FEATURE ARTICLE

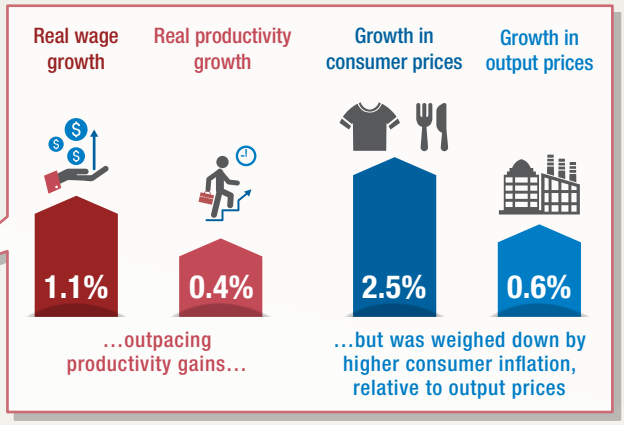
PRODUCTIVITY AND WAGE GROWTH IN SINGAPORE

INTRODUCTION

This article examines the extent to which real labour productivity gains have translated into real wage growth in Singapore. This is because the most direct mechanism by which productivity gains affect living standards is through higher wages. Furthermore, for wage growth to be sustainable, it has to grow in tandem with productivity growth.

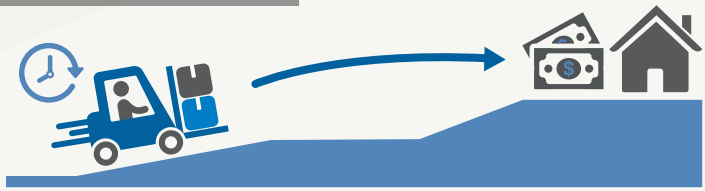
FINDINGS

At the overall economy level, real wages for resident workers grew 1.1% per annum over the past five years...



On average, over the last five years, sectors with higher productivity growth also saw higher wage growth for resident workers

POLICY TAKEAWAY



It remains vital to press on with our productivity drive, so as to ensure that Singaporeans' wages and living standards continue to improve

EXECUTIVE SUMMARY

- This article examines the relationship between productivity growth and the real wage growth of resident workers in Singapore. To do so, it adopts a methodology that decomposes the real average wage growth of resident workers into the following main components:
  (a) growth in labour productivity (i.e., real value-added per worker);
  (b) growth in labour's terms of trade (i.e., change in output prices relative to consumer prices); and
  (c) growth in the labour share of output (i.e., change in the share of output that accrues to labour).

- At the overall economy level, the real average wage growth of resident workers in Singapore outpaced labour productivity growth over the last decade (i.e., 2005 to 2015), and also in the more recent five-year period (i.e., 2010 to 2015). For both periods, this essentially reflected an increase in the labour share of output at the overall economy level.[1] The higher labour share helped to offset a decline in labour's terms of trade caused by stronger increases in consumer prices relative to output prices. However, it will be difficult to sustain increases in real wages over the longer term without a corresponding increase in productivity, given the potential impact on our economy's competitiveness.

- At the sectoral level, the real average wage growth of resident workers in some export-oriented sectors was dampened by a decline in labour's terms of trade, in part due to intense price competition faced by these sectors in global markets. On the other hand, weak productivity growth was found to have weighed on real wage growth in several domestically-oriented sectors. These findings suggest a continued need for export-oriented sectors to innovate and move up the value chain so as to offer products that command a price premium, and for domestically-oriented sectors to raise productivity, in order to raise the real wages of resident workers.

- Over the longer term, in order for real wage growth to be sustainable so that the living standards of Singaporeans can continue to improve, it is vital for us to press on with efforts to raise labour productivity.

The views expressed in this paper are solely those of the author and do not necessarily reflect those of the Ministry of Trade and Industry or the Government of Singapore.[2]

INTRODUCTION[3]

The most direct way in which productivity gains lead to improvements in living standards is through higher real wages. As such, it is important to understand the extent to which productivity gains have translated into real wage growth in Singapore.

Broadly, productivity gains have translated into real wage growth for resident workers in Singapore over the past ten years.[4] From 2005 to 2015, labour productivity in Singapore grew at a compounded annual growth rate (CAGR) of 0.5 per cent, while the real average monthly earnings (AME[5]) of resident workers rose by a higher 1.0 per cent per annum (p.a.) over the same period[6] [Exhibit 1]. In terms of the median real gross monthly income (GMI) (including employer CPF contribution) of resident workers, the growth was even higher at 2.0 per cent p.a. from 2005 to 2015.[7]

[1] The increase in the labour share of output at the overall economy level from 2010 to 2015 was driven largely by an increase in labour share across most sectors. There was also a slight shift in the composition of the economy towards sectors with above-average wage shares (e.g., construction and finance & insurance). For more details on the shift-share analysis of the change in labour share of output, please refer to Annex A.

[2] The author would like to thank Ms Yong Yik Wei, Dr Kuan Ming Leong and Mr Kenny Goh for their useful suggestions and comments. All remaining errors belong to the author.

