Wages, productivity and technology

Adding one more piece to the wage growth puzzle
In Australia aggregate nominal wage growth has averaged 1.8% per annum since 2013. This is less than half the average annual growth rate of nominal wages recorded over the previous 18 years.

For most developed economies stagnant wage growth has become a persistent feature since the global financial crisis. While increases in labour productivity and a decline in unemployment rates have been observed across a number of countries, the lack of wage growth has puzzled economists across the board.

The Australian Bureau of Statistics (ABS) produces six measures of wages or per unit labour costs based on a number of different survey’s from households and business.

The ABS suggests that if an analysis is focused on current value of average wages and salaries that reflects contemporary structural change in the labour market (e.g. changes in employment in particular industries), then Average Weekly Earnings (AWE) should be the preferred measure.

In this paper KPMG have considered real wage growth from the perspective of the employer via the behaviour of the Real Producer Wage (RPW), which reflects the real cost to producers of hiring workers, and from the perspective of the employee via the behaviour of the Real Consumer Wage (RCW), which reflects the workers’ purchasing power.

For large economies and for inwards-focused countries these two measures of real wages should move in a broadly similar fashion. For small open economies, like Australia, we show that the terms of trade can have a very influential role on real wages and, for a given nominal wage, can result in workers and firms having different outcomes.

The aggregate measure of the Australian RPW grew, on average, by about 0.9% per annum between 1995 and 2018. Also, between 2001 and 2013 the RCW grew more rapidly than the RPW; and there is an inflection point in the RCW around 2013 after which it has gone sideways (i.e., no growth in the RCW after 2013).

The recent lack of growth in the RCW has accentuated concerns that the long run relationship between wage growth and productivity in Australia has broken down.

Casual observation of the wage data at the industry level suggests that there is significant variation in growth rates across industries, with some industries recording growth rates in wages significantly above the national average and others significantly below.

Our analysis reaffirms the theoretical proposition that in competitive markets, an industry will maximise profits in the long run by employing labour up to the point where its marginal product is equal to the real wage.

Variability in labour productivity across industries in Australia over the past two decades has been significant.

Arguments that labour productivity in Australia has recently been non-existent, or materially below our long run average, does not hold true across all industries.

The industries which recorded the lowest net increase in their real technology capital stock between 1995 and 2018 are the same industries that recorded low growth in the RPW over the same time period.

Econometric analysis shows labour productivity is the key factor in driving growth in the RPWs in Australia, although, it is not the only factor.
• Slightly more than half of the change in our measure of the RPW comes from changes in labour productivity, while nearly 40% is due to industries propensity to employ more high-tech capital, and relatively more capital compared to labour, in their production processes.

• Our analysis also shows during the period 2013 to 2018 there has been something different in how productivity, the capital stock mix and labour and technology, either collectively or individually, have impacted the RPW.

• Further analysis shows there is some evidence:
  – in the last five years a given rate of growth in labour productivity has translated into a smaller increase in the RPW growth than was the case over the full sample;
  – growth in the capital-labour ratio across industries has been in a narrower range in the past 5 years compared to the full sample;
  – a step-change in the importance of the role of high tech capital as a driver of the RPW growth has occurred over the last 5 years compared to the last 20 years, which suggests that industries that are skewing their capital mix in favour of high tech capital may be in a better position to sustain wage growth in excess of output prices; and
  – there is an inverse relationship between the rate of growth of the RPW and the rate of growth in employment, meaning strong employment growth is difficult to achieve with strong growth in the RPW.

• Our analysis confirms there has not been a break down in the fundamental economic relationship that drives wages growth in Australia. Labour productivity remains the key factor influencing wages growth outcomes across all industries. The mix of capital and labour that an industry employs is also influential in the wage outcome for workers.

• If government is looking to ensure Australian’s enjoy real wages growth then it should be pursuing policy settings that promote productivity growth, investment in capital and labour, and proportionally more investment in high tech capital.

• Adopting policies that force wages growth without any underlying basis for that to occur, except the desire for an increase in income, is likely to result in businesses hiring fewer workers than otherwise would be the case.
Background

In Australia aggregate nominal wage growth has averaged 1.8% per annum since 2013. This is less than half the average annual growth rate of nominal wages recorded over the previous 18 years. Over the 23 year horizon extending from 1995 to 2018, only one year (1997) records a lower rate of wage growth than any of the 5 years since 2013.

For most developed economies stagnant wage growth has become a persistent feature since the global financial crisis. While increases in labour productivity and a decline in unemployment rates have been observed across a number of countries, the lack of wage growth has puzzled economists across the board.

Research by the Reserve Bank of Australia (RBA) has examined this wages paradox, suggesting differences in technologies adopted across firms to be a potential cause of declining labour returns, reflected in weak nominal wage growth in recent years (Weir, 2018).

The annual growth rates in aggregate Australian nominal wages have been very low by historical standards since 2013. Analysts have devoted considerable effort to understanding this phenomenon. For example, a study by Jacobs & Rush (2015) put forward several factors that could explain Australia’s lower wage growth, including post-recession spare capacity in the labour market, a decline in inflation expectations, lower profitability following the decline in the terms of trade, and the need for the real exchange rate to adjust to improve international competitiveness.

Amongst the OECD countries, there has been declines in the real wage growth since 2008, from already low pre-recession levels. While France, Germany, Iceland, Norway and Sweden saw average growth rates of above 1%, real wages in the UK have been stagnant. A study by the National Institute of Economic and Social Research in the UK attribute this subdued wage growth partly to high rates of underemployment which was driven by an increase in involuntary part-time working hours post 2008 (Bell & Blanchflower, 2018). They note this trend to be consistent amongst developed economies, with underemployment being a better measure of a slack in labour market and thus explaining downward pressure on wages.

Paz & Urrutia (2014) analyse wage stagnation in Peru over the period 1998 to 2012 in the context of changes in the quality of the local workforce based on levels of education and experience. They show a decline in the returns to education due to increase in supply of educated workers. While they do not investigate some of the demand side factors that may explain declines in the labour share, they identify factors like technological changes, sectoral shifts in production, etc, as being worth exploring.
The exploration of technological factors to explain declining returns to labour goes back to before 2000s. For example, a study by Beaudry & Green (2000) analysed the differences in the wage structures in the US and Germany considering differences in physical and human capital accumulation between 1979 and 1986. The study, which used matched employment data to look into the effects of transitioning to General Purpose Technology (GPT) on the wage structure, found that an under-accumulation of physical capital relative to human capital in the US, compared to the experience in Germany, helped explain the difference in the average wage gains between the two countries.

Another recent study into the wage growth puzzle by Daly, Hobijn, & Pyle (2016) found that new full-time workers, either entering from outside the labour force or moving from part-time work to full-time work, typically earn below-median wages. This suggests median weekly earnings experience more downward pressure in times when there are increased numbers of new full-time workers entering the employed labour force.

A study by the IMF in 2018 (authored by Abdih & Danninger) sought to provide further explanation into the wage dynamics in the US using micro and macro level data. The study found low growth rates of labour productivity and technological progress were factors driving weak aggregate wage growth. Unit record data from the US Census corroborated the macro-econometric findings.

Finally, in its latest Economic Outlook the OECD (Volume 2018, Issue 2) attributes lower than expected real wage growth to technological changes and increasing market shares of high-productivity capital-intensive firms with low shares of labour inputs. This trend has been consistent across most OECD countries in the past two decades.

