FEATURE ARTICLE

PRODUCTIVITY AND WAGE GROWTH IN SINGAPORE

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EXECUTIVE SUMMARY

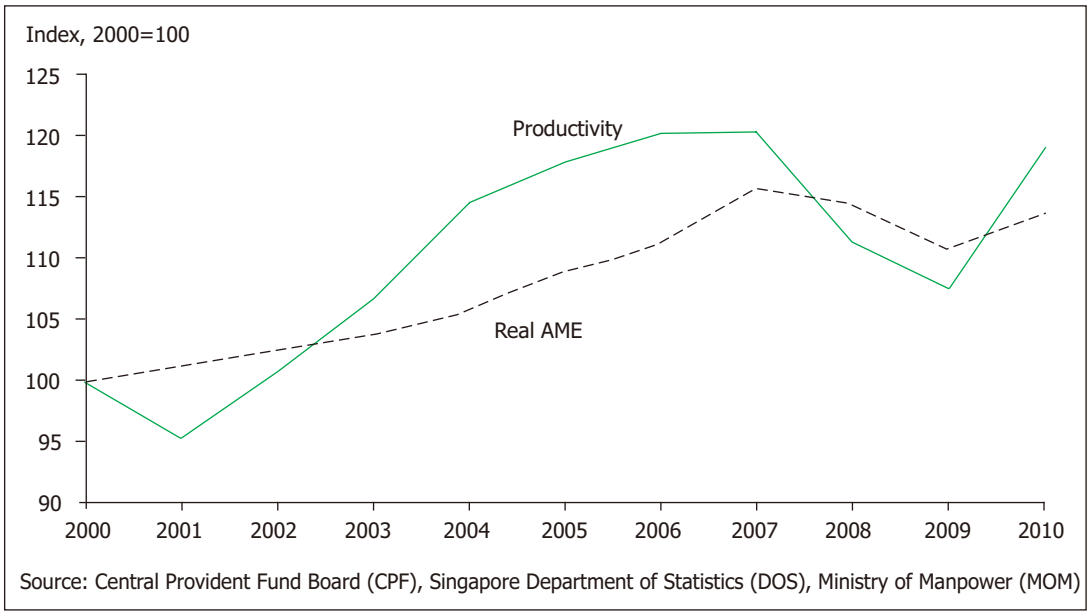
- In this paper, we examine the link between productivity and wages by decomposing real average wage growth into three components, viz. (a) productivity growth; (b) relative output price changes; and (c) growth in labour share of output.
- At the macro level, we find a relatively strong relationship between productivity growth and the real average wage growth of resident workers in Singapore. In recent years, however, weak output price growth has dampened the translation of productivity gains to real wage growth for residents. This suggests a need to help firms restructure and move up the value chain, so that they can produce high value-added goods and services that can be sold at higher prices in global markets.
- At the sectoral level, the productivity-wage relationship is weaker. Our analysis suggests that apart from helping externally-oriented sectors restructure and move into higher value-added product segments, emphasis should also be placed on raising the productivity of domestically-oriented sectors to enable sustainable wage growth in these sectors.

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

INTRODUCTION

The most direct mechanism by which productivity gains affect living standards is through higher wages. As such, the extent to which productivity gains translate into wage growth is a pertinent issue.[1] Broadly, the link between productivity and wages has been strong in Singapore. From 2000 to 2010, productivity in Singapore increased by 1.8 per cent per annum (p.a.) while resident real average monthly earnings (AME) grew by 1.3 per cent p.a. (Exhibit 1).

Exhibit 1: Real Labour Productivity and Real Wage Growth in Singapore, 2000-2010



Source: Central Provident Fund Board (CPF), Singapore Department of Statistics (DOS), Ministry of Manpower (MOM)

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

However, a brief survey of international data suggests that the translation of productivity gains to real wage growth cannot be taken for granted. Exhibit 2 shows the productivity and real average wage growth of various economies from 2000 to 2010. Singapore fared relatively well in this comparison, with the ratio of real average wage growth to productivity growth coming in at 0.7. In other countries such as the United States, Japan and Germany, real average wage growth was much lower than the productivity gains over this period.