[3] This article updates the earlier work done by Guo and Tan (2012) published in the Economic Survey of Singapore 2011.

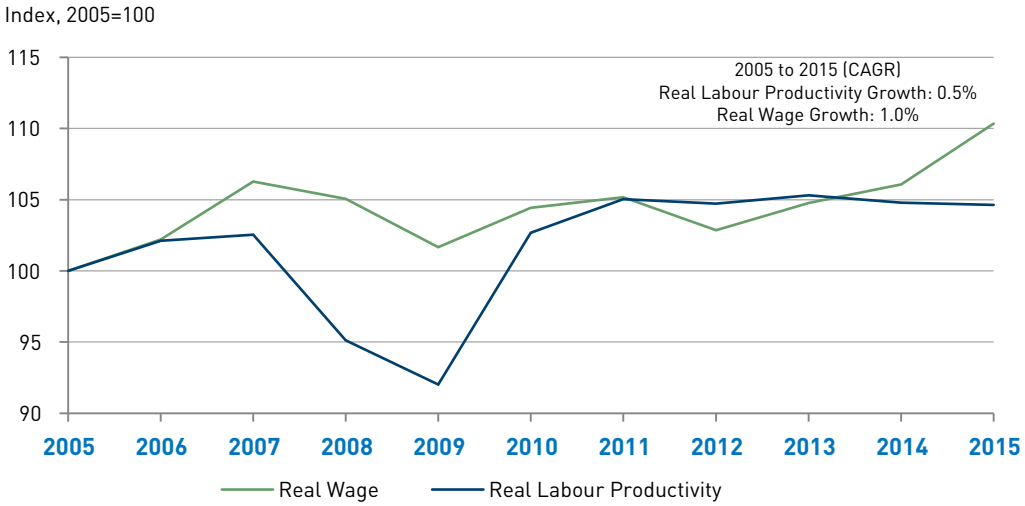
[4] In this article, productivity refers to labour productivity, i.e., real value-added (VA) per worker.

[5] AME refers to a worker's average monthly remuneration received before deduction of the employee Central Provident Fund (CPF) contributions and personal income tax. It comprises basic wages, overtime pay, commissions, allowances and bonuses but excludes employer CPF contributions. Data on AME are compiled based on the payroll of contributors to the CPF (administrative records), and cover full-time and part-time employees who have CPF contributions. They exclude identifiable self-employed persons who have made voluntary CPF contributions.

[6] The deflator for wages used throughout this study is the Consumer Price Index (CPI) for All Items.

[7] Data for 2005 is based on an average of the median GMI of resident workers in 2004 and 2006, as the Comprehensive Labour Force Survey was not conducted due to the conduct of the General Household Survey. There are a few possible reasons for the differences in the growth of the median real GMI of resident workers and real AME growth, including : (i) the AME growth measures average wage growth on a monthly year-on-year basis using wage data from CPF administrative records, whereas GMI growth measures changes in wages on a June-to-June basis using data from the Labour Force Survey; and (ii) due to the salary ceiling on CPF contributions, the AME may understate the wage growth of resident workers who earn above the ceiling.

Exhibit 1: Labour Productivity and Real Wage[8] Growth in Singapore, 2005 to 2015



Source: MTI Staff estimates based on administrative and survey records

Internationally, there is considerable variation in the extent to which productivity gains translate to real wage growth among the developed economies. Exhibit 2 shows the productivity and real wage growth in several developed economies from 2004 to 2014. Compared to these economies, the translation of productivity growth to real wage growth in Singapore has been relatively strong, with the ratio of real wage growth to productivity growth exceeding one (i.e., real wage growth exceeds productivity growth). By contrast, in economies such as the United States, Hong Kong and Japan, real wage growth was lower than the productivity gains over the same period.

Exhibit 2: Real Productivity and Real Average Wage Growth for Various Developed Economies[9]

	Real Productivity	Real Average Wage	Real Average Wage Growth as a Ratio of Productivity Growth
	CAGR (2004-2014)[10]		
Canada	0.6	2.0	3.1
France	0.5	0.9	2.0
Germany	0.5	0.6	1.4
Singapore[11]	**0.8**	**0.9**	**1.2**
Australia	0.9	0.9	1.0
United States	1.0	0.7	0.7
Korea	2.4	0.9	0.4
Hong Kong	2.5	0.1	0.1
Japan	0.5	0.0	0.0
United Kingdom	0.6	-0.3	-0.5

Source: MTI Staff estimates based on administrative and survey records, Hong Kong Census and Statistics Department, and the Organisation for Economic Co-operation and Development

[8] Real wage is measured by the real AME for resident workers.

[9] Data for the other developed economies is based on total real annual average wages, while data for Singapore is based on real AME for resident workers.

[10] Data for 2004-2014, instead of 2005-2015, is used due to the lack of available data for the other economies.

[11] Based on data from 2005-2015, real productivity growth in Singapore is 0.5% p.a., real wage growth for resident workers is 1.0% p.a., and the ratio of real wage growth to productivity growth is 2.2.

