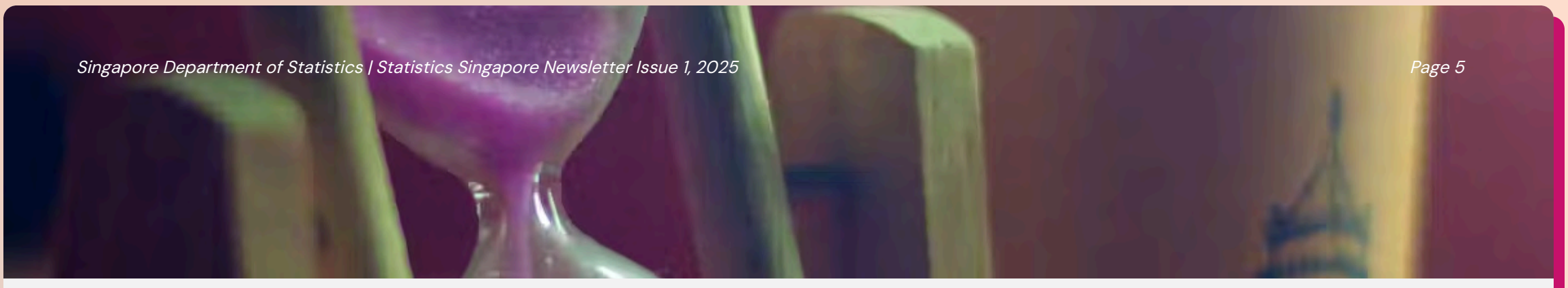

Multifactor Productivity: An Experimental Series on Using Total Actual Hours Worked as a Measure for Labour Input

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Introduction

The Singapore Department of Statistics (DOS) publishes annual data on multifactor productivity (MFP) using total employment and net fixed capital stock as measures for labour and capital inputs respectively. After the COVID-19 pandemic, as part-time and other flexible work arrangements became increasingly prevalent, DOS developed an experimental data series [1] for MFP using total actual hours worked (AHW) as the measure for labour input in the economy. The experimental MFP data series will be compiled alongside the existing published MFP data series, allowing DOS to evaluate the reliability and robustness of the revised methodology.

Compared with using total employment as the measure for labour input, total AHW better reflects variations in work hours in the economy. For example, while employment levels have remained generally stable during the COVID-19 pandemic with support from the Singapore government via the Jobs Support Scheme [2], the total actual hours worked had significantly dropped during the Circuit Breaker [3] due to restrictions on selected economic activities.

This article provides an overview of the MFP concepts and methodology, and highlights key findings on the experimental MFP series.

Concepts & Methodology

What is Productivity?

Productivity measures how much output is produced relative to the inputs of labour, capital (e.g., plant and equipment) and technology. An increase in productivity implies that more output can be produced with the same or fewer inputs.

Labour Productivity

Measures output per unit of labour input. Value added is generally used as the measure of output, while labour input may be measured by total employment (i.e., total number of employed persons) or total actual hours worked by all employed persons.

Multifactor Productivity (MFP)

Measures output to a set of combined inputs, usually labour and capital. A change in MFP reflects the change in output that cannot be accounted for by the change in the combined inputs. Therefore, MFP measures the effects of changes such as technological progress, human capital, and changes in the organisation of production.

When MFP grows, it implies that the economy is producing more output with the same inputs, indicating an increase in overall economic efficiency. MFP growth is estimated with the formula on the right.

MFP Growth =

Growth in Output

– *Average Share of Labour Input* x *Growth in Labour Input*

– *Average Share of Capital Input* x *Growth in Capital Input*

[1] A set of preliminary statistics or data that are in the developmental stage, subject to revisions or methodological changes.

[2] The Jobs Support Scheme (JSS) was introduced in Budget 2020 to provide wage support for employers to retain their local employees during the period of economic uncertainty. Under the JSS, the Government co-funded a proportion of the first $4,600 of gross monthly wages paid to each local employee. The JSS was extended by up to 6 months in Budget 2021 for selected sectors such as aviation and hospitality.

[3] An elevated set of safe distancing measures implemented by the Singapore government to rapidly curb the spread of a contagious disease, most notably used during the COVID-19 pandemic.

The economy's growth in output is first decomposed into contributions of labour and capital before deriving MFP growth as a residual. The derived MFP growth reflects changes in output which are not due to changes in labour and capital inputs. Examples include technological progress, improvements in the quality of capital and/ or labour inputs such as increased educational attainment of the workforce. More importantly, the MFP growth offers important insights into the productive trajectory of an economy.

The average share of labour input is expressed as the share of compensation of employees to nominal gross domestic product (GDP) at factor cost. The use of nominal GDP at factor cost is preferred over GDP at market prices to avoid distortion of taxes on production on labour or capital shares. The average share of capital input is thus assumed to complement the average share of labour input i.e., it equals 100% minus the share of labour input.

Total employment or total AHW is used as a measure for labour input while net fixed capital stock compiled using the perpetual inventory method (PIM) [4] is used as a proxy measure for capital input.

Key Findings

A comparison of the existing MFP data series using total employment (MFP(EMP)) versus the experimental MFP using total AHW [5] (MFP(AHW)) as the measure for labour input showed that both series are generally consistent across the years (Chart 1).

It is also worth highlighting that MFP growth tends to closely correlate with real GDP growth, reflecting similar economic peaks and troughs.

