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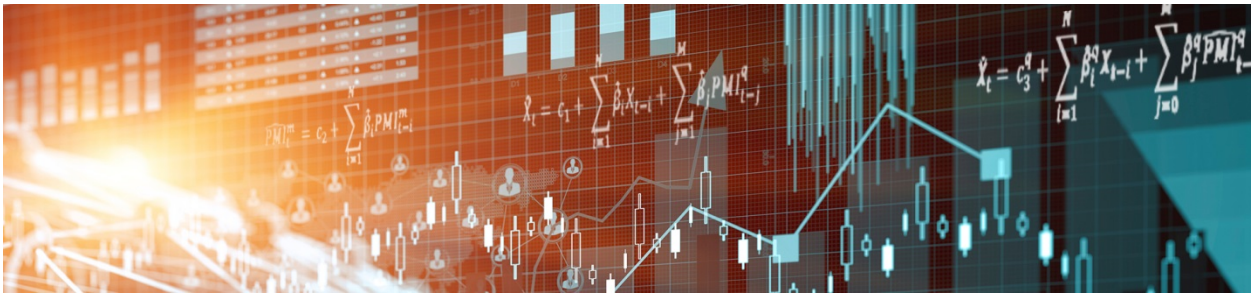
The Share of Systematic Variations in the Canadian Dollar—Part II



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Abstract

This analytical note examines how much of the systematic variation in the Canadian dollar is attributable to its sensitivity to commodity prices. We introduce a new "oil" portfolio that captures systematic variations when the exchange rates of commodity exporters and commodity importers move in opposite directions. We find that the Canadian dollar's sensitivity to the oil portfolio has increased with the growing importance of commodities in the Canadian economy; this trend accelerated between 2007 and 2014. However, we find that only a small share of the depreciation of the Canadian dollar in 2014–15 can be attributed to the oil portfolio, even if this depreciation coincided with a sharp decline in oil prices.

Bank topic: Exchange rates

JEL code: F31

Résumé

Dans cette note analytique, nous cherchons à déterminer dans quelle mesure la variation systématique du dollar canadien s'explique par la sensibilité de ce dernier aux prix des produits de base. Nous créons un portefeuille « pétrolier » qui rend compte des variations systématiques lorsque les taux de change de pays exportateurs de produits de base et de pays importateurs de ces produits évoluent dans des directions opposées. Les résultats montrent que la sensibilité du dollar canadien au portefeuille pétrolier a augmenté avec le poids du secteur des produits de base dans l'économie canadienne, et que cette tendance s'est accélérée entre 2007 et 2014. Toutefois, seule une faible part de la dépréciation du dollar canadien dans les années 2014-2015 peut être attribuée au portefeuille pétrolier, même si cette dépréciation a coïncidé avec une baisse prononcée des prix du pétrole.

Sujet : Taux de change

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The first of this series of staff analytical notes discussing the Canadian dollar established that the share of systematic variations in the Canadian dollar has increased dramatically over the past decade (Fontaine and Nolin 2016). Systematic exchange rate variations originate from common economic or financial conditions affecting all exchange rates. One conclusion from this previous work was particularly surprising: the share of systematic variations had increased the most for the currencies of large commodity exporters—not only for the Canadian dollar.

This note takes a closer look at this group of commodity currencies. Starting from the observation that the increased systematic variations coincided with the latest "commodity boom," this note asks how much of the systematic variations reflects the sensitivity of exchange rates to commodity prices. To do so, we add a new oil portfolio to the baseline model in Fontaine and Nolin (2016). This oil portfolio captures systematic variations when the exchange rates of commodity exporters and commodity importers move in opposite directions.

