

## International Comparison of Railway Freight Rates

Prepared for:

**Railway Association of Canada (RAC)** 

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## **International Comparison of Railway Freight Rates**

CPCS was requested by the Railway Association of Canada (RAC) to conduct this independent examination comparing railway freight rates internationally, and to prepare a report on this work.

### Acknowledgements

CPCS acknowledges and is thankful to RAC for providing information used in the preparation of this report, including data from the Association of American Railroads (AAR) and the International Union of Railways/Union Internationale des Chemins de fer (UIC).

#### **Opinions and limitations**

All opinions expressed herein are those of the authors and do not necessarily reflect the views of RAC.

CPCS endeavours to validate data obtained from third parties but cannot warrant the accuracy of these data.

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## **Executive Summary**

The Railway Association of Canada (RAC) requested CPCS to prepare this report comparing railway freight rates internationally. The report is the result of CPCS' independent work. As well, the data used here are not confidential and, with two exceptions, are readily available with links to access the data included in this report.

For the international comparison, railway freight rates are measured as annual freight revenues per revenue ton-mile (RTM) for 2021 in US cents, with the conversion to US currency made on the basis of purchasing power parity or PPP. This is a credible basis for comparison at a highly aggregated national level. Individual shippers may, of course, pay rates higher or lower than the average as rail rates can vary depending on many factors. Except for the average rail rate for Western Canadian grain, this study does not present rail rates at a commodity or subnational level.

Figure ES1 shows the results of the international comparison. Among the countries examined, Canada's railway freight rates are among the lowest with an average freight revenue per RTM of 4.16 cents (US). While Russia and China show the lowest rates, the validity of a comparison with those countries may be limited as their railways are state-owned and operated entities. India, where the railway is also government owned and operated, and Japan show the highest rates. Canada's overall rate is 11% lower than that of the US, and significantly lower than those of the European countries examined. The lowest rate is that for the rail movement of Western Canadian grain, this being constrained by the statutory railway grain Maximum Revenue Entitlement (MRE). The implied MRE rate is 29% lower than the overall average Canadian freight rate.





Source: CPCS analysis.

Australia, because of its many similarities to Canada, should be included in the comparison but is not due to the limited data available. The available data for Australia relate predominantly only to coal. Notably, Canadian revenue per RTM for coal shipments alone are more than 20% lower than the estimable Australian rates.

The intercountry comparison is supplemented by an examination of trends since 1988 (the year following enactment of the National Transportation Act, 1987). The trend in Canadian railway freight



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rates is examined vis-à-vis the trends in prices in general, and vis-à-vis the trend in US railway freight rates.

Between 1988 and 2001, average Canadian railway freight rates grew more slowly than prices in general, and more slowly than US rail rates. However, with respect to US rail rates, this result is actually due to the relative performance of Canadian and US rail rates since 2010, with the result that average rail rates in Canada have been lower than those in the US since 2015.



# 1 Introduction

CPCS was requested by the Railway Association of Canada (RAC) to conduct an independent examination comparing railway freight rates internationally and to prepare a report on this work.

No confidential data is used in this report. Most of the data used are readily available to the public and links to access this are included, while certain non-confidential data has come from the Association of American Railroads (AAR) on US railways and the International Union of Railways/Union Internationale des Chemins de fer (UIC) on European railways.

The intention of the study is to compare average railway freight rates at the national level, measured for purposes of international comparison as railway annual freight revenues per revenue ton-mile (RTM) for 2021 in US cents. The conversion to US currency is made on the basis of purchasing power parity or PPP (see Appendix on PPP). Except for determining the average rail rate for Western Canadian grain, this study does not present rail rates at a commodity or subnational level.

Railway freight revenue per RTM converted on the basis of PPP is a credible basis for comparison of national average rail freight rates across countries. For example, this approach has been used by the Organisation for Economic Co-operation and Development (OECD) for similar research.<sup>1</sup>

Individual shippers may, of course, pay freight rates that are higher or lower than the average. Rail rates can vary significantly depending on many factors such as commodity, distance, and volume, among others. A detailed analysis at a commodity or subnational level is beyond the scope of this review and, in general, would require substantial data that are not publicly available.

The countries reviewed are shown in the map below:



### Figure 1: Map of Countries Reviewed

In addition to the intercountry comparison the study is supplemented by an examination of trends; Canadian railway freight rates are examined vis-à-vis the trends in prices in general and in US railway freight rates.

