RESERVE BANK OF AUSTRALIA

Bulletin

July 2025

Some graphs in this publication were generated using Mathematica.

ISSN 1837–7211

July 2025

Bulletin

Articles

A (Closer to) Real Time Labour Quality Index

Angelina Bruno, Jonathan Hambur and Lydia Wang*

Photo: davidf – Getty Images

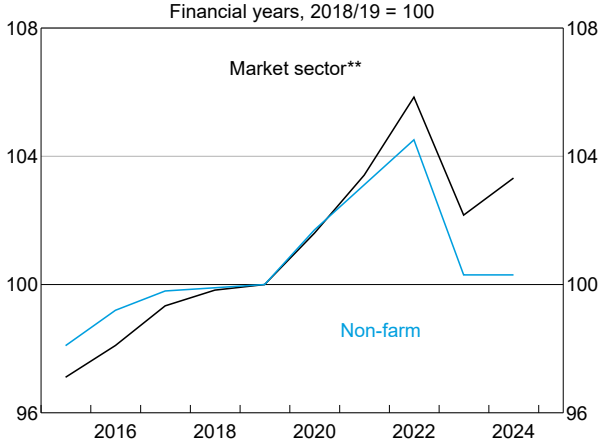
Abstract

One explanation that has been put forward for weakness in productivity growth over the past few years is the entry of less experienced or less educated workers to the strong labour market. However, existing labour 'quality' statistics that capture such dynamics use delayed information and so can be hard to interpret in real time. To address this problem, we used microdata sources to construct a timely version of the existing labour quality statistics. In doing so, we found evidence that labour quality has actually increased strongly since the COVID-19 pandemic and supported growth in market sector productivity over recent years. While initial work suggests that standard approaches may miss some relevant dimensions of human capital, such as time outside employment, these do not appear substantive enough to overturn the main findings.

Introduction

Productivity growth is the key driver of rising living standards over time. Looking through recent volatility, productivity growth has been slow over recent years – focusing on the entire economy, it was broadly unchanged over the five years to June 2024 (Graph 1). Even if we remove industries like health care where measuring productivity can be quite hard, growth has been slower than previous decades.

Graph 1
Labour Productivity*
Financial years, 2018/19 = 100



* Using financial year data.
** Market sector excludes health, education and public administration industries.
Sources: ABS; RBA.

One potential explanation that has been put forward for the slow productivity growth over recent years is the entry of younger, less educated or less experienced workers into the very strong labour market (Productivity Commission 2025). These workers may have fewer accumulated skills – or less 'human capital' – making them less productive. If this is the case, we might expect productivity to pick up over coming years if the labour market weakens, or as some of these workers build up new skills.

One way to consider these dynamics is to look at quality-adjusted labour input (QALI) indices. When measuring labour productivity – that is, how much output is produced for every hour of input – all hours tend to get treated the same, no matter what type of worker is completing them. But QALI indices try to account for changes in the types of workers doing these hours, in terms of how much 'human capital' they have. So, if output increases, but this reflects more hours being worked by highly educated workers, on face value it looks like productivity has gone up. But we might equally argue the amount of labour inputs in terms of the amount of human capital and skills actually going into production has risen, and so maybe productivity did not actually rise. QALI indices capture this, so would rise as the amount of human capital increases. By measuring labour inputs using a QALI index rather than total hours, we can get a sense of the role that changing labour 'quality' had in supporting productivity.

The Australian Bureau of Statistics (ABS) constructs and reports on such measures. However, the ABS index relies on lagged data from five-yearly Censuses, which could lead to misleading results during exceptional periods, such as the past five years. To address this issue, we developed a higher frequency measure of labour quality using the microdata underlying the Longitudinal Labour Force Survey (LLFS) to assess how changes in labour quality have affected productivity.

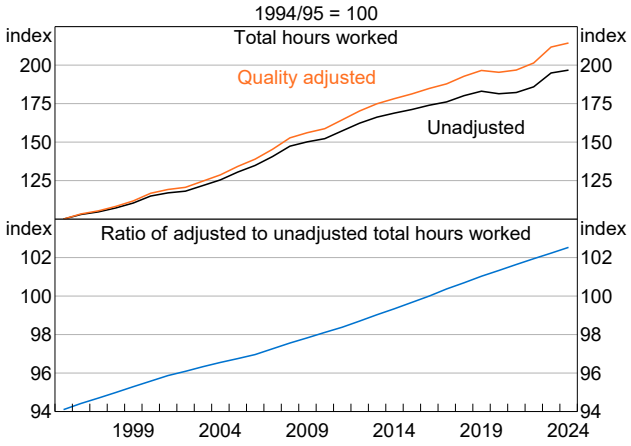
Current approaches to adjusting for labour quality in productivity measurements

QALI indices attempt to account for compositional changes in the number of hours worked by different types of workers with different levels of human capital. In constructing their measure, the ABS (2005) focuses on two determinants of worker human capital and productivity: their age (a proxy for experience); and their education. They measure the share of hours worked by each age and education cohort using the Census, and take the average wage earned by each cohort as a measure of their human capital.[1] The share of hours and average wages are then combined using a Tornqvist index, which is a particular way of combining changes in several different groups into a single number. As this approach relies on the five-yearly Census, the ABS must interpolate the number of hours and pay between Censuses and extrapolate out from the 2021 Census based on what happened over the previous five years.[2] The ABS only constructs a QALI index for the market sector (ABS 2022).

Over time, the ABS QALI index has grown more quickly than an unadjusted labour input index (i.e. total hours worked) (Graph 2). In part, this reflects growth in the share of hours worked by workers with higher education. This means that standard labour input metrics understate the growth in labour inputs, at least

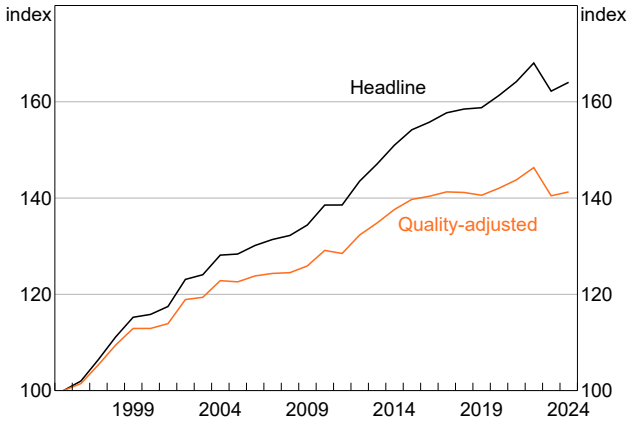
in terms of the total amount of human capital used in production. If we use the ABS's QALI index as our measure of labour inputs when constructing productivity rather than just total hours, productivity growth since the mid-1990s would be around one-third lower (Graph 3). While crude, this suggests that growth in the 'quality' of labour inputs accounted for one-third of the growth in labour productivity in the market sector since the mid-1990s.

Graph 2
Labour Input Indices*
1994/95 = 100



* Market sector.
Sources: ABS; RBA.

Graph 3
Labour Productivity*
1994/95 = 100



* Market sector.
Sources: ABS; RBA.

While QALI-adjusted productivity data are not generally what people focus on, they can be used to assess the contribution from changing labour quality or 'labour composition' to headline productivity and economic growth (D'Arcy and Gustafsson 2012; Duretto, Majeed and Hambur 2022). Given the indices are fairly simple, such calculations should be interpreted with some caution. However, they can still provide a useful sense of how human capital could be contributing to productivity growth.

Constructing a timely QALI index using more frequent data

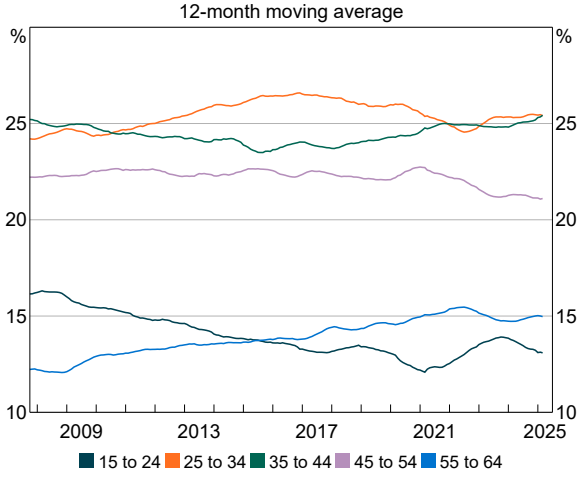
As noted, the ABS uses Census data to construct its QALI index. As the last Census was in 2021, for outcomes in the past three years they extrapolate using growth between 2016 and 2021. While this may be reasonable in normal times, it may be misleading in the context of recent unusual labour market dynamics.

To overcome this issue, we turn to the person-level Longitudinal Labour Force Survey (LLFS) microdata asset. This dataset contains deidentified person-level responses to the ABS Labour Force Survey at a monthly frequency. It contains information on hours worked, education, age and other characteristics. As such, it contains all the information we need to replicate the official ABS index at a higher frequency.

As discussed before, there are two key components in the QALI index: the average wage rate for different groups, which reflect their productivity level; and the share of hours worked by different groups. The former we take directly from the official index. For the latter, we construct measures of the share of hours worked in all jobs in the market sector by different age and education cohorts using the LLFS.

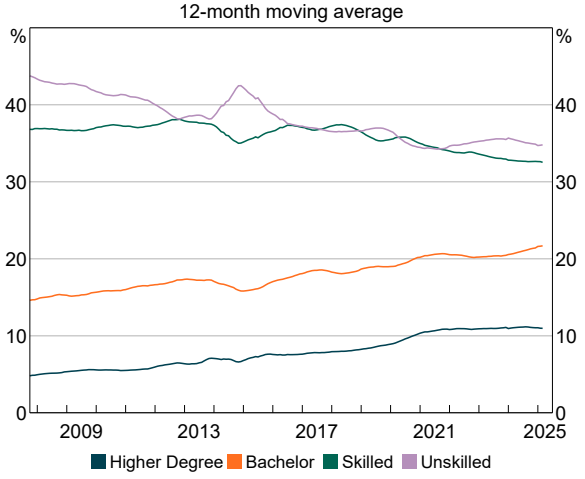
Graphs 4 and 5 show some of the compositional trends coming out of the data. Consistent with Brown and Guttmann (2017), older workers have accounted for a growing share of the labour force over time. Over the pandemic period there were some further shifts, with the share of very young workers (aged 15–24 years old) falling and then rebounding, while the share of older prime-aged workers (45–54) fell sharply.[3]

Graph 4
Hours Worked by Age
12-month moving average



Sources: ABS; RBA.

Graph 5
Hours Worked by Education*
12-month moving average



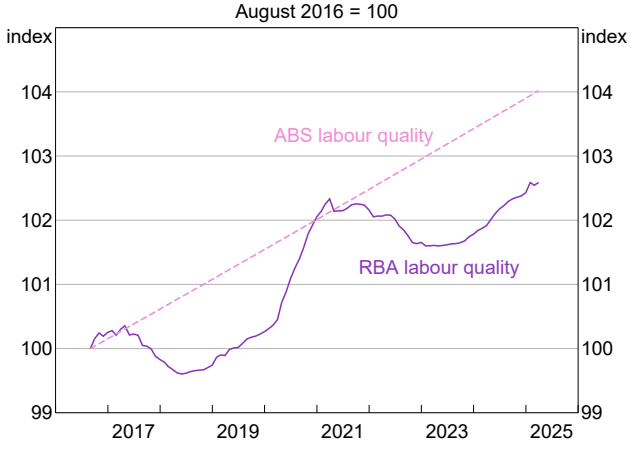
* Level of highest educational attainment.
Sources: ABS; RBA.