Given these trends, the rest of the article examines in greater detail the relationship between real wage growth and productivity growth in Singapore. The first section describes the framework used to decompose real wage growth into productivity growth as well as other components that affect real wage growth. The following section presents the empirical results of the decomposition, at both the overall economy and sectoral levels in Singapore. The final section concludes and discusses the policy implications.

FRAMEWORK TO DECOMPOSE REAL WAGE GROWTH

While productivity growth is a key factor affecting real wage growth, real wage growth may also be affected by other factors, especially in the short run. To better understand what these factors may be, this study adopts the methodology developed by Sharpe, Arsenault and Harrison (2008) to decompose real wage growth in the economy into three components, namely, (i) labour productivity growth; (ii) growth in labour's terms of trade; and (iii) growth in the labour share of output.

The following identity is used:

$$W \equiv S \times GDP \tag{1}$$

Where
W = Total Nominal Compensation of Employees[12]
S = Labour Share of Nominal Gross Domestic Product
GDP = Nominal Gross Domestic Product

Dividing the identity throughout by the number of workers in the economy and the consumer price index (CPI), and multiplying the right-hand-side by $\frac{P_Y}{P_Y}$ leads to equation (2):

$$\frac{W}{N \times P_C} = S \times \frac{GDP}{N \times P_Y} \times \frac{P_Y}{P_C} \tag{2}$$

Where
N = Number of Workers
P_C = Consumer Price Index
P_Y = GDP deflator

Next, taking log on both sides of equation (2) leads to the following:

$$\text{Log}\frac{W}{N \times P_C} = \text{Log}\frac{GDP}{N \times P_Y} + (\text{Log}P_Y - \text{Log}P_C) + \text{Log}S \tag{3}$$

Differentiating equation (3) with respect to time allows us to obtain the decomposition equation as follows:

$$\%\Delta\omega \approx \%\Delta p + \%\Delta r + \%\Delta S \tag{4}$$

Where
$\%\Delta\omega = \%\Delta \frac{W}{N \times P_C}$ = Growth in real wages per worker
$\%\Delta p = \%\Delta \frac{GDP}{N \times P_Y}$ = Growth in real labour productivity
$\%\Delta r = \%\Delta P_Y - \%\Delta P_C$ = Growth in labour's terms of trade
$\%\Delta S$ = Growth in labour share of output

As the decomposition equation above explains the drivers of overall real wage growth, the framework has to be adapted to focus on the real wage growth of resident workers.[13] In the adapted framework, the fourth component of the decomposition equation is a residual term that captures the difference between the real wage growth of resident workers and overall real wage growth:[14]

[12] Compensation of Employees (COE) is a national accounting concept. It measures the income that employers pay to employees for the services rendered. The United Nation's System of National Accounts defines COE as total remuneration, in cash or in kind, payable by an enterprise to an employee in return for work done in the period.

[13] Similar to Guo and Tan (2012), resident wages is used for the decomposition, as this is the main series of interest to policymakers.

[14] As the residual term reflects the difference between the real average growth in COE (based on National Accounts data) and real average wage growth of resident workers (proxied by AME), it includes other compensation components such as benefits in kind, employers' CPF contributions and the remuneration of foreign workers working on work passes in Singapore, which are computed as part of COE but not AME. For more details on the definitions of COE and AME, please refer to Chang (2009).

$$\%\Delta AME \approx \%\Delta p + \%\Delta r + \%\Delta S + \%\Delta z \quad (5)$$

Where $\%\Delta AME$ = Growth in real wages per resident worker
$\%\Delta z \approx \%\Delta AME - \%\Delta \omega$ = Residual
All the other terms are as defined before

Exhibit 3 below provides a more detailed description of the components in the decomposition framework and how they may influence real wage growth (see Guo and Tan (2012) for details). It also explains the indicators and data used for the decomposition.