<sup>&</sup>lt;sup>1</sup> See: OECD Economics Department Working Papers No. 1322, C. Luu, "Strengthening competition in network sectors and the internal market in Canada," 2016, see page 31



## 2 Data and Methodology

## 2.1 Railways Included in the Intercountry Comparison

The railways included in the intercountry comparison, and whose data have been aggregated to produce the national level results, are as follows:

- In Canada, the data is from RAC's *Rail Trends 2022* report (<u>link</u>), which covers virtually all railways in Canada, and is specific to Canadian railway operations, i.e., excludes the US operations of CN and CP.
- In the US, the railways include the Class I railroads, excluding the US operations of CN and CP. These are Burlington North Santa Fe (BNSF), CSX, Kansas City Southern (KCS), Norfolk Southern (NS), and Union Pacific (UP).
- Four European countries France, Germany, Italy and Spain are covered. For these countries, national freight rail statistics are taken from a database provided by the International Union of Railways (UIC), obtained via RAC.<sup>2</sup> The freight operators covered are SNCF for France, Deutsche Bahn (DB) for Germany, Ferrovie dello Stato Italiane (FS) for Italy, and Renfe for Spain.<sup>3</sup>
- In China, the China State Railway Group (China Railway) is the national, government-owned passenger and freight rail corporation.
- In Japan, Japan Railways Group (JR Group) is the successor to the national railway, and includes seven companies of which one, Japan Freight Railway Company (JR Freight), operates nationwide freight service (the other six operate passenger services).
- In India, Indian Railways is the national railway owned by the government, and is the primary operator for both passenger and freight operations.
- In Russia, Russian Railways is the national, government-owned passenger and freight rail corporation.

Australia would be an important country to include because of its many similarities to Canada. However, sufficient data is not available and Australia has been excluded from the international comparison. In Australia, the largest freight rail operators are Aurizon, Pacific National and SCT Logistics.<sup>5</sup> The latter two are privately owned and up-to-date information on their freight rail operations was not identified as available, while Aurizon's freight rail operations are predominately focused on coal.<sup>6</sup>

<sup>&</sup>lt;sup>6</sup> Aurizon has three segments corresponding to its principal activities (described on p. 7 of the Annual Report): Network, Bulk and Coal. Of these, Coal is the only one which conclusively corresponds strictly to rail freight haulage. Network manages the provision of, and access to, its open-access rail network. Bulk offers integrated supply chain services, including rail and road transport, port services and material handling; its revenues partly derive from non-rail sources.



<sup>&</sup>lt;sup>2</sup> Note: UIC also has an online portal "Railisa UIC Statistics" which is publicly available and can be used to replicate these statistics (<u>link</u>) by selecting, under Financial Result, "7216: Operating revenue – Freight Traffic Turnover," and under Freight Traffic,

<sup>&</sup>lt;sup>3</sup> Note that while the database provides a breakdown of in-country and out-of-country tonne-kilometres, the same breakdown is not available for freight revenues. Therefore, we have used total rail freight revenues and volumes for these operators. In other words, the values for each country reflect the results for the leading national freight rail operator based in that country, which may be a general proxy for (but not necessarily identical to) rates for shippers in that country specifically.

<sup>&</sup>lt;sup>5</sup> A 2016 government report listed the market shares for freight rail as 40% for Aurizon, 33% for Asciano (Pacific National), and 23% for SCT Logistics.

## 2.2 Rail Freight Revenues

Figure 2 shows the collected data for rail freight revenues, along with sources and links provided for convenience, which we have reviewed for appropriateness. Where the source is not a primary source, we examined additional sources to confirm the reasonableness of the value used. In some cases, companies that operate rail freight services may have other or secondary smaller sources of income. To the extent possible from the available sources, we have excluded non-rail-freight revenues.

