

CHAPTER 7

PRODUCTIVITY IN THE IRISH RESIDENTIAL CONSTRUCTION INDUSTRY

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ABSTRACT

Irish residential construction is currently undergoing a transformation in productivity terms. This was achieved through increased skills in the industry, increased mechanisation, the use of more modern site management techniques and increases in the average scheme size. This has occurred mostly in urban centres, with rural areas still typified by traditional, low-productivity methods. We estimate that while it took 33 workers a year to complete ten homes in 1993, by 2003 it took only 26 workers to build the same number of homes of a similar size.

¹ The views expressed are solely those of the authors and do not necessarily reflect the views of Forfás.

7.1 Introduction

The purpose of this chapter is to provide an assessment of the productivity performance of the Irish residential construction sector and its drivers since 1993. We estimate that the productivity levels of the Irish residential construction sector grew by 27 per cent from 1993 to 2003. Section 7.2 of this chapter presents an outline of the key characteristics of the sector and its importance to the Irish economy. Section 7.3 describes the methodology used, which is based on a measure of physical outputs and inputs (number of houses produced divided by number of employees) rather than value added. This estimate is adjusted for factors such as changes in house quality etc. Section 7.4 decomposes the estimate of productivity into the role played by increased technical efficiency/mechanisation and changes in scheme size. Section 7.5 sets out the implications of this improvement in productivity on the wider economy, while Section 7.6 concludes with areas for further research.

7.2 The Irish Construction Sector

Some key characteristics of the Irish residential construction sector are summarised below.

- The construction sector in Ireland is a key driver of economic growth and employment. In 2005, the sector accounted for ten per cent of the value added in the Irish economy and 12 per cent of the Irish labour force. Further, of the total growth in employment in the economy of 530,000 from 1998 to 2006, over one-quarter is accounted for by the construction industry;
- The residential construction sector accounts for almost 62 per cent of the value of output from the construction sector.¹ Given that residential construction is relatively labour intensive compared to other areas of construction, its share of employment is even higher. The other key segments of the sector are commercial and infrastructure construction;
- In 2005, there were over 80,000 new house completions in Ireland, which per capita, is around four times the European average;
- The construction sector is characterised by a large number of small companies. Of the 200,000 people employed in the sector in 2003, less than 30 per cent worked for companies with more than 20 employees. This compares to a corresponding figure for manufacturing industries of 88 per cent;
- The construction sector works through a complex system of contractors and sub-contractors, which allows for a great deal of flexibility and specialisation. However, it also requires strong project management skills to coordinate the various contractors and sub-contractors that may be working on an individual project; and
- The labour market is very open, with free entry into the crafts. Education is provided by a number of bodies, including FÁS and the Construction Industry Federation (CIF) and Dublin City University (DCU). An important feature of the Irish construction labour market over the last number of years has been the increasing role of migrants, particularly from the ten new EU Member States.

7.3 Outline of Methodology

This chapter calculates productivity as the number of residential units completed in a particular year divided by the number of hours worked in the construction sector, with an adjustment for changes in average new home size and quality. As such, productivity would increase if output were maintained in the face of lower employment or a shorter working week, or if more or larger homes were built with the same amount of labour.²

Output in the residential construction sector is calculated as the sum of two components, namely increases in number of new homes completed, and increases in average home size. It is based on the assumption that productivity growth from 1993 to 2003 in residential construction was the same as in non-residential construction. It is calculated in five steps:

- **Step 1: Calculate Home Completions, 1993 – 2003;**

This is calculated as the sum of houses and apartments. Data on the number of house and apartment completions is provided by the Department of Environment, Heritage and Local Government (DOEHLG). The DOEHLG data is based on the number of new dwellings connected by the Electricity Supply Board (ESB).

- **Step 2: Adjust Home Completions for Changes in Average Size of New Homes;**

The increase in average new home size is not directly observable, so it is taken from the CSO planning permissions data. This figure is then adjusted to allow for the fact that increasing aggregate floor space by increasing average home size requires only half of the labour needed to achieve the same increase through an increase in house numbers.