Focusing on education, as noted above, the share of highly educated workers in the labour force has increased over time. Over the pandemic period, there was a further shift up in the share of hours worked by those with Bachelor degrees or higher. This was offset by a fall in the number of skilled workers (those with non-university post-secondary qualifications) and unskilled workers (those with secondary equivalent education or lower qualifications); at least in part, this likely reflected disruption in many contact-intensive industries such as hospitality during the pandemic (Bruno, Dunphy and Georgiakakis 2023). Most of the industry compositional change over 2020/21 had unwound by the 2021/22 financial year. Nevertheless, the labour quality index remained above pre-pandemic levels, in part reflecting an increase in the share of highly educated workers in most industries (see Table A1 in Appendix A). These patterns are interesting, but it is hard to assess how they could affect the overall productivity of the labour force by simply looking at them directly. Incorporating them into a QALI index can provide a framework to assess the net effects.

We constructed our QALI index by combining the wage and hours data using the same Tornqvist index methodology as used in the ABS index. We then took a 12-month moving average and index to August 2016 to smooth out seasonal volatility.

Graph 6 compares our higher frequency QALI index to the ABS index. The two are very similar in mid-2016 and mid-2021 – that is, the dates of the Censuses underlying the official index. This provides a good check that our approach is capturing the same underlying information. However, the patterns look very different between and after the Census dates. While the official index interpolates linearly between 2016 and 2021, our index shows that growth in labour quality was slow over the years leading up to the COVID-19 pandemic. It then increased sharply over 2020, catching up to the official index. This likely reflects the level shift up in the share of hours worked by higher educated workers as hospitality and other face-to-face services were closed during lockdowns (Graph 5). After peaking in 2021, our QALI index then declined slightly over 2022 and 2023 as industry compositional changes unwound, before ticking up over 2024 and early 2025. This is in stark contrast with the ABS index, which assumes that labour quality continued to grow quickly.

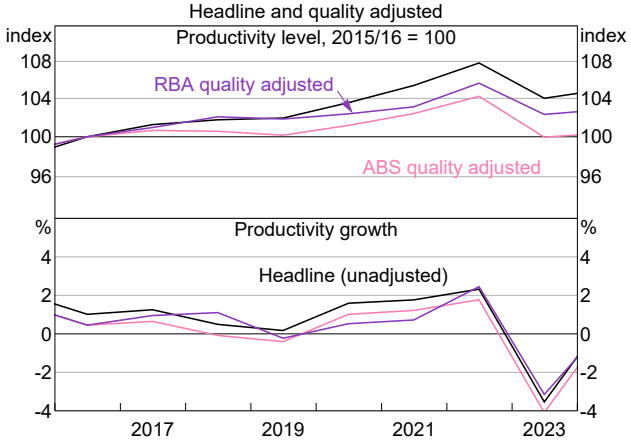
Graph 6
Labour Quality Indices*
August 2016 = 100



* Market sector.
Sources: ABS; RBA.

Overall, according to our higher frequency QALI index, labour quality increased over the pandemic period – rather than decreased, as some have argued – though the increase was smaller than implied by the ABS index. This has implications for our understanding of recent developments in productivity growth. Using our QALI index as the measure of labour inputs leads to a smoother pattern in productivity, with the spike and then fall in productivity during the pandemic becoming smaller. Moreover, average growth in market sector productivity is slower than implied by the ABS headline index, at around 0.3 per cent per year from 2018/19 to 2023/24, compared with around ¾ per cent per year in the official ABS statistics (Graph 7). This suggests that, according to this measure, growth in labour quality accounted for around two-thirds of the growth in labour productivity over the period, and that actual productivity growth was substantially worse than suggested by the headline index.

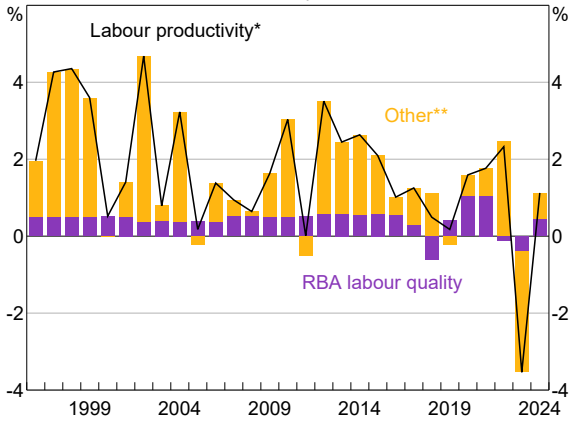
Graph 7
Labour Productivity*
Headline and quality adjusted



* Market sector.
Sources: ABS; RBA.

That said, changes in labour quality can potentially account for some of the weakness in productivity in 2022/23, as the labour market rebounded strongly from the pandemic period. The tick down in labour quality may have subtracted around 0.4 percentage points from productivity growth, but this is only a small share of the 3.5 per cent fall during this period (Graph 8). This means that factors other than fluctuations in labour quality contributed to the fall in productivity growth over the 2022/23 financial year.

Graph 8
Contributions to Labour Productivity Growth
Financial years



* Headline ABS measure of labour productivity growth.
** Non-labour quality related factors, including but not limited to capital deepening, allocative efficiency and technology adoption.
Sources: ABS; RBA.

So far, we have discussed how changes in the composition of the labour force (labour quality) affected actual observed productivity. However, is this the right way to look at things? For example, while labour quality has continued to grow over the past five years, maybe this growth was slower than normal? This would be consistent with our index being below the ABS index since 2021 (where the ABS index extrapolates the 2016–2021 period forwards).

Our index can also be useful in assessing this question. In particular, it shows that there was almost zero growth in labour quality from 2016 to 2019, before the sharp increase in 2021. If we were to take the 2016–2019 period to be 'normal', it would suggest that labour quality growth has actually been quite strong in recent years. This is obviously very simplistic, and the only way of assessing what 'normal' is going forward will be to continue to monitor the index.

Caveats and extensions

There are two key caveats to keep in mind with this analysis. The first is that the QALI index is a measure of the human capital of workers. It does not consider how well matched workers are to a job. So, for example, if we have a big increase in the number of people trained as doctors, but they are doing something completely unrelated to their training, the QALI index will increase, but the amount of skills and training going into production might not be, due to a mismatch between the skills of the workers and the jobs they are doing. While it is possible that this could have happened in recent years, there is no evidence that it has. In fact, evidence suggests that the quality of job matching outcomes did not deteriorate in 2022 as productivity declined, though it did fall in 2020 (Wiley and Wang 2024).

The second caveat is that there may be many important factors that determine a person's human capital and productivity that are not captured in QALI indices. For example, while age may be a good proxy of experience for most people, some people may have spent extended periods out of the labour force (e.g. due to caring responsibilities or unemployment spells). So, our index could be missing drivers of human capital. This is an area of ongoing work, but evidence to date suggests that it is likely not a major issue. Bruno, Hambur and Wang (2024) explore several additional factors that may affect human capital accumulation, such as spells outside of employment. While they found that these affect wages, our measure of productivity and human capital, they also found that there had not been a large increase in the share of hours worked by those with these characteristics. As such, while the exclusion of some of these characteristics from our main index may lead to some bias, this does not appear to be great enough to change the overall conclusions.

Conclusions

Understanding productivity outcomes – and in particular the weakness in productivity growth – over recent years is important, as it can give us some insights into what might happen to productivity going forward. Overall, we found little to no evidence that the entry of workers with less skills and human capital can explain weak productivity growth over recent years. In fact, human capital grew over the period, contributing to productivity growth, and this growth was if anything faster than what was observed over the years leading up to the COVID-19 pandemic. This suggests that productivity is unlikely to pick up as recent dynamics unwind – for example, through some of these workers gaining new skills or leaving the labour market. More generally, it suggests that other factors – including those evident before the pandemic – are contributing to the recent weak productivity outcomes.

Appendix A: Industry composition from 2019 to 2024

Table A1: Change in Employment Share of Bachelor (or Higher Degree) Holders, by Industry
Percentage points

Industry	2019–2024	2019–2022	2021–2024
Agriculture	−0.20	−1.86	1.67
Mining	−0.74	−0.14	−0.60
Manufacturing	2.71	0.09	2.62
Utilities	7.60	−3.44	11.04
Construction	2.67	0.25	2.42
Wholesale	6.58	2.10	4.47
Retail	−0.66	−0.08	−0.58
Hospitality	1.24	2.03	−0.79
Transport	4.28	2.72	1.56
Info media	1.68	−3.21	4.90
Finance	3.22	0.35	2.87
Rental	−2.02	4.88	−6.91
Professional	3.42	0.37	3.05
Admin and support	1.49	0.66	0.83
Arts and recreation	−4.31	−0.74	−3.57
Other services	2.70	1.44	1.26

Sources: ABS; RBA.

Endnotes

* Angelina Bruno is from Economic Analysis Department, Jonathan Hambur is from Economic Research Department and Lydia Wang completed this work while in Economic Analysis Department.

1 This is a fairly standard assumption, that wages reflect productivity. But it might be imperfect in some cases – for example, in the non-market sector where productivity is harder to measure. That said, we exclude the non-market sector.

2 For more details, see Annex B, Chapter 19 of ABS (2021).

3 The uptick in the share of very young workers may in part reflect the brief 'baby boom' that occurred in the mid-2000s to mid-2010s, with many of these children now entering the labour market (Australian Treasury 2023).

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International Students and the Australian Economy

Madeleine McCowage, Harry Stinson and Matthew Fink*

Photo: freemixer – Getty Images

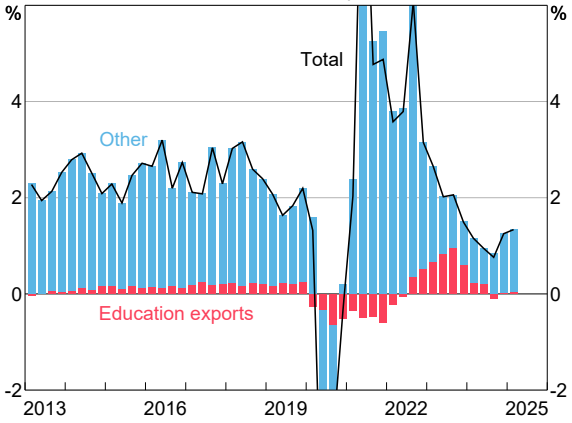
Abstract

International students play a significant role in the Australian economy. They contribute to demand through their spending on goods and services and are an important source of labour for some Australian businesses. This article shows that international students tend to add more to demand in the economy than they do to supply in the short run, in large part reflecting their spending on tertiary education fees. In periods of large swings in international student numbers or when the economy has little spare capacity, this means that changing international student numbers can affect macroeconomic outcomes, particularly in sectors of the economy where supply cannot respond quickly. The rapid growth in international student numbers post-pandemic likely contributed to high inflation over this period, but was not a major driver.

Introduction

International students play a significant role in the Australian economy by spending on goods and services and providing labour for Australian businesses. The number of international students grew strongly after international borders reopened following the COVID-19 pandemic; education exports are currently Australia's fourth largest category of export, at approximately $50 billion in 2023/24. International students have been an important driver of net overseas migration and GDP growth in recent years (Graph 1).