Purpose of this paper

The purpose of this paper is to contribute to the analysis of wage behaviour in Australia by examining wage dynamics at the industry level. A particular focus of the paper is on the role that technology has played in influencing wages growth in Australia over the past few decades. We will examine whether the long run relationship between real wages, labour productivity and technical change posited by standard economic theory still holds in Australia at the industry level or whether there has been a break down in this relationship as has been suggested by many commentators.

Other analysts have tackled this issue from the macroeconomic perspective. This involves focusing on aggregate wage behaviour and considering whether there has been a breakdown in the Phillips curve relationship between wages and the rate of unemployment. This is a useful line of attack but in the absence of centralised wage setting behaviour we believe that examining wage behaviour at the industry level may yield important insights, at least for short run and medium run horizons.

The distinction between analysis done at the macro level and the industry level is important in the context of considering what, if any, combination of macro and industry policies is appropriate to boost wage growth. The analysis in this paper is aimed at identifying impediments to wage growth and proposing practical policy options for overcoming these that are commercially viable and consistent with key economic principles.

There are many official measures of wages at the aggregate and industry levels. The first part of our paper carefully considers which measure of wages is most appropriate for this analysis. We also consider different measures of real wages, and which of these should be used for analysis of this type. Finally, we analyse recent trends in factors that influence real wages growth, including labour productivity, capital, employment and output.

KPMG’s goal for this paper is to provide some insight into the wages growth puzzle that is bemusing policy makers not only in Australia but in many countries across the globe. This is a complex problem, and one that is unlikely to be solved through the simple application of one action by governments, central banks, workers or the business community. However, if our analysis can provide more information as to the cause and effect of this low wage conundrum in Australia – in effect adding one more piece to the wages growth puzzle – then this paper would have achieved its goal.

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Which measure of wages

The Australian Bureau of Statistics (ABS) produces six measures of wages or per unit labour costs based on a number of different survey’s from households and businesses (see Table 1).

While all of the indicators broadly measure payments to labour, each of the measures prepared by the ABS is developed for a different purpose and correspondingly composed using different methodologies, statistical concepts and collection mechanisms. Most importantly, as shown in Chart 1, depending on which measure of wages or per unit labour cost is chosen, the conclusion regarding the rate of growth in real wages can be vastly different.

In preparing this paper KPMG consulted with various academics and labour market researchers regarding which measure is regarded as the most appropriate to use in seeking to understand the wages growth story in Australia. Not surprisingly, the most common view was given the nuances of each indicator choosing which measure to use depends on the nature of the question being asked. That being said, it was also commonly agreed that:

- The aggregate nature of the national accounts compensation of employees data and unit labour cost data limits its use to economy-wide analysis;
- The wages index, like CPI, incorporates a ‘basket of jobs’, and therefore does not allow compositional change of the skills / make-up of the labour force to be considered in any wages analysis; and
- AWE hours data is only available every 2 years, and one must be careful in using labour force hours data as it is reported by the employee, whereas the AWOTE data is reported by the employer.

The ABS also notes that if an analysis is focused on the current value of average wages and salaries that reflects contemporary structural change in the labour market (e.g. changes in employment in particular industries), then AWE should be the preferred measure. However, if an analysis is concerned with the inflationary pressure associated with wages and salaries, then researchers should consider using the WPI.

Both the Australian Treasury and Kirchner (2019) define the Real Producer Wage (RPW) by using Compensation of Employees in the national accounts deflated by the GDP deflator.

Such a measure is reasonable when considering trends in real wages growth at an aggregate (or national) level. However, for the purposes of this research we are seeking to determine the drivers of real wage growth in the long run at an industry level, and in particular, whether realised wage growth is consistent with the rate predicted by theory. Given this, and based on our assessment of the different measures compiled by the ABS, we have chosen Average Weekly Earnings (AWE) as the indicator to calculate wages growth. To estimate an equivalent RPW we have discounted nominal AWE by the ABS producer price index (PPI) which includes exports.

In common usage the term “real wages” usually refers to the purchasing power of the wages paid to workers. We will refer to this measure of real wages as the Real Consumer Wage (RCW). Statements about real wages by politicians, worker representatives and other commentators in the popular press almost always refer to the RCW.

Another concept of the real wage that economists focus on considers wages from the perspective of firms (or producers). In making hiring decisions producers must consider the cost of labour inputs relative to the final price of their outputs. This ratio of the wage to the price of output is an alternative measure of the real wage that we will refer to as the RPW.

1. ABS Cat. No. 64270, Table 10, Series ID A2314862X.
In simple terms, the RPW reflects the real cost to producers of hiring workers, whereas the RCW reflects the workers’ purchasing power. We note that the numerator on both of these measures of real wages is the same (i.e., wages) while the denominator acts as the differentiator between the two concepts.

In Australia the prices received by producers often move very differently to the prices faced by consumers. This means that the RPW can move very differently to the RCW. Terms of trade movement are one of the key reasons why consumer prices can move independently to producer prices and, hence, why there can be a wedge between growth in the RPWs and growth in the RCWs. Appendix 1 provides a short technical explanation of this mechanism.

The intuition is that the prices received by Australian producers for their outputs depends on the prices of domestically produced goods, which includes exports, while the prices paid by workers for the goods they consume depends in the prices of domestically produced goods as well as the prices of imported goods. When export prices rise relative to import prices we would expect the RPW to grow less rapidly than the RCW (and vice versa).

Chart 2 shows how the RPW and the RCW have diverged over time against a backdrop of the terms of trade. The positive terms of trade movements since 2000 have allowed Australian producers to charge foreigners more for the goods and services they produced, while at the same time Australian consumers were able to enjoy lower prices for foreign goods. This has allowed the RCW to grow marginally faster than the RPW over the period 1995 to 2018. Chart 2 shows the RCW grew significantly faster than the RPW over the 10 year period starting 2003 when Australia’s terms of trade rose rapidly.
Table 1: Summary of ABS Data Series on Wages or per unit Labour Costs

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Data Availability</th>
<th>Sample</th>
<th>Detail</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wage price index</td>
<td>Quarterly</td>
<td>• 18,000 matched jobs from employers</td>
<td>• Sector</td>
<td>• Reflects market forces</td>
</tr>
<tr>
<td>ABS 6345.0</td>
<td>First published December 1997</td>
<td></td>
<td>• Industry (excluding Agriculture, forestry and fishing)</td>
<td>• Measures inflationary pressure for national accounts</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Structural changes not accounted for</td>
<td></td>
</tr>
<tr>
<td>Average weekly earnings</td>
<td>Biannual</td>
<td>• Uses payroll data from 5,500 employer units</td>
<td>• Sector</td>
<td>• Measures average value of wages paid to employees</td>
</tr>
<tr>
<td>ABS 6302.0</td>
<td>First published June 1969</td>
<td></td>
<td>• Industry (excluding Agriculture, forestry and fishing)</td>
<td>• Reflects compositional change – quality and quantity adjustments</td>
</tr>
<tr>
<td>Compensation of employees</td>
<td>Quarterly</td>
<td>• Uses various ABS Surveys and data from ABARES for farm costs</td>
<td>• National (from Sept 1959)</td>
<td>• Measures total remuneration, including non-wage labour costs</td>
</tr>
<tr>
<td>ABS 5206.0</td>
<td></td>
<td></td>
<td>• Industry (from Sept 2002)</td>
<td>• Reflects compositional change in economy</td>
</tr>
<tr>
<td>Unit labour costs</td>
<td>Quarterly</td>
<td>• Based on Compensation of employees data from National Accounts</td>
<td>• Sector</td>
<td>• Measures average cost of labour per unit of output</td>
</tr>
<tr>
<td>ABS 5206.0, Table 42</td>
<td>First published September 1985</td>
<td></td>
<td></td>
<td>• Calculated by dividing average labour costs by average labour productivity</td>
</tr>
<tr>
<td>Wages and salaries</td>
<td>Quarterly</td>
<td>• 16,000 businesses surveyed as part of Business Indicators Survey</td>
<td>• Industry (excluding Agriculture, forestry and fishing and Public administration and safety)</td>
<td>• Reflects only private sector</td>
</tr>
<tr>
<td>ABS 5676.0</td>
<td>First published May 2001</td>
<td></td>
<td></td>
<td>• Measures gross earnings (including entitlements) before taxation and other deductions</td>
</tr>
<tr>
<td>Average weekly total cash</td>
<td>Biennial</td>
<td>• Surveys from 8,200 employer units; Data collected from employers on 53,000 employees</td>
<td>• Sector</td>
<td>• Provides information on earnings by method of setting pay</td>
</tr>
<tr>
<td>earnings</td>
<td>First published May 1993 (annual between 1993 and 1996; biennial thereafter)</td>
<td></td>
<td>• Industry</td>
<td>• Composition of sample changes for each survey period</td>
</tr>
<tr>
<td>ABS 6306.0</td>
<td></td>
<td></td>
<td>• All workers split by role (managerial/ non-managerial)</td>
<td></td>
</tr>
</tbody>
</table>