Exhibit 3: Real Wage Growth and its Key Components

Component	Description and Drivers	Indicator / Data
Real average wage growth of resident workers	Real wage growth can be decomposed into the following main components: labour productivity growth, growth in labour's terms of trade, and growth in labour share of output in accordance with equation (5).	Real AME is used to measure the real average wages of resident workers. The data is obtained from administrative records. Moreover, average (rather than median) wages are used, as the components of the decomposition equation (including labour productivity) are based on an average concept.
Labour productivity growth	Labour productivity growth can be driven by technological improvements or process innovation leading to improvements in Total Factor Productivity (TFP); improvements in the quality of inputs (e.g., labour quality may be improved through training); and increasing capital intensity through capital investments.[15]	Labour productivity is measured as real VA per worker, rather than real VA per actual hour worked, as the wage series used for the decomposition is on a per worker (as opposed to per hour) basis.
Growth in labour's terms of trade	The difference between the increase in output prices and the increase in consumer prices is known as the growth in labour's terms of trade. Intuitively, if the prices of goods and services produced by workers increase more quickly than the prices of the goods and services consumed by workers, then the workers are said to be better off, or have seen an improvement in their terms of trade (Sharpe et al, 2008).	The GDP deflator is used as a proxy for the price of output, or the price of goods and services produced by workers. The CPI-All Items is used to measure changes in consumer prices.
Growth in labour share of output	Real wages can rise if labour gains a larger share of the value of the output produced by firms. However, unlike the former two components (i.e., productivity growth and growth in labour's terms of trade), an increase in labour share may not be a sustainable way to raise wages. This is because an increase in labour share implies an increase in the labour cost per unit of output produced, or a decline in the economy's competitiveness. There are many factors that can affect the labour share of output. These include market structure, institutional factors, labour market conditions, extent of displacement of labour by capital, and outsourcing (see details in Guo and Tan (2012)). Take market structure for example. If the labour market is not competitive and employers have the ability to influence market wages (i.e., the employers have monopsony power), then employment and wages for workers are likely to be lower, leading to a smaller labour share in output. This may occur if there are labour market rigidities (e.g., search frictions) that hinder the ability of workers to switch jobs. Another example relates to labour market conditions. A relatively tight labour market can increase the bargaining position of workers, thus leading to an increase in wages and labour share.	The labour share of output, or wage share, is computed as nominal COE divided by nominal GDP, both obtained from the National Accounts.

Source: MTI Staff, and Guo and Tan (2012)

[15] *For more details, please refer to Fan and Goh (2014).*

EMPIRICAL RESULTS

This section applies the decomposition framework described above to analyse the relationship between the real wage growth of resident workers and productivity growth at both the overall economy and sectoral levels in Singapore.

(I) Decomposition of Real Average Wage Growth at the Overall Economy Level

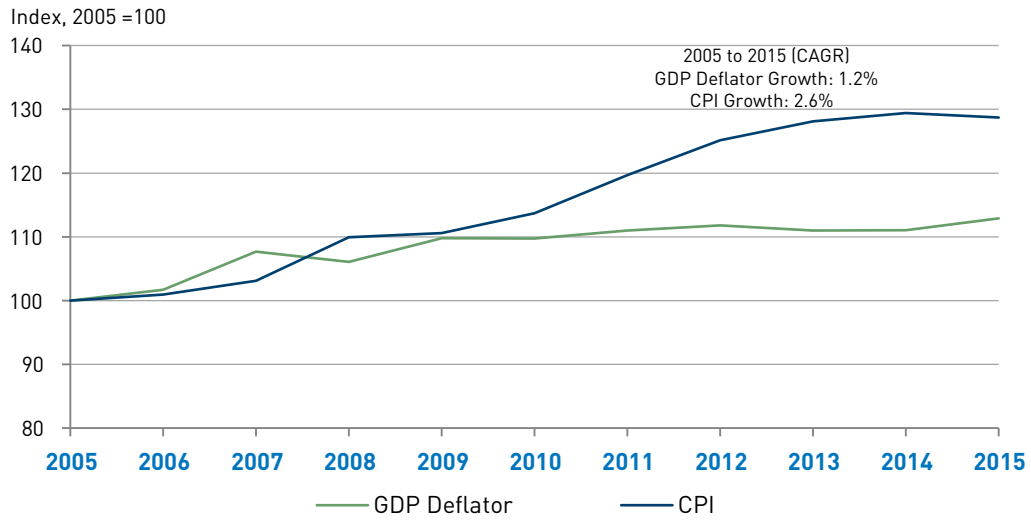
Results for the decomposition at the overall economy level are presented in Exhibit 4. Over the period 2005-2015, the real average wages of resident workers grew by 1.0 per cent p.a.. Real wage growth was supported by productivity growth of 0.5 per cent p.a., but was dampened by a decline in labour's terms of trade (-1.3 per cent p.a.) as the rise in output prices (1.2 per cent p.a.) lagged behind CPI inflation (2.6 per cent p.a.) [Exhibit 5]. An increase in the labour share of output, from 39.3 per cent in 2005 to 43.3 per cent in 2015 (or CAGR of 1.0 per cent), also contributed to real wage growth over the period. At the same time, the positive residual term suggests that the real wage growth of resident workers had outpaced overall real wage growth over the period.

Exhibit 4: Decomposition of Real Wage Growth for Resident Workers in Singapore, CAGR, 2005-2015

Period	Real Wage Growth	Productivity Growth	Growth in Labour's Terms of Trade	Growth in Labour Share of Output	Residual
2005-2015	1.0%	0.5%	-1.3%	1.0%	0.8%
2005-2010	0.9%	0.5%	-0.7%	-0.1%	1.2%
2010-2015	1.1%	0.4%	-2.0%	2.0%	0.7%

Source: MTI Staff estimates based on national accounts data and administrative records

Exhibit 5: Increase in the GDP Deflator and CPI, 2005-2015



Source: MTI Staff estimates based on administrative and survey records

For the more recent period of 2010 to 2015, the real average wage growth of resident workers (1.1 per cent p.a.) similarly outpaced productivity growth (0.4 per cent p.a.) amidst the tight labour market. There was also a stronger decline in labour's terms of trade (-2.0 per cent p.a.) compared to that experienced over the past ten years. Labour's terms of trade fell on the back of low growth in output prices (0.6 per cent p.a.), even as consumer prices rose by 2.5 per cent p.a.. Over this period, consumer prices had risen strongly, largely due to the relatively high inflation in 2011 and 2012 which had in turn come on the back of sharp increases in accommodation costs. At the same time, the labour share of output rose by 2.0 per cent p.a., reversing the marginal decline in the preceding five years.[16] The residual term similarly increased, by 0.7 per cent p.a., over the more recent five-year period, as resident wage growth continued to surpass overall wage growth.