Graph 1
GDP Growth*
Year-ended contributions by component



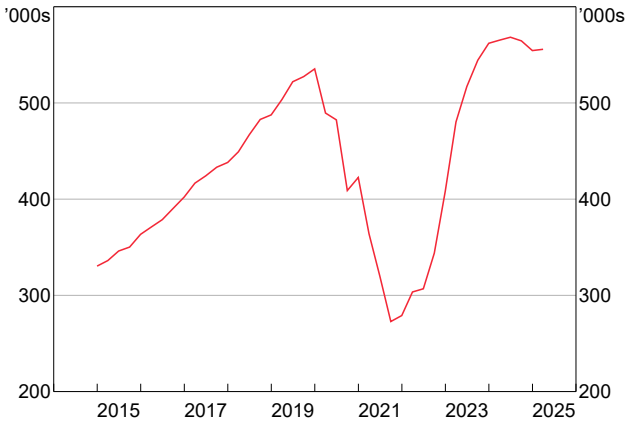
* Outliers during the COVID-19 pandemic have been truncated.
Sources: ABS; RBA.

This article begins by stepping through developments in international student flows since the start of the pandemic in 2020. It then examines the ways in which international students interact with and contribute to the Australian economy, first by taking an economy-wide view of how international students contribute to supply and demand, and then considering their specific interactions with the market for goods and services, the labour market and the housing market. Finally, it concludes by assessing whether large changes in international student numbers have affected macroeconomic outcomes in recent years. Throughout the article, our analysis primarily considers how international students interact with and contribute to the economy from a shorter run perspective; longer run effects are outside the scope of the work.

Recent developments in international student flows

Global demand for education in Australia grew solidly in the decade prior to the pandemic. This reflected a range of factors, including rising household disposable income in Asia, the active promotion of Australia as an education destination, changes to migration policies that enabled higher education students to work in Australia after their studies, global population growth, and the depreciation of the Australian dollar after the mining boom (Grozinger and Parsons 2020; Norton 2024). However, with the introduction of border restrictions in March 2020 to contain the spread of the COVID-19 virus, new students were unable to enter the country. As a result, the number of international students onshore fell sharply (Graph 2).

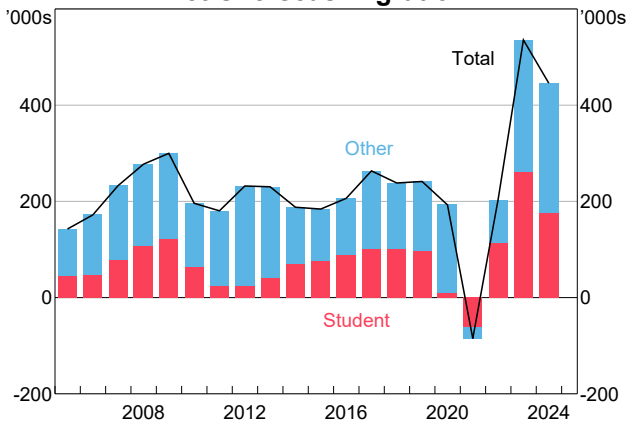
Graph 2
International Students in Australia*



* Primary student visa holders, seasonally adjusted by the RBA.
Sources: Department of Home Affairs; RBA.

After Australia's international borders reopened in late 2021, the number of international students onshore rose rapidly. While student arrivals quickly returned to around pre-pandemic levels, departures were lower because there were fewer students onshore to depart. Overall, these dynamics led to the international student stock rising sharply from just under 300,000 in 2022 to 560,000 by the end of 2023. Accordingly, international students were an important driver of net overseas migration during this period, accounting for around half of Australia's total net overseas migration (Graph 3). Spending by international students was also an important contributor to growth in consumer demand in Australia following the pandemic (Graph 4).

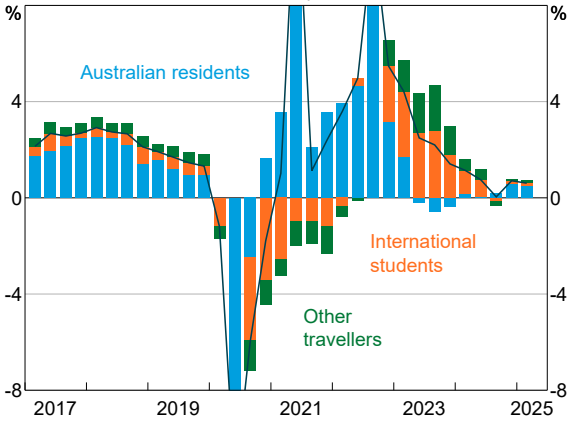
Graph 3
Net Overseas Migration



* Includes migrants on permanent visas (e.g. family, skilled), migrants on other temporary visa classes (e.g. working holiday), and New Zealand citizens.

Sources: ABS; RBA.

Graph 4
Total Consumer Demand in Australia*
Chain volumes, year-ended

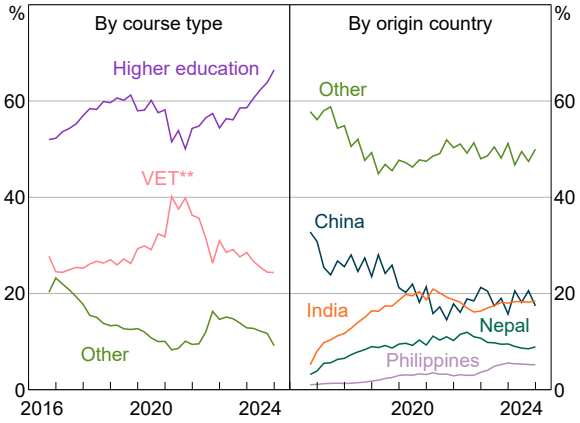


* Consumption and travel exports, less travel imports; outliers during the COVID-19 pandemic have been truncated. Seasonally adjusted by the RBA.

Sources: ABS; RBA.

As the student stock has recovered, the share of international students studying higher education courses has risen, while the share studying vocational education and training (VET) and other types of courses has declined. Most international students are from Asian countries, with Chinese and Indian students making up close to two-fifths of those studying higher education courses (Graph 5).

Graph 5
Australia's International Students*
Share of total students onshore



* Primary student visa holders.

** Vocational education and training students.

Sources: Department of Home Affairs; RBA.

More recently, growth in the number of students onshore has slowed. Student visa grants have fallen, particularly for VET students since mid-2023, and the contribution of international students to growth in total consumer demand has fallen after driving growth following the pandemic. During this time, the Australian Government has tightened processing standards and increased requirements for student visa applicants, including by increasing proof of savings and English language requirements, raising visa application fees, and introducing a Genuine Student Test, in which students must demonstrate they are entering Australia for the purpose of studying (Norton 2024).[1] The Government also reintroduced a cap on how many hours international students can work (48 hours per fortnight during teaching periods). Nevertheless, the number of international students onshore is still near record highs, and timely Australian Bureau of Statistics (ABS) data indicate that student visa arrivals have exceeded departures in recent months, suggesting the number of students onshore is growing.

How do international students interact with and contribute to the Australian economy?

Given the significant number of international students in Australia, it is important to consider how international students interact with and contribute to the Australian economy and, in particular, how they have added to both demand and supply in recent years. To do so, we begin with an aggregate perspective before turning to the market for goods and services, the labour market and the housing market. There is significant variation in the working and spending behaviour of students from different countries and in different courses of study. The analysis below mostly draws on data covering the total pool of international students, and so likely masks important compositional differences.

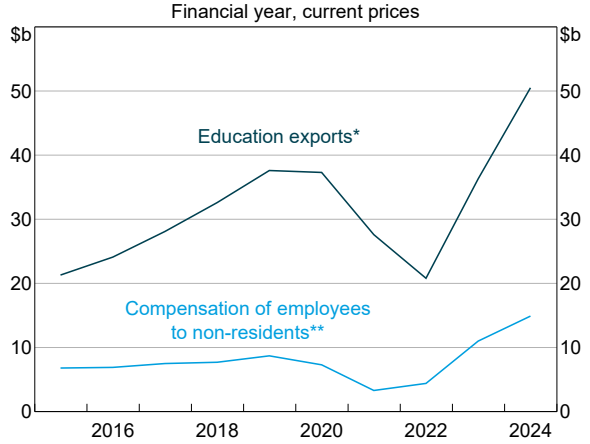
The aggregate impact of international students

The value of education exports is an indication of the demand that international students add to the economy. All spending by international students in Australia on tuition fees and all other goods and services is recorded as an education export in Australia's Balance of Payments (ABS 2024).[2]

However, international students also contribute to the economy's supply potential because many will work while they are in Australia. The Balance of Payments (BOP) provides an estimate of the value of this labour supply contribution.[3] If an international student is employed in Australia while studying, payments from their employer are recorded in the primary income account as Compensation of Employees (COE) to non-residents.[4] International students comprised around 90 per cent of COE to non-residents in 2023/2024. Note that this estimate of student earnings will not capture funds a student may receive from or send overseas (transactions between non-residents are not captured in the BOP). It will also not include any 'cash-in-hand' earnings. (This could mean student earnings are underestimated in the BOP: Coates, Wiltshire and Reysenbach (2023a) provide survey evidence that temporary migrants are much more likely to be paid below-minimum wages, meaning cash-in-hand work may be prevalent.)

The value of education exports has been consistently higher than measured COE to non-residents, suggesting that in aggregate international students spend more than they earn in Australia (Graph 6).[5] In 2023/24, education exports were worth $50 billion – more than three times higher than the estimated $13.4 billion of COE earned by international students.

Graph 6
International Students in the Balance of Payments
Financial year, current prices

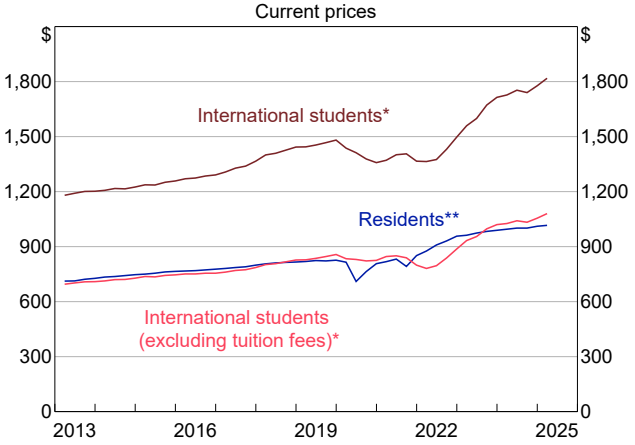


* Includes tuition fees as well as the value of international student spending on food, accommodation and other goods and services.
** Approximately 90 per cent of non-residents in this series were international students in 2023/24.
Sources: ABS; RBA.