The results confirm that the Canadian dollar's sensitivity to the oil portfolio has increased with the growing importance of commodities in the Canadian economy. Indeed, we find that this trend accelerated between 2007 and 2014. Nonetheless, only a small share of the depreciation of the Canadian dollar in 2014–15 can be attributed to the oil portfolio, even if this depreciation coincided with a sharp decline in oil prices. Other types of systematic variation played a dominant role, most notably the dollar portfolio. Overall, we find that sensitivity to commodity prices explains only a small part of the increased share of systematic variations in the Canadian dollar.

Constructing the Oil Portfolio to Capture Systematic Exchange Rate Variations

We construct an oil portfolio designed to capture the share of systematic variations arising from common exposures of currencies to commodity prices.[1] We use oil prices not only for simplicity, but also because oil is the largest component of most leading commodity price indexes. Rather than modelling the effect of oil prices on individual currencies and trying to aggregate these effects in a systematic factor, our methodology isolates oil-related systematic variations directly from cross-sectional variations in the panel of exchange rates.

We proceed in two steps. In the first step, we estimate the sensitivity of each of our 53 bilateral exchange rates with the US dollar to West Texas Intermediate (WTI) futures prices using five years of data starting in 1983.[2] This five-year window is rolled forward until 2016. Hence, the last estimation covers a five-year sample beginning in 2011 and ending in 2016.

In the second step, we sort currencies based on our estimate of their sensitivity to oil prices. We construct the oil portfolio as the difference between the portfolio of currencies that appreciate when the oil price rises ("exporters") and the portfolio of currencies that appreciate when the oil price

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[1] Cayen et al. (2010) obtain similar results using a dynamic state-space model of systematic exchange rate variations and a small sample of six countries.

[2] The regression is given by $\Delta s_{t+1} = \alpha + \beta\, \Delta WTI_{t+1} + \delta Carry_{t+1} + \tau Dollar_{t+1} + u_{t+1}$, where Δs_{t+1} is the log change in the spot exchange rate, and ΔWTI_{t+1} is the log change in the price of the WTI futures with the closest expiry date.

declines ("importers").[3] This sorting procedure is commonly used to identify risk factors in other markets. In the case of the stock market, the value and size portfolios are two widely known systematic risk factors (Fama and French 1992). Intuitively, the sorting procedure acts as a filter. Using returns from a long-short strategy eliminates other systematic factors that have similar effects on the currencies of exporters and importers. Grouping several currencies in portfolios eliminates country-specific shocks. Using a rolling sample captures changes in the relative size of each country's commodity sector over time.

Table 1: Correlation between the oil portfolio and commodity prices

Brent crude oil	0.42
Reuters/Jefferies CRB	0.41
S&P GSCI	0.41
WTI crude oil	0.39
Heating oil	0.38
Nickel	0.26
Aluminum	0.21
Copper	0.19
Platinum	0.17

Source: Bloomberg

The oil portfolio is positively correlated with a variety of commodity prices and commodity indexes (Table 1). Therefore, the oil portfolio captures systematic variations related to commodity prices but unrelated to other systematic exchange rate portfolios. Its correlation with Brent or WTI crude oil prices is about 0.4, showing that some but not all oil price changes are relevant for exchange rates.

Measuring Exchange Rate Sensitivity to Oil

We add the oil portfolio to our benchmark decomposition, which also uses dollar and carry portfolios (Verdelhan 2015; Fontaine and Nolin 2016).[4] The carry portfolio captures the performance of a typical carry trade, that is, the exchange rate variations of high interest rate "lending" currencies minus those of low interest rate "funding" currencies. The dollar portfolio corresponds to the equally weighted portfolio of exchange rates relative to the US dollar. The oil portfolio captures systematic exchange rate variations that are not correlated with either the carry or the dollar portfolio (Table2).

Table 2: Portfolio correlations

	Dollar	Carry
Carry	0.10	
Oil	-0.07	0.01

A large number of currencies exhibit significant sensitivity to the oil portfolio after controlling for the dollar and carry portfolios. Table 3 reports currencies with the highest sensitivities to the oil

[3] In the second step, we form six equally weighted portfolios of currencies sorted by sensitivity to oil prices.

