in emissions of CO_2 reflects the increase in wind generation on the system, the addition of newer, more efficient gas-fuelled plants, and the decrease in the use of the most polluting fuels: peat and coal. Moreover, there is a large increase in electricity imports, which have no associated carbon emissions (in the Republic of Ireland). Box 5.3 discusses what CO_2 emissions would be in the absence of climate policy.

Emissions of sulphur dioxide are shown in Figure 5.6. Sulphur dioxide emissions from electricity have greatly decreased in Ireland. Moneypoint, the largest emitter, has installed desulphurisation equipment in 2007-2008, leading to a significant drop in emissions. Natural gas plants produce almost no sulphur dioxide during the electricity generation process.

[67] Although carbon capture and storage (CCS) is a compilation of proven technologies, the plans for building the first large-scale demonstration plants in the UK and USA have been postponed. It is uncertain whether CCS will be a proven technology when the Moneypoint replacement will be commissioned (around 2020) or, if not, whether the then government will underwrite the technical risk.

Box 5.3: The Impact of Climate Policy on Power Generation

In the *Benchmark* forecast, we assume that the spot price of carbon dioxide emission permits in the EU Emissions Trading System (ETS) will be as is currently foreseen by the futures markets of the ETS (up to 2012) and as is predicted by the European Commission (up to 2020). Table 5.1 shows the numbers, which entail a steadily rising carbon price.

We here use a radically different assumption: We set the price of carbon to zero.[68] The main purpose of this exercise is to distinguish the changes in the electricity sector induced by climate policy from the changes due to other reasons.

Table 5.3.1 compares the electricity sector in 2020 and 2025 for the two scenarios. We assumed that the investment in generation capacity and power grid is identical between the scenarios. Indeed, the planned expansion of wind power and interconnection may have more to do with market regulation than with climate policy. However, climate policy does imply that the invested capital is deployed in a different way.

Table 5.3.1: The Effect of Climate Policy on Power Generation

	2020	2025	2020	2025
Carbon cost/KWh 2004 €	0.16	0.21	0.0	0.0
Net imports (KTOE)	229	236	57	262
CO_2 emissions (000 tCO_2)	10,074	10,915	15,307	12,885
Fuel used in power generation				
Coal (%)	9.9	22.8	19.0	23.0
Gas (%)	56	40.3	41.6	33.0
Peat (%)	0.0	0.0	6.6	6.1
Renewables (%)	34.0	36.9	32.8	37.9

The main impact of carbon pricing is on peat. With a price of carbon in the order of €40/tCO_2, Ireland's peat stations only occasionally produce electricity. With a zero price, peat supplies 6 to 7 per cent of the power generated in the Republic of Ireland. Table 5.3.1 also shows that climate policy curtails the output of Moneypoint towards the end of its lifetime – but not of its assumed coal-fired successor. As a result, more electricity would need to be imported from the United Kingdom.

Finally, carbon dioxide emissions would be substantially larger if the price of carbon dioxide emissions permits were zero. In 2020, CO_2 emissions in electricity would be 50 per cent higher than in the *Benchmark* forecast. In the 2025, the difference is much smaller because the assumed new coal-fired power plant is able to compete, even with a €50/tCO_2 permit price.

[68] Boehringer and Loeschel (2003) and Svendsen (2005) discuss reasons why the permit price may be very low.

5.4 Transport

The transport sector includes all road transport (both passenger and freight), air transport (including international aviation) and rail, but it excludes other forms of transport such as sea shipping. Transport is a derived demand, in the sense that there is little transport performed for the sake of transport. People travel to get to and from places of work and leisure and goods are transported between their place of production and their market outlet. Energy use in transport has grown rapidly in the past ten years, as shown in Table 5.6. Between 1990 and 2005 growth in energy consumed in transport (measured in thousand tonnes of oil equivalent) was significantly higher than growth in GNP, although growth slowed to a level more into line with GNP growth after 2000.

Energy consumption in the transport sector is mainly accounted for by petrol (36 per cent in 2005), diesel oil (46 per cent in 2005) and kerosene (17 per cent in 2005) with negligible amounts of electricity, LPG and biofuel. Most of the kerosene used in the transport sector is to fuel jet aircraft for international travel. With the increase in domestic aviation and the expansion of low-cost international carriers such as RyanAir, the consumption of kerosene took off after 1995. However, the most rapid growth up to 2005 is in diesel consumption. It has outstripped the growth in GNP for the whole period between 1990 and 2005. Note that diesel fuels most of the freight vehicles transporting goods as well as all diesel-powered cars.

MAIN ASSUMPTIONS

The demand for transport is driven both by the level of economic activity and its cost, which is directly tied to the price of fuel. The early 1990s saw a drop in the price of fuel, whereas it started recovering in the late 1990s and has grown steadily since. The assumption is that it will continue to grow in line with the world market price of oil. In the following forecasts a key assumption is that a carbon tax will be implemented starting in 2010 and that it will equal the price of carbon emission permits in the European Trading System (ETS).[69]

Starting this year, *HERMES* forecasts the demand for petrol separately from the demand for diesel. Petrol consumption is driven by the number of cars in the economy and the relative price of petrol in Ireland with respect to the United Kingdom. The number of cars in turn is a function of disposable income, the underlying demographic trends and the rate at which the number of cars per adult reaches saturation (set at 0.8 cars per adult – roughly the same level as in Germany today). The relative price of fuel with respect to the United Kingdom drives the extent of "fuel tourism" (see Box 5.4).

The model does not consider other forms of transport. Implicitly, we assume that cycling and walking continue to decline, and that the consequent additional demand for motorised transport is met by public transport. Car and lorry remain the main mode of transport.

[69] See Table 5.1 for the detailed assumptions on the price of fuel and the cost of carbon.

Diesel consumption is a function of tonne-kilometres[70] of freight (which depend on GNP) and the price of diesel in Ireland relative to its price in the United Kingdom. The latter again drives the amount of "fuel tourism".

Box 5.4: Fuel Tourism

Fuel tourism is defined as the amount of fuel bought in Ireland but consumed abroad. When fuel is cheaper in the Republic of Ireland, consumers from Northern Ireland and Great Britain will engage in cross-border fuel shopping. *HERMES* estimates this behaviour by measuring the sensitivity of sales of fuel to the ratio of the fuel price in the Republic of Ireland with respect to its price in the UK.

In this *Medium-Term Review* we estimate that in 2005 between 5 and 9 per cent of total petrol sales in Ireland were consumed abroad. The figure for diesel is 15 to 20 per cent. More work is needed to measure fuel tourism with precision. We can, however, get an idea of the effect of changes in taxation on fuel tourism and revenue entries. Adopting a carbon tax equal to €20/tonne of CO_2 would reduce fuel tourism and associated carbon emissions by about 285 thousand tonnes of CO_2 in 2005, which is about 0.5 per cent. The decrease in fuel tourism would reduce the amount of excise taxes paid by non-residents to the Irish revenue by about €26 million. The non-residents who continue buying fuel in Ireland pay the carbon tax, thereby increasing Irish revenues by €14 million. On net, the Irish revenue would lose approximately €12 million (or about 0.03 per cent of its 2005 revenue) by imposing a tax of €20/tonne of CO_2.

FORECAST

Table 5.6 shows the forecasted growth rates of the main transport variables up to 2025 in five-year periods. The growth rate of GNP is also reported for convenience.

Table 5.6: Average Growth Rates of Transport Variables and their 2005 Levels

		Average Annual Growth Rates						
	2005	1990-	1995-	2000-	2005-	2010-	2015-	2020-
	Level*	1995	2000	2005	2010	2015	2020	2025
GNP		4.3	8.6	4.4	4.1	3.8	3.5	3.0
Total energy	5,031	3.4	11.3	4.3	2.1	2.7	2.5	2.1
Kerosene	857	1.4	9.5	6.4	4.3	4.3	3.7	3.3
Petrol	1,822	3.2	7.6	2.7	0.7	0.2	0.0	-0.2
Diesel	2,329	4.7	16.6	4.9	2.3	3.8	2.4	2.8
Cars	1,662	4.5	5.9	4.7	2.8	2.0	1.8	1.6
Freight	18.2	1.4	17.6	8.0	7.5	4.2	3.7	2.8

* Thousand tonnes of oil equivalent for total energy and fuels; thousand cars; billion tonne-kilometres.

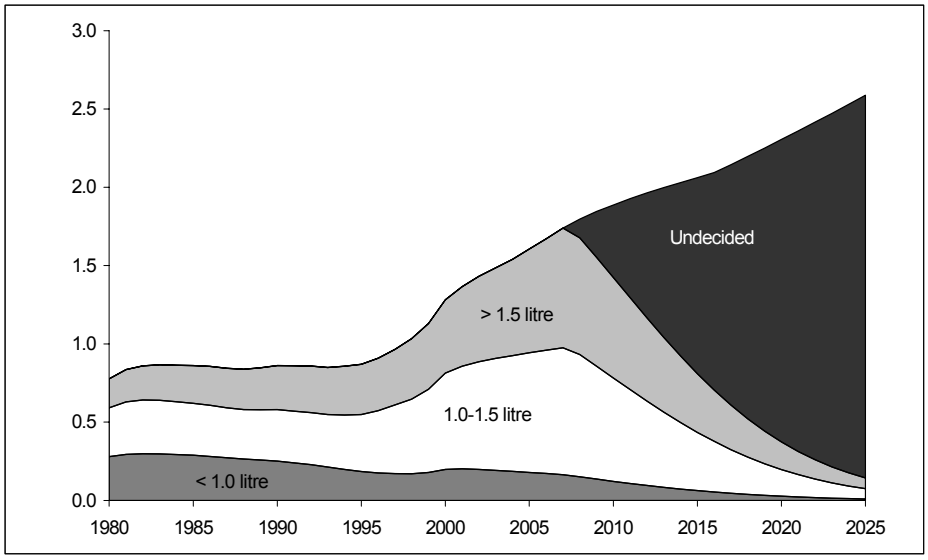
The growth rate in the demand for petrol decreases over time. This is due to a combination of factors: the number of cars is increasing, but this is accompanied by a slight decrease in the average mileage of cars; there is an

[70] A tonne-kilometre is equal to a tonne of goods transported for one kilometre.

increase in the number of diesel cars; and there is an improvement in fuel efficiency, although this is in part countered by a tendency towards buying larger cars.[71]

Figure 5.1 shows the profile of the Irish stock of cars, disaggregated by size of engine. The engine size has been growing over time.[72] The type of cars that will be bought in the future (shown as "undecided" in Figure 5.1[73]) will be influenced by consumers' income, the price of fuel and government policies. If the price of fuel continues to rise and a carbon tax is implemented, small-engine cars would become more appealing.

Figure 5.1: The Stock of Cars by Engine Size (Million Cars)



Diesel use grows much faster than petrol use (Table 5.6). This is due in part to an increased adoption of diesel-fuelled cars, which are cheaper per kilometre to drive. The main driver of the growth in diesel use, however, is the increase in the amount of freight transported. Table 5.6 shows that after 2010 the amount of freight transported in Ireland, measured in tonne-kilometres, grows broadly in line with GNP. This reflects the limited options available in Ireland to shift the transport of goods away from the road. Road freight transport represented about 99 per cent of total inland freight transport in 2006, and freight transport by rail is unlikely to increase within the next 20 years. This is because of limited capacity of the current rail infrastructure, and because the average length of haul in Ireland is short, which makes the use of rail unattractive.

[71] As the 2008 reform of the Vehicle Registration Tax and the Motor Tax left the prices of most cars unchanged, we have no reason to assume that these trends will not continue in the future.

[72] Note that this trend was reversed in the first two months of 2008. It is too early to say whether this is a trend break, or a temporary deviation as in 1996-7.

[73] Note that after 2007, the assumption is that existing cars will be scrapped at the same rate as they have in the past.

Finally, the increase in kerosene use mirrors the expected increase in flights, both domestically and internationally.[74]

TRENDS IN CO_2 EMISSIONS

Given the level of activity shown in the previous paragraphs, it is possible to forecast CO_2 emissions from transport.

Table 5.7 shows the level of carbon dioxide emissions from transport and their average yearly growth rate. In Table 5.7, CO_2 emissions from kerosene are limited to the amount of fuel used in domestic aviation in accordance with the international accounting rules for greenhouse gas emissions.

Table 5.7: Average Growth Rates of Greenhouse Gases and their 2005 Levels

			Average Annual Growth Rates						
		2005	1990-	1995-	2000-	2005-	2010-	2015-	2020-
		$kTCO_2eq$	1995	2000	2005	2010	2015	2020	2025
GNP			4.3	8.6	4.4	4.1	3.8	3.5	3.0
Greenhouse gases	Total	70,269	1.3	3.1	0.4	-0.1	0.0	1.1	0.5
Carbon dioxide	Total	47,723	1.7	4.8	1.3	0.3	0.4	1.4	0.7
	Electricity	15,136	3.7	3.7	-0.7	-2.5	-3.7	-1.8	1.6
	Transport	12,797	3.9	11.5	4.0	1.8	2.3	2.4	2.0
	Cement	4,431	-5.6	10.7	10.2	1.6	3.6	4.8	3.8
	Other	15,358	0.3	1.7	-0.7	1.1	0.7	1.1	-2.9
Methane	Total	13,262	0.5	-0.4	-0.4	-1.1	-1.4	0.6	-0.6
	Agriculture	11,454	0.3	-0.3	-0.6	-1.7	-1.5	-1.5	-1.6
	Waste	1,646	3.2	-0.8	1.6	2.7	-0.9	5.3	4.6
Nitrous oxide	Total	8661	0.9	0.3	-2.9	-1.4	-1.5	-1.4	-1.5
Halocarbons	Total	623	41	23	1.8	10.5	8.1	7.9	6.5

Even with a carbon tax that starts at €20/tonne of CO_2 emissions in 2010 and grows over time, emissions from transport grow by more than 35 per cent between 2005 and 2020. This is notably higher than the 20 per cent decrease for the economy as a whole suggested by the EU climate change and renewable energy package currently being discussed in Brussels. There are two reasons for this. First, the level of the carbon tax is low. Petrol, for instance, would be taxed by €0.11 per litre in 2025 (see Table 5.1). One would not expect a large change in driving behaviour, a substantial increase in the purchase of more energy-efficient cars, or a modal shift to public transport, cycling, or walking. Second, even if commuters would like to change their behaviour, they are not necessarily able to. Alternative modes of transport may be unavailable and impractical, or may be deemed unsafe or of low social status. Public transport infrastructure, in particular, takes considerable time to build. Currently, planned extensions of rail and light rail will provide an alternative to a

[74] Kerosene used for international flights is assumed to grow in proportion to the number of outbound and inbound international tourists according to Hamilton, Maddison and Tol, 2005.

fraction of commuters only. Cars with very high energy- or carbon-efficiency are a niche market at present, and although we expect this niche to grow, we do not expect that these cars will dominate sales by 2020, let alone the stock of cars. Driving behaviour, finally, is determined by habit and patterns of living and work – both factors change only slowly, and are difficult to influence.

The above forecasts assume that little biofuel will be burned before 2025. There is an EU biofuels target for Ireland, but this has yet to be implemented in domestic policy. Economically, biofuels are a bad proposition (Fitz Gerald, 2003) and the environmental benefits are controversial (Crutzen *et al.*, 2007). If policy mandates a 5 per cent mix of biofuel in total transport fuel, CO_2 emissions from transport would increase by about 0.2 per cent in 2020, relative to the baseline in Table 5.7.[75] Box 5.5 explains in more detail the issues associated with the adoption of biofuel in Ireland.

Box 5.5: CO_2 Emissions and Biofuel Adoption

Biofuels are transformed from biomass into liquid or gas fuels that can be used for transport or heating. They are seen as an alternative to fossil fuels and are encouraged for two main reasons. First, they reduce the need for oil imports, although this does not necessarily increase the security of supply (Brännlund *et al.*, 2008). Second, some biofuels (but not all) reduce air pollution. The most common types of biofuel at the moment are ethanol, a substitute for petrol, and biodiesel, a substitute for diesel. Ethanol is mostly made from corn and sugarcane, whereas biodiesel is mainly produced from plant oils such as rapeseed, palm, coconut and soybean. Whether or not these biofuels are net providers of energy is subject to debate. The answer depends on the biomass source of the fuel, the refinement process and the estimation techniques (Dufey, 2007; Brännlund *et al.*, 2008).

At the moment at least 90 per cent of biofuels are consumed in the country in which they are produced (Dufey, 2007). However, international trade is bound to grow quickly, especially if countries pursue biofuel adoption targets. It is unlikely that there will be sufficient biomass available in Ireland to produce the amount of biofuel necessary to replace 5 per cent of motor fuel. This means that Ireland, and other countries in the same situation, will need to import at least part of their biofuel needs, which makes it important to understand issues surrounding international trade of bioenergy.

The international law governing bioenergy trade is at the moment undeveloped (Switzer, 2007). Dufey (2007) points out the potential pitfalls in international trade of bioenergy.

First, there are no well-recognised standards that certify bioenergy as being sustainable. The life-cycle emissions of biofuels depend heavily on the way in which biomass is grown and on the process used to transform the raw material into fuel. Life-cycle emissions also depend on transport

[75] This specific calculation assumes that biodiesel would substitute traditional diesel in order to attain the 5 per cent target. The result is the same if we assume 5 per cent biodiesel and 5 per cent bioethanol.

and land use change. There is ongoing work to determine standards and standard certification, but they are not at all defined.

Second, there are huge disparities in tariffs applied to bioenergy products, since they are classified as food (biodiesel) and spirits (bioethanol). Developing countries may end up exporting raw materials, which face lower tariffs, and therefore miss out on the stages of biofuel refinement that produce the most value added. This is subject to ongoing negotiations in the World Trade Organisation.

Third, biofuels production may replace food production. Although this should diminish with the adoption of second-generation of biofuels – based on the transformation of non-edible (parts of) plants – competition for land and water will remain an issue.

In addition, accounting rules for greenhouse gas emissions need to be clarified. If biofuels are produced in Brazil and consumed in Ireland, which country accounts for the carbon sequestration taking place while the biomass is growing? Most likely Ireland will not be allowed to claim any of the carbon sequestration benefits, but will have to account for all the tailpipe emissions of the biofuel it uses. Since CO_2 emissions for biofuel and fossil fuel combustion are similar, imported biofuels would help in meeting the biofuel target, but would not help in curbing Irish carbon emissions.

Given the uncertainty surrounding all stages of international trade in biofuels, our best guess is that carbon emissions for countries like Ireland will not change significantly even if biofuel targets are met, be they at 5 per cent, 10 per cent or 20 per cent of oil consumption in transport.

5.5 Emissions to Air

Emissions to air are projected using the *ISus* model.[76] Following O'Doherty and Tol (2007), *ISus* uses the median change in the past emission intensities per sector and substance to project future emission intensities. *ISus* further uses the projected sectoral output from the *HERMES* model, downscaled to the 19 sectors in the ESRI Environmental Accounts (Lyons, Mayor and Tol, 2008). For household emissions, we use the estimated income elasticities of emission per capita and the number of people as projected by the demographic model. Emissions of carbon dioxide from power generation are taken from the dispatch model (see Section 5.3). Emissions of methane from landfill are taken from the waste model (see Section 5.6).

[76] See http://www.esri.ie/research/research_areas/environment/isus/

Figure 5.2: Carbon Dioxide Emissions by Sector

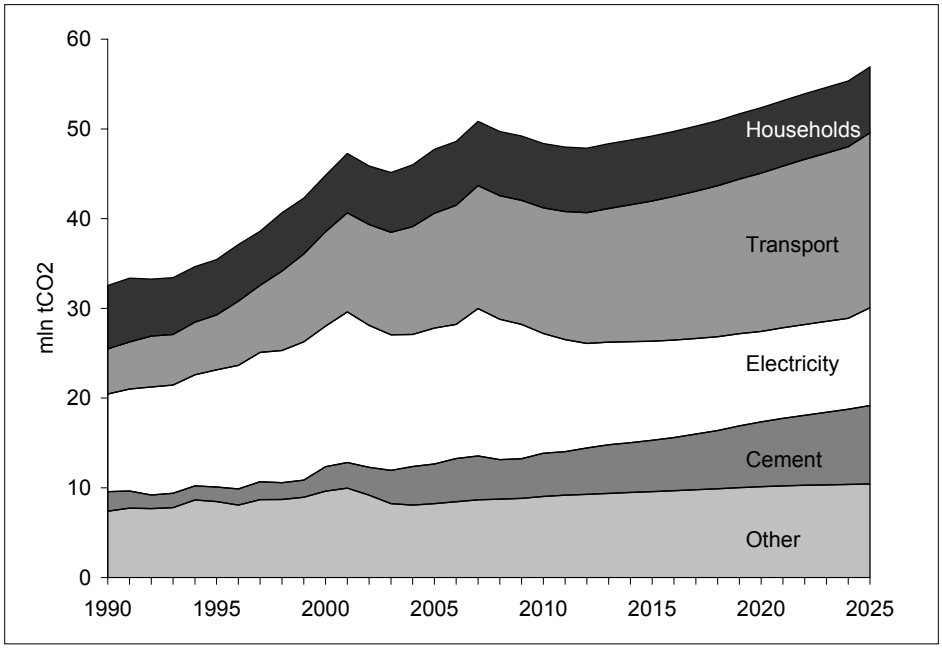


Figure 5.2 shows carbon dioxide emissions by production sector as observed (1990-2005) and as projected (2006-2025).[77] In the past, emissions have grown considerably slower than the economy. Figure 5.3 compares the emission intensity of Ireland (measured in grams of carbon dioxide emitted per dollar of gross domestic product) to the rest of the "old" European Union (EU-15), the recent Member States, and the USA. In 1990, Ireland emitted considerably more CO_2 per euro earned than the rest of the EU-15, but progress has been much faster so that Ireland is now close to the average. In fact, the Irish rate of progress in reducing the carbon intensity of the economy is almost at par with the accession countries, many of which experienced a major economic restructuring after the fall of the Berlin Wall. Diakoulaki and Mandaraka (2007) show that, for economic production, Ireland was one of the most carbon-intense economies in the EU-15 in 1990, and one of the least carbon-intense economies in 2005. They attribute this to the modernisation of the power generation sector and the shift from manufacturing to services. However, transport in Ireland is more carbon-intensive than elsewhere in the European Union, which explains why Ireland is slightly above the EU-15 average.

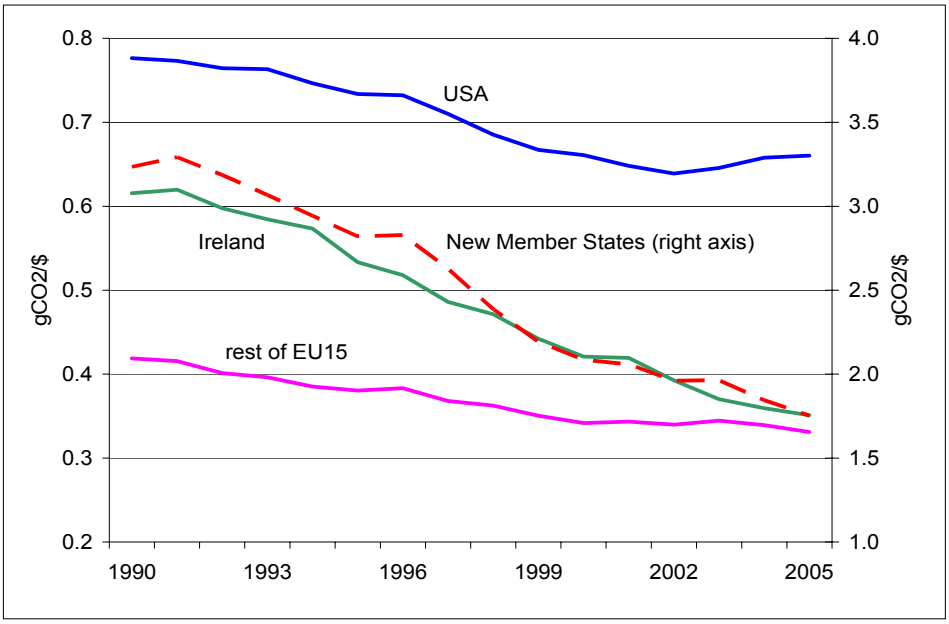
Emissions from power generation are expected to fall substantially (Section 5.3), but Figure 5.2 reveals that emissions from other sectors do not fall, despite the carbon tax.[78] Emissions from transport and cement production are responsible for most of the growth. Emissions from households and the service sector are essentially flat. For services, this is because the economic expansion is by and large offset by energy efficiency improvements. The trend towards larger homes and smaller households is offset by improved insulation and more efficient heaters. There are limited

[77] Projected emissions for 2006 are 1.8 per cent above observed emissions.

