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CURRENCY INDEX AND ITS RELATIONSHIP WITH THE LEVEL OF COUNTRY'S DEVELOPMENT

The vast majority of foreign operations are serviced by currency. The exchange rate of the national currency has a significant impact on both the terms of foreign trade and the international movement of capital. For a more accurate assessment of the impact of the exchange rate on foreign economic activity, it is advisable to use the currency index as the ratio of the market (official) exchange rate to purchasing power parity. The aim of our study is to establish the relationship between the level of development of the country and the currency index (including quantitative), as well as the rationale for approaches to the choice of foreign trade partners based on the currency indices.

As a factorial basis for the study, statistics in 130 countries of the world were used. In the analysis of the results, a hypothesis about the existence of the relationship between the level of development of the country (which was determined by GDP per capita) and the index of the currency index was put forward. The hypothesis test was conducted using correlation and regression analysis. The indicator of R^2 was used as the criterion of connection density. The research was carried out both in the whole array of countries, and for individual groups.

The analysis showed a fairly close relationship between the currency index and the level of country development (which is reflected in the high value of the coefficient of determination). Even the unification of countries into economic unions and the transition to duty-free trade does not eliminate the differentiation of the price level and, accordingly, differences in the currency index. This is confirmed by the analysis of the calculated in the article currency index for the EU. And even the use of a single currency in the euro area does not eliminate this problem.

Keywords: *market exchange rate, purchasing-power parity, currency index, level of economic development, inflation, foreign economic activity*

Переважає більшість закордонних операцій обслуговується валютою. Курс національної валюти має істотний вплив як на умови зовнішньої торгівлі, так і на міжнародний рух капіталу. Для більш точної оцінки впливу валютного курсу на зовнішньоекономічну діяльність доцільно використовувати валютний індекс як відношення ринкового (офіційного) курсу до паритету купівельної спроможності. Метою нашого дослідження

є встановлення зв'язку між рівнем розвитку країни та валютним індексом (у тому числі кількісним), а також обґрунтування підходів до вибору зовнішньоекономічних партнерів на основі валютних індексів.

У якості факторної основи дослідження використано статистику 130 країн світу. Під час аналізу результатів висунуто гіпотезу про існування зв'язку між рівнем розвитку країни (який визначався ВВП на душу населення) та значенням валютного індексу. Перевірку гіпотези проводили за допомогою кореляційного та регресійного аналізу. У якості критерію тисноти зв'язку використовувався показник R^2 . Дослідження проводилися як у цілому масиві країн, так і для окремих груп.

Аналіз показав досить тісний зв'язок між валютним індексом та рівнем розвитку країни (що відображено у високому значенні коефіцієнта детермінації). Навіть об'єднання країн в економічні союзи і перехід до безмитної торгівлі не усуває диференціації рівня цін і, відповідно, відмінностей у валютному індексі. Це підтверджує аналіз розрахованого в статті валютного індексу для ЄС. І навіть використання єдиної валюти в зоні євро не усуває цю проблему. Результати представлені в наочній формі за допомогою таблиць і графіків.

Ключові слова: *ринковий валютний курс, паритет купівельної спроможності, валютний індекс, рівень економічного розвитку, інфляція, зовнішньоекономічна діяльність*

Introduction

In the context of increasing globalization of the world economy, almost all spheres of international economic relations are expanding at a high rate. In 2021, global exports of goods and services reached \$ 27.93 trillion (29.18% of world GDP) and increased compared to the previous year by 25% [1]. All these operations (and not only these) are serviced by currency. Therefore, the scale of foreign exchange transactions is several times higher than world GDP.

Most foreign trade operations are related to the ratio of national or regional currencies (exchange rate). Foreign exchange rates can both promote the export of goods and services, and restrain it, encourage the inflow of foreign investment or restrict it. However, most often, when assessing the impact of the exchange rate on foreign economic activity, they rely on the official or market rate of the national currency.

