Global Factors and Inflation in Canada

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Acknowledgements

Abstract

This note investigates whether the recent weakness in inflation in Canada can be related to global factors not included in the current staff analytical framework (domestic slack, movements in commodity prices and in the exchange rate). A global common factor for inflation among selected advanced economies appears to contain marginal information for Canadian inflation beyond what is found in movements in commodity prices and the exchange rate. However, our analysis of potential channels (import prices, global slack and the integration in global value chains) does not help to improve our understanding of the recent weakness in inflation. The analysis reinforces our current assessment that the weakness in inflation over recent quarters is mostly due to Canada-specific temporary factors (food and electricity prices). Still, there is a risk that part of the recent unexplained weakness in CPI inflation may not be due exclusively to Canada-specific factors, although the channels through which that global common factor operates remain undetermined. Further work is therefore needed to explore other channels (e.g., digitalization) through which the effect of this common factor might operate.

Bank topics: Inflation and prices; Recent economic and financial developments
JEL codes: E, E3, E31

Résumé

Cette note cherche à déterminer si la faiblesse récente de l'inflation au Canada peut être mise en relation avec des facteurs mondiaux qui ne sont pas pris en compte dans l'actuel cadre d'analyse du personnel (capacités excédentaires intérieures, mouvements des prix des produits de base et du taux de change). Un facteur commun aux évolutions de l'inflation estimé pour certaines économies avancées semble apporter peu d'informations sur l'inflation au Canada autres que celles extraites des variations des prix des produits de base et du taux de change. Si notre analyse des canaux par lesquels ce facteur produit ses effets (prix des importations, capacités excédentaires mondiales et intégration aux chaînes de valeur mondiales) ne permet pas de mieux comprendre les causes de la faiblesse récente de l'inflation, elle conforte notre évaluation présente : la faiblesse observée ces derniers trimestres serait essentiellement attribuable à des facteurs temporaires propres au Canada (les prix des aliments et de l'électricité). La possibilité qu'une part de la faiblesse inexpliquée de l'inflation mesurée par l'IPC enregistrée récemment ne tienne pas entièrement à des facteurs proprement canadiens ne peut être écartée, bien que les canaux par lesquels ce facteur commun à plusieurs économies influe sur l'inflation restent inconnus. Des travaux consacrés à l'exploration d'autres canaux (p. ex., la numérisation de l'économie) sont par conséquent nécessaires.

Sujets : Inflation et prix; Évolution économique et financière récente
Codes JEL : E, E3, E31

Summary

This note investigates whether the recent weakness in inflation in Canada can be related to global factors, such as import prices, global slack and integration in global value chains, that are not included in the current staff analytical framework. The main takeaways are the following:

- In our current Phillips curve framework, inflation dynamics in Canada are explained by a measure of economic slack (domestic factors) and movements in commodity prices and in the exchange rate (global factors).
  - Since the third quarter of 2016, inflation measured by year-over-year changes in the consumer price index (CPI) has been, on average, about 0.7 percentage points below what our framework would suggest.
  - Recent unexplained weakness in CPI inflation appears to primarily reflect special factors in inflation in goods rather than in services.
- Our analysis reinforces our current assessment that the weakness in inflation over recent quarters is mostly due to Canada-specific temporary factors (food and electricity prices).
- A global common factor for inflation among selected advanced economies appears to contain marginal information for Canadian inflation beyond what is found in movements in commodity prices and the exchange rate.
  - Over the sample period (1997–2012), this global common factor outside of food and energy accounts for only about 5 per cent of the variability of CPI inflation, although it does seem to coincide with the recent unexplained weakness (residual), since both have been negative since the third quarter of 2016.
- There is thus a risk that part of the recent unexplained weakness in CPI inflation may not be due exclusively to Canada-specific factors.
- However, the channels through which that global common factor operates remain undetermined. Import prices, global slack and the integration in global value chains have been evaluated as potential channels and their impact has been assessed; but none of them provides greater insight into the recent weakness in inflation.
- Further work is therefore needed to explore other channels (e.g., digitalization) through which the effect of this common factor might operate.

1. Context

Inflation in Canada has slowed over the first half of 2017, after reaching a recent peak of 2.1 per cent in January, and has remained in the lower part of the inflation-control range in recent months despite diminishing economic slack.[1] This phenomenon is not unique to Canada; inflation has decelerated in most advanced economies (**Chart 1**). In recent years, missing disinflation or missing inflation and the potential drivers of inflation in advanced economies have been the subject of many studies (Ciccarelli and Osbat 2017; Abdih, Balakrishnan and Shang 2016; and ECB 2017).

Canadian consumer price index (CPI) inflation dynamics over recent history and the projection horizon are usually decomposed into commodity price movements, exchange rate movements and the output gap (**Chart 2**).[2] However, at the time of the July *Monetary Policy Report* (MPR), a significant part of the weakness in the staff framework remained unexplained: from the third quarter of 2016 to the second quarter of 2017, negative residuals (labelled as other factors) were removing on average about 0.7 percentage points from CPI inflation.[3] Moreover, sectoral decomposition suggests that the unexplained weakness is driven by inflation dynamics in goods, but not in services. **Box 1** presents the decomposition for goods inflation.

The simple framework staff use to decompose inflation could, however, be omitting the impact of other domestic and global factors related to globalization and technological changes. This note reviews and assesses the impact of some of the channels (import prices, global slack and integration in global value chains) through which global common factors could influence Canadian inflation.

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[1] The last observation considered in this note for Canadian CPI data is August 2017. It does not incorporate the September CPI release of October 20, 2017.

[2] This representation is similar to the decomposition presented in the *Monetary Policy Report*. This decomposition is based on a Phillips curve estimation over 1995 to 2012. Estimation is made on quarterly data, seasonally adjusted when needed and transformed into the first difference of their natural logarithm. The results are then transposed into a year-over-year percentage change to create the decomposition graph.

[3] While the residuals were unexplained by the macroeconomic factors included in the decomposition, staff analysis conducted at the time of the July MPR suggests that below-average inflation in food products and the expected impact on electricity prices of Ontario's Fair Hydro Plan could account for most of the weakness in inflation.