Source: ABS, Fair Work Commission, KPMG Economics

2. Presented in Log of Index number (1995 = 100.0)
Real producer wages by industry

The aggregate measure of the Australian RPW grew, on average, by about 0.9% per annum between 1995 and 2018. Chart 2 highlight two key features:

i. between 2001 and 2013 the RCW grew more rapidly than the RPW; and
ii. there is an inflection point in the RCW around 2013 after which it has gone sideways (i.e., no growth in the RCW after 2013).

This lack of growth in the RCW over the last 5 years has been the focus of concern. Over the same period the RPW, reflecting the real cost of hiring labour, grew sharply until 2016 before falling back in the last couple of years to remain almost 4% higher than in 2013.

The rate of growth in the RPW was particularly rapid between 2009 and 2016. Since 2016 the RPW has fallen by almost 2.5%, which may explain in part the rapid growth in employment experienced in that period.

The recent lack of growth in the RCW has accentuated concerns that the long run relationship between wage growth and productivity in Australia has broken down. The growth in the RPW over the same period suggests that care must be taken in analysing the drivers of wage growth in the recent period.

Our priors are that analysing wage growth at the aggregate level may be masking key underlying mechanisms. Casual observation of the wage data at the industry level suggests that there is significant variation in growth rates across industries, with some industries recording growth rates in wages significantly above the national average and others significantly below.

Charts 3 and 4 show how the RPW wage has moved on an industry basis over the past 23 years.

The industries that have recorded the greatest overall increase in the RPW have been the Information, communication and telecommunication sector (195%); Wholesale trade (82%) and Retail trade (62%). Conversely, the industries with the lowest growth in the RPW are Administrative and support services (-29%) and Accommodation and food services sector (-14%). Over the last 5 years however, the sectors experiencing the lowest growth in the RPW have been Construction, Accommodation and food services, and Manufacturing.

A standout feature of this analysis are the results for the Mining industry, which as per Chart 3, is shown to have experienced dramatic rises and falls in its estimated RPW during the past two decades. As discussed previously, this substantial movement in the RPW for the Mining industry can be predominately explained by the correspondingly highly volatility in the market price for Mining outputs. This is shown in Chart 5 where the movements in the RPW for the Mining sector are inversely correlated to prices for bulk commodities (i.e., coal) and base metals (i.e., iron ore).

In the context of this analysis, the rise in Australian dollar price of mining outputs has the effect of reducing the real wage rate from the perspective of the producer (i.e., the real cost of labour is lower). Conversely, when the Australian dollar price of mining output fell, it had the opposite effect in increasing real wages for producers in the industry.

An alternative to looking at the RPW growth through a narrow lens (such as individual industry growth) is to consider real wages growth in each industry relative to the labour market as a whole and also against other individual industries.

3. As explained in Footnote 1, for the disaggregated industry analysis in this section of the report we have applied a GDP factor cost deflator for each industry calculated using the Fisher equation to measure the price wedge between Industry Gross Value Added at constant prices and IGVA at current prices.
Chart 3: Average Weekly RPW by Selected Industry, Australia

Source: ABS, KPMG Economics

Chart 4: Average Weekly RPW by Selected Industry, Australia

Source: ABS, KPMG Economics
Chart 5: Mining RPW and Price of Base Metals & Bulk Commodities

Source: RBA, ABS, KPMG Economics

Chart 6 shows the compound average annual growth in the RPW by industry for the period 1995 to 2018 and 2013 to 2018, while Chart 7 shows the same but for the RCW. This analysis helps us frame wage performance by industry, which can be broadly classified into 4 different categories with respect to their experience with movement in the RPW and the RCW.


Source: ABS, KPMG Economics
Chart 7: Compound average annual growth in the RCW by Industry, 1995 – 2018 and 2013 – 2018

Chart 8: Analysis of drivers of the RPW and the RCW changes in terms of Nominal Wages, Producer Prices and Consumer Prices

Source: ABS, KPMG Economics

Source: KPMG Economics
These categories, which align to the coloured quadrants in Chart 8, are presented in terms of gains and losses in real wages from the perspective of the employer (RPW) and the employee (RCW). That is:

**Quadrant 1: Upper Left**
The RCW goes up at the same time as the RPW goes down. In this case wages grow faster than the CPI increasing the purchasing power of workers employed in this industry. The output price of the industry grows faster than wages. Other things equal, this reduces the cost of hiring workers and induces the industry to increase its labour intensity. Whether this results in an increase in employment is uncertain as the output price for industries in this quadrant grow faster than the CPI, which may indicate a reduction in their competitiveness.

**Quadrant 2: Upper Right**
The RCW goes up at the same time as the RPW goes up. In this case wages grow faster than the CPI increasing the purchasing power of workers employed in this industry. Wages also grow faster than the output price of the industry. Other things equal this increases the cost of hiring workers and induces the industry to reduce its labour intensity. Above the diagonal the output price for industry grows faster than the CPI, which may indicate reduced competitiveness. Below the diagonal the output price grows slower than the CPI, which may reflect an increase in competitiveness.

**Quadrant 3: Lower Right**
The RCW goes down at the same time as the RPW goes down. In this case wages grow slower than the CPI reducing the purchasing power of workers employed in this industry. Wages grow faster than the output price of the industry. Other things equal this decreases the cost of hiring workers and induces the industry to reduce its labour intensity. Whether this results in a decrease in employment is uncertain. The output price grows slower than the CPI, which may reflect an increase in competitiveness.

**Quadrant 4: Lower left**
The RCW goes down at the same time as the RPW goes down. In this case wages grow slower than the CPI reducing the purchasing power of workers employed in this industry. Wages grow slower than the output price of the industry. Other things equal this decreases the cost of hiring workers and induces the industry to increase its labour intensity. Whether this results in an increase in employment is uncertain. Above the diagonal the output price for industry grows faster than the CPI, which may indicate reduced competitiveness. Below the diagonal the output price grows slower than the CPI, which may reflect an increase in competitiveness.

