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by Danny Leung and Ryan Macdonald

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Real wages and productivity during the COVID-19 pandemic

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Abstract

Rising wages and prices have characterized the pandemic in 2021 and 2022. Soaring unit labour costs have raised competitiveness concerns. This article contributes to the discussion by examining how real wages in the business sector have evolved over the pandemic and whether their movements have been consistent with those of labour productivity. It is found that the real wage (total compensation per hour worked deflated by the gross domestic product deflator) in the second quarter of 2022 was 7.1% lower than in the first quarter of 2019. In contrast, labour productivity declined by only 0.3% over the same period. While the gap that has opened since the beginning of the pandemic is unprecedented, it is close to the limit of its historical range. In addition, real wages calculated by deflating total compensation per hour worked by the consumer price index have risen by 3.6% over the same time period. The difference in the real wages suggests that the price of the goods and services produced by workers has risen compared with the price of goods and services being consumed by workers. The increase in the relative price can be traced to stronger growth in the price of gross fixed capital formation (particularly residential and non-residential structures) and the price of exports compared with the price of final consumption expenditure.

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Introduction

The year-over-year increase in consumer price inflation reached 8.1% in June 2022, its highest level since January 1983.¹ Indeed, much of 2021 and 2022 so far have been marked by rising inflation. The sources of this inflation include global supply challenges and strong demand as the economy recovers from the COVID-19 pandemic.²

There is evidence to suggest that Canadian firms expect to continue raising prices and wages. Results from the Canadian Survey on Business Conditions for the second quarter of 2022 showed that nearly two-fifths (39.0%) of businesses expected to raise prices over the next three months, a continued increase from one-quarter of businesses (25.9%) from the previous quarter.³ Consulting data from the same survey in the first quarter of 2022, Morissette (2022) finds that of firms that expected labour shortages to be an obstacle over the next three months, nearly half (46%) planned to increase wages for new employees, and close to two-thirds (64%) planned to increase the wages of existing employees.

As the result of rising wages, unit labour costs (total compensation of labour per unit of output) have soared. In the second quarter of 2022, unit labour costs (in US dollars) in the business sector were 21.7% higher than in the first quarter of 2019. This can be compared with a growth in unit labour costs of 16.6% in the United States over the same time period. Higher relative unit labour costs, especially relative to key trading partners, make investment in Canada less attractive, and may lead to a loss in future competitiveness.

This article studies how real wages have evolved relative to labour productivity to determine if the increase in wages is in line with price increases and fundamentals. Gains in labour productivity (value-added output per hours worked) are shared between firms and workers. Sharpe et al. (2008b) and Williams (2021) show that, despite some deviations, real wages and labour productivity have grown comparably over the long term. In many countries, however, real wages have grown more slowly than labour productivity.⁴ Reasons for this phenomenon include globalization and the reduced bargaining power of workers, digitalization and the rise of superstar firms that appropriate a large share of the surplus from production, the rising importance of faster-depreciating capital assets (such as intangible capital) that require a higher capital share to maintain, and shifts in industry structure toward capital-intensive industries.

Following recent studies that have examined this development in Canada in the past—see Sharpe et al. (2008a, 2008b), Greenspon et al. (2021), Sharpe and Ashwell (2021), and Williams (2021)—this article examines the relationship between real wages and productivity. In particular, it analyzes whether the relationship has changed since the beginning of the pandemic, and whether the relationship is sensitive to the use of different deflators to calculate real wages.

Total compensation per hour worked deflated by the gross domestic product (GDP) deflator has grown at a slower rate than labour productivity from the first quarter of 2019 to the second quarter of 2022. While the gap between real wages and labour productivity that has opened since the beginning of the pandemic is unprecedented, it is close to the limit of its historical range. The entire gap cannot be explained by higher oil and gas prices. Real wages relative to labour productivity have also declined when the oil and gas sector is omitted from the business sector as a whole, though less than when the oil and gas sector is included. Total compensation per hour worked deflated by consumer prices has risen from the first

1. See Statistics Canada (2022, July 20).

2. See Bank of Canada (2022).

3. See Statistics Canada (2022, May 30).

4. See, for example, International Labour Organization and the Organisation for Economic Co-operation and Development (2015).

quarter of 2019 to the second quarter of 2022. This has been made possible by faster growth in the prices of goods and services being produced by workers (GDP deflator) compared with the growth in the prices of goods and services being consumed by workers (consumer prices).