At the same time, it will be erroneous to limit itself only to the analysis of the influence of the level of the market rate of the national currency and even the directions of its dynamics on the conditions of foreign economic activity. In this case, a lot of real problems will remain out of sight. Among them it is important to highlight the following:

1. *What gives reason to argue about the undervaluation or overvaluation of foreign currency in a particular country? What is the need to compare the market or official rate in this situation with?* Sometimes they seek to answer this question by comparing the market rate and the official exchange rate of the national currency. However, this is applicable (but also on a limited scale) only for those countries where the official exchange rate is strictly regulated by the state and then there is such a difference. In the absolute majority of countries, there is no particular difference between the market and official exchange rates, since the basis for establishing the official exchange rate is its market value. In this regard, in our further reasoning, the concepts of “market” and “official” exchange rate will be used as synonyms.

2. *Are there any differences in the conditions of foreign economic activity with countries using a common currency?* For example, the market rate of the euro against the dollar is not significantly different in all Eurozone countries. But this does not give grounds to assert that the currency aspects of trade with Germany and Slovakia are absolutely identical. Most likely the market rate simply does not reflect the fullness of the currency conditions of foreign economic activity and must be supplemented by an analysis of other indicators.

3. *If the market rate remains unchanged, does this mean that the currency aspects of foreign economic activity also do not change?* Most likely not. After all, it can be observed when the exchange rate of the national currency in a country decreases and, according to all theories of international trade, exports should increase, but in fact it decreases, and exporters point to deteriorating conditions for export activities.

To answer these and similar questions, we introduced the “currency index” indicator, which is calculated as the ratio of the market (official) exchange rate of the national currency to its exchange rate calculated at purchasing power parity [2]. Unfortunately, in economic studies, very often the difference between the market exchange rate and the rate calculated at purchasing power parity remains out of sight. This is fully justified for developed countries, where this distinction is not significant and can be ignored. But for medium-developed countries, and even more so for countries with a low level of development, this difference reaches several times. And then the currency index has a very significant impact on the general conditions of foreign economic activity of the country, and on the choice of its trading partner.

The aim of our study is to establish the relationship between the level of development of the country and the currency index (including quantitative), as well as the rationale for approaches to the choice of foreign trade partners based on the currency indices.

Literature review

Gustav Cassel (1866–1945) was one of the first to formulate the idea of purchasing power parity (PPP) and the possibilities of using it in the development of foreign economic strategy. However, later on, a number of interesting points made by this scientist were not of our application and were unreasonably forgotten [3].

Since the 60s of the 20th century, the purchasing power parity is beginning to be widely used to compare the price level in different countries. Since 1968, the United Nations has been using the International Comparison Program, which is based on PPP.

Purchasing power parity is widely used by other international organizations. Every three years, the World Bank compiles and publishes a report comparing different countries in terms of PPPs. EU statistics provide ongoing information on purchasing power parity across 37 countries. Moreover, since 2007, the procedure adopted by the European Parliament for the provision of information and the calculation of purchasing power parity [4] has been in force.

Most commonly PPP is used to compare price levels and income levels in different countries. For these reasons, using the analysis of purchasing power

parity, many scientists tried to prove empirically the law of a one price, the essence of which is that in conditions of free competition, the absence of price regulation and additional costs for the implementation of the same goods in different countries will be sold at the same price denominated in a common currency [5].

At the same time, research conducted in the 80s of the 20th century gave grounds for a number of objections against the operation of this law. On the other hand, explanations were given as to why the law of one price does not find its empirical confirmation [6].

In the 90s, studies appear that are trying to go beyond the relationship “purchasing power parity - the law of one price”. An analysis of the relationship between purchasing power parity and the market exchange rate begins [7], which, in our opinion, is very promising.

In recent years, studies have emerged that analyze the relationship of purchasing power parity not only with the price level, but also with other economic indicators: real exchange rates [8]; uncovered interest rate parity [9]. A very interesting study is the article Alan Gelb and Anna Diofasi, where the factors influencing the parity of purchasing power are analyzed using the example of 168 countries [10].

The authors [11] study the relationship between purchasing power parity, the nominal exchange rate and the relative price level on the example of China. Based on empirical research, they conclude that PPP does not have a significant impact on the price level and the nominal market rate. However, in order to form a valid conclusion, in our opinion, it is necessary to significantly expand the scope of the study and involve a significantly larger number of countries.

