BOX ARTICLE 1.1

Trends in Actual Hours Worked and Implications for Labour Productivity

EXECUTIVE SUMMARY

- The measurement of labour productivity is ideally based on real value-added (VA) per hour worked, rather than real VA per worker employed.[1] In this article, we estimate Actual Hours Worked (AHW) – a measure of labour input used internationally for comparisons of hours worked and productivity – for Singapore. We then examine the trends in AHW per worker and VA per AHW in recent years.

- We find that AHW has varied over the last five years, in line with the economic cycle. AHW per worker in the economy rose by 1.5 per cent in 2010, along with the economic recovery. It then declined by 3.6 per cent on a cumulative basis between 2010 and 2014. The decline in AHW per worker over the last four years was observed across all sectors of the economy. We find that the fall in AHW per worker was driven predominantly by a fall in hours worked by full-time local employees. A shift in employment patterns towards a greater reliance on part-time local employees also contributed to this trend.

- We find consequently that growth in labour productivity, as measured by real VA per AHW, has been higher than the growth in real VA per worker at the overall economy level, as well as in each sector in recent years. For the overall economy, real VA per AHW increased at a compounded annual growth rate (CAGR) of **2.9 per cent over 2009 to 2014**, compared to the 2.5 per cent recorded when productivity is measured simply as real VA per worker. It also increased by a compound average of **1.3 per cent over the four years from 2010 to 2014**, higher than the 0.3 per cent per annum for real VA per worker. The higher rate of growth reflects the fall in AHW per worker over this period.

Labour productivity can be measured on a per worker or per hour worked basis…

Internationally, labour productivity, as a measure of how efficiently labour inputs are used to produce a given level of output, is computed either as real value-added (VA) per worker or real VA per hour worked, depending on whether data is available on hours worked. In developed economies like the US, labour productivity is measured in terms of real VA per hour worked.

In Singapore, real VA per worker is the most commonly cited measure of productivity, as VA and employment data are readily available and easy to compute.[2] However, using hours worked as a measure of labour input better captures the actual amount of work in the economy. This alternative measure becomes more relevant given the entry of more part-time workers in the economy in recent years, and in view of cyclical changes in hours worked by full-time employees.

[1] The International Labour Organisation (ILO) recommends that international comparisons of productivity be based on actual hours worked.

[2] Employment refers to total employment in the economy, and includes full-time and part-time employees as well as self-employed.

Current measures of hours worked compiled in Singapore are Paid Hours Worked and Usual Hours Worked…

Singapore currently compiles two measures of hours worked, namely Paid Hours Worked (PHW) and Usual Hours Worked (UHW). Exhibit 1 below sets out the definitions and coverage of PHW and UHW. Neither of the measures comprehensively reflects the number of hours worked by the average worker in the economy due to the various gaps in coverage. At present, the PHW series is used to compute real VA per hour worked in Singapore as it captures the hours worked by both local and foreign employees, who form the bulk of the workforce.[3]

Exhibit 1: Definition and Coverage of Paid Hours Worked and Usual Hours Worked

Measure	Definition	Coverage and Source
Paid Hours Worked	Sum of standard and paid overtime hours worked per employee.	Covers both local and foreign employees.[4] However, self-employed workers are excluded. Excludes unpaid overtime work, e.g., by executives and management staff who are normally not paid for working overtime. No adjustments are made for annual leave, paid sick leave, etc. Data is collected through Ministry of Manpower's (MOM) Labour Market Survey of establishments, and is published on a quarterly basis.
Usual Hours Worked	Number of hours a person usually works in a typical week, regardless of whether he or she is paid for it.	Covers local employees and self-employed, but not foreign employees. Includes unpaid overtime work. No adjustments are made for annual leave, paid sick leave, etc. Data is collected through MOM's Labour Force Survey, and is published on an annual basis.

The International Labour Organisation recommends using Actual Hours Worked as a measure of labour input in the computation of productivity…

However, Actual Hours Worked (AHW) is regarded as the most reflective measure of labour input, with the International Labour Organisation (ILO) recommending its use for international comparisons of hours worked and productivity (Schreyer, 2001). Exhibit 2 sets out the definition and coverage of AHW. Nonetheless, given the comprehensive coverage of AHW, the ILO has also acknowledged that it is a measure that is difficult to obtain or to estimate reliably.

Internationally, countries adopt different approaches to estimate AHW due to differences in underlying data sources and coverage (Fleck, 2009). A brief survey of the methodologies can be found in Annex 1.

[3] While the self-employed are not covered in the establishment surveys used to collect the PHW data, it is assumed that they have the same number of PHW as employed workers when calculating VA per PHW.

[4] Although the PHW data covers both local and foreign employees, the data cannot be split by nationality.