[4] The specification is the same as in Verdelhan (2015) but also includes the oil portfolio,

$$\Delta s_{t+1} = \alpha + \beta(i_t^* - i_t) + \gamma(i_t^* - i_t)Carry_{t+1} + \delta Carry_{t+1} + \tau Dollar_{t+1} + \rho\, Oil_{t+1} + \varepsilon_{t+1}, \quad (1)$$

which we estimate daily from November 1983 to October 2016 using a rolling five-year window. The dependent variable Δs_{t+1} is the log change in the spot exchange rate, and $(i_t^* - i_t)$ is the log difference between one-month interest rates relative to the United States. We construct the carry and dollar portfolios as in Verdelhan (2015), using a panel of 53 spot and forward exchange rates representing the world's most actively traded currencies based on the Bank for International Settlements' Triennial Central Bank Survey of foreign exchange and derivatives market activity in 2013. The sample includes some former European currencies until the introduction of the euro. We exclude observations with large deviations from covered interest rate parity.

portfolio in the left panel and currencies with the lowest (negative) sensitivities in the right panel, based on five years of data up to October 2016.

Currencies with positive coefficients tend to be associated with economies with a large commodity sector but are not necessarily associated with large oil exporters; this is the case with the Chilean peso (CLP), the South African rand (ZAR) and the New Zealand dollar (NZD). European currencies have negative coefficients on the oil portfolio. This is not surprising, given that European Union members are collectively the largest importer of oil in the world.

Table 3: Coefficient for the oil portfolio (estimate from 2011–16 rolling window)

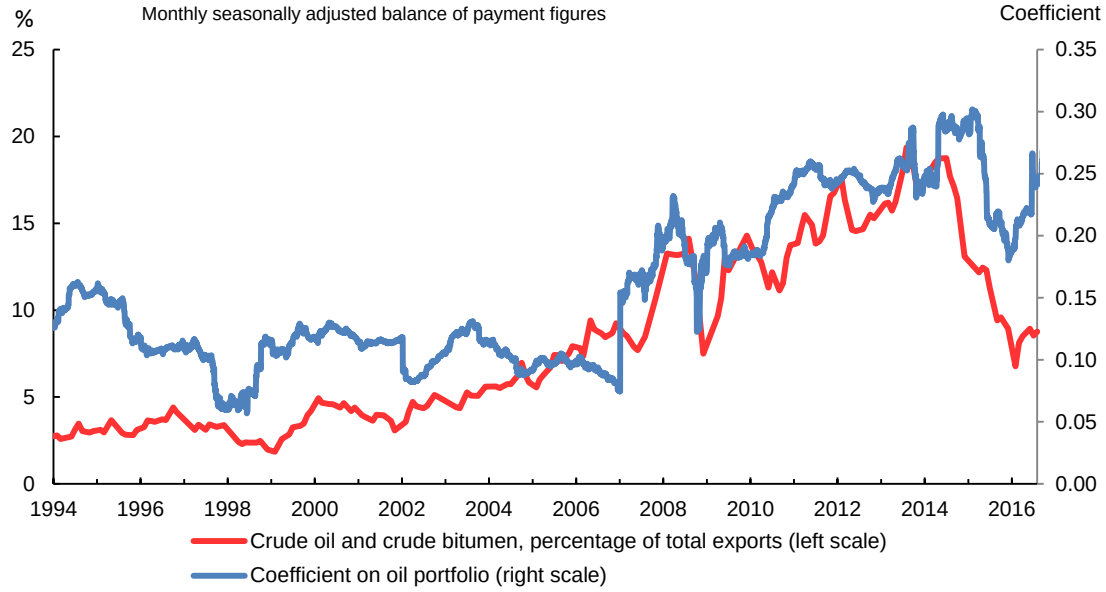
Exporters	Coefficient	Importers	Coefficient
Brazilian real	0.47	Czech koruna	-0.43
Mexican peso	0.39	Hungarian forint	-0.34
South African rand	0.37	Polish zloty	-0.33
New Zealand dollar	0.32	Danish krone	-0.33
Australian dollar	0.31	Chilean peso	-0.32
Turkish lira	0.30	Euro	-0.31
South Korean won	0.28	Bulgarian lev	-0.30
Canadian dollar	0.27	Romanian new leu	-0.27
Malaysian ringgit	0.18	Icelandic króna	-0.21
Peruvian nuevo sol	0.16	Swiss franc	-0.21