Chart 1: CPI inflation has decelerated in several advanced economies over the past year
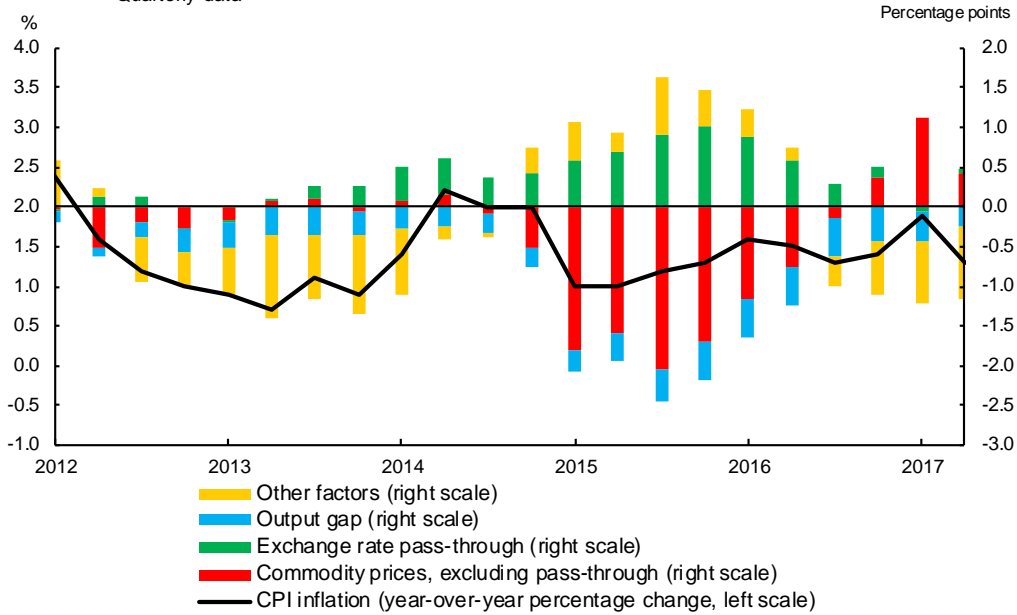
Year-over-year percentage change, monthly data
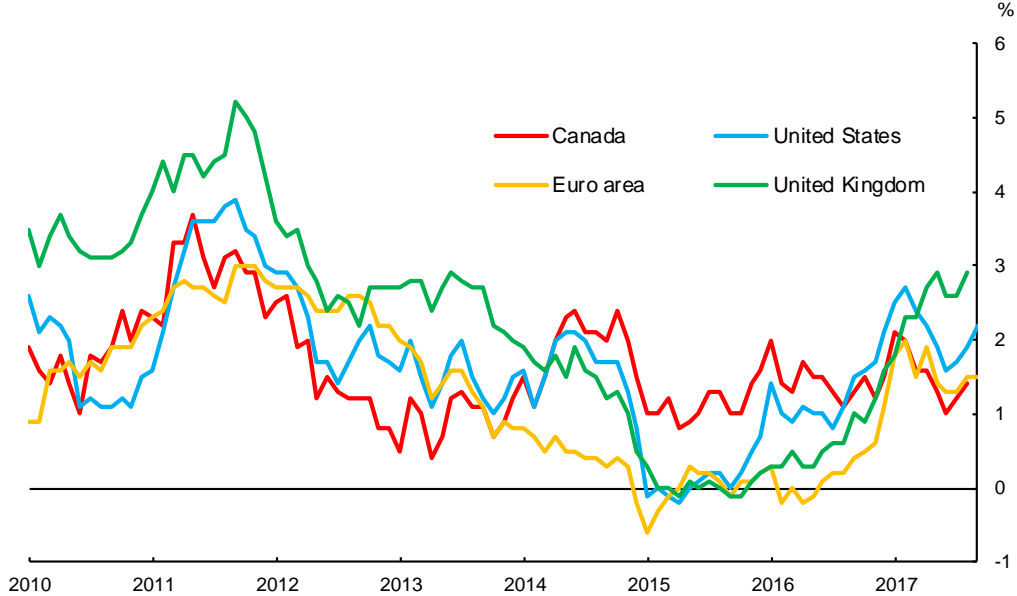
Sources: US Bureau of Labor Statistics, Office for National Statistics and Eurostat via Haver Analytics, Statistics Canada and Bank of Canada calculations

Last observations: Canada and the United Kingdom, August 2017; the United States and the euro area, September 2017

Chart 2: Contribution to the deviation of inflation from 2 per cent

Quarterly data

- Other factors (right scale)
- Output gap (right scale)
- Exchange rate pass-through (right scale)
- Commodity prices, excluding pass-through (right scale)
- CPI inflation (year-over-year percentage change, left scale)

Sources: Statistics Canada and Bank of Canada calculations

Last observation: 2017Q2

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Box 1: Recent Weakness in Canadian Inflation Is More Related to Goods

To dig further into the source of the weakness in CPI inflation, separate decompositions are done for goods and services inflation. This exercise suggests that the unexplained weakness in inflation observed over recent quarters must be coming from the goods side.[4]

The specification for the Phillips curve for goods inflation is similar to the base case for total inflation. The equation was also estimated using quarterly data from the second quarter of 1997 to the fourth quarter of 2012.[5] Since almost 40 per cent of the cost of goods embedded in the CPI is related to imported goods (**Chart 1-A**), it makes sense to include the exchange rate and commodity prices in the Phillips curve. But domestic conditions also matter: **Chart 1-A** shows that costs related to domestic goods and services account for about 60 per cent of the overall prices of goods, therefore justifying controlling for the domestic output gap.
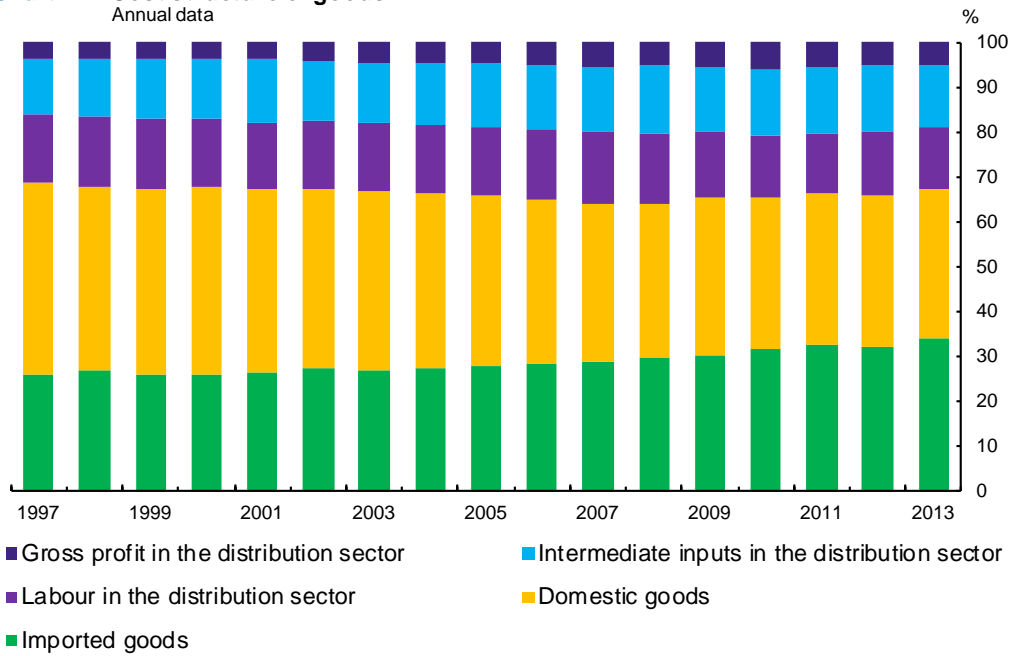
Chart 1-B shows the decomposition of inflation in goods in recent years. Since the second half of 2016, residuals have been negative, in line with the observed weakness in food inflation and more recently with electricity rebates.

When applying the analytical framework used in this note to goods inflation, the conclusions are similar to those for CPI inflation: considering other global (import prices, global slack and integration in global value chains) or domestic (wages or labour productivity) factors do not add much to our base-case Phillips curve for goods.

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[4] This appears to be common among advanced economies (Bhatnagar et al. 2017). The latter analysis suggests that softer core inflation rates since 2016 in advanced economies are mostly driven by goods prices, with the exception of the United States. Their work suggests that subdued inflation might have been due to import prices, but this is likely easing given the exchange rate depreciation in many advanced economies and the pickup in Chinese export prices.