A number of studies devoted to European countries should be singled out. The authors [12] use economic and mathematical methods to identify the degree of influence of purchasing power parity on the real exchange rate using the example of 10 Eastern European countries. They conclude that the real exchange rate is decisively influenced by external factors. The authors [13] extended the research base to all European countries. Comparing the ratio of purchasing power parity and the nominal exchange rate before and after the introduction of the euro, the authors conclude that empirical data do not support the hypothesis that the introduction of a common currency will accelerate the process of convergence of purchasing power parity and the real exchange rate.

In recent years, PPP studies for developing countries have also appeared. In them, in particular, the authors analyzes the influence of PPP on the market rate, if the country uses the regime of flexible exchange rate formation [14].

Many researchers criticize the very methodology of calculating purchasing power parity. On this basis, they even refuse to use official data on purchasing power parity and study its informal version - the Big Mac index [15].

However, in all these studies, purchasing power parity is viewed through the prism of the ratio of price levels. In our work, we use the currency index, which shows the relationship between purchasing power parity and the market (official) exchange rate of the national currency.

Empirical results and discussion

In accordance with the stated objective of the study, a database on 150 countries of the world for 2021 was created on the basis of material from the World Bank website [16]. From the list of countries were excluded:

- small states that do not have a significant impact on world processes (GDP less 10 billion \$);
- countries for which there are no complete statistical data;
- countries with an inflation rate above 50%.

For each of the selected countries a currency index (C_I) was calculated as the ratio of the official national currency rate (MCR) to purchasing power parity (PPP):

$$C_I = \frac{MCR}{PPP} \quad (1)$$

In the course of analyzing the obtained results, a hypothesis about the existence of a relationship between the level of a country's development (which was determined in terms of GDP per capita) and an indicator of the currency index was put forward. Testing the hypothesis was carried out by correlation and regression analysis. The indicator R^2 was used as a criterion for closeness. The study was conducted both throughout the array of selected countries, and in separate groups.

The second hypothesis, which was tested during the study, was about the existence of a link between the currency index and the inflation rate. To eliminate the influence of random factors, 130 countries (from the list countries for which there were no data on inflation rates for 2021 were excluded) were grouped into 13 groups of 10 countries, and then the correlation between the average currency index and the average inflation rate for each group was studied.

The calculation of the currency index and the analysis of its value demonstrate several important points:

1. The modern world economy is characterized by a massive overvaluation of the US dollar compared with its purchasing power parity. In 2021, only 9 countries of the world (Switzerland – 0.83, Iceland – 0.84, Israel – 0.85, Norway – 0.89, Australia – 0.93, New Zealand – 0.95, Denmark – 0.95, Sweden – 0.98, Luxemburg – 0.99) had a currency index lower than one. In the remaining 120 countries, the overvaluation of the dollar ranged from a few percent (in Canada the currency index was 1.01) to several times (in Uzbekistan the currency index was 5.27).

2. A simple ranking of countries by currency index shows that in the upper part of the table there are countries with a higher level of development, whereas among countries with a significant revaluation of the dollar, less developed countries prevail. This is confirmed by a correlation-regression analysis of the relationship between the level of development of the country and the currency index (Fig. 1).

The calculations were carried out separately for two indicators of the level of the country development: GDP per capita, calculated at purchasing power parity, and calculated at the official rate.

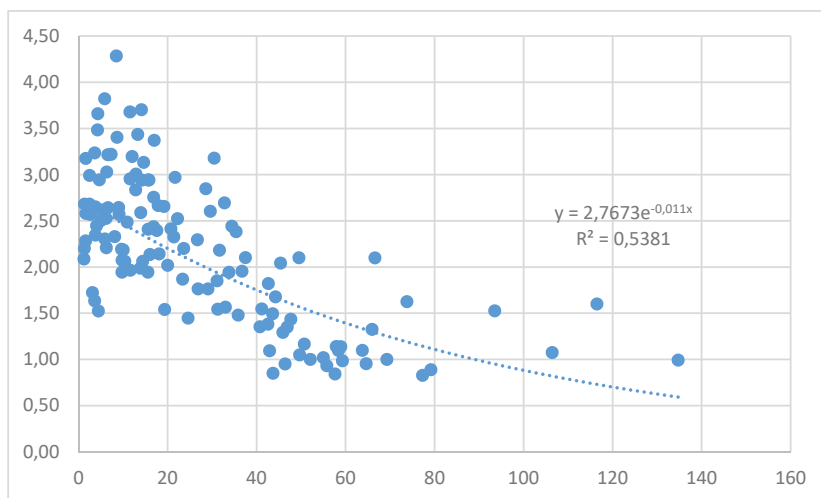


Fig. 1. The relationship between the level of development of the country and the currency index

Source: authors' calculations, output from World Bank [16]

If we analyze the relationship between GDP per capita, calculated at PPP, then the exponential function is closest to the actual distribution. The rather high value of the coefficient of determination (0.52) indicates the presence of a significant relationship between the studied parameters.