[16] *The increase in the labour share of output at the overall economy level from 2010 to 2015 was driven largely by an increase in labour shares across most sectors. There was also a slight shift in the composition of the economy towards sectors with above-average wage shares (e.g., construction and finance & insurance). For more details on the shift-share analysis of the change in labour share of output over the last five years, please refer to Annex A.*

In sum, the decomposition exercise shows that real wage growth for resident workers had outpaced productivity growth over the last ten- and five-year periods, and reflected in part a rise in the labour share of output. However, over the longer term, it may not be sustainable for real wages to continue to exceed productivity growth. This is because a sustained increase in wages without a corresponding increase in productivity will lead to rising labour cost per unit of output produced, which could in turn result in a decline in Singapore's competitiveness. As such, it is important for wages to rise in tandem with productivity over the longer term, in order to ensure that our competitiveness is not eroded.

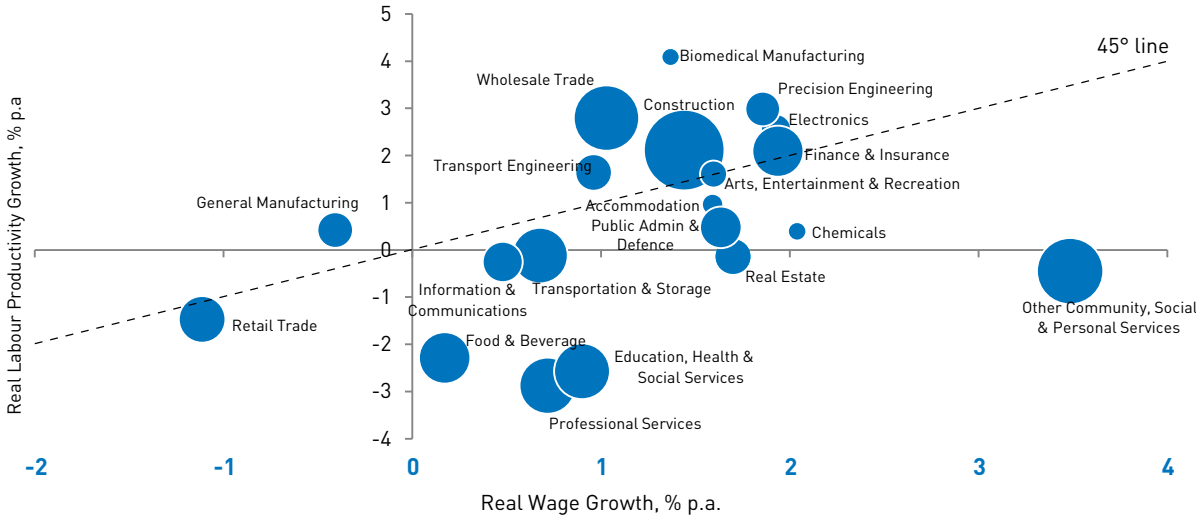
Moreover, the decline in labour's terms of trade suggests that efforts to help the economy restructure towards higher value-added activities that command a price premium, while keeping domestic inflation in check, are important in order to help boost real wage growth.

(II) Decomposition of Real Average Wage Growth at the Sectoral Level

Exhibit 6 shows the relationship between the real average wage growth of resident workers and productivity growth across the various sectors in Singapore over the period of 2005-2015.

As can be seen, the real average wage growth of resident workers outpaced productivity growth in some sectors, but was lower than productivity growth in other sectors. For instance, real average wage growth for residents in the biomedical manufacturing sector lagged behind productivity growth in the sector. On the other hand, the education, health & social services sector saw real average wage growth that was higher than productivity growth.

Exhibit 6: Productivity and Resident Real Average Wage Growth across Sectors in Singapore, CAGR, 2005-2015



Size of the bubbles represents the sector's employment size in 2015.

Source: MTI Staff estimates based on administrative and survey records

Next, the decomposition framework was applied to obtain a better understanding of the link between productivity growth and real average wage growth of resident workers in the various sectors over the more recent period of 2010-2015.[17] The results are shown in Exhibit 7.