Country	Year	Currency	Value	Source
Canada	2021	CAD, mil.	15,841	RAC Rail Trends 2022 (link), p.41
United States				
BNSF	2021	USD, mil.	22,274	2021 Annual Report ( <u>link</u> ), p.16 <sup>7</sup>
CSX	2021	USD, mil.	11,368	2021 Q4 Financial Report (link), p.78
KCS	2021	USD, mil.	2,797	2021 Q4 Financial Report (link), p.6
NS	2021	USD, mil.	11,142	2021 Annual Report (link), p.K38
UP	2021	USD, mil.	20,244	2021 Annual Report (link), p.16
France – SNCF	2021	EUR, mil.	641	UIC data
Germany – DB	2021	EUR, mil.	4,195	2021 Annual Report ( <u>link</u> ), p.190 <sup>9</sup>
Italy – FS	2021	EUR, mil.	796	UIC data
Spain - RENFE	2021	EUR, mil.	175	UIC data
China (total)	2021	USD, mil.	51,800	IBIS Research Report (link) <sup>10</sup>
Japan – JR Freight	2021	JPY, bil.	151.3	Statista ( <u>link</u> ) <sup>11</sup>
India – Indian Railways	2020-21	INR, crore	111,472	2020-21 Year Book ( <u>link</u> ), p.6
<b>Russia</b> – Russian Railways	2021	RUB, bil.	1,613	2021 Annual Report ( <u>link</u> )

#### Figure 2: Rail Freight Revenue Data and Sources

Source: CPCS analysis of data from sources listed. UIC online database: Railisa UIC statistics (<u>link</u>) Notes: CAD – Canadian dollars; USD – US dollars; EUR – euros; JPY – Japanese yen; INR – Indian rupees; RUB – Russian rubles; Crore is an Indian unit of account which corresponds to ten million rupees. Mil. is millions, Bil. is billions.

## 2.3 Rail Freight Volumes

Figure 3 shows rail freight volumes for the selected countries/companies. A standard unit of output for rail freight is RTM (or net tonne-kilometres), where one ton-mile (tonne-kilometre) corresponds to the equivalent of one ton (tonne) carried over a distance of one mile (kilometre). RTM (or net tonne-kilometres) takes into account both the tonnage carried as well as the length of haul.

<sup>&</sup>lt;sup>11</sup> The original source for the Statista data is not available in the public-access version of this website. We were not able to find officially published data for 2021. However, the 2020 figures (which are of a similar magnitude) have been corroborated against information on the JR Freight website (<u>link</u>), which as of the date of access is updated to show data up to 2020.



<sup>&</sup>lt;sup>7</sup> Note: there is a difference between the freight revenues reported in this source and those reported in the <u>10-K form</u> (p.12). The discrepancy is the equivalent of about a 3-cent impact on the total value for US aggregate revenue per ton-mile.

<sup>&</sup>lt;sup>8</sup> Subtotal from table on p.7 has been adjusted to remove revenue from Trucking and Other

<sup>&</sup>lt;sup>9</sup> Upon review, the original value for rail freight revenue in the UIC database was determined to be anomalously high. We reviewed Deutsche Bahn's 2021 Annual Report and successfully reproduced the value in the UIC database as the sum of revenues for DB Cargo and DB Schenker, two DB subsidiaries which are involved in freight transport. As described in the annual report (p. 112), DB Cargo is involved in rail freight transportation, while (p. 147) DB Schenker is a global integrated transport and logistics services provider and a leader in global air and ocean freight, as well as land transport and contract logistics. Therefore, we have used DB Cargo's revenue and excluded the revenue from DB Schenker in our analysis.

<sup>&</sup>lt;sup>10</sup> Data for Chinese freight rail revenues for 2021 are available from an IBIS World research report. This report lists the US-dollar equivalent, which we understand from analysis to be based on a conversion using market exchange rates. We were not able to find any government sources for total rail freight industry revenues for 2021. However, based on some older sources (e.g. 187.7 billion yuan or \$26.9 b. for first half of  $2020 - \underline{link}$ ) the published IBIS World value appears to be of a reasonable magnitude.

"Revenue" and "net" refer to the revenue-generating freight tonnage only, excluding the weight of equipment used.

As with the rail freight revenues, we reviewed the sources for appropriateness, and where the source consulted was not a primary source, examined additional sources to assess general reasonableness.