Over the long term we expect industries to be clustered in quadrant 2 along the diagonal, with productivity growth determining how far from the origin industries cluster. The clustering of industries will reflect flexibility of the labour market with workers able to move to higher paying industries and new entrants to the labour market acquiring skills required to work in the high paying industries. In the shorter term we know from our previous analysis that terms of trade movements can allow the RPW and the RCW to move differently, bringing into play other quadrants. Other transitory impacts on the labour market, including demand shocks (such as construction booms), supply shocks (such as increases/decreases in the immigration rate or temporary foreign workers) and changes in industrial relations practices may also allow the RPW and the RCW growth rates to be negative and/or to diverge.

Chart 9 plots the average annual growth rate of the RPW against the RCW for each industry over the full sample period of 1995 to 2018. Chart 10 plots the same information for the sub-sample period of 2013 to 2018.
Chart 9: Average annual growth in the RPW and the RCW, 1995 – 2018

Source: KPMG Economics

Chart 10: Average annual growth in the RPW and the RCW, 2013 – 2018

Source: KPMG Economics
Chart 9 shows that for the full sample most industries are placed in quadrant 2 and there is some clustering close to the diagonal in the range of 1% – 1.5% for the RPW and the RCW. Chart 9 also reveals some outliers.

- Average growth in the RPW for the Mining sector is marginally negative while the RCW is relatively high, most likely reflecting the strong growth in the price of Mining outputs over this period. The Rental, hiring and real estate services industry records similar RCW growth to the Mining sector with no growth in the RPW.

- The Administrative and support services and Accommodation and food services sectors record the largest negative rate of RPW growth, with the former recording the RCW growth that is similar to the majority of industries and the latter recording the only negative RCW;

- The Information, media and telecommunications sector records the highest growth in the RPW by some margin and the highest RCW. This indicates that the output price for this sector has grown less rapidly than the CPI, which may reflect technical innovation in the sector and pricing pressure for foreign competitors.

Chart 10 shows that for the sub-sample ranging from 2013 to 2018 most industries are placed in quadrant 2 although relative to the full sample the mass of the observations is closer to horizontal axis (i.e., generally lower RCW growth rates). Other notable features of the recent sub-sample include:

- Four industries – Mining, Construction, Electricity, gas, water and waste services, and Other services – experienced negative growth in their RCW during the most recent years, while over the past two decades they have generally enjoyed positive growth in their RCW. It is the employees in these industries that will have noticed the greatest apparent decline in their wage growth and their consumption power;

- Only Transport, postal and warehousing experienced an increase in their RCW during the last five years compared to their longer run experience; and even then this only amounted to a slight difference of around 0.5% in compound average annual growth terms; and

- None of the five low income earning industries have achieved an improvement in their RCW during the last five years, indicating that the lowest paid workers in the economy have continued to experience little progression, or have even gone backwards, in the purchasing power associated with any wage growth outcome.

In Appendix 3 we show that in a stylised model of long run equilibrium the RPW is a function of technical change and the capital-labour ratio. In this stylised model the growth in the RPW is equal to the sum of the rate of growth in technical change and the growth in the capital-labour ratio multiplied by an elasticity that reflects the capital intensity of the industry. The theoretical analysis in Appendix 3 reaffirms the proposition that in competitive markets, an industry will maximise profits in the long run by employing labour up to the point where its marginal product is equal to the real wage.
Table 2: Relative movement in the RCW by industry

<table>
<thead>
<tr>
<th>Industry</th>
<th>Zone in full sample</th>
<th>Zone in sub-sample</th>
<th>Difference in RCW growth</th>
<th>Nominal AWE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>3</td>
<td>8</td>
<td>-3.1%</td>
<td>M</td>
</tr>
<tr>
<td>Other services</td>
<td>3</td>
<td>6</td>
<td>-2.8%</td>
<td>L</td>
</tr>
<tr>
<td>Mining</td>
<td>2</td>
<td>5</td>
<td>-2.7%</td>
<td>H</td>
</tr>
<tr>
<td>Info., media &amp; telco.</td>
<td>4</td>
<td>4</td>
<td>-2.3%</td>
<td>H</td>
</tr>
<tr>
<td>Elect., gas, wat. &amp; waste serv.</td>
<td>3</td>
<td>4</td>
<td>-2.3%</td>
<td>H</td>
</tr>
<tr>
<td>Accom. &amp; food serv.</td>
<td>8</td>
<td>7</td>
<td>-2.2%</td>
<td>L</td>
</tr>
<tr>
<td>Prof., scien. &amp; technical serv.</td>
<td>3</td>
<td>4</td>
<td>-2.0%</td>
<td>H</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>4</td>
<td>7</td>
<td>-1.9%</td>
<td>M</td>
</tr>
<tr>
<td>Wholesale trade</td>
<td>4</td>
<td>4</td>
<td>-1.9%</td>
<td>M</td>
</tr>
<tr>
<td>Financial &amp; insurance serv.</td>
<td>4</td>
<td>2</td>
<td>-1.3%</td>
<td>H</td>
</tr>
<tr>
<td>Retail trade</td>
<td>4</td>
<td>4</td>
<td>-0.9%</td>
<td>L</td>
</tr>
<tr>
<td>Arts &amp; recreation serv.</td>
<td>4</td>
<td>4</td>
<td>-0.8%</td>
<td>L</td>
</tr>
<tr>
<td>Rental, hiring &amp; real est. serv.</td>
<td>2/3</td>
<td>4</td>
<td>-0.2%</td>
<td>M</td>
</tr>
<tr>
<td>Admin. &amp; support serv.</td>
<td>1</td>
<td>4</td>
<td>0.0%</td>
<td>L</td>
</tr>
<tr>
<td>Trans., postal &amp; warehousing</td>
<td>4</td>
<td>4</td>
<td>0.1%</td>
<td>M</td>
</tr>
</tbody>
</table>

Source: KPMG Economics
Key factors influencing wages

Economic theory tells us that in competitive markets, firms will maximise profits in the long run by employing labour up to the point where its marginal product is equal to the RPW (ratio of the price paid for a unit of labour to the price received for a unit of output). Under these conditions the marginal product of labour is a function of the capital-labour ratio and labour productivity. The RPW is, therefore, a function of the capital-labour ratio and labour productivity.

In this chapter we examine these factors and consider whether they individually or collectively are materially influencing real wage outcomes in Australia.

Labour productivity

Labour productivity is simply measured as the change in output per unit of labour. In this study we have utilised the measures of labour productivity by industry as presented in the national accounts (ABS 5204.0, Table 15).

Despite the ABS improving their data collection and analysis techniques to estimate gross value added (on a chain volume basis) within Australia’s national accounts for other service industries considered to be non-market, the ABS also notes that the improvements are not sufficient to enable the creation of reliable productivity estimates for the education and training sector (ABS, 2001).

Also, given the well-known problems of estimating MFP for government services that are provided at non-market prices (Productivity Commission, 2017b), the whole social services sub-sector has been excluded from the productivity calculations contained within this study (ABS, 2001).

Charts 11 and 12 show estimated labour productivity by selected industry since 1995, while Table 2 presents compound average annual growth rates for labour productivity by industry for three time periods; 1995 to 2018; 1995 to 2013; and 2013 to 2018.

The industries exhibiting the strongest improvement in labour productivity over this period were Wholesale trade; Information, communications and media; and Financial and insurance services. Conversely, the industries exhibiting the poorest growth in labour productivity over the past 23 years were Electricity, gas, water and waste services; Mining; and Arts and recreation.