Exhibit 2: Definition and Coverage of Actual Hours Worked

Measure	Definition	Coverage
Actual Hours Worked	Number of hours that a person in paid or self-employment spends on work activities.	Includes all hours spent on work activity, including paid or unpaid overtime work; time spent on preparation, repairs and maintenance; all hours spent waiting for reasons such as a lack of work, breakdown of machinery or accidents; time corresponding to short rest periods and breaks. Excludes hours paid but not worked such as paid annual leave, paid public holidays, and paid sick leave; meal breaks; time spent on travel from home to work and vice versa.

Constructing a proxy for AHW using PHW and UHW data….

Singapore currently does not compile statistics on AHW. As such, we estimate AHW using existing UHW and PHW data [Exhibit 3]. Our AHW estimate uses UHW to measure hours worked by local employees and self-employed, as UHW includes **unpaid** overtime hours on top of paid hours worked and is thus a more comprehensive measure of hours worked. However, as UHW data is only available for local employees and the self-employed, we proxy the hours worked by foreign employees using the PHW of full-time employees.[5] Lastly, we adjust the data to take into account total paid leave and holidays. Using this approach to estimate AHW is in line with international practices, and provides a better gauge of the hours an average worker in Singapore actually spends on work.

Exhibit 3: Proxy for AHW using PHW and UHW

	Local employees	Foreign employees	Self-employed	Adjustment for leave and holidays
Proxy for AHW	UHW	PHW	UHW	Adjust for public holidays, annual and sick leave based on MOM's Conditions of Employment Survey[6]

AHW per worker has trended down across all sectors…

Examining the trends over time, we find that AHW per worker in the economy rose by 1.5 per cent in 2010 in tandem with the economic rebound from the global financial crisis, before declining by 3.6 per cent on a cumulative basis from 2010 to 2014. The decline in AHW per worker over the last four years was also observed across all sectors of the economy [Exhibit 4].

[5] This is done at the industry level, i.e., we use the PHW for full-time employees in a particular industry to proxy for hours worked by foreign employees in the same industry.

[6] As the survey is conducted once every two years, the figures from the survey are used for that reference year and the previous year. Part-time employees are assumed to take half the amount of leave as full-time employees, while no correction was made for self-employed persons.

Reasons for the Fall in Hours Worked After 2010

We conduct a shift-share analysis to understand the factors affecting the decline in AHW per worker for the overall economy and for each sector, using the following formula:

$$\frac{H_t - H_{t-1}}{H_{t-1}} = \sum_{j=1}^{4}\left[\frac{W_{jt-1}}{W_{t-1}} * \frac{H_{jt} - H_{jt-1}}{H_{t-1}}\right] + \sum_{j=1}^{4}\left[\left(\frac{W_{jt}}{W_t} - \frac{W_{jt-1}}{W_{t-1}}\right) * \frac{H_{jt-1}}{H_{t-1}}\right] + \varepsilon,$$

where H is the average annual hours worked per worker, W is the number of workers, ε is the dynamic shift effect, t is the time period, j refers to four types of workers – part-time local employees, full-time local employees, foreign employees or self-employed.[7]

In summary, under the shift-share analysis, the change in AHW per worker is decomposed into three components:

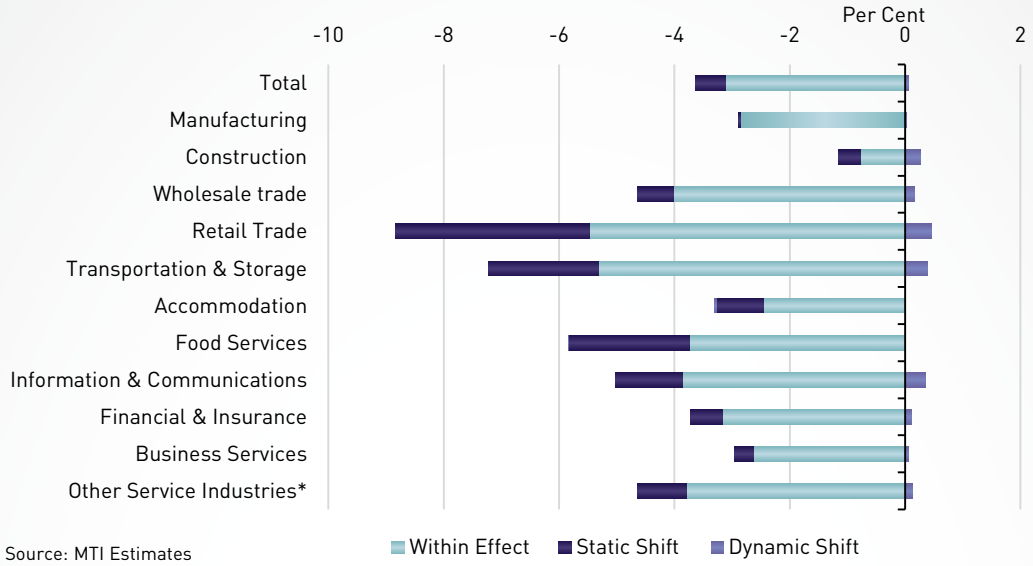
- Within Effect: the contribution of changes in the hours worked by part-time and full-time local employees, foreign employees and self-employed on the economy/sector's AHW per worker;
- Static Shift Effect: the contribution of changes in the shares of part-time and full-time local employees, foreign employees and self-employed on the economy/sector's AHW per worker; and
- Dynamic Shift Effect: the contribution resulting from changes in both the AHW and the shares of the different types of workers in the economy/sector.