Spending on goods and services

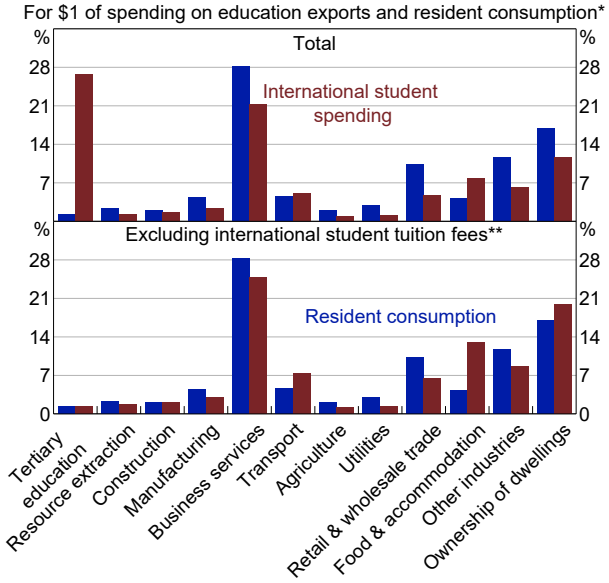
While living and studying in Australia, international students consume goods and services. Our estimates of the average weekly spend of international students using BOP data suggest that international students spend twice as much as residents (as measured by consumption per capita in the Australian National Accounts: National Income, Expenditure, and Product) (Graph 7).[6] A large proportion of this is due to tuition fees, which account for 40 per cent of international student spending. Excluding fees, international students spend roughly the same as residents on average.[7] The BOP figures on international students' average spending on goods and services are based on a survey of visitors who have travelled to Australia for education purposes by Tourism Research Australia, and course fee spending data from the Department of Education, Skills and Employment.

Graph 7
Average Weekly Expenditure Per Person
Current prices



* Four quarter moving average; Balance of Payments estimate.
** Estimate based on National Accounts household final consumption expenditure (seasonally adjusted) divided by an estimate of the population excluding students.
Sources: ABS; RBA.

Graph 8
Economic Contribution by Industry*
For $1 of spending on education exports and resident consumption*



* 2017/18 data.
** Contributions to spending if international student spend on tuition fees is set at the same share as that in resident consumption.
Sources: ABS; RBA.

Certain industries face relatively more demand from international students.[8] Unsurprisingly, international student spending is more concentrated in the tertiary education sector than that of other residents, given their higher spending on tuition fees (Graph 8). When we exclude tuition fee spending, international student spending patterns are quite similar to that of residents – it is broadly based across industries and as such disperses widely through the economy. There are, however, some slight sectoral differences. Accommodation and food, transport, and housing make up a slightly higher share of the gross value added associated with education export spending, while business services, and retail and wholesale trade, make up a lower share.

As mentioned above, international student spending plays a significant role in the tertiary education sector. International student tuition fees make up a material share of revenues for universities, and this share has risen over time (Norton 2023). For the major universities, this share ranges from 15 per cent to over 40 per cent of total revenue (including grants) (Sato, Higgins-Devine and Austin 2024). As such, the fees paid by international students have important spillover benefits to university research, employment and capital expenditure. International students have also come to account for a substantial share of enrolments in the VET sector, with enrolments from this group having risen sharply over the last 10 or so years (NCVER 2024; Norton 2024).

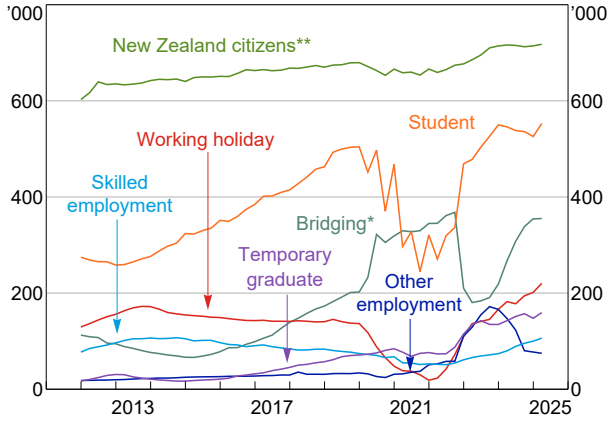
A unique feature of international student spending relates to the savings that international students bring to set up and finance their life in Australia. Currently, international students need to provide proof of nearly A$30,000 of savings to receive a student visa; up from around A$25,000 in 2023, which is higher than the cash savings most Australian residents have in their bank accounts. This could mean there is a temporal dimension in international student consumption, whereby consumption is strong upon arrival in Australia as individuals use these savings to set up their lives (i.e. purchasing furniture and other goods) but then slows afterwards; this same dynamic may hold for domestic residents moving out of home to attend university.[9] In periods of strong inflows of students, such as just after borders reopened after the pandemic, this likely had an important effect on aggregate demand in the economy.

The labour market

International students make an important contribution to the labour market. While they only made up around 2 to 3 per cent of the labour force prior to the pandemic, they constitute the second largest group of temporary visa holders with work rights in Australia after New Zealand citizens, making them a large source of potential labour supply for the Australian economy (Graph 9). There is also a sizeable cohort of individuals on

temporary graduate visas, which allow international students to live and work in Australia for between one and five years after they have finished their studies.

Graph 9
Temporary Visa Holders in Australia*
Primary visa holders



* The stock of temporary visa holders in Australia at a particular date in the last month of each quarter. Seasonally adjusted by the RBA.

** The Special Category visa for New Zealand citizens is classified as a temporary visa, though visa holders can remain in Australia for as long as they are a New Zealand citizen.

Sources: Department of Home Affairs; RBA.

Prior to the pandemic, the average international student appeared to contribute less to labour supply than an average member of the working age population and an average member of the entire resident population (i.e. including those aged 15 years and under and those aged over 64 years). International students had lower labour force participation rates than working age residents and were limited to working 40 hours per fortnight. Using experimental estimates derived from the ABS Longitudinal Labour Force Survey (LLFS), we estimate that the average international student worked around half of the weekly hours of an average member of the working age population prior to the pandemic, and around two-thirds of the hours of an average member of the total resident population (Table 1).[10]

In the years immediately following the pandemic, the contribution of international students to labour supply has risen, reflecting both a rise in their participation rates and a lift in the limit on how many hours they can work (from 40 hours to 48 hours per fortnight). In 2024, we estimate that the average international student worked around three-quarters of the hours of an average member of the working age population, and around the same hours as an average member of the total resident population. Note that these are likely upper bound estimates since we assume all international students who participate in the labour force work up to the legal limit. Although these estimates apply to the entire student population, the propensity of international students to work varies by country of origin, with students from India and Nepal typically having higher rates of labour force participation (Grozinger and Parsons 2020; Norton 2023) and those from China having lower rates of participation.

Table 1: Labour Force Participation and Average Hours Per Capita[(a)]

	Pre-pandemic				2024		
	International students (2015-2019 average, LLFS estimate)	International students (2016 Census estimate)	Working age population	Entire resident population	International students (LLFS estimate)	Working age population	Entire Resident population
Participation rate (%)	44	51	65	53	61	67	55
Average weekly hours per capita	9	10	20	16	15	20	16

(a) Average hours per capita is calculated as total hours worked divided by either the international student population, the working age population, or the estimated resident population. Total hours worked for international students is estimated by assuming all international students in the country work up to the legal limit of 40 hours per fortnight (pre-pandemic) and 48 hours per fortnight in 2024, and then multiplying this by their participation rate.

Sources: ABS; RBA.

Looking forward, while rules around the number of hours that international students can work are higher than pre-pandemic, average participation may decline from the levels seen in 2024. This is because the recent tightening in visa policy has targeted groups of students who were more likely to be seeking to work; that is, those international students who *do* receive visas going forward are less likely to be focused on employment opportunities in Australia on average (Norton 2024).

International students nevertheless make a notable contribution to labour supply in certain sectors. A greater share of international students work in accommodation and food, as well as retail, compared with the share of the total labour force (Table 2). Further, an increasing share of students are now working in health care, consistent with strong labour demand in this sector. This contribution was important in helping businesses in these sectors facing labour shortages in the tight labour market that emerged post-pandemic.

Many international students will also add to labour supply beyond their 'direct' contributions during their studies. Over time, many international students transition to temporary graduate visas or permanent residency. About 30 per cent of international students went on to apply for temporary graduate visas in the five years to 2022, with this share having risen over time, and international students making up around one-third of Australia's permanent resident intake (Department of Education 2022).[11] Coates, Wiltshire and Reysenbach (2023b) discuss the longer term benefits of having the 'best students' stay permanently in Australia, including in terms of taxes paid over their lifetimes and spillovers to innovation and productivity growth (the authors note, however, that many international students may remain in 'visa limbo' on temporary graduate visas, working in low-skilled jobs and earning lower incomes than domestic students).

The housing market

An important area in which international students contribute to demand and, potentially over time, supply is in the housing market.

International students are more likely to rent than Australian residents. About 50 per cent of over 70,000 international students surveyed in the 2023 Student Experience Survey reported that they rent in the private rental market (either in a private rented house, flat or room) (QILT 2023);[12] by contrast, around one-third of the rest of the population are renters (Agarwal, Gao and Garner 2023). In the Student Experience Survey, around 24 per cent of international students reported living with family or friends, 15 per cent in student accommodation, 3 per cent in a homestay and 2 per cent in 'other' accommodation. Housing demand from international students also tends to be geographically concentrated around areas where educational institutions are based, notably inner-city locations. According to the 2016 Census, international students were twice as likely to live in inner-city areas than domestic students (Evans, Rosewall and Wong 2020).

Table 2: Sectoral Composition of Employment – International Students vs Labour Force[(a)]
Per cent

		Retail	Accommodation and food	Transport	Administrative	Education	Health care	Other
2016–2019	International students	13.1	37.4	5.7	8.4	6.9	11.5	18.4
	Total labour force	10.2	7.0	5.1	3.4	8.1	13.2	52.9
2023	International students	13.7	23.4	8.7	6.7	5.6	17.0	24.8
	Total labour force	9.5	6.6	5.1	2.9	8.3	15.4	52.2

(a) This table shows experimental LLFS estimates of the sectoral composition of international student (and labour force) employment; note that the ABS recommends that the Labour Account should typically be used for analysis of employment and jobs by industry division.

Sources: ABS; RBA.

Housing market outcomes are determined by the interaction of housing supply and demand. In theory, in the face of a relatively fixed supply of housing in the short term, we would expect an increase in international students to put upward pressure on rental demand and rents (all else equal), in the same way that any kind of increase in the renting population would impact demand.

As a back-of-the-envelope exercise, if we assume that 50 per cent of international students rent, an additional 100,000 students would increase private rental demand by 50,000 individuals. Models of the housing market used by the RBA suggest that a 50,000 increase in population would raise private rents by around 0.5 per cent compared with a baseline projection. The marginal effect of an additional renter may be greater in periods where the rental market is tight and vacancy rates are low, such as occurred post-pandemic.[13] Nonetheless, the rise in international student numbers is likely to have accounted for only a small share of the rise in rents since the onset of the pandemic, with much of the rise in advertised rents occurring before borders were reopened.

With time, higher demand for housing due to a greater number of international students in Australia could spur more dwelling investment, in the way it would for an expansion of the population more broadly. However, capacity constraints, high costs in the construction sector and low levels of building approvals relative to the population may mean the housing supply response could be slower to materialise compared with in the past (Hunter 2024). One area where higher international student numbers have generated a supply response has been in purpose-built student accommodation, with rapid growth in building approvals for such projects in recent years (ABS 2025). Industry projections are for continued rapid growth in this area in the years ahead (CBRE 2024).

Assessment and conclusion

Australia's BOP suggests that, overall, international students spend more than they earn.[14] In line with this aggregate finding from the BOP, analysis of how international students interact with and contribute to key sectors in the economy suggest that international students likely contribute more to demand than they do to supply, although this gap appears to have narrowed following the pandemic. In the market for goods and services, the 'average' international student spends more than other Australians, driven by high average spend on tuition fees. On the other hand, lower average hours worked and labour force participation rates mean that, at least prior to the pandemic, their labour supply contribution was less than that of an average member of the working age population and the average Australian resident. In the housing market, supply is constrained in the near term, so changes in the number of international students in Australia could impact market outcomes, in the same way changes in the population more broadly could.