Country	Year	Unit	Value (mil.)	Source
Canada	2021	RTM	303,883	RAC, Rail Trends 2022 ( <u>link</u> ), p.14
United States				
BNSF	2021	RTM	621,451	2021 Annual Report ( <u>link</u> ), p.80
CSX	2021	RTM	193,200	2021 Q4 Financial Report (link), p.10
KCS	2021	RTM	52,549	2021 Q4 Financial Report (link), p.8
NS	2021	RTM	178,000	2021 Annual Report (link), p.K5
UP	2021	RTM	411,273	2021 Annual Report (link), p.81
France – SNCF	2021	TKM	15,870	UIC data
Germany – DB	2021	TKM	84,850	UIC data
Italy – FS	2021	TKM	21,880	UIC data
Spain - RENFE	2021	TKM	5,638	UIC data
China – China Railways	2021	TKM	3,319,000	2021 Statistical Communiqué (link)
Japan (total)	2021	TKM	18,040	Statista ( <u>link</u> ) <sup>12</sup>
India – Indian Railways	2020-21	NTK	719,762	2020-21 Year Book ( <u>link</u> ), p.6
Russia – Russian Railways	2021	TKM	2,639,000	Market Overview ( <u>link</u> )

### Figure 3: Rail Freight Volume Data and Sources

Source: CPCS analysis of data from sources listed.

Note: RTM = revenue ton-miles; TKM = tonne-kilometres; NTK = net tonne-kilometres. NTK is used in some countries to distinguish this from gross tonne-kilometres (which would include non-revenue generating tonne-kilometres). To the best of our understanding, where TKM are listed these can also be regarded as representative of NTK.

<sup>&</sup>lt;sup>12</sup> The original source for the Statista data is not available in the public-access version of this website. We used data from the World Bank (<u>link</u>), which as of the date of access are updated to 2019, to confirm the general reasonableness of the magnitude.



## 3 International Comparison

## 3.1 National Average Rail Freight Rates

Average rail freight rates in this study are computed by dividing total rail freight revenues measured in a common currency by their corresponding total rail freight volumes measured on the same basis. This a reasonable and standard approach for undertaking highly aggregate, national-level comparisons since it places the revenue and traffic from all countries on the same basis, thereby enabling direct and valid assessments.

For rail freight volume, the US predominantly uses ton-miles, while overseas tonne-kilometres are more common. In Canada, both units are sometimes used but this report uses ton-miles.

In order to facilitate comparison, the data from the various countries must be converted into standardized units. We use the following types of conversions:

- To compare freight rates across countries, currencies are converted to US-dollar equivalents using Purchasing Power Parity or PPP (see Appendix). Since all of the data in the crosscountry comparison are essentially for the same year (calendar year 2021 or fiscal year 2020-2021, as the case may be) there is no adjustment for inflation.
- 2) Conversion of revenue freight volumes to a common unit i.e., revenue ton-miles (RTMs).

Figure 4 provides an overview of the average rail rates by country, in terms of US cents per RTM.

Country	Revenue, USD (PPP-adjusted) \$bil.		Revenue Ton- Miles (RTMs), bil.	US Cents per RTM
Canada	\$	12.6	304	4.16
United States	\$	67.8	1,456	4.66
France	\$	0.9	11	8.13
Germany	\$	5.7	58	9.73
Italy	\$	1.2	15	8.12
Spain	\$	0.3	4	7.26
China	\$	79.8	2,273	3.51
Japan	\$	1.5	12	12.19
India	\$	50.0	493	10.15
Russia	\$	59.0	1,808	3.26

#### Figure 4: Comparative Statistics for Freight Revenue, Volume and Rates

Source: CPCS analysis.

## 3.2 Western Canadian Grain Rail Maximum Revenue Entitlement Rate

The carriage of Western Canadian grain on Canada's railways is subject to a unique regulatory provision, namely, a limit or cap on the amount of revenues that CN and CP may earn in any given crop year in transporting western grain, known as the Maximum Grain Revenue Entitlement (MRE). Effectively, the MRE is a form of indirect rate regulation under Canadian law. No other commodity transported on Canada's railways is subject to such a statutory revenue limitation.

The MRE was introduced in 2000 to replace a more restrictive regime of maximum regulated grain freight rates, and made two basic changes: (1) instead of a cap on grain rates, the MRE placed a



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ceiling on the total revenues CN and CP could earn for moving western grain in any crop year, effectively constraining the average rate that CN and CP could charge; and (2) it provided CN and CP with much greater freedom in establishing the individual rates for moving western grain. However, the MRE was always intended to be a transitional step towards shifting the rail transportation of western grain to a more fully commercial regime like all other commodities.<sup>13</sup> In addition, the recommendations of both the Canada Transportation Act Review Panel in 2001 and the Canada Transportation Review in 2015 contemplated the elimination of the MRE.<sup>14</sup>

Given the impact of its regulatory treatment, it is appropriate to present, along with the overall average rail freight rate in Canada, the implied MRE rail rate. As shown in Figure 5, the MRE rail rate per RTM is 2.97 (crop year 2021-2022, US cents), as compared to the overall average Canadian rail rate per RTM of 4.16 (2021, US cents) as shown in Figure 4 above. The implied MRE rate is 29% lower than the overall average Canadian freight rate.