- **Step 3: Adjust for Changes in Quality;**

Interviews with industry experts suggest that there have been improvements in the quality of new homes over the period in question. These arise from improvements in the skill level of the industry, regulatory changes in terms of improved disabled access and significant improvements in the quality of social housing. It is not possible from existing data to measure the impact of these changes. For the purposes of this report, we assume that improvements in quality equivalent to a four per cent increase in output per house were achieved in the period 1993 to 2003.

- **Step 4: Adjust for Repair and Maintenance Employment;**

While output in the construction industry is based on new housing, employment is based on both new housing and Repair and Maintenance (R&M) of existing housing. Figures for R&M output, which only go back as far as 1997, suggest that it did not grow as fast as new housing output in the period 1997 - 2003. Therefore, an adjustment must be made to remove R&M construction labour from the calculations. This is done by assuming that 50 per cent of all R&M is non-household labour – i.e. involves outside contractors. This estimate is based on a compromise between two opposing estimates of the importance of external labour in R&M. First, 68 per cent of all R&M expenditure involves significant projects (attic conversions, garden walls etc.), a lot of which are likely to be done by outside contractors. The remaining 32 per cent expenditure relates to small projects, which are likely to be dominated by own labour (DIY). Second, the Household Budget Survey shows that only ten per cent of all repairs and improvements expenditure is on external contractors.

- **Step 5: Change in Productivity in Construction**

The adjusted total new home completions are then combined with changes in non-residential construction, with the weightings being based on the estimate employment shares of residential (75 per cent as of 2003) and non-residential (25 per cent) in total construction employment. This provides an index of output in the construction sector. This is then divided by total construction employment to arrive at a productivity estimate. No adjustment is made for possible changes in the ratio of black market employment as a percentage of total employment in construction. Industry feedback suggests that black market employment was a higher share of construction employment in 1993 compared to 2003, suggesting that the productivity estimate produced in this report is an underestimate of actual productivity improvements in the industry.

7.4 Analysis of Productivity Changes, 1993 – 2003

This chapter calculates productivity as the number of residential units completed in a particular year divided by employment in the construction sector, with an adjustment for changes in average new home size and quality. As such, productivity would increase if output were maintained in the face of lower employment or a shorter working week, or if more or larger homes were built with the same amount of labour.³

Based on the measure chosen, we estimate that productivity in the Irish residential construction sector grew by 27 per cent from 1993 to 2003. An initial estimate was calculated based on the number of dwellings completed per hour worked in the construction industry in Ireland (26 per cent). This figure was then adjusted for factors such as quality, repair and maintenance and change in average dwellings size, leading to a final central estimate of 27 per cent.

This estimate suggests that while it took on average 33 workers one year to complete ten homes in 1993, today it only takes 26 workers to build the same number of homes of a similar size and quality as in 1993.

The output of residential construction sector has increased substantially since 1993, most importantly due to increases in numbers employed, but also because of improvements in productivity. The sector is now producing more than three times as many houses than in 1993, with these units being on average almost 20 per cent larger than those completed in 1993.

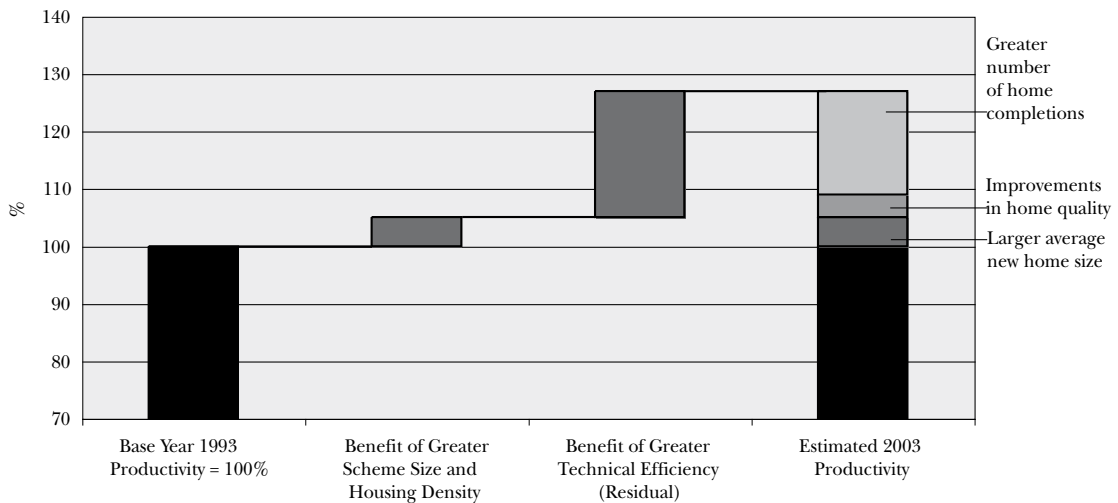
Despite the significant growth in productivity in Irish residential construction, the sector may still lag behind European best practice. A recent study in 2006 for the European Commission compiled an index based on a composite of a number of physical and value added measures of productivity in the wider construction sector.⁴ The results suggest that the overall efficiency of the Irish construction sector falls below that achieved in many European countries. This is based on a compilation of various indices of labour and input usage, which span a period from 2000 – 2005.