At the same time, it should be understood that economic laws act as trends and cannot be directly applied to each country in each specific case. In addition to the level of development, a huge number of other factors influence the state of the currency index: the state of the balance of payments of the country, openness of the market, the regime of currency regulation and many other features of a particular country. To eliminate the effect of random deviations, we will use the grouping method: we will unite all countries into 13 groups (10 countries in each group) depending on the indicator of the currency index and calculate for each of the groups average GDP per capita (official exchange rate) and currency index (Table 1).

Table 1

Average indicators for group

Groups	Currency index	Average indicators for group	
		GDP per capita (official exchange rate), thousand US \$	currency index
Group 1	0.80 - 1.00	68.81	0.92
Group 2	1.01 - 1.28	59.6	1.09
Group 3	1.29 - 1.52	39.85	1.41
Group 4	1.53 - 1.72	45.97	1.6
Group 5	1.73 - 1.96	26.07	1.88
Group 6	1.97 - 2.10	26.89	2.06

End of table 1

Groups	Currency index	Average indicators for group	
		GDP per capita (official exchange rate), thousand US \$	currency index
Group 7	2.11 – 2.30	14.51	2.2
Group 8	2.31 – 2.44	18.00	2.38
Group 9	2.45 – 2.59	7.87	2.54
Group 10	2.60 – 2.68	10.73	2.65
Group 11	2.69 – 2.95	15.45	2.85
Group 12	2.96 – 3.22	11.61	3.11
Group 13	3.33 – 4 28	9.13	3.61

Source: authors' calculations, output from World Bank [16]

A study of the correlation between the averaged data reveals a close relationship (Fig. 2). The logarithmic function demonstrates the greatest closeness: the coefficient of determination R^2 is greater than 0.84. All this gives grounds to assert that it is the level of development of the country that is the most significant factor in the overvaluation of the dollar. Such an overvaluation is a kind of protection of the domestic market and an attempt to increase the competitiveness of domestic goods in the domestic market. In addition, a higher official foreign exchange rate makes the economies of less developed countries more attractive to foreign capital, since real estate, raw materials and labor will be relatively cheaper for it. But, on the other hand, a foreign investor is faced with the problems of repatriating profits earned in national currency. Therefore, it is not possible to clearly assess the impact of a high currency index on the formation of an attractive investment climate in the country.

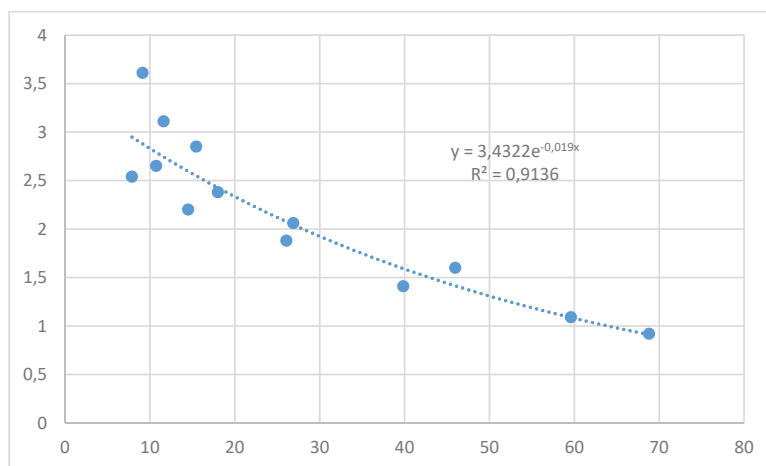


Fig. 2. The impact of the level of development of the country on the currency index for groups of countries

Source: authors' calculations

3. Based on the general theory of one price, it was possible to assume that in countries united in an economic union, where there is duty-free trade and the freedom of movement of goods (like capital and labor), price equalization will occur in a short time. And, therefore, the currency index in this case should be about the same. However, analysis of the currency index for the EU does not confirm this assumption. We calculated the currency index for 27 EU countries (Table 2). This figure ranges from 0.95 in Denmark to 2.65 in Latvia.