Measure	CN	СР	Class 1 (Total)
Tonnes (metric)	15,265,089	13,118,637	28,383,726
Conversion rate to tons (short)	1.1023	1.1023	1.1023
Tons (short)	16,826,708	14,460,674	31,287,381
Average length of haul (miles)	977	909	946
Maximum Revenue Entitlement (CAD)	589,140,501	513,144,863	1,102,285,364
Revenue ton-miles	16,439,693,330	13,144,752,271	29,584,445,600
MRE freight rate per RTM (cents, CAD)	3.58	3.90	3.73
Conversion rate to USD (PPP)			0.798042561
MRE freight rate per RTM (cents, USD)			2.97

#### Figure 5: Implied MRE Average Rail Freight Rate per RTM, 2021-2022 Crop Year

Source: Tonnes (metric), average length of haul and Maximum Revenue Entitlement are from Canadian Transportation Agency, Determination No. R-2022-183, December 22, 2022 (link)

## 3.3 Rail Freight Rates Comparison

Figure 6 shows the average freight rates by country, measured as revenue per RTM, in US cents. The countries are ordered from lowest to highest. Canada's revenue per RTM is 4.16 cents (US).

According to the analysis, Russia and China have the lowest values, although the validity of a comparison with those countries may be limited as their railways are state-owned and operated entities. India, where the railway is also government owned and operated, and Japan show the highest rates. Canada has a somewhat lower average freight rate compared to the US, and also significantly lower than the European countries examined.

Australia, as noted, is omitted from the comparison because of the limited data available which relate predominantly to Australia's leading coal transport service. Notably, Canadian freight revenue per RTM for coal shipments alone is more than 20% lower than the estimable Australian rates.

<sup>&</sup>lt;sup>14</sup> Canada Transportation Act Review Panel, *Vision and Balance* (June 2001), p. 73. Canada Transportation Act Review, Pathways: Connecting Canada's Transportation System to the World – Volume 1 (December 2015), p. 159.



<sup>&</sup>lt;sup>13</sup> Canada Transportation Act Review Panel, Vision and Balance (June 2001), p. 73. Canada Transportation Act Review, Pathways: Connecting Canada's Transportation System to the World – Volume 1 (December 2015), p. 159.



### Figure 6: Revenue per Revenue Ton-Mile by Country, 2021 (US cents)

Source: CPCS analysis.



## 4 Trend Analysis

This chapter supplements the preceding intercountry comparison of railway freight rates by examining the trend in railway freight rates since enactment of the National Transportation Act, 1987 (NTA 1987). The NTA 1987 introduced major reforms to the regulation of railway pricing in Canada. The purpose was to promote greater competition among railways, in particular by allowing railways and shippers to negotiate confidential contracts. The NTA 1987 also introduced new mechanisms for resolving disputes, including Final Offer Arbitration (FOA). Adoption of the NTA 1987 followed the railway regulatory reforms introduced in the US in 1980 through passage of the Staggers Act.

The trend in Canadian railway freight rates is examined here from two perspectives: vis-à-vis the trends in prices in general; and vis-à-vis the trend in US railway freight rates.

## 4.1 Rail Freight Rates Versus General Price Indexes

Figure 7 compares the total increase since 1988 (the first year after enactment of the NTA 1987) in Canadian railway freight rates versus US railway freight rates,<sup>15</sup> the Canadian Industrial Product Price Index (IPPI),<sup>16</sup> the Canadian Consumer Price Index (CPI)<sup>17</sup> and the Bank of Canada Commodity Price Index (BCPI).<sup>18</sup> The BCPI is an index of the spot prices, in US dollars, of 26 commodities produced in Canada and sold in world markets. All variables have been expressed in index form with 1988 equal to 100.

US railway freight rates in Figure 7 have been converted to Canadian dollar terms using the Canada-US dollar exchange rate.<sup>19</sup> As the Canada-US exchange rates were similar in 1988 (0.81255) and 2021 (0.79753), the exchange rate does not have a significant impact on the total price growth between 1988 and 2021.