If and how the short-term demand-supply imbalance of international students affects macroeconomic outcomes will depend on several factors. This could include the degree of spare capacity in the economy and labour market, the pace of change in student numbers (in addition to the overall level) and developments in the economy's supply side. For example, rapid growth in the international student stock post-pandemic likely contributed to some of the upward pressure on inflation from 2022 to early 2023, especially as arriving students frontloaded their spending as they set up in Australia and took time to join the labour market. However, the increase in international students was just one of many other forces at play in this time that drove demand above supply in the economy, and hence higher inflation. For instance, supply-side factors were the biggest driver of the increase in inflation in 2022 and 2023 (RBA 2023; Beckers, Hambur and Williams 2023) while strong domestic demand arising from supportive fiscal and monetary policy also played an important role.

Endnotes

* Madeleine McCowage and Harry Stinson are from Economic Analysis Department and Matthew Fink is from Economic Research Department. The authors would like to thank Phil Grozinger, Tom Williams, Natasha Cassidy, Tania Blessing, Maddy Terrell and Mick Plumb for their comments and contribution to the analysis.

1 There has also been a large increase in the number of bridging visa holders onshore since mid-2023. Some of this increase may reflect that some students who arrived after the pandemic no longer satisfy student visa requirements under the tighter requirements.

2 Education exports are measured as the number of primary student visa holders onshore multiplied by average expenditure per student. The number of student visa holders onshore depends on students arriving and departing from Australia, as well as people transitioning to and from student visas while in the country. Average spend includes a survey-based estimate of all expenditure by international students while studying in Australia – for example, tuition fees, food, accommodation and local transport.

3 There are reasons why COE may not reflect the full value of international student labour supply, such as if there is imperfect competition or market frictions that mean the value of students' output is greater than what they are paid, or if cash-in-hand work is prevalent among international students.

4 For BOP purposes, the ABS classifies international students as non-residents for the entire duration of their studies, with the move to a different country considered a temporary motivation rather than a change in their centre of predominant economic interest. By contrast, for the Labour Force Survey, an international student would be captured in the labour force if they have been (or expect to be) residing in Australia for at least 12 months in a given 16-month period.

5 Some of the difference between international student spending and earnings is likely made up with transfers from home. Norton (2023) found that over 50 per cent of international students reported receiving a regular allowance from family overseas.

6 A note of caution on these data. While the rough magnitudes at play are informative, the series are compiled on different bases. The BOP measure is based on the International Visitors Survey data supplemented with fee data from the Department of Education, while National Accounts HFCE is compiled using data from a wide range of sources (and includes imputed categories).

7 This conclusion does not materially change when we exclude residents' spending offshore from resident consumption per capita.

8 Estimates in Graph 8 utilise ABS input-output table data from 2017/18 and involve assumptions around how international student spending is dispersed across industries based on Tourism Research Australia's 2019 International Visitor Survey.

9 The Bank of Canada (2024) found that the boost to migrants' consumption on arrival in Canada from home country savings had a relatively small effect on aggregate consumption, but minimum required funds to enter Canada are lower at around C$13,000.

10 These estimates are based on Labour Force Survey (LFS) microdata, where survey respondents are identified as international students by proxy if they were born overseas, were currently enrolled in full-time tertiary education and had lived in Australia for five years or less.

11 In 2023, post-study work rights for international students were temporarily extended by two years for graduates of degrees in select skill shortage areas; this was ended in mid-2024 (Department of Education 2024).

12 Note that, depending on the data source and scope, estimates of the share of international students that rent vary. Using 2016 Census data, Hurley (2020) estimated that 65 per cent of international students live in a rented dwelling.

13 Moreover, model averages based on national data may understate the effect on rental demand in geographic areas where international students are highly concentrated (such as inner-city locations), while overstating the effect in areas with low concentrations of students.

14 The Bank of Canada (2024) found a similar conclusion in their analysis for the effect of 'newcomers' on the Canadian economy, noting the timing dimensions of when migrants contribute to demand and supply: 'The effects on overall supply and demand from increased population growth are expected to largely offset each other over the medium term. However, because newcomers affect demand sooner than supply, this unevenness contributes to inflationary pressures in some sectors. In particular, there are additional upward pressures on house prices and rents.' See also Champagne *et al* (2023).

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How Do Changes in Global Shipping Costs Affect Australian Inflation?

Vanessa Li*

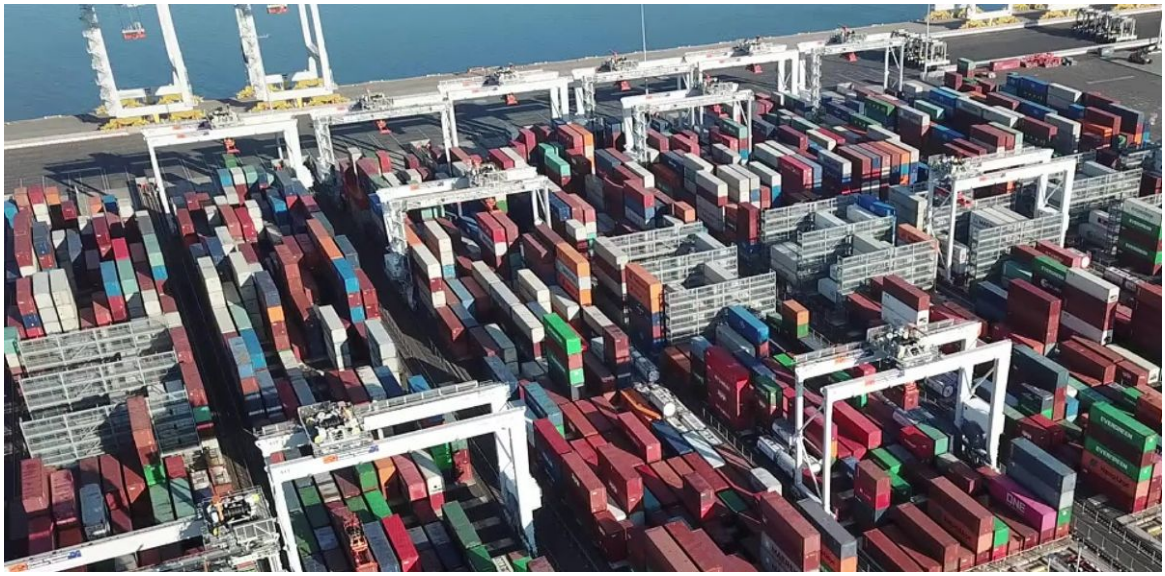


Photo: DLMcK – Getty Images

Abstract

Australia's experience during the COVID-19 pandemic showed that developments in international shipping can have a significant effect on domestic inflation. This is because higher global shipping costs can flow through the supply chain for imports and increase costs for Australian firms, who can in turn pass on those higher costs to consumers. This article addresses the question of when and how unexpected changes in global shipping costs have tended to pass through to Australian consumer price inflation since 2003. It finds that the pass-through to 'shippable' goods inflation can be material, and that shocks to global shipping costs were large enough to have contributed materially to trimmed mean inflation during the pandemic. That said, there is substantial uncertainty around the estimated pass-throughs, particularly because excluding the pandemic period leads to much smaller and less precise estimates of the pass-through to trimmed mean inflation.

Introduction

Over recent years, the global shipping market has been hit by several large shocks that have significantly affected the cost of ocean freight. Higher shipping costs can increase consumer prices in Australia if importers pass on higher freight prices or upstream cost pressures to consumers, or if lower import volumes lead to higher prices for domestic alternatives. Given that the cost of freight services as a share of total Australian import values doubled to around 7 per cent during the COVID-19 pandemic (ABS 2023),[1] shipping cost shocks have the potential to materially increase costs for Australian firms that rely on imports. As such, quantifying the pass-through of shipping costs to consumer prices in Australia can help to inform the RBA's assessment of the outlook for domestic inflation. This article examines the extent to which shocks to global shipping costs tend to pass through to Australian inflation.

The article first discusses how the balance of supply and demand for shipping services has contributed to recent episodes of elevated shipping costs. Second, it discusses the channels through which higher shipping costs can flow through to Australian consumer price inflation. Third, it presents estimates of the average pass-through of shocks to global shipping cost inflation to Australian consumer price inflation. Finally, it presents estimates of the contributions of shipping cost shocks to trimmed mean inflation during the pandemic.

Recent episodes of elevated shipping costs

A shipping operator can charge a cargo owner either:

- a **spot rate** for a one-time, on-demand request to move cargo; or
- a **charter rate** that is agreed upon in advance and fixed for a term of up to two years.

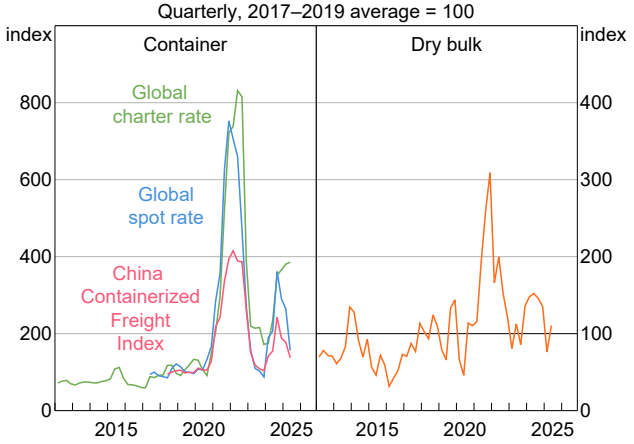
Changes in charter rates tend to lag changes in spot rates, which vary daily based on conditions in the global shipping market.

Movements in global shipping costs are driven by the relative balance of supply and demand for shipping services. Shipping costs increase when demand for shipping increases without an offsetting increase in shipping capacity. Conversely, an increase in global shipping capacity without an offsetting increase in shipping demand can put downwards pressure on shipping costs.

Global shipping costs were relatively stable in the decade leading up to the start of the pandemic in 2020. However, since then, there have been several large shocks to the demand for and supply of shipping that have led to unprecedented fluctuations in global shipping costs (Graph 1):

- **COVID-19 pandemic (2020–2022):** Widespread lockdowns and travel restrictions severely reduced the number of ships available to transport cargo. At the same time, limited opportunities to consume services due to lockdowns and travel restrictions drove a strong increase in goods demand and therefore container demand. Over this period, some measures of shipping costs increased to around eight times their pre-pandemic levels.
- **Reduced water levels in the Panama Canal (2023–2024):** Around 5 per cent of global maritime trade volumes pass through the Panama Canal each year. Extreme drought reduced the number of ships that were able to pass through each day by around 30 per cent. This decline in global shipping capacity contributed to a 50 per cent increase in dry bulk shipping costs in 2023.
- **Red Sea conflict (October 2023 onwards):** Conflict in the Red Sea prevented container ships from safely passing through the Suez Canal (a major transit point for ships travelling between Europe and Asia). Many ships along that route were forced to divert around Africa, increasing transit times by around 30 per cent and reducing the number of voyages that those ships could make per year. Given that around 15 per cent of global maritime trade volumes normally passes through the Suez Canal each year (Kamali *et al* 2024), the effect of these diversions was to reduce global shipping capacity by around 5 per cent. When this coincided with importers placing Christmas orders earlier than usual from April to August 2024, global container rates increased to nearly four times their 2019 average.

Graph 1
Global Shipping Costs*
Quarterly, 2017–2019 average = 100



* Global spot rate measured using Freightos Baltic Index. Global charter rate measured using Harpex Petersen Charter Rates Index. Dry bulk rate measured using Baltic Exchange Dry Index.

