

INFERRING THE ROLE OF PRODUCTION AND FOREIGN TRADE IN DOMESTIC CONSUMPTION MEASUREMENT: A CASE STUDY OF TOP TEN GLOBAL ECONOMIES

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ABSTRACT

Consumption is the sole reason and purpose of all economic activities. However, no specific concept exists to measure the level of real consumption in an economy. This study attempts to understand the concept that measures the consumption level of a domestic territory and evaluates the consumption levels of the top ten global economies using Multiple Regression Analysis, T-Test, and CAGR for the years 2005 and 2022. The findings reveal noticeable variations in consumption levels across these economies. The study also concludes that there is a high positive correlation between consumption and production levels.

Keywords: Gross Domestic Aggregate Consumption (GDAC), Aggregate Imports, Gross Domestic Product, Aggregate Exports, Top Ten Global Economies, GDAC Index.

JEL CODES: B22, C12, C31, E21, E23, F23, F62

INTRODUCTION

The desire to consume drives economic activities, which fundamentally revolve around “production” and “consumption.” Consumption patterns determine the volume and nature of production in a country, influencing what and how much is produced. The welfare of an economy depends not only on production but also on the quantity and quality of goods consumed by its population. A nation with high consumption of quality products signifies a higher standard of living.

Despite the importance of consumption, no specific macroeconomic tool exists to measure its level directly. While tools like GDP_{MP} , NDP_{FC} , NNP_{FC} , Per Capita Income etc. measure output and income, they do not address key questions such as:

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- What is the level of consumption in a domestic economy?
- Is the economy self-reliant in terms of consumption?
- To what extent does the economy depend on foreign countries for consumption?
- What is the relationship between production, exports, imports, and consumption?
- Are there regional or income-based variations in consumption levels?

This study aims to fill this gap by developing a method to measure consumption levels in macroeconomics, similar to existing tools for measuring output.

REVIEW OF LITERATURE:

Several studies have explored the relationship between GDP, consumption, and foreign trade:

- **Guisan (2001)** analyzed the link between GDP and private consumption in OECD countries, emphasizing the importance of excluding other nations' GDP in such analyses.
- **Thangavelu & Rajaguru (2004)** found that imports significantly influence productivity growth in rapidly developing Asian economies.
- **Dutta & Ahmed (2004)** showed that real GDP determines import demand in India, but imports do not determine GDP.
- **Samuelson & Nordhaus (2005)** classified consumption into durable goods, non-durables, and services, highlighting its role in economic progress.
- **Gomez & Zaldivar (2009)** found no link between consumption and GDP trends in Mexico, but evidence of such a connection in the US.
- **Fouladi (2010)** demonstrated that government spending in oil/gas sectors positively impacts GDP, while spending on agriculture or industry has negative effects.
- **Mishra (2010)** identified a long-run causal relationship between private consumption and economic growth in India.
- **Stefano & Valerio (2011)** emphasized sustainable production and consumption strategies.
- **Anghelache (2011)** and **Amin (2011)** highlighted the significant role of final consumption in GDP growth.
- **Abdullahi et al. (2013)** linked foreign trade to GDP growth in Africa.
- **Tapsin & Hepsag (2014)** found that a \$1 increase in GDP raises household consumption by \$0.566 in the Eurozone.
- **Sugiarto et al. (2018)** and **Tan & Vincent (2019)** confirmed strong correlations between GDP and consumption in Indonesia and Malaysia, respectively.
- **Bishop et al. (2022)** underscored the impact of household consumption on economic performance during the COVID-19 pandemic.

Research Gap

While past studies have explored GDP, foreign trade, and consumption expenditure, none have empirically examined the relationship between production, foreign trade, and consumption. This study fills that gap by analyzing these components in the top ten global economies.

OBJECTIVES

On the basis of above literature review and research gap, present research paper aims to achieve the following objectives:

- (i) Measure domestic consumption levels using an appropriate tool.
- (ii) Evaluate the consumption levels of the top ten global economies.
- (iii) Rank these economies based on consumption levels for 2005 and 2022.
- (iv) Determine the correlation between consumption and production.

LIMITATIONS

- i. This research study is based on only top ten global economies selected on the basis of their respective GDP_{MP} for the year 2022.
- ii. This research study is based on the data related with domestic production, foreign trade and consumption only for the year of 2005 and 2022.

HYPOTHESES

- i. **(H1):** “There is no significant correlation between Production (GDP_{MP}) and Consumption (GDAC) of top ten global economies in the year 2005 and 2022.”

(H2): “There is no significant change in Consumption (GDAC) of top ten global economies for the year 2005 and 2022.”

RESEARCH METHODOLOGY

Research Period And Sample Size

For the analysis of the domestic consumption, purposive sampling method has been adopted. This sampling method is used when a research study is focused on comparatively small samples. Purposive sampling is useful to access a specific division of the population that shares certain features. So, top ten global economies (countries) are selected as purposive sample for the study.

Following are the main reasons for such sample economies:

- All these countries are advanced and emerging countries.
- In aggregate, the GDP of all these countries is more than \$6,73,18,163 million which is a significant part of aggregate global GDP.
- These ten countries are involved in foreign trade with more than 100 countries across the globe.

- These countries are the major producer of all kind of goods and services.
- The production and foreign trade of these countries can be taken as standard for maximum number of countries in the world.

So, present study is based on the macroeconomics data of top ten global economies, selected on the basis of their respective GDP_{MP} for the year 2022. The data comprising 2005 and 2022 are used for analysis.