The key observations are as follows [Exhibit 4]:

- At the overall economy level, the decline in AHW per worker (-3.6 per cent) from 2010 to 2014 was primarily due to the within effect. This was in turn driven by a fall in the average number of hours worked by full-time local employees, and could possibly reflect a greater emphasis on leisure time or the impact of a gradual slowdown in the economy in recent years. Another factor contributing to the decline in AHW per worker was the negative static shift effect, which was in turn largely due to an increase in the share of part-time local employees in the economy.
- All key sectors saw a decline in AHW per worker from 2010 to 2014, with the retail trade (8.4 per cent), transportation & storage (6.8 per cent) and food services sectors (5.8 per cent) registering the largest declines. Similar to the case for the overall economy, the within effect (i.e., full-time local employees working less hours on average) was the main factor driving the decline in the AHW per worker in each sector.
- The static shift effect was also negative in all sectors, primarily reflecting an increase in the share of part-time local workers in the sectors. In some sectors (e.g., retail and food services), a decline in the share of self-employed (who tend to work longer hours) also contributed to the negative shift effect for the sectors. The negative static shift effect was particularly strong for the retail trade, food services and transportation & storage sectors, with this effect explaining more than one-third of the decline in the AHW per worker in the respective sectors.

[7] *Full-time workers are defined as workers who worked at least 35 hours a week, while part-time workers are defined as workers who worked less than 35 hours a week.*

Exhibit 4: Decomposition of the Change in AHW Per Worker by Sector, 2010-2014



Source: MTI Estimates

* Excludes foreign domestic workers

Growth in real VA per AHW outpaces growth in real VA per worker…

Implications for Productivity Growth

Next, we compute real VA per AHW for the entire economy and the various sectors. Exhibit 5 summarises the trends in labour productivity growth for the economy from 2009 to 2014.

We find that labour productivity, measured as real VA per AHW, increased at a compounded annual growth rate (CAGR) of **2.9 per cent from 2009 to 2014**, compared to the 2.5 per cent recorded when productivity is measured as real VA per worker. This is consistent with the Economic Strategies Committee's aim of achieving 2-3 per cent productivity growth per annum over the 10 years from 2009, but much of it was due to the strong rebound of 9.9 per cent in 2010 as the economy recovered from the global financial crisis.

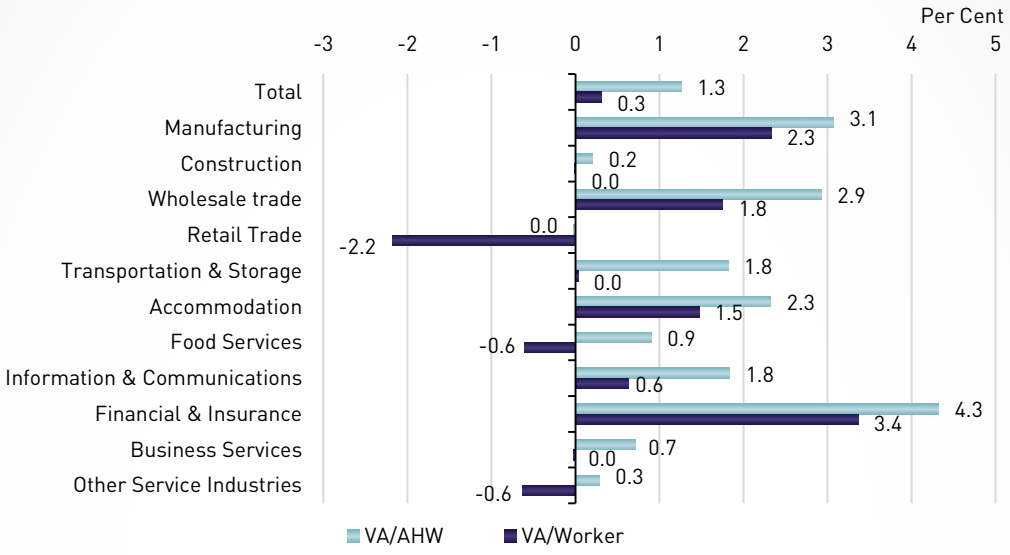
Real VA per AHW increased by a CAGR of **1.3 per cent in the subsequent four years from 2010 to 2014**, higher than the 0.3 per cent per annum for real VA per worker. The faster growth in real VA per AHW was in turn due to the fall in AHW per worker over the last four years, as described above.