The sources of these productivity changes can be divided into two categories, namely improvements in technical efficiency and increases in the scale and type of building schemes. Changes in technical efficiency have made the greatest contribution to productivity growth (22 percentage points), though larger scheme sizes and greater housing density also helped (five percentage points). In terms of the former, many of the greatest efficiencies realised over the last number of years can only be fully taken advantage of by having building schemes of

a sufficient size. This estimate of 22 percentage point productivity improvement should be interpreted as the improvement in productivity that would have been realised even if average scheme size in Ireland had remained unchanged. However, building houses in larger schemes has always been more productive than building isolated units - what has changed is that this productivity gap has widened. As such, the increase in average scheme size would have increased productivity regardless of whether efficiency had changed or not, and it is on this basis that the five percentage point increase is calculated.

This increase in residential construction productivity has been reflected in a greater number of dwelling completions, an increase in the average home size and improvements in building quality. Figure 7.1 illustrates the sources of productivity improvement. Section 7.4.1 analyses the sources of improvements in technical efficiency, Section 7.4.2 discusses the impact of an increase in the scale of building, while Section 7.4.3 analyses changes in the type of home output.

Figure 7.1: Decomposition of Productivity Changes, 1993 – 2003



Source: Authors Calculations.

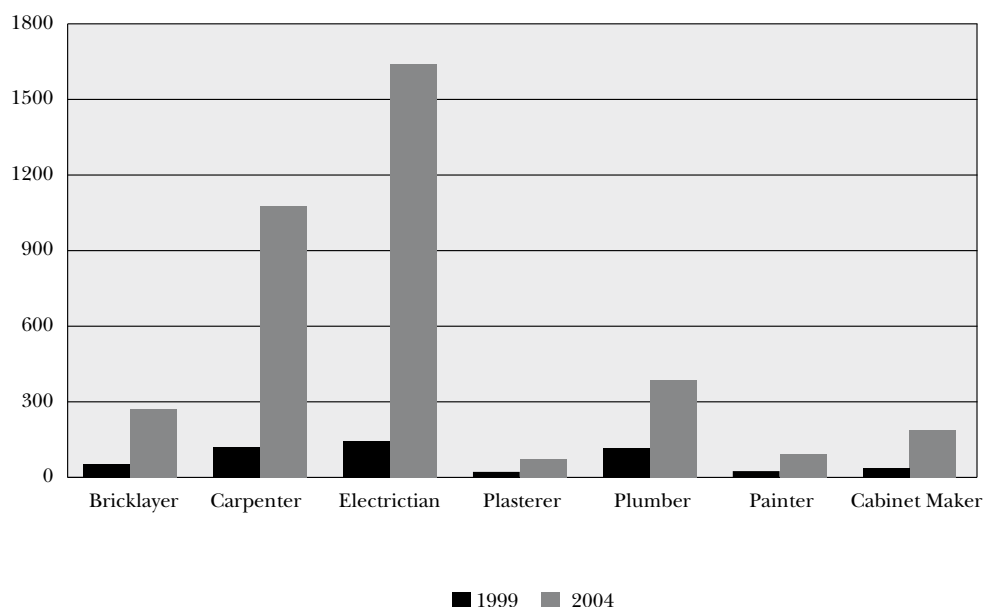
7.4.1 Improvements in Technical Efficiency

Our estimates suggest that improvements in technical efficiency account for much of the productivity gains in the sector from 1993 to 2003. Interviews with industry participants suggest that this performance has been driven by three key factors: improvements in construction labour skills, the increased use of mechanisation, and changes in management and organisational structure.