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

	Productivity	Real Average Wage	Real Average Wage Growth as a Ratio of Productivity Growth
	CAGR, 2000-2010, Per Cent p.a.		
Canada	0.4	1.6	3.7
France	0.6	1.1	1.7
Australia	0.8	1.1	1.4
United Kingdom	0.9	0.8	1.0
Korea	2.9	2.1	0.7
Singapore*	**1.8**	**1.3**	**0.7**
Hong Kong	3.2	1.3	0.5
United States	1.7	0.5	0.3
Germany	0.6	0.2	0.3
Japan	1.0	0.2	0.2

*Resident real average monthly earnings (AME) used for Singapore
Source: CPF, DOS, MOM, Hong Kong Census and Statistics Department, OECD

In this paper, we first explore the factors that may dampen the translation of productivity gains into real wage growth. We then review the empirical evidence on the link between productivity and real wages at both the macro and sectoral levels in Singapore. Finally, we conclude with some policy implications.

FRAMEWORK TO DECOMPOSE REAL WAGE GROWTH

While productivity growth is a key driver of real wage growth, real wage growth may also be affected by many other factors, especially in the short run. To better understand what these factors may be, we follow the methodology employed by Sharpe et al (2008a) to decompose real average wage growth in the economy into three components, viz. (a) productivity growth; (b) relative output price changes; and (c) growth in labour share of output.[2] (See Annex A for a derivation of the decomposition identity.)

Each of the components is in turn influenced by a variety of factors, including those stated in Exhibit 3. We discuss the components and their factors in greater detail below.

Exhibit 3: Decomposition of Real Average Wage Growth

Growth in Real Wages = Growth in Productivity + Relative Output Price Changes + Growth in Labour Share	
Component	**Driving Factors**
Productivity Growth	• Total Factor Productivity (TFP) growth • Capital per hour worked • Labour quality
Relative Output Price Changes	• Prices of goods produced • Inflation
Labour Share Growth	• Market structure factors • Institutional factors • Labour market conditions • Extent of displacement of labour by capital • Outsourcing

[2] This decomposition technically only holds for the real average wages of all workers in the economy.

(I) Productivity Growth

Based on the decomposition framework, productivity growth should lead to a rise in real average wage growth, all other things being equal. Productivity growth can in turn be driven by improvements in the quality of inputs (e.g., labour quality can be raised through education and training), increasing capital intensity through capital investments, as well as technological improvements or process innovations leading to growth in Total Factor Productivity (Syverson, 2010).

(II) Relative Output Price Changes[3]

Relative output price change is defined as the difference between the change in output prices and the change in the prices of consumption goods (i.e., domestic inflation). The intuition is that the real wages of workers can only increase on a sustainable basis if the average price of the goods and services they produce exceeds the average price of the goods and services they consume. Otherwise, the purchasing power of the value of their labour will gradually decline.

Weak growth in the price of goods and services produced by workers may be driven by several factors. For instance, externally-oriented sectors may face intense price competition from low-cost competitors or may be producing outdated products for which demand is rapidly declining. Even domestically-oriented sectors may face downward price pressures if the sector is fragmented with many firms competing against one another. However, for the domestically-oriented sectors, while an increase in the price of the goods and services produced tends to raise real wages in the sector, it will also result in inflation, thereby eroding real wage gains for all workers across the economy (e.g., strong price growth in retail or food services may raise the cost of living for all workers).

(III) Growth in Labour Share of Output

The third channel by which real wages can rise is if labour gains a larger share of the value of the output produced by firms. However, in contrast to the former two components, wage growth through a rise in labour share is not likely to be sustainable as this implies a decline in firm profitability. An excessive erosion of profits is likely to lead to business closure and a significant disruption to economic activity. Factors that can influence labour share include the following:

a. Market structure. If the labour market is not perfectly competitive in that employers can influence market wages (i.e., they have monopsony power), employment and wages are both likely to be lower, leading to a smaller labour share in the firms' value-added (VA). This may occur if there are labour market rigidities that hinder workers from changing jobs easily (e.g., search frictions) or if workers lack skills that are transferable across jobs.

b. Institutional factors. These include factors that affect workers' bargaining power relative to firms, such as rules on union formation and wage legislations. For instance, unions with strong membership can push for higher wages at the expense of profits even if productivity remains unchanged, while minimum wage legislation can force firms to raise wages.

c. Labour market conditions. A relatively abundant supply of workers in the labour market can reduce the bargaining position of workers, thus leading to a decline in wages and labour share.

d. Extent of displacement of labour by capital. The labour share may decline if workers are replaced by capital in the production process (i.e., when capital and labour are substitutes).[4]

e. Outsourcing. If firms outsource to take advantage of cheaper production costs overseas, the cost savings will result in productivity gains. However, as these gains do not arise from the workers, their wages may not increase. Furthermore, there could be a net loss of jobs when firms outsource production. As a result, the labour share of VA is likely to fall.