The next section presents the relationship between labour productivity and total compensation per hour worked deflated by the GDP deflator.

Growth in real total compensation per hour worked has fallen behind labour productivity from the first quarter of 2019 to the second quarter of 2022

In this section, the relationship between labour productivity and total compensation per hour worked is examined. In general, firms maximize profits by choosing inputs such that their marginal costs equal to their marginal revenue. In the case of labour, the marginal cost of using an extra hour of labour is the hourly wage rate (w), while the marginal revenue is the value of the extra production created by working that extra hour holding other inputs constant:

$$w = p \times \frac{\Delta Y}{\Delta H} . \quad (1)$$

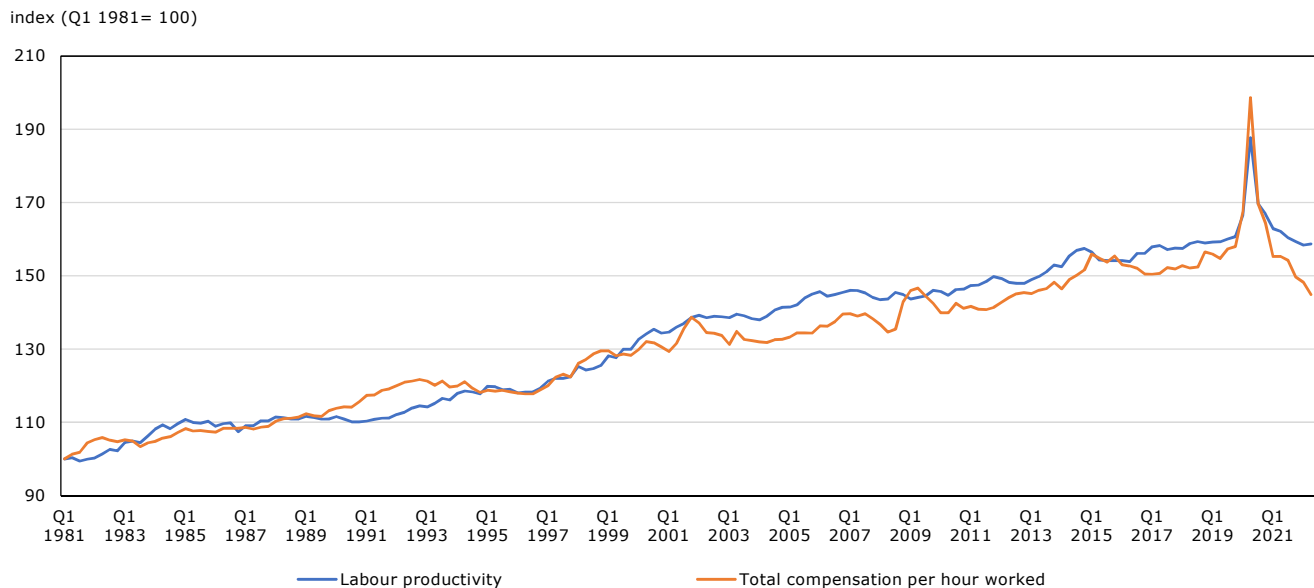
p is the price of the firm's output, ΔY is the change in the output and ΔH is the change in the number of hours worked. The increase in output per additional hour worked depends on the firm's production technology. Under constant returns to scale, assuming a standard Cobb-Douglas production function, and dividing both sides by the price of output, equation (1) becomes:

$$\frac{w}{p} = \alpha \frac{Y}{H} . \quad (2)$$

The real hourly wage is proportional to labour productivity (output per hour worked). That proportion is affected by the production technology being used by the firm, which establishes the relative importance of labour in the production process, α . Over time, if α is held fixed, the growth in the real hourly wage would be expected to be equal to the growth in labour productivity. Moving from the firm-level theory to the business sector means that a perfect correlation is not to be expected each period. There are variations in the composition of firms and industries over time, each with its own production technologies and circumstances, and wages are not always being automatically and instantaneously reset by firms. Furthermore, some of these changes can be long-lasting. As discussed, real hourly wages relative to labour productivity have declined in many countries.