Labour Skills

Growing skills intensity in the residential construction sector has been an important source of productivity growth, through the formal development of core and specialist building skills using apprenticeships schemes. The number of National Craft Certificates awarded per annum to apprentices whose trades are oriented towards residential construction increased from 518 to 3,727 between 1999 and 2004. This represents an average annual increase of almost 57 per cent per annum compared to construction employment growth of eight per cent per annum during the same period. FÁS and the CIF also provide a number of non-apprentice courses in disciplines such as crane operation and site management.

Figure 7.2: Apprentices Awarded National Craft Certificate, 1999 and 2004



Source: FÁS, unpublished data.

Other factors have contributed towards increasing the skills base of the industry, such as the increase in the number of school leavers entering construction with Leaving Certificate qualifications and the influx of skilled immigrants. Further, buoyant demand is enabling construction companies to pay what it takes to attract skilled labour from other sectors of the economy to the construction sector.

One impediment to promoting training through apprenticeships is that the length of time required for an apprentice to be awarded a National Craft Certificate is the same regardless of the level of skill involved. Furthermore, the move to greater specialisation in the sector as a whole has not been reflected in the structure of apprenticeships, and as such skills are more general than is required. For example, while a National Craft Certificate is available for relatively generic skills such as carpenters/joiners, there is currently none available for apprentices wishing to specialise in roofing or crane operation.

Mechanisation and Quality of Work Materials

The construction industry in Ireland has seen an increased use of labour-saving machinery (mechanisation) over the last decade, as well as an increased use of work materials which improve efficiency. Both of these contribute towards reducing input costs and increasing labour productivity.

Some of the major changes include the gradual shift away from traditional bricklaying in favour of pre-cast concrete and steel or timber framed structures. This reduces the need for bricklayers, is more time efficient, and reduces the time needed to plaster, plumb and wire a residential unit. Other simple but effective changes in mechanisation include increased use of nail guns and telescopic handlers. Innovative working materials are also increasingly being used, such as the adoption of polyethylene piping as a substitute for traditional copper piping. Figure 7.3 reviews the key developments in mechanisation and material inputs that have occurred within the eight main building processes between 1993 and 2003, and assesses their impact on productivity.

Figure 7.3: Developments in Mechanisation and Quality of Work Materials

Process	Changes	Importance
Bricklaying	Pre-cast concrete Steel Frame Ready to Use Mortar Telescopic Handlers	High
Plastering	Ready to use plaster	High
Roofing	Pre-made Segments off-site Telescopic handlers Nail guns	Medium
Glazing	Pre-made in factory	Medium
Wiring	Little change	Medium
Plumbing	Polyethylene piping	Medium
Tiling	Bathroom pods	Medium
Painting	Little change	Low

Source: Industry Interviews.

Industry interviews suggests that many of these developments have contributed significantly to productivity improvements in large scale residential developments, but not in smaller scale developments or once off housing. This reflects both a lack of knowledge by purchasers/ developer/architects of once off housing as to the possible advantages of some of these innovations, as well as the fact that many of the innovations are dependent on sufficient scale to make their introduction financially worthwhile. An example of the latter is pre-cast and steel frames. These are commonly used in industrial construction and have been incorporated into some large-scale residential developments, but may not be economical in smaller developments.

Better Management and Organisational Structure

In an effort to reduce cost, construction companies have been adopting site management techniques that aim to cut down on the time lost between the completion of sequential tasks. This requires a very tight sequencing and control of construction tasks. For example, it requires that a task such as bricklaying be completed on time so that subsequent tasks such as wiring can be planned for with a high degree of precision. Further, it requires that building materials arrive in sufficient time so as not to delay work, but not so early that they are lying around on a building site, where there is a greater chance of loss through theft, damage or degradation.