[78] We agree with McCarthy and Scott (2008) that the National Climate Change Strategy will do little for emission reduction.

options for reducing carbon dioxide emissions from the residential and services sector, because its energy use is to a large extent determined by building design and long-lived equipment. A large share of the stock of houses and offices is relatively young and will, therefore, not be replaced in the near future. Box 5.6 shows CO_2 emissions in the absence of climate policy.

Figure 5.3: The Carbon Intensity of the Irish Economy Relative to Other Countries



Box 5.6: The Impact of Climate Policy on Carbon Dioxide Emissions

In the *Benchmark* forcast, we assume the domestic carbon tax equals the permit price in the Emissions Trading System of the European Union. Table 5.1 shows the assumed carbon tax.

We here explore the implications for emissions if there were no carbon tax. A comparison of the cases with and without a potential carbon tax yields valuable insights into the impact of this policy. Box 5.3 discusses the implications of a zero carbon price for the power generation sector.

Box 4.1 in Chapter 4 shows the implications of a carbon tax for economic growth, employment, and the government budget. We assume that the revenue from the carbon tax is used to reduce income tax. Because labour costs are more important than energy costs for the competitiveness of the Irish economy, this implies that the economy is stimulated by a shift from income to carbon taxation. There are therefore two counteracting effects. On the one hand, a carbon tax would induce people and companies to use less and different energy. On the other hand, faster economic growth would increase energy use.

Table 5.6.1 shows the carbon dioxide emissions with and without climate policy. Emissions from power generation are taken from Box 5.3. Without climate policy, carbon dioxide emissions in 2020 would be 10 per cent higher than in the *Benchmark* forecast. Most of the emission reduction is realised in electricity, where emissions fall by 34 per cent. In the rest of the economy, emission reduction is only 1 per cent.

Table 5.6.1: The Impact of Climate Policy on 2020 Carbon Dioxide Emissions (000 tCO_2)

	No Policy	Tax + ETS	Difference	Percentage Difference
				%
CO_2 from power generation	15,307	10,074	5,232	-34.20
CO_2 from other sources	42,743	42,273	470	-1.10
Total CO_2	58,049	52,348	5,702	-9.80

The 470 $kTCO_2$ emissions avoided by a carbon tax consist of an increase in emissions of 408 $kTCO_2$ due to faster economic growth, and a reduction of 878 $kTCO_2$ due to energy efficiency and fuel switching. That is, 47 per cent of the gains in carbon efficiency of the economy (bar electricity) are negated by faster economic growth.

It should be noted that our current models do not allow for major shifts in technology. This is not a big problem for the period to 2025 and the relatively modest carbon tax assumed here, but it does imply that we slightly underestimate emission reduction for any given carbon tax. In the short- to medium-term, the main purpose of a small but rising carbon tax is not an immediate emission reduction. The carbon tax rather serves as a signal to industry and innovators that the time has come to start preparing for substantial, perhaps even radical, changes in energy and transport technologies.

In considering Irish emissions of greenhouse gases we have so far used the standard practice of accounting for all emissions which enter the atmosphere in Ireland, either from domestic production or domestic consumption. However, there is a different way of looking at this issue, where accounting is based on the emissions embodied, directly or indirectly, in the goods and services consumed in Ireland. For example, when we import a desk, a machine or a bunch of flowers, emissions have resulted from the production of the item abroad and its transport to Ireland. Under the alternative consumption-based accounting framework the emissions embodied in the goods and services we consume, including those embodied in imports, would be allocated to Ireland while the emissions produced in making goods and services in Ireland for export would be allocated to the foreign consumer.

This alternative consumption-based accounting framework would be difficult to implement on a consistent basis as part of a legal agreement – hence the concentration on the production based measure. However, it is of considerable importance to examine trends in the consumption based measure. Helm, Smale and Phillips (2007) show that while UK emissions under the normal production-based measure have fallen in recent years, under the consumption based measure they have risen. This reflects the fact that "dirty" business has been outsourced to countries like China. Here we apply the consumption-based accounting framework to Irish emissions.

Figure 5.4: Carbon Dioxide Emissions by Final Demand

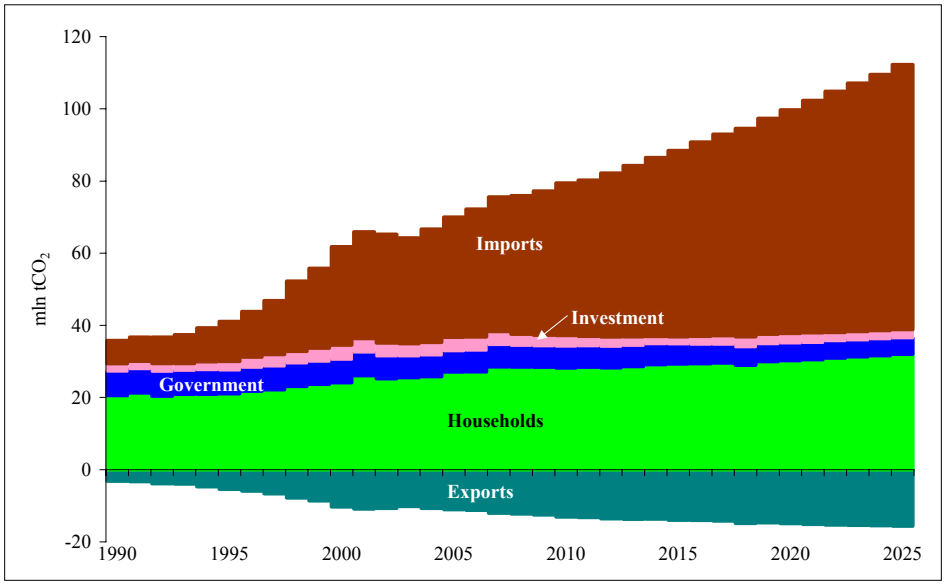


Figure 5.4 shows carbon dioxide emissions by final demand. Emissions are attributed to final demand using an environmental input-output model (O'Doherty and Tol, 2007). The 2002 input-output table (CSO, 2006) is updated with the RAS method (Parikh, 1979) using the projected production from *HERMES* and the projected consumption according to Lyons, Mayor and Tol (2007). Virtual CO_2 imports[79] for 2001 are taken from Peters and Hertwich (2008) and projected using non-energy imports according to *HERMES* assuming that the CO_2 intensity of imports falls by 1 per cent per year. In 2005, 54 per cent of CO_2 can be ascribed to household consumption, 12 per cent to government consumption, 8 per cent to investment, and 23 per cent to exports. The trade balance for CO_2 is very negative: 11 million tonnes of CO_2 emitted in Ireland are for exports, but companies abroad emit 33 million tonnes of CO_2 to meet the demand of Irish households and companies. Figure 5.4 shows that the CO_2 contained in Irish imports grows much more rapidly than the CO_2 emitted in Ireland. This pattern is similar to that of the UK (Helm *et al.*, 2007).

Figure 5.5 shows total greenhouse gas emissions. Emissions of methane and nitrous oxide from agriculture fall slightly with improved management. However, methane emissions from landfill increase, even though this trend is moderated by the diversion of waste from landfill to incineration. The projected growth rate of halocarbons is much slower than observed in the past, but halocarbons do continue to grow rapidly and could contribute 4.0 per cent of total greenhouse gas emissions in 2025, up from 0.9 per cent in 2005. Halocarbons are emitted by very specific industrial processes, and are therefore extremely volatile and very hard to predict. If we re-estimate the model for the data of the last six years only, emissions grow from 0.6 million tonnes of carbon dioxide equivalent (tCO_{2eq}) in 2005 to 2.1 million

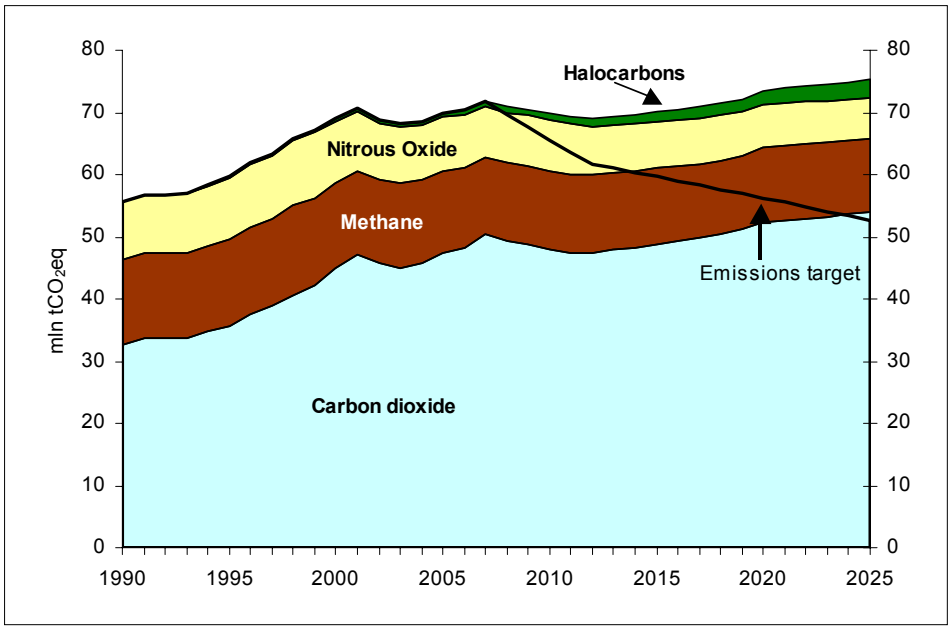
[79] That is, carbon dioxide emitted abroad to produce goods and services consumed by Irish residents. Virtual CO_2 is also referred to as embedded CO_2 or embodied CO_2.

tCO_{2eq} in 2025, which is considerably lower than the 3.0 million tCO_{2eq} in Figure 5.5, but still very rapid growth.[80]

Figure 5.5 compares the projected emissions of greenhouse gases with the policy targets.[81] Current policy is clearly insufficient to meet the current aspirations – even if we assume that the proposed carbon tax will become reality. The gap between targets and projections grows if one considers the emissions trade balance. Although a substantial share of Irish greenhouse gas emissions is generated for export, a larger amount of carbon dioxide is emitted abroad to satisfy the import needs of Irish consumers and businesses. Even the decline in CO_2 emissions is partly due to the import of fossil-based electricity from the UK.

Figure 5.6 shows total emissions of sulphur dioxide. Power generation used to be the dominant source, but changes in the fuel mix and technical interventions have led to substantial emission reduction. Other sectors emit much less, but emission reduction has been more gradual. We expect that Ireland will meet its 2010 target (42 thousand tonnes of SO_2) by 2014.

Figure 5.5: Greenhouse Gas Emissions by Type



[80] Expressing emissions in terms of CO_{2eq} is convenient, since it refers to the combination of all greenhouse gases, e.g. carbon dioxide, methane, halocarbons.

[81] We assumed -3 per cent per year for the current legislative period. For 2020, the target is 80 per cent of 2005 emissions, while for 2025 we assumed a 75 per cent target. Between 2012 and 2020, we used a linear interpolation.

Figure 5.6: Sulphur Dioxide Emissions by Sector

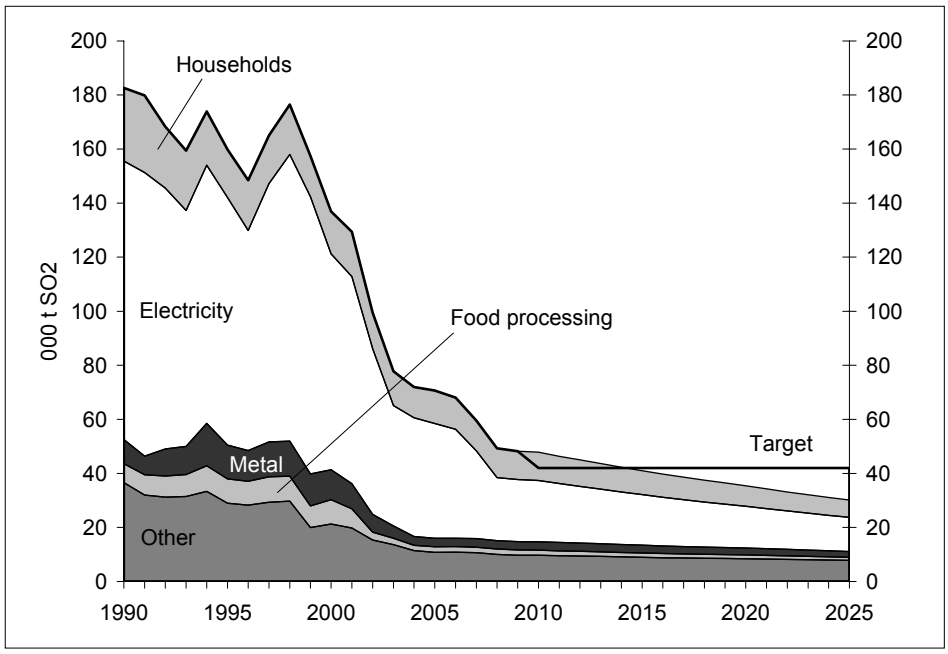


Table 5.8 summarises the trends for all emissions to air included in the *ISus* model. Greenhouse gas emissions (least improvement) and sulphur dioxide (most improvement) emissions span the range. Ammonia emissions are projected to fall gradually, which should ease problems of eutrophication. Ireland has been in compliance with its 2010 ammonia target (116 thousand tonnes of NH_3) since 2003. Emissions of oxides of nitrogen, carbon monoxide and volatile organic compounds (VOCs) also fall gradually, which should improve the quality of air in the cities and towns. The 2010 target for VOCs (55 thousand tonnes) will probably be met by 2009 already. Emissions of nitrogen oxides (NO_x) fall more rapidly at first because of the scrubbers being installed at Moneypoint. However, emissions only fall to 102 thousand tons of NO_x in 2025, substantially in excess of the 2010 target of 65 thousand tonnes.

Table 5.8: Average Growth Rates of Emissions to Air and their 2005 Levels

		Average Annual Growth Rates						
	2005	1990-	1996-	2001-	2006-	2011-	2016-	2021-
	kTonnes	1995	2000	2005	2010	2015	2020	2025
GNP		4.3	8.6	4.4	4.1	3.8	3.5	3.0
Greenhouse gases	70,269	1.3	3.1	0.4	0.0	0.1	1.0	0.5
Sulphur dioxide	71	-2.6	-3.1	-12.4	-7.5	-3.1	-2.9	-3.2
Nitrogen oxides	124	0.2	1.6	-1.8	-2.6	-0.6	-0.2	-0.5
Carbon monoxide	183	-5.4	-4.5	-5.5	-1.3	-0.9	-0.3	-0.4
Volatile organic compounds	46	-1.0	-5.7	-6.7	-1.9	-1.3	-0.7	-0.8
Ammonia	113	n/a	0.5	-1.6	-0.4	-0.2	-0.2	-0.2

5.6 Waste

Solid waste includes a wide range of materials with varying physical and economic characteristics. We group these materials into three broad types:

- Hazardous waste, which includes materials classified by regulators as having a significant potential to harm human health or the environment if not managed appropriately;
- Biodegradable municipal waste (BMW), another regulatory category that includes waste materials from the household and services sectors that are prone to biodegrade over time, releasing environmentally-harmful or noxious decay products; and
- Other waste, which includes both biologically inert and biodegradable materials that are not classified as hazardous waste or BMW.

Because the environmental and economic effects of solid waste may be significantly different depending upon how the material is managed, we further divide the waste categories by disposition, including whether it was sent to landfill, recycled,[82] incinerated or where the disposition is not known. Available sources of data do not include much information on the reuse of materials, although this is another potentially important disposition.

There is as yet little published research into the socio-economic determinants of solid waste generation and disposition in Ireland.[83] Time series analysis is generally not possible for these emissions, because detailed sector-level data has only recently become available through the EPA's National Waste Reports.[84] As a consequence, when forecasting waste flows we rely mainly on estimates of behavioural parameters drawn from microeconomic analyses.

The quantity of hazardous waste generated in Ireland is dominated by the construction sector, in the form of contaminated soil, and the chemical production sector (see Table 5.9). As of 2006, over 78,000 tonnes was not attributed to any sector. The fall off in construction activity noted in Chapter 4 and, in particular, the recent decline in residential housing construction, are expected to lead to a significant reduction in hazardous waste emissions of 4.5 per cent per annum on average for the 2006-10 period. This is a very considerable change from the trend in recent years: hazardous construction waste grew 84 per cent between 2004 and 2006. Emissions from chemical production, driven by modest growth in manufacturing, are projected to grow at an annualised rate of 5.9 per cent over the same period. However, we expect hazardous waste from chemical production and other manufacturing sectors to grow at a lower rate thereafter. We project that total hazardous waste emissions will rise gradually over the period of this review. Of course, this rise may or may

[82] The recycled category includes other forms of waste recovery such as 'reuse as fuel'.

[83] Contributions include O'Callaghan-Platt and Davies (2007), Scott and Watson (2007) and Barrett and Lawlor (1995).

[84] Fully disaggregated data for most emissions is available only for 2001, 2004 and 2006. Also, the coverage and quality of data collected improved over this period, making comparisons between historical years difficult.

not represent an increase in the potential environmental effects from hazardous waste, since hazardous wastes vary in toxicity and the mix of materials within the total may change over time.

Table 5.9: Hazardous Waste Quantities and Projected Growth Rates by Sector

	2006	Average Annual Growth Rates			
	Tonnes	2007-2010	2011-2015	2016-2020	2021-2025
Agriculture, fishing, forestry	22,923	-0.4	-0.3	-0.3	-0.4
Coal, peat, petroleum, metal ores, quarrying	9,929	1.2	2.0	2.0	2.0
Food, beverage, tobacco	2,482	2.9	2.0	2.0	2.0
Textiles Clothing Leather & Footwear	1,343	1.2	2.0	2.0	2.0
Wood & wood products	420	1.2	2.0	2.0	2.0
Pulp, paper & print production	17,152	1.2	2.0	2.0	2.0
Chemical production	168,179	5.9	3.2	3.1	1.7
Rubber & plastic production	1,866	1.2	2.0	2.0	2.0
Non-metallic mineral production	21,156	-2.8	0.8	1.9	1.0
Metal prod. excl. machinery & transport equip.	19,302	5.9	3.2	3.1	1.7
Agriculture & industrial machinery	1,964	5.9	3.2	3.1	1.7
Office and data process machines	1,313	5.9	3.2	3.1	1.7
Electrical goods	10,447	5.9	3.2	3.1	1.7
Transport equipment	1,333	5.9	3.2	3.1	1.7
Other manufacturing	1,687	1.2	2.0	2.0	2.0
Fuel, power, water	13,426	6.9	1.3	1.3	1.0
Construction	406,905	-4.5	0.3	0.5	-0.9
Services (excl. Transport)	501	4.6	4.4	3.7	3.0
Transport	2,539	n/a	n/a	n/a	n/a
Residential	10,251	3.4	4.0	3.7	4.0
Sub-Total	715,117	-0.4	1.5	1.7	0.6
Not attributed to any sector	7,8491	n/a	n/a	n/a	n/a
Total	**793,608**	**-0.4**	**1.4**	**1.6**	**0.5**

Biodegradable Municipal Waste (BMW) is projected to continue growing as the number of households and level of real incomes in Ireland rise (Table 5.10). These factors are expected to more than offset the negative impact of a projected fall in the number of persons per household.

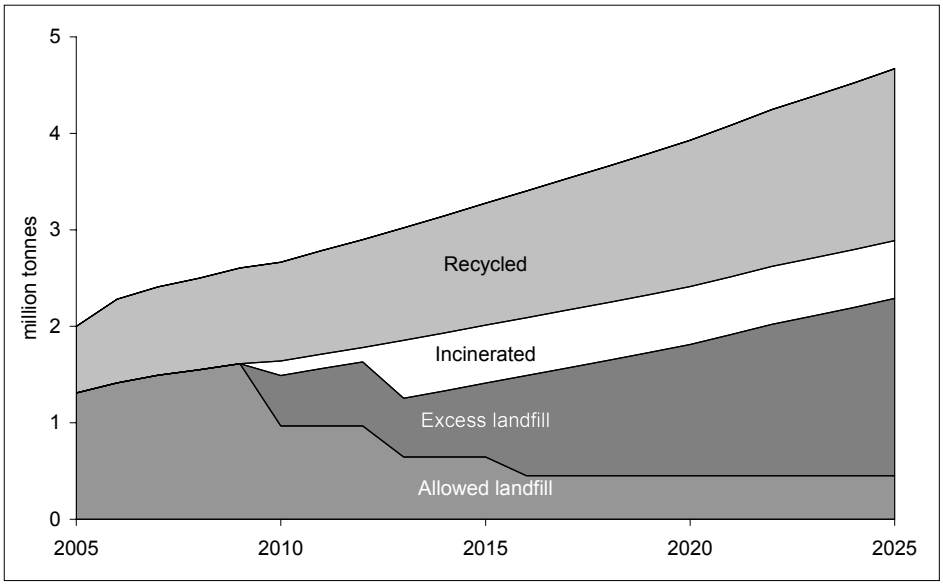
Table 5.10: Biodegradable Municipal Waste (BMW) Quantities and Projected Growth Rates by Sector

	2006	Average Annual Growth Rates			
	Tonnes	2007-2010	2011-2015	2016-2020	2021-2025
Services (excl. Transport)	1,080,478	4.6	4.4	3.7	3.0
Residential	1,199,072	3.4	4.0	3.7	4.0
Total	**2,279,550**	**4.0**	**4.2**	**3.7**	**3.5**

The broadly similar sector shares apparent in BMW generation contrast with the very different patterns of disposition exhibited by services and the residential sector. While about 43 per cent of services sector waste was sent

to landfill in 2006, almost 80 per cent of residential BMW went to landfill. Unless there is a substantial shift to recycling[85] or large-scale use of incineration, it is unlikely that Ireland's targets for diverting BMW from landfill will be met. Figure 5.7 illustrates the baseline development of disposition over time, assuming that planned incinerators at Carranstown and Poolbeg are brought into service in 2010 and 2013, respectively, and that no changes are made to the relative prices or availability of disposition options. Landfill charges have been falling and may well fall further. On current trends, it is not inconceivable that landfill will become cheaper than incineration. EU targets require Ireland to reduce landfilled waste as a proportion of total BMW to 967,433 tonnes in 2010; 644,956 tonnes in 2013 and 451,463 tonnes in 2016.[86]

Figure 5.7: Projected Biodegradable Municipal Waste by Disposition



The largest sectoral contributors to other (non-BMW, non-hazardous) waste are agriculture, construction, mining and quarrying, food production and metal production (see Table 5.11). Agricultural organic waste is no longer classified as "waste" for regulatory purposes, but we report it here because it may have significant effects on the environment if not managed properly. However, we also report the total for this category with agricultural waste excluded for comparability with official statistics. We expect this emission category to undergo a contraction in the short term due to the slowdown in construction, which is driven by the slowdown in residential housing construction (see Figure 5.8). However, we project that emissions will exhibit slow positive growth in the medium term.

[85]e.g. through changes in collection arrangements or widespread adoption of mechanical-biological treatment, perhaps supported by charges and other incentives for separation at source.

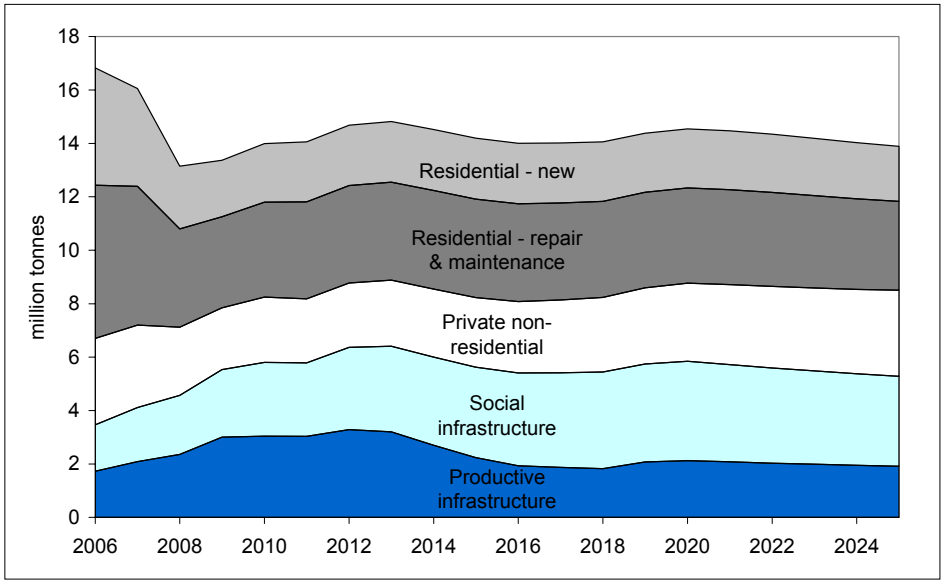
[86] *National Waste Report*, 2006, Table 15.