Chart 1 shows that real total compensation per hour worked (hourly wage divided by the GDP deflator) has moved together with labour productivity (real value-added output per hour worked) over time in the business sector. In recent quarters, however, the real wage has declined faster than labour productivity. Total compensation per hour worked deflated by the GDP deflator in the second quarter of 2022 was 7.1% lower than in the first quarter of 2019, compared with only 0.3% lower for labour productivity. Chart 2 shows that while the gap between labour productivity and real total compensation per hour worked in the first and second quarter of 2022 was unprecedented, it was at the higher end of its historical range and warrants further monitoring. The year-to-date index for 2022 (up to the second quarter) was 93.7, with the base year in 1997 being 100. The lowest data point being 92.7 in 2005.

Chart 1
Business sector labour productivity and real total compensation per hour worked



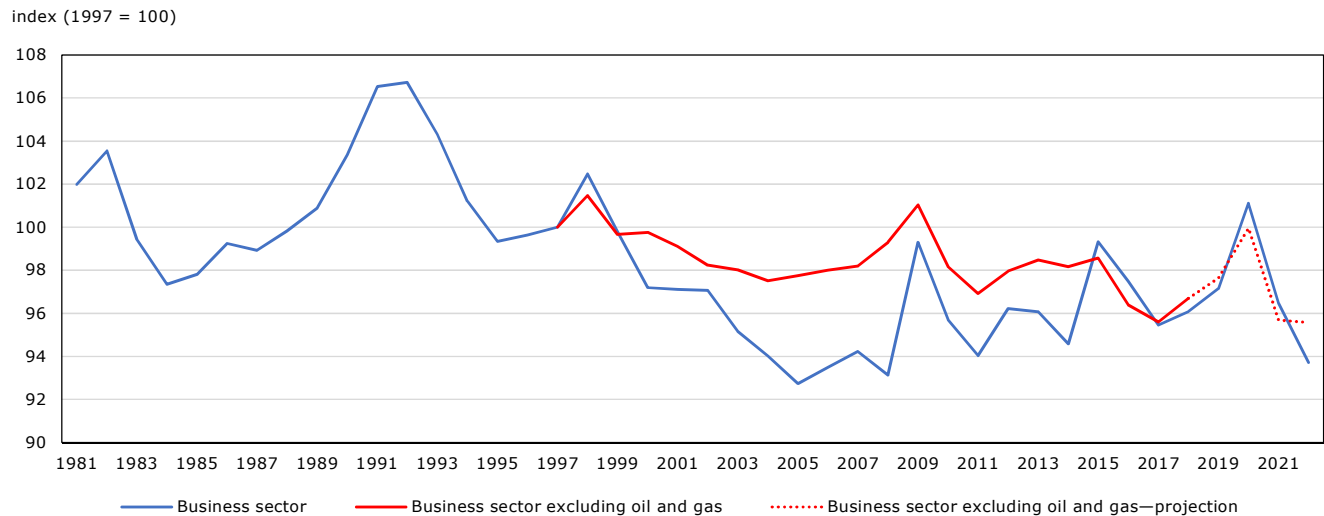
Source: Common Output Data Repository Table 36-10-0206-01.

Chart 2 indicates how real total compensation per hour worked relative to labour productivity has evolved when the oil and gas sector is excluded from the business sector. The data points for 2019 to 2022 year to date are projected for the oil and gas sector, because nominal value added for that sector is not available in those years.⁵ The oil and gas sector is capital intensive, so labour has a relatively smaller claim to the productivity of the industry compared with labour-intensive sectors (α is smaller for the oil and gas sector). A shift towards that sector (higher oil and gas prices raise the oil and gas sector's share of nominal value added) would slow the growth of real total compensation per hour worked relative to labour productivity. Chart 2 shows that removing the oil and gas sector does slow the decline in real wages relative to labour productivity, but does not eliminate it. From 2019 to 2022 year to date, real wages relative to labour productivity in the business sector declined 3.5% compared with 2.1% in the business sector less the oil and gas sector.⁶

5. While real value added for the oil and gas sector was available up to June 2022 at the time this article was written, nominal value added and the implicit price for the oil and gas sector were not available after 2018. As a result, the energy portion of the Bank of Canada commodity price index was used to project the implicit price for the oil and gas sector. The correlation between the growth rates of the implicit price for the oil and gas sector and the energy price index was 0.95 over the 1997 to 2018 period.

6. Given that workers can move between sectors, the labour productivity of one sector will not be the only determinant of wages in the sector. If productivity rises in only one sector, the workers in that one sector may not benefit from those productivity gains if similarly skilled workers from other sectors can be hired at the current wage. Therefore, a further disaggregation of the business sector by industry is not presented.