[3] This is also known as the "labour terms of trade" in the academic literature.

[4] This does not mean that an increase in the use of capital will necessarily lower labour share. In cases where capital is complementary to labour in the production process (i.e., workers are still needed to operate the new machines), the use of labour may increase as firms invest in capital.

EMPIRICAL EVIDENCE ON THE LINK BETWEEN PRODUCTIVITY AND REAL WAGE GROWTH

In this section, we examine the link between productivity growth and the real average wage growth of resident workers, as proxied by the real average monthly earnings (AME), at both the macro and sectoral levels in Singapore.

As the decomposition framework described above is intended to explain the drivers of overall wage growth (i.e., incorporating both resident and foreign wage growth), we have adapted the framework to focus on resident wage growth.[5] In the adapted framework, the third component of the decomposition identity becomes a residual term that captures both the effect of labour share growth as well as the difference between resident wage growth and overall wage growth.

(I) Analysis at Macro Level[6]

Our results are presented in Exhibit 4. Over the period 1991-2010, real average wage growth for resident workers (3.2 per cent p.a.) was faster than productivity growth (2.5 per cent p.a.). A closer examination of the data reveals that real average wage growth for resident workers significantly outpaced productivity growth in the earlier decade (i.e., 1991-2000), coming in at 5.4 per cent p.a. and 3.3 per cent p.a. respectively. The main cause of the divergence was the positive residual term. Given that the labour share of output, based on the national accounts, only grew by 0.2 per cent over this period, we can surmise that the residual term was driven by the faster growth of resident wages compared to overall wages.[7]

In the more recent decade (i.e., 2000-2010), real average wage growth of residents (1.3 per cent p.a.) was broadly in line with productivity growth (1.8 per cent p.a.). The slight divergence between productivity and real wage growth was largely due to a fall in relative output prices, with the GDP deflator (a proxy for the price of goods and services produced by workers) increasing by 0.9 per cent p.a. compared to the growth in the consumer price index (a proxy for the price of goods and services consumed by workers) of 1.6 per cent p.a.[8]

Exhibit 4: Decomposition of Real Wage Growth for Resident Workers in Singapore, CAGR Per Cent p.a.

Period	Real Wage Growth[9]	Productivity Growth	Relative Output Price Changes	Residual
2000-2010	1.3	1.8	-0.7	0.2
1991-2000	5.4	3.3	-0.3	2.4
1991-2010	3.2	2.5	-0.5	1.2

Source: Authors' estimates using data from DOS and MOM

[5] There are two reasons why we choose to focus on resident wages. First, the resident wage series is the main series of interest to policymakers. Second, at the sectoral level, data on overall wage growth and labour shares are not available.

[6] Our analysis is based on real average monthly earnings of resident workers as proxied by AME, which does not account for Employer Central Provident Fund (CPF) contributions. As a check on our results, we adjusted the AME series to account for employer CPF contributions. The growth of the adjusted wage series was broadly similar to the growth in AME, which suggests our results are not driven mainly by changes in employer CPF contributions.

[7] Growth in the residual term may also be driven by an increase in the employer CPF contribution rate over the period. However, from 1991 to 2000, the employer contribution rate actually declined from 17 per cent to 10 per cent. As such, the significant growth in the residual term is likely to be driven by factors other than the employer contribution rate.