Table 5.11: Other (Non-BMW, Non-Hazardous) Waste Quantities and Projected Growth Rates, by Sector

	2006	Average Annual Growth Rates			
	Tonnes	2007-2010	2011-2015	2016-2020	2021-2025
Agriculture, fishing, forestry	59,382,027*	-0.4	-0.3	-0.3	-0.4
Coal, peat, petroleum, metal ores, quarrying	4,782,614	1.2	2.0	2.0	2.0
Food, beverage, tobacco	1,737,955	2.9	2.0	2.0	2.0
Textiles Clothing Leather & Footwear	10,547	1.2	2.0	2.0	2.0
Wood & wood products	245,819	1.2	2.0	2.0	2.0
Pulp, paper & print production	146,208	1.2	2.0	2.0	2.0
Chemical production	175,412	5.9	3.2	3.1	1.7
Rubber & plastic production	22,652	1.2	2.0	2.0	2.0
Non-metallic mineral production	84,216	-2.8	0.8	1.9	1.0
Metal prod. excl. machinery & transport equip.	1,242,469	5.9	3.2	3.1	1.7
Agriculture & industrial machinery	40,069	5.9	3.2	3.1	1.7
Office and data process machines	23,436	5.9	3.2	3.1	1.7
Electrical goods	53,674	5.9	3.2	3.1	1.7
Transport equipment	12,031	5.9	3.2	3.1	1.7
Other manufacturing	24,223	1.2	2.0	2.0	2.0
Fuel, power, water	333,341	6.9	1.3	1.3	1.0
Construction	16,824,257	-4.5	0.3	0.5	-0.9
Services (excl. transport)	445,708	4.6	4.4	3.7	3.0
Transport	744,136	n/a	n/a	n/a	n/a
Residential	833,294	3.4	4.0	3.7	4.0
Total	**87,164,088**	**-0.8**	**0.2**	**0.2**	**0.0**
Total excluding Agriculture, fishing, forestry	**27,782,061**	**-1.5**	**1.3**	**1.4**	**0.6**

*2004 estimates.

Figure 5.8: Projected Construction Waste (Non-BMW, Non-hazardous) Broken Down by Subsector



5.7 Conclusions

Over the last fifteen years, there has been a substantial decoupling between the growth of the Irish economy and the pressure it exerts on the environment. Ireland was one of the least carbon-efficient economies in the EU in 1990 (as measured by the amount of carbon dioxide emitted per euro value added), but got close to the EU-15 average in 2005. The scenario presented in this chapter shows a further decoupling between economic growth, energy use, emissions to air, and waste. In some cases – sulphur dioxide, other air pollution, ammonia, hazardous waste, other waste, and carbon dioxide from electricity – there is even a reduction of environmental pressure. However, these trends are not necessarily sufficient to meet the stated targets of environmental policy. In our *Benchmark* forecast carbon dioxide emissions are about 30 per cent higher than the target for 2020, as seen in Figure 5.6. For sulphur dioxide, it appears that the policy target will be met some four years later than planned. For oxides of nitrogen, it will be very difficult to meet the target without a major shift in policy.

In the areas of biodegradable municipal waste and climate change – perhaps the most significant environmental issues in Ireland – the trends are in the opposite direction of the declared policy targets, even though the *Benchmark* forecast assumes an acceleration of policy implementation.

For energy and climate, the projected price level in the EU Emissions Trading System (ETS) is high enough to drive peat out of the electricity market. The current regulatory regime will lead to a further expansion of wind power, while enhanced interconnection with Great Britain will secure the supply of electricity. All this implies that carbon dioxide emissions from power generation will fall between now and 2020. Ireland will also easily meet the EU renewables target in power generation.

We assume that the carbon tax will equal the price of carbon dioxide emission permits. Such a tax would be cost-effective (in the sense that the costs of emission reduction are minimised) and fair (in the sense that every sector pays the same per tonne of CO_2). The assumed carbon tax, however, would not be high enough to induce substantial changes in emissions in the medium term – be it from transport, households, or industry not covered by the ETS. In some cases, the assumed carbon tax is not high enough to induce a shift in behaviour, and in other cases there are no practical alternatives or existing infrastructure precludes a change in behaviour. For instance, the boom in construction of recent years means that a large part of the energy requirements of households are, literally, set in stone. The investment in, and reform of, mass transit for commuting required to reduce transport emissions to the desired levels far exceed the investments and reforms that are currently planned and discussed. Hybrid cars are expensive and will only serve a small market niche. A substantial reduction of CO_2 emissions from transport by 2020 therefore requires a massive shift towards cycling and walking. Even if substantial emission reduction is very costly or even infeasible in the medium term, it is much easier in the long term. However, a long-term transition to a carbon-neutral economy requires a considerable period of preparation, particularly with regard to the development of new technologies for energy and transport. A small but rising carbon tax, as assumed in the *Benchmark* forecast, may not have much of an effect in the 2020 time frame, but it does signal to industry that it is

worthwhile to invest in current carbon-saving technologies and in R&D to improve such technologies.

For biodegradable municipal waste, there is a similar discrepancy between the stated ambitions of government and the actual policies in place. The amount of waste arising will continue to grow as the population grows and gets richer. Although the share of waste that is recycled will grow, the amount of waste destined for disposal (via incineration or landfill) will grow too. Specifically, the current planned infrastructure for recovery and incineration of biodegradable municipal waste appears to be insufficient to reduce landfill by the amount required to reach EU and national targets – and there is no guarantee that the incineration capacity will be used in full.

In sum, although there have been marked improvements in the pressures that the economy exerts on the environment, and although we expect that the rate of progress in environmental protection will accelerate, there will remain a substantial gap between the ambitions of policymakers and reality – particularly in climate change and waste.

6. ALTERNATIVE SCENARIOS

6.1 Introduction

The *Benchmark* forecast presented in Chapter 4 represents our best estimate of the likely course of the Irish economy over the next decade. This, in turn, is based on a detailed set of assumptions about the world economy, demographics, and the likely future policies pursued by the government over this period, as outlined in Chapter 3.

As with any set of forecasts, there is a margin of error surrounding these numbers, particularly the forecasts for individual years. As discussed in Appendix 1, past experience can provide some guidance as to the possible margin of error in the future. For the last ten *Reviews* the average absolute error in the estimate of the growth in GNP over the forecast horizon was around 1 percentage point, with a somewhat smaller error for the most recent five *Reviews*. Based on this past experience with our forecasts, we explore two scenarios which might provide an upper and a lower bound to the range of possible outcomes for growth in GNP over the next five or ten years. The first, the high growth scenario, envisages growth in GNP around 0.7 per cent above the *Benchmark*, and the low growth scenario examines what would happen if growth were on average around 0.7 per cent below the *Benchmark*.

As outlined above, growth in GNP is driven by a range of factors, in particular by developments in the global economy and domestic competitiveness. The make up of the different forces driving the economy will, in turn, affect the composition of the growth and its broader economic impact. Thus, in examining possible alternative growth paths it is essential to develop full scenarios that explain why the economy would behave differently from the *Benchmark* forecast. This characterisation of the alternative scenarios will determine their wider economic effects.

In the first two sections of this chapter we discuss two scenarios that depart from the *Benchmark* forecast in important ways. In Section 6.2 of this chapter we examine a stylised low-growth scenario: this describes a situation where the Irish economy grows significantly below potential over the medium term, due to excessive domestic cost increases. This scenario describes a "wasted opportunity". Our second scenario, described in Section 6.3, examines the possibility that the economy could grow faster over the medium term than anticipated in our *Benchmark*. Here we examine a scenario where the economy is more competitive than we have assumed in the *Benchmark*. The consequences of these shocks for Ireland's carbon dioxide emissions are outlined in Box 6.1.

Table 6.1 contrasts the growth in key macroeconomic aggregates under these two scenarios. Over the forecast period 2010-2025, average annual growth in GNP is over 4 per cent under the higher growth scenario and the unemployment rate averages 4.1 per cent over the period. The higher growth leads to higher demand for labour and an inflow of migrants averaging 17,000 per annum.

Table 6.1: Overview of Two Scenarios: Impact on Key Aggregates

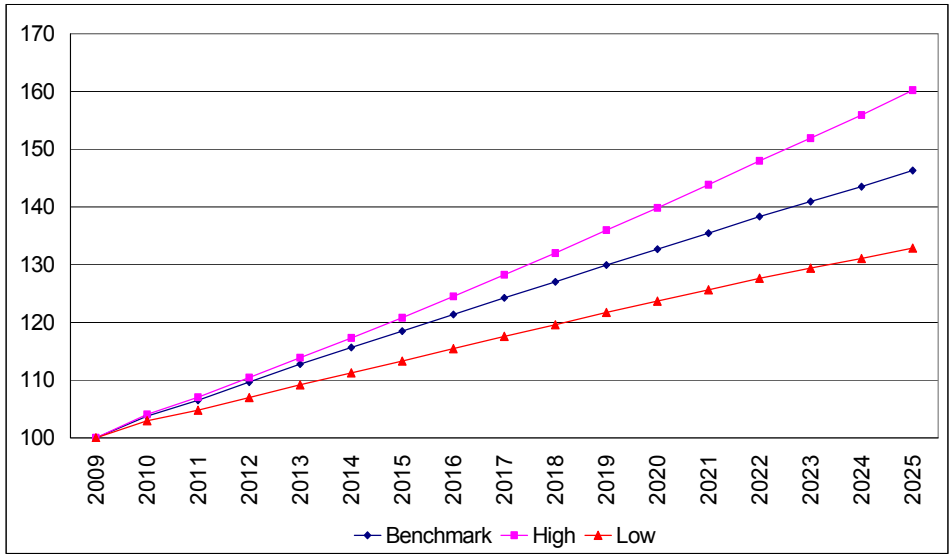
Average Annual Growth Rate:	**2010-15**	**2015-20**	**2020-25**	**2010-25**
Higher Potential Growth Scenario				
GNP	4.3	4.2	3.8	4.1
Average Non-Agricultural Earnings	4.3	4.5	5.3	4.7
Employment, April	1.5	1.5	1.3	1.4
Wasted Opportunity Scenario				
GNP	3.0	2.8	2.3	2.7
Average Non-Agricultural Earnings	4.9	5.3	6.2	5.5
Employment, April	0.7	0.6	0.4	0.6
For End Year:	**2015**	**2020**	**2025**	**2010-25 Average**
Higher Potential Growth Scenario				
Net Immigration	18.6	18.1	18.7	16.7
Unemployment rate, ILO Basis %	4.6	3.1	2.0	4.1
Wasted Opportunity Scenario				
Net Immigration	-11.6	-11.3	-11.4	-9.6
Unemployment rate, ILO Basis %	6.7	6.7	7.2	7.0

Under the wasted opportunity scenario, average growth is just 2.7 per cent and the average unemployment rate is 7 per cent. Higher domestic cost increases reduce the demand for labour in this scenario, with net emigration flows per year just under 10,000 on average over the forecast period.

Both of these scenarios concentrate on uncertainties surrounding our assumptions on competitiveness. The effects of the different assumptions on competitiveness on the future growth path of the economy is summarised in Figure 6.1. If we accept GNP per capita as a measure, albeit a proximate one, of living standards, then our *Benchmark* forecast implies real growth in living standards of over 45 per cent out to 2025. Under the wasted opportunity scenario this falls to less than 33 per cent, while under the high growth scenario it exceeds 60 per cent.

In addition to its vulnerability to differing outturns for domestic competitiveness, the Irish economy is also exposed to external demand and supply shocks, as witnessed by the current slowdown in the economy. Section 6.4 looks at the likely consequences of a more prolonged world recession than we have assumed in the *Benchmark* forecast, consequent on the current credit crunch. This would knock almost 5 percentage points off the level of GNP by 2010 relative to the *Benchmark* and would cause a sharp further deterioration in the public finances.

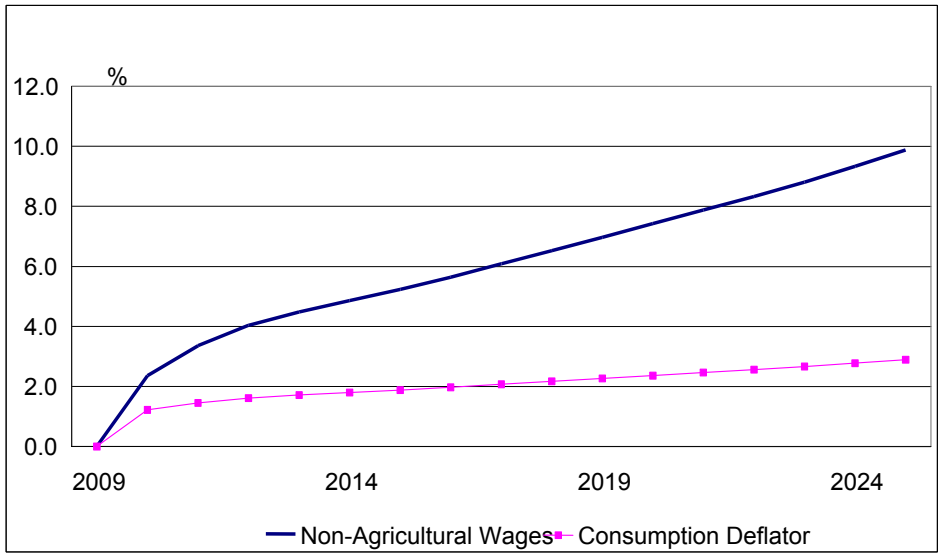
Figure 6.1: Alternative Scenarios for Real GNP Per Head: 2009=100



6.2 Wasted Opportunity: A Low-Growth Scenario

The *Benchmark* forecast assumes that domestic policies will accommodate the objective of maintaining competitiveness over the medium term. To explore the sensitivity of Ireland's growth prospects to these assumptions we examine the possible effects of a higher rate of wage and price inflation than in the *Benchmark* forecast. In addition, we assume a lower level of world demand for Irish produced goods and services, this assumption is designed to simulate a situation where the Irish economy loses comparative advantage relative to the *Benchmark*. Beginning in 2010, in this scenario a more rapid rise in wage rates in the public and private sector is assumed than in the *Benchmark*, so that wages are 10 per cent above the baseline by 2025 (see Figure 6.2). Furthermore, we assume that world demand for Irish goods and services is 0.25 per cent per annum lower than in the baseline.

Figure 6.2: Wasted Opportunity: Inflation and Wage Rates Compared to *Benchmark*



The growth in non-agricultural wage rates in the medium term at a rate well above that in the *Benchmark* would involve a serious loss of

competitiveness (Figure 6.2). In this scenario we have also assumed that in the face of a deterioration in the public finances the government would raise taxes to ensure that the borrowing requirement would be unchanged in the longer term compared to the *Benchmark*. These higher taxes would further increase pressures in the labour market, and further increase the loss of competitiveness. The increase in domestic cost inflation in this scenario would be domestically generated, thereby leading to a steady deterioration in Ireland's competitiveness on world markets.

Because of the increasingly export-oriented nature of services output, as discussed in Chapter 2, this competitiveness shock not only adversely affects the traded industrial sector, but also the market services sector. In both cases output is down almost 14 per cent relative to the *Benchmark* by 2025 (Figure 6.3). This leads to a permanent reduction in the growth rate of the economy. In Figure 6.4 we show the impact on the level of GNP of the loss in competitiveness. On average the rate of growth would be 0.7 percentage points lower per annum, leaving the level of real GNP over 10 per cent below the *Benchmark* by 2025.

Figure 6.3: Industrial and Market Services Output Compared to *Benchmark*

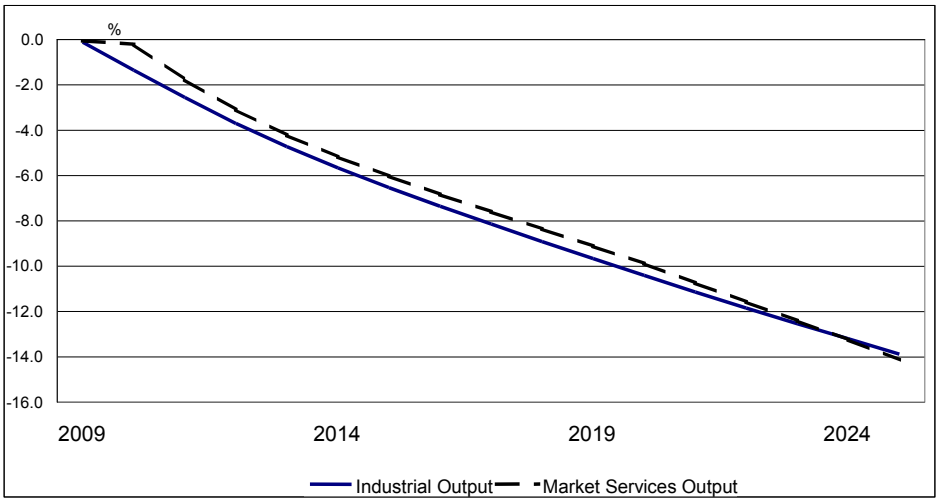
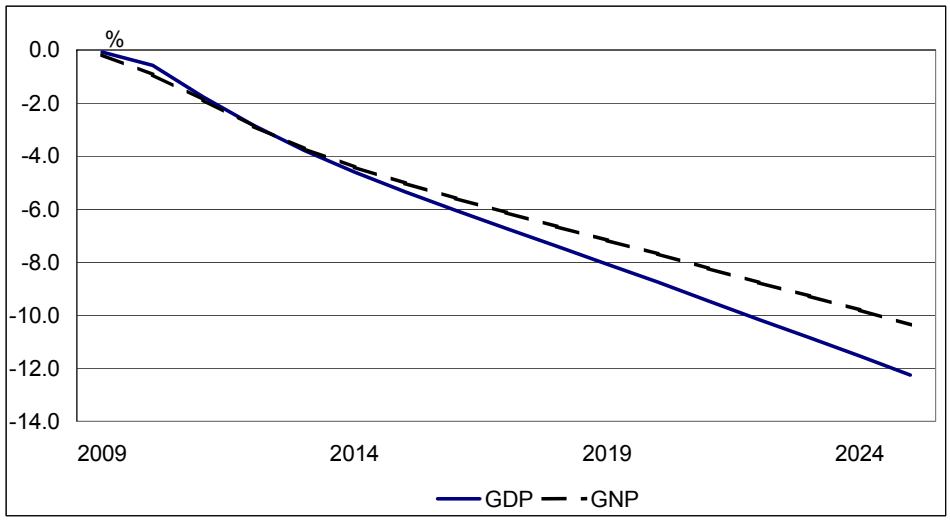


Table 6.2: Impact on Key Aggregates of Wasted Opportunity Scenario

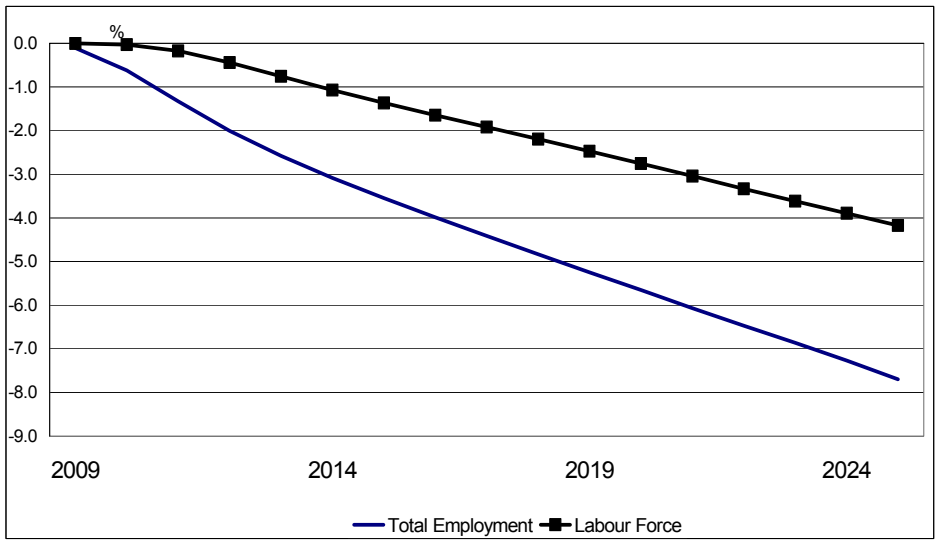
GDP	2010	2015	2020	2025
Percentage change relative to the *Benchmark*				
GDP	-0.6	-5.3	-8.8	-12.3
GNP	-0.9	-5.0	-7.7	-10.4
Consumption	-0.7	-5.9	-9.5	-13.1
Total Investment	-0.7	-5.1	-7.7	-10.2
Labour Force	0.0	-1.4	-2.8	-4.2
Total Employment	-0.6	-3.5	-5.7	-7.7
Consumption Deflator	1.2	1.9	2.4	2.9
Non-Agricultural Wages	2.4	5.2	7.4	9.9
New House Prices	0.9	-2.6	-5.0	-7.0
Absolute change relative to the *Benchmark*				
Housing Completions	-0.2	-3.8	-6.6	-8.1
Balance of Payments	0.4	0.9	1.0	0.9
Unemployment Rate	0.5	2.1	2.8	3.5
Net Immigration	-0.1	-3.4	-3.7	-3.6

Figure 6.4: GDP and GNP Compared to *Benchmark*



The underperformance of the economy would seriously affect employment. By 2025 total employment would be almost 8 per cent below the *Benchmark* (Figure 6.5). The result would be that the unemployment rate by 2025 would be 3.5 percentage points above the *Benchmark*. This rise would occur in spite of a reduction in the labour force through lower participation rates and lower immigration.

Figure 6.5: Employment and Labour Force Compared to *Benchmark*



Faced with this very unfavourable situation, we assume that the government would hold the borrowing requirement unchanged by raising the personal income tax rate.[87] The position of the public finances would be further aggravated by the rise in unemployment transfers, and lower levels of employment, which reduce revenue. To keep the budget balance at the *Benchmark* level would require an increase of 12 percentage points in

[87] This balancing of the books could be effected through raising other taxes or cutting current expenditure. The choice of labour taxes is made here to simplify the modelling exercise, not because it would necessarily be the wisest choice of instrument.

the average personal tax rate by 2025. This is a stylised assumption; in practice current expenditure would also need to be cut to balance the budget as reliance on tax measures alone would be clearly unsustainable.

This scenario shows that the Irish economy is highly sensitive to its international competitive position. Higher domestic costs, together with a failure to capture market share in international markets, could put the Irish economy onto a lower growth trajectory. This would not only affect income measured in terms of GNP; lower employment, higher unemployment and higher emigration would constitute an expensive loss to society as a whole, which would take time to reverse.

6.3 Higher Potential Growth

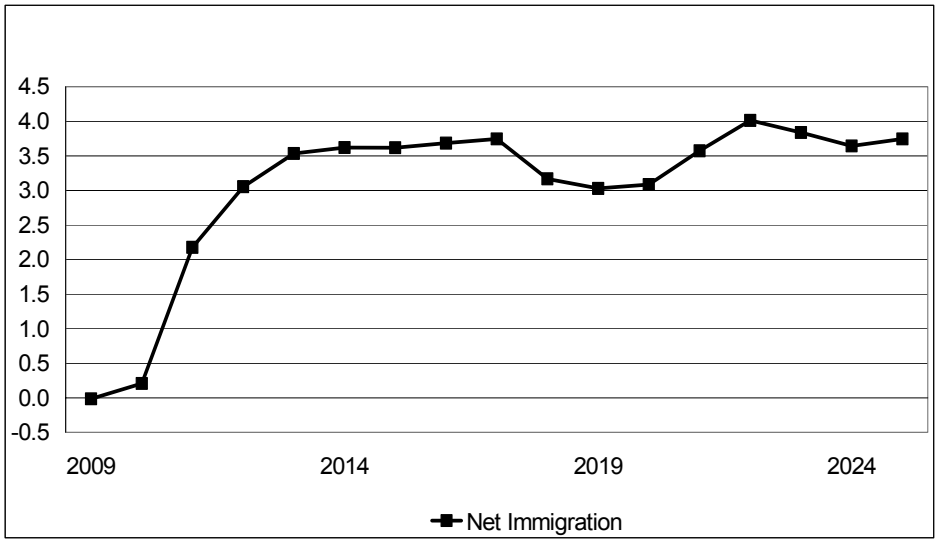
Given the current slowdown in the Irish economy, it may well seem overly optimistic to consider a scenario of higher potential growth. Nevertheless, the Irish economy, over the past 15 years, has more often than not exceeded forecasts of its medium-term growth path. With this in mind it is important to explore the possibility that the estimate of the potential growth of the economy underlying the *Benchmark* forecast is too low. Here we describe the results of a simulation where the economy turns out to be more competitive than assumed in the *Benchmark*. This scenario is captured in the simulation by a higher level of world demand – assumed to be one quarter of a percentage point higher each year.