Sources: LSEG; RBA; Shanghai Shipping Exchange.

There are a range of indicators available that measure the cost of shipping, each of which captures a different aspect of the costs faced by businesses globally. This article uses the China Containerized Freight Index (CCFI) – a measure of the weighted average cost of shipping a container from ports in China to various destinations around the world – to measure the change in the global shipping costs.[2] The main benefit of using the CCFI is that China is Australia's largest source of imports, meaning that this index is likely to have the most significance for the cost structure of Australian imports compared with other more global measures of shipping costs.

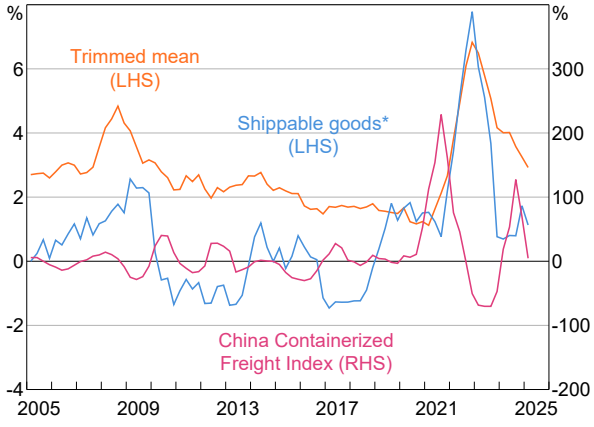
The link between global shipping costs and domestic inflation

Higher global shipping costs can increase the costs associated with importing goods, which Australian firms may pass on to consumers. One reason for this is that Australian importers may need to pay higher freight costs to have goods shipped to Australia. Higher global shipping costs can also increase input costs for Australian firms that rely on imported inputs or sell imported goods, especially those that are produced using international supply chains. For example, an Australian firm may import phones produced in China that require parts to be shipped from Japan. Producers at each stage of the supply chain may pass on some proportion of an increase in global shipping costs, resulting in higher import prices for the Australian firm ultimately selling the phone to consumers in Australia.

Further, in response to imported goods becoming more expensive, Australian households and businesses may substitute towards domestically produced goods (where available). At first instance, this could dampen the direct pass-through of higher shipping costs to the Australian economy. However, without an offsetting increase in the domestic supply of goods, the increase in demand could lead to higher prices for domestically produced goods. The indirect pass-through of higher shipping costs to domestic inflation through this channel could be significant, as there can be long lags in ramping up domestic supply.

During the pandemic, global shipping costs increased dramatically from late 2020 and remained elevated until the end of 2022 (Graph 2). The significant increase in the cost of these freight services reflected a combination of supply-side disruptions in shipping from lockdowns and travel restrictions, as well as a strong increase in the demand for traded goods as consumers substituted away from services due to pandemic-related restrictions on activity (Bishop, Boulter and Rosewall 2022; Beckers, Hambur and Williams 2023). There was limited scope for global shipping supply to ramp up quickly to meet higher demand because cargo ships take between one to two years to build. Domestic inflation in Australia began to increase around 6–12 months later, reaching a peak in late 2022 (Graph 2).

Graph 2
Inflation
Year-ended



* Tradable goods less volatile goods, alcohol, tobacco, gas, overseas travel, therapeutic goods, and goods with administered or regulated prices.

Sources: ABS; RBA; Shanghai Shipping Exchange.

The sharp increase in Australian inflation during this period cannot be entirely explained by increases in shipping costs. Indeed, it is likely that changes in global demand and supply during the pandemic described above simultaneously affected shipping costs and Australian inflation. Disentangling the inflation impact of changes in global shipping costs from the inflation impact of changes in global demand and supply during the pandemic is a key challenge, as discussed below.

Estimating the pass-through of shipping costs to Australian inflation

I used a local projections model to estimate the average pass-through from shocks to global shipping cost inflation to different measures of Australian consumer price inflation since 2003. This approach follows the literature on this topic (Jordà 2005; Carrière-Swallow *et al* 2023).[3] I included observations from the pandemic as this period contains important variation that helps to identify the relationship between global shipping costs and Australian inflation.

The main benefit of using a local projections model is that it can directly estimate the impact of a global shipping cost shock on Australian inflation because Australia is a small open economy that does not have sufficient market power to affect global shipping prices (Carrière-Swallow *et al* 2023). The model also controls for many factors unrelated to shipping that could affect Australian inflation, such as the Australian output gap and the world food price.

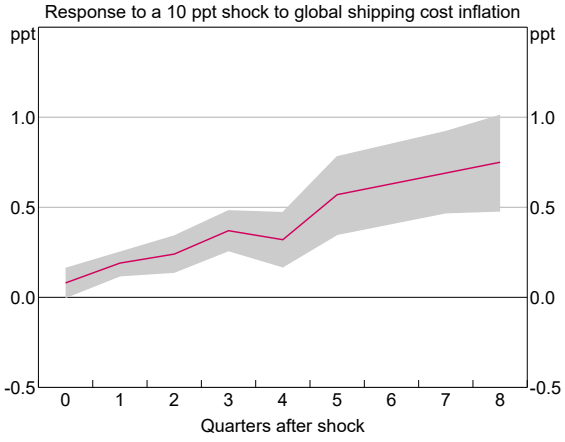
As discussed above, a key challenge for estimating the pass-through of global shipping cost shocks to Australian inflation is that changes in global demand or supply outside of the global shipping market could simultaneously affect both shipping costs and Australian inflation. Failing to control for these kinds of changes in global demand or supply – particularly during the pandemic – might lead us to overestimate or underestimate the impact of global shipping costs on Australian inflation. I address this issue by controlling for the output gap across advanced economies (a proxy for global supply and demand) and the change in oil prices (a proxy for global supply), in line with the literature (Carrière-Swallow *et al* 2023).

For further details on my modelling approach and assumptions, see Appendix A.

Pass-through to Australian consumer price inflation

First, I considered how higher shipping costs affect the prices of a smaller subset of 'shippable' goods in the CPI basket that are more likely to arrive in Australia by ocean freight.[4] I found that a 10 percentage point shock to global shipping cost inflation increases shippable goods inflation in Australia by around 0.4 percentage points after one year and around 0.75 percentage points after two years (Graph 3). This suggests that global shipping cost shocks tend to flow through to Australian inflation with a lag. That said, the estimates have reasonably wide uncertainty bands, which imply that the pass-through could be between 0.4 to over 1 percentage points after two years.

Graph 3
Shippable Goods Inflation*
Response to a 10 ppt shock to global shipping cost inflation

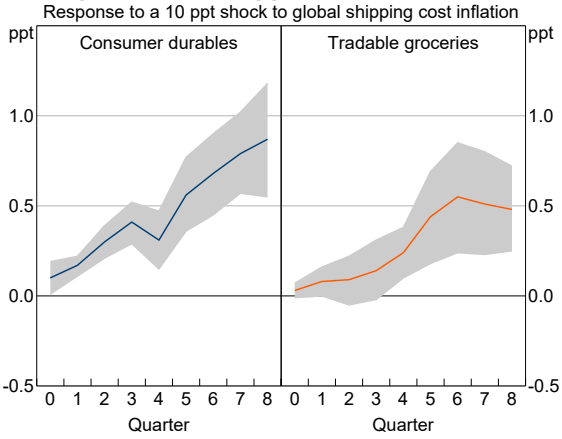


* Tradable goods less volatile goods, alcohol, tobacco, gas, overseas travel, therapeutic equipment, and goods with administered or regulated prices. Shaded area represents 95 per cent confidence intervals constructed using Newey-West HAC standard errors.

Sources: ABS; FAO; IMF; RBA; Shanghai Shipping Exchange.

The next two measures of inflation I tested with the model were for subsets of shippable goods – consumer durable goods and tradable groceries, which make up around two-thirds and one-third of the basket of 'shippable' goods, respectively (Graph 4). This gives us a sense of what kinds of consumer products are most likely to experience price increases following a shock to global shipping costs. I found that the response of shippable goods inflation to the shock is driven mainly by higher inflation in consumer durables, where pass-through is much larger. I found that inflation for consumer durables increases by around 0.8 percentage points two years after the shock, whereas the pass-through to inflation for tradable groceries peaks at around 0.5 percentage points after 1.5 years.

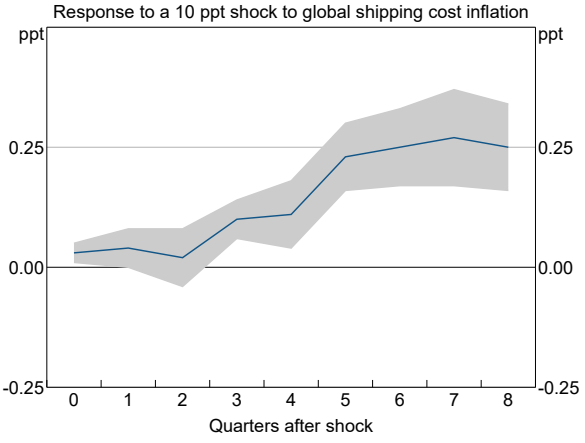
Graph 4
Components of Shippable Goods Inflation*
Response to a 10 ppt shock to global shipping cost inflation



* Shaded area represents 95 per cent confidence intervals constructed using Newey-West HAC standard errors.
Sources: ABS; FAO; IMF; RBA; Shanghai Shipping Exchange.

Finally, I tested whether shocks to global shipping costs have an impact on inflation in the broader CPI basket by estimating the response of trimmed mean inflation to shocks to global shipping costs (Graph 5).[5] I found that the average pass-through of a 10 percentage point shock to global shipping cost inflation to trimmed mean inflation is around 0.1 percentage points after one year and 0.25 percentage points after two years. These estimates are consistent with the results in Carrière-Swallow *et al* (2023), who found an average pass-through to headline inflation of 0.15 percentage points after 1.5 years across a sample of over 100 economies.[6]

Graph 5
Trimmed Mean Inflation*
Response to a 10 ppt shock to global shipping cost inflation



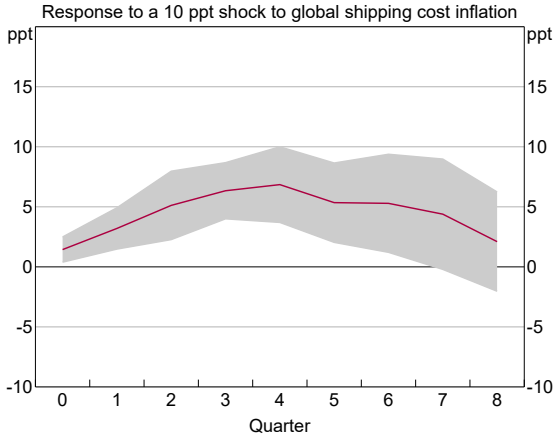
* Shaded area represents 95 per cent confidence intervals constructed using Newey-West HAC standard errors.
Sources: ABS; FAO; IMF; RBA; Shanghai Shipping Exchange.

How do higher global shipping costs flow through the supply chain for Australian imports to affect Australian CPI inflation?

Having found that increases in global shipping costs tend to put upwards pressure on Australian CPI inflation, I then looked more closely at how that effect works through the imports supply chain. I first estimated how Australian shipping costs respond to higher global shipping costs. Second, I estimated the impact of higher shipping costs on the price and volume of goods imports (noting that freight is a service and so does not contribute directly to goods import volumes or prices).