DATA SOURCES

This conceptual, quantitative and analytical research study is mainly based on secondary or published data. The main source of data is the annual reports published by International Monetary Fund (IMF) for the year 2005 and 2022. It is the latest set of country-wise data available from IMF.

ANALYTICAL METHOD AND TOOLS

Following concepts of macroeconomics are applied for the analysis and interpretation purposes:

GROSS DOMESTIC AGGREGATE CONSUMPTION (GDAC)

i. Concept:

Gross Domestic Aggregate Consumption (GDAC) can be defined as a monetary value of aggregate goods and services consumed by all sectors of a domestic territory during an accounting period. In other words, GDAC is total expenditure on the consumption of goods and services within the domestic territory. These goods and services are either produced within the country or purchased by making payment in domestic currency or it is purchased from abroad (foreign) by making payment in foreign exchange.

ii. Justification of Each Term of GDAC:

In Gross Domestic Aggregate Consumption (GDAC):

Gross: Gross measures the comprehensive value of goods and services based on their market price, as consumption invariably occurs at market rates rather than factor costs. This valuation encompasses factor costs, production expenses, consumption of fixed capital (depreciation), and indirect taxes applied to these goods and services. The production cost comprises payments made to factors of production—rent to landlords, interest to capital, wages to laborers, and profit to entrepreneurs. Consumption of fixed capital denotes the reduction in fixed asset value, stemming from their utilization in production processes. This decrease is permanent. In the market all the goods and services are available for the consumption after adding the indirect taxes charged by the Government. Thus, indirect taxes are also included in the gross value.

Illustration:

Following is the workings of the market price of a commodity (i.e. a Table Lamp):

Rent Cost	\$ 9
Interest Cost	\$ 6
Wages Cost	\$ 15
Profit	\$ 5
Factor Cost	\$ 35
(+) Depreciation	\$ 5
(+) Net indirect Taxes	\$ 4
<u>Gross Value of Consumption</u>	<u>\$ 34</u>

Domestic :

In common terms, “domestic territory” typically refers to the land within a country’s borders. However, in economics, it carries a broader meaning. In economics, domestic territory encompasses the economic region where the movement or exchange of people, goods, and capital flows freely and is governed by a specific government. Therefore, “domestic” refers to the aggregate expenditure on the consumption of goods and services within this economic territory.

Aggregate Consumption:

- Aggregate means the sum of all the goods/merchandise/visible items and services (invisible items) consumed in the domestic country.

Thus, **Aggregate Consumption = Consumption of Goods/Merchandise/Visible Items + Consumption of Services/Invisible Items**

- Aggregate refers to the total value of all goods and services consumed either directly as final consumption or indirectly as intermediate consumption. Final consumption, also known as direct consumption, occurs when a good or service is utilized to directly fulfill a consumer’s immediate needs, resulting in satisfaction. For instance, consuming grains as food, eating fruits, or drinking milk are examples of final consumption. On the other hand, intermediate consumption, or indirect consumption, happens when a good or service is employed in the production process of another good. Under intermediate consumption, goods and services are utilized in the production of goods that ultimately satisfy human needs. For example, soybean is used in the production of edible oil.

Aggregate Consumption = Final Consumption + Intermediate Consumption

- Aggregate means the sum of all the goods and services consumed by all the sectors of economy. It signifies the consumption expenditure incurred by the firms (producing units), consumers (households), Government and financial services sector.

Aggregate Consumption = Consumption Expenditure by firm + consumers + Government + Financial Services

- **Aggregate means** the sum of all the goods and services consumed which are produced in the domestic territory and produced in the foreign countries. It means the portion of the domestic output which is purchased by the people in domestic currency and the purchases from abroad which is paid in the foreign exchange.

Aggregate Consumption = Consumption expenditure incurred in domestic currency + consumption expenditure in foreign exchange.

Procedure for Measurement of GDAC:

Gross Domestic Aggregate Consumption = Gross Domestic Production at Market Price – Aggregate Exports + Aggregate Imports.

Or

$$\text{GDAC} = \text{GDP}_{\text{MP}} - \text{AE} + \text{AI}$$

Or

Gross Domestic Aggregate Consumption = Gross Domestic Production at Market Price + Net Imports

Or

$$\text{GDAC} = \text{GDP}_{\text{MP}} + \text{NI}$$

(Here Net Imports = Aggregate Imports - Aggregate Exports)

(Here NI = AI - AE)

Validation:

Only GDP_{MP} is the base of GDAC: Gross Domestic Aggregate Consumption is measured based on Gross Domestic Production at Market Price, as all final goods and services produced within the domestic territory are primarily intended for domestic consumption. While there are other concepts of GDP as well such as GDP_{FC}, NDP_{MP}, NDP_{FC}, etc., However, GDP_{MP} is considered the most suitable for measuring consumption levels due to consumption always occurring at the market price of goods and services.

- **Aggregate Exports to be deducted:** A portion of the final goods and services produced within the domestic territory is not consumed domestically, but rather sold to foreign countries as exports. To accurately measure the level of domestic consumption, it is necessary to subtract the aggregate exports of both goods and services from the Gross Domestic Product (GDP). This is because all exports are not intended for domestic consumption. In essence, domestic consumption can only be measured by deducting exports from the domestic product.

Aggregate Exports = Merchandise (Goods) Exports + Invisible (Services) