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Economic Analysis of Building and Construction Industry Productivity: 2010 Report

This report was prepared for Master Builders Australia.

26 July 2010

ADVISORY

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Executive Summary

Introduction

Each year since 2007, KPMG Econtech has prepared an annual report analysing the contribution of industry reforms and other factors in driving construction industry productivity (collectively referred to as "the Previous Reports"). The 2007 report found that 'industry reforms', consisting of: the Australian Building and Construction Commissioner (ABCC); its predecessor, the Building Industry Taskforce; and industrial relations reforms in the years to 2006, had a positive impact on construction industry productivity. Following the identification of this positive impact, KPMG Econtech estimated the flow-on benefits to the wider economy from the gain in construction industry productivity resulting from these industry reforms.

The updated reports in 2008 and 2009 took into consideration the latest information on construction industry productivity from various sources. The results from each report are similar; the various data sources showed that following industry reforms, the construction industry has outperformed past productivity trends.

This 2010 report updates the economic analysis and economic modelling conducted in the Previous Reports for developments over the last year.

Methodology

KPMG Econtech has once again reviewed the latest data on construction industry productivity from a variety of sources to provide an up-to-date analysis of trends in construction industry productivity and the factors driving these trends.

The main focus of the analysis is examining the contribution of industry reform to the recent outperformance of construction industry productivity. To do this, the study uses the latest information to perform the same three types of productivity comparisons as reported in the Previous Reports. Broadly, the comparisons are designed to compare the timing of the period of outperformance with the timing and nature of changes in industrial relations policies and the timing and nature of the operations of the ABCC and the Taskforce. The three types of productivity comparisons and the reason for conducting the comparisons are outlined in detail below.

- **Year-to-year** comparisons of construction industry productivity are made using a variety of sources to determine whether there has been a link between the timing of industry reform and productivity outperformance in the construction industry.

- Rawlinsons data on costs is used to assess whether industry reforms have succeeded in improving productivity in **non-housing** construction vis-à-vis **housing** construction. Industry reforms have been focused on the more regulated, non-housing side of the industry, where costs for the same construction tasks are higher than on the housing side of the industry. We assess whether industry reforms have reduced this cost penalty for the non-housing side of the industry by improving its productivity.

- Comparisons are made of **individual projects** undertaken before and after industry reforms to see whether industry reform has affected productivity at the individual-project level.

The results of these three productivity comparisons were assessed to identify the outperformance in construction industry productivity that can be attributed to industry reforms. Following the identification of this positive productivity impact, it was introduced to an economy-wide model to estimate the flow-on benefits to the wider economy.

In this report the economy-wide modelling is undertaken using KPMG Econtech's MM900 model, the successor to the MM600+ model used in the Previous Reports. The economy-wide modelling provides estimates of the permanent long-term gains in activity in the construction industry and other industries from having a more productive construction industry. It also estimates the permanent long-term flow-on benefits to consumers in the form of lower prices.

At the time of the Previous Reports, MM600+ was the leading model for this type of analysis. However, the use of the new MM900 model means that the modelling in this report has a greater degree of the sophistication than the Previous Report, leading to even more robust and conservative estimates of the economy-wide impact of industry reforms.

MM900 has the following enhancements that are important for this report:

- MM900 uses the latest information available, including the latest detailed Input-Output tables from the ABS. This means that the analysis presented in this report is based on the most up to date picture of the structure of the Australian economy.

- MM900 identifies construction trade services as a separate sector of the construction industry. This increases the number of identified construction industry sectors from two sectors in MM600+ to the following three sectors in MM900: residential building construction; non-residential building construction; and construction trade services.

- The modelling of production processes in each of the models 109 industries is more sophisticated in MM900. Different types of labour and capital are distinguished, and the roles of land and natural resources in production processes are taken into account. MM900 takes into account that residential land is scarce and plays an important role in the supply of housing services.

- MM600+ was well ahead of other models in presenting an rigorous measure of the gains to consumers from industry reforms. MM900 widens this gap by explicitly allowing for the fact that individuals derive welfare not only from current consumption, but also from future consumption and leisure. Consumer welfare is the key measure for assessing the merits of economic policies, such as the industry reforms considered in this report.

The Impact of Reform on Construction Industry Productivity

The analysis of the latest information continues to support the findings of the Previous Reports; that there has been a greater gain in construction industry productivity than would otherwise have been the case, due to industry reforms. Specifically, the productivity comparisons outlined above support the conclusions in the Previous Reports with respect to the source of the productivity outperformance – that the ABCC has played an essential role, but its effectiveness has depended on industrial relations reforms.

This conclusion is based on the three types of productivity comparisons - year-to-year, residential versus non-residential and individual projects.

Year-to-Year Comparisons

- ABS data shows that, since the start of industry reforms in 2002, construction industry labour productivity has outperformed predictions based on its historical performance relative to other industries by **7.7 per cent**.

- The Productivity Commission[1] has found that multifactor productivity in the construction industry was no higher in 2000/01 than 20 years earlier, but then accelerated to rise by **14.8 per cent** in the six years to 2007/08.

Non-residential versus residential

- As noted above, traditionally the same construction tasks have been more costly when undertaken on the non-residential side of the construction industry compared to the residential side. However, using Rawlinsons data to January 2010, this cost penalty for non-residential construction has shrunk in concert with the industry reforms that have targeted improved productivity in non-residential construction. The shrinkage in the cost penalty implies a relative productivity gain for non-residential construction conservatively estimated at **9.1 per cent between** 2004 and 2010 on a simple analysis, or considerably higher once other factors are taken into account.

Individual Project Case Studies

- Case studies undertaken as part of the Previous Reports found that the ABCC and industrial relations reforms have improved productivity in the building and construction industry.

- Other studies considered in the Previous Reports support the findings of KPMG Econtech's analysis. These studies submit that industry reform has lifted construction productivity by approximately **10 per cent**.

All of this evidence continues to support the findings of the Previous Reports, that there has been significant outperformance in construction industry productivity. What remains is to identify whether or not the productivity gain can be split by source. The data sources above indicate that the significant productivity gains in construction industry productivity developed from 2002/03 onwards. This supports the interpretation that it was the activities of the Taskforce, established in October 2002, and the ABCC, when it was established in October 2005, that made a major difference.

Thus, the productivity and cost difference data suggest that effective monitoring and enforcement of the general industrial relations reforms and those that related specifically to the

[1] Productivity Commission, *Productivity Estimates and Trends*, February 2009.

building and construction sector were necessary before the reforms could lead to labour productivity improvements. As such, the most appropriate finding is that separate attribution of labour productivity improvements to the ABCC and industrial relations reforms in the years to 2006 is not possible. This is because, to be effective, all of the industry reforms need to be in place, in other words, both the ABCC and relevant industrial relations reforms need to operate together.

All the latest data continue to point to the industry reforms leading to a significant productivity outperformance in the construction industry. As reported above, the estimated gain ranges between 7.7 and 14.8 per cent, depending on the measure and the source of information that is used. While not all of these measures are strictly comparable, the most recent data indicates that, on balance, the modelling assumption made in the Previous Reports remain reasonable. That is, the ABCC and related industrial relations reforms have added in the vicinity of 9.4 per cent to labour productivity in the construction industry. Hence, consistent with the Previous Reports, this report bases its modelling of economy-wide impacts on a gain in construction industry labour productivity of 9.4 per cent.

Economic Impact of Improving Productivity in the Building and Construction Industry

KPMG Econtech has used its highly detailed MM900 model of the Australian economy to model the long-term economy-wide impact of industry reforms. MM900 is the successor to the MM600+ model, the model used in the Previous Reports. MM900 was developed by KPMG Econtech for an engagement for the Australian Treasury and is used to analyse the economic impacts of the tax system.

The economy-wide impact of construction industry reform was estimated from the differences between the following two scenarios:

- a “Baseline Scenario” where industry reforms were not implemented; and
- a “Reform Scenario” which reflects a situation where industry reforms were implemented.

The key aggregate long-term economic effects under the Reform Scenario, when compared with the Baseline Scenario, are shown in Table 1.

Table 1: Summary of Economy-Wide Effects of the Impact of Industry Reform

	Reform
Annual Economic Welfare Gain (2009/10 terms)	$ 5.9 billion
Consumer Price Index	-0.7%
Household consumption	0.7%
GDP	0.6%

Source: KPMG Econtech MM900 simulation
Note: The above results refer to permanent effects on the levels, not growth rates, of indicators relative to what they otherwise would be. For example, the Reform Scenario shows a gain of 0.6% in the level of GDP relative to what it would otherwise be, and not its annual growth rate.

The modelling results suggest that, in the long run, the improvements in labour productivity outlined in the Reform Scenario lower construction costs, relative to what they would otherwise be. This in turn reduces business costs across the economy, as most industries are significant users of commercial building or engineering construction. Lower business costs mean lower consumer prices. As shown in Table 1, the Consumer Price Index is an estimated 0.7 per cent lower than what it would otherwise be under the Baseline Scenario. Furthermore, as also shown in Table 1, due to industry reforms, consumers are better off by $5.9 billion on an annual basis, in 2009/10 terms.

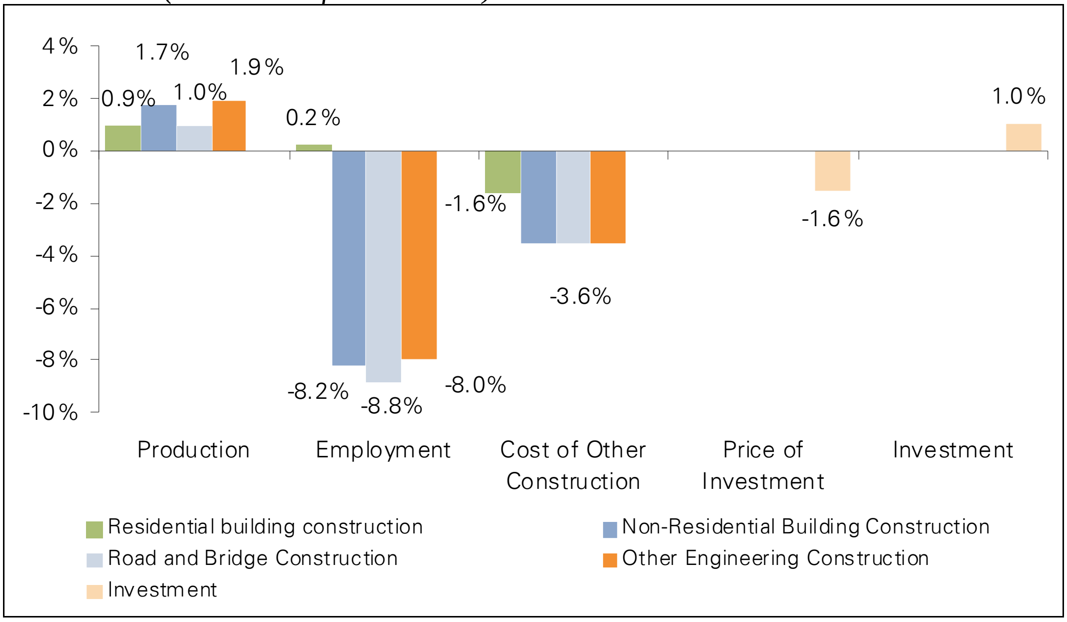
This is similar to the consumer gain estimated in the Previous Reports of $5.5 billion in 2007/08 terms (or 6.2 billion in 2009/10 terms after allowing for inflation and economic growth). The similar estimate of consumer gain across reports is unsurprising since the source and magnitude of the productivity gain is consistent across reports. Specifically, the gain to consumers stems from the labour cost saving in the construction industry of 9.4 per cent.

Importantly, consumer welfare is the key measure by which to assess the benefits of a policy as this represents the gain to households from the policy. In other words, consumer welfare is the measure by which we can assess whether or not a particular policy is in the public interest and thus the public policy argument for industry reform remains unchanged.

The Reform Scenario confirms that higher productivity in the construction industry lowers its costs, leading to lower prices for new construction. This stimulates demand for new construction, leading to a significant permanent gain in construction activity of 1.2 per cent. This comprises a gain of 0.9 per cent for residential construction, 1.6 per cent for non-residential construction (road & bridge, non-residential building and other engineering construction) and 1.1 per cent for construction trade services. The sectoral results in this report are not directly comparable to the results presented in the Previous Reports. This is because in this report construction trade services is separately identified; in the Previous Reports the sector was incorporated into the residential construction and non-residential construction sectors instead.

Higher productivity boosts activity in the main categories of non-residential construction relative to the situation in the absence of the reforms. The long-term gains range from 1.0 per cent for roads and bridges to 1.7 per cent for non-residential building and 1.9 per cent for other engineering. The gain in non-residential and residential construction underpins a long-term lift in total investment of 1 per cent. Diagram A summarises these effects.

Diagram A: Effect of Increased Efficiency on Residential and Other (Non-Residential) Construction (% deviation from baseline)



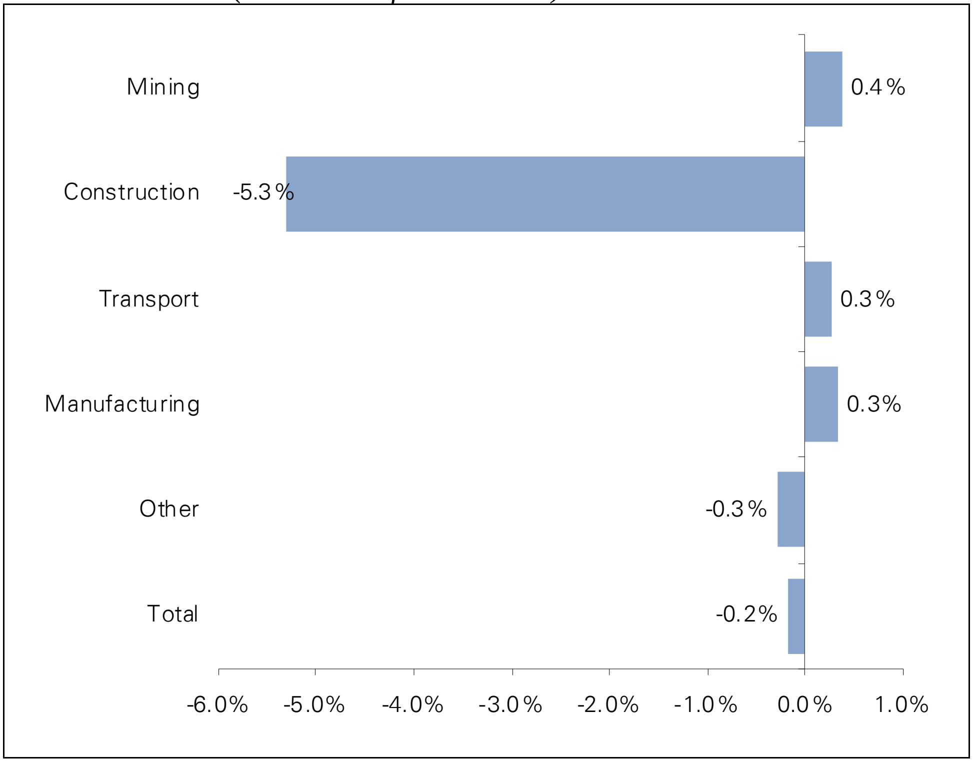
Source: KPMG Econtech MM900 simulation

At the same time, the reforms cause some shifting of jobs away from construction and towards other industries compared to the situation in the absence of the reforms. Higher labour productivity reduces labour demand in construction and this effect is only partly offset by an increase in labour demand from higher construction activity. Overall, as shown in Diagram B (on the following page), employment in construction is estimated to be 5.3 per cent lower than in the Baseline. However, this loss in employment in construction is largely offset by gains in employment in other industries. Further, this loss is relative to a Baseline Scenario without reform and does not mean that there is a fall in construction employment from one year to the next. Indeed, construction employment grew strongly during the industry reform process. This reallocation of employment means a more efficient allocation of labour between industries, underpinning the permanent gains to consumers from industry reform.

The modelling allows for the fact that individuals value both leisure and consumption. The gain to productivity in the construction industry lowers prices across the economy and thus results in an increase in the real wage. The model takes into account that consumers can take the benefit of higher real wages in two ways. Consumers can choose between using the extra income to consume more or take more leisure time (while maintaining the same level of consumption as before). Thus, in the modelling, the benefit takes the form of a mixture of consumption and leisure, not just one. A consequence of higher leisure is a lower level of full-time employment.

Importantly, as noted earlier, there is an overall consumer welfare gain from both gains in consumption and a greater number of leisure hours.

Diagram B: Effect of Increased Efficiency in the Construction Industry on Employment in Selected Industries (% deviation from baseline)



Source: KPMG Econtech MM900 simulation

The economy-wide modelling results in this report are muted compared to the Previous Reports. This is mainly due to two factors outlined below.

- The responsiveness of costs in non-residential construction to labour productivity changes is subdued compared to Previous Reports. This is because the labour cost share in the construction industry in 2004/05[2] is unusually low. This means that for a given lift in labour productivity, there is a smaller cost reduction compared to the case a few years earlier. Thus, the economy-wide results presented in this report are conservative. Since 2004/05, labour costs have risen in importance in the construction industry.

- The model used in this report allows for the role of inputs to production that are in fixed supply, including land and natural resources. This is a more realistic representation of the economy's production process. The implication of this added layer of sophistication is that supply is not as responsive to changes in price.

[2] MM900 uses the 2004/05 input-output tables as a data source. Importantly, 2004/05 is the latest year for which detailed input-output table data is available from the ABS.

1 Introduction

1.1 Background

Each year since 2007, KPMG Econtech has prepared an annual report analysing the contribution of industry reforms and other factors in driving construction industry productivity (collectively referred to as "the Previous Reports"). The 2007 report found that 'industry reforms', consisting of: the Australian Building and Construction Commissioner (ABCC); its predecessor, the Building Industry Taskforce; and industrial relations reforms in the years to 2006, had a positive impact on construction industry productivity. Following the identification of this positive impact, KPMG Econtech estimated the flow-on benefits to the wider economy from the gain in construction industry productivity resulting from these industry reforms.

The ABCC commissioned the initial report and its subsequent update in 2008. In 2009, the report was once again updated at the request of Master Builders Australia (MBA). Each updated report took into consideration the latest information on construction industry productivity from various sources. Each report analysed the updated data sources and came to the same general conclusion; that after allowing for other factors which affect construction industry productivity, the data suggests that industry reforms have led to productivity outperformance within the industry.

For the Previous Reports, the components of construction industry outperformance attributed to industry reform were then introduced into KPMG Econtech's MM600+ economy-wide model to estimate the impacts of the outperformance on the Australian economy as a whole. The modelling results suggest that the improvements in labour productivity have lowered construction costs, relative to what they would otherwise have been. This has in turn reduced business costs across the economy, as all industries are significant users of commercial building or engineering construction. Lower business costs mean lower consumer prices. Furthermore, the Previous Reports found that, due to industry reforms, consumers are better off by about $5.5 billion in 2007/08 terms on an annual basis.

1.2 Project Scope and Objectives

One year on, it is timely to update the economic analysis in the 2009 Report for the latest available data. Thus, this 2010 Report, also commissioned by Master Builders Australia (MBA) updates the economic analysis in the Previous Reports to incorporate all the new data. In addition, this report updates the economy-wide modelling initially undertaken in 2007 by using our newly developed Computable General Equilibirum (CGE) model, MM900. MM900 is the successor to the MM600+ model, the model used in the earlier reports, and was developed by KPMG Econtech in an engagement for the Australian Treasury and is used to analyse the economic impacts of the tax system.

The updated information included in this report includes the following.

- In February 2010, Rawlinsons released its Australian Construction Handbook 2010, containing January 2010 data on comparative costs for the same tasks on the residential and non-residential sides of the construction industry.

- In June 2010, the Australian Bureau of Statistics (ABS) released national accounts and employment data showing that, despite the national economic slowdown, productivity in the construction industry remains above trend.

- In June 2010, the ABS also released data showing that, in 2009, the construction industry continued to outperform the *all other industries* average in terms of significant reductions in working days lost from industrial disputes.

1.3 Structure of this Report

The remainder of this report is structured as follows.

- Section 2 analyses productivity in the construction industry by undertaking a range of productivity comparisons. It compares construction industry productivity between different years and between the non-residential and residential sides of the industry. It then assesses the extent to which productivity changes can be split across different sources.

- Section 3 describes the MM900 model, its main assumptions, and the scenarios that are modelled.

- Section 4 presents and explains the impact on the Australian economy of productivity outperformance in the building and construction industry that is attributable to industry reforms.

- Attachment A provides detailed information on MM900, the economy-wide model used in this report.

2 Productivity Comparisons in the Construction Industry

This section provides an analysis of productivity trends in the construction industry. Similar to the earlier reports we perform several types of productivity comparisons.

- **Year-to-year** comparisons of construction industry productivity are made using KPMG Econtech analysis of the latest data from the Australian Bureau of Statistics (ABS) and a Productivity Commission productivity report. Our interest is in whether there was a link between the timing of industry reform and outperformance of construction industry productivity.

- Comparisons of productivity for the **non-residential versus residential** sides of the industry are made using Rawlinsons data on construction costs. The Taskforce and the ABCC have largely operated on the more regulated, non-residential side of the construction industry. Our focus is on whether this has resulted in any improvement in productivity compared with the residential side of the industry.

- Comparisons are made between **individual projects** undertaken before and after industry reforms.

This section first provides an explanation of differences in productivity measures. Following this explanation, each of the different types of productivity comparisons (listed above) is then discussed in turn. That is, subsection 2.1 examines year-to-year comparisons and subsection 2.2 compares residential and non-residential construction productivity. Subsection 2.3 outlines other studies in the area of construction industry productivity, while subsection 2.4 outlines other general indicators of the influence of industry reform on the construction industry.

In subsection 2.5, an assessment of the impact of industry reform on productivity in the building and construction industry is presented. Specifically, the findings from the productivity comparisons are used to assess the extent to which construction productivity outperformance is attributable to the ABCC and its precursor, the Taskforce.

Differences in Productivity Measures

As noted in our earlier reports, there are a number of alternative approaches to measuring an industry's productivity. The most common measures are labour productivity, capital productivity, multifactor productivity and total factor productivity.

For ease of exposition, the discussion on productivity measures contained in our earlier reports is included below.

- *Labour Productivity.* Labour productivity is the ratio of real output produced to the quantity of labour employed. Labour productivity is typically measured as output per person employed or per hour worked. Changes in labour productivity can be attributed to labour where they reflect improvements in education levels, labour efficiency or technology that makes labour more productive. Changes in labour productivity can also reflect changes in capital and intermediate inputs, in technical and organisational efficiency, as well as the influence of economies of scale and varying degrees of capacity utilisation.

- *Capital Productivity.* Capital productivity is measured as output per unit of capital. This ratio shows the time profile of how productively capital is used to generate output. Capital productivity reflects the joint influence of capital, labour, intermediate inputs, technical change, efficiency change, economies of scale and capacity utilisation.

- *Multifactor Productivity (MFP).* MFP is defined as the ratio of output to combined inputs of labour and capital. In principle, MFP is a more comprehensive productivity measure because it identifies the contribution of both capital and labour to output. In practice, labour input can be measured more accurately than capital input. Reflecting these competing considerations, both labour productivity and MFP continue to be used as measures of productivity.

- *Total Factor Productivity (TFP).* TFP is the ratio of output to the combined inputs of labour, capital and intermediate inputs (such as fuel, electricity and other material purchases). While this measure is the most comprehensive, often it cannot be calculated because there is insufficient data.

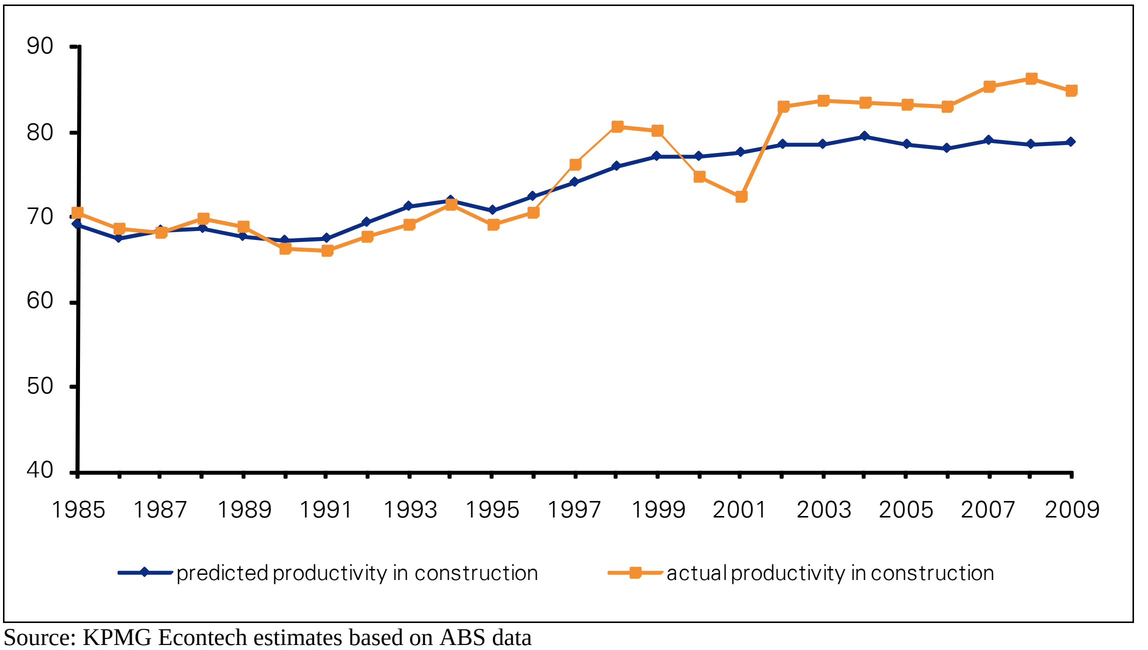
2.1 Year to year Comparisons

This section reviews trends in productivity in the construction industry over a number of years. It begins by analysing the aggregate construction industry labour productivity data from the ABS. The section then reviews an analysis of productivity trends in the construction industry undertaken by the Productivity Commission.

2.1.1 KPMG Econtech Analysis of Latest ABS Data

KPMG Econtech has analysed the latest ABS data on construction industry output and employment to make year-to-year comparisons of construction industry productivity. Diagram 2.1 shows actual productivity in the construction industry compared to predictions based on historical performance.

Diagram 2.1: Construction Industry Labour Productivity compared with a Prediction based on a Historical Benchmark



Source: KPMG Econtech estimates based on ABS data

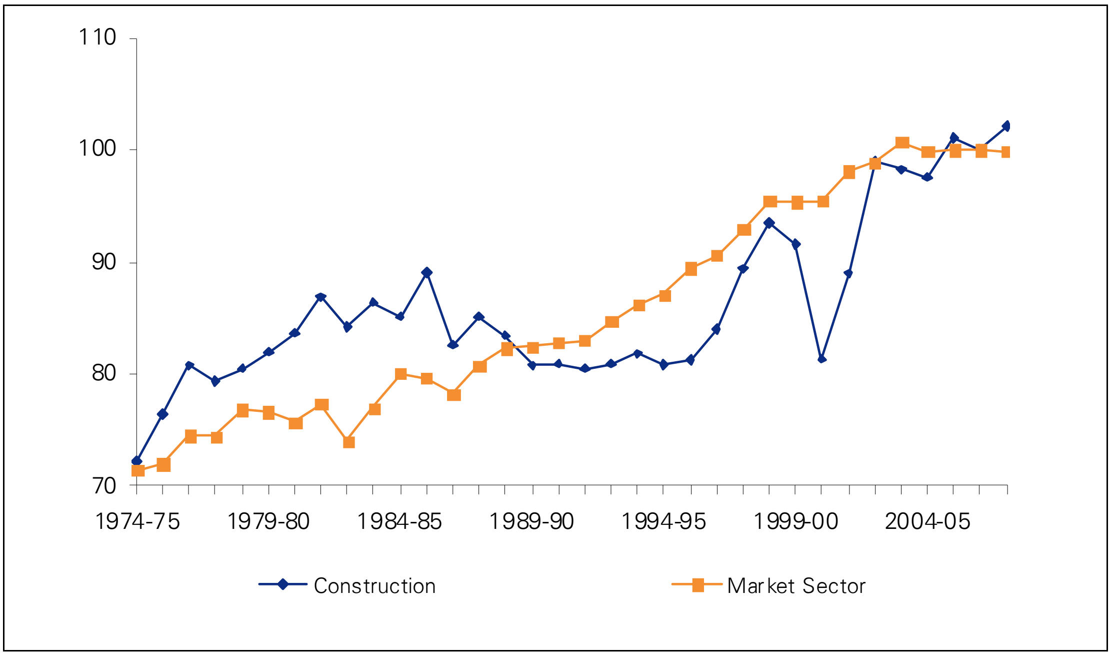
The historical productivity performance of the construction industry is assessed using data for the period from 1985 to 2002. This period was chosen as it is prior to the establishment of the Taskforce/ABCC. For this period, regression analysis was used to establish the trend in productivity in the construction industry, relative to the trend in productivity for the economy as a whole. A comparison between actual productivity and this estimated trend productivity may assist in identifying whether industry reforms have lifted productivity in the construction industry.

As can be seen in Diagram 2.1, since 2002 actual construction industry labour productivity has consistently outperformed predictions based on past trends. The latest reading, for 2009, shows that actual construction industry productivity was 7.7 per cent higher than predictions based on its relative historical performance.

2.1.2 Productivity Commission Report

This section examines changes in multi-factor productivity (MFP) in the construction industry using aggregate data from the Productivity Commission (PC). The PC calculates indices of productivity in 12 industry sectors. These PC estimates are based on data provided by the ABS. Diagram 2.2 compares this MFP in the construction industry with MFP in the market sector as a whole from 1974-75 to 2007-08.

Diagram 2.2: Construction Sector Multifactor Productivity, 1974-75 to 2007-08 (2006-07 = 100)



Source: Productivity Commission 2009, *"Productivity Estimates and Trends"* and ABS *"Australian System of National Accounts 2005-06"*.

While productivity in the market sector has followed a fairly steady upward trend, productivity in the construction industry was fairly flat through the 1980s and 1990s. The PC[3] found that multifactor productivity in the construction industry was no higher in 2000/01 than 20 years earlier. In fact, Diagram 2.2 above shows that there have been periods where construction industry productivity is below the level seen in 1980/81.

However, construction industry productivity then strengthened considerably to achieve a higher level for the six years from 2002/03 to 2007/08. The PC noted that the most recent data shows that multifactor productivity has continued to grow strongly in the construction industry[4]. The PC data shows construction industry productivity rose by 14.8 per cent in the six years to 2007/08. This is a faster pace of growth compared to the six years from 1996/97 to 2001/02; in the six years to 2001/02 construction industry productivity increased by 9.5 per cent. This confirms the strong construction industry productivity performance of recent years already seen using labour productivity in Diagram 2.1.

[3] Productivity Commission, *Productivity Estimates to 2005-06*, December 2006.
[4] Productivity Commission, *Recent Movements (in productivity)*, http://www.pc.gov.au/research/productivity/estimates-trends/recent-movements, (accessed 22 June 2010).

2.2 Commercial versus Domestic Residential Comparison

The ABCC and supporting industrial relations reforms are expected to have their main impact on the non-house building side of the construction industry, rather than on the house building side. This is because the ABCC's jurisdiction does not cover housing construction of four dwellings or less (as well as the extraction of minerals, oil and gas).

The ABCC's mandate is on the non-house building side of this industry because this is where, traditionally, there were more industrial disputes and higher costs for specific tasks. The house building side, on the other hand, is considered to be more flexible – reflecting the involvement of many small, independent operators and the extensive use of piece rates for work performed.

So another way of testing the impact of the ABCC is by examining whether it has led to any improvement in productivity on the non-house building side of the industry compared with the house building side. This can be assessed at a detailed level by comparing the relative performance of the two sides of the industry in undertaking the same tasks.

Changes in the relative performance of the two sides of the industry can be assessed using quantity surveyors data. This data is used to investigate how the ABCC has affected the cost comparison between the two sides of the industry for the same building tasks in the same locations. This report updates the analysis of the Previous Reports by including the latest (January 2010) data available from Rawlinsons.

The cost comparison involves the following analysis. The Rawlinsons data is used to investigate movements in recent years in the cost comparison between commercial building and domestic residential building for the same building tasks in the same locations.

In making this comparison, the first point to clarify is the definitions of the two sides of the industry that are used in the Rawlinsons data. Commercial building includes larger-multi-unit dwellings, offices, retail, industrial and other buildings besides domestic residential buildings. It excludes engineering construction (roads, bridges, rail, telecommunications and other infrastructure). Domestic residential building includes all dwellings except larger multi-unit dwellings.

The building tasks used in this cost comparison of commercial building with domestic residential building are as follows:

- concrete to suspended slab;
- formwork to suspended slab;
- 10mm plasterboard wall;
- painting (sealer and two coats);
- hollow core door; and
- carpentry wall.

Table 2 shows the cost penalties for commercial building compared with domestic residential building for completing the same tasks in the same states for each year.

Table 2: Cost Differences between Commercial Building and Domestic Residential Building for the Same Tasks in the Same State, 2004 – 2010 (per cent)

	2004	2005	2006	2007	2008	2009	2010	Change since 2004
SA	9.2	7.3	6.6	6.6	6.1	6.1	5.2	-3.9
Qld	23.9	20.8	21.7	22.4	22.7	24.8	21.7	-2.1
Vic.	22.7	24.0	21.8	15.1	15.7	15.7	15.2	-7.4
WA	15.5	11.3	10.4	10.5	12.0	11.6	10.2	-5.3
NSW	16.2	14.7	12.6	12.4	12.3	12.5	11.3	-4.9
Aust. Average	19.0	17.3	16.2	14.8	15.3	15.7	14.2	-4.8

Source: Rawlinsons Australian Construction Handbook, 2004 – 2010[5]
Notes: (1) Aust. Average is weighted according to turnover on a state-by-state basis.
(2) Dates indicate beginning of each calendar year, for example 2004 refers to January 2004.

As outlined in the introduction, this report follows the same methodology as was employed in the Previous Reports. The only change in updating this analysis is to incorporate the recently released 2010 Rawlinsons data.

Similar to the Previous Reports, this report uses the Rawlinsons data to compare cost gaps in 2010 with cost gaps in 2004[6]. This comparison may yield insights into the economic effects of the activities of the Taskforce (established in October 2002) and its successor the ABCC (established in October 2005). Further, the base year is chosen to remove the effects of an apparent break in some of the data series.

Table 2 confirms that, similar to the findings of the reports since 2008, the average costs of completing the same tasks in the same states have been generally higher in the commercial building sector than in the domestic residential building sector. However, our interest is in whether this cost penalty for commercial building has shrunk since the introduction of industry reforms.

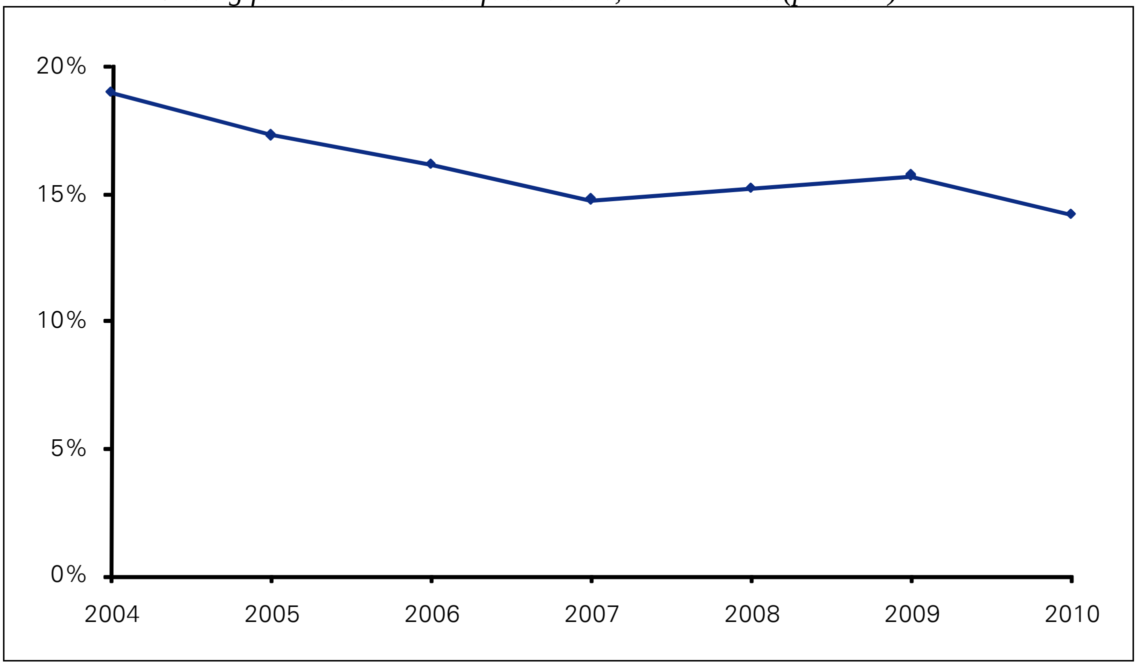
The final column of Table 2 shows that the cost penalty for commercial building compared with domestic residential building has fallen in all mainland states, suggesting that the industry reforms have been effective. The biggest fall is in Victoria, where it is down from about 23 per cent to about 15 per cent. Victoria is the state where restrictive work practices in commercial building were generally acknowledged to be most pervasive[7]. Similarly, in Queensland, where restrictive work practices in commercial building were generally acknowledged to be less pervasive, the cost gap has remained relatively constant.

Table 2 also presents cost penalties for Australia as a whole, calculated as weighted averages of the cost penalties for individual states. These Australian cost penalties are also displayed in Diagram 2.3.

[5] Rawlinsons is a construction cost consultancy in Australia and New Zealand. The Rawlinsons Australian Construction Handbook is the leading authority on construction costs in Australia.
[6] Survey data refers to January of each year.
[7] Wilcox, "Transition to Fair Work Australia for the Building and Construction Industry", April 2009.

Table 2 and Diagram 2.3 show that, since the introduction of the Taskforce[8], across Australia the cost penalty for commercial building compared with domestic residential building has fallen. The cost penalty was around 19 per cent in 2004, but has declined over the past five years to be 14.3 per cent in 2010, or a fall of 4.8 percentage points.

Diagram 2.3: Average Cost Differences between Commercial Building and Domestic Residential Building for the Same Tasks for 5 States, 2004 – 2010 (per cent)



Source: KPMG Econtech estimates.

Many possible explanations for the fall in the cost penalty are ruled out by the close nature of the comparison used in estimating the penalty. In particular, the cost penalty is calculated for performing the same building tasks in the same locations. The only major aspect that is varied in the calculation is whether a task is undertaken as part of a commercial building project or as part of a domestic residential building project. Both types of projects pay similar costs for materials.

This leaves a fall in the labour cost penalty (for commercial building) as the most plausible explanation for the fall in the total cost penalty. On this interpretation, Table 3 uses the fall in the total cost penalty for commercial building to estimate the fall in the labour cost penalty. It does this conversion using the average share of labour in total costs for the six building tasks. Information on labour cost shares are also sourced from Rawlinsons, and come to approximately 53 per cent. The result is an estimated fall from 2004 to 2010 in the labour cost penalty for commercial building of 9.1 percentage points, as shown in the table below.

[8] The Taskforce was established in October 2002 but it is reasonable to expect a lag before its activities started to make an impact. The data also relate to January of each year so that for 2004, the data relates to January 2004.

Table 3: Average Labour Cost Differences between Commercial Building and Domestic Residential Building, 2004-2010 (per cent or percentage points)

	2004	2005	2006	2007	2008	2009	2010	Change since 2004
Total Cost Gap	19.0	17.3	16.2	14.8	15.3	15.7	14.2	4.8
Labour Cost Gap	35.9	32.7	30.6	27.9	28.8	29.7	26.8	9.1

Source: KPMG Econtech estimates

Notes: (1) The Labour cost gap uses an estimate from the most recent Rawlinsons handbook showing labour costs for the six tasks account for 53 per cent of total costs for those tasks.
(2) Excludes Site & Other Allowances.

It is important to note that 9.1 per cent is a conservative estimate of the labour cost penalty as the cost measure published in Rawlinsons excludes the return to capital. Specifically, the cost measure excludes the components of cost related to off-site overheads and profit. As such, the true labour cost share, once allowing for a return to capital, is lower than 53 per cent. This means that the labour cost penalty for commercial building construction is greater than 9.1 per cent based on the latest data available.

In principle, this fall in the labour cost penalty for commercial building compared with domestic residential building could be due either to movements in relative productivity or wages between the two sectors. These two possible explanations are considered in turn.

Relative wages in commercial building compared with domestic residential building could have moved for two reasons. First, site allowances associated with non-residential construction have been restricted by the ABCC. However, site allowances are not included in the data for the costs of building tasks and so do not explain the fall in the cost penalty. Second, enterprise bargaining may have affected relative wages. However, enterprise bargaining easily predates our cost comparison, which begins in 2004.

This leaves post-2004 improvements in labour productivity in commercial building compared with domestic residential building as the most likely explanation for the fall in the commercial building labour cost penalty. This coincides with the activities of the Taskforce/ABCC in improving work practices and enforcing general industrial relations reforms in commercial building.

Thus, the conclusion is that there has been a recent improvement in labour productivity in commercial building compared with domestic residential building of 9.1 per cent. However, as Mitchell points out in his comment on the 2007 Report[9], using the Rawlinsons domestic construction data "blurs the distinction [between commercial building and domestic construction categories] by including small-scale construction within domestic construction". To the extent that the classification blurs the desired distinction in categories, the cost gap and its movements will be understated.

That is, the Rawlinsons definition of domestic construction includes small-scale commercial construction. However, this type of construction also falls within the ABCC's mandate. Thus, the inclusion of small-scale commercial construction in the Rawlinson domestic construction category means that this category would also show some gains in labour productivity (cost

[9] Mitchell, "An examination of the cost differentials methodology used in 'Economic Analysis of Building and Construction Industry Productivity' – the Econtech Report", August 2007.

savings) as a result of commercial construction industry reforms. This means that without this blurring of categories the cost gap would have fallen by a greater magnitude. That is, the 9.1 per cent is a conservative estimate of the recent gain in productivity for commercial building relative to domestic residential building from the industry reforms.

Domestic residential building is less useful as a cost benchmark for engineering construction, which largely involves other, unrelated tasks. However, a previous study has estimated that there is a similar cost advantage for engineering construction projects by comparing the construction of EastLink to CityLink. Specifically, a previous study showed a significant "advantage to EastLink by operating under the post-WorkChoices/ABCC environments" of 11.8 per cent (see sub-section 2.3.2 for more details)[10]. Thus, in absence of any other information, it is reasonable to assume that the engineering cost improvement is likely to be at least equal to KPMG Econtech's estimate of the improvement in commercial building costs (of 9.1 per cent).

Hence, based on the evidence above, the relative labour productivity gain for the non-residential construction sector as a whole is conservatively estimated at 9.1 per cent, based on a simple analysis. As noted earlier, this is a conservative estimate for two reasons. Firstly, Rawlinsons excludes a return to capital from the overall cost measure when calculating the labour cost share. Secondly, Rawlinsons' classification of domestic construction blurs the distinction between residential and non-residential construction. The productivity gain estimate from an analysis which incorporates these two factors is likely to be considerably higher.

2.3 Other supporting studies

Other studies also support the notion that there has been a labour productivity gain in commercial construction. The results from these studies are summarised in the table below. A more detailed discussion of these studies can be found in our 2009 Report.

[10] Phillips, Ken (2006), "Industrial Relations and the Struggle to Build in Victoria", *Institute of Public Affairs Briefing Paper*, November 2006

Table 4: Summary of other supporting studies

Study	Findings	Estimated Gain in Productivity
KPMG Econtech case studies	Projects undertaken post-ABCC activity have fewer project days lost per year than projects under taken pre-ABCC activity.	$2.71 million in cost saving from reduction in days lost to industrial dispute
The Allen Consulting Group	The report examined multifactor productivity in the non-residential construction industry and found that there had been a gain in productivity in the five years to 2007.	12.2 per cent gain in multifactor productivity
Ken Phillips	Comparison of two major construction projects in Victoria, the EastLink project and the CityLink project. The study found that there would have been additional costs for EastLink had it been constructed under industrial agreements outside of the ABCC and Workchoices environment.	$295 million in direct cost saving and toll revenue or 11.8 per cent of the total construction cost
BHP Billiton	Provided industry-wide observations and on-the-ground examples of changes that have occurred in their business. The business noted that there has been an improvement in industrial relations since the establishment of the ABCC.	N/A
Grocon	Provided industry-wide observations and on-the-ground examples of changes that have occurred in their business. The business noted that there was a fall in the number of days lost to industrial disputes following the introduction of the ABCC.	N/A
John Holland Group	The constructiom industry has enjoyed an "unprecendented increase in productivity" since the completion of the Cole Royal Commission.	10% productivity dividend

2.4 Other general indicators

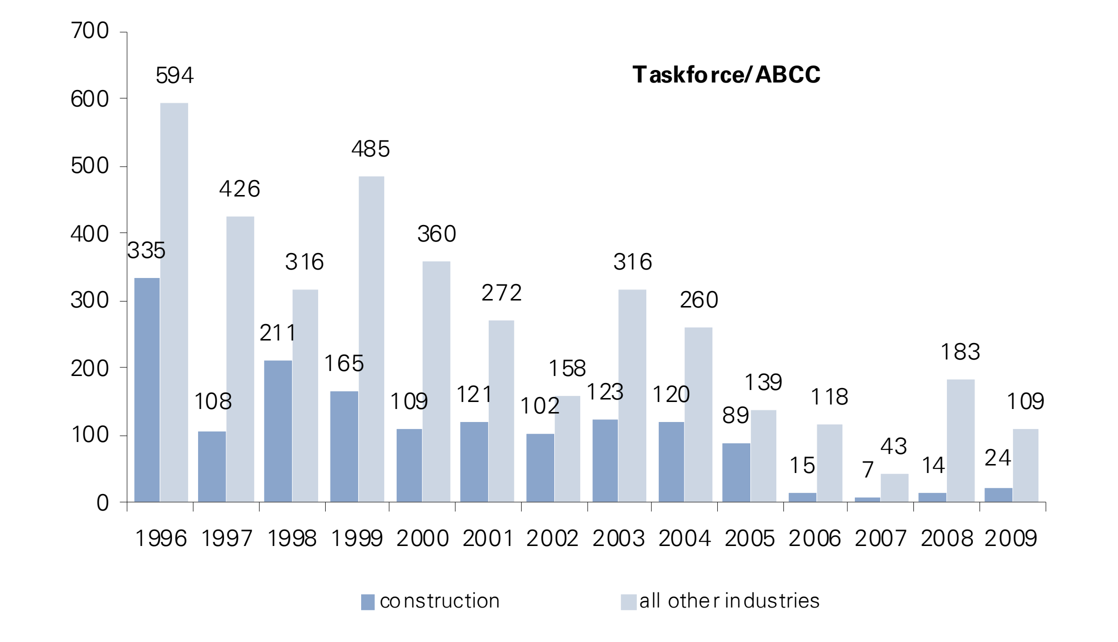
An indication of the influence of industry reform across the construction industry as a whole is the considerable decrease in the number of days lost due to industrial action. Diagram 2.4 shows ABS data on the number of working days lost in the construction industry due to industrial disputes. The average number of working days lost each year for the period 1996 to 2002 was 164,000. In contrast, the diagram shows that since 2003 the number of days lost in the industry has been decreasing. 2003 was the full first year of operation of the Taskforce, which started operations in October 2002. The ABCC started its operations in October 2005. After four years of operation of the ABCC, the annual number of working days lost in the Construction industry due to industrial disputes has fallen dramatically to only 24,000 in 2009 (or 14 per cent of the 1996-02 average).

The diagram also shows work days lost in all other industries due to industrial disputes. While it is true that work days lost has been decreasing across all industries, construction has outperformed other industries in reducing its working days lost. While construction working days lost are at only 14 per cent of earlier levels (as noted above), for all other industries the corresponding figure is 29 per cent.

In other words, all other industries, on average, lost 71 per cent as many working days in 2009 as they did each year, on average, between 1996 and 2002. In contrast, the construction industry's working days lost in 2009 were 86 per cent lower than their 1996-2002 average.

For 2010, data is only available for the March quarter. In that quarter, there were 12,300 days lost in the construction industry, including from a large-scale industrial action at an LNG development in Western Australia. While this is higher than for recent quarters, data for only one quarter does not provide sufficient information from which to draw conclusions regarding the overall outcome for the 2010 year.

Diagram 2.4: Working Days Lost in Construction due to Industrial Disputes ('000)



Source: Industrial Disputes, Australia, ABS (Cat. 6321.0.55.001).

2.5 Summary – The Impact of Construction Industry Reform on Productivity

The previous sub-sections update the analysis of the Previous Reports for the latest data. Importantly, the data covers a broad spectrum of productivity indicators. In each of the years that we have conducted this analysis, all the data continues to show that there has been significant outperformance in construction industry labour productivity in recent years.

- ABS data shows that, since the start of industry reforms in 2002, construction industry labour productivity has outperformed predictions based on its historical performance relative to other industries by **7.7 per cent**.

- The Productivity Commission[11] has found that multifactor productivity in the construction industry was no higher in 2000/01 than 20 years earlier, but then accelerated to rise by **14.8 per cent** in the six years to 2007/08.

- Using Rawlinsons data to January 2010, the cost penalty for non-residential construction has shrunk in concert with the industry reforms that have targeted improved productivity in non-residential construction. The shrinkage in the cost penalty implies a relative productivity gain for non-residential construction conservatively estimated at **9.1 per cent between** 2004 and 2010 on a simple analysis, or considerably higher once other factors are taken into account.

- Other studies considered in the earlier reports support the findings of KPMG Econtech's analysis. These studies submit that industry reform has lifted construction productivity by approximately **10 per cent**.

All of this evidence continues to support the findings of the Previous Reports, that there has been significant outperformance in construction industry productivity. What remains is to identify whether or not the productivity outperformance can be separated into individual sources.

The key industry reforms that have occurred in the building and construction industry are the following:

- the Taskforce was established in October 2002 but it lacked enforcement powers;
- the ABCC was established in October 2005; and
- amendments to the Workplace Relations Act were implemented on the 27 March 2006.

The effectiveness of the ABCC relies mainly on the *Building and Construction Industry Act 2005*. The majority of the cases brought by the ABCC rely on this Act. While the ABCC has also used the *Fair Work Act 2009* (FW Act) that came into full effect from 1 January 2010 as a

[11] Productivity Commission, *Productivity Estimates and Trends*, February 2009.

platform of prosecution, it has commenced only three cases involving alleged breaches of the FW Act[12].

In addition to the key industry reforms identified above, significant industrial relations reforms to encourage enterprise bargaining were introduced in 1993. Further changes were introduced in 1996 to reinforce the incentive for enterprise bargaining as well as reduce the scope for industrial action. These industrial relations reforms provided a more productivity-friendly environment.

However, these other reforms did not appear to have any effect in terms of improving construction industry productivity until after the Taskforce was put in place in October 2002. The data sources above indicate that the significant productivity gains in construction industry productivity appear around 2002/03. This supports the interpretation that it was the activities of the Taskforce and, more importantly, the ABCC (given its enforcement powers) when it was established in October 2005 that made a major difference.

Thus, the productivity and cost difference data suggest that effective monitoring and enforcement of the general industrial relations reforms and those that related specifically to the building and construction sector were necessary before the reforms could lead to labour productivity improvements. As such, the most appropriate finding is that separate attribution of labour productivity improvements to the ABCC and industrial relations reforms in the years to 2006 is not possible. This is because, to be effective, all of the industry reforms need to be in place, in other words, both the ABCC and relevant industrial relations reforms need to operate together.

In summary, following this latest review of the data, the updated evidence continues to point to industry reforms leading to a significant productivity outperformance in the construction industry As reported above, the estimated gain ranges between 7.7 and 14.8 per cent, depending on the measure and the source of information that is used. While not all of these measures are strictly comparable, the most recent data continues to indicate that, on balance, the modelling assumption made in the earlier reports remains reasonable. That is, industry reforms have added in the vicinity of 9.4 per cent to labour productivity in the construction industry. Hence, consistent with the earlier reports, this report bases its modelling of economy-wide impacts on an outperformance in construction industry labour productivity of 9.4 per cent.

[12] Office of the Australian Building and Construction Commissioner, *Industry Update*, 14 July 2010

3 Modelling the Impacts of Industry Reform

This section provides details of the modelling approach used to estimate the economy-wide impacts of industry reform. The section is structured as follows. Section 3.1 summarises Econtech's previous studies in this area. Section 3.2 outlines the scenarios that were simulated using MM900 to quantify the economic contribution of industry reform. Section 3.3 outlines the main data inputs that KPMG Econtech used to build the alternative scenario and describes how these inputs were derived. Section 3.4 discusses the main features of the economic model (MM900) that was used to estimate the economic contribution of industry reform.

3.1 Previous Studies

Econtech's analysis of Construction industry productivity began with its 2003 study commissioned, and accepted, by the (then) Department of Employment and Workplace Relations. The '2003 Report' reached two key conclusions about productivity in the Construction industry.

- Costs were significantly higher for the construction of commercial buildings than for domestic residential buildings. The same standard building tasks – such as laying a concrete slab, building a brick wall, painting and carpentry work – cost more for commercial buildings than for domestic residential housing.

- Even if labour productivity in the construction of commercial buildings increased up to the levels applying in the construction of domestic residential building, productivity in Australia's construction industry would still lag well behind international best practice.

The 2003 Report went on to model the economy-wide benefits of reducing the cost gap through reform to work practices in the commercial building sector.

While the 2003 Report estimated the *potential productivity gains* from workplace reform in the construction industry, by 2007/08 the reform process was well established. Hence in 2007 the ABCC commissioned Econtech to estimate the *actual productivity gains* that can be attributed to the activities of the ABCC and its predecessor the Taskforce.

The initial 2007 report on actual productivity gains in the construction industry was updated in 2008 and 2009. Similar to the 2007 findings, these subsequent reports showed that there had been a gain in construction industry productivity, due to the activities of the Taskforce and the ABCC in conjunction with related industrial relations reforms, than would otherwise have been the case. Each report then modelled the economy-wide benefits of this gain in construction industry productivity from workplace reform.

The 2008 and 2009 reports considered the impact of workplace reform on construction industry productivity from three different angles. It compared construction industry productivity between different years, between the non-residential and residential sides of the industry, and between individual projects undertaken before and after the establishment of the ABCC.

These reports are the only studies available which analyse the impacts of industry reform on construction industry productivity and the economy generally. Hence it is important that the analysis is fully up-to-date. This report updates the economic analysis in the Previous Reports to incorporate all the new data. In addition, this report also updates the economy-wide modelling initially undertaken in 2007 using our newly developed Computable General Equilibrium (CGE) model, MM900. MM900 is the successor to the MM600+ model, the model used in the Previous Reports, and was developed by KPMG Econtech in an engagement for the Australian Treasury is used to analyse the economic impacts of the tax system.

This section presents the methodology used to model the economic impacts of industry reform within the building and construction industry.

3.2 Scenarios

To simulate the economic impacts of industry reforms, the following two scenarios were modelled:

- a "Baseline Scenario" where industry reforms were not implemented; and
- a "Reform Scenario" which reflects a situation where industry reforms were implemented.

Differences in economic outcomes between the Reform Scenario and the Baseline Scenario were calculated to determine the economic contribution of industry reform.

The main inputs for each of the scenarios are discussed in detail below.

3.3 Model Inputs

As explained in Section 2, the latest data continues to point to a significant productivity outperformance in the construction industry, due to industry reform. In particular, this industry reform includes the establishment of the ABCC and its predecessor, the Building Industry Taskforce, as well as relevant industrial relations reforms to 2006. An analysis of the latest information confirms that our initial modelling assumption remains reasonable. Hence, consistent with the Previous Reports, this report also presents the economy-wide impacts of a gain in construction industry labour productivity of 9.4 per cent. Based on the available information, it is assumed that the productivity gain is concentrated in the sectors of the construction industry where the ABCC has jurisdiction, namely non-residential construction and multi-unit residential building.

In line with the ABS' industrial classification, MM900 identifies three sub sectors of the construction industry: non-residential construction, residential construction and construction trade services. In MM600+ construction trade services was incorporated into both the non-residential construction and residential construction sectors. This is because construction trade services are used as an input into the production of both non-residential construction and residential construction.

The estimated gains in labour productivity for the various sectors of the building and construction industry are shown in Table 5. Based on the available information, it is assumed that the productivity gain is concentrated in the sectors of the construction industry where the

ABCC has jurisdiction, namely non-residential construction and multi-unit residential building. Combining a gain of 14.1 per cent in these sectors, with a zero gain in domestic residential building, achieves consistency with the assumption of an overall industry productivity gain of 9.4 per cent. For residential building overall, this implies a productivity gain of 4.2 per cent, which is concentrated in multi-unit residential. These sector-specific productivity gains are not inconsistent with the data presented in section 2.

Table 5: Simulated Gains in Labour Productivity (per cent)[13]

	Reform Scenario (2 sector basis)	Reform Scenario (3 sector basis)
Total non-residential construction	14.1	17.5
Total residential building	4.2	0.6
Trade Services		9.4
Total construction	**9.4**	**9.4**

Source: KPMG Econtech estimates based on total estimated productivity improvements and current labour cost relativities between the construction sectors.

For modelling purposes, the gains were reconstructed so that they could be applied in a consistent manner after allowing for construction trade services as an additional subsector in the construction industry. The simulated gains across the three sectors – that are consistent with the two-sector gains outlined above and the overall productivity gain in the construction industry of 9.4 per cent – are also shown in Table 5. Specifically, the following productivity gains were simulated: 17.5 per cent in non-residential construction; 0.6 per cent in residential construction and 9.4 per cent in construction trade services. This particular pattern of gains is necessary because construction trade services are an important input into the production of both residential and non-residential construction.

3.4 MM900 Model

The economy-wide contributions of industry reform were estimated using the MM900 model. It is a long-term CGE model of the Australian economy that models a long-run equilibrium (approximately 5 to 10 years). The MM600+ model was developed into the MM900 model for a study to assist the Department of the Treasury in their review of Australia's Future Tax System.

The updates incorporated into the model include the following.

- *The latest detailed Input-Output table from the ABS* – means that MM900 provides an updated picture of the structure of the Australian economy and allows for the fact that the structure of the economy has changed slightly from when MM600+ was first developed.

[13] For modelling purposes the following gains were simulated: 17.5 per cent in non-residential construction; 0.6 per cent in residential construction and 9.4 per cent in construction trade services. After allowing for construction trade services as an additional subsector in the construction industry, the simulated gains are consisted with the gains shown in the table and the overall productivity gain in the construction industry of 9.4 per cent. This is because construction trade services are an important input into the production of both residential and non-residential construction.

- *Expanded product detail* – with MM900 distinguishing 109 industries, producing 889 products. This makes MM900 eight times more detailed than any comparable model. In particular, the model now contains three construction industries producing ten products compared to MM600 which contains two construction industries producing eight products. The ten construction products in the model are:
    - residential building construction;
    - repair and maintenance of residential buildings;
    - non-residential building construction;
    - repair and maintenance of non-residential buildings;
    - road and bridge construction;
    - repair and maintenance of roads and bridges;
    - engineering construction other than roads and bridges;
    - repair and maintenance of engineering construction other than roads and bridges;
    - trade services repair and maintenance; and
    - other construction and trade services.
- *Highly detailed production process* – with each of the 109 industries using up to six different primary factors (or types of labour, capital and fixed factors), compared with two primary factors in MM600+. Notably, physical capital is split into two types, structures and other capital (which includes items such as motor vehicles, machinery and computers). Each industry's mix of primary factors is separately chosen depending on relative prices and the industry's production technology. In addition, the model explicitly allows for the use of land and natural resources in the production of goods and services. Importantly for this project, the model accounts for the use of residential land in the provision of housing services and the use of mining resources in the mining industry.
- *Leisure is explicitly incorporated* – In MM900, households face a choice in dividing the time in which they could be working, between work and discretionary leisure.
- *Households derive welfare from savings* – In MM900, future consumption or saving is incorporated in the analysis of household behaviour. For example, foregoing leisure for the income from additional work allows additional consumption and saving.

Many of the key features of MM600+ that made it well suited to analyse the economy-wide impact of a lift in construction industry productivity have been maintained in the MM900 model. Specifically, the model continues to incorporate the following features.

- It estimates the effects of productivity changes on key macroeconomic aggregates such as GDP, exports, imports, consumption and investment.

- It breaks down the effects of productivity changes into even more detailed industries and products. This means that the model is able to estimate the impacts of productivity gains in the building and construction industry and other industries and products at a very detailed level.

- For each industry and product, it produces comprehensive results including for production, employment, consumption, trade flows and prices.

- It provides valid measures of changes in consumer welfare or living standards based on compensating and equivalent variations so that policy changes can be correctly evaluated in terms of the public interest. Notably, the consumer welfare measure now allows for the fact that leisure adds to an individual's wellbeing.

The alternative scenarios modelled in this report are based on the standard long-run closure of the MM900 model. Thus, the long-run closure shows the long-term effects of policy changes, after the economy has fully responded. This is fitting because economic policies should be judged against their lasting effects on the economy, not just their effects in the first one or two years. Some of the assumptions underlying the MM900 long-term closure are as follows.

- Profit maximisation: the representative business in each industry chooses inputs and outputs to maximise profit subject to prices and a production function.

- Utility maximisation: A representative household maximises utility, which depends on leisure, saving and consumption of products, subject to a budget constraint.

- Labour market equilibrium: in the long run the labour market is assumed to attain equilibrium. The amount of time they devote to work depends on the after-tax real wage that is available from working, and their real 'full income', which is the potential income they could receive if they take no discretionary leisure.

- External trade balance: in the long run, external balance is assumed to be achieved, so that trade shocks have no lasting effect on the trade balance.

- Budget balance: in the long run fiscal policy must be sustainable, and in MM900 this is achieved by assuming budget balance.

- Private saving: in the long run the level of private sector saving and associated asset accumulation must be sustainable.

More detailed information about MM900 is presented in Attachment A.

4 Economic Impact of Industry Reform

The previous section described the scenarios that were simulated using MM900, outlined the main data inputs that KPMG Econtech used to build the scenarios and described how these inputs were derived. This section provides the results of modelling the economic impacts of industry reform at three different levels, as follows.

- Section 4.1 describes the detailed economic impacts on the building and construction industry.
- Section 4.2 describes the wider industry impacts of reform in the building and construction industry.
- Section 4.3 presents the economy-wide impacts of reform in the building and construction industry.

Importantly, the results presented in this section refer to permanent effects on the levels, not growth rates, of indicators relative to what they otherwise would be. This means, for example, that a gain of 0.6 per cent in the level of GDP is interpreted as the increase in GDP relative to what it would otherwise be the case, and not the annual growth rate.

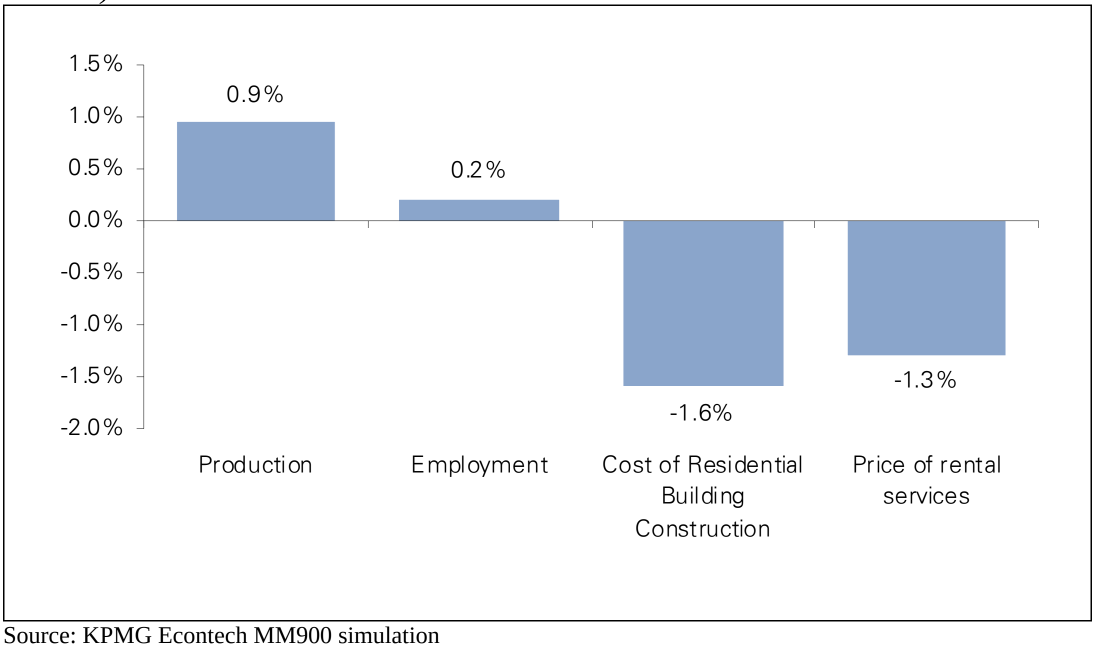
4.1 Building and Construction Industry Effects

This section presents the economic impacts on the building and construction industry of labour productivity outperformance in the industry stemming from the activities of the ABCC and relevant industrial relations reforms to 2006, collectively referred to as ‘industry reforms’.

In considering the effects on the construction industry itself of higher construction productivity, it is important to distinguish between residential construction, non-residential construction and construction trade services. It is also important to note that the impacts outlined below are not directly comparable to the results presented in the Previous Reports. In this report construction trade services is separately identified, while in the Previous Reports the sector was incorporated into the residential construction and non-residential construction sectors.

Diagram 4.1 shows the estimated long-term effects on residential construction. These effects are driven mainly by the assumed direct gain in labour productivity in residential construction of 0.6 per cent which is solely attributable to increased labour productivity in the multi-unit component of the residential construction sector. As discussed in section 3.3, the residential construction sector also benefits from having a more productive construction trade services sector as trade services are an important input into the production of housing services.

Diagram 4.1: Effect of Increased Efficiency on Residential Construction (% deviation from baseline)



Source: KPMG Econtech MM900 simulation

The boost in labour efficiency in the residential construction sector reduces the costs of production in this sector relative to what they would otherwise be. While direct labour efficiency rises by 0.6 per cent, there is also a lift in the efficiency of another input, construction trade services. This leads to an overall cost reduction of 1.6 per cent, as shown in Diagram 4.1. The price of rental services falls by a similar percentage.

Lower prices lead to an increase in the demand for residential building construction. This, in turn, boosts construction activity in this industry. Indeed, Diagram 4.1 shows a long-term increase in construction activity of 0.9 per cent in this sector relative to what it would otherwise be. This is a muted production response compared to our Previous Reports. The subdued response is driven by MM900's more realistic representation of the production process for housing. Specifically, MM900 accounts for the use of land in the provision of housing services. Since land is a fixed resource, it limits the responsiveness of the supply of housing services to falls in the price of housing.

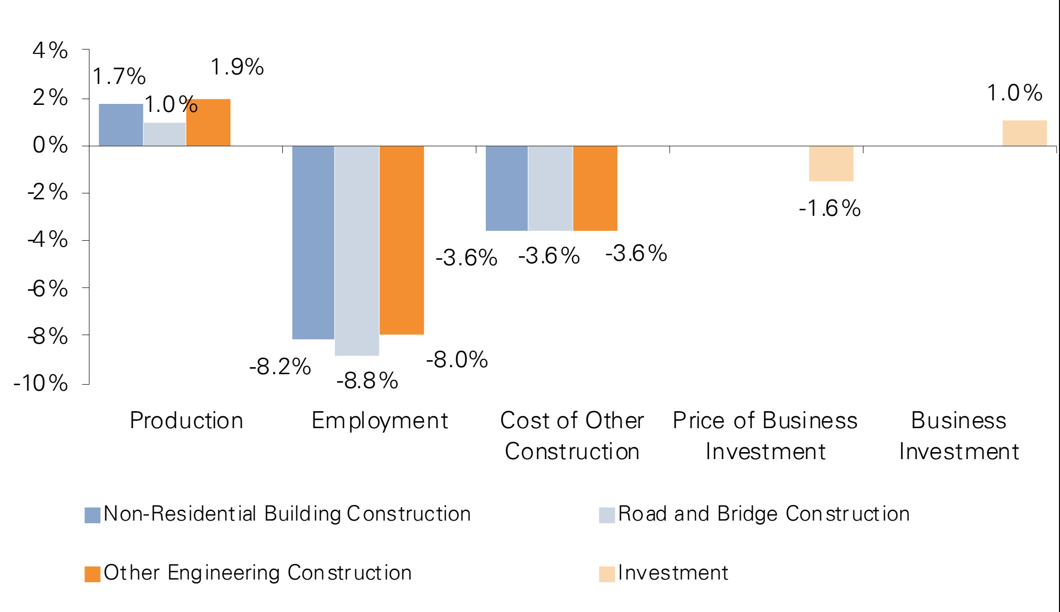
Employment in residential construction is affected by three separate factors.

- The assumed gain in labour efficiency of 0.6 per cent reduces employment by a similar percentage, for an unchanged level of activity ("labour saving effect").
- The rise in activity of 1.3 per cent adds a similar percentage to employment ("output effect").
- The gain in labour efficiency makes labour cheaper, inducing some substitution of labour for capital and land ("substitution effect").

The negative effect on employment from the labour saving effect is overshadowed by the positive effects of the output and substitution effects, leaving a net gain of 0.2 per cent in residential building employment in the long-term.

The effects on the non-residential side of the construction industry are shown in Diagram 4.2. As discussed previously in Table 3.1, these effects are based mainly on an assumed increase in direct labour efficiency of 17.5 per cent for non-residential construction in the long-term, relative to the situation in the absence of the reforms. However, similar to the residential sector, the non-residential construction sector also benefits from having a more productive construction trade services sector, as trade services are an important input into the production of buildings and other structures.

Diagram 4.2: Effect of Increased Efficiency on Other (Non-Residential) Construction (% deviation from baseline)

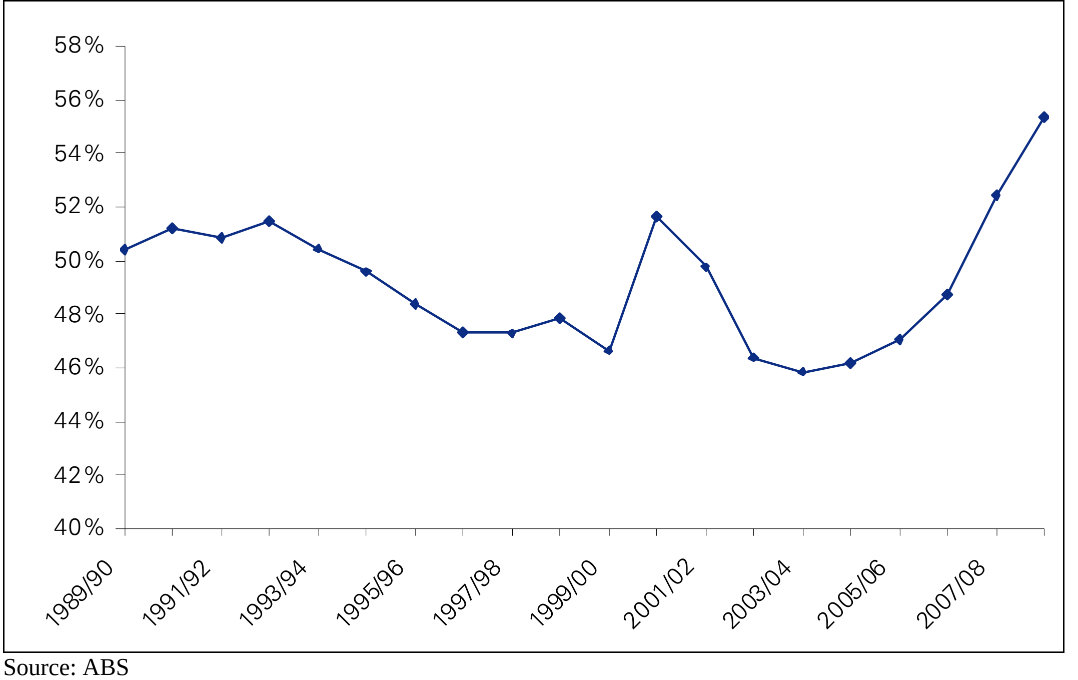


Source: KPMG Econtech MM900 simulation

The larger assumed gain in labour efficiency means that the cost reduction for non-residential construction is larger than for residential building construction, 3.6 per cent compared to 1.6 per cent.

The responsiveness of costs in non-residential construction to labour productivity changes is subdued compared to our Previous Reports. This muted response reflects the updated cost structure of the construction industry that is incorporated into MM900. That is, the underlying data for MM900 is based on the 2004/05 input-output table, which is the latest detailed input-output table released by the ABS. In particular, 2004/05 is an unusual year with labour costs a relatively smaller component of total costs for the construction industry in that year. This means that, for a given lift in labour productivity, there will be a smaller cost reduction compared to the case a few years earlier. Thus, the economy-wide results presented in this report are conservative. Since 2004/05, labour costs have risen in importance in the construction industry (as shown in Diagram 4.3 below which charts the labour share of construction value added).

Diagram 4.3: Compensation of Employees in the Construction industry as a share of Construction value added (per cent)



Source: ABS

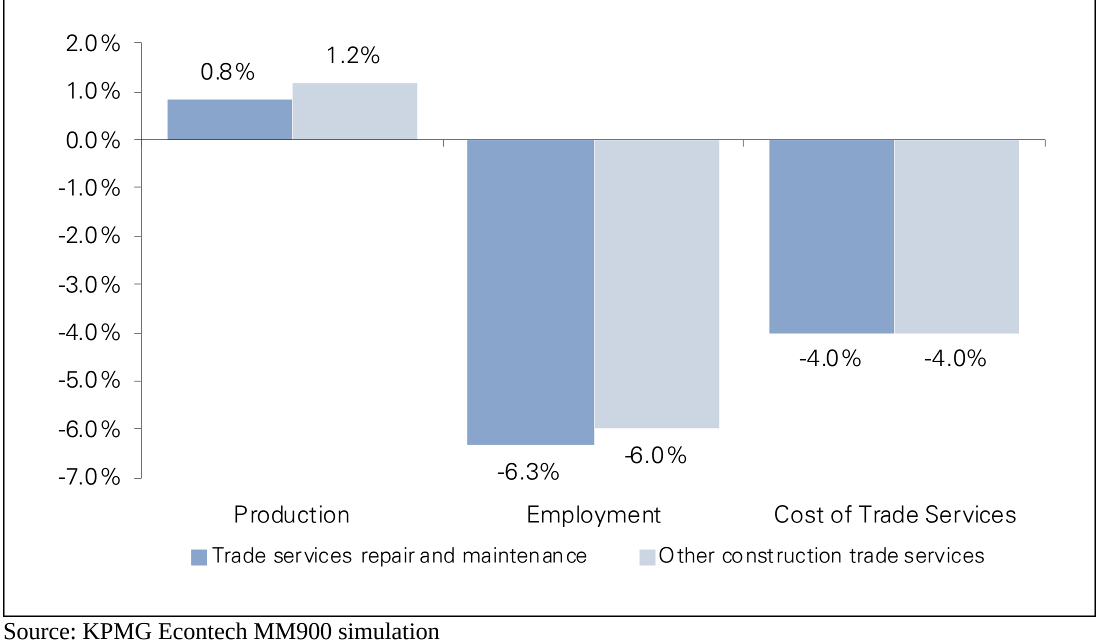
Lower non-residential construction costs flow through to lower the overall cost of business investment by 1.6 per cent (as seen in Diagram 4.2). This is because construction represents a major part of business investment. Cheaper business investment stimulates a lift in the overall level of business investment of 1.0 per cent, which includes a rise in construction. Cheaper construction provides a further boost to construction activity, by shifting the composition of business investment in favour of construction. The resulting long-term gains in construction activity range from 1.0 per cent for roads and bridges to 1.7 per cent for non-residential building and 1.9 per cent for other engineering, as shown in Diagram 4.2.

Similar to residential construction, higher labour efficiency in non-residential construction affects employment in the same three separate ways (labour saving, output and substitution effects). However, for residential construction, positive output and substitution effects offset only part of the negative labour saving effect. This leaves net employment losses in non-residential construction of around 8 per cent. Importantly, while there are offsetting employment effects in other sectors of the economy, there would be short-term adjustment costs from job shifting from construction to other industries.

As outlined in section 3, in comparison to earlier MM600+ modelling, MM900 specifies an additional sector to the construction industry – construction trade services. Construction trade services include businesses engaged in site preparation services, building structure services, installation trade services, building completion services and other construction services. The majority of output from this industry is purchased by the residential and non-residential construction sectors as an intermediate input into production. As such, in line with the analysis outlined in section 2, the non-residential side of this sector is assumed to have enjoyed higher labour efficiency than would otherwise have be the case as a result of industry reforms.

Specifically, we have assumed a 9.4 per cent increase in the labour efficiency of this sector, which is in line with the overall productivity gain assumed for the broader construction industry. This gain in efficiency translates to lower trade service costs of around 4 per cent, as shown in Diagram 4.4 below.

Diagram 4.4: Effect of Increased Efficiency on Construction Trade Services (% deviation from baseline)



Source: KPMG Econtech MM900 simulation

Activity in construction trade services is stimulated by two factors. Firstly, cheaper prices boost construction trade activity. Secondly, because there has been a lift in activity in residential construction and non-residential construction, there is a gain in demand for construction trade services. Both of these effects lift activity in construction trade services by 0.8 per cent for trade services repair and maintenance and 1.2 per cent for other construction trade services.

Similar to the case for residential and non-residential construction, the increase in labour efficiency in construction trade services affect employment in three separate ways (labour saving, output and substitution effects). In this case, only part of the negative labour saving effect is offset by positive output and substitution effects. Overall, employment in construction trade services falls by around 6 per cent. While this loss in employment is largely offset by gains in employment in other sectors of the economy, there would be short-term adjustment costs as workers shift from construction to other industries.

To summarise, overall, the results presented in this section show that the increase in productivity stemming from industry reform has provided significant permanent gains to the construction industry. These gains range from:

- 0.8 per cent for trade services repair and maintenance;
- 1.2 per cent for other trade services;

- 0.9 per cent for residential building;
- 1.0 per cent for road and bridge construction;
- 1.7 per cent for non-residential building; and
- 1.9 per cent for other engineering construction.

At the same time, these permanent long-term gains in construction activity will have been accompanied by short-term adjustment costs, due to job shifting from construction to other industries.

Note that the losses in construction industry employment are relative to a Baseline Scenario without reform. This does not mean that there has been a fall in construction employment during the reform process. Indeed, construction employment is now much higher than it was at the start of the reform process, despite the setback from the Global Financial Crisis.

4.2 Wider Industry Effects

The change in activity in the building and construction industry is expected to affect activity in other industries. This section outlines the simulated production impacts on other industries of industry reform in the building and construction industry. These effects are presented in Diagram 4.5 on the following page.

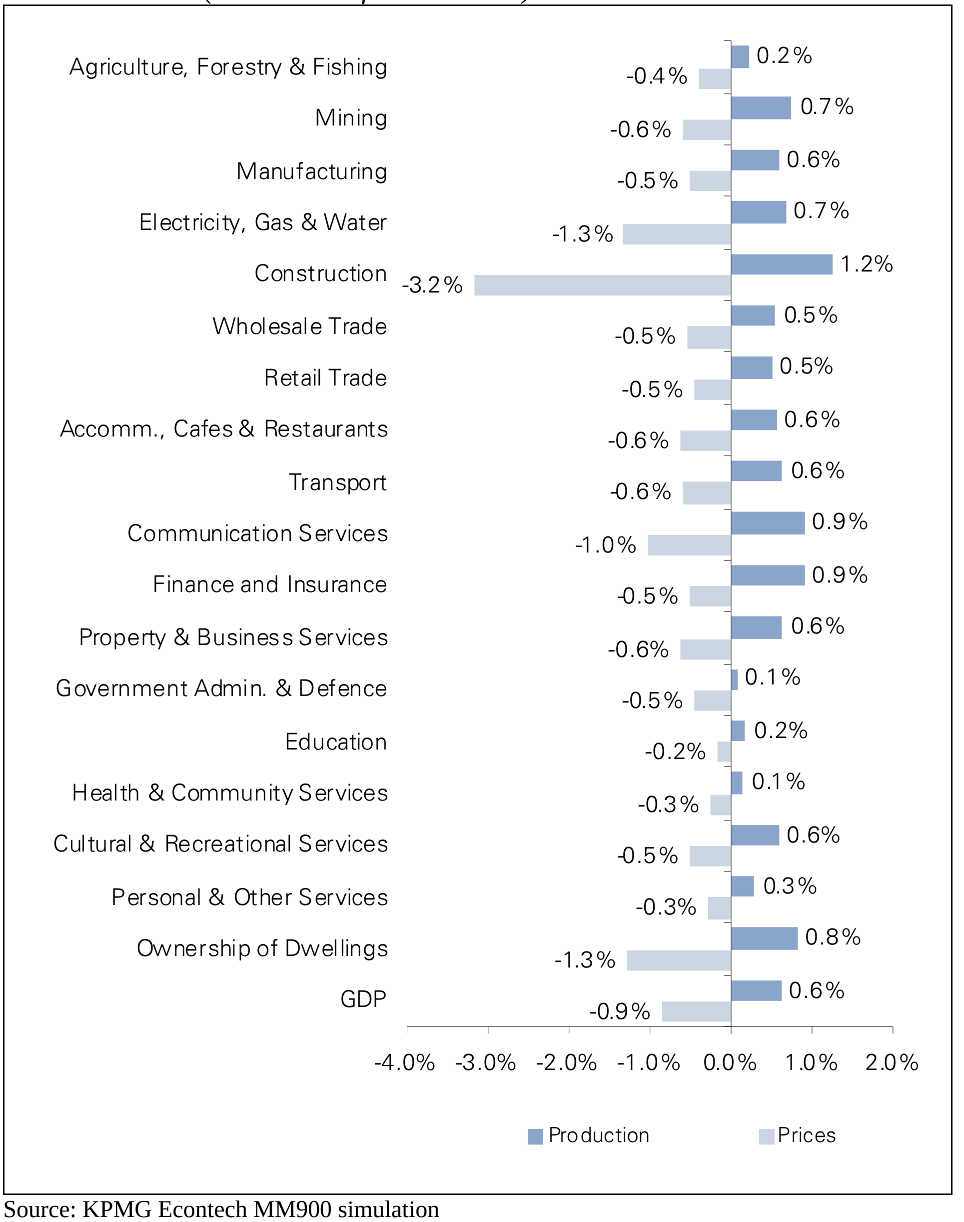
As discussed in Section 4.1, higher labour productivity reduces the price of housing services by around 1.3 per cent (also shown in Diagram 4.5). This stimulates a long-term rise in demand for housing services ("ownership of dwellings") of 0.8 per cent, relative to what it otherwise would be, as also shown in Diagram 4.5.

The detailed effects within the construction industry itself were discussed in Section 4.1. These effects add up to an average fall in construction costs of 3.2 per cent and a rise in construction activity of 1.2 per cent, as shown in Diagram 4.5. These are average effects only. As explained before, the production gains are lower for residential building and road and bridge construction, and higher for non-residential building and other engineering.

As discussed in the previous section, the price falls for construction (flowing from productivity outperformance) reduce the overall cost of new business investment by 1.6 per cent. This is of particular benefit to relatively capital-intensive sectors. Diagram 4.5 shows that electricity, gas and water and communications receive cost savings that reduce prices by 1.3 and 1.0 per cent respectively. Because of the price-sensitive nature of demand for communication services, the price reduction in this industry leads to large production gains. In contrast, the relatively price insensitive nature of demand for utilities means that the production gain is not as large.

In most industries, the impact of a more productive construction industry are broadly similar to those outlined in the Previous Reports, after allowing for the smaller fall in the cost of construction. In this report, there is an added layer of sophistication in modelling production in the mining and agriculture industries. This enhancement to the modelling means that compared to the Previous Reports, the impact in the mining and agriculture industries are more subdued. Similar to the case for housing services, the production response in mining and agriculture is muted due to the role of land and natural resources in production. For mining, mining resources are an important input while for agriculture, rural land is an important input. Allowing for the role of land and natural resources provides a more realistic picture of how these two industries operate. Taking account of these factors in modelling production implies that the supply of mining and agricultural goods is not as responsive to changes in price.

Diagram 4.5: Effect of Increased Efficiency in the Construction Industry on Production in Other Industries (% deviation from baseline)

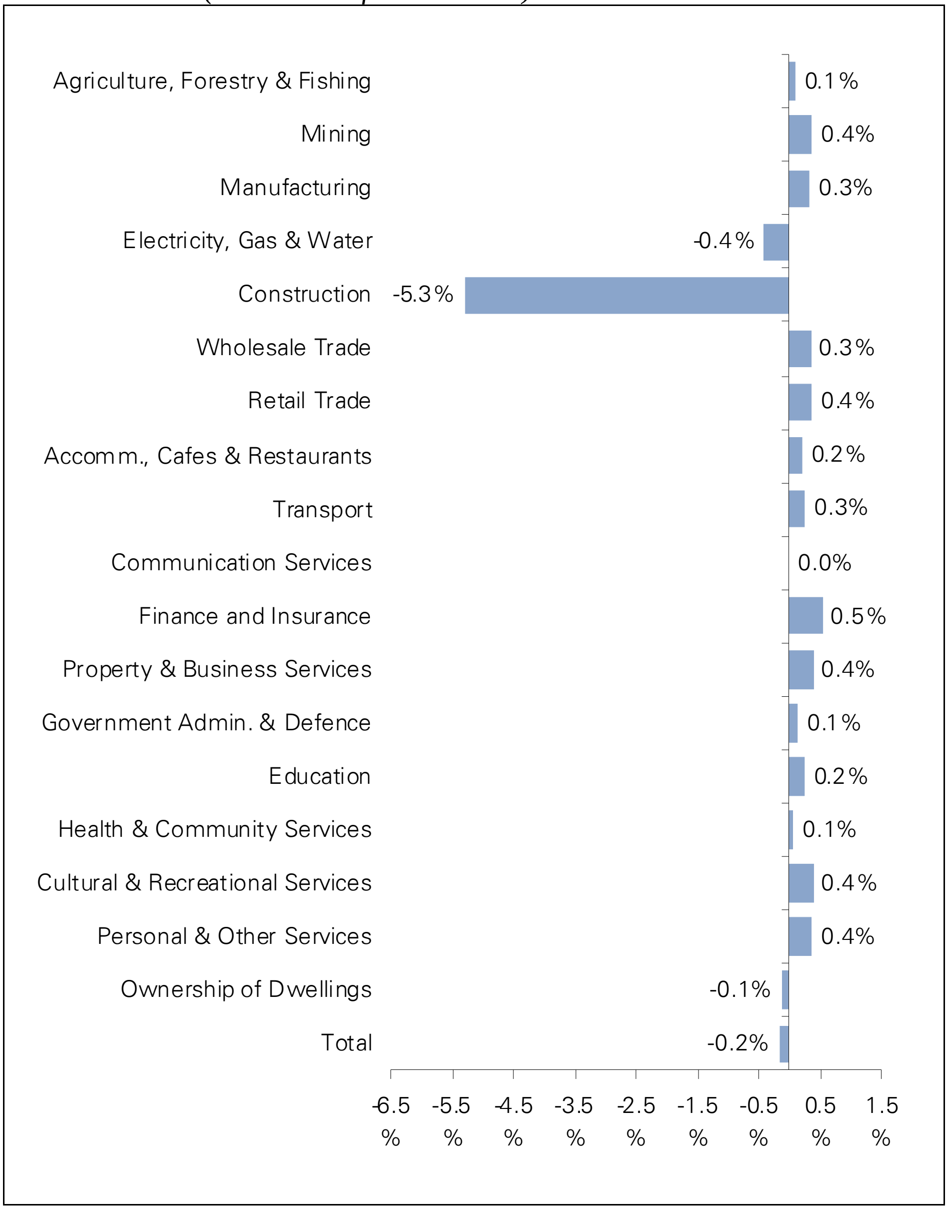


Source: KPMG Econtech MM900 simulation

For the economy as a whole, production costs are down 0.9 per cent, while production volumes are up 0.6 per cent, relative to what they would otherwise be. The long-term production gains are widespread but are largest in the communications services industry and the construction industry itself. Consistent with the dampened industry impacts, particularly in mining and agriculture, the impact of a gain in construction industry productivity on overall economic activity is also dampened compared to the Previous Reports.

Diagram 4.6 shows the pattern of industry job shifting induced by higher productivity in the construction sector. While employment in construction is down, the effect of this on national employment is largely offset by employment gains in other industries.

Diagram 4.6: Effect of Increased Efficiency in the Construction Industry on Employment in Other Industries (% deviation from baseline)



Source: KPMG Econtech MM900 simulation

The biggest employment gain is in the finance and insurance industry, where employment is higher by 0.6 per cent. This additional employment is driven by higher production in the industry of 0.9 per cent. The second highest percentage gain is a 0.6 per cent rise in employment in the culture and recreational services industry, which is also a result of the boost in production in this industry (shown in Diagram 4.5 above).

As discussed in Section 4.1, employment in the construction industry itself is expected to be lower than otherwise, with the negative labour saving effect only partly offset by the positive output and substitution effects in this industry. Minor reductions are also expected in employment in the electricity, gas and water industry and ownership of dwellings (the industry which provides rental services) as businesses in these industries substitute away from labour towards relatively cheaper capital.

Diagram 4.6 shows that, overall, there is a small loss in employment. This is because the modelling allows for the fact that individuals value both leisure and consumption. The gain to productivity in the construction industry lowers prices across the economy and thus results in an increase in the real wage. The model takes into account that consumers can take the benefit of higher real wages in two ways. Consumers can choose between using the extra income to consume more or take more leisure time (while maintaining the same level of consumption as before). A consequence of higher leisure is a lower level of full-time employment, as shown in the chart above.

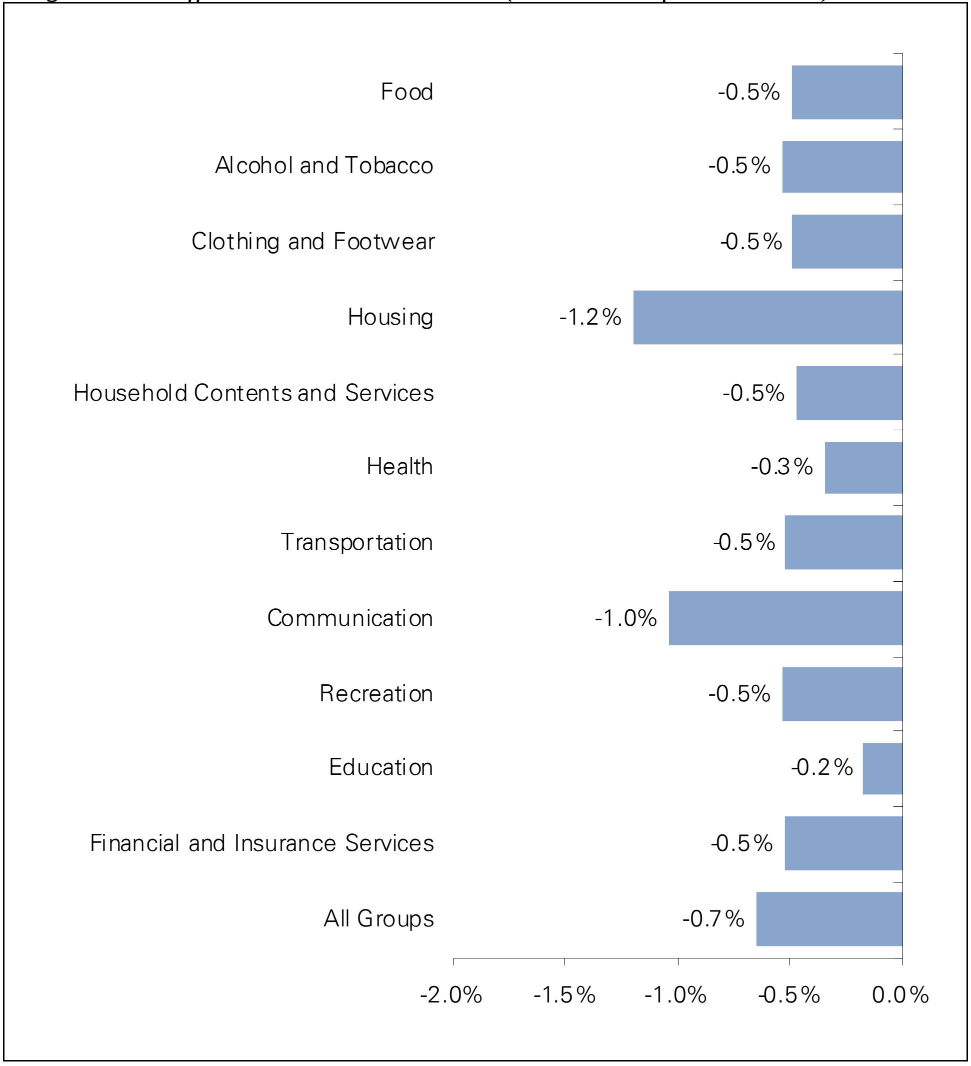
While there is a small loss in full time employment there is an overall consumer welfare gain from both gains in consumption and a greater number of leisure hours – this is discussed further in section 4.3. It is also important to note that the loss in overall employment is relative to a Baseline Scenario and does not mean that there has been a fall in employment during the reform process. In fact, similar to construction employment, total employment is now much higher than it was at the start of the reform process, despite the setback from the Global Financial Crisis.

4.3 National Macroeconomic Effects

As explained in the previous sections, higher construction productivity leads to lower construction prices. This flows through to savings in production costs across the economy, because all industries are reliant on construction to some extent as part of their business investment. As shown in Diagram 4.5, the average saving in production costs is reflected in a reduction in production prices of 0.9 per cent.

This flows through to similar savings in consumer prices. Diagram 4.7 shows a fall in the Consumer Price Index (CPI) of 0.7 per cent, resulting from the gains in construction productivity. It also shows the long-term price falls for each of the groups that make up the CPI.

Diagram 4.7: Effects on Consumer Prices (% deviation from baseline)



Source: KPMG Econtech MM900 simulation

The biggest saving is in the price of housing services, which falls by 1.2 per cent in the long-term. This is a direct effect of gains in labour productivity on the multi-unit side of the residential construction industry and an indirect effect of a more productive construction trade services sector. The second biggest saving is a fall of 1.0 per cent in the communication services group of the CPI. As outlined earlier, communications is a relatively capital-intensive industry and thus reaps a large benefit from cheaper investment costs. Specifically, construction costs, including laying telecommunications cables and building mobile phone towers, account for a large share of the cost of providing communication services.

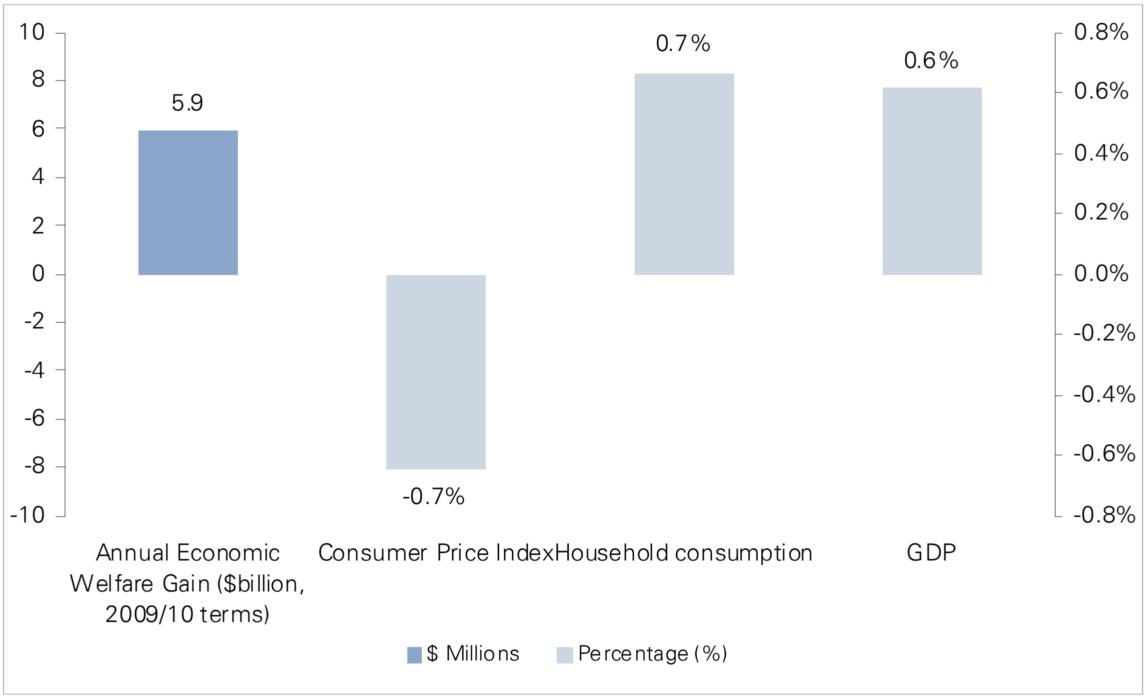
There are also price falls for every component group of the CPI. The smallest fall, of 0.2 per cent, is for education services. This is because education services are generally produced using methods that are labour-intensive rather than capital-intensive.

Diagram 4.8 shows the effects of higher construction productivity on other economy-wide indicators. The fall of 0.7 per cent in the CPI leads to a gain in real private consumption of 0.7 per cent. That is, lower living costs lead to higher living standards.

This gain in living standards is more rigorously measured as an annual gain in consumer welfare. MM900 provides estimates of the change in annual economic welfare by using the compensating variation and equivalent variation methodology from welfare economics. These are alternative measures of the gain in real consumption. Importantly, the welfare measure in MM900 also allows for the fact that individuals derive welfare not only from consumption but also from leisure. Diagram 4.8 shows the higher construction productivity leads to an increase in consumer living standards (the annual economic welfare gain) of $5.9 billion in 2009/10 terms[14].

This is similar to the consumer gain estimated in the Previous Reports of $5.5 billion in 2007/08 terms (or 6.2 billion in 2009/10 terms after allowing for inflation and economic growth). The similar estimate of consumer gain across reports is unsurprising since the source and magnitude of the labour productivity gain is consistent across reports. Specifically, the gain to consumers stems from the labour cost saving in the construction industry of 9.4 per cent. Importantly, consumer welfare is the key measure by which to assess the benefits of a policy as this represents the gain to households from the policy. In other words, consumer welfare is the measure by which we can assess whether or not a particular policy is in the public interest.

Diagram 4.8: National Macro-economic Effects (% deviation from baseline)



Source: KPMG Econtech MM900 simulation

[14] In the 2007 Econtech Report, the gain in annual economic welfare was expressed in 1998/99 terms, giving a gain of $3.1 billion. Here the gain is expressed on a more up-to-date basis in 2007/08 terms, giving the gain reported in the text of $5.5 billion after allowing for inflation and economic growth,.

Diagram 4.8 also shows a 0.6 per cent increase in the level of GDP in the long-term, relative to what it otherwise would have been in the absence of the reforms. This gain was reported earlier in Diagram 4.5 as the gain in production for all industries added together. Production gains for individual industries can be seen in the same diagram.

A Attachment A – KPMG Econtech's MM900 model

Introduction

KPMG Econtech's MM900 model is the latest edition of our detailed computable general equilibrium (CGE) model of the Australian economy focussing on tax analysis. The first edition, MM303, was developed for the South Australian Department of Treasury and Finance in the late 1990s to assist it in participating in a developing debate on indirect tax reform. That debate culminated in the introduction of the New Tax System (NTS) in July 2000. In the lead up to the introduction of the NTS, MM303 was further developed to MM600+ to assist the Australian Competition and Consumer Commission (ACCC) in its price surveillance work. For this study for the Federal Treasury, MM600+ has been re-developed as MM900, extending its tax analysis capabilities from indirect taxes to also include direct taxes.

This development process has meant that MM900 goes well beyond other Australian modelling in capturing the economic effects of the tax system on the Australian economy. It does this by distinguishing 19 different major taxes at the Federal, State and Local levels. Further, for each tax, the model identifies the true tax base as closely as possible, and aims to capture the main behavioural responses to the tax's imposition. The modelling also allows for certain negative externalities in consumption that may justify certain specific taxes. A key feature of MM900 is its fine level of detail.

MM900 contains even a finer level of product detail than MM600+. For example, in MM900 the economy produces 889 different products (i.e. about 900 products), which represents eight times as much product detail as other comparable models. This allows the model to more accurately capture the application of certain product-based taxes.

As noted in Han (1998), a greater level of detail will also lead to a smaller amount of aggregation bias in CGE estimates of excess burdens. The greater the product detail, the more distortions the model will pick up, and the better the estimates of the excess burdens. For example, MM900 treats beer, wine and spirits as separate substitutable products within one broad group. Less disaggregated models aggregate all alcohol products together, and therefore miss the excess burdens that arise from taxing closely substitutable alcoholic beverages at different rates.

MM900 includes a detailed treatment of consumer's responses to taxes that cause relative price changes. MM900 does this by specifying a two-tier consumer demand system covering the 889 products in the model.

- First, the consumer decides between 17 different broad groups of products using a linear expenditure system.
- Second, and importantly, MM900 also allows for substitution within these 17 broad groups, between individual products, with the degree of substitutability able to vary from one group to the next, adding extra sophistication.

This detail in consumer decisions means that MM900 will produce high quality estimates of excess burdens.

MM900 also contains a fine level of detail in modelling production processes. Each of the 109 industries use up to six different primary factors (or types of labour, capital and fixed factors), compared with two primary factors in MM600. The different fixed factors include land and natural resources, allowing for much more robust modelling of the effects of taxes based on the value of land or the value of natural resource use.

In addition, in comparison to earlier studies, MM900 incorporates a more comprehensive analysis of the behavioural responses to each tax. In MM900, taxes can cause households to change their supply of labour and their levels and patterns of spending. Taxes can cause businesses to change their choices between the six primary factors of production, affecting employment, investment and valuations of land and natural resources. Finally, taxes can affect the propensity to import and export each of the model's 889 products.

These behavioural responses to taxes, by impairing the functioning of the economy, can reduce consumer welfare, that is, give rise to excess burdens on households. Capturing these welfare losses accurately requires that the modelling of household behaviour is underpinned by a consistent treatment of consumer welfare. In MM900, this occurs by using a utility function in which a representative household derives welfare or utility from leisure, saving and consumption of products, and then deriving all household behaviour from that same utility function. Other comparable models include more ad hoc elements in modelling household behaviour.

In summary, by better capturing where taxes impact on the Australian economy, how it responds, and how these responses flow through to change consumer welfare, MM900 is uniquely well suited to the analysis of the excess burdens of Australian taxes.

MM900 is also carefully designed to capture the economic incidence of each tax. This involves recognising that, as a relatively small part of the world economy, Australia in close to being a 'price taker' in world trade markets. It also means taking into account that natural resources and land are completely immobile, capital is highly mobile, and labour has a low degree of mobility. Other comparable models have more limited or no treatments of natural resources and land.

The following sections systematically summarise the main features of MM900, emphasising those that are most pertinent to this tax study. It begins by noting the main, over-arching assumptions, and then moves on to summarise the behaviour of the 'economic agents' in the model – households, producers, government and the foreign sector.

Over-arching Assumptions

In keeping with most long-run CGE models, in MM900 economic agents engage in optimising behaviour, markets are in equilibrium and the government and private sectors live within their means.

Long-run Horizon

MM900 refers to a long-run equilibrium, after the economy has fully responded to shocks. For example, stocks of capital in each industry have fully adjusted. This long-run focus is important for tax policy, because good tax policy is based on the lasting effects of tax policy changes, not the transitional effects.

Optimising behaviour

Economic agents engage in optimising behaviour. In MM900, this means that a representative business in each of the 109 industries chooses inputs and outputs to maximise profit under perfect competition subject to a production technology with constant returns to scale. It also means that a representative household maximises utility, which depends on leisure, saving and consumption of products, subject to a budget constraint. This focus on consumer utility is important for drawing conclusions about how individual taxes affect consumer welfare.

Equilibrium

In keeping with MM900's long-run horizon, all markets are assumed to have achieved equilibrium. This includes markets for the six factors of production – low-skilled labour, high-skilled labour, structures, other capital, land, and other fixed factors – and markets for the 889 products (goods and services) that are produced.

Government Budget constraint

Governments must always pay their way in the long run. For simplicity, in MM900 the government is assumed to always balance its budget. To achieve this, a budget policy instrument must be selected that, instead of being an input to the model, automatically adjusts to balance the budget. For this study, a hypothetical lump sum tax/transfer is chosen as the swing instrument, because the efficiency of any tax is traditionally assessed against a lump sum tax, which by definition is perfectly efficient. Hence, when a change in a tax rate is simulated in this study, the potential impact on the budget balance is automatically neutralized through a change in lump sum tax. Any change in consumer welfare can then be attributed to economic distortions associated with the tax that has been changed. This approach to tax efficiency analysis is standard in the literature.

Private Budget constraint

Private saving behaviour must also be sustainable in the long run. As explained further below, the private propensity to save is constant in MM900. Based on that saving rate, together with the return to savings and the growth rate of the economy, the model then deduces the level of private assets. Remaining assets are owned by the foreign sector and are supplied perfectly elastically at the world required rate of return on capital. In the long run, the stock of foreign liabilities (just like the stock of private assets) must also grow at the same rate as GDP, requiring a particular current account deficit. In MM900, the exchange rate adjusts to deliver that current account deficit (external balance).

Households

In MM900, a representative household maximises utility, which depends on leisure, saving and current consumption of products, subject to a budget constraint. This is an important development from MM600, in which utility only depended on consumption of products.

While MM900 is a 'static' model, saving generates utility on the basis that it represents future consumption of products. This approach leads to a Generalised Linear Expenditure System, which includes relationships for labour supply, total consumption expenditure, and its spread across 889 products. These three sets of relationships are now discussed in turn, beginning with the labour supply choice.

Labour Supply versus Leisure

In MM900 households face a choice in dividing the time in which they could be working, between work and discretionary leisure, whereas in MM600 the labour supply was fixed. Under the MM900 utility maximising approach, the amount of time they devote to work depends on the after-tax real wage that is available from working, and their real 'full income', which is the potential income they could receive if they take no discretionary leisure. MM900 makes full allowance for the taxes that influence this work-leisure choice.

For example, higher labour income tax directly reduces the real after-tax wage, reducing the economic return to work. This leads to lower labour supply, but higher leisure. Lower labour supply leads to lower incomes, reducing levels of consumption and saving.

Many other taxes reduce the economic return to work, as measured by the real after-tax wage, by increasing consumer prices. Put another way, higher consumer prices reduce the consumer purchasing power generated by a given work effort. GST and 'sin taxes' on alcohol, tobacco and gambling have obvious effects on consumer prices. Other taxes, such as company tax and payroll tax, have different tax bases, but ultimately are also likely to be largely passed on into higher consumer prices or lower wages. All of these taxes act as a disincentive to work by reducing real after-tax wages. They also have other disincentive effects that are captured in MM900.

Importantly, explicitly including leisure in the analysis helps to make the excess burden estimates more robust. For example, increasing labour income tax (or many other taxes) will reduce the after-tax real wage and reduce labour supply. While reduced labour supply will reduce utility as lower labour incomes lead to lower consumption and saving, this will be partly offset by the utility derived from increased leisure. Without the inclusion of leisure in the utility function, the excess burden of labour income tax would be overstated. This will also be true for other taxes that reduce real after-tax wages, such as GST, 'sin taxes', payroll tax, company tax etc.

Given the amount of labour that households choose to supply, they will receive a certain income. The next choice is how to divide this income between consumption and saving.

Consumption versus Saving

Modelling saving behaviour poses an issue for long run models such as MM900. In particular, saving (i.e. sacrificing present consumption for future consumption) can appear artificially attractive. This is because, if saving rates are increased, long-run model results will show the gain in future consumption, but not the sacrifice of present consumption. To avoid this problem, the private propensity to save is constant in MM900, as a consequence of the deliberate design of the household's utility function. In particular, saving generates utility on the basis that it represents future consumption of the same products that are consumed in the present. Allowing for saving and the utility it brings is an important development in moving from MM600+ to MM900.

Incorporating saving in the analysis of household behaviour, just like incorporating leisure, helps to make the estimates of excess burden more robust. In particular, foregoing leisure for the income from additional work allows additional consumption and saving, and it is important that both of these lead to higher utility if leisure is not to appear artificially attractive.

At the same time, assuming a *constant propensity to save* means that MM900 is not useful for estimating excess burdens for taxes that mainly distort the propensity to save. These taxes include personal income tax on income from assets and taxes on superannuation earnings and benefits.

Having determined the split of income between consumption and saving, the next choice is how to divide consumption between the various products.

Pattern of Consumption

Similar to MM600, MM900 allocates total consumption expenditure between products using a two-tier consumer demand system, corresponding to a Generalised Linear Expenditure System. In MM900 there are 889 products and the two tiers are as follows.

- In the first tier, the consumer decides between 17 different broad groups of commodities in a Linear Expenditure System.
- In the second tier, MM900 allows for substitution between individual products within these 17 broad groups, with the degree of substitutability able to vary from one group to the next, adding extra sophistication.

This detail in consumer decisions means that MM900 will produce high quality estimates of excess burdens. For example, MM900 treats beer, wine, spirits as separate products, and they are all substitutable in consumption. Less disaggregated models treat all alcohol products as a single product group, and will therefore miss the excess burden that arises from taxing substitutable alcoholic beverages at different rates.

In short, MM900 includes a detailed treatment of consumers' responses to taxes which cause relative price changes, and so generates more robust estimates of excess burdens.

Producers

In MM900, production occurs in 109 industries that produce 889 products. Within each industry, a representative business operating under perfect competition chooses inputs and outputs to maximise profit subject to a production technology. Apart from the unusually large number of products in MM900, this approach is typical of CGE models.

For its production, each industry uses products produced by other industries as well as primary factors of production. In MM600, the two primary factors of production of labour and capital were recognised and treated as substitutable – this is typical of CGE models. However, in MM900 the number of primary factors is extended from two to six. As discussed further below, this extension is important for robustly modelling the excess burden and economic incidence of certain taxes, such as resource rent taxes, land tax, municipal rates, and motor vehicle registration.

In each industry, the demand for the six primary factors is modelled in a two-tier approach based on a nested CES production function. In the first tier, the representative producer chooses a mix of the three broad primary factors – labour, capital and fixed factors – taking into account their relative prices. In the second tier, for each broad primary factor, they choose a mix between two types. For example, for labour, they choose a mix between low skilled labour and high skilled labour, taking into account their relative prices. These mixes vary from one industry to the next.

The six primary factors, which are now discussed in turn, are as follows:

- low-skilled labour;
- high-skilled labour;
- capital – structures;
- capital – other;
- land; and
- other fixed factors such as natural resources.

Demand for these six primary factors is driven by producer decisions. In the following discussion of each primary factor, each explanation of how producer behaviour determines demand is followed by an explanation of supply, and how an equilibrium is achieved in which supply and demand are balanced.

Low and High Skilled Labour

Labour is divided into two types, low skilled and high skilled. This is equivalent to dividing labour into a 'heads' aspect, which keeps track of the number of people who are employed and a 'quality' aspect, which determines the average productivity of labour in each industry. The reason for dividing labour into skilled and unskilled labour is so that the model can account for both labour input in terms of the number of people, or total employment, as well as effective labour input, or the total productivity of labour.

Following profit maximizing behaviour, the representative producer in each industry generates a demand for low skilled labour and high skilled labour. This demand depends on the prices of low skilled and high skilled labour, the prices of other inputs, and industry production. These demands are aggregated over industries to determine the total demand for low skilled labour and the total demand for high skilled labour. This raises the question of how this demand for low skilled and high skilled labour is balanced with supply.

The supply of labour is determined by household behaviour in the way described in section 3.1. The mix of that supply between low skilled and high skilled labour is held fixed as an input to the model. The wage for low skilled labour relative to the wage for high skilled labour then adjusts until the mix of demand matches the fixed mix of supply.

Total labour demand equals total labour supply in MM900 by virtue of Walras' Law. That Law states that, when considering any particular market, if all other markets in an economy are in equilibrium, then that specific market must also be in equilibrium.

The average wage is not determined by the model but rather is fixed as the "numeraire". The idea here is that in any general equilibrium model, all prices are determined in relative terms, but expressed in nominal terms. To do this conversion to nominal terms, one good is chosen to be the "numeraire". This good has a set fixed price, and all other prices can be expressed relative to that fixed price. In MM900, the average nominal wage has been chosen as the numeraire. Although the choice of numeraire does not affect the modelling results in real terms, it does need to be taken into account in interpreting nominal price changes.

Structures and Other Capital

Physical capital is split into two different types. These are:

- structures - residential and other; and
- other capital, which is all other capital goods, such as motor vehicles, machinery and computers.

Structures include residential structures, which are only used by the ownership of dwellings industry (in producing housing services) and other structures such as commercial buildings and engineering construction, which are used by all of the other 108 industries in the model.

Other capital is also used by all of the other 108 industries in the model. Other capital covers all capital other than structures, and includes motor vehicles, computers, machinery etc, and has a fixed composition.

Following profit maximizing behaviour, the representative producer in each industry generates a demand for structures and other capital. This demand depends on the prices of the services of structures and other capital, the prices of other inputs, and industry production. These demands are aggregated over industries to determine the total demand for structures and the total demand for other capital. This raises the question of how this demand for structures and other capital is balanced with supply.

In MM900, an industry can access as much capital as it needs so long as it can achieve the after tax rate of return required by international investors. This perfect elasticity of capital supply means that the required after tax rate of return on capital is effectively fixed on world capital markets in the long run. Stocks of structures and other capital adjust in each industry until this rate of return is achieved.

As noted, it is the *after tax* rate of return on capital that is determined on world capital markets and governs the terms on which capital is supplied to Australia. This means that any tax that is put on capital in Australia will ultimately increase the required *before tax* rate of return to offset the tax impost. Capital will flow out of the country until its greater scarcity achieves the increase in its before tax rate of return. The resulting lower capital intensity of production will reduce the marginal productivity, and therefore the incomes, of other factors of production, including labour, land and other fixed factors of production.

Land

MM900 includes land as a fixed factor, which is an unusual feature in CGE models of the Australian economy. This feature was developed to enhance the estimates of the excess burden of land tax and municipal rates.

Specifically, MM900 has the following three types of land:

1. *rural land*, which is land used only by sectors within the agriculture, forestry, fishery and mining industries;
2. *residential land*, which is land used only by the ownership of dwellings industry; and
3. *urban land*, which is used by all other industries.

Following profit maximizing behaviour, the representative producer in each industry generates a demand for land services. This demand depends on the rental price of land, the prices of other inputs, and industry production. These demands are then aggregated to determine the total demand for rural land, for residential land, and for urban land. This raises the question of how this demand for each of the three types of land is balanced with supply.

The total supply of each of the three types of land is fixed, which reflects the overall availability of land in the economy and somewhat mimics zoning legislations. This implies that the price of each of the three types of land will adjust until total demand is reconciled with the fixed supply.

Any tax placed on a type of land will not change the supply of that land. With the fixed supply of land to the market, the land rents that users will be prepared to pay will be unaffected by the tax. This means that the burden of the tax will be fully borne by the land owners.

Natural Resources and Other Generators of Economic Rents

The zero profit assumption is a common assumption in economic modelling. However, in reality, excess returns do exist in some industries. These excess returns can arise as a result of factors such as access to a natural resource (such as petroleum or minerals deposits), monopoly power, branding, patents or barriers to entry.

In MM900, these excess returns are modelled as a return on a fixed factor, that is as a "rent". To identify the excess returns in an industry, the rate of return on capital in each industry was examined. When this return has consistently been greater than the "normal" rate of return on capital, then the industry may be making excess returns[15]. Further, the idea that any particular industry would systematically make excess returns has been subject to a "reality check". This was done by examining whether factors that generally lead to excess returns, such as access to a natural resource or barriers to entry, appear to be present for that industry.

The following industries are identified as having "excess returns" that, for modelling purposes, are attributed to a fixed factor:

- Coal;
- Oil and gas;
- Iron ore;
- Non-ferrous metal ores;
- Beer;
- Banking; and
- Non-bank finance.

Each of these seven industries is assumed to use a different fixed factor. The remaining 102 industries use no fixed factor.

Following profit maximizing behaviour, the representative producer in each of the seven industries with a fixed factor generates a demand for fixed factor services. This demand depends on the rental price of the fixed factor, the prices of other inputs, and industry production. This raises the question of how demand for each of the seven fixed factors is balanced with supply.

The total supply of each fixed factor is fixed, which reflects the overall availability of natural resources and other fixed factors in the economy. This implies that the price of each of the seven types of fixed factors will adjust until total demand is reconciled with the fixed supply.

[15] Industries making "excess returns" have been identified in the following way. First, a "normal" rate of return of return for each of the 109 industries in MM900 has been estimated using employment data and an estimate of output per employee in each industry. Next, the actual GOS according to the national accounts was compared to the estimate of the "normal" rate of return. Where the actual GOS was significantly larger than the estimate, then it is considered that the industry may be making "excess returns".

Any tax placed on a type of fixed factor will not change the supply of that fixed factor. With the fixed supply of the fixed factor to the market, the rent that users will be prepared to pay for use of the fixed factor will be unaffected by the tax, and will continue to reflect the fixed factor's marginal productivity. This means that the burden of the tax will be fully borne by the fixed factor owners.

This inclusion of fixed factors is particularly useful for measuring the excess burden of the Petroleum Resource Rent Tax, which is intended to be a tax on the above normal profits of the oil extraction industry.

Government Sector

Government sector spending accounts for part of final demand for various products, and is financed by taxes. Table 1 shows the 19 key taxes in MM900 that are analysed in this study. These include a range of Federal, State and Local taxes.

The table divides the key taxes into three groups, according to how they appear in MM900. These are general taxes (that are applied at a single rate), industry taxes (that can be varied from one industry to the next), and product taxes (that can be varied from one product to the next and even between different categories of end users of a product). Some specific comments on particular taxes can be made.

Table 1 Key Taxes

General	By industry	By product
Labour income tax	Payroll tax	GST
Corporate income tax	Land taxes	Alcohol excise and WET
	Municipal rates	Tobacco excise
	Resource rent tax	Luxury car tax
	Motor vehicle registration	Import duties
		Fuel taxes
		Royalties and crude oil excise
		Gambling taxes
		Conveyancing stamp duties
		Motor vehicle stamp duties
		Stamp duties (other)
		Insurance taxes

"Labour income tax" refers to personal income tax as it applies to labour income. Other personal income tax, which is collected from non-labour income such as interest income, is much smaller in magnitude, and is not explicitly modelled in MM900. This is because the main excess burden from personal income tax on non-labour income (such as income from assets) is likely to be through its influence on private saving, but the private saving rate is fixed in

MM900. Hence, MM900 is not designed to capture the excess burden from personal income tax as it applies to non-labour income.

Company income tax is modelled in MM900. In addition, the reduction in personal income tax collections from the claiming of franking credits is also taken into account.

In modelling payroll tax in each industry, the small business exemption is taken into account.

The model allows for resource rent tax to be applied at any rate in most sectors of the mining sector. In constructing the model, resource rents were identified for: the coal industry; the oil and gas industry; the iron ore industry; and the non-ferrous metal ores industry. In the baseline scenario of the existing tax system, the existing petroleum resource rent tax is applied in the oil and gas industry, while in the other three industries resource rents are not taxed. The model also identifies economic rents in some other industries – the banking industry, the non-bank finance industry, and the beer industry.

The model assumes that GST is applied at a single, specified rate, which is 10 per cent in the baseline scenario of the existing tax system. However, GST status (taxable, GST-free or exempt) is set product-by-product, separately for both residents and foreign tourists visiting Australia.

In modelling fuel taxes, separate account is also taken of fuel subsidies that partly offset fuel taxes. In simulating the model for this study, when fuel taxes are altered, associated fuel subsidies are altered in the same proportion.

Foreign Sector

Australia's interactions with the global economy are important for the domestic economy. As a small country, Australia is generally considered to be close to being a 'price taker' on world markets. In MM900, Australia is a price taker for capital and imports, and is close to being a price taker for most exports.

In a world of highly mobile capital, Australia is assumed to be a price taker in world capital markets. This means that the world supplies capital to Australia at a fixed real after-tax rate of return. On the demand side, industries generate demand for structures and other capital following profit-maximizing behaviour. They do not differentiate between local and foreign owned capital. The supply of local-owned capital is determined by saving behaviour, while remaining capital demands are met by foreign-owned capital.

Similarly, the rest of the world supplies Australia, as a small open economy, with as much imports as demanded at the world price i.e. supply is perfectly elastic. On the demand side, consumers and producers perceive imported and locally produced goods to be different from one another, and choose their mix of imported and locally produced goods and services depending on their relative prices.

For exports, Australia's status as a small open economy is again recognised, but this time by assuming export demand is highly elastic but not perfectly elastic. That is, Australia is close to being a price taker, but has a small degree of pricing power. This pricing power may arise through product differentiation or by supplying a large share of the world market. For most goods, export demand elasticities in MM900 are set to a very responsive -12. For goods where Australia is considered to have some market power, export demand elasticities are lower. The smallest elasticity is for wool, where the value is -4, in recognition of our large share of the world market. The same elasticity is used for tourism, which takes into account the product differentiation between the tourism services that Australia offers compared with those offered by other countries.

On the supply side of export markets, in CGE models with perfect competition and constant returns to scale, commodity supply is also elastic. The combination of highly elastic export demand and supply commonly leads to problems because small shifts on either side of the market can lead to large changes in export volumes.

Some models attempt to overcome this by making export demand less responsive to price changes. However, this is not reflective of Australia's position as a small open country. For a more realistic approach, MM900 incorporates two features.

First, MM900 includes fixed factors of land and natural resources. This reduces the flexibility in export supply of agricultural and mining products in a realistic way.

Second, MM900 introduces some friction between supplying domestic and export markets. Intuitively, this friction may arise because some exported commodities are tailor made for export, or are more narrowly defined than the corresponding home commodity. For example, Australian consumers may eat all types of apples, but Australia may only export Fuji apples to Japan. Thus, there will be a cost involved in switching from supplying the domestic market to supplying the export market. This reduces flexibility in supplying the export market.

Australian taxes applied in world markets can be expected to have little impact on prevailing world prices. Rather, such taxes will largely be absorbed on the Australian side of the market. Taxes on foreign capital will increase the before tax rate of return on capital in Australia, and accordingly reduce the demand for foreign capital. Taxes on imports will have no influence on the world price, and instead raise the price that Australian consumers pay for imports and therefore reduce their demand for them. Likewise taxes on exports will have little effect on the price that foreign consumers will pay because export demand is highly elastic. Instead, they will reduce the price that Australian producers receive and therefore reduce export supply.