I found that around three-quarters of the shock to global shipping costs passes through to Australian freight services inflation after two quarters and this effect persists for around 1.5 years (Graph 6). The lag and persistence of the effect could be explained by the tendency for most Australian importers to lock in freight prices ahead of time under fixed-term contracts. For those importers, overseas developments in global shipping do not flow through to affect their Australian freight prices until their contracts are renegotiated, and higher prices are then locked in for the full term of the new contract.

Graph 6
Inflation – Australian Freight Services Costs*
Response to a 10 ppt shock to global shipping cost inflation



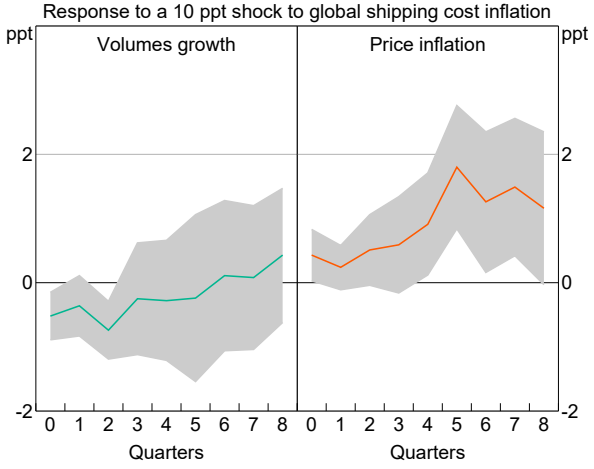
* Year-ended change in the ABS BOP Services Debits Freight Transportation Implicit Price Deflator. Shaded area represents 95 per cent confidence intervals constructed using Newey-West HAC standard errors.
Sources: ABS; FAO; IMF; RBA; Shanghai Shipping Exchange.

In response to higher global shipping costs, overseas exporters could plausibly raise their export prices to cover higher upstream freight costs. To determine whether this adds to upstream cost pressures for Australian importers, I used a measure of goods import price inflation that excludes the cost of freight between

the exporting country and Australia. The pass-through I estimated here captures the indirect impact of global shipping costs on import prices received by Australian firms, rather than the direct impact on the cost of freight services to Australia (estimated above). I found that goods import price inflation increases temporarily by up to 2 percentage points for one year after a 10 percentage point shock to global shipping cost inflation (Graph 7). This suggests that overseas exporters do tend to pass on higher upstream freight costs at earlier points in the global supply chain through higher export prices.

By contrast, I found that import volumes growth on average does not tend to respond to a shock to global shipping cost inflation (Graph 7). However, the inclusion of the pandemic – a period where import volumes were extremely volatile – may have affected the results (see below). Further, during the pandemic, strong increases in shippable goods inflation alongside domestic goods inflation could have reduced the incentive for consumers to substitute away from imported goods, which could also explain the limited response of goods import volumes to a shipping cost shock.

Graph 7
Goods Imports*
Response to a 10 ppt shock to global shipping cost inflation



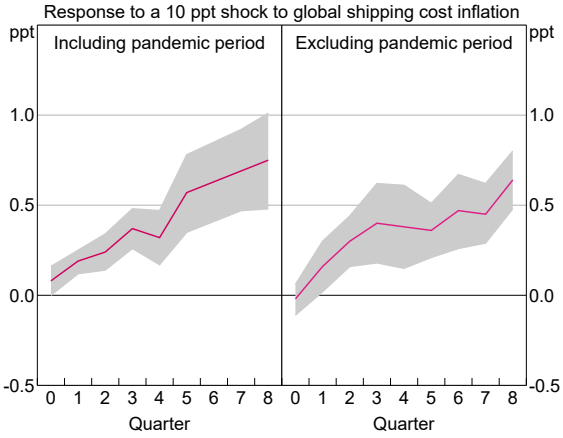
* Shaded area represents 95 per cent confidence intervals constructed using Newey-West HAC standard errors.
Sources: ABS; FAO; IMF; RBA; Shanghai Shipping Exchange.

Have shipping costs affected Australian inflation outside of the COVID-19 pandemic?

As discussed above, changes in global demand or supply outside of the global shipping market could simultaneously affect both shipping costs and Australian inflation. This was especially the case during the pandemic period, which contained the largest increases in shipping costs and Australian inflation in the sample. To check the robustness of my results to the inclusion of the pandemic period, I dropped observations from 2020 to 2022 and re-estimated the pass-through from shipping cost shocks to Australian inflation.

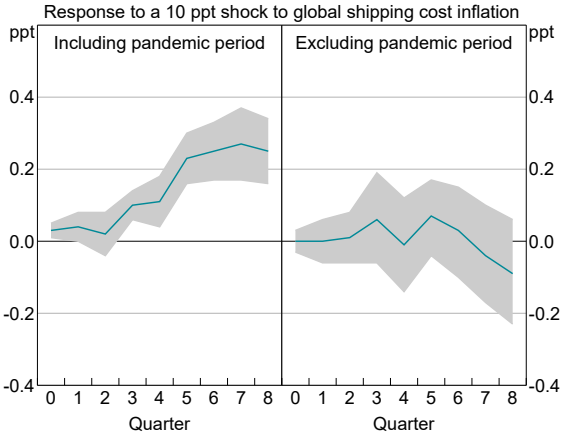
I found that the pass-through to shippable goods inflation is roughly similar once observations from the pandemic are excluded (Graph 8), but that the pass-through to trimmed mean inflation is much smaller in size and less sustained (Graph 9). This suggests that shocks to global shipping costs have had only a limited pass-through to prices of the broader CPI basket in 'normal' times outside of the pandemic.

Graph 8
Shippable Goods Inflation*
Response to a 10 ppt shock to global shipping cost inflation



* Tradable goods less volatile goods, alcohol, tobacco, gas, overseas travel, therapeutic equipment, and goods with administered or regulated prices. Shaded area represents 95 per cent confidence intervals constructed using HAC standard errors.
Sources: ABS; FAO; IMF; RBA; Shanghai Shipping Exchange.

Graph 9
Trimmed Mean Inflation*
Response to a 10 ppt shock to global shipping cost inflation

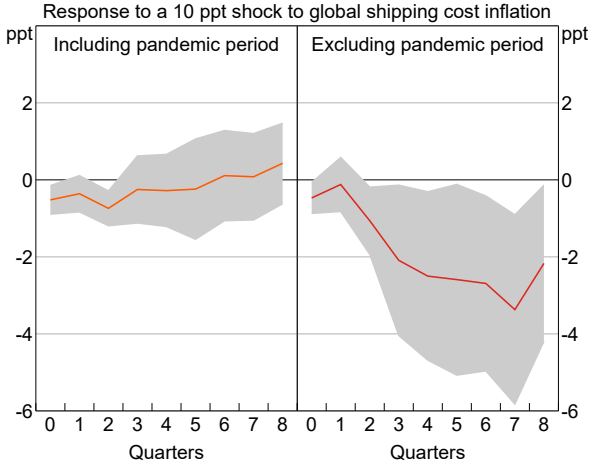


* Shaded area represents 95 per cent confidence intervals constructed using Newey-West HAC standard errors.
Sources: ABS; FAO; IMF; RBA; Shanghai Shipping Exchange.

There could be several explanations for this. On the one hand, this result could indicate that my baseline estimates of the pass-through to trimmed mean inflation are biased because they inadvertently capture the impact of other kinds of shocks during the pandemic, even after controlling for proxies for global supply and demand.

On the other hand, the muted response of trimmed mean inflation outside of the pandemic could be explained by Australian consumers being able to substitute away from more expensive imported goods – for example, towards services – in more 'normal' times, which was not possible during the pandemic due to activity restrictions. This substitution towards services would dampen the pass-through from higher shipping costs to broader measures of inflation that include services, such as trimmed mean. The idea that Australian consumers substitute away from shippable goods when shipping costs are high is also consistent with my finding of a strong negative response of goods import volumes once I excluded the pandemic period (Graph 10). Further, the sub-components of shippable goods – consumer durables and tradable groceries – were generally more prone to being trimmed out of trimmed mean CPI inflation outside of the pandemic period.

Graph 10
Goods Imports – Volumes Growth*
Response to a 10 ppt shock to global shipping cost inflation



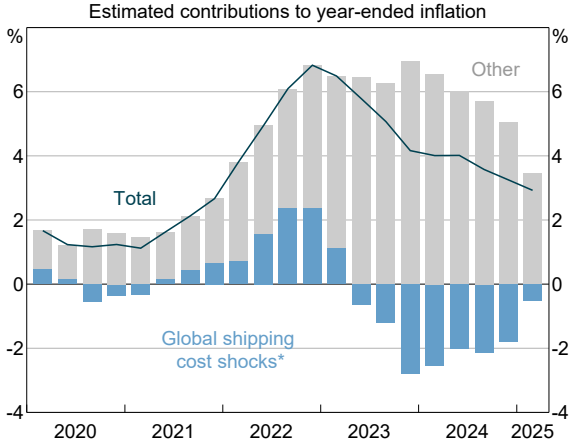
* Shaded area represents 95 per cent confidence intervals constructed using Newey-West HAC standard errors.
Sources: ABS; FAO; IMF; RBA;Shanghai Shipping Exchange.

On balance, the differing estimates of pass-through to trimmed mean inflation with and without the pandemic in the sample suggest that it is much more ambiguous whether higher global shipping costs tend to pass through to broader measures of CPI inflation like trimmed mean. In light of this, the full-sample estimates of pass-through to trimmed mean CPI inflation should loosely be considered an upper bound of the possible impact of global shipping cost shocks.

Quantifying the impact of recent movements in global shipping costs on Australian inflation

To provide a sense of how much global shipping cost shocks contributed to Australian inflation during the pandemic, I used my model to calculate their contribution to trimmed mean CPI inflation since 2020.[7] Presented below are contributions calculated using my full-sample estimates of the pass-through to trimmed mean, though it should be noted that the resulting contributions are subject to substantial uncertainty and could be larger or smaller than estimated (Graph 11).

Graph 11
Trimmed Mean Inflation
Estimated contributions to year-ended inflation



* Calculated using passthroughs estimated using full sample that includes the COVID-19 pandemic. While the underlying point estimates are statistically significant, there remains substantial uncertainty around these estimates, particularly because excluding the pandemic period leads to much smaller estimates of the passthrough of shipping costs to trimmed mean inflation.
Sources: ABS; FAO; IMF; RBA; Shanghai Shipping Exchange.

During the pandemic, the year-ended change in the CCFI was over 200 per cent at its peak in 2021, alongside peak increases in trimmed mean CPI of around 6 per cent in late 2022. My estimates of the pass-through from above suggest that the peak impact of global shipping cost shocks on trimmed mean inflation over the pandemic was around 2 percentage points in 2022.

The estimated contributions suggest that movements in global shipping costs have largely been disinflationary from 2023 onwards, which could reflect the significant easing in global shipping costs over that period as goods demand normalised and shipping capacity expanded. That said, factors other than declining shipping costs have almost certainly contributed to disinflation from 2023 onwards (RBA 2025).

While the CCFI increased in year-ended terms by up to 75 per cent in late 2024, subsequent reversals in global shipping costs as container demand eased and new global shipping capacity coming online have likely contributed to there being a limited impact on trimmed mean inflation in 2025 so far.

Conclusion

This article finds evidence of a material pass-through from increases in global shipping costs to the prices of 'shippable' goods in Australia, in line with the existing literature. However, evidence of a pass-through to broader measures of CPI inflation such as trimmed mean is less clear. While the average pass-through to trimmed mean CPI inflation since 2003 is material, that pass-through is much smaller and not statistically significant when the pandemic period is excluded from the sample.