## Figure 7: Rail Freight Rates vs General Price Indexes, 1988-2021

Sources: RAC; AAR; Statistics Canada; Bank of Canada; UBC Sauder School of Business

<sup>&</sup>lt;sup>19</sup> University of British Colombia, Sauder School of Business, PACIFIC Exchange Rate Service, (link)



<sup>&</sup>lt;sup>15</sup> US railway freight revenue per ton-mile for 1988-2021 has been calculated from data on total revenue ton-miles and total freight revenue provided by the Association of American Railroads (AAR).

<sup>&</sup>lt;sup>16</sup> Statistics Canada, Table: 18-10-0265-01, (link)

<sup>&</sup>lt;sup>17</sup> Statistics Canada, Table: 18-10-0005-01, (link)

<sup>&</sup>lt;sup>18</sup> Bank of Canada, Commodity Price Index, (link)

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The above figure shows that Canadian average railway freight rates have risen by a total of 43% between 1988 and 2021, while U.S. rates have grown 72%. Both industrial prices and consumer prices have increased substantially more than the Canadian and US rail freight rates, while commodity prices have more than doubled, having increased by 120%.

## 4.2 Canada Versus US Rail Freight Rates

The Canada-US trade relationship is one of the world's largest, with Canada's bilateral trade with the US totalling \$774 billion (CAD) in 2021.<sup>20</sup> The countries, because of their proximity, also cooperate in numerous other ways. Moreover, the enactment of the Canada-US Free Trade Agreement in 1987 and the North American Free Trade Agreement in 1994 fundamentally changed North American economies by unprecedented integration of their supply chains. Railways in Canada and the US, however, have operated within an integrated network for far longer, since the late 1800s. These ties prompt a closer examination of Canadian versus US rail freight rates.

Figure 8 compares, year-by-year, the Canada and US rail freight rates (the latter converted to Canadian dollar terms using the Canada-US exchange rate). While there is an evident strong correlation between the two series, US rail rates increased considerably faster over the period than Canadian rail rates. From 1988 through 2021, rail freight rates in the US grew by an average of 1.7% per year, compared to an increase of 1.1% per year in Canada.<sup>21</sup> Note, however, that this faster growth is actually due to the relative performance since 2010, which has also resulted in average rail rates in Canada being lower than those in the US since 2015 (Canadian rates averaging about 12% below US rates).



#### Figure 8: Canada vs US Rail Freight Rates, 1988-2021 (CAD)

Sources: RAC; AAR; UBC Sauder School of Business (exchange rate)

<sup>&</sup>lt;sup>21</sup> Calculated using the compound annual growth rate (CAGR).



<sup>&</sup>lt;sup>20</sup> Government of Canada, Canada-United States fact sheet (link)

## Appendix A PPP Calculation

In order to compare railway freight rates between countries, it is necessary to translate the different countries' freight rates measured in local currencies into a common currency. This presents the problem of determining the appropriate exchange rate to use for the currency translation. For goods and services that are traded, ordinary currency market exchange rates could be used. But this would not be appropriate for railway services as these are not traded. Instead, a Purchasing Power Parity (PPP) exchange rate can be used.

The PPP exchange rate is the rate at which the currency of one country would have to be converted into that of a second country to enable buying the same amount of goods and services in both countries. Since the PPP exchange rate equalizes the cost of purchasing the same basket of physical goods and services in the two countries, it is a "real" exchange rate as opposed to the exchange rate prevailing in financial markets from which the "real" rate may differ significantly.

The PPP exchange rate of one country with respect to a second country can be derived by dividing the local cost of a given basket of goods and services in the first country by the local cost of a comparable basket of goods and services in the second country. It is common to calculate the PPP exchange rate of a country with respect to the US, i.e., to use the US as the benchmark. The formula would then amount to dividing the local cost of the basket of goods and services in the particular country by the cost of the comparable basket in the US in US dollars. While the determination of PPP exchange rates may seem straightforward, it poses many challenges.<sup>22</sup>

The PPP exchange rates used in the present analysis are those developed by the World Bank and are as follows:

Country	PPP Exchange Rate
Canada	1.25
China	4.19
France	0.73
Germany	0.74
India	23.14
Italy	0.65
Japan	100.41
Russia	27.33
Spain	0.62
US	1.00

### Figure 9: PPP Exhange Rates Used

Source: World Bank, PPP conversion factor, GDP (LCU per international \$), link

<sup>&</sup>lt;sup>22</sup> See World Bank, Fundamentals of Purchasing Power Parities, (link)





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