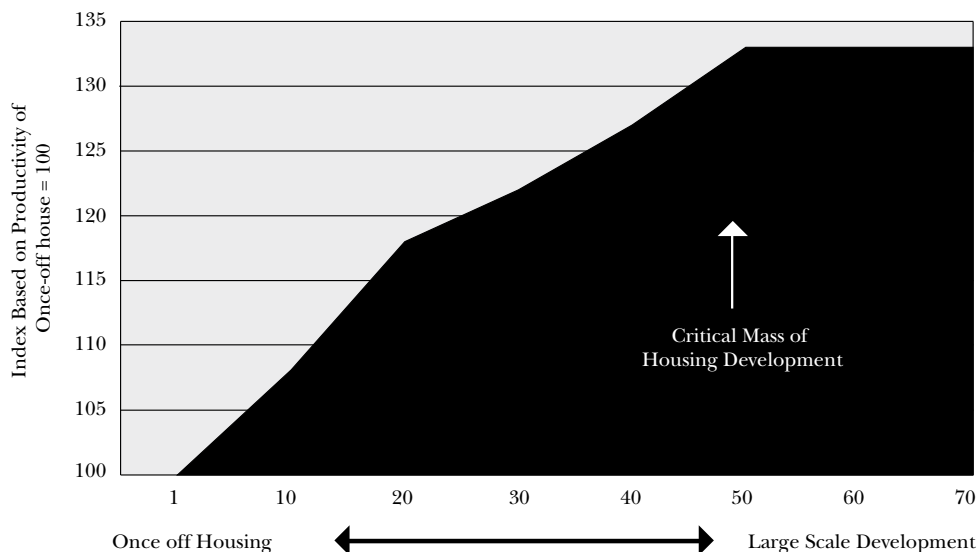
In an effort to improve the predictability of when each stage of a project will be completed, some firms have decided to reduce their use of on-site labour. This has been done in part by designing buildings so that labour intensive tasks such as bricklaying are minimised. Furthermore, many firms are increasingly opting for prefabrication. For example, in many of the larger apartment complexes currently under construction prefabricated pod bathrooms are being used, greatly reducing the need for a large number of different tradesmen (e.g. plumbers, tilers and plasterers) on site. Often, these options can cost more than traditional labour-intensive methods, but are favoured because of the greater predictability they offer. The efficiency savings enabled by greater predictability outweighs the additional cost involved.

Another important change in the way construction tasks are organised is a greater specialisation of tasks, particularly in urban areas, which has improved productivity. In Ireland, this has been achieved through the practice of sub-contracting to specialised smaller firms. However, evidence from Europe suggests that larger firms with greater in-house specialisation are generally more productive than those with extensive sub-contracting.⁵ The increased use of lean construction and sub-contracting depends on better management skills. Feedback from industry interviews suggests that project management skills in Ireland are weak.

7.4.2 Increases in the Scale and Type of Building Schemes

Our estimates suggest that increases in building scheme scale coupled with a move to denser housing in Ireland have accounted for up to five percentage points of the total productivity gains of 27 per cent over the 1993 to 2003 period.

Figure 7.4: Productivity of House Construction Based on Scheme Size



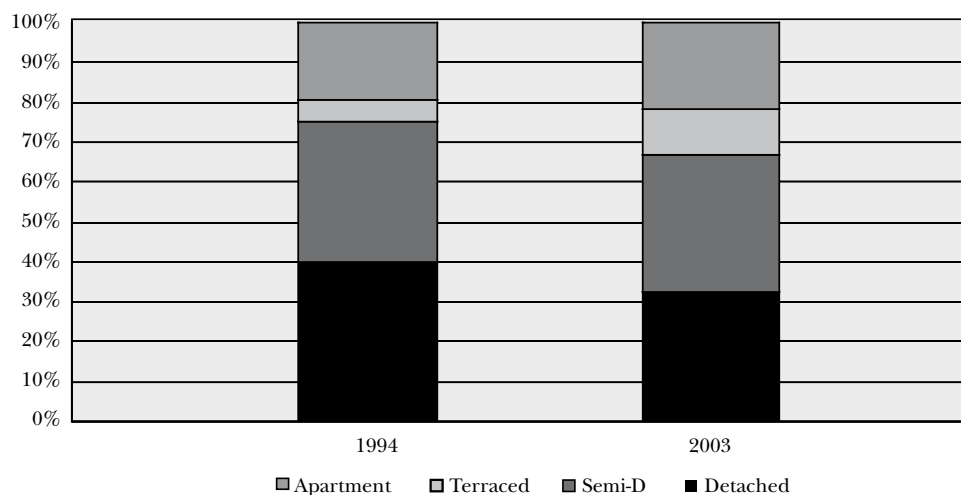
Source: Adapted from McKinsey Global Institute (1997).

The scale of a housing scheme is of critical importance to the productivity of an individual construction project. Research by the McKinsey Global Institute indicate that a once off house requires almost 33 per cent more hours worked than does a house of equivalent size on a large housing estate.⁶ Further, estimates by McKinsey Global Institute (see Figure 7.4) suggest that productivity is maximised in developing housing projects with at least 50 units.

While there is a paucity of Irish statistics in this area, planning permission statistics would suggest that the number of units per new housing scheme in Ireland has increased by around 13 per cent from 1993 to 2003. In addition, data on planning permissions suggests that the average number of apartments in a new complex has almost doubled from ten units to 18 units per block over the same period.

There has been a move towards greater construction density in Ireland, reflected in a higher proportion of apartments and terraced housing of 33 per cent of total residential units completed in 2003, up from 24 per cent in 1993. Both market and regulatory forces have encouraged the shift to greater housing densities. First, higher land prices have led to reduced average plot sizes. Second, the introduction of the planning guidelines on residential density in 1999, by providing guidance on the benefits of higher residential density in appropriate locations, has prompted many local authorities to allow higher density levels when giving planning.

Figure 7.5: Composition of New Housing in Ireland by Type, 1994 - 2003



Source: DOEHLG, Housing Statistics, downloaded from www.environ.ie.

Despite increases in the scale of building schemes, the Irish housing market is still notable for the number of once off detached houses, particularly in rural areas, a reflection of our dispersed population structure and agrarian background. Supported by an accommodative planning system, almost 40 per cent of new housing in Ireland is once off.⁷ This approach is impacting on productivity growth.

Further, dispersed housing settlements may have negative productivity implications on a host of other sectors including transport, utilities (electricity, postage, telephony, water, waste, etc.) and other services (e.g. health, education, etc.). There are, of course, a range of social, economic and environmental factors which are relevant to the debate on the regulation of rural land use, and productivity is just one of the factors to be considered.

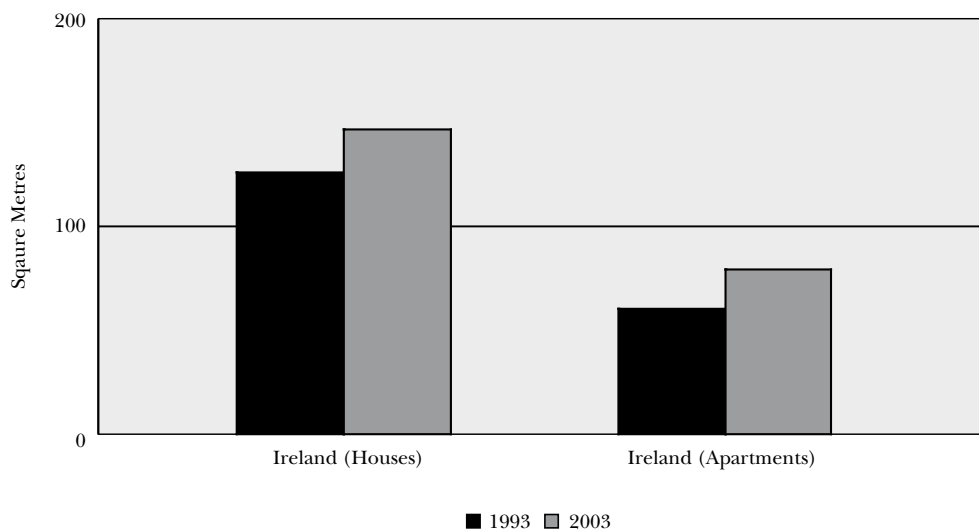
7.4.3 Changes in Home Output

Increases in productivity levels of the Irish residential construction sector are reflected in three developments: more homes are being built per hour worked, the average home size in 2003 is significantly larger than in 1993, and the average home quality has increased over the period in question.

We estimate that the number of homes completed per worker increased by 27 per cent from 1993 to 2003. The average floor size of both houses and apartments has also increased by around 20 square metres from 1993 to 2003 (see Figure 7.6). For houses this represents an increase of around 20 per cent in terms of floor space. For apartments, the change is even more dramatic, with an average increase in floor space of 33 per cent. It requires less additional labour to increase the amount of aggregate residential floor size by building bigger houses than to build more houses, because large houses tend to have fewer fittings per square metre than small houses (e.g. sockets, lighting, toilets, staircases etc.), so increasing floor space is not very labour intensive.

It is unclear if house sizes will continue to increase in Ireland. On the one hand, Irish home buyers are better off today than in 1993, and are willing to devote a lot of that additional income to purchase larger homes. On the other, smaller family sizes and increasing land prices are forcing buyers and planners to economise on land, particularly in central urban locations.

Figure 7.6: Average Size of New Homes



Source: Derived from CSO Planning Permissions, Q3 2005 and Q4 1999.

We assume based on industry interviews that house quality has improved by four per cent over the period 1993 – 2003.⁸ This is, by necessity, an estimate, as changes in house quality are generally not measured. By way of illustration, if there had been no change in housing quality over the period under review, the total productivity increase would have been 23 per cent. Evidence from industry interviews suggests that the quality of once-off housing and local authority housing has improved over the period in question, though the quality of finish of some larger scale building projects, such as apartment blocks, has deteriorated. Examples of changes in quality include: disabled access, downstairs toilet facilities, ensuite bathroom facilities, durability, quality of finish, fittings, etc.

7.5 The Implications of Higher Productivity

How has higher productivity in the residential construction sector enhanced the competitiveness of the Irish economy? There are three inter-related mechanisms through which this could happen, namely, moderating house prices, increasing housing output, and releasing scarce labour resources that could be employed elsewhere in the economy.

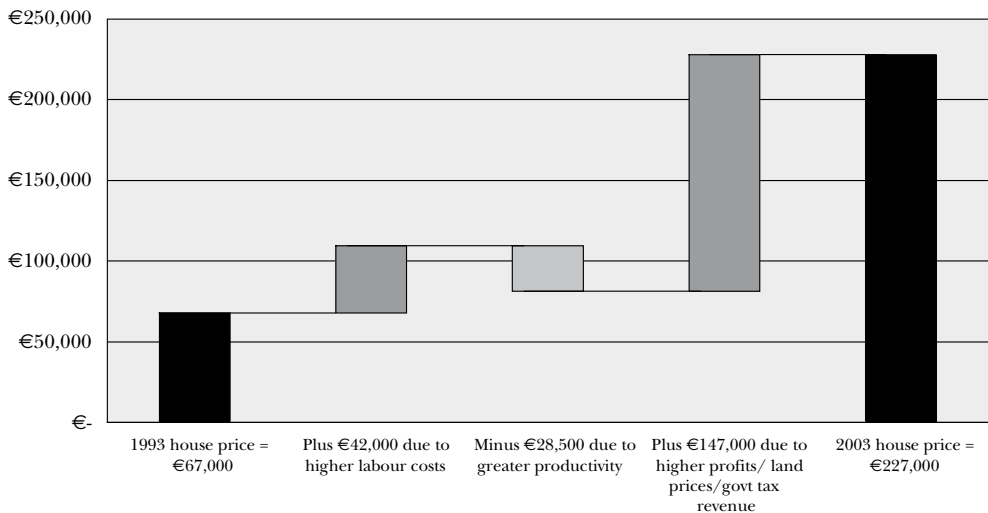
7.5.1 Reducing House Prices

For most goods and services, greater productivity results in a lower cost to the final consumer. However, the period 1993 to 2003 has been one of extremely strong growth in house prices in Ireland. Figure 7.7 below assesses the role that growing labour productivity has contributed toward reducing housing costs. Two conclusions emerge:

The improvements in labour productivity of 27 per cent (2.4 per cent per annum) that have been identified over the period 1993 to 2003 have been more than offset by the growth in residential construction labour costs. A rapid increase in demand for housing has resulted in a large increase in land prices and profits in the construction industry, while government revenue from the housing sector has also risen commensurately.