[5] The estimation period was changed because of data limitations for some of the new indicators. All estimations in this note are made over the 1997Q2–2012Q4 period.
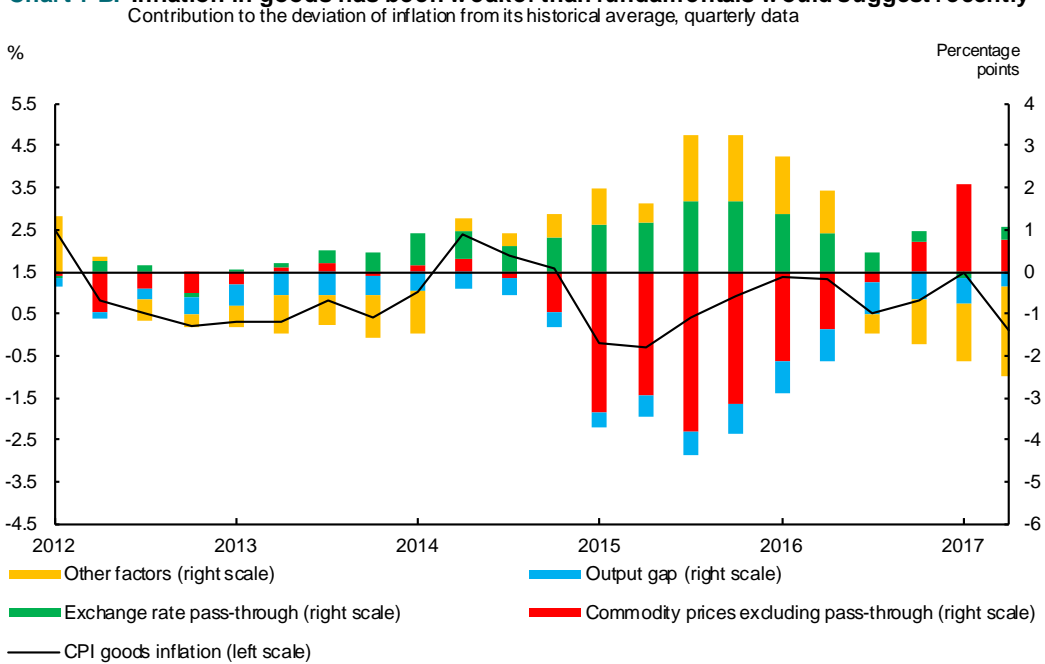
Chart 1-A: Cost structure of goods
Annual data

%

- Gross profit in the distribution sector
- Intermediate inputs in the distribution sector
- Labour in the distribution sector
- Domestic goods
- Imported goods

Sources: Statistics Canada; Innovation, Science and Economic Development Canada; and Bank of Canada calculations

Last observation: 2013

Chart 1-B: Inflation in goods has been weaker than fundamentals would suggest recently
Contribution to the deviation of inflation from its historical average, quarterly data

%

Percentage points

- Other factors (right scale)
- Output gap (right scale)
- Exchange rate pass-through (right scale)
- Commodity prices excluding pass-through (right scale)
- CPI goods inflation (left scale)

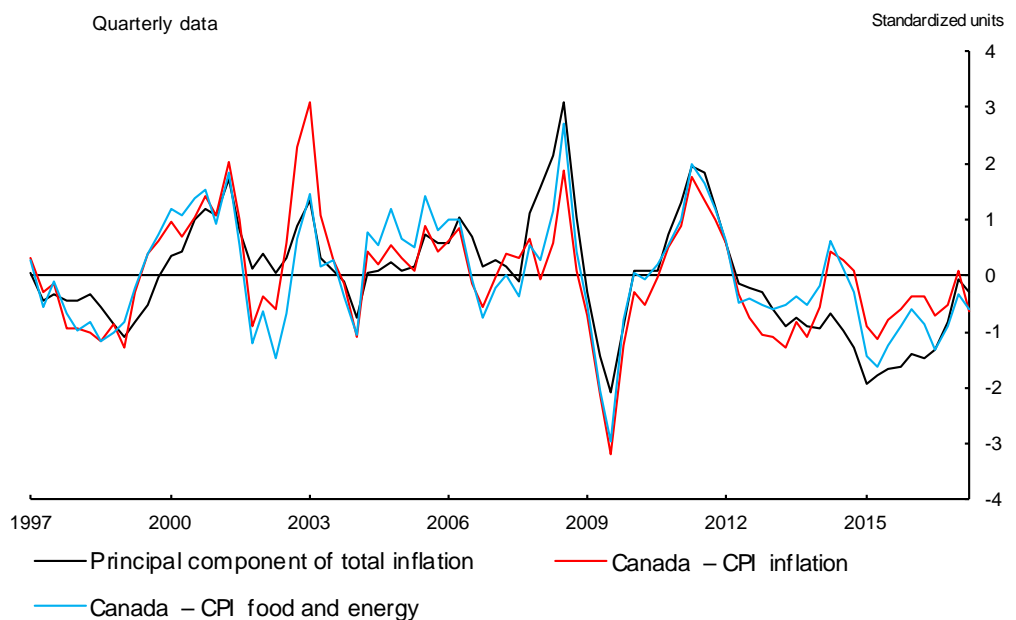Sources: Statistics Canada and Bank of Canada calculations

Last observation: 2017Q2

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2. Global Factors

Commodity prices and global common factors

While movements in commodity prices and the exchange rate could capture to a large extent the influence of global factors on inflation dynamics, the presence of other channels cannot be ruled out. **Chart 3** shows the first principal component extracted from total CPI inflation in 11 advanced economies against a standardized inflation rate for the Canadian CPI as well as the Canadian CPI for food and energy.[6]

Chart 3: **The global common factor appears to largely reflect movements in CPI inflation in Canada**

Quarterly data   Standardized units

— Principal component of total inflation   — Canada – CPI inflation

— Canada – CPI food and energy

Sources: Statistics Canada, Organisation for Economic Co-operation and Development and Bank of Canada calculations
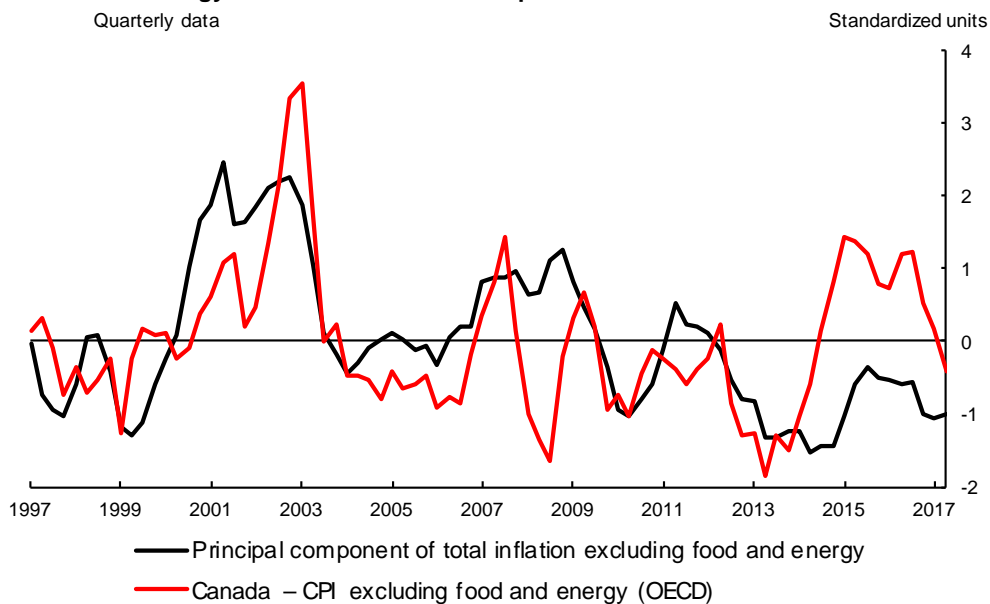
Last observation: 2017Q2