Chart 2
Real total compensation per hour worked relative to labour productivity for the business sector and business sector excluding the oil and gas sector



Note: The last data points for 2022 are the year-to-date indexes up to the second quarter.
Sources: Authors' calculations using Common Output Data Repository Tables 36-10-0206-01, 36-10-0207-01, 36-10-0480-01, 10-10-0132-0, 36-10-0390-01 and 36-10-0434-01.

Total hourly compensation per hour worked deflated by the consumer price index has risen because the price of the goods and services produced relative to the price of goods and services consumed has increased

In the previous section, total hourly compensation was deflated by the GDP deflator, the implicit price of the value-added output produced in Canada. From the point of view of a profit-maximizing firm, the use of the GDP deflator is appropriate because it is the price that it receives for its output. However, workers perceive real wages differently from firms, since the combination of goods and services they consume is different from that which is produced. This combination differs because of international trade (e.g., workers consume goods and services from other countries), and because goods created are not all consumed immediately (e.g., investment in housing or machinery and equipment).

The consumer price index is often interpreted as a measure of the change in cost of living for households. It represents the rise in the price level of a typical basket of goods and services purchased out-of-pocket by households. Chart 3 shows how total compensation per hour worked deflated by the consumer price index compares with total compensation per hour worked deflated by the GDP deflator and with labour productivity since the first quarter of 2019. Total compensation per hour worked deflated by consumer prices rose at the beginning of the pandemic, then declined until the first quarter of 2021 and has remained relatively flat since. Overall, total compensation per hour worked deflated by consumer prices in the second quarter of 2022 is 3.6% higher than in the first quarter of 2019. In comparison, labour productivity is 0.3% lower and total compensation per hour worked deflated by the GDP deflator is 7.1% lower.

The fact that the GDP deflator has risen faster than consumer prices means that the price of the goods and services that workers are producing is rising faster than the price of goods and services that they are consuming. Sharpe (2008a, 2008b) and Williams (2021) refer to this ratio—the price of production to price of consumption—as the labour’s terms of trade. Its improvement (increase over the pandemic), has allowed workers’ total compensation relative to consumer prices to rise relative to labour productivity, despite the decline in total compensation per hour worked deflated by the GDP deflator relative to labour productivity. To make this idea more concrete, the left-hand side of equation (2) can be modified by multiplying it by one, the price of consumption (p_C) over the price of consumption,

$$\frac{w}{p} \times \frac{p_C}{p_C} = \alpha \frac{Y}{H}, \tag{3}$$

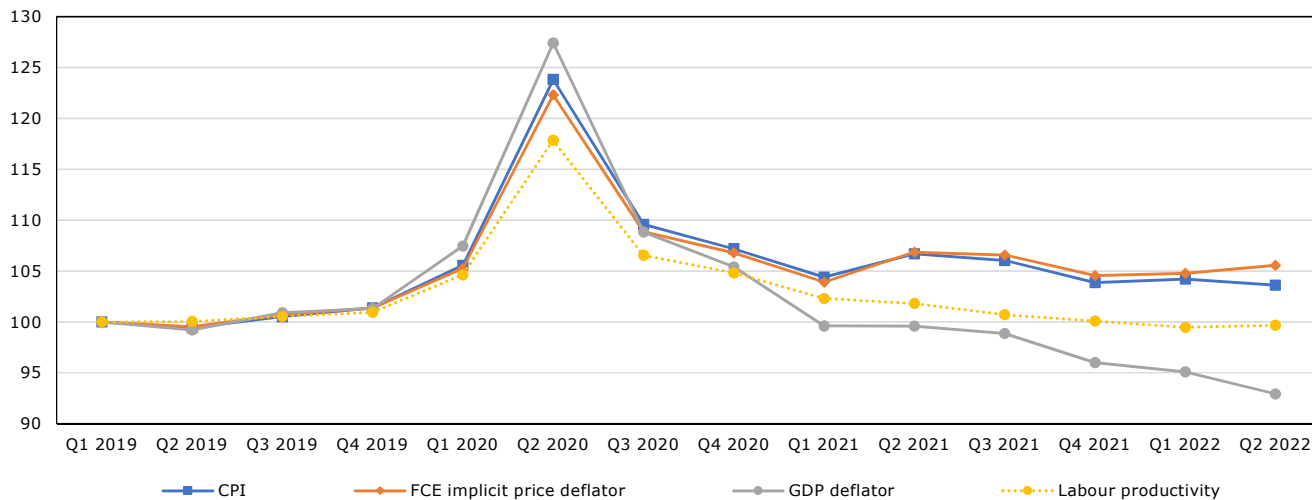
and then rearranging:

$$\frac{w}{p_C} = \alpha \frac{Y}{H} \times \frac{p}{p_C}. \tag{4}$$

Equation (4) shows that total compensation per hour worked deflated by the price of consumption is proportional to labour productivity and the ratio of the GDP deflator over the price of consumption (labour’s terms of trade).