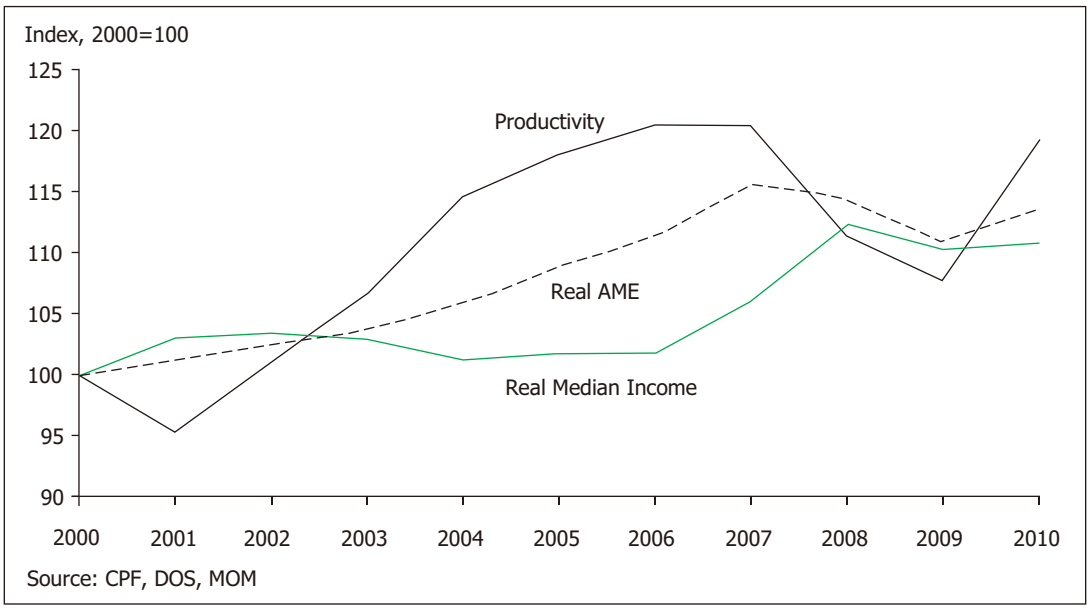
[8] Resident real wage growth was not dampened by a fall in labour share. The positive residual term reflects a relatively constant labour share of output (around 42 per cent) and continued outstripping of resident wage growth over overall wage growth over the period.

[9] This is based on real average monthly earnings of resident workers.

One possible reason why output prices failed to keep pace with inflation in the last decade is the intense competition faced by our externally-oriented sectors (which make up a sizeable part of our economy) in global markets, given the rise of low-cost producers like China. This suggests that there is a need to help sectors restructure and move up the value chain so that they can produce high VA goods and services that can be sold at higher prices in global markets.

It is important to note that the above analysis focuses on real average wages, and does not take into account the distribution of wage growth across worker segments. In reality, if skilled workers are valued over unskilled workers, the wages of skilled workers will grow relative to the wages of unskilled workers. Rising average wages may then not be reflective of the extent to which lower-skilled workers are benefiting from productivity growth. Indeed, if we examine the relationship between productivity and the real median wages of residents in Singapore, we find that it is weaker than that between productivity and the real average wages of residents (Exhibit 5). This suggests that there are distributional concerns in Singapore, and that more effort will be needed to ensure that the fruits of productivity gains do not just benefit the average worker but also workers at the lower end of the income spectrum.

Exhibit 5: Real Median Wage, Real AME and Labour Productivity Growth



(II) Analysis at Sectoral Level[10]