Therefore, the productivity growth achieved has not resulted in reduced house prices in recent years. Nonetheless, if houses had been constructed in 2003 based on the lower 1993 productivity levels, they could have cost an average €28,500 more per unit to build in real terms. Of course, it is unlikely that all or any of this saving has been passed on to house purchasers, and may have had the effect of further raising profits and land prices instead.

Figure 7.7: Decomposition of Changes in House Prices, 1993 – 2003



Source: Authors Calculations.

7.5.2 Increased Housing Output

We estimate that the increase in productivity in the residential construction sector over 1993 levels had increased the output of the sector by around 14,500 units per annum by 2003, based on 2003 employment levels. Cumulatively the productivity growth during the ten-year period has allowed the construction of over 80,000 additional new homes.

7.5.3 Releasing Scarce Labour Resources

An alternative way of examining the benefits of productivity is to calculate how much additional labour would have been required to produce the number constructed in 2003, at 1993 productivity levels.⁹ Based on the estimates, over 40,000 additional workers would be needed to produce the 2003 level of output at 1993 productivity levels. This would have the effect of driving up wages, and using up scarce labour that is required elsewhere in the economy. In particular, the residential sector draws labour from other areas of construction such as commercial buildings and infrastructure construction.

7.6 Conclusion

The purpose of this chapter is to provide an assessment of the productivity performance of the Irish residential construction sector and its drivers since 1993. We estimate that the productivity levels of the Irish residential construction sector grew by 27 per cent from 1993 to 2003, mainly through improvements in technical efficiency, but also because of increases in the average size of building schemes. This could have affected the economy by moderating house price increases, increasing housing output, and releasing scarce labour resources that could be employed elsewhere in the economy.

Although the residential construction sector is one of the biggest employers in the economy, the statistical data needed to accurately assess its productivity performance is not available. An improved understanding of the industry through the availability of better data can help guide policies aimed at promoting further productivity growth. The estimate of productivity growth contained in this report is based on a number of simplifying assumptions which were necessitated by this lack of data. A much more detailed breakdown of labour utilisation by skill level and sub-sector within the construction sector is required. Further, very detailed data is currently collected from mortgage providers which could allow the development of a comprehensive new-housing quality survey, which could include indices tracking changes in house quality. However this data is currently not published. An additional issue to be addressed is the influence on average residential construction productivity of the share of apartments in total output, given the different construction methods used.

Notes

- 1 DKM (2005), "Economic Consultants, Review of the Construction Industry 2004 and Outlook 2005–2007", Estimate for 2005.
- 2 Productivity for some industries can be calculated in a number of ways, for example using a measure of physical outputs and inputs as in this report, or using value added in the industry divided by an appropriate deflator. Both methods should come up with the same answer, given the availability of all necessary data.
- 3 Productivity for some industries can be calculated in a number of ways, for example using a measure of physical outputs and inputs as in this report, or using value added in the industry divided by an appropriate deflator. Both methods should come up with a similar answer, given the availability of all necessary data.

- 4 BWA Associates (2006). The study is not based on data from a single year, but rather is based on a composite of data and surveys from 2000 to 2005.
- 5 BWA Associates (2006).
- 6 McKinsey Global Institute (1997).
- 7 Department of the Environment and Local Government (2001: 9-13).
- 8 This based on estimated labour input requirements for the observed quality improvements, in other words that a house in 2003 would require four per cent more labour than a corresponding house in 1993, assuming an identical level of productivity.
- 9 It should be noted that this is an alternative way of examining the benefits as discussed in the paragraph above, and is not additional to them.

References

BWA Associates (2006), *Benchmarking of Construction Efficiency in the EU Member States – Scoping Study*. Report commissioned by the Enterprise and Industry Directorate-General of the European Commission.

Department of the Environment and Local Government (2001), *Irish Spatial Perspectives: Rural and Urban Roles*, Dublin.

DKM Economic Consultants (2004), “Review of the Construction Industry 2004 and Outlook 2005–2007.”

FÁS (2006), *Study of Project Management Skills in the Irish Construction Industry*. Report Commissioned for the FÁS Construction Industry Group.

McKinsey Global Institute (1997), *Boosting Dutch Economic Performance*.