The Sensitivity of the Canadian Dollar to Oil Is Higher

Consistent with the findings of Maier and DePratto (2008) and Cayen et al. (2010), the Canadian dollar's sensitivity to the oil portfolio has increased. Indeed, this trend accelerated between 2007 and 2014, in parallel with the growth in importance of the commodity sector in the Canadian economy. Chart 1 shows the dramatic increase in the coefficient for the oil portfolio since 1994, as calculated using five-year rolling regressions. The coefficient estimate rises modestly until around 2007, and then it essentially triples by 2015. This is not surprising given that the share of oil in Canadian exports more than doubled over the same period.[5]

[5] Statistics Canada. Table 126-0001- Supply and disposition of crude oil and equivalent, monthly (cubic metres), CANSIM.

Chart 1: Canadian petroleum exports and Canadian dollar's oil portfolio coefficient



Sources: Statistics Canada and Bank of Canada calculations

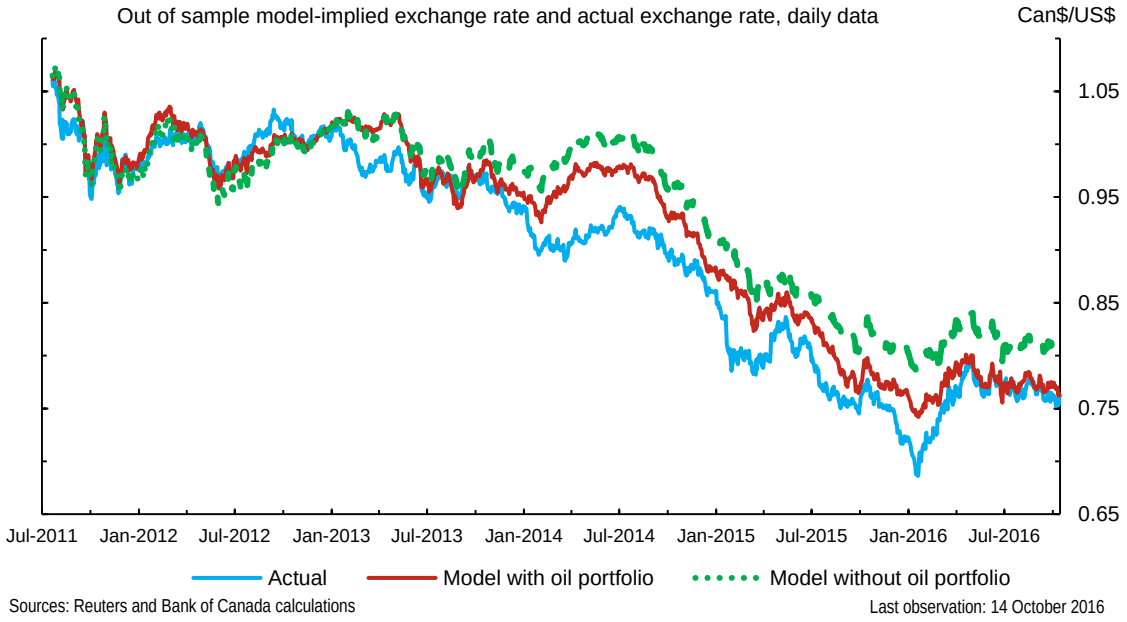
Last observation: August 2016

Accounting for the Recent Depreciation of the Canadian Dollar

The recent depreciation of the Canadian dollar can reflect either systematic variations or the effects of purely domestic developments. The model can be used to assess what share of this depreciation was systematic, including the share attributable to the oil portfolio. The estimates of the sensitivity of the Canadian dollar to the carry, dollar and oil portfolios can be combined with the observed variations in other exchange rates to produce the hypothetical path that the Canadian dollar would have followed had it been driven solely by systematic variations.

We examine the paths produced by alternatively including and excluding the oil portfolio. Chart 2 shows the Canadian dollar exchange rate (against the US dollar) and these two paths. The first model-implied path (in green) accounts only for the systematic variations of the dollar and carry portfolios. This is the decomposition reported in the first note of this series (Fontaine and Nolin 2016). The second model also takes into account the oil portfolio. The chart starts on 21 July 2011, the date when the Canadian dollar reached its post-crisis high. This is an out-of-sample exercise: the sensitivity coefficients of the Canadian dollar to the carry, dollar and oil portfolios are kept at their value estimated based on five years of data ending 20 July 2011.

Chart 2: The tracking of the Canadian dollar is improved by the oil portfolio



Out of sample and over a very long horizon, both models closely track the Can$/US$ exchange rate. When neglecting the effect of the oil portfolio, the model-implied exchange rate is four cents higher than the actual exchange rate after 2014, a gap that remains relatively constant for the following two years. Accounting for the sensitivity to the oil portfolio improves the tracking of the Canadian dollar exchange rate after 2014, precisely when oil prices are falling.