Table 6.3: Impact on Key Aggregates of Higher Potential Growth Scenario

	2010	2015	2020	2025
Percentage change relative to the *Benchmark*				
GDP	0.2	1.9	5.6	10.1
GNP	0.1	2.1	5.9	10.3
Consumption	-0.5	1.5	6.1	11.8
Total Investment	-0.3	1.2	4.2	7.8
Labour Force	0.0	0.8	2.0	3.4
Total Employment	0.1	1.0	3.0	5.5
Consumption Deflator	0.2	0.2	-0.2	-0.6
Non-Agricultural Wages	0.9	0.8	-0.9	-2.6
New House Prices	0.1	2.7	6.0	9.2
Absolute change relative to the *Benchmark*				
Housing Completions	-0.2	-0.3	1.9	4.5
Balance of Payments	0.5	0.7	0.6	0.5
Unemployment Rate	-0.1	-0.2	-0.9	-2.0
Exchequer Borrowing Requirement	-0.1	-0.6	-0.7	-0.7
Net Immigration	0.2	3.6	3.1	3.7

Such a higher-growth path implies higher productivity growth (with the level of productivity being 4.6 per cent higher than the *Benchmark* by 2025) and higher net immigration than assumed in the *Benchmark*. As shown in Figure 6.6, net immigration would have to average 4,000 a year above that in the *Benchmark*. In addition, this immigration would have to be predominantly skilled labour if the realised rate of productivity growth in the *Benchmark* were to rise.

Figure 6.6: Higher Potential: Net Immigration Compared to *Benchmark*



In this scenario we assume that the investment in public infrastructure will be adequate to cope with the higher level of activity and the higher population. If this were not the case the direct effects of congestion, and its indirect effects via the labour market, could prevent this scenario from being fully realised.

Figure 6.7: Higher Potential: GNP Compared to *Benchmark*

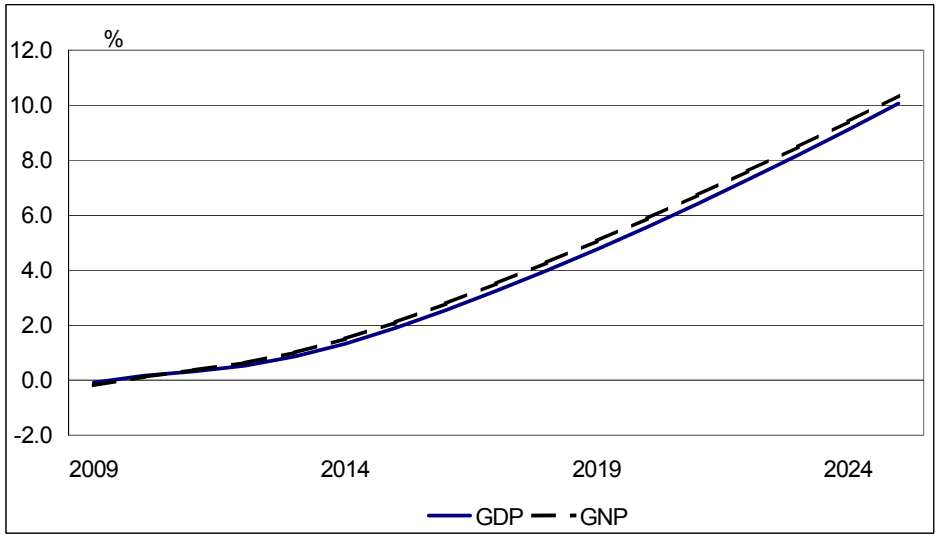
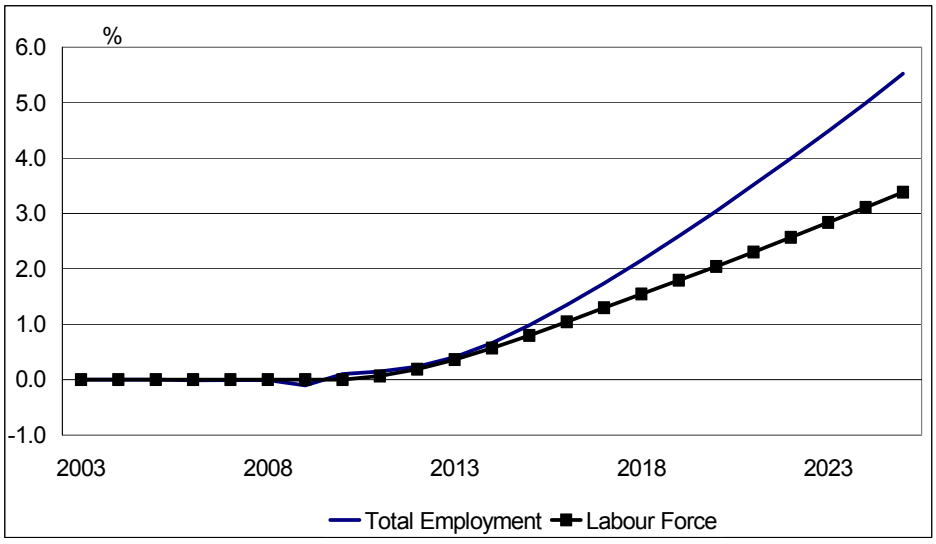


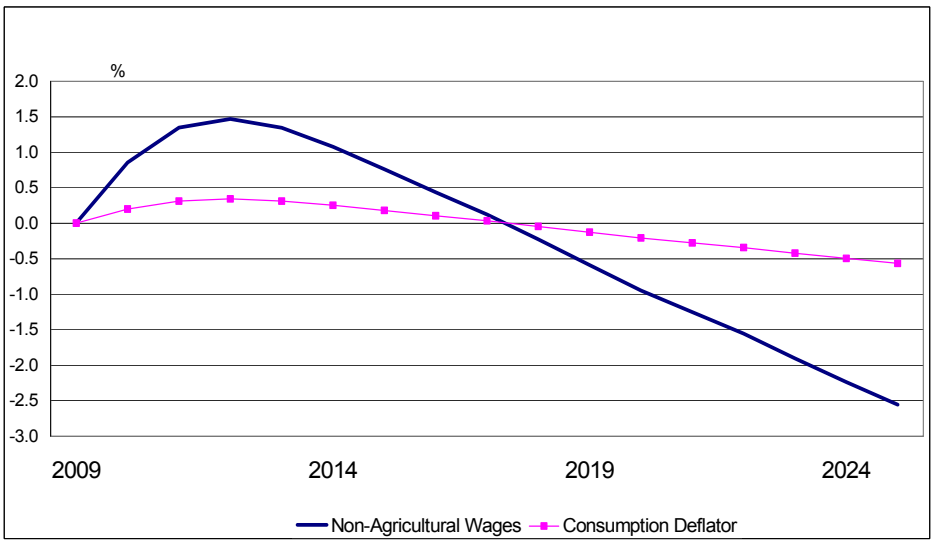
Figure 6.7 shows the level of GNP rising steadily compared to the *Benchmark*. The additional growth in GNP would amount to around 0.7 percentage points a year, with GNP per head up by just over 0.6 per cent by 2025 relative to the *Benchmark*. This would leave overall economic welfare, measured by GNP per head, higher as a result of the higher skilled immigration and higher productivity growth. However, in order to assess the full impact a positive scenario like this one would need to take account of the impact of higher growth on congestion and the environment (see Chapter 5). Additional investment would be required to deal with these problems, which is not taken account of here.

Figure 6.8: Higher Potential: Employment Compared to *Benchmark*



Under this scenario, the level of employment would also rise more rapidly over the course of the decade (Figure 6.8). By 2025 it would be almost 6 per cent above the *Benchmark*. Higher net immigration and higher labour force participation would raise the labour force to 3.5 per cent above the *Benchmark*, so that there would also be a further fall in the unemployment rate of 2 percentage points by 2025.

Figure 6.9: Higher Potential: Inflation and Wages Compared to *Benchmark*



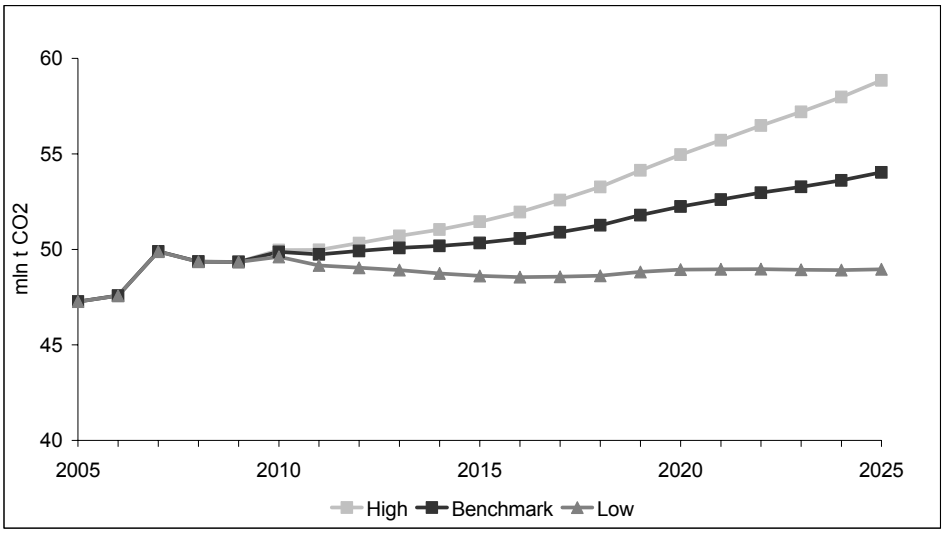
The improved competitive position is illustrated in Figure 6.9. The higher growth and employment levels would leave consumer prices slightly lower, while non-agricultural wage rates would be 2.5 percentage points lower by 2025 reflecting the assumption of increased competitiveness. However, this would not constitute a loss in real income for workers; the real after tax non-agricultural wage rate in this scenario would be more than 5.5 percentage points higher than in the *Benchmark* by 2025. This would be partly due to the fact that the higher level of economic activity would allow for a reduction in average tax rates, and it would also be partly attributable to the lower rate of inflation.

Box 6.1: CO_2 Forecast

Chapter 5 discusses the carbon dioxide emissions associated with the *Benchmark* forecast in considerable detail. One would expect that faster economic growth would lead to higher emissions, and slower economic growth would mean lower emissions. At the same time, economic growth, energy use, and carbon dioxide emissions are decoupled to a certain extent – and one cannot say that 1 per cent faster economic growth implies 1 per cent faster growth of emissions. Figure 6.1.1, therefore, shows the carbon dioxide emissions for the *Benchmark* forecast, the High Growth scenario, and the Low Growth scenario. While CO_2 emissions grow on average by 0.7 per cent per year between 2005 and 2025, the growth rate increases to 1.1 per cent in the High Growth scenario and falls to 0.2 per cent in the Low Growth scenario.[88] This is further evidence of decoupling. The difference between economic growth in the alternative scenarios is roughly 1 per cent, but the difference in emissions growth between the Low Growth and the *Benchmark* forecast is 0.5 per cent, and between the *Benchmark* and High Growth scenario only 0.4 per cent.

One of the results of the *Benchmark* forecast is that Ireland will not meet its targets for greenhouse gas emission reduction, even though a carbon tax is imposed. In the High Growth scenario, the gap between the projected emissions and the target is even larger. In the Low Growth scenario, emissions grow for a number of years and then plateau – even though the stated aim is to reduce emissions.

Figure 6.1.1: Carbon Dioxide Emissions for Alternative Scenarios



6.4 Credit Crunch

In the last *Medium-Term Review* we examined the impact on the Irish economy of a sharp slowdown in the US economy beginning in 2007. It seems that this slowdown is currently underway. However, there remains a substantial degree of uncertainty surrounding the likely length and depth of this slowdown. Our *Benchmark* forecast is based on the assumption that the

[88] Note that emissions *fall* by 0.1 per cent per year in the Low Scenario between 2007 and 2025. Emissions increase by 2.7 per cent per year between 2005 and 2007. Although the economic scenarios start to separate after 2009, we report CO_2 emissions relative to 2005 because that is the year against which emission targets are defined.

effects of the current credit squeeze are short lived and that growth in the US, UK and Euro Area revert to rates close to trend by 2010/2011.

In this shock, we consider the impact of a more severe slowdown in output. The scenario we consider is one in which risks on financial assets have effectively been underpriced and risk premia rise in the US, the UK and to a lesser extent in the Euro Area. The consequence of this change in the financial environment is that interest rates for borrowers are much higher than would be normal given the current official rate of interest, and banks may implement credit rationing as they hoard liquidity. This combination of events is difficult to model directly. We have implemented this using the *NiGEM* model by raising technical risk premia. This drives a wedge between deposit and loan rates and also affects the risk of investing in equities and physical assets. These increased risk premia are maintained until the end of 2010. This would represent a severe shock to the international economy and is not meant as a forecast of things to come. This scenario probes the potential impact of a severe credit crunch in the international economy and its possible impact on Ireland.

The effects on output in the US, UK and Euro Area of this scenario would be quite large. In the short term, investment would fall dramatically below base as a result of the credit crunch, and consumption would also be adversely affected. The impact of the shock would put downwards pressure on the price level. The main Central Banks are assumed to react to the shock by cutting interest rates. As the effects of the credit crunch would be larger in the US and the UK, the Federal Reserve and UK Monetary Policy Committee would react aggressively to the shock and cut interest rates to below 1 per cent in the short term. The cut in Euro Area interest rates would be less dramatic: interest rates are assumed to be cut to around 2.5 per cent.

Table 6.4: International Shock Versus Baseline

	2008	2009	2010
Interest Rates, %			
Euro Area Short	-0.5	-1.5	-1.4
UK Short	-0.1	-2.1	-4.3
US Short	-1.0	-0.9	-1.5
Japan Short	-0.1	-0.2	-0.8
Growth Rate of GDP			
Germany	-0.7	-1.7	-1.2
UK	-0.4	-1.2	-1.3
USA	-1.3	-3.8	-2.0
OECD	-1.0	-0.3	-1.0

The implications of this deflationary shock for the Irish economy would be very significant, testament to our heavy exposure to the world economy, and in particular to events in the US. In Table 6.5 we present the likely impact of the shock on some key economic aggregates. The effect of this credit crunch scenario on the short-term performance of the economy is stark. The economy would move into recession in 2009, with GNP and employment both falling. Despite emigration this decline in activity would lead to a sharp rise in the unemployment rate, peaking at 9 per cent in

2010. The deflationary effect of the shock would show up in very low growth in non-agricultural wages: in 2010 wages would rise by as little as 1.4 per cent, with a larger rise in the consumption deflator of 1.9 per cent. This would result in a fall in real wages. Such a shock would also impact on the growth in new house prices, over the three years 2008-2010 new house price levels would be 5 per cent lower than in the *Benchmark*.

The decline in real wages implies a level of flexibility in the labour market in the advent of a severe external shock. However, this measure of flexibility would not be nearly enough to reverse the negative impact on the labour market over the short to medium term.

Table 6.5: Credit Crunch Shock Simulation Results

Annual Growth Rates	**2008**	**2009**	**2010**	**2011**
GDP	0.7	-0.6	2.9	4.7
GNP	0.8	-0.3	3.9	5.5
Consumption	2.4	1.1	0.5	0.9
Total Investment	-7.4	-2.4	3.4	-2.9
Labour Force	1.9	1.6	1.2	1.2
Total Employment	-0.6	-0.4	0.1	1.7
Consumption Deflator	1.8	1.2	1.9	1.9
Non-Agricultural Wages	3.7	2.2	1.4	1.8
New House Prices	-0.2	1.5	0.8	0.7
Level				
Balance of Payments, % of GNP	-5.5	-7.0	-8.8	-6.8
Unemployment Rate	6.5	8.0	9.0	8.6
Exchequer Borrowing Requirement, % of GNP	-3.6	-6.0	-5.9	-5.9
Debt-GNP Ratio	20.7	22.0	27.1	31.6

Arguably, however, the most dramatic effect of this shock would be its effect on the public finances. In this simulation we held tax and expenditure levels roughly unchanged in order to assess the likely consequences for the budget of such a shock. Looking at Table 6.5 it can be seen that the impact on the exchequer borrowing requirement after three years is a deficit of 6 per cent of GNP, while the debt-GNP ratio is 6 percentage points higher than in the *Benchmark*. This would clearly be unsustainable, possibly requiring remedial action when the economy was already in serious difficulties.

As presented, this shock is short term in nature. Beyond 2011 once the credit crunch squeeze would have ended, the Irish economy would recover rapidly and return relatively quickly to its medium-term growth trajectory described in the *Benchmark* forecast. This rapid recovery is, in part, a result of the boost to economic activity from the sharp cut in international interest rates.

The lesson for the medium term from this shock is that even in the face of a serious downturn in the economy, if managed appropriately, there need not necessarily be serious long-term damage. The assumption, based on past experience, of considerable flexibility in the labour market is an important ingredient in this resilience. This flexibility has been manifested in recent years both when the labour market was tight (increasing wage inflation) and when it was somewhat slacker (a fall in the rate of wage

inflation in some sectors in 2001 and 2002). However, the size of this shock would take the labour market into uncharted waters and the low rates of wage increase necessary to bring about rapid recovery might not be realised.

6.5 Conclusions

Given the uncertainty that surrounds any forecasting exercise it is always unwise to rely on a single projection for the future. Following on from the *Benchmark* forecast presented in Chapter 4, in this chapter we explore a number of different scenarios that could alter the future course of the economy over the medium term. The first two scenarios concentrate on competitiveness on world markets, while the third looks at Ireland's vulnerability to a very sharp credit crunch shock.

In the first scenario we examine the likely consequences of a deterioration in our competitiveness. The results suggest that there are significant downside risks over the medium term if policy does not focus on promoting competitiveness, broadly defined, on world markets; growth and employment could fall significantly.

In the second scenario we consider the possibility that Ireland will be more competitive over the medium term than is assumed in the *Benchmark*. This simulation suggests that GNP could grow at 0.7 per cent per year above the *Benchmark* growth rate under these circumstances. However, it would require higher levels of migration than in the *Benchmark* forecast, with some consequences for congestion. Nonetheless, if policies could be found to bring about a higher rate of productivity growth than in the *Benchmark* scenario this could have a significant beneficial impact on the living standards of all of the population.

Our third scenario looks at the possibility that the current slowdown in the world economy could be sharper and deeper than in the *Benchmark*. This scenario suggests that a severe liquidity crisis in the US could lead to a recession in the US, with substantial negative consequences for the Irish and EU economies over the three-year horizon considered here. Rapid deflation in this scenario, combined with much lower world demand, would lead to much lower output and employment than in the *Benchmark* forecast, despite significantly lower rates of wage and price inflation. There would be severe problems making the public finances add up in the face of a mushrooming deficit.

The analysis in this chapter, which illustrates the uncertainty inherent in medium-term forecasts, highlights the importance of choosing robust policies, which will be suitable whatever the likely outcome. In the light of the current substantial infrastructural deficit, delivering the major increase in investment that is needed to allow the economy to achieve its potential growth rate over the next decade continues to be appropriate. Public policy also needs to focus on restoring the broad competitiveness of the economy. This entails attention to micro-economic issues to ensure the efficient operation in markets, including the market for public goods. It also means that fiscal policy needs to preserve a focus on medium-term sustainability.

7. CONCLUSIONS

7.1 Introduction

The main purpose of ESRI *Medium-Term Reviews* is to look five to seven years ahead, providing some insights into the factors that will drive the economy over that period. This *Review* continues that tradition and concentrates the bulk of its analysis on the prospects for the economy out to 2015 and beyond, rather than concentrating on the immediate problems of the economy. A major conclusion of this *Review* is that, despite the temporary difficulties the Irish economy currently faces, the medium-term prospects remain bright.

It is likely that Ireland's standard of living, which is already one of the highest in the EU and indeed the world, will show some further relative improvement in the coming decade. As the very substantial investment in infrastructure currently under way begins to come on stream, this too will enhance the quality of life for many residents. With the prospect of a return to full employment after the current difficulties, a gradual improvement in the quality of public services, and a substantial rise in the resources available for household consumption, the next decade should see relatively steady economic progress in terms of living standards. However, because of the immediacy of current problems there is always a danger that this prospect of a brighter future may be obscured or forgotten. Such a loss of focus could be damaging if the associated planning and structural changes needed to underpin these brighter medium-term prospects were to be neglected.

Two and a half years ago, when we published the last *Medium-Term Review*, there was a sense of foreboding, with fears that pent up problems in both the Irish and the US economies could, at some future date, blight economic prospects. Since that *Review* was published in December 2005, some of those fears have been borne out by events. As a result, the Irish and the US economies have both entered on a period of below average growth in economic activity. To date the impact of this downturn on the Irish economy is less than might have been feared. In particular, the rate of unemployment in Ireland is well below what was anticipated in that *Review* in the scenario that incorporated a major fall in house prices.

The housing market is currently undergoing serious adjustment. This is the unavoidable consequence of expectations about future capital gains running ahead of reality in the period 2004-2006 (OECD, 2006). While unfortunate, the timing of the current adjustment phase is not too unfavourable, having commenced against the backdrop of a buoyant Euro Area economy. Though the external environment has recently weakened, the adjustment process has been eased by continued strength in EU demand for our goods and services. This *Review* points to the need for a

large number of additional dwellings over the coming fifteen years to house the rapidly growing population. It is these special demographic circumstances that make Ireland different from most other EU countries, necessitating continued substantial investment in housing.

It is difficult to predict exactly when the Irish and the US economies will recover from their current problems, and this *Review* does not attempt this task. The developments in the US financial system in Autumn 2007 have proved more long lasting and much more substantial than was initially anticipated. As a result, it remains possible that the current difficulties could persist longer than we envisage in the *Benchmark* forecast in Chapter 4. With this in mind, in Chapter 6 we explore a scenario where the US recession is more severe than anticipated and where it impacts more on the EU economy than is assumed in the *Benchmark* forecast. Under these circumstances, the effects on the Irish economy could be more severe, pushing the economy, including the housing market, further down and delaying the eventual recovery by about one year. However, what is significant about this scenario is that it suggests that if the current problems last longer than anticipated, the eventual recovery will be all the more vigorous. The economy has the potential to grow at an average of 3.5 per cent a year over the coming decade and, provided that appropriate policies are implemented, this objective is attainable.

On past experience our medium-term forecasts come with a margin of error on the average growth rate over the forecast time horizon. This margin is between three-quarters and one percentage point of GNP (Appendix 1). Also the last ten *Reviews* have tended towards the pessimistic side in terms of their forecasts, with underestimation of future growth being more frequent than overestimation. Chapter 6, therefore, explores two further scenarios where the economy grows by around 0.7 percentage points more and 0.7 percentage points less respectively than in the *Benchmark* forecast. This gives a range of possible outcomes and, in discussing future economic policies, we need to test the robustness of those policies against these alternative possible scenarios.

The analysis underpinning the forecasting exercise involves a detailed examination of the domestic and foreign processes driving the economy. This analysis is as important as the numbers themselves in identifying key issues for economic policymakers. Section 7.2 of this chapter sets out the major conclusions on how the behaviour of the Irish economy is evolving. Section 7.3 summarises the main conclusions on the medium-term prospects for the Irish economy. Finally, in Section 7.4, we discuss some of the key policy implications of the analysis outlined in this *Review*.