The difference in these results could reflect bias from the simultaneous effect of global demand and supply shocks on global shipping costs and Australian inflation; this might suggest that there is little pass-through of shipping cost inflation to trimmed mean CPI inflation in 'normal times'. However, there are other plausible explanations, such as consumers being able to substitute away from shippable goods towards services outside of the pandemic period. On balance, the full-sample estimates of pass-through to trimmed mean inflation presented in this article should loosely be interpreted as an upper bound of the possible impact of global shipping cost shocks.

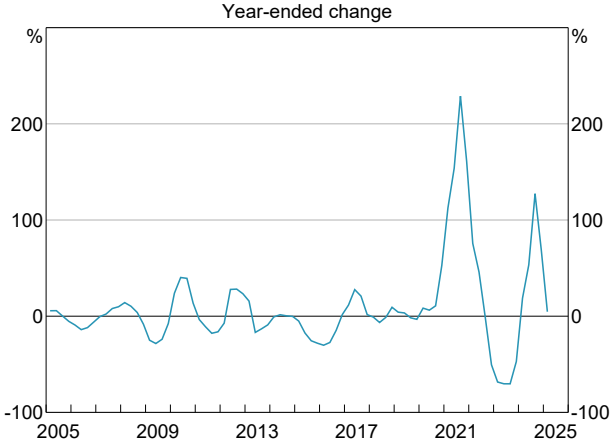
Appendix A: Modelling approach and assumptions

Measure of global shipping costs

I measured fluctuations in global shipping costs using the year-ended change in the CCFI. The CCFI measures the weighted average cost of shipping a container from ports in China to various destinations around the world, using a combination of both spot and charter rates.

The CCFI is available from 2003 to the March quarter of 2025. To create a measure of the year-ended change in global shipping costs, I calculated the quarter average of the CCFI to align with the frequency of the inflation data and calculated the year-ended change (Graph A1).

Graph A1
China Containerized Freight Index
Year-ended change



Sources: LSEG; RBA; Shanghai Shipping Exchange.

Global shipping costs can fluctuate seasonally, which could possibly bias our estimates of the pass-through to Australian inflation. For example, container rates for routes out of China and east Asia tend to be higher from May to August as this is the typical time for importers to place orders for stock in time for Christmas. My model is estimated in terms of year-ended changes, which should limit the impact of any seasonality in global shipping costs. Further, I seasonally adjusted the CCFI, calculated the year-ended change and re-estimated the model and found no statistically significant differences.

Model

I followed the modelling approach in Carrière-Swallow *et al* (2023). I estimated the response β^h of 'shippable' goods inflation π_t in the $h = 0, \ \ldots \ , 8$ quarters after a shock to global shipping cost inflation s_t in quarter t using a local projection (Jordà 2005; Carrière-Swallow *et al* 2023).

In equation form:

$$\pi_{t+h} = \alpha^h + \beta^h s_t + \sum_{k=1}^{4} \gamma_k^h \pi_{t-k} + \sum_{k=0}^{4} \boldsymbol{\theta_k^h X'_{t-k}} + \sum_{k=1}^{4} \boldsymbol{\vartheta_k^h Y'_{t-k}} + \varepsilon_{t+h}^h$$

I scaled β^h to represent the percentage point response of year-ended inflation h quarters after a 10 percentage point increase in year-ended global shipping cost inflation. I focused on year-ended changes and included four lags of each variable and the controls per the modelling approach in Carrière-Swallow *et al* (2023). The vector $\boldsymbol{Y'_{t-k}}$ includes lags of Australian inflation and global shipping cost inflation. The vector of controls $\boldsymbol{X'_{t-k}}$ consists of the following variables:

- the year-ended change in the Brent crude oil price
- the year-ended change in the world food price
- the year-ended change in Australia's goods terms of trade
- the Australian output gap
- the IMF measure of the advanced economies output gap.

I presented my results with 95 per cent confidence intervals constructed using Newey-West heteroskedasticity and autocorrelation consistent (HAC) standard errors. This allows the model to account for possible heteroskedasticity and autocorrelation introduced by using year-ended growth rates in a regression estimated on quarterly data.

Checking for reverse causality

One issue with estimating a causal impact of shipping cost shocks on inflation is that there could be reverse causality because Australian shipping costs are also likely to be responsive to Australian inflation. For example, weaker goods demand that flows through to weaker inflation could also reduce demand for imported goods, demand for shipping and in turn shipping costs.

To deal with the possibility of reverse causality, I focused on the impact of global (rather than Australian) shipping costs on Australian inflation, following the approach of Carrière-Swallow *et al* (2023). Because Australia is a small open economy, Australian economic conditions and inflation do not have the power to affect global shipping costs. This means that changes in Australian inflation should not induce changes in global shipping costs.

To check that changes in Australian inflation do not cause changes in the CCFI, I regressed the year-ended change in the CCFI on the Australian output gap. I found no statistically significant response of the CCFI to the Australian output gap at any horizon, which provides evidence that the CCFI is exogenous to changes in Australian economic conditions.

Checking for any non-linearities in the pass-through of shipping costs to Australian inflation

Larger shocks to shipping costs could plausibly result in higher rates of pass-through to domestic inflation. For example, during relatively smaller shocks to shipping costs, firms may be more able to absorb higher costs or can draw down on inventories to make up for lower import volumes. I checked for possible non-linearities by introducing a quadratic term into my model:

$$\pi_{t+h} = \alpha^h + \beta^h s_t + \varphi^h Sign(s_t) \cdot s_t^2 + \sum_{k=1}^{4} \gamma_k^h \pi_{t-k} + \sum_{k=0}^{4} \boldsymbol{\theta}_k^h \boldsymbol{X'}_{t-k} + \sum_{k=1}^{4} \boldsymbol{\vartheta}_k^h \boldsymbol{Y'}_{t-k} + \varepsilon_{t+h}^h$$

The coefficient φ^h captured possible non-linear effects from large fluctuations in global shipping costs. I found that the non-linearities are not statistically significant at any horizon, even when the pandemic period is excluded.

Appendix B: Calculating the basket of 'shippable' goods

I arrived at the subset of 'shippable' goods as follows:

1. I started with the basket of tradable goods in the CPI basket. This excludes components of the CPI basket such as housing and market services.
2. I then removed any volatile goods (fruit, vegetables, tobacco and automotive fuel), administered or regulated goods (such as pharmaceuticals), any goods that cannot be transported by ship, and overseas travel.
3. The resulting basket of 'shippable' goods is around 25 per cent of the CPI basket and can be split further into two sub-categories – consumer durables and tradable groceries (Table B1).

Table B1: Shippable Goods

Consumer durables ⅔ of shippable goods	**Tradable groceries** ⅓ of shippable goods
Garments	Cakes and biscuits
Footwear	Breakfast cereals
Accessories	Other cereal products
Furniture	Beef and veal
Carpets and other floor coverings	Lamb and goat
Household textiles	Other meats
Major household appliances	Fish and other seafood
Small electric household appliances	Cheese
Glassware, tableware and household utensils	Ice cream and other dairy products
Tools and equipment for house and garden	Jams, honey and spreads
Cleaning and maintenance products	Food additives and condiments
Personal care products	Oils and fats
Other non-durable household products	Snacks and confectionary
Motor vehicles	Other food products
Spare parts and accessories for motor vehicles	Coffee, tea and cocoa
Audio, visual and computing equipment	Waters, soft drinks and juices
Audio, visual and computing media and services	
Books	
Newspapers, magazines and stationery	
Equipment for sports, camping and open-air recreation	
Games, toys and hobbies	

Sources: ABS; RBA.

Appendix C: Estimating contributions from global shipping costs to Australian CPI inflation

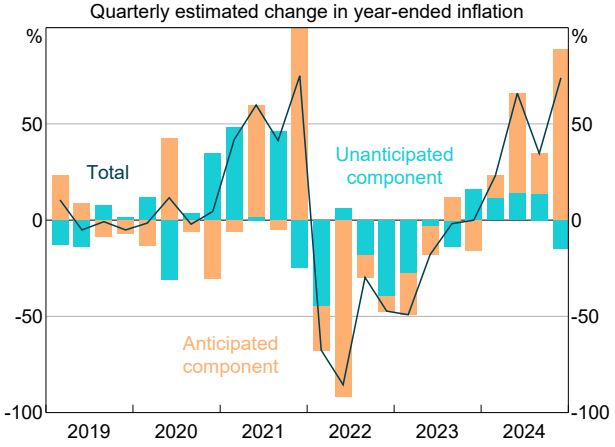
I estimated contributions from shocks to global shipping costs to trimmed mean inflation as follows:

1. To isolate the unanticipated change in global shipping costs, I regressed the CCFI on the controls in my model. The residuals from this regression represent unanticipated 'shocks' to global shipping costs that cannot be explained by the controls in my model (Graph C1).
2. I calculated the contribution of the shock in each period to trimmed mean inflation at each subsequent horizon, using the pass-through estimates presented in the article. I used the pass-throughs estimated from the full sample that includes the pandemic period.
3. For each quarter I then summed those contributions from each of the shocks in prior periods to estimate the overall contribution of shipping costs to trimmed mean inflation.

Graph C1

Global Shipping Cost Inflation*

Quarterly estimated change in year-ended inflation



* Components estimated using a sample period that includes the pandemic.

Sources: ABS; FAO; IMF; RBA; Shanghai Shipping Exchange.

Endnotes

* The author completed this work while in Economic Group. The author would like to especially thank Hamish Sullivan for his significant contribution to early versions of this article and Matthew Read for his assistance with the modelling approach. The author is also grateful to Benjamin Beckers, Michelle Bergmann, John Boulter, Ashwin Clarke, Patrick Hendy, Martin McCarthy, Isaac Pockney and Joshua Spiller for their feedback.

1 This figure includes the cost of both ocean and air freight. Around 85 per cent of all Australian freight is transported by ocean rather than by air (BITRE 2023).

2 The CCFI is calculated using a combination of both spot and charter rates.

3 Other central banks have used a similar approach to estimate the impact of higher shipping costs on domestic inflation. See, for example, Sly *et al* (2016); Attinasi, Bobasu and Gerinovics (2021); Vehbi *et al* (2022); RBNZ (2024).

4 I arrive at this subset of 'shippable' goods by removing from the CPI basket any volatile goods, administered or regulated goods, and any goods that cannot be transported by ship. The resulting basket of 'shippable' goods is around 25 per cent of the CPI basket. For further details, see Appendix B for a breakdown of shippable goods.

5 I use trimmed mean CPI over headline CPI as my preferred measure of inflation in the broader CPI basket, despite the tendency for shippable goods to be trimmed out of trimmed mean CPI before 2020. This is because the pass-throughs to Australian headline inflation estimated using the model in this article were implausibly large and imprecise, which could reflect additional bias from the broad scope of the CPI basket. That said, the pass-through to headline inflation implied by scaling the estimated pass-through to shippable goods inflation by the 25 per cent weight of shippable goods in the CPI basket is consistent with the estimates in Carrière-Swallow *et al* (2023).

6 Carrière-Swallow *et al* (2023) estimated the average response of headline inflation across a sample of over 100 economies (including Australia) in response to shocks to bulk commodity shipping prices, using a sample period of 2006–2021.

7 See Appendix C for an explanation of how I estimated contributions to trimmed mean inflation.

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