Chart 3
Business sector total compensation per hour deflated by consumer price index, final consumption expenditure implicit deflator and gross domestic product deflator, and business sector labour productivity

index (2019 Q1 = 100)



Note: CPI stands for consumer price index. GDP stands for gross domestic product. FCE stands for final consumption expenditure.
Sources: Authors’ calculations using Common Output Data Repository Tables 18-10-0006-01, 36-10-0104-01, and 36-10-0206-01.

An examination of the deflators for the components of expenditure-based GDP sheds additional light on this finding. The implicit deflator for expenditure-based GDP and the implicit GDP deflator from the business sector labour productivity accounts are not strictly comparable, because the former is for the total economy, while the latter is for the business sector. Over the 2019 to 2022 period, however, their movements are very similar.

Major components of expenditure-based GDP include final consumption expenditure, gross fixed capital formation and net trade (exports minus imports). Final consumption expenditure includes household final consumption expenditure (the total expenditure on goods and services purchased out-of-pocket by households), and non-profit institutions serving households' final consumption expenditure and general governments' final consumption expenditure (goods and services consumed by households but paid for indirectly by non-profit institutions and governments). The implicit price deflator for final consumption expenditure gives a broader measure of the cost of consumption by households than the consumer price index.⁷ Chart 3 illustrates data for total compensation per hour worked deflated by the implicit price for final consumption expenditure. The data are nearly identical when consumer prices are used as the deflator. Therefore, the price of the other components of GDP expenditure is responsible for the difference in the GDP deflator and the consumer prices.

Table 1 shows the cumulative growth and the contribution to growth of the implicit price deflators for select components of expenditure-based GDP from the first quarter of 2019 to the second quarter of 2022. The implicit deflator for expenditure-based GDP was 20.1%, almost twice that of the rise in the price of final consumption expenditure (10.3%). Both residential (33.3%) and non-residential structures prices (18.8%), important parts of gross fixed capital formation,⁸ rose faster than the price of final consumption expenditure. The prices for the other components of gross fixed capital formation either grew more slowly than final consumption expenditure (e.g., machinery and equipment and intellectual property products) or composed a relatively small part of gross fixed capital formation.

The rapid rise in export prices for goods (44.4%) over this period also contributed importantly to the difference between the trends in the GDP deflator and final consumption prices. This contribution is displayed in Table 1, which also shows the percent contribution to the cumulative growth of the deflator for GDP at market prices. The contribution of the change in export and import prices (34.0%) is larger than the price growth in gross fixed capital formation (21.7%). The price increase of residential structures (33.3%) accounted for more than half (13.5 percentage points of the 21.7%) of the gross fixed capital formation.

In summary, workers have benefited from the increase in labour's terms of trade, because it has allowed their total compensation per hour worked deflated by consumer prices to rise, despite the decline in labour productivity and the greater decline in total compensation per hour worked deflated by the GDP deflator.⁹ Whether this increase in labour's terms of trade can be maintained in the coming quarters is uncertain. The tightening of monetary policy—the two-percentage-point increase in the policy interest rate—in the second quarter of 2022 will likely have an impact on the price of gross fixed capital formation, particularly residential and non-residential structures. Statistics Canada (2022, July 21) reported that the growth in new home prices decelerated in June 2022. New home prices registered their smallest year-over-year increase since March 2021. Furthermore, the energy component of the Bank of Canada commodity price index declined by 18.7% from June to August 2022.

7. Given that total compensation per hour worked is measured before taxes, it could be argued that the use of the implicit price deflator for final consumption expenditure is more appropriate to reflect the real consumption of households.

8. Expenditures on residential structures and non-residential structures accounted for 32.7% and 25.5%, respectively, of gross fixed capital formation in 2019.