The common trend among inflation rates could be relatively important, since the correlation between the first principal component and Canadian inflation is 0.77 (0.83 with food and energy). This high correlation is due to the food and energy components in the CPIs being largely driven by their respective commodity prices, which are typically determined internationally and influenced by global developments. Results from a regression of the principal component (black line) on energy and agricultural prices (from the Bank of Canada commodity price index, BCPI) suggest that nearly 60 per cent of the variability of the principal component is explained by movements in commodity

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[6] These economies are Australia, Canada, Denmark, Japan, New Zealand, Norway, South Korea, Sweden, the United Kingdom, the United States and the euro area (see Bhatnagar et al. 2017).

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prices.[7] This means that a large part of the channel related to this first global factor is already imbedded in our CPI decomposition since BCPI is included.

If food and energy were excluded from the inflation rates, would there still be a common factor among advanced economies? **Chart 4** shows the first principal component extracted from CPI excluding food and energy in the same 11 advanced economies against the standardized appropriate inflation rate for Canada. While the correlation between the two lines is much lower (0.48), it still suggests some common movement.

Chart 4: **The relationship between the principal component of inflation excluding food and energy and its Canadian counterpart is much weaker**

Quarterly data   Standardized units

— Principal component of total inflation excluding food and energy

— Canada – CPI excluding food and energy (OECD)

Sources: Statistics Canada, Organisation for Economic Co-operation and Development and Bank of Canada calculations
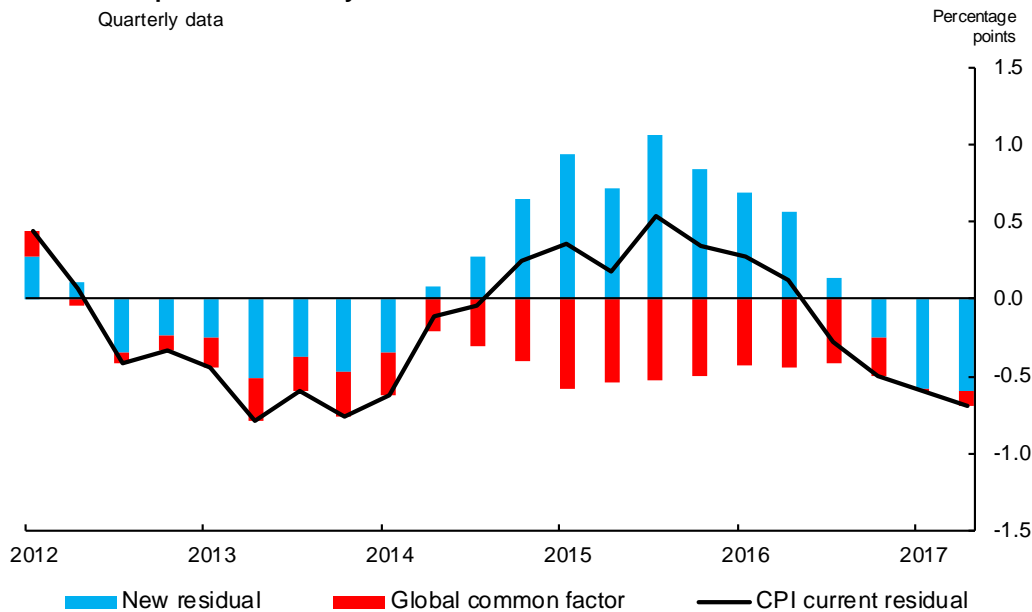
Last observation: 2017Q2

To formally assess the relevance of this factor in our framework, we regress the residuals from our base-case Phillips curve on the first principal component separately for CPI inflation and CPI inflation excluding food and energy.[8] **Chart 5** and **Chart 6** show that both principal components help to slightly reduce the residuals of the base-case

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[7] When the principal component is regressed on standardized changes in the BCPI, the adjusted R-squared remains elevated at 0.41.

[8] The advantages of proceeding in this way—instead of inserting the common global factor in our Phillips curve—are (1) maintaining the contribution of the base-case variables constant and (2) allowing for direct testing of whether the global factors contain information beyond the information from the variables included in the base-case that could help reduce the residuals.

Phillips curve in some periods (e.g., 2012–13), although residuals are also larger over other periods (e.g., 2014–15). The global common factor derived from total inflation is barely able to account for any of the weakness in Canadian CPI inflation in the first half of 2017, once we account for BCPI.[9] The global common factor for CPI excluding food and energy accounts for only about 5 per cent of the variability of CPI inflation over the estimation period (1997–2012), albeit it does seem to coincide with the recent weakness (both the residuals and this global common factor have been negative since the third quarter of 2016), supporting the conjecture that part of the unexplained weakness in inflation could be common to all advanced economies. These results do not, however, reveal the exact channels through which this might operate. As such, some of the potential channels (import prices, global slack and integration into global value chains) are reviewed in the next section.[10]

Chart 5: **The global common factor barely reduced any of the residuals in the base-case Phillips curve recently…**

Quarterly data

Percentage points

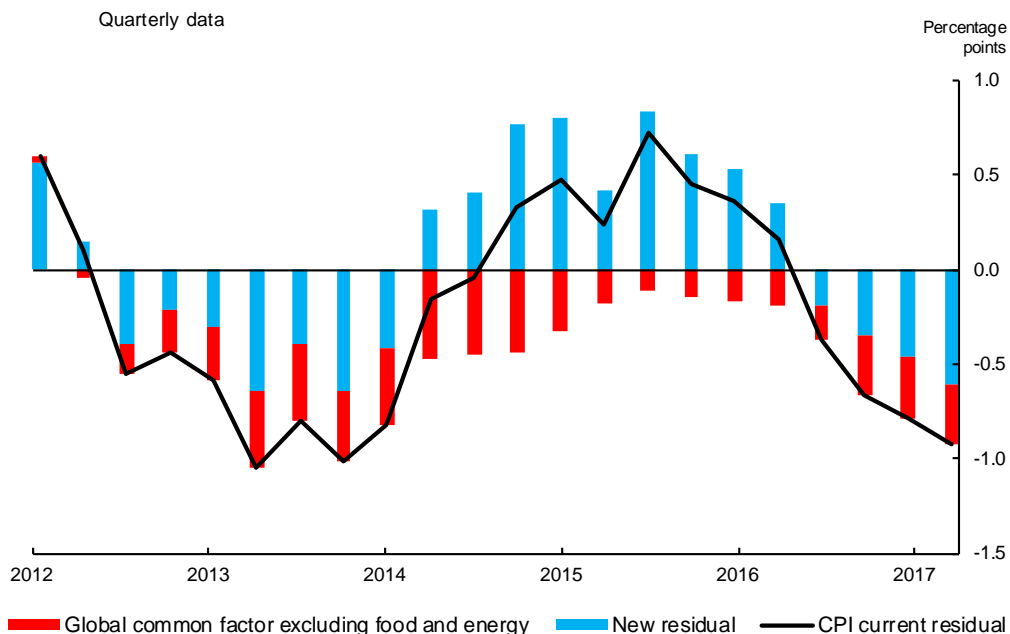New residual   Global common factor   CPI current residual

Source: Bank of Canada calculations

Last observation: 2017Q2

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[9] Despite not being able to explain the recent recent weakness in inflation, the global common factor accounts for about 20 per cent of the residuals over the estimation period.