7.2 Changing Economic Behaviour

The analysis in Chapter 2 examined the different channels through which world economic activity impacts on the Irish economy. In past decades manufacturing played a hugely important role in internationalising the economy and in helping bring about the convergence of living standards to the EU norm (Barry, 2002). While this analysis indicates that the manufacturing sector still remains very important to the economy, its role is now changing. Since 2001 output growth has slowed down and employment in the sector has been declining and this process is likely to continue in the forecast period. In the future, net expansion of

employment will only occur in the high-tech industries where the technology involves skilled workers in the production process.

Commensurate with the changing role of manufacturing, the analysis in Chapter 2 shows that the business and financial services sector is in the process of becoming significantly more important as a channel through which world economic activity is transmitted to the Irish economy. It would appear that Ireland's comparative advantage on world markets is shifting towards the production and export of business and financial services. This sector is among the most human-capital intensive in the economy. Many of the services produced by this sector also benefit from the fact that English is the language of the sector internationally.

The move from manufacturing to business and financial services could be expected to have some negative effect on measured productivity, because statistical methodologies are not yet sufficiently developed to capture productivity changes in these services. However, even if there were to be a negative productivity effect, it is likely that it would be significantly offset by a terms of trade gain. The business and financial services sector seems to be able to increase exports and its market share in world trade without any negative impact on prices. This probably reflects a relative undersupply of skilled labour worldwide causing output prices of services with a high skill content to rise. As a result, Gross National Disposable Income (GNDI), a more appropriate measure of living standards than GDP or GNP, may rise more rapidly than GNP over the coming decade due to a reversal of the past trend loss in the terms of trade.

The second major area where changes in behaviour are under way is the labour market. Whereas in the past there was a large potential supply of mobile Irish labour that moved backwards and forwards from the UK, the rest of the EU or even the US, the bulk of the mobile workers in Ireland today are foreigners. The variables that drive decisions on migration by foreigners are different from those that mattered to Irish migrants. For example, for Polish immigrants a key factor influencing their decision to come to Ireland is their potential earnings in Ireland relative to Poland whereas for previous generations of returning Irish emigrants it was their potential earnings in Ireland relative to the UK. The rapid growth of the economy in recent years also means that public and private infrastructure (housing in particular) is in short supply, raising the cost of living in Ireland for returning emigrants and new immigrants alike. This means that the more emigrants that come to Ireland in a particular year the higher will be the cost of housing which will, in turn, affect the numbers coming. This means that the bigger the increase in employment in a year, requiring more immigrants, the bigger will be the rise in wage rates. In effect, the supply curve of labour is now much less elastic than in the past, which affects the labour market in two important ways:

First, any domestic stimulus to the economy, e.g. from fiscal policy, will tend to raise domestic wages and prices, crowding out the domestic tradable sector. This has been the experience of the economy in recent years, in contrast with earlier years, when there was an ample supply of mobile Irish labour and fewer infrastructure constraints.

Second, it also shifts the incidence of labour taxation. In the past, most of the incidence was on employers. To the extent that they could not bear

the cost of increased labour taxes, they reduced output and employment. By contrast, today a significant part of any increase in labour taxation will fall on employees, having a more limited impact on competitiveness and employment than in the past. Obviously, the converse holds for cuts in taxation.

A further effect of the change in labour supply behaviour is that the labour market seems to adjust to changes in demand for labour more rapidly than in the past. While in the 1970s and 1980s people were slow to move abroad (or move back), today they seem to relocate more readily when faced with strong incentives – e.g. unemployment. This helps explain why the current rise in unemployment, though significant, has not been as severe as anticipated in the last *Review*.

The move from net emigration of Irish citizens to net immigration of foreigners not only changes the supply curve of labour; it also has wider implications for how the economy adjusts to shocks. Because many of the immigrants into Ireland are very well educated, immigration tended to narrow wage dispersion between 1997 and 2003 (Barrett, Fitz Gerald and Nolan, 2002). However, since then, while immigrants have still tended to be well educated, those from non-English speaking countries have been less successful in obtaining skilled jobs. This has probably contributed to some limited widening of wage dispersion since 2003 (Barrett and McCarthy, 2007).

The potential effects of migration on productivity were discussed in Chapter 2. However, there is limited evidence to date on this issue. What evidence there is suggests that having a mobile and flexible labour force does enhance productivity (e.g. Barrett and O'Connell, 2001). Also, access to a work force with varied experience and backgrounds seems to be important for the business and financial sector.

7.3 Medium-term Prospects

In preparing our *Benchmark* forecast for the economy to 2015 we have incorporated a series of assumptions about the external environment, the stance of domestic economic policy and demographic trends.

The external scenario we are using is based on the January 2008 *National Institute Economic Review*[89] supplemented by the IMF's January 2008 forecast. It sees the US being technically in recession this year, with continuing low growth in 2009. However, it is expected to recover quite strongly in 2010. The EU economy follows a more muted path with continuing substantial growth this year and some slowdown thereafter. After a bounce back in 2010, the major world economies are assumed to revert to their long-term growth path out to 2015 and beyond.[90]

Domestic fiscal policy is assumed to be broadly neutral and, as a result, the substantial increase in the general government deficit in 2007/2008 will

[89]Produced by the National Institute for Economic and Social Research (NIESR) in London. It is NIESR's *NiGEM* model that is used in this *Review* to examine alternative scenarios on the external environment.

[90]Because of the uncertainty inherent in any such forecast an alternative scenario is explored in Chapter 6 where the US and hence the world recovery is delayed.

be corrected gradually over the forecast period. The National Development Plan is assumed to continue as planned. Current government expenditure as a share of GNP is assumed to remain broadly unchanged out to 2015. This will see some improvement in public services in line with projected economic growth. As a first step to reducing Ireland's greenhouse gas emissions, it is assumed that a carbon tax is implemented from 2010 onwards and that it is set at the EU Emissions Trading Scheme (ETS) price for carbon permits. It is also assumed that after 2012 all tradable emissions permits are auctioned, with the revenue accruing to the government and being used to moderate taxes on labour.

The main area of demographic uncertainty is migration. Because migration is driven by changing economic incentives, its level in our forecast is determined by the economic environment in Ireland relative to that elsewhere in the EU. Given our current forecasts for Ireland and the EU, we envisage continuing net immigration into Ireland, but at a much lower level than that experienced in recent years.

Based on these assumptions, we see the Irish economy rebounding in 2010, with more rapid growth making up for "lost time". Thereafter, the rate of growth in GNP should be around 3.5 per cent a year. The growth in Gross National Disposable Income (GNDI) will be slightly slower. In the 2005-2010 period, it is expected to grow by 1.5 percentage points less than GNP due to losses in the terms of trade. Between 2010 and 2015, the rate of growth of GNDI will be much closer to that of GNP and, as discussed in Chapter 2, the shift towards services exports should see GNDI growing more rapidly than GNP in the second half of the next decade. Employment will grow at a little over 1 per cent a year, much slower than in the recent past. This reflects somewhat lower trend growth and a somewhat higher productivity increase. As discussed elsewhere in this *Review,* the higher productivity is partly due to the reduction in importance of the low productivity building and construction sector.

Unemployment (as defined by the International Labour Organisation) is expected to peak at just under 7 per cent of the labour force in 2011 and to fall back gradually in subsequent years. The economy should be back to close to full employment by the end of the forecast period. The pattern of employment growth will be different from that in the past: industrial employment will gradually fall while the major growth in employment will be in business and financial services.

The consumption deflator is expected to grow at between 2.5 per cent and 3.0 per cent a year. However, the recent fall in the sterling exchange rate could imply some moderation in this rate of inflation in the next few years. The rate of growth in non-agricultural wage rates will be rather similar to that of today – around 4.3 per cent a year. This will not be enough to restore the competitiveness lost in recent years; hence the slow growth forecast for manufacturing.

The balance of payments deficit is expected to peak by 2010 at over 5 per cent of GNP. Thereafter, it is expected to fall as domestic demand grows more slowly than trade. It is expected that the main growth in trade will come from rapidly growing services exports.

The housing sector is expected to be back on an even keel in 2010. Thereafter, housing completions are expected to lie in the range 45,000-50,000 a year. This would be consistent with unchanging real house prices between 2010 and 2015.

7.4 Implications for Policy

The changing behaviour of the economy, together with the evolving needs of a much richer and more mobile society, will pose new issues for policy. We explore some of these here, recognising that there are many others, which lie beyond the scope of this *Review*. Here we consider first fiscal policy, whose primary focus is to moderate the inherently cyclical nature of the economy. In the absence of monetary policy controls, fiscal policy is of increasing importance for EMU countries. We then look at structural policies, whose main focus is to enhance long-term economic growth and productivity, primarily by fostering structural change. Next we look at environmental policy, which is moving up the overall national agenda rapidly, as concerns about climate change are growing. Finally, we look briefly at the overall implications for policy of Ireland's favourable demographic situation over the period to 2025. This provides a window of opportunity to address the long-term challenges of an ageing society, which will inevitably affect Ireland in the second quarter of the current century.

FISCAL POLICY

The changing behaviour of the economy has implications for the operation of fiscal policy. In the past, when labour supply was very elastic, fiscal policy, through influencing aggregate demand, could have only a limited impact on wage or price inflation. However, with the changed behaviour of the economy, stimulatory fiscal policy will add to labour demand, when the economy is close to or above its long-term potential output. In turn, with a less elastic supply of labour, this will give rise to higher wage rates and domestic prices. If the economy were already at capacity such a stimulus would produce little increase in output, while adding significantly to the loss of competitiveness.

Under current circumstances this is not an issue, and with output growth falling below the long-run potential for the economy the government's current planned fiscal deficit is appropriate. However, pro-cyclical fiscal policy in earlier years has left the economy less well prepared to deal with the current problems than might otherwise have been the case (European Forecasting Network, 2007 Autumn Report). Given the new labour market situation, it will be more important to operate countercyclical fiscal policies in the coming decade, to keep the economy close to its potential growth rate.

The changing incidence of taxation is also of relevance to the conduct of fiscal policy. While in the past the fact that all the incidence of labour taxes fell on employers meant that low labour taxes were good for competitiveness, the change in incidence has implications for fiscal policy. Today, while some of the benefits of a cut in labour taxes will still be passed through to employers, improving competitiveness, this improvement will be less than it was in the past. The analysis using the *HERMES* model still suggests that the imposition of a substantial carbon tax (as assumed in the *Benchmark Forecast*) would increase employment if the tax revenue were recycled through reducing the tax on labour.

As noted above, prior to EMU, member states had the opportunity to manage the economy using monetary policy. This was particularly important for the domestic housing market, where interest rates and credit controls could quickly affect the demand for housing. However, under EMU, monetary policy is targeted at the Euro Area inflation rate and, because of the idiosyncratic nature of the housing sector across the Euro Area, there can be no expectation that the stance of monetary policy will be able to help manage the housing market in specific economies. This is particularly so if there is a housing bubble (European Forecasting Network Spring Report, 2006, Appendix).

Under these circumstances the best instrument available to governments to manage national housing markets is fiscal policy (HM Treasury, 2003). Through suitably targeted tax instruments, the authorities can change the cost of housing services faced by households, influencing their investment behaviour. However, as housing booms and slumps do occur from time to time, it will be important for governments throughout the Euro Area to develop fiscal instruments which are administratively feasible and acceptable to society, recognising the potential dangers of shocks in the housing sector to the wider economy.

Finally, it is clear that with rising living standards the public will demand improvements in public services, and the government's capacity to provide these improvements will depend, *inter alia,* on the rate of growth in resources. In boom periods, such as we have experienced, it has been possible to ramp up expenditure very significantly in certain areas, for example, health. However, because of administrative problems, this expenditure has not produced the expected increase in quality services, a challenge which is now more difficult to face in a tighter budgetary situation. It will be very important in the forecast period to reform the administrative system in health to ensure that it will produce the demanded quality health service at a realistic cost. More generally, the importance of good public services, efficiently delivered, for the quality of life is now widely accepted (NESC, 2005) and may well be a factor in attracting and retaining the highly-skilled people that the labour market needs. In this context, the recent OECD report, which discussed key challenges for public administration in Ireland, including the implications of the current decentralisation plan for the efficient and coherent delivery of public services, warrants careful consideration (OECD, 2008b).

STRUCTURAL POLICIES

While governments can smooth the cycle through appropriate use of fiscal policy, it is not an effective instrument to influence future productivity growth and living standards in a modern economy. Instead, a range of structural policies, including investment in suitable public infrastructure, is the appropriate instrument that governments can use for such longer-term goals.[91]

[91]In effect, structural policies work in tandem with fiscal policy, but they differ in that the financial commitment to them should be more long term in focus and remain independent of the economic cycle. This is consistent with the current commitment to the NDP in the present budgetary situation.

The shift from dependence on growth in the manufacturing sector to growth in business and financial services as a driver of growth has important implications for policy. For example, there is a need to consider how the requirements of the business and financial services sector can be best met through structural policies in the future. In the past "Industrial policy" focused on manufacturing, with some considerable success. However, while industrial policy has been gradually changing its focus, there is a need for a broader reassessment of the suitability of a wide range of other public policies for the changed circumstances.

Like the high-tech sector, parts of the business and financial sector are very human capital intensive. To some extent the labour market is already adjusting to the sector's needs as individual students choose their courses of study at third level. In addition, it is noteworthy that the financial sub-sector has a relatively high proportion of foreign workers and the continued ability to attract and hold such skilled labour is important to the sector.

With a downturn in the economy and a return to significant unemployment it will be important to revisit some of the labour-market policies of the 1990s. Research then showed that it was important to invest in developing the skills and education of those who become unemployed to ensure that they return rapidly to the active labour market. In addition, the changing structure of the economy will also need to be reflected in future policy on training and education.

Because of the importance of skilled labour to the internationally-traded sections of the services sector, the factors affecting the supply of such skills are also of concern. This not only includes ensuring an appropriate range of suitable third level graduates but it is also necessary to ensure that Ireland is an attractive location for the skilled workers in the sector, be they Irish or foreign. Other economies have increased the supply of skilled labour only to see this labour move abroad in the search for more attractive living conditions and lifestyle. Thus ensuring a good quality of life[92] may be of substantial indirect benefit to the sector through its potential effects on labour supply.

Since the late 1990s, there has been a strong commitment to investing in Research and Development. This policy is being implemented through a substantial increase in public funding for R&D, both in third level institutions and in businesses, as well as in supports to build research networks and collaborations across public and private institutions. While it is early days to assess the effects of this policy, it requires increasing attention to ensure that the economic benefits will begin to be realised over the forecast period. This is essential to ensuring the process of structural change into high-tech manufacturing and high value-added internationally traded services. Also policy on R&D needs to take account of the changing structure of the economy, as discussed in Chapter 2.

[92]We use quality of life to indicate access to good housing, a supportive working environment, high quality health services, good educational system, and a broad based cultural and social environment.

The analysis in this *Review* suggests that the objectives of the National Development Plan remain appropriate to the needs of the rapidly changing economy. The range of physical infrastructure projects planned is necessary, not only to facilitate future economic growth, but also to improve living standards, broadly defined. Even if it is not directly captured in GNP or GNDI, the benefits that flow from the improved infrastructure, such as reduced congestion, improved health services and a better environment, all improve the welfare of those living in Ireland.

There remain certain concerns about the implementation of the NDP. These pertain in particular to the public transport area. It is not clear that the necessary planning has been undertaken to ensure the investments will produce the benefits that are promised. In addition, the ability of the public administration to manage and implement very large projects in a very tight time scale has yet to be proved. Ramping up investment in any sphere, be it public transport or R&D, is difficult at the best of times. This was one of the reasons why Morgenroth and Fitz Gerald (2006), suggested that large projects should be ramped up gradually.

In addition, that report on investment priorities suggested that the implementation of supporting policies to ensure efficient use of resources is at least as important as the physical investment. In some cases, for instance public transport, more competition is the appropriate response, while in other cases more but especially better regulation is required. In particular, there is a need for policy on physical planning to focus on developing sustainable urban centres that can provide a high standard of living. This not only involves investment but it also requires an appropriate regulatory response to move towards much denser development. If good value is to be obtained from the huge investment in infrastructure, and if we are to develop sustainable urban centres, it will be important to move fairly rapidly towards some system of congestion charging. Given the EU's plans for reducing emissions of greenhouse gases, and given its proposed limits for Ireland, the current trend towards dispersed development and long-distance commuting is simply not sustainable on environmental grounds. In fact, one of the key policy challenges over the forecast period will be to explore how to increase the spatial coherence of the large stock of housing that has been created over the past decade.

To some extent the shift in the sectoral pattern of production emphasises the need for a review of how regional policy is implemented. For example, jobs in the internationally-traded sections of the business and financial services sector are generally concentrated in large urban centres. Policy will need to take this into account and it provides additional urgency to implementing the *National Spatial Strategy*.

In addition, to public infrastructure, the analysis in this *Review* suggests that there will be a need for many more dwellings over the coming ten or fifteen years. Over the period it would appear that there will be a need for up to 50,000 dwellings a year to meet the needs of the growing and wealthier population. Even with the slowdown in immigration envisaged in the *Benchmark* forecast, the relatively low existing headship rates (proportion of adults of a given age who are in an independent household) suggests that, with more realistic prices, there is scope for significant new demand for independent living from those in their twenties. This analysis suggests that there is an effective demographic floor under the housing

market. While output and prices may fall in the short term, with continued economic growth as envisaged in the *Benchmark* forecast, the housing market will eventually rebound. Thus, as suggested in Chapter 2, the current slowdown may provide an opportunity to explore how fiscal policy and government intervention can best influence the housing market in the future.

ENVIRONMENTAL POLICY

The current EU proposal for limits on emissions of greenhouse gases will prove extremely difficult to achieve in Ireland. The targets require a very large reduction in emissions compared to the forecasts outlined in Chapter 6. These forecasts already include tradable permits (for some sectors) and a carbon tax (for the other sectors).

The projected permit price is high enough to induce significant changes in the electricity generation sector, lowering its carbon emissions over time, but it is not high enough to substantially change behaviour in the medium term in other areas, such as transport, cement production and agriculture. Probably the most important role of a carbon tax is to provide incentives for both investment and research designed to achieve a more carbon efficient life style in the long term. Such investment in houses, cars, etc. will be encouraged by a carbon tax but will take many years to mature. Also a carbon tax would provide the vital incentive to undertake the R&D, which will ultimately prove crucial to developing a low or zero carbon society.

The target for greenhouse gas emission reduction will, therefore, be missed unless further policy actions are taken. The gap between the target and the outturn is even larger if one considers the rapidly growing emissions embedded in Irish imports. The target of 20 per cent of renewables in the power generation sector will readily be met, mostly by wind power. However, this implies a substantial increase in the price of electricity.

There is considerable uncertainty about just how costly (and as a result, feasible) it will be to meet the EU limits on emissions of greenhouse gases by 2020. For the limited carbon tax assumed in the *Benchmark* forecast, there is no net cost to the economy because the income tax reduction offsets the higher price of energy. For higher taxes, the costs could be large. However, as discussed above, the long-term benefits of a carbon tax would be substantial, providing the cheapest way to meet Ireland's climate change objectives.

If all EU countries face the same price of carbon, then no country within the EU will suffer a loss of competitiveness relative to its EU neighbours. Under these conditions, the costs of compliance will be limited. However, if the cost were much higher for some countries than for others, then the economic cost of compliance would be greatly magnified by the resulting loss of competitiveness. This would be true for Ireland, which has the most stringent target of all EU member states. Of course even if the price is similar for all countries in the EU, there will still be a loss of competitiveness relative to countries that are not part of the scheme, but the negative effects on production will be much more muted as trade is limited (Fitz Gerald, Keeney and Scott, 2007).

The easiest way to achieve a common compliance cost across Europe is to create a European-wide 'cap and trade' system. Under this scheme, if the EU cost of the permits were less than the carbon tax necessary to achieve compliance domestically then countries would buy permits (and vice versa if their domestic carbon tax were lower). Unlike the Clean Development Mechanism (CDM) under the Kyoto Protocol, such a regime would not change the overall EU emissions limit. However, it would ensure that the cost of compliance per unit of carbon was the same across the EU. This would ensure that climate policy would not change the competitiveness of the Irish economy (or any other EU economy) relative to its EU neighbours and it would minimise the cost of emissions reduction for the EU as a whole.

For environmental problems other than climate change, we find relatively benign trends. Most emissions are stable or declining, primarily because of technological progress and structural change in the economy. However, biodegradable municipal waste emissions have continued to rise fast and have evoked a similar policy response to greenhouse gas emissions with a focus on setting targets rather than implementing policies to change behaviour. Although the government has set ambitious targets for limiting the share of waste sent to landfill, partly of its own volition and partly induced by the EU, policies have not yet been put in place to make sure that those targets are met. Meeting the targets would require substantial changes in household behaviour and post-collection treatment to favour some mixture of recycling, composting and incineration. The incentives to induce such changes are not yet in place. Even assuming (as the *Benchmark* scenario does) that the planned incinerators will be used fully, their capacity does not appear sufficient to close the gap.

PREPARING FOR THE CHALLENGES OF AN AGEING POPULATION

The gradual increase in the average age of the population and in the proportion of the population that is retired will put increasing pressures on public services in the years after 2020. These potential pressures have been considered in detail in Barrett and Bergin (2005).

As part of the preparation for the rising burden in the second quarter of this century, the government has established the National Pensions Reserve Fund. Current policy is to save 1 per cent a year of GNP out of the public finances and put it into the fund. The fund is being invested so that the proceeds will part-fund the state's pension liabilities after 2030. At a time when the economy is enjoying a favourable demographic profile, it is certainly appropriate that prudent provision be made for adverse changes in demographic structure in future decades.

The *Benchmark* forecast suggests that by the end of the next decade Ireland will still be experiencing a relatively low dependency rate. However, by that time the bulk of Ireland's infrastructure needs will have been met. As a result, that forecast envisages a continuing substantial government surplus of up to 3 per cent of GNP over the period 2015-25. While this may be an unrealistic estimate, it does remind us that it may be appropriate for the government to save more than the planned 1 per cent a year in the period 2015 to 2030 to help prefund age-related fiscal pressures that will arise in the middle of the next century.

7.5 Conclusions

The research discussed in this *Review* focuses on the key factors that will drive growth in Ireland in the medium to long term. This analysis suggests that for the next five or ten years the Irish economy still has the potential to grow more rapidly than its immediate EU neighbours. However, such a desirable outcome is not guaranteed but will need careful tuning of domestic policies.

The analysis in this *Review* also suggests that the Irish economy is reasonably resilient. Thus, even if there is a significant downturn over the coming years, the economy will be likely to rebound in tune to a world recovery.

Finally, the *Review* describes the results of new research which suggests that for some areas of the environment, pressure will ease in the forecast period in spite of continuing economic growth. However, for other areas, such as greenhouse gas emissions, current policies will not be sufficient to ensure relevant targets are met.

REFERENCES

ADDISON-SMYTH, D., K. McQUINN and G. O'REILLY, 2008. "Estimating the Structural Demand for Irish Housing", CBFSAI Working Paper, 1/RT/08, March.

BARRELL, R., J. FITZ GERALD and R. RILEY, 2007. "EU Enlargement and Migration: Assessing the Macroeconomic Impacts", ESRI Working Paper No. 203, Dublin: The Economic and Social Research Institute.

BARRETT, A. and A. BERGIN, 2005. "Assessing Age-related Pressures on the Public Finances: 2005 to 2050" in T. Callan and A. Doris (eds.), *Budget Perspectives 2006*, Dublin: The Economic and Social Research Institute.

BARRETT, A., A. BERGIN and D. DUFFY, 2006. "The Labour Market Characteristics and Labour Market Impacts of Immigrants in Ireland", *The Economic and Social Review,* Vol. 37, No. 1, pp. 1-26.

BARRETT, A., A. BERGIN and Y. McCARTHY, 2007. "A Fiscal Window of Opportunity? Projecting Public Spending Out to 2022" in M. Callanan, (ed.), *Ireland 2022*: *Towards One Hundred Years of Self Government*, Dublin: IPA.

BARRETT, A., J. FITZ GERALD and B. NOLAN, 2002. "Earnings Inequality, Returns to Education and Immigration into Ireland", *Labour Economics*, Vol. 9, No. 5.

BARRETT, A., I. KEARNEY and M. O'BRIEN, 2008. *Quarterly Economic Commentary,* Spring, Dublin: The Economic and Social Research Institute.

BARRETT, A. and J. LAWLOR, 1995. *The Economics of Waste Management in Ireland*, Policy Research Series, No. 26, Dublin: The Economic and Social Research Institute.

BARRETT, A. and P.J. O'CONNELL, 2001. "Is There a Wage Premium for Returning Irish Migrants", *The Economic and Social Review*, Vol. 32, No. 1, pp. 1-22.