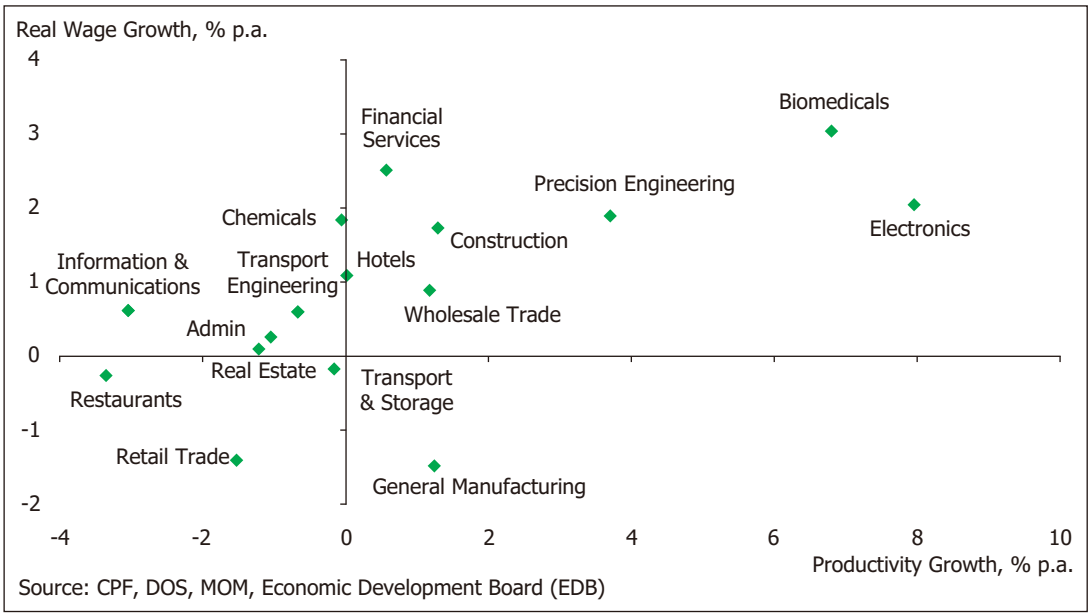
The consensus in the academic literature is that the productivity-wage link at the sectoral level is at best weakly positive. For example, Montuenga-Gomez et al (2007) observe that while macro studies tend to yield strong correlations between productivity and wages, sectoral-level studies yield correlations as low as 0.1. Graafland and Lever (1996) and Sharpe et al (2008b) also find that macro factors far outweigh the impact of sectoral productivity on sectoral wages in the Netherlands and Canada respectively.

Likewise, in Singapore, the correlation between productivity and real average wage growth is relatively weak 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 2005-2010.[11] While the relationship appears positive, it is much weaker than a one-to-one relationship. For instance, real average wage growth in the electronics sector lagged significantly behind productivity growth in the sector. By contrast, the financial services sector saw real average wage growth that was much stronger than productivity growth, while several other sectors (e.g., administrative and support services, real estate and transport engineering) experienced positive real average wage growth even though their productivity growth rates were negative.

[10] Unless otherwise stated, SSIC 2005 figures are used for the calculation of productivity, wage and output price figures for the various sectors.

[11] Due to data constraints at the sectoral level, the analysis can only be done for the period 2005-2010.

Exhibit 6: Productivity and Real Wage Growth across Sectors in Singapore, 2005-2010



Note: Due to data limitations, 2006-2010 data is used for administrative and support services, and not all sectors are covered.

Using the adapted decomposition framework to understand the reasons for the divergence between productivity growth and the real average wage growth of resident workers at the sectoral level, we find the following (details are in Annex B):

a. Most of the externally-oriented sectors suffered from declining relative output prices. Real average wage growth of resident workers in many of the externally-oriented sectors, including services sectors such as wholesale and financial services, was dampened by declining relative output prices, rather than weak productivity growth. This mirrors what was observed at the macro level in the last decade.

b. Most of the domestically-oriented sectors suffered from low or negative productivity growth. Real average wage growth of resident workers in the domestically-oriented sectors tended to be lower than that in the externally-oriented sectors. Often, this was accompanied by low productivity growth as well. Unless productivity growth in these sectors improve, it would be difficult for sustainable wage growth to take place.

There are three key takeaways from the sectoral analysis. First, given intense global competition, externally-oriented sectors must continue to restructure away from segments where product prices are falling, and into segments where product prices are higher. Second, more needs to be done to improve the productivity growth of domestically-oriented sectors (e.g., through training or investments in labour-complementing capital). Otherwise, it will be difficult for sustainable wage growth in these sectors to take place without an increase in domestic prices. Inflation would in turn lead to an erosion of real wage gains for workers across the entire economy. Finally, given the complex inter-play of factors within each sector, solutions to raise real wages will have to be tailored to the specific circumstances in each sector.

CONCLUSION

In this paper, we have shown that while productivity growth is a key driver of real wage growth, real wages may also be affected by other factors such as changes in labour share and relative output prices. In Singapore, the productivity-wage link for resident workers has been relatively strong at the macro level. In recent years, however, falling relative output prices has dampened the translation of productivity growth to real wage growth for residents. This suggests that efforts are required to limit inflation and help the economy restructure.