Systematic and Domestic Variations in the Canadian Dollar

Using systematic variations to explain the depreciation of the Canadian dollar provides a very good fit. More than five years out of sample, the difference between the model-implied (including the oil portfolio) and actual exchange rates is only a tenth of a cent. Yet, the results leave a substantial role for domestic developments influencing the exchange rate during that period. This gap ranges from one to five cents over time and reflects developments specific to Canada, including domestic economic shocks and policy decisions. This gap appears to have largely disappeared at the end of our sample, suggesting that these Canada-specific developments have offset each other over the sample.

Looking Forward

While the oil portfolio plays a significant role in the evolution of the Canadian dollar, the dollar portfolio has been the dominant driver of its depreciation against the US dollar since 2011. In other words, most of its depreciation is attributable to the depreciation of all other currencies against the US dollar during that period. The relatively smaller role of the oil portfolio may seem surprising, since the depreciation coincided with a large decline in oil prices. But our finding of a larger role for the dollar portfolio is consistent with the well-known argument that a global demand shock led to both the fall in the price of oil and the depreciation of most currencies (see Hamilton 2014 and Bernanke 2016). This interpretation is also consistent with a broad array of research suggesting

that major oil price fluctuations dating back to 1973 are often largely explained by shifts in the demand for crude oil (see the review in Baumeister and Kilian 2016).

Yet, a mystery lingers. On the one hand, systematic variations in the Canadian dollar increased substantially during the period that saw commodities rapidly taking a greater role in the Canadian economy. On the other hand, our results suggest that the sensitivity to the oil portfolio is not the primary driver behind fluctuations in the Canadian dollar. Postulating that commodity prices play almost no role in the growing share of systematic variations seems far-fetched. How can we reconcile the evidence? One possibility would be that the greater co-movement of the Canadian dollar with the average currency is related to—or perhaps *due to*—the growth of its commodity sector. In other words, the Canadian economy may have become more financially integrated with the rest of the world at the same time as or because of the growing importance of the commodity sector in its economy. Noticeably, these changes have occurred just as commodity markets themselves have become more closely integrated with other financial markets. Investigating the financialization of commodity and exchange rate markets offers a stimulating avenue for future work.

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