[10] The role of digitalization is addressed in a separate staff analytical note; see Charbonneau et al. (forthcoming).

Chart 6:   …although it could with the global common factor excluding food and energy

Quarterly data

Percentage points

Legend: Global common factor excluding food and energy (red) — New residual (blue) — CPI current residual (black line)

Source: Bank of Canada calculations

Last observation: 2017Q2

Openness to trade, the relative importance of low-cost countries and import prices

Growing openness to trade has been suggested as a global factor that could have had a tempering effect on consumer prices, more specifically, on goods through import prices and greater competition. Such measures could be proxied by the share of total exports and imports in the Canadian economy. This share peaked at about 80 per cent in the early 2000s before steadily declining to about 65 per cent in 2016. This decline suggests that the tempering effect of international trade on inflation could be weaker now than before, thus not necessarily an explanation for the recent weakness in Canadian inflation.

Looking more specifically into the countries of origin of the imported items in the CPI basket could lead to a different conclusion. **Chart 7** shows that the importance of imports from China in the Canadian CPI has steadily increased since 1997. [11,12,13]

[11] Shares after 2013 are preliminary estimates given that the Statistics Canada's Supply and Use tables stopped in 2013. However, CPI weights and trade data (from Trade Data Online) are used until 2016.

[12] Morel (2007) concludes that the direct effect of imports from China decreased average inflation in Canada by 0.1 percentage point between 2001 and 2006 as a result of the increasing share of Canadian imports in consumer goods and the lower prices of these imported goods. This effect was, however, considered to be transitory.

Moreover, given that about 25 per cent of the CPI goods are imported, a share that has been progressively increasing since the 2000s (**Chart 7**), this may suggest a further role for trade openness in influencing inflation in Canada.

Chart 7: **Direct import content of the CPI**
Annual data
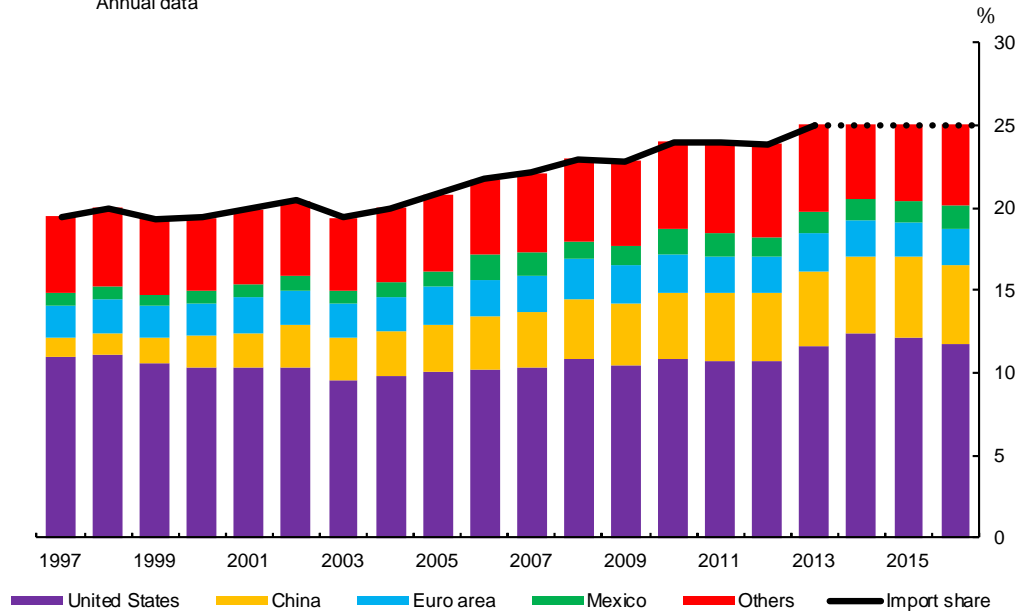
Sources: Statistics Canada; Innovation, Science and Economic Development Canada; and Bank of Canada calculations
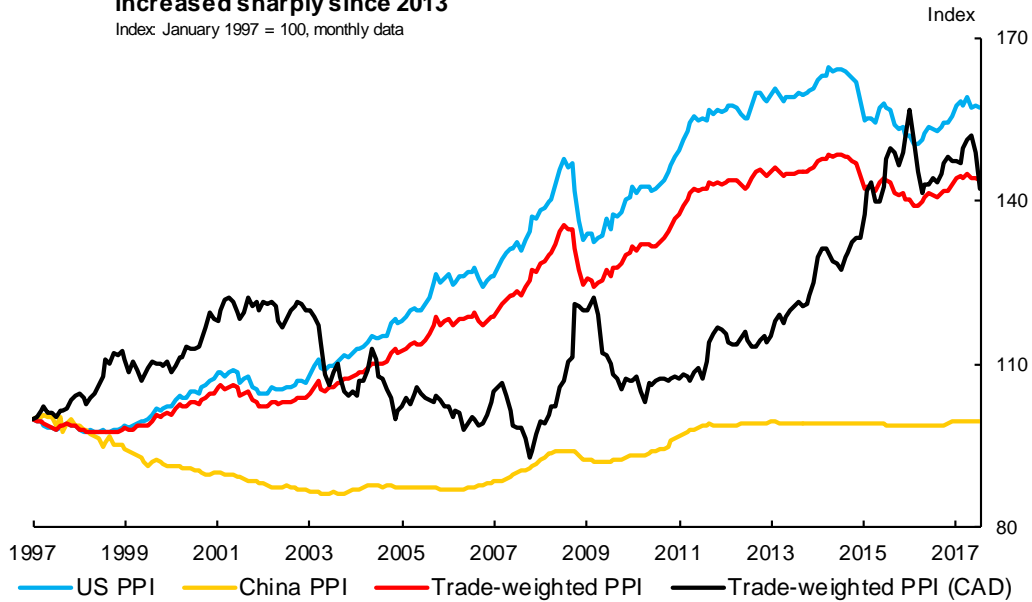
Last observation: 2016

The impact of openness to trade will be assessed through import prices since they were not directly included in the original CPI decomposition—except for those captured in the BCPI. **Chart 8** shows how import prices are greatly influenced by movements in the Canadian dollar, since the trade-weighted producer price index (PPI) in Canadian dollars increased sharply after 2013. [14] However, with the exception of food and energy, most PPIs either point to stable or increasing prices in local currency, suggesting that they would not help explain the recent softness in CPI inflation (**Chart 9**).

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[13] ECB (2017) investigates the influence of China on inflation dynamics in advanced economies through two main channels with opposite effect: the supply side through lower-cost producers and the demand side through higher commodity prices resulting from China's high growth. It concludes that since mid-2011 China has, on net, exerted a modest drag on inflation in advanced economies as China's growth slowed.

[14] Only the United States and China's series were considered given that they comprise more than half of the import content of the Canadian CPI. Goods imported from both countries are labelled in local currency.