Exhibit 7: Decomposition of Resident Real Wage Growth for Various Sectors, CAGR, 2010-2015

Sector	Real Wage Growth	=	Real Productivity Growth	+	Growth in Labour's Terms of Trade	+	Growth in Labour Share of Output	+	Residual
Export-oriented Sectors									
Electronics	1.8%	=	-2.5%	+	1.3%	+	3.8%	+	-0.8%
Chemicals	2.2%	=	0.8%	+	5.4%	+	-3.7%	+	-0.3%
Biomedical Manufacturing	-0.3%	=	1.0%	+	-4.9%	+	4.8%	+	-1.2%
Precision Engineering	1.8%	=	2.3%	+	1.6%	+	-2.7%	+	0.6%
Transport Engineering	1.3%	=	4.0%	+	-3.9%	+	2.7%	+	-1.5%
General Manufacturing	0.7%	=	-0.3%	+	2.3%	+	-2.2%	+	0.9%
Wholesale Trade	1.2%	=	2.7%	+	-7.8%	+	4.1%	+	2.2%
Transportation & Storage	1.5%	=	-0.2%	+	-3.9%	+	4.8%	+	0.8%
Accommodation	2.1%	=	0.8%	+	0.7%	+	1.0%	+	-0.4%
Finance & Insurance	1.4%	=	4.0%	+	-3.5%	+	0.3%	+	0.6%
Professional Services	0.7%	=	-2.9%	+	0.2%	+	1.6%	+	1.8%
Domestically-oriented Sectors									
Construction	1.1%	=	0.1%	+	-1.6%	+	3.4%	+	-0.8%
Retail Trade	-0.8%	=	-0.6%	+	-0.5%	+	3.6%	+	-3.3%
Food & Beverage Services	0.6%	=	-1.5%	+	0.5%	+	0.4%	+	1.2%
Information & Communications	0.3%	=	0.9%	+	-1.9%	+	0.6%	+	0.7%
Real Estate Services	3.3%	=	-0.5%	+	0.1%	+	0.8%	+	2.9%
Administrative & Support Services	1.2%	=	3.2%	+	-0.3%	+	-1.2%	+	-0.5%
Other Services	2.0%	=	-0.9%	+	1.1%	+	1.4%	+	0.4%

Source: MTI Staff estimates based on national accounts data and administrative records

Broadly, the following trends for the export- and domestically-oriented sectors can be observed:

a. Some export-oriented sectors experienced a decline in labour's terms of trade, which had in turn weighed on real wage growth in the sectors. While real wages in sectors such as precision engineering and chemicals were boosted by positive productivity growth and favourable labour's terms of trade changes, this was not the case in other export-oriented sectors such as biomedical manufacturing, transport engineering, wholesale trade and finance and insurance. In these sectors, while productivity gains were relatively strong, their impact on the real wage growth of resident workers in the sectors was eroded by a fall in labour's terms of trade. This could be in part due to stiff global competition limiting price increases for the sectors' output.

b. Most of the domestically-oriented sectors suffered from low or negative productivity growth, on top of a worsening labour's terms of trade. Real average wage growth of resident workers in domestically-oriented sectors tended to be lower than that in the export-oriented sectors. Often, this was accompanied by low productivity growth (e.g. in the retail trade and food & beverage services sectors). This suggests that unless productivity growth in these sectors improve, it may be difficult for wages to rise sustainably.

[17] *The sectoral results over the longer period of 2005 to 2015 are presented in Annex B.*

c. Most sectors have seen an increase in their labour share of output in recent years. An increase in the labour share of output was seen across most sectors, possibly the result of the tight labour market in recent years. However, as mentioned in Exhibit 3, an increase in the labour share of output may not be sustainable, as it implies an increase in the labour cost per unit of output produced, and a decline in our economic competitiveness. This implies that productivity growth remains paramount if we want to drive sustainable real wage increases at the sectoral level.

There are two key takeaways from the sectoral analysis. First, given intense global competition, export-oriented sectors must continue to innovate and move up the value chain, so as to offer products that command a price premium internationally. This will improve labour's terms of trade, and contribute to real wage growth in these sectors. Second, productivity, especially in the domestically-oriented sectors, needs to continue to improve in order to sustain wage increases for resident workers.

CONCLUSION

At the overall economy level, real average wage growth for resident workers had outpaced productivity gains over the past decade, and in the recent five-year period. While productivity growth is a key driver of wage growth in the long run, real wages may also be affected in the short run by other factors, including changes in labour's terms of trade and the labour share of output.

In recent years, a fall in labour's terms of trade has weighed on real wage growth for resident workers. This suggests that efforts to help the economy restructure towards higher value-added activities that command a price premium, while keeping domestic inflation in check, can help to boost real wage growth. At the same time, the labour share of output has increased in recent years, possibly due to the tight labour market, thereby boosting real wage growth. However, a continual increase in the labour share may not be sustainable, given the potential impact on Singapore's competitiveness.

At the sectoral level, different trends are observed for the export-oriented and domestically-oriented sectors. Productivity growth tended to be stronger in the export-oriented sectors, but the translation to real wage growth for resident workers was dampened by a decline in labour's terms of trade in some sectors. By contrast, real average wages for resident workers in some domestically-oriented sectors continued to rise despite low productivity growth, which may not be sustainable. The findings thus suggest that apart from helping export-oriented sectors to restructure into higher value-added products and services, emphasis should also be placed on raising the productivity of domestically-oriented sectors in order to sustain wage growth in these sectors.