9. Relevant to this article is the discussion of whether the treatment of owner-occupied housing in the consumer price index adequately reflects the cost of living. Sabourin (2015) proposed enhancements to Statistics Canada's approach. He noted that the enhanced approach requires assumptions about the expected future appreciation of housing, which can introduce excessive volatility. When he implemented the proposed enhanced approach with smoothed expectations on housing prices, he found that it yielded results that are close to the official measure over his study period.

Table 1

Cumulative growth and contribution to cumulative growth of implicit price deflators for select components of expenditure-based gross domestic product, first quarter 2019 to second quarter 2022

| | Cumulative growth | Contribution |
|---|-------------------|--------------|
| | percent | |
| Final consumption expenditure | 10.3 | 39.1 |
| Gross fixed capital formation | 19.8 | 21.7 |
| Residential structures | 33.3 | 13.5 |
| Non-residential structures | 18.8 | 4.5 |
| Machinery and equipment | 1.0 | 0.1 |
| Intellectual property products | 8.8 | 0.8 |
| Non-profit institutions serving households' gross fixed capital formation | 18.2 | 0.1 |
| General governments gross fixed capital formation | 13.9 | 2.5 |
| Exports of goods and services | 38.6 | 53.5 |
| Exports of goods | 44.4 | 50.2 |
| Exports of services | 12.2 | 3.0 |
| Less: imports of goods and services | 13.1 | -19.5 |
| Net exports | 25.5 | 34.0 |
| Gross domestic product at market prices | 20.1 | 100.0 |

Note: Components do not add to total because of the omission of investment in inventories and statistical discrepancy.

Source: Common Output Data Repository Table 36-10-0104-01.

Conclusion

This article examined the relationship between real wages and productivity. The purpose was to see whether real wage growth (growth in total compensation deflated by the GDP deflator) has lagged behind labour productivity growth over the pandemic. It was found that total compensation per hour worked deflated by the GDP deflator has grown slower than labour productivity since the first quarter of 2019. While this gap isprecedented, it is close to the range of its historical limits. The year-to-date index of the gap for 2022 (up to the second quarter) was 93.7, with the base year in 1997 being 100. This can be compared to a low of 92.7 in 2005.

Past studies, such as Williams (2021), have shown that the relationship between real wages and labour productivity has remained relatively stable in Canada. Therefore, if the relationship is to be maintained, total compensation per hour worked deflated by the GDP deflator would rise relative to labour productivity in the future. This may not be the case if, over the course of the pandemic, the way in which goods and services are produced in the economy has changed. For example, the increase in automation caused by labour shortages and the need to work in a socially distanced environment will decrease labour's share of the GDP and prevent real wages from returning to their historical position.

Past evidence from other countries has shown that labour productivity growth surpasses real wage growth over long periods of time. A number of reasons for this have been put forward, including shifts in industry structure toward more capital-intensive industries. Given the recent increase in oil and gas prices, the relationship between real wages and labour productivity was examined for the business sector excluding the oil and gas sector. The decline in real wages relative to labour productivity was still evident with the exclusion of this sector, but was less than two-thirds the size.

The article also examined the evolution of total compensation per hour worked deflated by the consumer price index. Real wages are often presented using the consumer price index instead of the GDP deflator, because it represents the purchasing power of the total hourly compensation from the workers' point of view. It was found that, unlike real wages calculated using the GDP deflator, which declined by 7.1% between the first quarter of 2021 to the second quarter of 2022, real wages calculated using the consumer price index rose 3.6% over the same period. This finding suggests that there has been an increase in the price of goods and services being produced in Canada relative to the price of goods and services being consumed. An investigation of the components of the GDP deflator indicates that the improvements in the price of exports relative to the price of imports was the most important factor, followed by higher prices for gross fixed capital formation, particularly in residential structures. The recent tightening of monetary policy (which could dampen the price of structures) and the moderation in the price of oil (which could dampen the price of exports) could weaken these gains in the future.

A disadvantage of the approach taken in this paper is that it stays at the aggregate level. Further insight could be gained if real wages paid to a different group of workers were examined. Although total compensation per hour worked deflated by the consumer price has risen at the aggregate level, it may not adequately describe the experience of all Canadians. The Portrait of Canadian Society survey, conducted from April 19 to May 1, 2022, found that three in four Canadians reported that rising prices are affecting their ability to meet day-to-day expenses (Statistics Canada, June 9). In the future, a more detailed study could shed light on why so many Canadians were reporting this.

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