Table 2

Calculation of currency index for EU

	Country	GDP per capita (thousand \$US)	Currency index
1	Denmark	64,65	0,95
2	Sweden	59,32	0,98
3	Luxemburg	134,75	0,99
4	Finland	55,01	1,02
5	Ireland	106,46	1,07
6	Austria	58,43	1,10
7	Netherlands	63,77	1,10
8	Belgium	58,93	1,14
9	Germany	57,93	1,14
10	France	50,73	1,17
11	Italy	45,94	1,29
12	Spain	40,78	1,35
13	Cyprus	42,56	1,38
14	Malta	47,71	1,43
15	Portugal	35,89	1,48
16	Slovenia	43,62	1,49
17	Greece	31,3	1,54
18	Estonia	41,19	1,55
19	Slovakia	33,01	1,57
20	Czechia	44,26	1,68
21	Lithuania	42,66	1,82
22	Croatia	33,8	1,94
23	Hungary	36,75	1,95
24	Poland	37,5	2,10
25	Bulgaria	26,71	2,30
26	Romania	35,41	2,38
27	Latvia	34,47	2,44

Source: authors' calculations, output from World Bank [16].

Although most countries with a high currency index have been members of the EU for 10-17 years and are working under conditions of free movement of goods, the dollar overvaluation in them remains (and even increases in some years).

The problem of overvaluation of the dollar is not solved even with the transition to a single currency. Table 2 contains the calculation of the currency index for the Eurozone countries. As you can see, although the official rate of the euro against the dollar in these countries differs little, the difference in the currency index persists: in Latvia it is two and half times more (2.44) than in Luxembourg (0.99).

All this gives grounds to assert that the decisive factor determining the currency index (the degree of overvaluation / undervaluation of foreign currency) is not the conditions of foreign trade, or even the use of a common currency unit. Just as for the whole world, for this group of countries there is a fairly close relationship between GDP per capita and currency index. The tightness of the relationship is very significant and confirms the correctness of the expressed hypothesis.

Thus, the analysis showed that the factor that determines the ratio of the official exchange rate and the parity of the purchasing power of the national currency is the level of development of the country, as measured by GDP per capita. It is the level of development of the country that forms additional transaction costs, the presence of which counteracts the equalization of prices in various countries. For developed countries, the deviation of purchasing power parity from the official rate may vary by up to a few percentage points, for less developed countries, these deviations amount to hundreds of percentage points.

It should be noted that purchasing power parity, although not directly related to foreign economic activity, is largely determined by the conditions of foreign trade. It is known that in the conditions of globalization there is a convergence of the general price level (some authors raise this convergence to the rank of economic law).

The market rate of the national currency is used for actual settlements, is an element of foreign economic contracts and is more or less known at any given moment. It is quite dynamic and may change several times within one working day. The purchasing power parity is a calculated, analytical, estimated value, which is practically not used in real contracts, but it is very important when making informed management decisions. Purchasing power parity is more conservative. It changes under the influence of the ratio of inflation rates in comparable economies.

The dynamics of the currency index more fully characterizes the change in the conditions of foreign economic activity, since it reflects not only changes in the market rate of the national currency, but also a change in the price ratio. Therefore, the currency index can be one of the criteria for determining foreign trade partners. With other things being equal, for export of products among foreign trade partners, it is preferable to choose the country with the lowest currency index, and for import with the highest. In this case, you can get the greatest gains from national differences in price levels.

Conclusion

Thus, the analysis showed a significant differentiation of the currency index in the modern world. Most countries are characterized by an excess market exchange rate over purchasing power parity. This excess can range from a few per-

centage points to a few hundreds. In fact, the currency index most fully characterizes the difference in prices, expressed in dollars, for different countries.

The most significant factor that determines the value of the currency index is the level of a country's development, which is estimated based on GDP per capita (at the official exchange rate). The relationship between these indicators is quite close (which is reflected in the high value of the coefficient of determination), especially when eliminating random fluctuations, which is achieved by averaging the data.