BARRETT, A., and Y. McCARTHY, 2007. "The Earnings of Immigrants in Ireland: Results from the 2005 EU Survey of Income and Living Conditions", *Quarterly Economic Commentary*, Winter, Dublin: The Economic and Social Research Institute.

BARRETT, A., S. McGUINNESS and M. O'BRIEN, 2008. "The Immigrant Earnings Disadvantage across the Earnings and Skills Distributions: The Case of Immigrants from the EU's New Member States in Ireland" ESRI Internal Seminar Paper, February. Dublin: The Economic and Social Research Institute.

BARRY, F., 2002. "The Celtic Tiger Era: Delayed Convergence or Regional Boom?", *Quarterly Economic Commentary*, Summer, Dublin: The Economic and Social Research Institute.

BERGIN, A. and I. KEARNEY, 2007. "Human Capital Accumulation in an Open Labour Market: Ireland in the 1990s", *Economic Modelling*, November.

BLANCHARD, O., J.F. GIAVAZZI and F.G. SA, 2005. "The U.S. Current Account and the Dollar", MIT Department of Economics Working Paper, No. 05-02.

BOEHRINGER, C. and A. LOESCHEL, 2003. "Market Power and Hot Air in International Emissions Trading: The Impacts of US Withdrawal from the Kyoto Protocol", *Applied Economics*, Vol. 35, No. 6, pp. 651-663.

BRADLEY, J. and J. FITZ GERALD, 1988. "Industrial Output and Factor Input Determination in an Econometric Model of a Small Open Economy", *European Economic Review*, Vol. 32, pp. 1227-1241.

BRADLEY, J., J. FITZ GERALD, and I. KEARNEY, 1993. "Modelling Supply in an Open Economy Using a Restricted Cost Function", *Economic Modelling*, Vol. 10, No. 1, pp. 11-21, January.

BRADLEY, J., J. FITZ GERALD, D. HURLEY, L. O'SULLIVAN and A. STOREY, 1993. "*HERMES*: A Macrosectoral Model for the Irish Economy", in Commission of the European Communities (ed.), *HERMES: Harmonised Econometric Research for Modelling Economic Systems*, North Holland.

BRÄNNLUND, R., B. KRISTRÖM, T. LUNDGREN and P. MARKLUND, 2008. "The Economics of Biofuel", Umeå Economic Studies, WP736.

CALLAN, T. and J. FITZ GERALD, 1989. "Price Determination in Ireland: Effects of Changes in Exchange Rates and Exchange Rate Regimes", *The Economic and Social Review*, Vol. 20, pp. 165-188.

CENTRAL STATISTICS OFFICE, 2006. *2000 Supply and Use and Input-Output Tables*, Cork: Central Statistics Office.

COMMISSION FOR ENERGY REGULATION (CER), 2007. "Direction to ESB PES on Tariffs to apply from 1st November 2007", CER/07/191.

CRUTZEN, P.J., A.R. MOSIER, K.A. SMITH and W. WINIWARTER, 2007. "N_2O Release from Agro-Biofuel Production Negates Global Warming Reduction by Replacing Fossil Fuels", *Atmospheric Chemistry and Physics Discussions*, Vol. 7, pp. 11191-11205.

CURTIS, J. and J. FITZ GERALD, 1996. "Real Wage Convergence in an Open Labour Market", *The Economic and Social Review*, Vol. 27, No. 4.

DIAKOULAKI, D. and M. MANDARAKA, 2007. "Decomposition Analysis for Assessing the Progress in Decoupling Industrial Growth from CO_2 Emissions in the EU Manufacturing Sector", *Energy Economics*, Vol. 29, pp. 636-664.

DORIS, A., 2001. "The Changing Responsiveness of Labour Supply during the 1990s", *Quarterly Economic Commentary,* December, Dublin: The Economic and Social Research Institute.

DUFEY, A., 2007. "International Trade in Biofuels: Good for Development? And Good for Environment?" IIED Briefing Paper.

DUFFY, D., 2002. "A Descriptive Analysis of the Irish Housing Market", *Quarterly Economic Commentary*, Summer, Dublin: The Economic and Social Research Institute.

DUFFY, D., 2007. "The Housing Tenure of Immigrants in Ireland: Some Preliminary Analysis", ESRI Working Paper No. 188. Dublin: The Economic and Social Research Institute.

DUFFY, D., J. FITZ GERALD and I. KEARNEY, 2005. "Rising House Prices in an Open Labour Market", *The Economic and Social Review*, Vol. 36, No 3, Winter.

DURKAN, J., D. FITZGERALD and C. HARMON, 1999. "Education and Growth in the Irish Economy" in F. Barry (ed.), *Understanding Ireland's Economic Growth*, London: Macmillan Press Ltd.

ECOFYS, 2008. *All Island Grid Study: Analysis of Impacts and Benefits*, Workstream 4, A Report to the Department of Communications, Energy and Natural Resources and Department of Enterprise, Trade and Employment, www.ecofys.de

EUROPEAN FORECASTING NETWORK, 2006. "Economic Assessment of the Euro Area: Forecasts and Policy Analysis", Spring Report 2006.

EUROPEAN FORECASTING NETWORK, 2007. "Economic Assessment of the Euro Area: Forecasts and Policy Analysis", Autumn Report 2007.

FAHEY, T., J. FITZ GERALD and B. MAÎTRE, 1998. "The Economic and Social Implications of Population Change", *Journal of the Statistical and Social Inquiry Society of Ireland*, 1997/1998.

FAUST, J., J. ROGERS and J. WRIGHT, 2001. "An Empirical Comparison of Bundesbank and ECB Monetary Policy Rules", Washington: Board of Governors of the Federal Reserve System, International Finance Discussion Papers Number 705.

FITZ GERALD, J., 1999. Wage Formation and the Labour Market, in F. Barry (ed.), *Understanding Irish Economic Growth*, London: Macmillan.

FITZ GERALD, J., 2000. "The Story of Ireland's Failure – and Belated Success" in B. Nolan, P. O'Connell and C. Whelan (eds.), *Bust to Boom? The Irish Experience of Growth and Inequality*, Dublin: Institute of Public Administration.

FITZ GERALD, J., 2001. "Fiscal Policy in a Monetary Union: the Case of Ireland", *Quarterly Economic Commentary*, March, Dublin: The Economic and Social Research Institute.

FITZ GERALD, J., 2003. "*Energy Policy in Ireland",* ESRI Working Paper No. 160, Dublin: The Economic and Social Research Institute.

FITZ GERALD, J., 2005. "The Irish Housing Stock: Growth in Number of Vacant Dwellings", *Quarterly Economic Commentary*, Spring, Dublin: The Economic and Social Research Institute.

FITZ GERALD, J., 2006. "Lessons from 20 Years of Cohesion" in S. Mundschenk, M. Stierle, U. Stierle-von Schütz and I. Traistaru (eds.), *Competitiveness and Growth in Europe: Lessons and Policy Implications for the Lisbon Strategy*, Edward Elgar.

FITZ GERALD, J. and J HORE, 2002. "Wage Determination in Economies in Transition: Ireland, Spain and Portugal", ESRI Working Paper No. 147, Dublin: The Economic and Social Research Institute.

FITZ GERALD J., and I. KNIPPER, 1993. "Distribution", *European "Economy - Social Europe, Reports and Studies*, No. 3, Brussels: Commission of the European Communities.

FITZ GERALD, J. and D. McCOY, 1992. E*conomic Effects of Carbon Taxes*, Policy Research Series No. 14, Dublin: The Economic and Social Research Institute.

FITZ GERALD, J., J. HORE and I. KEARNEY, 2002. "A Model for Forecasting Energy Demand and Greenhouse Gas Emissions in Ireland", ESRI Working Paper No. 146, Dublin: The Economic and Social Research Institute.

FITZ GERALD, J., M. KEENEY and S. SCOTT, 2007. "Assessing Vulnerability of Selected Sectors under Environmental Tax Reform: The Issue of Pricing Power", ESRI Working Paper No. 222, Dublin: The Economic and Social Research Institute.

FITZ GERALD, J., C. McCARTHY, E. MORGENROTH and P.J O'CONNELL (eds.), 2003. *The Mid-Term Evaluation of the National Development Plan and Community Support Framework for Ireland, 2000 to 2006*: Final Report to the Department of Finance, ESRI Policy Research Series No. 50, Dublin: The Economic and Social Research Institute.

FULTON, L. and G. EADS, 2004. "IEA/SMP Model Documentation and Reference Case Projection" available at: www.wbcsd.org/web/publications/mobility/smp-model-document.pdf

HARRIS, J. and M. TODARO, 1970. "Migration, Unemployment and Development: A Two-Sector Analysis", *American Economic Review*, Vol. 60, pp. 259-288.

HALLER, S., 2007. "The Distribution of Productivity in Irish Manufacturing, 1995 and 2004", *The Economic and Social Review*, Vo. 39, No. 1, Spring 2008.

HAMILTON, J.M., D.J. MADDISON and R.S.J. TOL, 2005. "Effects of Climate Change on International Tourism", *Climate Research*, Vol. 29, pp. 245-254.

HELM, D., R. SMALE and J. PHILLIPS, 2007. "Too Good To Be True? The UK's Climate Change Record", http://www.dieterhelm.co.uk/publications/Carbon_record_2007.pdf

HM TREASURY, 2003. UK Membership of the Single Currency: EMU Studies, www.hm-treasury.gov.uk./documents/the_euro/assessment/studies/euro_assess03_studindex.cfm

HONOHAN, P., 1984. "The Evolution of the Rate of Unemployment in Ireland 1962-83", *Quarterly Economic Commentary*, May, Dublin: The Economic and Social Research Institute.

HONOHAN, P., 1992. "The Link Between Irish and UK Unemployment", *Quarterly Economic Commentary*, Spring, pp. 33-44, Dublin: The Economic and Social Research Institute.

HONOHAN P. and B. M. WALSH, 2002. "Catching up with the Hare", *Brookings Papers on Economic Activity*, 1.

INTERNATIONAL MONETARY FUND (IMF), 2007. *IMF Ireland Country Report 07/325*, Ireland Staff Report, Article IV Consultation, September.

INTERNATIONAL MONETARY FUND (IMF), 2005. *World Economic Outlook,* September 2005.

KEENAN, J.G., 1981. "Irish Migration, All or Nothing Resolved?", *The Economic and Social Review*, Vol. 12, No. 3, pp. 169-186.

KELLY, J., M. CUSSEN and G. PHELAN 2007. *The Net Worth of Irish Households – An Update,* CBFSAI Quarterly Bulletin 3.

KOMAN, R. and D. MARIN, 1997. "Human Capital and Macroeconomic Growth: Austria and Germany, 1960-92", London: Centre for Economic Policy Research Discussion Paper No. 1551.

LANE, P., 2007. "Fiscal Policy for a Slowing Economy" in Tim Callan (ed.), *Budget Perspectives 2008,* Dublin: The Economic and Social Research Institute.

LE BOLLOCH, O., J. COPE, I. KURZ, and B. MEANEY, 2007. "*National Waste Report 2006"*, Dublin: Environmental Protection Agency.

LYONS, S., K. MAYOR and R. TOL, 2008. "Environmental Accounts for the Republic of Ireland: 1990-2005", ESRI Working Paper No. 223, Dublin: The Economic and Social Research Institute.

McCARTHY, C. and S. SCOTT, 2008. "Controlling the Cost of Controlling the Climate: The Irish Government's Climate Change Strategy", ESRI Working Paper No. 229, Dublin: The Economic and Social Research Institute.

McCARTHY, N., 2005. "Market Size, Market Structure and Market Power in the Irish Electricity Industry", ESRI Working Paper No. 168, Dublin: The Economic and Social Research Institute.

McQUINN, K., 2004. "A Model of the Irish Housing Sector", Research Technical Paper 1/RT/04, Central Bank and Financial Services Authority of Ireland.

McQUINN, K. and G. O'REILLY, 2007. "Assessing the Role of Income and Interest Rates in Determining House Prices, *Economic Modelling*, forthcoming.

MILES, D.K. and V. PILLONCA, 2007. "Financial Innovation and European Housing and Mortgage Markets", Morgan Stanley Research Europe, July.

MORGENROTH, E., J. FITZ GERALD (eds.), 2006. *Ex-ante Evaluation of the Investment Priorities for the National Development Plan 2007-2013*. ESRI Policy Research Series No. 59, Dublin: The Economic and Social Research Institute.

MURPHY, A, 1998. "Appendix E: Econometric Modelling of the Irish Housing Market" in P. Bacon, F. MacCabe and A. Murphy (eds.), *Economic Assessment of Recent House Price Developments*, April, Dublin: Stationery Office.

MURPHY, A., 2005. "Modelling Irish House Prices: A Review and Some New Results", December. http://www.nuff.ox.ac.uk/users/murphya/

NESC, 2005. "Strategy 2006: People, Productivity and Purpose", Report No. 114, Dublin: National Economic and Social Development Office.

OBSTFELD, M. and K. ROGOFF, 2005. "Global Current Account Imbalances and Exchange Rate Adjustments" in W. Brainard and G. Perry (eds.), *Brookings Papers on Economic Activity*, Vol. 1, pp. 67-146.

O'CALLAGHAN-PLATT, A. and A. DAVIES, 2007. "A Nationwide Review of Pay-By-Use (PBU) Domestic Waste Collection Charges in Ireland: Extensive Survey Findings", EPA ERTDI Report Series No. 63.

O'DOHERTY, J. and R.S.J. TOL, 2007. "An Environmental Input-Output Model for Ireland", *The Economic and Social Review*, Vol. 38, No. 2, pp. 157-190.

O'DOHERTY, J., K. MAYOR and R. TOL, 2007. "Irish Sustainable Development Model (*ISus*): Literature Review, Data Availability and Model Design", ESRI Working Paper No. 186, Dublin: The Economic and Social Research Institute.

OECD, 2006. *OECD Economic Surveys: Ireland*, Paris: OECD.

OECD, 2008a, *Economic Survey – Ireland*, Volume 2008/5 April.

OECD, 2008b, "Ireland – Towards an Integrated Public Service", OECD *Public Management Reviews*.

O'GRÁDA, C., 2002. "Is the Celtic Tiger a Paper Tiger?", *Quarterly Economic Commentary,* Spring, Dublin: The Economic and Social Research Institute.

O'ROURKE, K., 1995. "Emigration and Living Standards in Ireland Since the Famine", *Journal of Population Economics*, Vol. 8, pp. 407-421.

O'MALLEY, E. and Y. McCARTHY, 2006. "New Drivers of Growth? Sectoral Contributions to the Irish Economy", *Quarterly Economic Commentary*, Summer, Dublin: The Economic and Social Research Institute.

PARIKH, A., 1979. "Forecasts of Input-Output Matrices using the RAS Method", *Review of Economics and Statistics*, Vol. 61, No. 3, pp. 477-481.

PETERS, G.P. and E.G. HERTWICH, 2008. "CO_2 Embodied in International Trade with Implications for Global Climate Policy", *Environmental Science and Technology*, Vol. 42, No. 5, pp. 1401-1407.

SCOTT, S. and D. WATSON, 2007. "Introduction of Weight-based Charges for Domestic Solid Waste Disposal", EPA ERTDI Report Series No. 54. Dublin: The Economic and Social Research Institute.

STERN, N.H., S. PETERS, V. BAKHSHI, A. BOWEN, C. CAMERON, S. CATOVSKY, D. CRANE, S. CRUICKSHANK, S. DIETZ, N. EDMONSON, S.-L. GARBETT, L. HAMID, G. HOFFMAN, D. INGRAM, B. JONES, N. PATMORE, H. RADCLIFFE, R. SATHIYARAJAH, M. STOCK, C. TAYLOR, T. VERNON, H. WANJIE, and D. ZENGHELIS, 2006. "*Stern Review: The Economics of Climate Change",* Cambridge: Cambridge University Press.

SVENDSEN, G.T., 2005. "Lobbying and CO_2 Trade in the EU" in B. Hansjürgens (ed.), *Emissions Trading for Climate Policy,* Cambridge: Cambridge University Press, pp. 150-161.

SWITZER, S., 2007. "International Trade in Biofuels: Introducing the Concept of Sustainability", *Icfai Journal of International Business Law*.

TOL, R.S.J., 2007. "Irish Climate Policy for 2012: An Assessment", *Quarterly Economic Commentary*, Winter, pp. 104-117.

VAN ARK, B., M. O'MAHONY and M. TIMMER, 2008. "The Productivity Gap Between Europe and the US: Trends and Causes", *Journal of Economic Perspectives*, Vol. 22, No. 1, pp. 25-44.

WALSH, B.M., 1968. *Some Irish Population Problems Reconsidered*, General Research Series Paper No. 42, Dublin: The Economic and Social Research Institute,

WEITZMAN, M.L., 1974. "Prices vs. Quantities", *Review of Economic Studies*, Vol. 41, No. 4, pp. 477-491.

YOHE, G.W. and R.S.J. TOL, 2007. "The Stern Review: Implications for Climate Change", *Environment*, Vol. 49, No. 2, pp. 36-42.

APPENDIX 1: FORECASTING RECORD OF THE *MEDIUM-TERM REVIEW*

A1.1 Introduction

This *Medium-Term Review (MTR) 2008-2015* represents the eleventh in the series of reviews published since 1986. Over the last two decades, the *MTR* has been built around forecasts for the Irish economy using the *HERMES* macroeconomic model. Economic models are an invaluable tool for explaining the workings of the economy. Starting from a set of assumptions about how the economy works – about the international economy, demographics and domestic fiscal policy – macroeconomic models provide an essential framework which can be used to develop forecasts for key economic variables, to quantify the effect of alternative policy options and to simulate the impact of potential future shocks to the economy in an internally consistent manner. Economic models, however, can only provide a snapshot of the economy at a particular point in time and, therefore, their application in the context of an economy which is experiencing rapid change poses a particular challenge for the economic modeller.

In order to describe accurately the rapidly changing behaviour of the Irish economy over the last two decades, major changes have been made to the *HERMES* model over time. These changes have been designed to model the transition underway in the Irish economy while at the same time improving the accuracy of the *MTR* forecasting process. This Appendix continues the exercise undertaken in previous *Reviews* of evaluating the forecasting record of the *MTR*. The performance of the *MTR* in forecasting three key aggregates is examined – the volume growth rate of gross national product (GNP), unemployment and inflation, (as measured by the Personal Consumption Deflator). In each case the record is evaluated by comparing the forecast growth in each variable from successive *Reviews* against its actual outturn as measured by the CSO. Revisions to CSO data mean that final figures for a year only appear a number of years after the first release of the data so that the actual outturn figures for 2007 do not represent a definitive benchmark against which the forecasting record can be assessed.

Successive *MTR* forecasts have focused on the five-year average growth rates for key variables rather than on the individual year-by-year forecasts and, therefore, these average growth rates over a medium-term horizon are also relevant in assessing the forecasting performance. Full details of the forecasts and the historical figures are given in Tables A1.4 to A1.6.

In the light of the major changes that have been made to the *HERMES* model since the last *MTR*, it is instructive to first assess the within sample performance of the model itself before analysing the forecasting performance of the *MTR*. Overall the latest version of the *HERMES* model used to produce this review shows more satisfactory behaviour within sample than any of its predecessors. This is illustrated in Table A1.1 which contains the within sample root mean square percentage errors, RMSPE, (or root mean square error, RMSE, where appropriate) for a number of the key variables in the model. The root mean square error is a measure of the absolute differences between the values predicted by a model and the values actually observed. The errors for all of the variables in Table A.1.1 is lower using the latest model than was achieved with any previous version.

The fact that the RMSPE and RMSE for single year estimates are much higher than those for five-year moving averages[93] reflects the fact that the model, like economic forecasters, is not good at predicting turning points in the economy. However, the much lower RMSPE for the five-year averages reflects the fact that the model is good at explaining the behaviour of the economy in the medium term, what it was specifically designed to do.

Table A1.1: Errors for Within Sample Estimation Period

	1992	2001	2003	2005	2008	
	Root Mean Square Percentage Error					
	Annual data					5 year moving average
GDP	3.7	2.1	3.0	5.6	1.7	1.2
GNP	4.5	2.2	2.1	6.4	1.9	1.1
Labour Force	1.5	1.2	1.1	1.0	1.5	1.1
Employment	1.3	1.1	1.1	1.8	1.3	0.8
Consumer prices	1.7	1.0	1.9	2.5	1.6	0.7
Wage rates	3.4	1.9	2.6	2.4	2.2	1.2
	Root Mean Square Error					
Government borrowing, % of GNP	1.7	1.0	1.1	2.2	0.9	0.7
Unemployment rate	1.9	1.1	1.3	1.4	1.3	0.7

The RMSPE for the five-year average growth rate of GNP is just over 1 percentage point and the error for GDP is rather similar. In the previous version of the model problems in estimating profit repatriations seriously impacted on performance. For the 2005 version of the model, profit repatriations were endogenous and this partly explains the high RMSPE associated with that review. With profit repatriations exogenous, the RMSPE for GNP and GDP for the 2005 model fall significantly. The respecification of the latest version made a very big improvement in this area. For the five-year average of the unemployment rate and the government borrowing rate the RMSE is 0.7 percentage points of GNP.

[93]The error statistics are calculated on the rolling five-year average of the estimated and actual growth rates.

A1.2 Growth in GNP

For the 2001 edition of the *Medium-Term Review* two scenarios were presented: a relatively benign *Benchmark* scenario and an alternative *Slowdown* scenario. For the purpose of assessing the forecasting performance, the *Slowdown* scenario is used here. Similarly, the 2005 *MTR* developed two separate scenarios for the Irish economy – a *High Growth* and a *Low Growth* scenario. The *High Growth* scenario was based on an assumption of rapid economic growth in the US underpinning high growth in the Irish economy. At the time of publication the *Low Growth* scenario was viewed by the authors as providing a more realistic assessment of the growth potential of the economy out to 2020. Here we use that *Low Growth* forecast for the purpose of comparing *MTR* forecasts against actual outturns.[94]

In Table A1.2 we compare the forecasts for GNP growth rates in successive *MTR*s with the actual outturn. The average error shown in Table A1.2 for the forecast of GNP growth rates over the previous ten *MTR*s is 0.9 percentage points. The average error represents the difference between the annual average growth rate forecast in each review for the relevant time horizon and the average growth rate for the same period as reported in the latest CSO *National Accounts*.[95] While not directly comparable, it is interesting that this error is rather similar to the model's within sample RMSPE of 1.1 percentage points (Table A1.1).

A trend evident from Table A1.2 has been the tendency of the *Medium-Term Review* to underestimate volume growth in GNP. Since 1986, only two *MTR*'s have overestimated the actual growth of real GNP, *MTR89* and *MTR01*. The overestimation of growth in *MTR*89 was due to the failure to forecast the slowdown in the European economy that occurred post-German reunification. The *MTR01 Benchmark* forecast proved overly optimistic in the light of the international slowdown that occurred in the aftermath of September the 11th.

The largest average forecast error of 3.1 percentage points was recorded for *MTR94*, which significantly underestimated the growth in GNP recorded throughout the rest of the decade. This underestimation of growth for the 1990s was not a failing exclusive to the *MTR* and arose from an unsatisfactory method of estimating potential output.

The gap of 0.7 percentage points between the actual and forecast GNP growth rates for the last *MTR* is below the average absolute error of 1.0 percentage points. If the scenario including a housing shock from *MTR05* were used, the error would be even smaller.

[94] A further scenario in the 2005 *MTR* looked at a housing shock superimposed on the *Low Growth* scenario. The forecast in that scenario for 2007-2009 is remarkably close to the current forecast in this *MTR*.

[95] For example, for *MTR 1999*, the average error is calculated by comparing the forecast annual average growth rate for the period 1999 to 2005 from that *Review* to the actual annual average growth rate for the same period from the CSO.