Further, there is clearly a marked decline in labour productivity across a number of industries since the 2013, including Manufacturing; Electricity, gas, water and waste services; Construction; Information, media and communications; and Other services. However, there has also been a marked increase in labour productivity across a similar number of industries, including Mining; Wholesale trade; Financial and insurance services; Professional, scientific and technical services; and Arts and recreation services.
The point of highlighting these above average and below average industries is that the variability in labour productivity across industries in Australia over the past two decades has been significant. Arguments that labour productivity in Australia has recently been non-existent, or materially below our long run average, may hold at an aggregate level, but once data is considered at a disaggregated level, then such broad statements do not hold true across all industries.

We know that changes in labour productivity can occur for a variety of reasons, however two headline factors influencing labour productivity are the amount of capital available per worker (referred to as “capital-deepening”), and how well capital and labour work together (multifactor productivity) (Treasury, 2015). Research by Gust and Marguez (2004) also found that the countries that more intensely used information technology and operated with a less regulated labour market were also the countries that exhibited the highest levels of labour productivity.

**Chart 11: Labour Productivity by Selected Industry, Australia**

Source: ABS, KPMG Economics

**Chart 12: Labour Productivity by Selected Industry, Australia**

Source: ABS, KPMG Economics
The capital-labour (K/L) ratio is a measure of the proportion of capital to labour inputs. Where capital and labour inputs increase in the same proportion over time, then the K/L ratio remains constant, whereas if capital inputs increase relative to labour inputs, then the K/L ratio rises, and conversely, where labour inputs increase relative to capital inputs, the K/L ratio falls.

As noted above, the term “capital-deepening” is often referred to as one the key factors influencing labour productivity, and is reflective of an increasing capital-labour ratio over time.

Chart 13 shows the current capital-labour ratio, as measured by the real value of Australia’s productive capital stock (ABS 5260.0.55.002, Table 13) divided by the number of hours actually worked in all jobs (ABS 6291.0.55.003, Table 11), and the proportion of gross value added each industry contributed in 2018. As shown, there is not necessarily a causal relationship between the level of capital intensity each industry has and how much they represent of Australia’s economy.

Chart 14 extends this analysis and presents changes in the capital-labour ratio by industry between 1995 and 2018. This analysis shows the two most capital intensive industries, Mining and Electricity, gas, water and waste services, took marginally divergent approaches to employing factors of production during the past 23 years. In recent years mining employed significantly more capital than it has historically done in the past, pushing its capital-labour ratio notably higher by 2018 than what it was in 1995. In comparison, the utilities sector continued to employ high levels of capital relative to labour, but over the 23 year period to 2018 its increase in the use of capital was marginally lower than the increases in capital intensity experienced across all industries.

Another noticeable finding in the analysis presented in Chart 14 is that the Information, media and communications industry moved from being a relatively labour-intensive sector in 1995 to being a relatively capital-intensive sector by 2018. This is not a surprising result given over this period society has witnessed the significant uptake in computer technology, the use of the internet and the demise of traditional forms of print media to the current forms of electronic media.

Table 3: Labour productivity growth rates

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mining</td>
<td>0.1%</td>
<td>-2.4%</td>
<td>9.6%</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>1.6%</td>
<td>2.0%</td>
<td>0.1%</td>
</tr>
<tr>
<td>Electricity, gas, water, waste services</td>
<td>-0.6%</td>
<td>-0.6%</td>
<td>-0.2%</td>
</tr>
<tr>
<td>Construction</td>
<td>1.3%</td>
<td>2.5%</td>
<td>-2.8%</td>
</tr>
<tr>
<td>Wholesale trade</td>
<td>4.1%</td>
<td>3.7%</td>
<td>5.6%</td>
</tr>
<tr>
<td>Retail trade</td>
<td>2.6%</td>
<td>2.9%</td>
<td>1.4%</td>
</tr>
<tr>
<td>Accommodation and food services</td>
<td>1.3%</td>
<td>1.4%</td>
<td>1.1%</td>
</tr>
<tr>
<td>Transport, postal and warehousing</td>
<td>1.5%</td>
<td>2.2%</td>
<td>-0.9%</td>
</tr>
<tr>
<td>Information, communication and media</td>
<td>3.8%</td>
<td>3.3%</td>
<td>5.6%</td>
</tr>
<tr>
<td>Financial and insurance services</td>
<td>3.2%</td>
<td>3.3%</td>
<td>3.0%</td>
</tr>
<tr>
<td>Rental, hire and real estate services</td>
<td>1.1%</td>
<td>0.4%</td>
<td>3.9%</td>
</tr>
<tr>
<td>Professional, scientific and technical services</td>
<td>1.3%</td>
<td>1.4%</td>
<td>1.3%</td>
</tr>
<tr>
<td>Administrative and support services</td>
<td>1.1%</td>
<td>0.8%</td>
<td>2.5%</td>
</tr>
<tr>
<td>Arts and recreation</td>
<td>0.6%</td>
<td>0.7%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Other services</td>
<td>1.5%</td>
<td>1.8%</td>
<td>0.6%</td>
</tr>
<tr>
<td>Total</td>
<td>1.7%</td>
<td>1.8%</td>
<td>1.1%</td>
</tr>
</tbody>
</table>

Source: ABS, KPMG Economics
Chart 13: K/L Ratio and Proportion of GVA by Industry, 2018

Source: ABS, KPMG Economics

Chart 14: Movement in the K-L ratio by Industry, 1995 – 2018

Source: ABS, KPMG Economics
Technology and innovation

Technology and innovation are recognised as playing a crucial element in economic growth. Schumpeter, one of the leading economists of the 20th century, noted

The fundamental impulse that sets and keeps the capitalist engine in motion comes from the new consumers’ goods, the new methods of production or transportation, the new markets, …[it] incessantly revolutionises the economic structure from within, incessantly destroying the old one, incessantly creating a new one. (Schumpeter, 1942)

Importantly, technical augmentation should be considered more than just the number of computers a business or industry uses in its production process; but it also incorporates concepts like research and development and innovation. Such concepts are very difficult to measure, and historically economists have often assumed this factor remains constant over time.

The ABS disaggregates productive capital stock into a number of asset categories, including:

- Intellectual property products – computer software;
- Intellectual property products – research and development;
- Machinery and equipment – computers; and
- Machinery and equipment – electrical and electronic equipment.

While not exhaustive, we have considered these asset classes to be a reasonable representation of the type of capital necessary for technical augmentation to occur.

As shown in Charts 15 and 15a, all industries in Australia increased the relative proportion of technology assets in their capital stock except for Mining. Of the slightly more than $1 trillion net increase in the Mining industry’s real capital stock, nearly 70% was associated with non-residential construction assets, while only around 1% was associated with technology assets, which was not enough to improve or even maintain its high tech capital ratio.

The industries which recorded the greatest net increase in their real technology capital stock between 1995 and 2018 were Financial and Insurance services; Professional, scientific and technical services; and Manufacturing. Conversely, the industries with the lowest net increase in their real technology capital stock were Accommodation and food services; Other services; and Administration and support services – notably these are the same industries that recorded low growth in the RPW over the same time period.

Chart 15: Proportion of Industry Capital Stock associated with Technology Assets, 1995 and 2018

Source: ABS, KPMG Economics

Chart 15a: Proportion of Industry Capital Stock associated with Technology Assets, 1995 and 2018

Source: ABS, KPMG Economics
Wages, productivity and technology

Linking the RPW to labour productivity, capital, labour and technology

We have borrowed key ideas from economic theory relating to wage growth to analyse the available data. Having identified there are various measures of wages compiled by the ABS, we discussed the pros and cons of each, and identified Average Weekly Earnings (AWE) as the “best” measure for our analysis.