Chart 8: **Canadian-dollar import prices for finished consumer goods have increased sharply since 2013**

Index: January 1997 = 100, monthly data

US PPI — China PPI — Trade-weighted PPI — Trade-weighted PPI (CAD)

Sources: US Bureau of Labor Statistics and China National Bureau of Statistics via Haver Analytics; Statistics Canada; Innovation, Science and Economic Development Canada; and Bank of Canada calculations

Last observation: July 2017

Chart 9: **Import prices in local currencies have either been stable or increasing, with the exception of those for food and energy**

Index: January 1997=100, monthly data

Food (left scale)
Non-durables excluding food and energy (left scale)
Semi-durables (left scale)
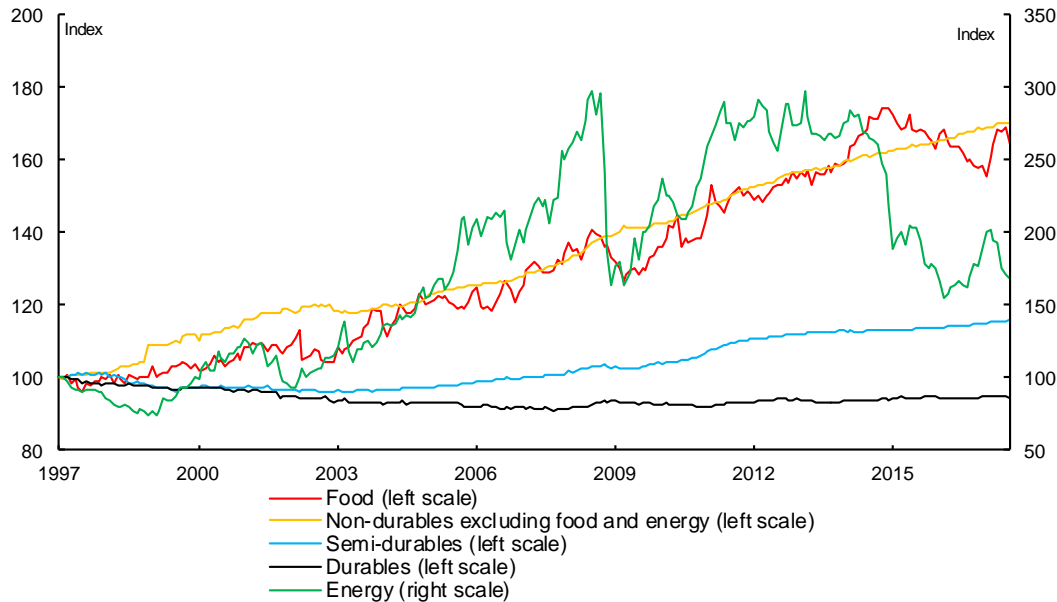Durables (left scale)
Energy (right scale)

Sources: US Bureau of Labor Statistics and China National Bureau of Statistics via Haver Analytics; Statistics Canada; Innovation, Science and Economic Development Canada; and Bank of Canada calculations

Last observation: July 2017

Chart 10 shows that regressing the trade-weighted PPI in local currency on the residuals from the base-case Phillips curve would actually increase the negative residuals in most recent quarters (its impact is, however, statistically significant over the entire estimation

sample). This reflects the fact that PPIs for most sub-aggregates have been increasing in recent quarters.

Chart 10: Including the PPI would actually increase the residuals in the most recent quarters

Quarterly data

Percentage points

Trade-weighted PPI   **New residual**   **CPI current residual**
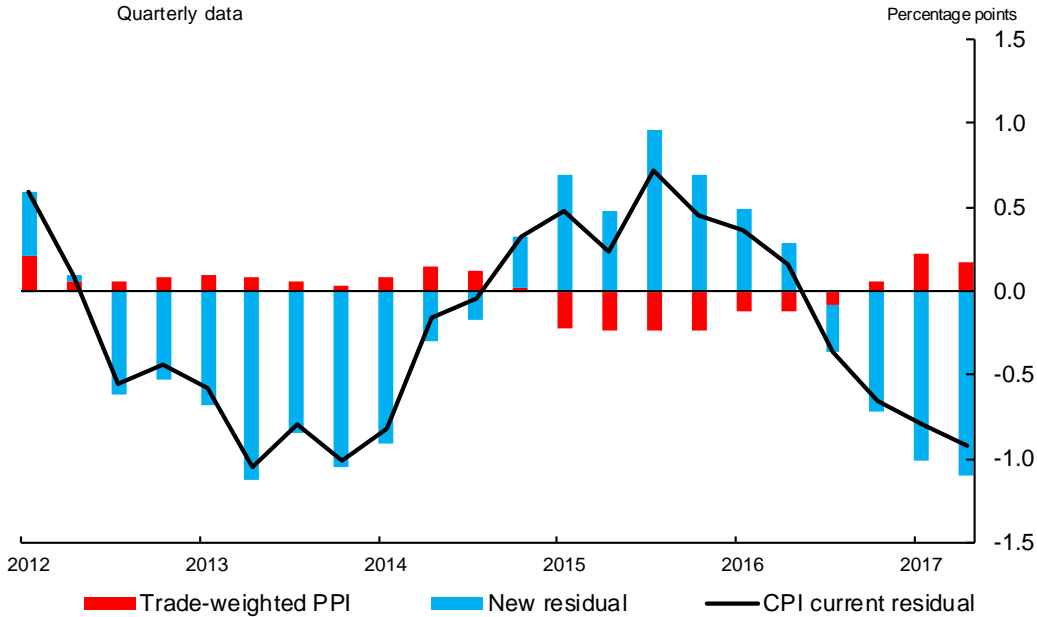
Source: Bank of Canada calculations

Last observation: 2017Q2

Global slack

International economic conditions can influence domestic inflation directly or indirectly through a global output gap. Global slack indirectly influences domestic inflation through commodity prices or other import prices as well as through the domestic output gap. For example, stronger global demand for Canadian goods and services supports domestic income through net exports that in turn positively influence the Canadian output gap.

Another view suggests that global economic conditions can have a more direct influence on domestic inflation (e.g., ECB 2017). According to this view, tightness in domestic supply conditions for a given good or service subject to international trade can be offset by its availability somewhere else, suggesting that domestic inflation is increasingly sensitive to global slack. The Canadian inflation rate and the Canadian output gap from the Integrated Framework are presented in **Chart 11** with the estimated output gap for

the world excluding Canada.[15] The Canadian output gap typically follows the global output gap, except over 2014–15, when commodity prices declined sharply. This suggests that global slack might not be adding any new information to our base-case specification, which is confirmed by regressing the residuals from our base-case Phillips curve on a measure of global slack.[16] Results indicate that the global slack does not add much.[17]

Chart 11: **Domestic economic conditions have evolved similarly to global slack**
Quarterly data
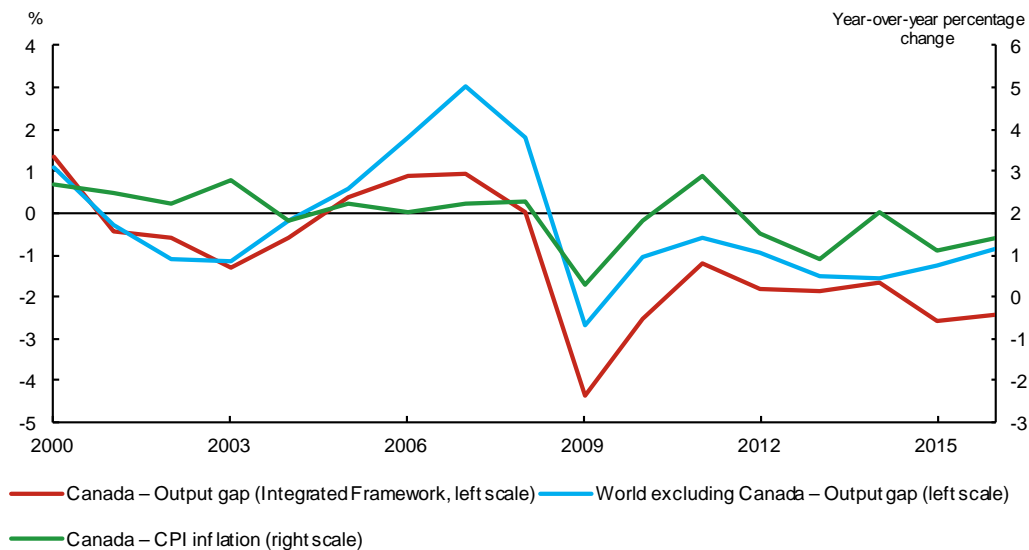
Note: The output gap series for the World and Canada are from the long-term baseline projections from the OECD Outlook No 95 (May 2014). Given that our estimation period ends in 2012, this should not have a major impact on our results.

Sources: Organisation for Economic Co-operation and Development and International Monetary Fund via Haver Analytics, Statistics Canada and Bank of Canada calculations

Last observation: 2016

Integration in global value chains

The role of foreign slack on domestic inflation could depend on the integration in global value chains (GVC) (e.g., Auer, Borio and Filardo 2017).[18] As the different stages of

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[15] The Bank's estimates of the output gap in the Integrated Framework can be found at Statistics > Indicators > Indicators of Capacity and Inflation Pressures for Canada on the Bank's website.

[16] Global output gap data are annual and were transformed to quarterly for the estimation.

[17] We acknowledge, however, that since measures of domestic and global slack are correlated, it may be difficult to disentangle the impact of each on CPI inflation in a reduced-form equation.

[18] The OECD summarizes GVC as follows: "International production, trade and investments are increasingly organised within so-called global value chains (GVC) where the different stages of the

production are relocated across different countries, this increases the importance of external factors and supply conditions on domestic wage and price-setting decisions by firms, which in turn influence domestic inflation. For example, domestic labour market conditions can be influenced by the credible threat that some production stages will be outsourced.

As such, the potential influence of GVC on inflation is investigated. There are different ways to proxy GVC. In this note we tested proxies based on work by Auer, Borio and Filardo (2017): the share of imports and exports in gross domestic product (GDP), the share of intermediate products imported and exported in GDP, the share of final products imported and exported in GDP, and foreign value added in exports as a share of total exports. The idea behind these measures is that integration into GVC should be associated with a higher share of low-cost imported content in domestic production and exports—most likely leading to lower domestic production costs and efficiency gains. **Chart 12** shows that the main selected proxies do not appear to support the increasing importance of GVC for Canada.[19] All the measures are either relatively flat or decreasing. Given those dynamics and the limitations of the data (available only annually and with major lags), it is not clear that the evolution in GVC will help us understand the recent weakness in Canadian inflation.[20] This is confirmed by doing a regression of the residuals from our base-case Phillips curve on the different proxy of GVC. In most cases, the coefficients on the proxy of GVC are not statistically significant (see **Box 2** for other potential channels of GVC).[21]
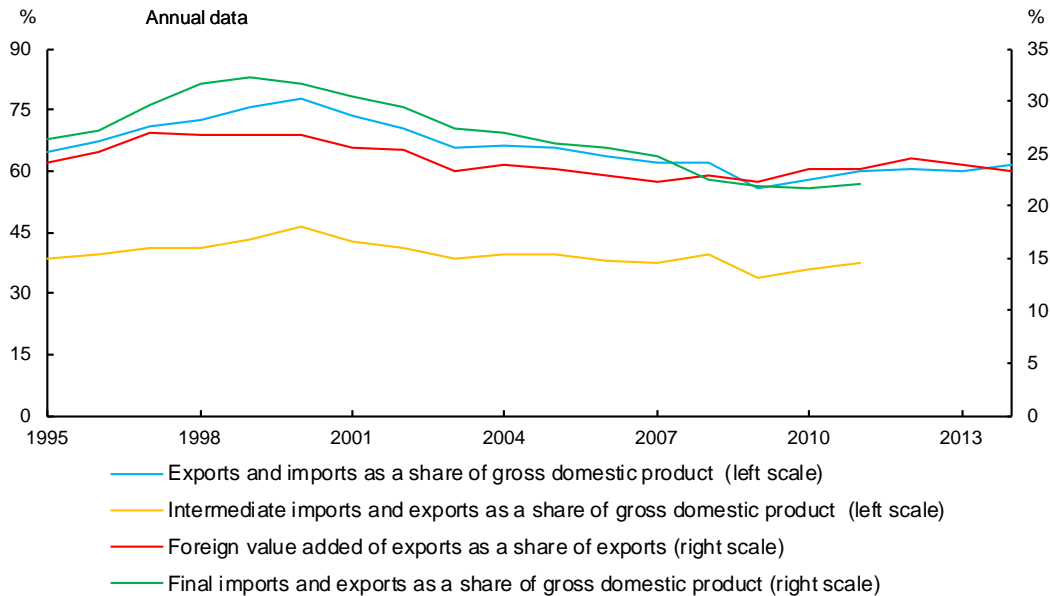
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production process are located across different countries. Globalisation motivates companies to restructure their operations internationally through outsourcing and offshoring of activities." (http://www.oecd.org/sti/ind/global-value-chains.htm)

[19] Global trade measures used in Francis and Morel (2015) also point to a decrease in Canada's involvement in GVC. While their measures are based on exports and imports, they do not account for the trade of intermediate and final goods or foreign content in domestic value added as the ones used in this note do.

[20] Data from Trade in Value Added (http://stats.oecd.org/Index.aspx?DataSetCode=TIVA_2016_C1) are used to construct some GVC measures. Data are available until 2011; data for 2012–14 are based on nowcasting.

[21] Both the level and changes in the measures were tested in our framework. All results were not statistically significant with the exception of the variable representing the change in the share of final products imported and exported in GDP.

Chart 12: **None of the measures of GVC suggests that they have gained in importance in Canada in recent years**

% Annual data %

Exports and imports as a share of gross domestic product (left scale)

Intermediate imports and exports as a share of gross domestic product (left scale)

Foreign value added of exports as a share of exports (right scale)

Final imports and exports as a share of gross domestic product (right scale)

Sources: Statistics Canada, Trade in Value Added (TiVA) from the Organisation for Economic Co-operation and Development, and Bank of Canada calculations

Last observations: Exports and foreign value added, 2014; intermediate and final imports and exports, 2011

Box 2: Alternative Channels for Global Value Chains

The main conclusion of Section 2 is that the global factor outside of food and energy coincides to some extent with the recent weakness of CPI inflation in Canada. However, the nature of the channel through which it could influence CPI inflation, besides BCPI, remains unknown. In attempt to shed further light on these global factor channels, we investigate the role of Canada-specific domestic factors. Wages, for instance, could have been restrained by integration in GVC, especially if this integration is mismeasured.[22] Therefore, the credible threat of relocation could have forced workers to accept more modest wage increases; and relocated activities should have reduced domestic demand for labour and, all else being equal, put downward pressure on wages.[23]

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[22] Given the complex and decentralized nature of GVC, good data are difficult to collect. Current indicators are capturing at best only some aspects of this phenomenon.