Over the longer term, it remains vital for us to press on with the productivity drive, as it is only by raising productivity that wage increases can be sustainable.

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ANNEX A: SHIFT-SHARE ANALYSIS OF THE CHANGE IN LABOUR SHARE OF OUTPUT

Exhibit A-1 shows the overall labour share of output, or wage share, of the economy over the past decade. Since 2010, the overall wage share has trended upwards. Specifically, between 2010 and 2015, the overall wage share rose from 39.1 per cent in 2010 to 43.3 per cent in 2015.

Exhibit A-1: Labour Share of Output from 2005 to 2015

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Labour Share	39.3%	39.3%	38.7%	41.1%	41.6%	39.1%	39.2%	40.1%	41.3%	42.9%	43.3%

Source: Singapore Department of Statistics

To examine the drivers of the increase in overall wage share from 2010 to 2015, a shift-share decomposition framework is used to decompose the change in overall wage share into the following three effects:

i. Within effect: the contribution of the increase in wage share of each sector to the growth in overall wage share;

ii. Static shift effect: the contribution of changes in the VA share of sectors with different wage shares to the growth in overall wage share; and

iii. Dynamic shift effect: the contribution of changes in the VA share of sectors with different rates of growth in wage share to the change in overall wage share.

The results based on the above decomposition framework are as follows:

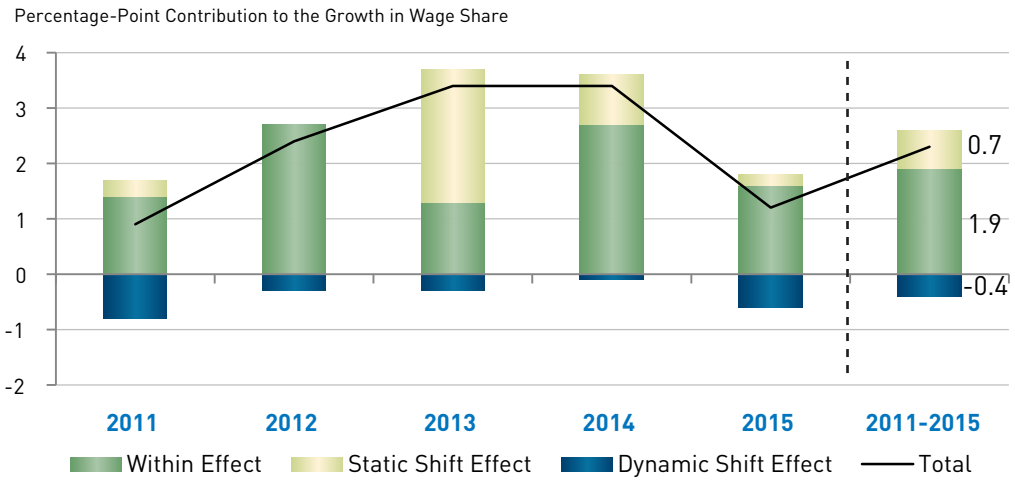
a. Within effect: Between 2010 and 2015, most sectors saw an increase in their wage share on the back of a rise in wages, alongside weak productivity growth. The rise in wages was in turn due to the tight labour market, as unemployment rate had remained low and job vacancies remained above the historical average over this period. On average, the increase in sectoral wage shares contributed around 60 per cent to the change in overall wage share from 2010 to 2015 [see Exhibit A-2].

b. Static shift effect: Over the same period, there was also a positive static shift effect due to an increase in the VA share of sectors with above-average wage shares, as illustrated in Exhibit A-3. These sectors included the finance & insurance, construction, food services and accommodation sectors. However, it should be noted that while these sectors had above-average wage shares, not all of them had above-average local wages.[18] For instance, local wages in the construction and food services sectors were $3,600 and $1,600 respectively in 2015, which were below the economy-wide average of $4,900.

c. Dynamic shift effect: The dynamic shift effect over the period was small and negative.