The analysis of actual wages growth in Australia by industry from 1995 to 2018 has been done from the perspective of both the employer and the employee. Our commentary on the underlying economic theory focussed on three key factors that influence the rate of growth in the RPW, being labour productivity, the capital-labour ratio and the technical augmentation, and each of these have been analysed on an industry-by-industry basis.

Appendix 3 shows that in a stylised model the long run relationship between the RPW, the capital-labour ratio and technical change is given by:

\[ \frac{W}{P_o} = \beta \cdot A \cdot (K/L)^\theta \]

In the special case of a Cobb-Douglas production function the technical change variable can be interpreted as labour-saving technical change.

To test whether the above relationship was a reasonable characterisation of the available data we tested it using OLS and a time series panel dataset disaggregated by industry for the period 1995 to 2018. We are satisfied that the statistical relationship between the RPW and the identified variables is sufficiently robust to be a meaningful basis for analysing the industry-level data.

Table 3 presents the estimates of the parameter values associated with the long run RPW’s model, being:

\[ Y_{i,t} = \theta + \delta X_{1i,t} + \phi X_{2i,t} + \psi X_{3i,t} + \varepsilon_t \]

where

\[ Y_{i,t} = \text{log RPW in year } t \text{ by industry } i \]
\[ \theta = \text{constant term}^8 \]
\[ X_{1i,t} = \text{log of labour productivity in year } t \text{ by industry } i \]
\[ X_{2i,t} = \text{log of the proportion of industry capital that is technology capital in year } t \text{ by industry } i \]
\[ X_{3i,t} = \text{log of capital-labour ratio in year } t \text{ by industry } i \]
\[ \varepsilon_t = \text{residual in year } t \]

Table 4: Estimates of long run parameter values

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Values(†)</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \theta )</td>
<td>4.802 (13.16)***</td>
</tr>
<tr>
<td>( X_1 )</td>
<td>0.563 (7.04)***</td>
</tr>
<tr>
<td>( X_2 )</td>
<td>0.154 (8.12)***</td>
</tr>
<tr>
<td>( X_3 )</td>
<td>0.193 (13.54)***</td>
</tr>
<tr>
<td>( R^2 )</td>
<td>0.437</td>
</tr>
<tr>
<td>( RSS )</td>
<td>35.3</td>
</tr>
<tr>
<td>( n )</td>
<td>360</td>
</tr>
</tbody>
</table>

*** Significant at 1% level
** Significant at 5% level
* Significant at 10% level
† Values in parentheses are t-statistics
Source: KPMG Economics

5. Industries included were Mining; Manufacturing; Electricity, gas, water and waste services; Construction; Wholesale Trade; Retail Trade; Accommodation and food services; Transport, postal and warehousing; Information, media and telecommunications; Financial and insurance services; Rental, hiring and real estate services; Professional, scientific and technical services; Administrative and support services; Arts and recreation services; and Other services.

6. Note that it was not our intention to test whether a constant returns to scale Cobb-Douglas production function was the best characterisation of the data. Rather, we were seeking to verify that it was reasonable to use this simplified structure to make some general observations regarding the relationship between real wages, labour productivity and the capital-labour ratio at the industry level with the available data.

7. The capital-labour ratio has been split between technology capital and all other capital.

8. A constant term is included in the equation to take into account for differences in the units of measure between the LHS and RHS variables.
The above analysis shows labour productivity to be the key factor in driving growth in the RPW. Consistent with basic economic theory it is not the only factor driving the RPW growth.

An interpretation of the above results is that slightly more than half of the change in our measure of the RPW comes from changes in our measure of labour productivity, while nearly 40% is due to industries propensity to employ more high-tech capital, and more relatively more capital compared to labour, in their production processes.

The above analysis looks at the relationship driving the RPW in the long run and assumes an absence of any structural breaks, including whether the relationship between real wages and key drivers has broken down in the recent period. While we do not formally test for structural breaks we have calculated the average residual values across all industries for the period 1995 to 2018 and also for the period 2013 to 2018.

Table 5: Estimates of average residual value of long run relationship

<table>
<thead>
<tr>
<th>Period</th>
<th>Average residual†</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995 - 2018</td>
<td>0.000</td>
</tr>
<tr>
<td>2013 - 2018</td>
<td>-0.063</td>
</tr>
</tbody>
</table>

† Residual = Log(estimated value) – Log(actual value)
Source: KPMG Economics

The information in Table 5 shows the residual of the long run relationship averages zero over the full sample – consistent with expectations under OLS – but over the last five years the residual averages –6%. This suggests that during the most recent period there has been something different in how productivity, the capital stock mix and labour and technology, either collectively or individually, have impacted the RPW.

To try to understand this change in the relationship we have analysed each partial indicator with respect to the RPW over the full sample and the sub-sample consisting of the last five years.

Table 6: Compound average annual growth rates by indicator, 1995 – 2018

<table>
<thead>
<tr>
<th>Industry</th>
<th>RPW</th>
<th>LP</th>
<th>KL</th>
<th>Tech Capital</th>
<th>Employ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information media and telecommunications</td>
<td>4.8%</td>
<td>3.8%</td>
<td>3.0%</td>
<td>5.4%</td>
<td>1.0%</td>
</tr>
<tr>
<td>Wholesale trade</td>
<td>2.6%</td>
<td>4.1%</td>
<td>2.5%</td>
<td>5.8%</td>
<td>-0.8%</td>
</tr>
<tr>
<td>Retail trade</td>
<td>2.1%</td>
<td>2.6%</td>
<td>1.8%</td>
<td>5.2%</td>
<td>1.5%</td>
</tr>
<tr>
<td>Financial and insurance services</td>
<td>1.9%</td>
<td>3.2%</td>
<td>-0.4%</td>
<td>21.5%</td>
<td>1.5%</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>1.8%</td>
<td>1.6%</td>
<td>2.3%</td>
<td>6.5%</td>
<td>-0.5%</td>
</tr>
<tr>
<td>Arts and recreation services</td>
<td>1.2%</td>
<td>0.6%</td>
<td>0.9%</td>
<td>4.4%</td>
<td>3.1%</td>
</tr>
<tr>
<td>Construction</td>
<td>1.1%</td>
<td>1.3%</td>
<td>0.5%</td>
<td>8.3%</td>
<td>3.0%</td>
</tr>
<tr>
<td>Transport, postal and warehousing</td>
<td>1.1%</td>
<td>1.5%</td>
<td>0.8%</td>
<td>1.4%</td>
<td>1.7%</td>
</tr>
<tr>
<td>Electricity, gas, water and waste services</td>
<td>0.7%</td>
<td>-0.6%</td>
<td>0.1%</td>
<td>2.6%</td>
<td>2.1%</td>
</tr>
<tr>
<td>Professional, scientific and technical services</td>
<td>0.7%</td>
<td>1.3%</td>
<td>1.2%</td>
<td>13.2%</td>
<td>3.5%</td>
</tr>
<tr>
<td>Other services</td>
<td>0.6%</td>
<td>1.5%</td>
<td>6.6%</td>
<td>8.2%</td>
<td>0.9%</td>
</tr>
<tr>
<td>Rental, hiring and real estate services</td>
<td>0.0%</td>
<td>1.1%</td>
<td>1.0%</td>
<td>2.0%</td>
<td>2.5%</td>
</tr>
<tr>
<td>Mining</td>
<td>-0.2%</td>
<td>0.1%</td>
<td>1.9%</td>
<td>-0.5%</td>
<td>4.4%</td>
</tr>
<tr>
<td>Accommodation and food services</td>
<td>-0.7%</td>
<td>1.3%</td>
<td>0.7%</td>
<td>2.7%</td>
<td>2.2%</td>
</tr>
<tr>
<td>Administrative and support services</td>
<td>-1.5%</td>
<td>1.1%</td>
<td>1.1%</td>
<td>13.9%</td>
<td>2.4%</td>
</tr>
</tbody>
</table>

Source: KPMG Economics
Tables 5 and 6 show the compound average annual growth rates of the RPW, labour productivity, the capital-labour ratio, the stock of technical capital, and employment by industry for the periods 1995 to 2018 (Table 5) and 2013 to 2018 (Table 6). The industries are ranked in each table from the highest to the lowest growth in the RPW across each respective time period (with the colour coding reflecting strongest growth in darker blue shades to weakest growth in darker red shades).