[23] While economic slack—which captures the effect of domestic price pressures in our base-case Phillips curve—has lately been a source of downward pressure on inflation, recent weakness in CPI inflation seems to be more important than what can usually be explained by economic slack, and thus alternative domestic factors should not be ruled out.

Using a similar framework as for global factors, several measures of domestic cost pressure are separately tested on the residuals of our Phillips curve framework: wage measures, unit labour cost (ULC), labour productivity, unit profit (UP), and an aggregate measure of domestic price pressures defined as the sum of ULC and UP.[24] No measures of domestic costs help reduce the residuals from our base case.

Combining global factors

Results suggest that some macroeconomic factors presented could contribute to a better understanding of the dynamics in Canadian inflation. While all the analysis was done by looking at those factors individually, we now combine them in our framework. Changes in trade-weighted PPI are combined with the first principal component (global factor) of either total inflation or total inflation excluding food and energy in a regression on the residuals of our base case.

Combining the change in trade-weighted PPI with the global common factor of total inflation results in a negligible and non-significant impact from PPI. This leaves room for only the global common factor of total inflation. As such, the results remain in line with **Chart 5**. However, when the change in the trade-weighted PPI is combined with the global common factor of total inflation excluding food and energy, the impact of both variables is significant (**Chart 13**). Import prices have been positively contributing to the residuals recently, thus offsetting a large part of the negative contribution from the global common factor excluding food and energy.

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[24] Fixed-weighted wage measures from the Labour Force Survey and the Survey of Employment, Payrolls and Hours are used. These measures are expected to better reflect inflationary pressures because they abstract from compositional effects (such as sectoral or occupational changes), leaving only the pure price effect.

Chart 13: Part of the negative residuals remains unexplained
Quarterly data

Percentage points

| Global common factor excluding food and energy | New residual |
| Trade-weighted PPI | CPI current residual |
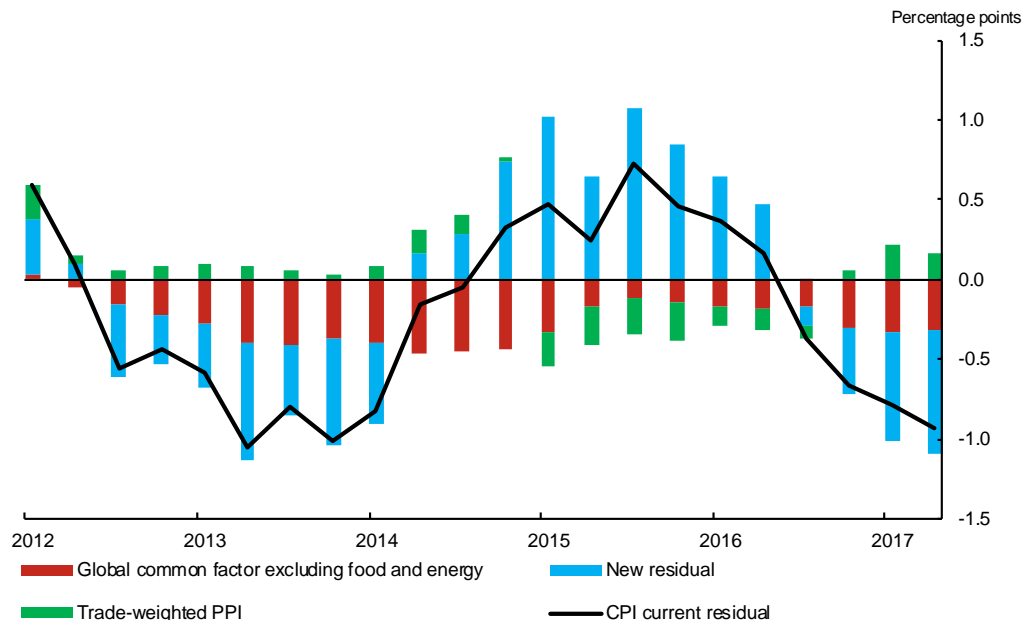
Source: Bank of Canada calculations   Last observation: 2017Q2

3. Conclusion

This note investigates the impact of a broader set of global economic factors on Canadian inflation than what is considered in our base-case Phillips curve. The results confirm that most of the valuable information is already considered in this base case (see **Table 1** for a summary of the results presented in this note). Only a few variables were found to provide additional information to our analysis. However, most of these variables were not able to account for the unexplained weakness observed over recent quarters. The exception is the global common factor outside of food and energy, which unfortunately does not allow the identification of the exact channels through which this effect operates.

These results reinforce our current assessment that the weakness in Canadian inflation observed recently is mostly due to temporary factors (food and electricity prices). However, a global common factor of inflation among major economies appears to contain marginal information for Canadian inflation above what is usually found in movements in commodity prices and the exchange rate. There is thus a risk that the recent unexplained weakness in total inflation may not be exclusively due to Canada-specific factors (food and electricity prices). Further work is thus needed to better

understand the exact channels through which the effect of this common factor operates.[25]

Table 1: Summary of results		
	Statistically significant?	Helps to reduce the residuals in 2017H1?
Global common factor	Yes	No
Global common factor excluding food and energy	Yes	Yes
Trade weighted PPI	Yes	No
Global output gap	No	-
Integration in global value chains	No*	-
Alternative measures of domestic cost	No*	-
* Most of the series tested were either not statistically significant or not helping to reduce the residuals in 2017H1.		

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[25] The work of Bhatnagar et al. (2017) on the common factor led to results that are relatively aligned with ours. They find a strong co-movement between the common factor of total inflation and commodity prices. Furthermore, their results suggest that the importance of the common factor in total inflation excluding food and energy in explaining dynamics in this series in Canada declined after 2011.

References

Abdih, Y., R. Balakrishnan and B. Shang. 2016. "What Is Keeping U.S. Core Inflation Low: Insights from a Bottom-Up Approach." IMF Working Paper No. WP/16/124.

Auer, R., C. Borio and A. Filardo. 2017. "The Globalisation of Inflation: The Growing Importance of Global Value Chains." BIS Working Papers No. 602.

Bhatnagar S., A.-K. Cormier, K. Hess, P. de Leon-Manlagnit, E. Martin, V. Rai, R. St-Cyr and S. Sarker. 2017. "Low Inflation in Advanced Economies: Facts and Drivers." Bank of Canada Staff Analytical Note 2017-16.

Charbonneau K., A. Evans, S. Sarker and L. Suchanek. Forthcoming. "Digitalization and Inflation: A Review of the Literature." Bank of Canada Staff Analytical Note.

Ciccarelli, M. and C. Osbat. 2017. "Low Inflation in the Euro Area: Causes and Consequences." European Central Bank Occasional Paper Series No 181.

European Central Bank. 2017. "Domestic and Global Drivers of Inflation in the Euro Area."

Francis, M. and L. Morel. 2015. "The Slowdown in Global Trade." *Bank of Canada Review* (Spring): 13–25.

Morel, L. 2007. "The Direct Effect of China on Canadian Consumer Prices: An Empirical Assessment." Bank of Canada Staff Discussion Paper No. 2007-10.