Table A1.2: Medium-Term Forecasts of GNP Growth Rates, Percentage Points

	Average Over Forecast Period				Annual Forecast
	Average Annual Growth		Average Error	Average Absolute Error	Average Absolute Error
	MTR	CSO			
MTR 1986	2.8	3.2	0.4	0.4	1.9
MTR 1987	2.6	3.7	1.0	1.0	1.9
MTR 1989	4.9	4.4	-0.4	0.4	2.1
MTR 1991	3.4	5.0	1.6	1.6	2.7
MTR 1994	5.1	8.1	3.1	3.1	3.2
MTR 1997	5.0	6.7	1.7	1.7	2.1
MTR 1999	5.4	5.6	0.2	0.2	1.8
MTR 2001	4.7	4.3	-0.5	0.5	0.6
MTR 2003	4.3	5.1	0.8	0.8	0.7
MTR 2005	4.7	5.4	0.7	0.7	0.7
Average for 10 *MTRs*			0.9	1.0	1.8

The final measure of the forecasting accuracy of the *MTR* provided in Table A1.2 is the average absolute error in the year-by-year forecasts contained in each *Review*. While this error has generally declined in each *MTR* since *MTR94*, it is still much larger at 1.8 percentage points than the error in the forecast of the average growth rate over the forecast time horizon. However, as previously noted, the *MTR* has consistently emphasised the five-year average growth rates for key variables rather than the year-by-year forecasts. This reflects the acknowledgement by medium-term forecasters of the hazards of forecasting turning points in the business cycle. It also reflects the fact that medium-term forecasts tend to predict with a much greater degree of accuracy trend growth rather than the changes in year-by-year growth rates.

A1.3 Inflation

Figure A1.1: Annual Average Inflation: Actual Minus Forecast PCD

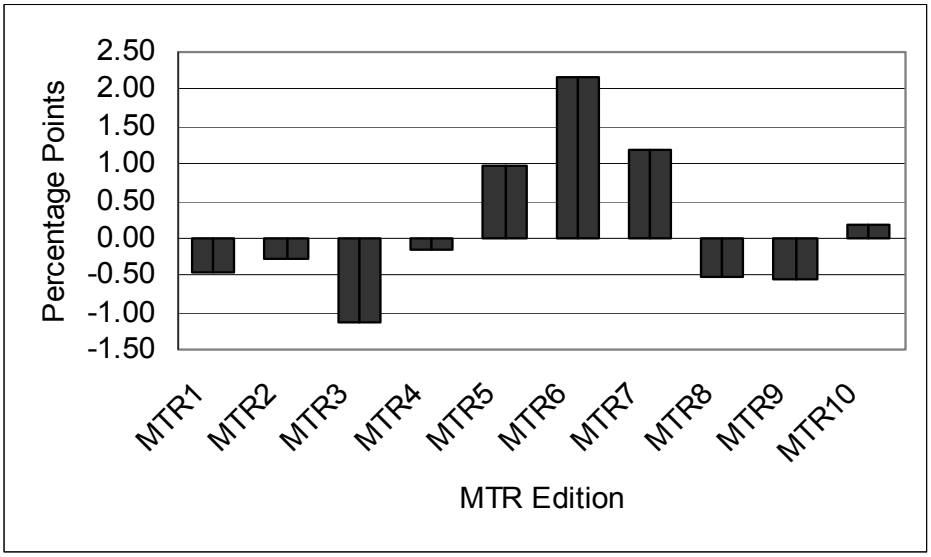


Figure A1.1 illustrates the forecasting record of the personal consumption deflator (PCD) in the ten *MTR*s since 1986. The standard deviation in the historical inflation rate since 1986 is much lower at 1.0 per cent than the standard deviation of the growth rate of GNP. This suggests that it should be possible to forecast the inflation rate with a greater degree of accuracy. Figure A1.1 shows that the *MTR* has had mixed results in forecasting the inflation rate. The average error in the forecast for the relevant time horizon of the last ten *MTR*s was 0.3 percentage points with an average absolute error of 0.8 percentage points.

The early *MTR*s up to and including *MTR91* tended to overestimate future inflation. During this period (1986-1996) the actual inflation rate fell from 3.7 per cent to 2.7 per cent. In contrast, the *MTR*s published during the peak of the economic boom (a period of rising inflation) tended to underestimate the inflation rate, and significantly so in the case of *MTR97*. Of the three *MTR*s published since 2001, two have overestimated the inflationary pressures in the economy by similar magnitudes while the last *MTR* slightly underestimated the inflation rate. The average absolute error in the year-by-year forecasts for the price deflator was 0.8 percentage points over successive reviews. This is identical to the error in the average growth rate over the forecast time horizon. The average absolute error of 0.8 percentage points for the inflation rate is also significantly below the error of 1.8 percentage points calculated for the GNP growth rate. Given the much lower standard deviation of the actual inflation rate in contrast to the GNP growth rate, the more accurate forecasting performance of the PCD in successive *MTR*s is not surprising.

A1.4 Unemployment

The labour market in Ireland experienced unprecedented change in the 1990s as the economy moved from an era of double-digit unemployment to virtually full employment in the space of a decade. Another outstanding feature of the current decade has been the extremely high levels of inward migration. The pace and extent of these changes have added to the difficulty associated with modelling the behaviour of the labour market. The Irish labour market has not stood still for long enough to allow for an accurate reading of its behaviour to be captured by an econometric model and this is reflected in the forecasting performance.

For the unemployment rate, the performance is evaluated by comparing the forecast unemployment rate for the last year shown in each review with the actual rate for that year.[96] The average absolute error for the unemployment rate in the last ten *Reviews* has been 3.1 percentage points. Forecasts of unemployment in *Reviews* published in the 1990s tended to be significantly higher than outturns. The largest error in forecasting the unemployment rate occurred in *MTR94*, which underestimated the dramatic reduction in the unemployment rate which occurred over the remainder of the decade. As the changes in the unemployment rate have stabilised in recent years, the forecasting performance of the *MTR* has improved significantly. Average absolute errors of 0.9, 0.1 and 0.7 have been recorded for the last three *Reviews* indicating a greater level of success in capturing the changing behaviour of the Irish labour market.

[96] For example, the last year forecast by *MTR 1999* was 2005. The forecast UE rate of 5.3 per cent for 2005 from that *Review* is compared to the actual unemployment rate for that year of 4.2 per cent in order to calculate the average error.

Table A1.3: Medium-Term Forecasts of Unemployment Rate (ILO)

	Forecast	Actual	Average Error	Average Absolute Error
MTR 1986	18.5	12.9	-5.6	5.6
MTR 1987	18.3	15.1	-3.2	3.2
MTR 1989	12.7	14.7	2.0	2.0
MTR 1991	16	11.9	-4.1	4.1
MTR 1994	13.4	4.3	-9.1	9.1
MTR 1997	8.4	4.4	-4.0	4.0
MTR 1999	5.3	4.2	-1.1	1.1
MTR 2001	5.5	4.6	-0.9	0.9
MTR 2003	4.7	4.6	-0.1	0.1
MTR 2005	5.3	4.6	-0.7	0.7
			-2.7	3.1

A1.5 Conclusion

This Appendix has evaluated the forecasting performance of the *Medium-Term Review* since 1986. The transformation of the Irish economy that has occurred since the early 1990s has necessitated major changes to the *HERMES* model in order to ensure that it accurately reflects the changing structure of the economy. These changes have succeeded in improving the behaviour of the model, as illustrated by its more satisfactory performance within sample. In addition, moderation in the pace of growth in the economy has reduced the level of variation in the key aggregates, such as GNP and unemployment, and this has also contributed to the generally improved forecasting performance of recent *Reviews*. Nonetheless there is an unavoidable degree of uncertainty associated with any forecasting exercise, in particular medium-term forecasting. The preparation of alternative scenarios around our central forecast is an acknowledgement of this uncertainty and indicates the possible margin of error in our *Benchmark* medium-term forecast.

Table A1.4: Forecast of Annual Growth in Real GNP, %

	MTR 1986	*MTR* 1987	*MTR* 1989	*MTR* 1991	*MTR* 1994	*MTR* 1997	*MTR* 1999	*MTR* 2001	*MTR* 2003	*MTR* 2005	Actual
1986	2.5										-0.2
1987	2.75										3.2
1988	3	-0.4									1.5
1989	3	3	4								5.0
1990	3	3.3	7.1								6.8
1991		3.7	5.6	2							2.8
1992		3.6	4.6	3.7							2.3
1993			4.8	4.3							3.3
1994			3.2	3.3	4.3						6.7
1995				3.6	6.9						7.3
1996				3.7	5.7						7.8
1997					4.6	5.7					9.4
1998					4.8	5.9					7.7
1999					4.7	5.3	6.3				8.5
2000					4.5	4.4	5.8				9.2
2001						3.7	5.5	6			4.2
2002						4.5	5	1.8			3.3
2003						5.3	4.9	4.2	2.4		5.6
2004							5	5.1	3		4.0
2005								5.3	4.7	5.6	4.9
2006								6.1	5.7	4.8	6.6
2007								4.6	5.6	3.8	4.5

Table A1.5: Forecast of Annual Inflation Rate for Consumers' Expenditure, %

	MTR 1986	*MTR* 1987	*MTR* 1989	*MTR* 1991	*MTR* 1994	*MTR* 1997	*MTR* 1999	*MTR* 2001	*MTR* 2003	*MTR* 2005	Actual
1986	4.5										3.7
1987	4										2.7
1988	4	3									4.0
1989	3.5	3	3.3								4.0
1990	3	3.7	4.2								2.0
1991		3.7	4.2	2.7							2.7
1992		3.7	3.5	2.4							3.0
1993			3	2.6							2.2
1994			3.5	3	3						2.8
1995				3.1	2.6						2.8
1996				3.1	2.3						2.7
1997					2.3	2.1					2.6
1998					2.4	1.9					4.0
1999					2.4	2.1	1.8				3.2
2000					2.4	2.2	2.2				4.8
2001						2.1	2.9	4.8			4.3
2002						2.1	2.9	3.9			5.2
2003						2.1	2.9	3.8	3.5		4.0
2004							3	3.5	2		1.6
2005								3.3	3.2	2.1	1.6
2006								3.3	2.8	2.7	2.1
2007								3.3	3.0	1.9	3.5

Table A1.6: Forecast of Unemployment Rate (ILO), % of Labour Force

	MTR 1986	*MTR* 1987	*MTR* 1989	*MTR* 1991	*MTR* 1994	*MTR* 1997	*MTR* 1999	*MTR* 2001	*MTR* 2003	*MTR* 2005	Actual
1986	17										17.1
1987	17.5										16.9
1988	18	19.5									16.3
1989	18.25	19.1	16								15.0
1990	18.5	18.5	14.6								12.9
1991		18.2	13.4	15.8							14.7
1992		18.3	13	15.9							15.1
1993			12.8	15.7							15.9
1994			12.7	16	16.9						14.7
1995				16	16.1						12.2
1996				16	15.3						11.9
1997					14.6	10.9					10.3
1998					14.2	9.1					7.8
1999					13.7	8.3	6.5				5.7
2000					13.4	8.6	5.6				4.3
2001						8.8	5.4	3.8			3.6
2002						8.9	5.3	3.6			4.2
2003						8.4	5.4	4.3	4.9		4.4
2004							5.3	5.3	5.7		4.4
2005								5.8	5.4	4.2	4.2
2006								5.7	5.2	4.2	4.3
2007								5.5	4.7	5.3	4.6

APPENDIX 2: MODELLING THE IRISH ECONOMY

This Appendix describes how the changing nature of the Irish economy is modelled in the latest version of the *HERMES* macroeconomic model. The two key areas of change discussed here are the supply side of the economy, especially business and financial services and the labour market.

A2.1 Business and Financial Services

In the latest version of the *HERMES* model exports of services (excluding tourism), X_s, are a function of world activity Q_w (proxied by US GDP), Irish wage rates, W_i, relative to those in the UK, W_u, and the rate of corporation tax, T.

$$X_s = f(Q_w, \frac{W_i}{W_u}, T) \quad (1)$$

The estimated elasticity of services exports with respect to world activity in recent years is very high – between 4 and 5. The elasticity with respect to domestic wage rates is -1.3.

Output in the business and financial sector, Q_i, is a function of exports of services, domestic demand weighted by input output coefficients, D, (McCarthy, 2005), and the price of output of the sector P_i relative to wage rates in the UK.

$$Q_i = f(X_s, D, {}^{P_i}\!/\!_{W_u}) \quad (2)$$

When simulated as a model these equations suggest an elasticity of domestic output in the sector with respect to world activity of 1.37. The elasticity with respect to relative prices/wage rates is around -0.7 (Tables 2.2 and 2.4).

A partial simulation of the model, where the effect on tax revenue is not taken into account, suggests that the level of GNP was raised by around 3 percentage points due to the reduction in the rate of corporation tax after 1994. This does not allow for the effects of the loss of revenue from existing firms, which had to be made good elsewhere. If this were taken into account the long-term effects would obviously be smaller. This change in the tax rate had a once-off effect, shifting the level of GNP upwards.

Once this adjustment is complete the growth rate should return to its original path.

A2.2 Manufacturing

Manufacturing is divided into three sectors, high-tech, traditional and food processing. High-tech covers chemicals and pharmaceuticals with the traditional sector covering the rest of the sector. The same basic model is applied to each of the three sectors. It is outlined in Bradley, Fitz Gerald and Kearney (1993).

The model assumes that the production of goods relevant to Ireland on a worldwide scale can be characterised by a cost function (3) where the cost of world output of manufactured goods, C_w, is a function of the unit cost of production in Ireland c_I relative to the rest of the world, c_R, and technical progress, t. Then the share of world output that is located in Ireland (4) is also a function of the unit cost of production in Ireland c_I relative to the rest of the world, c_R, and technical progress, t. The output of each sector in Ireland is defined as Q_I and the relevant output in the rest of the world is Q_W. The unit cost of production in Ireland is defined in Equation (5) as a function of the cost of labour, p_l, the price of inputs of goods and services, p_m, energy, p_e, the capital stock K and technical progress, t. From this the share of each of the factors of production – labour, energy and materials – in domestic output is defined (labour, L, is shown in Equation (6)). Finally, Equation (7) defines the optimal capital output ratio (optimal is denoted by "*").

$$C_w = f(c_I, c_R, t) \tag{3}$$

$$\frac{Q_I}{Q_W} = f(\frac{c_I}{c_R}, t) \tag{4}$$

$$c_I = \frac{C_I}{Q_I} = f(p_l, p_m, p_E, K, t) \tag{5}$$

$$\frac{L}{Q_I} = f(\frac{p_m}{p_l}, \frac{p_e}{p_l}, K, t) \tag{6}$$

$$\frac{K^*}{Q^*} = f(\frac{p_l}{p_k}, \frac{p_m}{p_k}, \frac{p_e}{p_k}, t) \tag{7}$$

The model, as estimated, suggests that technical progress is particularly strong in the manufacturing sector. Technical progress is generally very labour saving and results in a very substantial reduction in the unit cost of production. (It is also mildly capital saving and materials using.) In turn, the reduction in the unit cost of production, as a result of the labour saving, leads to strong growth in output. Over time the rate of increase in technical progress has tended to rise. However, as the industries producing in Ireland mature the rate of increase could slow in the future.

For example, in 2006 labour saving technical progress led to a 2.7 per cent reduction in the unit cost of production in the manufacturing sector. In the short run this would lead to a 0.9 per cent increase in the volume of output of the sector. In the long run this output effect would be almost doubled as the capital stock adjusts. Holding output constant, the effect of

technical progress would be to reduce employment in manufacturing by 7.7 per cent in the short run.

This effect on employment is quite dramatic. It means that for employment even to remain static in the sector, output must continue to grow rapidly. It explains the recent trends where what for other sectors would be quite rapid growth, is associated with significant falls in employment.

The production technology used in Ireland is probably the same as that used in similar industries elsewhere. The result is that with substantial rates of technical progress endemic in the relevant high-tech sectors, the world price of such products falls over time. For example, with technical progress each year a computer of comparable power costs less than it did last year. This has important implications for the terms of trade.

The price of output in the manufacturing sector is generally externally determined – firms are price takers on the world market. (The one exception is the food sector where output prices are based on the cost of production, especially the cost of the raw materials.) This is not surprising given the heavy preponderance of foreign firms producing for a global market. This result is consistent with Callan and Fitz Gerald (1989), and Fitz Gerald, Keeney and Scott, 2007. For the sectors that are price takers the weight on German prices is 55 per cent, on US prices 36 per cent and on UK prices 9 per cent. Compared to the results in Callan and Fitz Gerald (1989) the weight on US prices is substantially higher and that on UK prices much lower.

A2.3 Modelling the Labour Market

The traditional model of migration is given below.

$$N = f(\frac{w_I}{w_U}, \frac{U_I}{U_U}) \tag{8}$$

$$N = a + b\log(\frac{w_I}{w_U}) \tag{9}$$

Net migration (N) is a function of Irish real after tax wage rates (w_I) relative to those in the UK (w_U) and of the difference in the unemployment rate for Ireland (U_I) relative to that in the UK (U_U). Here we simplify by making net migration a simple linear function of the log of the relative wage rates.

For migration to be zero the following must be true:

$$0 = a + b\log(w_I) - b\log(w_U) \tag{10}$$

$$\log(w_I) = \log(w_U) - \frac{a}{b} \tag{11}$$

As shown here, with this specification, Irish wage rates must be set as a constant mark up on UK wage rates. Any deviation from this would give rise to indefinite flows of migrants – an infinitely elastic supply of labour.

While this specification provided a good approximation to the underlying true labour market behaviour for many decades, it is no longer appropriate. Instead the long-term stock of net migrants, rather than the

flow, is modelled as a function of the factors affecting the relative attractiveness of the Irish and UK labour markets. In addition, information on the sensitivity of labour force participation, especially by women, is taken from Doris (2001) and incorporated into the model.

A2.4 Housing Sector Sub Model

The demand for housing uses an inverted demand function specification.[97] Real Irish new house prices are positively related to the level of real disposable income per capita (Y) and the percentage of the population aged 25-34 years (POP2534), and is negatively related to the per capita housing stock (HSTOCK) and the real cost of capital for housing (rr).[98] A dummy variable is also included for 2003.[99]

$$\text{Log } P_h = A + B_1\log(Y) - B_2(HSTOCK) + B_3(POP2534) - B_4(rr) + B_5(2003)$$

A similar equation is included for second-hand house prices, which suggests that these prices are driven by changing living standards, with demographic changes and short-run income volatility having a much reduced effect.

The housing supply equation, which estimates the number of house completions (H_s), is modelled as a function of the profitability of new house building. Thus, it is driven by new house prices (P_h) and the cost of building (cc), represented by wage costs, input costs and the cost of capital.

$$\text{Log } H_s = A + B_1\log(P_h/cc).$$

Finally, the model includes an equation for the housing stock (HSTOCK) based on the housing stock in the previous period, housing completions in the current period, and assuming depreciation of 0.5 per cent a year:

$$HSTOCK_t = 0.995 * HSTOCK_{t-1} + HCOMP_t$$

[97] This specification draws on the work of Murphy (1998).
[98] The user cost of housing (proxied by the nominal mortgage interest rate less the change in house prices).
[99] This is in keeping with the approach of Murphy (2005). Murphy includes dummy variables for 1997 and 2003 that "…pick-up the combined effects of financial liberalisation, policy interventions since 1998 and speculative frenzy effects."

APPENDIX 3: DETAILED TABLES[100]

BENCHMARK FORECAST

Table A3.1: Expenditure on GNP

	2007 €m	Volume %	Price %	2008 €m	Cont. to Growth %	Volume %	Price %	2009 €m	Cont. to Growth %
Personal Consumption	90,913	6.5	3.5	95,764	1.7	3.0	2.3	100,522	1.9
Public Consumption	27,809	5.0	6.2	30,452	0.7	4.0	5.3	33,041	0.6
Fixed Investment	47,011	1.9	0.0	44,730	-2.0	-6.9	2.2	45,867	-0.1
Building	36,339	-1.3	1.2	33,031	-2.5	-11.9	3.2	33,367	-0.5
Machinery	10,673	13.0	-1.5	11,700	0.6	8.0	1.5	12,491	0.4
Final Domestic Demand	165,734	4.9	2.8	170,946	0.4	0.4	2.7	179,430	2.4
Stock Building	661			530	-0.1			421	-0.1
Agricultural	-12			-12	0.0			-12	0.0
Intervention	-231			-231	0.0			-231	0.0
Non-Agricultural	904			772	-0.1			664	-0.1
Total Domestic Demand	166,395	4.4	2.8	171,476	0.4	0.3	2.7	179,851	2.3
Total Exports	148,844	6.6	-0.2	158,109	5.4	5.4	0.8	168,785	5.9
Merchandise	84,230	3.5	-2.6	85,925	1.5	2.6	-0.6	87,654	1.6
Services	64,614	11.5	2.7	72,183	3.8	9.5	2.0	81,131	4.4
Total Demand	315,239	5.5	1.3	329,584	5.8	2.8	1.7	348,637	8.2
Total Imports	129,826	6.1	1.2	137,299	3.3	4.0	1.7	146,454	4.4
Gross Domestic Product	186,424	4.9	1.5	193,296	2.1	1.8	1.9	203,194	3.7
Net Factor Income	-27,065	6.9	-1.0	-28,347	-0.5	2.7	2.0	-30,098	-0.9
Gross National Product	159,358	4.5	2.0	164,949	1.6	1.6	1.8	173,095	2.9

	2009 €m	Volume %	Price %	2010 €m	Cont. to Growth %	Volume %	Price %	2011 €m	Cont. to Growth %
Personal Consumption	100,522	3.2	1.7	105,978	1.6	2.7	2.7	111,035	1.2
Public Consumption	33,041	3.5	4.8	34,698	1.0	6.1	-1.0	36,716	0.5
Fixed Investment	45,867	-0.3	2.9	48,476	1.5	5.9	-0.2	47,906	-0.8
Building	33,367	-2.6	3.7	34,753	1.0	5.6	-1.3	35,093	-0.3
Machinery	12,491	5.2	1.5	13,525	0.5	6.8	1.4	12,761	-0.6
Final Domestic Demand	179,430	2.3	2.6	189,153	4.1	4.1	1.3	195,657	0.8
Stock Building	421			886	0.2			835	0.0
Agricultural	-12			20	0.0			20	0.0
Intervention	-231			0	0.2			0	0.0
Non-Agricultural	664			866	0.1			815	0.0
Total Domestic Demand	179,851	2.3	2.6	190,038	4.3	4.3	1.3	196,492	0.8
Total Exports	168,785	5.7	1.0	180,759	7.1	6.6	0.4	194,027	6.7
Merchandise	87,654	2.6	-0.6	91,392	2.8	4.8	-0.5	93,473	2.0
Services	81,131	10.0	2.2	89,367	4.2	9.1	1.0	100,554	4.6
Total Demand	348,637	4.0	1.7	370,797	11.4	5.5	0.8	390,519	7.5
Total Imports	146,454	5.2	1.4	159,163	5.8	6.7	1.9	167,756	3.1
Gross Domestic Product	203,194	3.1	1.9	212,645	5.6	4.6	0.0	223,774	4.4
Net Factor Income	-30,098	4.4	1.7	-30,933	-0.5	2.3	0.4	-32,443	-0.7
Gross National Product	173,095	2.9	2.0	181,712	5.1	5.1	-0.1	191,331	3.7

[100] The detailed tables associated with the environmental output from the *ISus* model are available at: http://www.esri.ie/research/research_areas/environment/isus/ISusMTR08.xls.