We also present this same data in the following charts; being average annual growth in industry RPW is plotted against the compound average annual growth in labour productivity (Chart 16), the capital-labour ratio (Chart 17), the proportion of technology capital employed by industry (Chart 18) and employment (Chart 19). In each chart the full sample datapoints are represented by the blue markers and the sub-sample datapoints are shown by the green markers.

The key findings from this analysis are:

- There is some evidence that in the last five years a given rate of growth in labour productivity has translated into a smaller increase in the RPW growth than was the case over the full sample;
- There is some evidence that growth in the capital-labour ratio across industries has been in a narrower range in the past 5 years compared to the full sample and that the relationship between growth in the capital-labour ratio and growth in the RPW, which is relatively weak in the full sample is weaker still in the last five years;
- There appears to have been a step-change in the importance of the role of high tech capital as a driver of the RPW growth over the last 5 years compared to the full 20 years; and
- There is an inverse relationship between the rate of growth of the RPW and the rate of growth in employment. Chart 17 indicates that strong employment growth is difficult to achieve with strong growth in the RPW.

### Table 7: Compound average annual growth rates by indicator, 2013 – 2018

<table>
<thead>
<tr>
<th>Industry</th>
<th>RPW</th>
<th>LP</th>
<th>KL</th>
<th>Tech Capital</th>
<th>Employ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information media and telecommunications</td>
<td>6.5%</td>
<td>5.6%</td>
<td>4.6%</td>
<td>-0.8%</td>
<td>1.3%</td>
</tr>
<tr>
<td>Wholesale trade</td>
<td>2.3%</td>
<td>5.6%</td>
<td>4.8%</td>
<td>1.1%</td>
<td>-3.3%</td>
</tr>
<tr>
<td>Rental, hiring and real estate services</td>
<td>2.3%</td>
<td>3.9%</td>
<td>1.3%</td>
<td>-0.1%</td>
<td>2.6%</td>
</tr>
<tr>
<td>Retail trade</td>
<td>2.2%</td>
<td>1.4%</td>
<td>1.5%</td>
<td>0.7%</td>
<td>0.5%</td>
</tr>
<tr>
<td>Mining</td>
<td>1.9%</td>
<td>9.6%</td>
<td>9.4%</td>
<td>-0.9%</td>
<td>-2.0%</td>
</tr>
<tr>
<td>Professional, scientific and technical services</td>
<td>1.6%</td>
<td>1.3%</td>
<td>1.2%</td>
<td>2.6%</td>
<td>3.1%</td>
</tr>
<tr>
<td>Administrative and support services</td>
<td>1.6%</td>
<td>2.5%</td>
<td>-0.6%</td>
<td>4.9%</td>
<td>1.4%</td>
</tr>
<tr>
<td>Electricity, gas, water and waste services</td>
<td>1.6%</td>
<td>-0.2%</td>
<td>0.6%</td>
<td>0.4%</td>
<td>0.5%</td>
</tr>
<tr>
<td>Transport, postal and warehousing</td>
<td>1.3%</td>
<td>-0.9%</td>
<td>0.5%</td>
<td>0.1%</td>
<td>1.0%</td>
</tr>
<tr>
<td>Arts and recreation services</td>
<td>0.9%</td>
<td>0.0%</td>
<td>0.2%</td>
<td>1.1%</td>
<td>2.0%</td>
</tr>
<tr>
<td>Financial and insurance services</td>
<td>0.5%</td>
<td>3.0%</td>
<td>0.3%</td>
<td>7.1%</td>
<td>1.1%</td>
</tr>
<tr>
<td>Other services</td>
<td>0.2%</td>
<td>0.6%</td>
<td>4.7%</td>
<td>0.8%</td>
<td>0.9%</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>-0.3%</td>
<td>0.1%</td>
<td>-0.4%</td>
<td>0.7%</td>
<td>0.9%</td>
</tr>
<tr>
<td>Accommodation and food services</td>
<td>-0.5%</td>
<td>1.1%</td>
<td>-1.3%</td>
<td>0.6%</td>
<td>2.6%</td>
</tr>
<tr>
<td>Construction</td>
<td>-1.3%</td>
<td>-2.8%</td>
<td>-0.5%</td>
<td>-0.7%</td>
<td>3.6%</td>
</tr>
</tbody>
</table>

Source: KPMG Economics
Chart 16: Relationship between the Compound Average Annual Growth of the RPW and Labour Productivity by Industry

Source: ABS, KPMG Economics

Chart 17: Relationship between the Compound Average Annual Growth of the RPW and the Capital-Labour Ratio by Industry

Source: ABS, KPMG Economics
Chart 18: Relationship between the Compound Average Annual Growth of the RPW and Technology Capital Stock by Industry

Source: ABS, KPMG Economics

Chart 19: Relationship between the Compound Average Annual Growth of the RPW and Employment by Industry

Source: ABS, KPMG Economics
Further, from the charts one can also see the relationship between the RPW and labour productivity is broadly consistent across the two periods, with the difference in the last 5 years generally relating to one or two outlier industries (i.e., the mining sector has strongly influenced the relationship between the RPW and labour productivity in the last 5 years and the Information, media and communications sector has strongly influenced the relationship between the RPW and the capital-labour ratio in the last 5 years).

However, as noted above, there appears to have been a material change in the recent relationship between the RPW and high tech capital. This suggests that industries that are skewing their capital mix in favour of high tech capital may be in a better position to sustain wage growth in excess of output prices.

Overall, this analysis shows that there has not been a break down in the fundamental economic relationship that drives wages growth in Australia. Labour productivity remains the key factor influencing wages growth outcomes across all industries. The mix of capital and labour an industry employs is also influential in the wage outcome for workers.

Finally, our findings indicate that more recently technology assets may have become more influential in driving wages growth than has been the case in the past. This has potentially important implications because industries that fall behind in the use of high tech assets in their production processes will not be able to sustain wage growth and retain workers.
The wages growth puzzle has confounded economists, politicians and the general public alike. Some commentators and stakeholders have questioned whether the wage dynamics that have characterised labour markets in the past have broken down in more recent times.

In this paper KPMG has sought to examine this issue, and different to recent studies on this matter, we have considered wages growth on an industry-by-industry basis and contrasted outcomes in the last 5 years with outcomes over a longer historical period extending back to 1995. Importantly, we have considered real wage growth from the perspective of the employer via the behaviour of the RPW and from the perspective of the employee via the behaviour of the RCW. For large economies and for inwards-focused countries these two measures of real wages should more in a broadly similar fashion. For small open economies, like Australia, we show that the terms of trade can have a very influential role on real wages and, for a given nominal wage outcome, can result in workers and firms having different outcomes. The purchasing power of a worker’s wage can fall at the same time as the real cost of employing that worker rises.