As the growth of total AHW is generally lower than that of total employment, the experimental MFP(AHW) data series showed higher derived MFP growth [6] compared to the MFP(EMP) (Table 1).

Chart 1: MFP Growth Comparison (%)

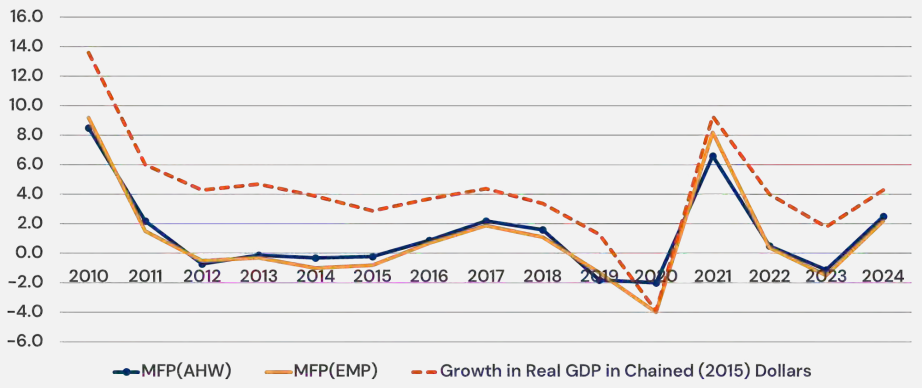


Table 1: MFP Growth using Total AHW versus Total Employment as the Measure for Labour Input

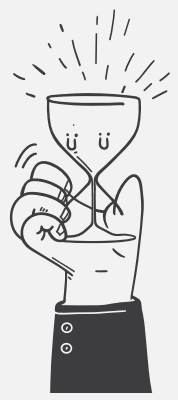
	Growth in Real GDP in Chained (2015) Dollars	MFP Growth		
		MFP(AHW) (1)	MFP(EMP) (2)	% Point Difference (1) – (2)
2010	13.6	8.5	9.2	-0.6
2011	6.0	2.2	1.5	0.7
2012	4.3	-0.7	-0.5	-0.1
2013	4.7	-0.1	-0.3	0.2
2014	3.9	-0.3	-1.0	0.7
2015	2.9	-0.2	-0.8	0.6
2016	3.7	0.9	0.7	0.2
2017	4.4	2.2	1.9	0.3
2018	3.4	1.6	1.1	0.6
2019	1.3	-1.8	-1.3	-0.5
2020	**-3.9**	**-2.0**	**-4.0**	**2.0**
2021	**9.3**	**6.6**	**8.2**	**-1.6**
2022	4.0	0.5	0.4	0.1
2023	1.8	-1.1	-1.5	0.4
2024	4.3	2.5	2.2	0.4
Average (2010 to 2024)	*3.6*	*0.7*	*0.5*	*0.3*

Note: The growth rates are expressed in log terms. Data may not add up due to rounding.

[4] The perpetual inventory method (PIM) involves the accumulation of past real investments in each asset type (gross fixed capital formation) while making allowances for the depreciation (fall in value) that accompanies the aging of these assets, which are eventually scrapped upon reaching the end of their service lives. A straight-line depreciation is adopted with the assets' average service lives estimated to range from five years for software investment to eighty years for residential buildings.

[5] Experimental data series on MFP using total AHW as the measure for labour input is only available from year 2010 onwards, due to the data availability of total AHW.

[6] As MFP is derived as a residual, the larger the growth of labour and capital input, the smaller the residual MFP growth.



The largest differences between MFP(AHW) and MFP(EMP) were observed during the COVID-19 pandemic in 2020 and 2021.

While the JSS had helped employers retain their employees during the pandemic, total AHW had considerably dropped during the Circuit Breaker due to restrictions in selected economic activities. As such, the derived MFP(AHW) growth reflected a smaller 2.0% decline compared to a 4.0% decline for MFP(EMP) in 2020.

MFP(AHW) declined to a smaller extent as the total AHW more accurately reflected the fall in labour inputs compared to total employment. Conversely, the growth of total AHW recovered while total employment continued to decline in 2021, resulting in a smaller growth in MFP(AHW) compared to MFP(EMP).

Singapore's MFP(AHW) rose 0.7% per annum (p.a.) between 2012 and 2022 (Table 2). This was comparable to other advanced economies like Switzerland (0.7% p.a.) and the United States of America (0.6% p.a.), but lower than that of the Republic of Korea (1.3% p.a.) [7].

Table 2: MFP(AHW) Growth across Selected Economies (% p.a.) from 2012 to 2022

Economy	MFP Growth per annum (2012-2022)
Singapore	**0.7%**
Republic of Korea	1.3%
Portugal	0.8%
Switzerland	0.7%
United States of America	0.6%
Sweden	0.6%
Germany	0.6%
Finland	0.4%
Netherlands	0.4%
United Kingdom	0.3%
Italy	0.3%

Source: Organisation for Economic Co-operation and Development

Conclusion

DOS's development of the experimental data series for MFP using total AHW as the measure for labour input can better reflect the growing prevalence of part-time and other flexible work arrangements after the COVID-19 pandemic. The alternative MFP data series provides policymakers and researchers with additional insights into Singapore's productivity trends in today's fast and evolving global economic landscape.

[7] MFP data for these economies are only available up to 2022.

Check out this dashboard!

SingStat Website

Productivity Dashboard

Explore quarterly and annual trends in productivity, in terms of value added per actual hour worked and per worker, across industries.