Even the unification of countries into economic unions and the transition to duty-free trade does not eliminate the differentiation of the price level and, accordingly, differences in the currency index. This is confirmed by the analysis of the calculated in the article currency index for the EU. And even the use of a single currency in the Eurozone does not eliminate this problem.

The calculation of the currency index is of great practical importance for determining foreign trade partners. With other things being equal, the country with the lowest level of the currency index should be chosen as a partner for export, and with the highest level - for import. Therefore, maintaining a high level of the currency index is one of the ways to protect the domestic market from external competition and create favorable conditions for the domestic exporter.

References

1. World Bank. URL: <https://data.worldbank.org/indicator/NE.EXP.GNFS.ZS?end=2021&start=1986&view=chart> (Accessed 3 November 2022)
2. Kholod, B., Zadoia, A. (2009). Exchange rate and its impact on foreign economic activity. *Review of General Management*, Volume 10, Issue 2, 18-36.
3. Kadochnikov, D. (2013). Gustav Cassel's purchasing power parity doctrine in the context of his views on international economic policy coordination. *European Journal of the History of Economic Thought*. 20 (6): 1101–1121. doi:10.1080/09672567.2013.824999
4. Regulation (EC) No 1445/2007 of the European Parliament and of the Council of 11 December 2007 establishing common rules for the provision of basic information on Purchasing Power Parities and for their calculation and dissemination. Retrieved April, 3, 2019. URL: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2007:336:0001:0024:EN:PDF> (Accessed 4 November 2022).
5. Law of one price. Cambridge University Press 2015. Retrieved April, 3, 2019. URL: <https://dictionary.cambridge.org/dictionary/english/law-of-one-price> (Accessed 15 November 2022)
6. Davutyan, N., Pippenger, J. (1985). Purchasing Power Parity Did Not Collapse during the 1970s. *American Economic Review*, December.
7. Evans Martin D.D., Lothian James R. (1993). The Response of Exchange Rates to Permanent and Transitory Shocks under Floating Exchange Rates. *Journal of International Money and Finance*, December.
8. Holub, R.R. (2014). Interrelation between purchasing power parity and a real currency exchange rate in a context of price competitiveness of export. *Financial and credit activity: problems of theory and practice*. Vol. 2, No17, 285-294. doi: 10.18371/fcaptop.v2i17.37367

9. Saadon, Yossi, Sussman, Nathan (2018). Nominal exchange rate dynamics and monetary policy: Uncovered interest rate parity and purchasing power parity revisited. 31 October. URL: <https://voxeu.org/article/uncovered-interest-rate-parity-and-purchasing-power-parity-revisited> (Accessed 15 October 2022)
10. Gelb, A., Diofasi, A. (2016). What Determines Purchasing-Power-Parity Exchange Rates? *Revue d'économie du développement*, 2016/2 (Vol. 24), 93-141. doi: 10.3917/edd.302.0093.
11. Kai-Hua Wang, Chi-Wei Su, Ran Tao & De-Ping Xiong (2019). Does the на прикладі purchasing power parity fit for China? *Economic Research-Ekonom-ska Istraživanja*, 32:1, 2028-2043, DOI: 10.1080/1331677X.2019.1637763
12. Jiang, C., Jian, N., Liu, T. Y., & Su, C. W. (2016). Purchasing power parity and real exchange rate in central eastern European countries. *International Review of Economics and Finance*, 44, 349–358. DOI: 10.1016/j.iref.2016.02.006
13. Huang, C. H., & Yang, C. H. (2015). European exchange rate regimes and purchasing power parity: An empirical study on eleven Eurozone countries. *International Review of Economics and Finance*, 35, 100–109. DOI: 10.1016/j.iref.2014.09.008
14. Mike, F., Kızılkaya, O. (2019). Testing the theory of PPP for emerging market economies that practice flexible exchange rate regimes. *Applied Economics Letters*, 26, 1411–1417. DOI: 10.1080/13504851.2018.1564111
15. Wee, J.-W.; Lee, H.-A. (2022). Testing the Validity of Purchasing Power Parity: Panel Cointegration Approaches with Big Mac Index. *Proceedings*, 82, 5. DOI: 10.3390/proceedings2022082005
16. The World Bank. URL: <https://data.worldbank.org/indicator> (Accessed 5 November 2022)

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