And our lived experience is precisely that; upward swings in our terms of trade helped workers not only achieve real wage increases that improved their purchasing power without causing the real cost of hiring workers firms to rise sufficiently to discourage businesses from expanding employment opportunities.

We can see once the benefit of the terms of trade improvements dissipated, real wages in Australia from the perspective of the consumer have remained virtually flat, while aggregate RPWs have continued to increase. A question that warrants further consideration is whether Australia’s stellar terms of trade performance has masked underlying structural problems, including lower productivity growth, under-investment in capital generally, and tech capital in particular, that has left some industries with capital mixes and capital-labour ratios that are sub-optimal.

Our analysis has also highlighted that considering wage growth at the aggregate level may be inadequate, and industry-specific factors are important for understanding wage outcomes; one size does not fit all.

Our analysis shows that wage growth outcomes at the industry level are broadly determined by labour productivity, the mix of capital and labour employed and the relative importance of high tech capital stock in an industry’s production process. These relationships appear to hold both over the longer time horizon we examined, and also over the last few years, although in the recent period there is some evidence that the role of high tech capital has become much more important for wages growth.

Our key findings can be simply articulated by the following points:

- the factors driving wages growth in Australia do not appear to have changed in the past few years;
- labour productivity continues to be the dominant factor across all industries influencing wages outcomes;
- the mix of capital and labour and the role of high tech capital are also influential in driving wages growth; and
- wages in Australia benefitted significantly from the terms of trade boost we received during the “commodities boom”; and it is unlikely this once-in-a-generation positive impact will give us another free kick in wages growth anytime soon.

Domestic policy setting has a role in ensuring that wage growth is consistent with maximising societal welfare. Attempting to force wage growth beyond what can be supported by productivity growth and the mix of capital and labour may benefit those being applied with a job, but may result in less jobs being available.

Similarly, it is important to ensure policy settings do not constrain productivity growth or inappropriately skew the sharing of returns between labour and capital, otherwise we are likely to experience under-investment, fewer jobs and lower wages.
While “Big picture” policies such as:

- minimising congestion within the economy so the time spent at work by employees generates the maximum level of output possible;
- setting taxation policies that incentivise people to work and businesses to invest in capital in a timely manner that improves the quantity and quality of the output produced per worker;
- training staff such that workers skills are reflective of contemporary needs of the business and economy; and
- ensuring markets are open and transparent, thereby encouraging competition and promoting efficiency;

are important to improving productivity and therefore growing wages, our study also reaffirms the proposition that macro focussed policies need to be combined with micro economic reforms tailored to individual industries.
Appendix 1

The RPW and RCW Theory

The following shows under what conditions would the RPW and the RCW diverge from each other.

The consumer real wage can be defined as:

\[ RWC = \frac{W}{CPI} \]

and the RPW can correspondingly defined as:

\[ RWP = \frac{W}{PPI} \]

Also, consumer price inflation and producer price inflation can be calculated by:

\[ cpi = 100 \times \frac{dCPI}{CPI} \]

and

\[ ppi = 100 \times \frac{dPPI}{PPI} \]

The change in the CPI can also be found by:

\[ cpi = S_D \times p_D + (1 - S_D) \times p_M \]  \(1\)

where

- \( S_D \) = share of household expenditures on domestically produced goods
- \( P_D \) = % change in the price of domestically produced goods
- \( P_M \) = % change in the price paid by consumers for imported goods

The change in the PPI can correspondingly be found by:

\[ ppi = H_D \times p_D + (1 - H_D) \times p_X \]  \(2\)

where

- \( H_D \) = share of domestically produced goods sold domestically
- \( P_X \) = % change in the price received by producers for exports

Where PPI and CPI are synchronous, then taking equations (1) and (2) away from each should equal zero. To the extent there is a divergence between the two inflation indicators, then equation (3) should be non-zero. That is,

\[ cpi - ppi = S_D \times p_D + (1 - S_D) \times p_M - H_D \times p_D - (1 - H_D) \times p_X \]  \(3\)

or

\[ cpi - ppi = [S_D - H_D] \times p_D + (P_M - P_X) - S_D \times p_M + H_D \times p_X \]  \(4\)

where

- \( S_M = (1 - S_D) \)
- \( H_X = (1 - H_D) \)

Equation (4) shows that to the extent that Australia’s output and prices are influenced by foreign demand for, and the prices of, our goods and services and our demand for, and the prices we pay for, foreign goods and services, then the RPW and the RCW can diverge from each other.

9. Or some measure of Producer Price Index, such as GDP deflator at factor cost
Appendix 2

Annual Movement in the RPW and RCW by Industry, and compared against Annual Change in the Total Market RCW
Appendix 3

Economic Theory on the drivers of the RPW growth

Economic theory states that in a perfectly competitive market, a firm will maximise profits in the long run by employing labour inputs up to the point where the marginal product of those inputs is equal to the real wage (see, for example, Strauss & Wohar, 2004). In this context the real wage refers to ratio of the unit price of labour to the unit price of the firm’s output. We refer to this as the RPW.

To show the relationship between the RPW, the capital-labour ratio and labour productivity we use a highly stylised model.

We assume that output is a Cobb-Douglas function of capital (K), labour (L) and technical progress (A). That is:

\[ Q = AK^\alpha L^\beta \]  

Where \( \alpha \) and \( \beta \) are positive fractions with

\[ \alpha + \beta = z \]  

The production function (1) is homogenous of degree \( z \). In the special case where \( z = 1 \) the production technology exhibits constant returns to scale and production function (1) is homogenous of degree 1 (linearly homogenous).

The marginal products of capital and labour can be derived from (1) as follows:

\[ \frac{\partial Q}{\partial K} = \alpha \frac{AK^\alpha L^\beta}{K} = \alpha \frac{Q}{K} \]  

and

\[ \frac{\partial Q}{\partial L} = \beta \frac{AK^\alpha L^\beta}{L} = \beta \frac{Q}{L} \]  

Under the assumption of competitive markets there will be zero pure profits with revenues equal to costs. That is:

\[ P \ Q = W \ L + rK \]  

Where \( P \) is the unit price of output and \( W \) and \( r \) are the unit prices of labour and capital respectively. From (5) we can deduce that the marginal product of labour is equal to the RPW. That is:

\[ \frac{\partial Q}{\partial L} = \frac{W}{P} \]  

Equations (4) and (6) imply that

\[ \frac{W}{P} = \beta \frac{Q}{L} \]  

From equation (7) we can deduce that \( \beta \) is the share of labour in total costs. If we assume constant returns to scale (i.e., \( z = 1 \)) then equation (7) can be conveniently re-written as:

\[ \frac{W}{P} = (1 - \alpha) A \left[ \frac{K}{L} \right]^\alpha \]  

Equation (8) shows the RPW rate as a function of technical change and the capital-labour ratio. Taking log changes of equation (8) shows that the growth in the RPW is a function of growth in technical change and in the capital-labour ratio:

\[ dln \left( \frac{W}{P} \right) = dln(A) + \alpha dln \left[ \frac{K}{L} \right] \]  

In percentage changes (8) can be expressed simply as:

\[ \frac{W - p}{P} = \alpha + \alpha \left[ k - t \right] \]  

Where lower case letter are used to denote percentage changes in their upper case counterparts.

Note that in this illustrative model there is no distinction between the consumer and producer real wage as only one good is produced.

10. For the special case of the Cobb-Douglas production function there is no difference between all-factor (neutral) technical change and labour-saving technical change.
References


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