At the sectoral level, the productivity-wage relationship is much weaker. We observe different trends for externally-oriented and domestically-oriented sectors. For the former, productivity growth tended to be strong, but the translation to wage gains for resident workers also tended to be dampened by declining relative output prices. By contrast, productivity growth in domestically-oriented sectors tended to be weak, holding back wage growth. Our analysis thus suggests that apart from helping externally-oriented sectors restructure and move into higher VA product segments, emphasis should also be placed on raising the productivity of domestically-oriented sectors to enable sustainable wage growth in these sectors.

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ANNEX A: DERIVATION OF WAGE GROWTH DECOMPOSITION

We begin with the following identity:

$$W = S \times GDP$$

Where W = Total compensation to all employees
S = Labour share of Gross Domestic Product
GDP = Nominal Gross Domestic Product

We then divide the identity throughout by the number of workers in the economy and the consumer price index (CPI), and multiply the right-hand-side by $\frac{P_Y}{P_Y}$:

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

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

Finally, we take logs on both sides:

$$\log \frac{W}{N \times P_C} = \log \frac{GDP}{N \times P_Y} + (\log P_Y - \log P_C) + \log S$$

Differentiating the whole equation with respect to time allows us to obtain the decomposition equation as follows:

$$\%\Delta\omega = \%\Delta p + \%\Delta r + \%\Delta S$$

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 labour productivity

$\%\Delta r = \%\Delta P_Y - \%\Delta P_C$ = Relative output price changes

$\%\Delta S$ = Growth in labour share

ANNEX B: DECOMPOSITION OF REAL AVERAGE WAGE GROWTH FOR VARIOUS SECTORS

We decompose each sector's real average wage growth between 2005 and 2010 to better understand the link between productivity and resident average wage growth in the various sectors. In the adapted decomposition framework, the third component of the decomposition identity becomes a residual term that captures both the effect of labour share growth as well as the difference between resident wage growth and overall wage growth. However, as data on labour shares and overall wages are not available at the sectoral level, we are unable to break down the residual term. In effect, the residual term would be a proxy for labour share only if resident and overall average wages grow at the same rate.

The results of the decomposition exercise are presented in Exhibit B-1. In general, we find different trends for externally- and domestically-oriented sectors. In externally-oriented sectors, real average wage growth is usually dampened by declining relative output prices in spite of robust productivity growth (see for instance, electronics and precision engineering). This is because externally-oriented sectors face intense global competition which drives down product prices. On the other hand, weak real average wage growth in domestically-oriented sectors can largely be attributed to weak productivity growth (see for instance, restaurants and retail).

Exhibit B-1: Decomposition of Resident Real Wages for Various Sectors, CAGR, 2005-2010[12]

Sector	Real Wage Growth	=	Real Productivity Growth	+	Relative Output Price Changes	+	Residual
Externally-oriented Sectors							
Electronics	2.0	=	7.9	+	-4.2	+	-1.7
Chemicals	1.8	=	-0.1	+	-6.2	+	8.1
Biomedical Manufacturing	3.0	=	6.8	+	-12.9	+	9.1
Precision Engineering	1.9	=	3.7	+	-3.8	+	2.0
Transport Engineering	0.6	=	-0.7	+	-0.1	+	1.4
General Manufacturing	-1.5	=	1.2	+	-0.9	+	-1.8
Wholesale Trade	1.0	=	1.2	+	-2.0	+	1.8
Transport and Storage	-0.2	=	-0.2	+	-2.1	+	2.1
Hotels	1.1	=	0.0	+	4.6	+	-3.5
Financial Services	2.5	=	0.6	+	-2.5	+	4.4
Domestically-oriented Sectors							
Construction	1.8	=	1.3	+	0.4	+	0.1
Retail	-1.4	=	-1.5	+	-0.2	+	0.3
Information and Communications	0.6	=	-3.1	+	-1.5	+	5.2
Restaurants	-0.3	=	-3.4	+	0.1	+	3.0
Real Estate	0.1	=	-1.2	+	5.8	+	-4.5
Administrative and Support Services	0.2	=	-1.1	+	-3.8	+	5.1

Source: Authors' estimates using data from CPF, EDB, DOS and MOM
Note: Due to data limitations, 2006-2010 data is used for Administrative and Support Services, and not all sectors are covered.

[12] Unless otherwise stated, SSIC 2005 figures are used in the wage, productivity and output price calculations for the various sectors.