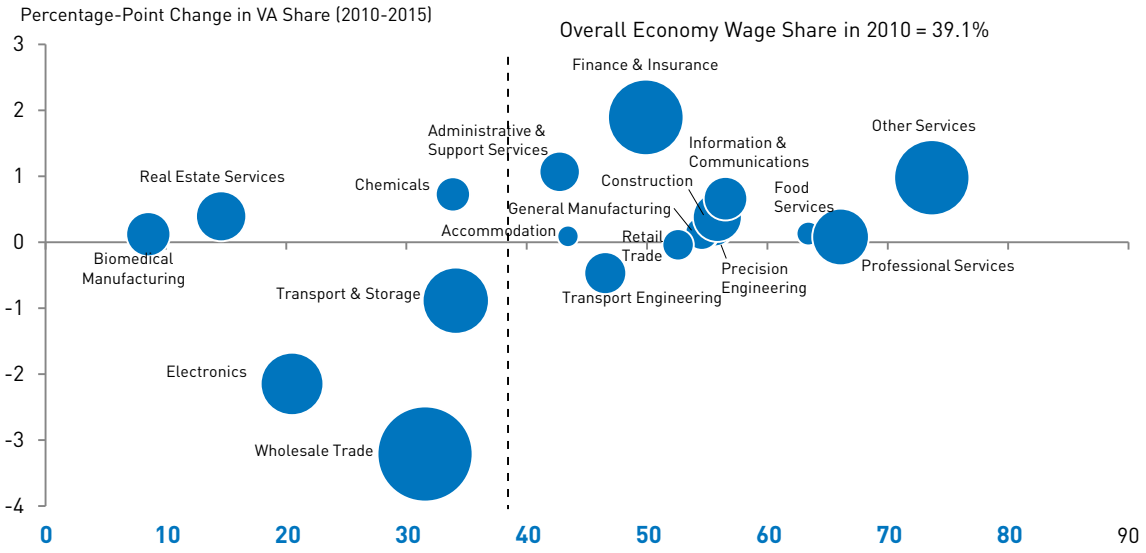
[18] In an earlier box article on "A Look at Wage Share and Wages in Singapore" by Goh (2013), it was highlighted that there was no clear relationship between average wages and wage share across sectors in Singapore. Using updated examples, the biomedical manufacturing sector had the lowest wage share of 10.8% in 2015, but the sector's average wages for resident workers was relatively high at $6,900. Conversely, while the food services sector had a relatively high wage share of 64.7% in 2015, its average wages for resident workers was relatively low, at $1,600.

Exhibit A-2: Decomposition of Wage Share Growth from 2010 to 2015[19]



Source: MTI Staff estimates based on administrative and survey records

Exhibit A-3: Static Shift Effects by Sectors from 2010 to 2015



Size of the bubbles represents the sectors' VA size in 2010
Source: MTI Staff estimates based on administrative and survey records

In summary, the rise in the wage share for the overall economy in recent years was largely driven by a rise in sectoral wage shares, which had in turn come on the back of an increase in wage cost alongside weak productivity growth. This implies an increase in labour cost per unit of output, and may have a negative impact on our cost competitiveness. While there had been a shift in VA towards sectors with higher wage shares, not all of these sectors were sectors that also had above-average wages (e.g., there had been a shift towards lower-paying sectors such as construction and food services).

Overall, the results suggest that it remains vital for us to press on with efforts to raise productivity at the sectoral level, and also to restructure the economy towards more productive sectors that provide well-playing jobs for locals.

[19] The within, static shift and dynamic shift effects do not sum up to the overall growth in wage share, as they exclude the contribution of taxes on products.

ANNEX B: SECTORAL DECOMPOSITION RESULTS FOR 2005 TO 2015

Exhibit B-1: Decomposition of Resident Real Wage Growth for Various Sectors, CAGR, 2005-2015

Sector	Real Wage Growth	=	Real Productivity Growth	+	Growth in Labour's Terms of Trade	+	Growth in Labour Share of Output	+	Residual
Export-oriented Sectors									
Electronics	1.9%	=	2.6%	+	-0.6%	+	1.0%	+	-1.1%
Chemicals	2.0%	=	0.4%	+	-0.6%	+	2.7%	+	-0.5%
Biomedical Manufacturing	1.4%	=	4.1%	+	-8.7%	+	8.2%	+	-2.2%
Precision Engineering	1.9%	=	3.0%	+	-1.1%	+	-0.7%	+	0.7%
Transport Engineering	1.0%	=	1.6%	+	-2.0%	+	0.8%	+	0.6%
General Manufacturing	-0.4%	=	0.4%	+	1.1%	+	-0.7%	+	-1.2%
Wholesale Trade	1.0%	=	2.8%	+	-3.2%	+	0.2%	+	1.2%
Transportation & Storage	0.7%	=	-0.1%	+	-2.7%	+	2.8%	+	0.7%
Accommodation	1.6%	=	1.0%	+	2.9%	+	-0.7%	+	-1.6%
Finance & Insurance	1.9%	=	2.1%	+	-2.3%	+	0.6%	+	1.5%
Professional Services	0.7%	=	-2.9%	+	0.9%	+	0.4%	+	2.3%
Domestically-oriented Sectors									
Construction	1.4%	=	2.1%	+	-0.8%	+	-1.1%	+	1.2%
Retail Trade	-1.1%	=	-1.5%	+	0.5%	+	2.3%	+	-2.4%
Food & Beverage Services	0.2%	=	-2.3%	+	-0.9%	+	1.1%	+	2.3%
Information & Communications	0.5%	=	-0.3%	+	-1.8%	+	2.0%	+	0.6%
Real Estate Services	1.7%	=	-0.1%	+	2.4%	+	-2.6%	+	2.0%
Other Services	1.2%	=	-0.3%	+	0.8%	+	0.3%	+	0.4%

Note: Due to data limitations, not all sectors are covered.

Source: MTI Staff estimates based on national account data and administrative records