Table A3.1 (continued): Expenditure on GNP

	2011 €m	Volume %	Price %	2012 €m	Cont. to Growth %	Volume %	Price %	2013 €m	Cont. to Growth %
Personal Consumption	111,035	2.0	2.7	117,042	1.5	2.6	2.7	124,436	1.9
Public Consumption	36,716	3.0	2.8	38,662	0.4	2.5	2.7	40,742	0.4
Fixed Investment	47,906	-3.3	2.2	50,770	0.7	3.1	2.7	53,522	0.6
Building	35,093	-1.6	2.6	37,457	0.6	3.5	3.2	39,450	0.3
Machinery	12,761	-7.1	1.6	13,296	0.2	2.4	1.8	14,035	0.2
Final Domestic Demand	195,657	0.8	2.6	206,473	2.6	2.7	2.7	218,699	2.8
Stock Building	835			832	0.0			812	0.0
Agricultural	20			20	0.0			20	0.0
Intervention	0			0	0.0			0	0.0
Non-Agricultural	815			812	0.0			792	0.0
Total Domestic Demand	196,492	0.8	2.6	207,305	2.6	2.7	2.7	219,511	2.8
Total Exports	194,027	6.2	1.1	209,543	6.9	6.3	1.6	225,997	6.5
Merchandise	93,473	3.4	-1.1	95,376	1.6	2.6	-0.6	97,617	1.5
Services	100,554	9.6	2.7	114,166	5.4	10.5	2.7	128,379	5.1
Total Demand	390,519	3.6	1.7	416,848	9.6	4.6	2.0	445,508	9.3
Total Imports	167,756	3.4	1.9	180,928	5.2	5.9	1.9	194,651	5.0
Gross Domestic Product	223,774	3.7	1.5	236,930	4.4	3.7	2.1	251,867	4.3
Net Factor Income	-32,443	3.7	1.1	-33,729	-0.4	2.3	1.6	-35,230	-0.5
Gross National Product	191,331	3.7	1.5	203,202	3.9	3.9	2.2	216,637	3.8

	2013 €m	Volume %	Price %	2014 €m	Cont. to Growth %	Volume %	Price %	2015 €m	Cont. to Growth %
Personal Consumption	124,436	3.3	2.9	132,790	2.0	3.6	3.0	142,016	2.2
Public Consumption	40,742	2.5	2.8	43,013	0.4	2.5	3.0	45,437	0.4
Fixed Investment	53,522	2.4	2.9	55,770	0.3	1.2	3.0	58,093	0.3
Building	39,450	1.9	3.3	40,838	0.0	0.0	3.5	42,239	0.0
Machinery	14,035	3.6	1.9	14,861	0.3	3.9	1.9	15,744	0.3
Final Domestic Demand	218,699	3.0	2.9	231,573	2.7	2.8	3.0	245,547	2.8
Stock Building	812			780	0.0			760	0.0
Agricultural	20			20	0.0			20	0.0
Intervention	0			0	0.0			0	0.0
Non-Agricultural	792			760	0.0			740	0.0
Total Domestic Demand	219,511	2.9	2.9	232,353	2.7	2.8	3.0	246,307	2.8
Total Exports	225,997	5.8	2.0	243,741	6.3	5.5	2.2	262,528	6.2
Merchandise	97,617	2.5	-0.1	100,246	1.4	2.5	0.2	103,145	1.4
Services	128,379	9.3	2.9	143,496	4.9	8.6	3.0	159,384	4.7
Total Demand	445,508	4.5	2.3	476,095	9.0	4.3	2.5	508,836	9.0
Total Imports	194,651	5.6	1.9	208,867	4.9	5.3	1.9	223,886	4.8
Gross Domestic Product	251,867	3.6	2.6	268,239	4.2	3.5	2.9	285,961	4.2
Net Factor Income	-35,230	2.4	2.0	-36,991	-0.5	2.7	2.2	-38,852	-0.5
Gross National Product	216,637	3.8	2.7	231,248	3.6	3.6	3.0	247,109	3.7

Table A3.2: Output

	2007 €m	Volume %	Price %	2008 €m	Cont. to Growth %	Volume %	Price %	2009 €m	Cont. to Growth %
Agriculture	3,996	-10.0	13.3	4,075	0.0	1.0	1.0	4,157	0.0
Industry	54,320	3.9	-1.4	53,732	-0.3	-0.9	-0.2	54,448	0.6
Manufacturing	37,035	5.7	-2.4	37,697	0.7	2.6	-0.8	38,137	0.8
Utilities	2,190	7.5	3.2	2,313	0.1	4.0	1.6	2,443	0.1
Building	15,096	-1.6	1.4	13,722	-1.1	-12.3	3.7	13,869	-0.2
Market Services	76,493	6.4	2.3	81,008	1.7	3.6	2.2	87,227	2.4
Distribution	16,258	5.0	1.5	16,872	0.2	2.0	1.7	17,494	0.2
Transport & Communications	8,333	5.0	1.5	8,648	0.1	2.0	1.7	8,976	0.1
Other Market Services	51,903	7.2	2.7	55,488	1.4	4.4	2.4	60,756	2.1
Non-Market Services	29,779	4.2	7.8	31,728	0.5	2.9	3.5	33,320	0.5
Health & Education	23,909	4.7	8.6	25,594	0.5	3.4	3.5	27,002	0.5
Public Administration	5,870	2.5	4.4	6,134	0.0	1.0	3.5	6,318	0.0
GDP at Factor Cost	163,577	4.8	2.3	169,533	2.0	1.9	1.7	178,141	3.5
Taxes on Expenditure	26,039	5.5	-1.4	26,876	0.2	1.5	1.7	28,037	0.2
Subsidies	3,193	3.0	15.2	3,113	0.1	3.0	-5.3	2,984	0.1
GDP at Market Prices	186,424	4.9	1.5	193,296	2.1	1.8	1.9	203,194	3.7
Net Factor Income	-27,065	6.9	-1.0	-28,347	-0.5	2.7	2.0	-30,098	-0.9
GNP at Market Prices	159,358	4.5	2.0	164,949	1.6	1.6	1.8	173,095	2.9

	2009 €m	Volume %	Price %	2010 €m	Cont. to Growth %	Volume %	Price %	2011 €m	Cont. to Growth %
Agriculture	4,157	1.0	1.0	4,225	0.0	2.1	-0.5	4,412	0.0
Industry	54,448	1.7	-0.4	52,139	1.9	5.2	-9.0	52,216	0.9
Manufacturing	38,137	2.9	-1.7	35,378	1.3	4.8	-11.4	34,888	0.9
Utilities	2,443	3.6	1.9	2,588	0.2	11.0	-4.6	2,605	0.1
Building	13,869	-2.7	3.8	14,173	0.4	5.6	-3.2	14,722	-0.1
Market Services	87,227	4.8	2.7	95,466	2.5	5.0	4.3	103,218	2.9
Distribution	17,494	1.9	1.7	11,508	0.3	2.6	-35.9	11,499	0.3
Transport & Communications	8,976	2.0	1.7	9,337	0.2	2.9	1.1	9,835	0.2
Other Market Services	60,756	6.2	3.1	74,621	2.1	6.0	15.8	81,884	2.5
Non-Market Services	33,320	2.9	2.1	34,817	0.3	2.0	2.5	36,543	0.3
Health & Education	27,002	3.4	2.0	28,241	0.3	2.0	2.5	29,669	0.3
Public Administration	6,318	1.0	2.0	6,575	0.1	1.9	2.1	6,874	0.1
GDP at Factor Cost	178,141	3.4	1.7	185,634	5.2	5.0	-0.7	195,378	4.1
Taxes on Expenditure	28,037	1.4	2.9	30,049	0.4	2.3	4.8	31,509	0.3
Subsidies	2,984	3.0	-6.9	3,038	0.0	2.0	-0.2	3,112	0.0
GDP at Market Prices	203,194	3.1	1.9	212,645	5.6	4.6	0.0	223,774	4.4
Net Factor Income	-30,098	4.4	1.7	-30,933	-0.5	2.3	0.4	-32,443	-0.7
GNP at Market Prices	173,095	2.9	2.0	181,712	5.1	5.1	-0.1	191,331	3.7

Table A3.2 (continued): Output

	2011 €m	Volume %	Price %	2012 €m	Cont. to Growth %	Volume %	Price %	2013 €m	Cont. to Growth %
Agriculture	4,412	0.4	4.0	4,589	0.0	0.0	4.0	4,742	0.0
Industry	52,216	2.4	-2.2	53,214	1.0	2.9	-1.0	54,608	0.8
Manufacturing	34,888	3.3	-4.6	34,814	0.7	2.7	-2.8	35,271	0.7
Utilities	2,605	4.5	-3.7	2,625	0.1	4.3	-3.4	2,644	0.0
Building	14,722	-1.6	5.6	15,775	0.2	3.5	3.6	16,693	0.1
Market Services	103,218	5.8	2.2	111,417	2.6	5.1	2.7	120,552	2.6
Distribution	11,499	2.5	-2.5	12,543	0.2	2.5	6.4	13,855	0.2
Transport & Communications	9,835	3.4	1.8	10,391	0.2	3.7	1.9	11,010	0.2
Other Market Services	81,884	7.1	2.5	88,483	2.2	6.1	1.9	95,687	2.2
Non-Market Services	36,543	2.0	2.9	38,307	0.3	2.0	2.8	40,194	0.3
Health & Education	29,669	2.0	3.0	31,130	0.3	2.0	2.9	32,694	0.3
Public Administration	6,874	1.9	2.6	7,177	0.1	1.9	2.4	7,500	0.1
GDP at Factor Cost	195,378	3.9	1.3	206,517	4.0	3.8	1.9	219,084	3.8
Taxes on Expenditure	31,509	2.0	2.8	33,604	0.4	2.8	3.8	36,055	0.5
Subsidies	3,112	0.6	1.8	3,190	0.0	0.6	1.9	3,272	0.0
GDP at Market Prices	223,774	3.7	1.5	236,930	4.4	3.7	2.1	251,867	4.3
Net Factor Income	-32,443	3.7	1.1	-33,729	-0.4	2.3	1.6	-35,230	-0.5
GNP at Market Prices	191,331	3.7	1.5	203,202	3.9	3.9	2.2	216,637	3.8

	2013 €m	Volume %	Price %	2014 €m	Cont. to Growth %	Volume %	Price %	2015 €m	Cont. to Growth %
Agriculture	4,742	0.5	2.8	4,873	0.0	0.8	2.0	5,006	0.0
Industry	54,608	2.4	0.2	56,230	0.7	2.0	0.9	57,970	0.7
Manufacturing	35,271	2.5	-1.2	36,168	0.7	2.5	0.0	37,231	0.7
Utilities	2,644	1.9	-1.2	2,658	0.0	1.6	-1.0	2,669	0.0
Building	16,693	1.9	3.8	17,404	0.0	0.0	4.2	18,071	0.0
Market Services	120,552	5.0	3.0	130,564	2.6	4.9	3.2	141,417	2.6
Distribution	13,855	2.5	7.8	15,295	0.2	2.5	7.7	16,755	0.2
Transport & Communications	11,010	3.9	2.0	11,692	0.2	4.0	2.1	12,433	0.2
Other Market Services	95,687	5.9	2.1	103,577	2.1	5.7	2.4	112,229	2.1
Non-Market Services	40,194	2.0	2.9	42,269	0.3	2.0	3.1	44,483	0.3
Health & Education	32,694	2.0	3.0	34,414	0.3	2.0	3.2	36,249	0.3
Public Administration	7,500	1.9	2.5	7,856	0.1	1.9	2.8	8,234	0.1
GDP at Factor Cost	219,084	3.6	2.4	232,926	3.6	3.4	2.8	247,866	3.6
Taxes on Expenditure	36,055	3.5	3.7	38,671	0.6	3.8	3.4	41,544	0.6
Subsidies	3,272	1.1	1.5	3,358	0.0	1.2	1.4	3,448	0.0
GDP at Market Prices	251,867	3.6	2.6	268,239	4.2	3.5	2.9	285,961	4.2
Net Factor Income	-35,230	2.4	2.0	-36,991	-0.5	2.7	2.2	-38,852	-0.5
GNP at Market Prices	216,637	3.8	2.7	231,248	3.6	3.6	3.0	247,109	3.7

Table A3.3: National Income and National Product, Current Prices, € million

	2007	2008	2009	2010	2011	2012	2013	2014	2015
Agricultural Incomes	3,270	3,335	3,402	3,446	3,649	3,813	3,949	4,060	4,172
Non-Agric. Wage Income	78,926	82,079	85,920	90,424	95,451	100,711	106,440	112,830	119,704
Non-Agric. Profits Net	61,478	63,286	66,806	67,910	71,795	76,293	81,387	86,984	93,188
Non-Agric. Profits Gross	61,678	63,486	67,006	68,110	71,995	76,493	81,587	87,184	93,388
Adjustment for Stock Appreciation	200	200	200	200	200	200	200	200	200
Domestic Income	143,674	148,700	156,127	161,781	170,895	180,817	191,775	203,874	217,064
Depreciation	19,903	20,832	22,014	23,854	24,483	25,700	27,309	29,053	30,801
GDP (Factor Cost)	163,577	169,533	178,141	185,634	195,378	206,517	219,084	232,926	247,866
Taxes on Expenditure	26,039	26,876	28,037	30,049	31,509	33,604	36,055	38,671	41,544
Domestic	25,585	26,398	27,535	29,510	30,943	33,010	35,431	38,016	40,856
EC	454	478	502	539	566	594	624	655	688
Subsidies (-)	3,193	3,113	2,984	3,038	3,112	3,190	3,272	3,358	3,448
Domestic	1,237	1,353	1,400	1,484	1,558	1,636	1,718	1,804	1,894
EC	1,956	1,760	1,584	1,554	1,554	1,554	1,554	1,554	1,554
GDP (Market Prices)	186,424	193,296	203,194	212,645	223,774	236,930	251,867	268,239	285,961
Net Factor Income	-27,065	-28,347	-30,098	-30,933	-32,443	-33,729	-35,230	-36,991	-38,852
Gross National Product	159,358	164,949	173,095	181,712	191,331	203,202	216,637	231,248	247,109

Table A3.4: Personal Income and Personal Expenditure, Current Prices, € million

	2007	2008	2009	2010	2011	2012	2013	2014	2015
Agricultural Incomes	3,270	3,335	3,402	3,446	3,649	3,813	3,949	4,060	4,172
Non-Agric. Wage Income	78,926	82,079	85,920	90,424	95,451	100,711	106,440	112,830	119,704
Transfer Income	20,807	22,263	23,934	25,243	26,872	28,446	30,048	31,712	33,525
Domestic	21,095	22,046	23,516	24,804	26,411	27,962	29,540	31,179	32,964
Foreign	-289	217	418	439	461	484	508	533	560
Other Personal Income	17,414	18,857	19,519	18,767	21,199	23,722	26,494	29,486	32,697
Non-Agricultural Profits	61,678	63,486	67,006	68,110	71,995	76,493	81,587	87,184	93,388
National Debt Interest	1,471	1,707	1,903	2,014	2,252	2,622	2,874	3,182	3,395
Net Factor Income	-27,065	-28,347	-30,098	-30,933	-32,443	-33,729	-35,230	-36,991	-38,852
Government Trading & Investment Income (-)	2,011	2,292	2,300	2,358	2,416	2,477	2,539	2,602	2,667
Other Private Income	34,073	34,554	36,511	36,834	39,388	42,909	46,693	50,773	55,263
Undistributed Profits (-)	16,659	15,696	16,991	18,067	18,189	19,188	20,199	21,287	22,566
Personal Income	120,416	126,535	132,774	137,880	147,170	156,693	166,930	178,088	190,099
Taxes on Personal Income	23,641	24,465	25,460	27,841	30,202	32,690	34,797	37,141	39,665
Personal Disposable Income	96,775	102,069	107,315	110,040	116,969	124,003	132,133	140,947	150,433
Personal Consumption	90,913	95,764	100,522	105,978	111,035	117,042	124,436	132,790	142,016
Personal Savings	5,862	6,306	6,792	4,062	5,934	6,961	7,697	8,157	8,417
Tax Ratio (% Personal Income)	19.6	19.3	19.2	20.2	20.5	20.9	20.8	20.9	20.9
Savings Ratio (% of Disposable Income)	6.1	6.2	6.3	3.7	5.1	5.6	5.8	5.8	5.6

Table A3.5: Balance of Payments, Current Prices, € million

	2007	2008	2009	2010	2011	2012	2013	2014	2015
Exports – Total	148,844	158,109	168,785	180,759	194,027	209,543	225,997	243,741	262,528
Merchandise	84,230	85,925	87,654	91,392	93,473	95,376	97,617	100,246	103,145
Services	64,614	72,183	81,131	89,367	100,554	114,166	128,379	143,496	159,384
Imports – Total	129,826	137,299	146,454	159,163	167,756	180,928	194,651	208,867	223,886
Balance of Trade	19,018	20,810	22,331	21,596	26,271	28,614	31,345	34,875	38,643
as % of GNP	11.9	12.6	12.9	11.9	13.7	14.1	14.5	15.1	15.6
International Transfers									
EC Subsidies	1,956	1,760	1,584	1,554	1,554	1,554	1,554	1,554	1,554
EC Taxes (-)	454	478	502	539	566	594	624	655	688
Government Payments (-)	2,241	2,480	2,500	2,638	2,747	2,863	2,987	3,118	3,258
Government Receipts	427	381	400	420	441	463	486	511	536
Private Transfers	-289	217	418	439	461	484	508	533	560
Net International Transfers	-600	-600	-600	-763	-857	-956	-1,062	-1,175	-1,295
Factor Income Flows	-27,065	-28,347	-30,098	-30,933	-32,443	-33,729	-35,230	-36,991	-38,852
National Debt Interest (-)	801	929	1,036	1,064	1,222	1,516	1,720	1,971	2,124
Profits etc. Outflows (-)	22,915	27,536	32,834	33,969	35,272	36,694	38,534	40,647	42,950
Other Factor income	-3,349	118	3,771	4,100	4,052	4,481	5,024	5,628	6,222
Current Account Balance	-8,647	-8,137	-8,367	-10,101	-7,028	-6,071	-4,947	-3,291	-1,504
as % of GNP	-5.4	-4.9	-4.8	-5.6	-3.7	-3.0	-2.3	-1.4	-0.6
Capital Transfers	300	300	300	0	0	0	0	0	0
Effective Current Balance	-8,347	-7,837	-8,067	-10,101	-7,028	-6,071	-4,947	-3,291	-1,504
as % of GNP	-5.2	-4.8	-4.7	-5.6	-3.7	-3.0	-2.3	-1.4	-0.6

Table A3.6: National Debt, Current prices, € million

	2007	2008	2009	2010	2011	2012	2013	2014	2015
Total Government Securities	31,306	31,307	31,306	32,203	32,647	33,115	33,602	34,103	34,612
Other Borrowing from Central Bank	-5,463	-5,463	-5,463	-5,463	-5,463	-5,463	-5,463	-5,463	-5,463
Small Savings	7,139	7,140	7,137	9,826	10,401	11,051	11,774	12,550	13,359
Total Debt Held Domestically	6,278	6,278	6,274	9,546	10,250	11,053	11,948	12,910	13,914
Total € Debt	32,983	32,983	32,979	36,566	37,585	38,703	39,913	41,190	42,509
Foreign Debt:									
Foreign Currency	80	88	170	1,607	5,343	8,597	10,919	11,316	9,567
Government Securities	26,705	26,705	26,705	27,020	27,335	27,650	27,965	28,280	28,595
Total Foreign Debt	26,785	26,793	26,875	28,627	32,678	36,247	38,884	39,596	38,162
Total National Debt	33,062	33,072	33,149	38,173	42,928	47,299	50,833	52,506	52,076
General Government Debt	47,277	52,626	60,229	65,253	70,008	74,379	77,912	79,586	79,155
Other Bank Borrowing	-2,310	-2,310	-2,310	-2,310	-2,310	-2,310	-2,310	-2,310	-2,310
Debt Ratios (% of GNP)									
Total National Debt	20.7	20.0	19.2	21.0	22.4	23.3	23.5	22.7	21.1
General Government Debt	29.7	31.9	34.8	35.9	36.6	36.6	36.0	34.4	32.0
Total Domestic Debt	3.9	3.8	3.6	5.3	5.4	5.4	5.5	5.6	5.6
Total Foreign Debt	16.8	16.2	15.5	15.8	17.1	17.8	17.9	17.1	15.4
Total € Debt	20.7	20.0	19.1	20.1	19.6	19.0	18.4	17.8	17.2
Total Foreign Currency Debt	0.0	0.1	0.1	0.9	2.8	4.2	5.0	4.9	3.9
Debt Ratios (% of GDP)									
Total National Debt	17.7	17.1	16.3	18.0	19.2	20.0	20.2	19.6	18.2
General Government Debt	25.4	27.2	29.6	30.7	31.3	31.4	30.9	29.7	27.7
Total Foreign Debt	14.4	13.9	13.2	13.5	14.6	15.3	15.4	14.8	13.3

Table A3.7: Public Authorities Accounts, Current Prices, € million

	2007	2008	2009	2010	2011	2012	2013	2014	2015
Taxes on Income and Wealth	30,030	31,031	32,389	35,180	37,662	40,576	43,176	46,078	49,216
Company	6,391	6,569	6,932	7,342	7,463	7,889	8,381	8,940	9,553
Personal	23,639	24,463	25,457	27,838	30,199	32,687	34,794	37,138	39,663
Taxes on Expenditure	25,585	26,398	27,535	29,510	30,943	33,010	35,431	38,016	40,856
Gross	25,802	26,639	27,800	29,811	31,272	33,366	35,818	38,434	41,306
EU Taxes deducted (-)	217	241	265	302	329	357	387	418	451
Net Trading & Investment Income	2,011	2,292	2,300	2,358	2,416	2,477	2,539	2,602	2,667
Transfers From Abroad	427	381	400	420	441	463	486	511	536
Total Current Receipts	58,056	60,106	62,626	67,470	71,465	76,528	81,635	87,209	93,278
Subsidies	1,237	1,353	1,400	1,484	1,558	1,636	1,718	1,804	1,894
National Debt Interest	1,471	1,707	1,903	2,014	2,252	2,622	2,874	3,182	3,395
Other Transfer Payments	23,336	24,527	26,016	27,441	29,158	30,826	32,527	34,297	36,222
Foreign	2,241	2,480	2,500	2,638	2,747	2,863	2,987	3,118	3,258
Residents	21,095	22,046	23,516	24,804	26,411	27,962	29,540	31,179	32,964
Public Consumption	27,809	30,452	33,041	34,698	36,716	38,662	40,742	43,013	45,437
Total Current Expenditure	53,853	58,038	62,360	65,638	69,685	73,746	77,861	82,296	86,948
Public Authorities Savings (net)	4,203	2,067	266	1,832	1,781	2,782	3,774	4,913	6,329
as % of GNP	2.6	1.3	0.2	1.0	0.9	1.4	1.7	2.1	2.6
Total Capital Receipts	6,162	6,229	6,298	6,739	7,109	7,500	7,913	8,348	8,807
Grants – Housing	67	68	69	67	72	76	80	84	87
Grants – Industry	56	59	60	57	53	49	51	53	55
Investment	7,376	8,413	10,336	10,847	10,957	12,211	12,608	12,198	11,802
Other Capital Expenditure	3,347	3,410	2,809	2,622	2,565	2,324	2,483	2,601	2,761
Total Capital Expenditure	10,846	11,950	13,274	13,594	13,648	14,659	15,222	14,936	14,706
Borrowing for Capital Purposes	-4,684	-5,721	-6,976	-6,856	-6,538	-7,159	-7,309	-6,588	-5,899
Total Borrowing	-481	-3,653	-6,710	-5,024	-4,758	-4,377	-3,535	-1,674	430
as % of GNP	-0.3	-2.2	-3.9	-2.8	-2.5	-2.2	-1.6	-0.7	0.2
Budgetary Definitions									
EBR	-1,626	-5,351	-7,603	-5,917	-5,651	-5,270	-4,428	-2,567	-463
as % of GNP	-1.0	-3.2	-4.4	-3.3	-3.0	-2.6	-2.0	-1.1	-0.2
Current Budget Saving / Deficit	6,990	4,282	2,585	4,151	4,099	5,101	6,092	7,232	8,648
as % of GNP	4.4	2.6	1.5	2.3	2.1	2.5	2.8	3.1	3.5
EU Definitions									
General Government Balance	-896	2,330	4,189	2,502	2,236	1,855	1,014	-847	-2,952
as % of GDP	-0.5	1.2	2.1	1.2	1.0	0.8	0.4	-0.3	-1.0
as % of GNP	-0.6	1.4	2.4	1.4	1.2	0.9	0.5	-0.4	-1.2

Table A3.8: Employment and the Labour Force, Thousands

	2007	2008	2009	2010	2011	2012	2013	2014	2015
Agriculture	110	110	109	106	103	101	98	95	93
Industry	567	548	541	548	542	535	528	521	513
Manufacturing:									
Traditional	87	84	81	75	72	69	66	64	63
Food Processing	49	49	49	49	48	47	46	45	44
High Technology	139	139	139	153	151	148	145	141	137
Manufacturing	275	272	269	276	270	264	257	250	243
Utilities	14	14	14	14	13	13	12	12	11
Building	278	261	258	259	259	259	259	259	259
Market Services	860	865	880	885	905	929	954	980	1,007
Distribution	287	290	293	280	283	288	295	301	307
Transport & Communications	121	121	121	119	119	119	119	120	121
Other Market Services	451	454	466	486	504	522	540	559	579
Non-Market Services	476	490	504	515	525	535	546	557	568
Health & Education	363	375	388	396	404	412	420	428	437
Public Administration	113	115	116	119	121	123	126	128	131
Total	2,013	2,012	2,035	2,054	2,076	2,100	2,126	2,153	2,181
Unemployment	119	160	173	186	193	190	181	169	160
Labour Force	2,133	2,172	2,208	2,240	2,269	2,290	2,307	2,322	2,340