Exhibit 5: Real VA and Labour Productivity Growth, %

	2010	2011	2012	2013	2014	2009-2014 (CAGR)	2010-2014 (CAGR)
Real VA	15.2	6.2	3.4	4.4	2.9	6.4	4.2
Real VA per AHW	9.9	3.8	-0.2	0.6	0.9	2.9	1.3
Real VA per worker	11.6	2.3	-0.5	0.3	-0.8	2.5	0.3

A comparison of the growth in real VA per worker and real VA per AHW by sectors from 2010 to 2014 is shown in Exhibit 6. Again, we find that the growth in real VA per AHW is higher than the growth in real VA per worker in every sector over this period. Notably, the retail trade, transportation & storage and food services sectors saw much higher growth in productivity when productivity is measured as real VA per AHW, in part due to the increase in part-time employment in these sectors.

Exhibit 6: Productivity CAGR (2010 – 2014) by Sector



Source: MTI Estimates

There is scope to improve compilation of AHW data…

Adopting real VA per AHW as a measure of productivity provides a more complete picture of productivity changes in the economy. It takes into account changes in employment patterns, such as the rise in part-time work, as well as cyclical effects on hours worked. Using this new measure, labour productivity growth over the last five years, as well as over the four years from 2010 to 2014, is higher compared to the real VA per worker measure. This is also true for all sectors of the economy from 2010 to 2014.

Going forward, MTI, along with the Department of Statistics (DOS) and MOM, will explore how to improve the compilation of AHW data and work towards publishing the real VA per AHW series on a regular basis.

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ANNEX 1 – International Comparison of Methodologies to Obtain AHW

Countries adopt different approaches to estimate AHW per worker. Exhibit A1 compares the approaches taken by the United States, Canada, Australia and OECD (for calculations of AHW for South Korea and United Kingdom), with the method adopted for Singapore in this study.

Exhibit A1: Comparison of Methodologies Adopted to Compute AHW per Worker

Country	Source of AHW	Sources of data on total hours worked (by importance)	Hours concept used in source data	Sources of data on employment (by importance)	Methodology used to create average annual AHW per worker
Singapore	MTI Estimates	Labour force survey, establishment survey	UHW, PHW	Administrative data, labour force survey	Use UHW for local employees and self-employed. Peg hours worked for foreign employees to PHW for full-time workers at the sector level. Adjust for paid leave and holidays. Divide total hours by total employment.
United States	Bureau of Labour Statistics	Establishment survey, labour force survey	PHW, AHW	Labour force survey, data on armed forces	Total hours is adjusted to account for sporadic events and interpolated to produce estimates for all weeks in the year. Divide total hours by total employment.
Canada	Statistic Canada	Labour force survey, establishment survey, national accounts	AHW	Labour force survey, establishment survey, national accounts	Total hours is adjusted to account for sporadic events and interpolated to produce estimates for all weeks in the year. Divide total hours by total employment.
Australia	Australian Bureau of Statistics	Labour force survey	AHW	Labour force survey	Estimate total hours worked in a year by linearly interpolating hours worked data collected from labour force surveys and correcting for sporadic events. Divide total hours by total employment.
South Korea	OECD Statistics	Labour force survey, establishment survey	AHW	Labour force survey, establishment survey	Weekly actual hours worked are multiplied by a factor of 52 weeks to obtain annual hours worked before dividing by total employment.
United Kingdom	OECD Statistics	Labour force survey	AHW	Labour force survey	Weekly actual hours worked are multiplied by a factor of 52 weeks to obtain annual hours worked before dividing by total employment.

Source: Statistics Canada, Australian Bureau of Statistics, OECD Statistics, Fleck (2009)

In general, data collected from establishment surveys tend to produce lower estimates of AHW than data collected from labour force surveys. This is due to firms underreporting hours worked by employees, and respondents from labour force surveys overstating hours worked. In addition, countries adopt different approaches to account for public events and holidays. This includes estimating the time not worked due to the holidays and subtracting it from the total hours worked, as well as other statistical approaches. The differences in sources and methodologies partially explain the differences in AHW when comparing across countries.

More broadly, OECD has noted that there are many problems associated with the accurate measurement of AHW (Schreyer, 2001). Challenges include combining information from different survey sources and measuring the labour input of self-employed persons. Fleck (2009), recognising the variety of approaches, further recommends that only broad comparisons of AHW across countries be made and that the data be analysed as trends instead of levels.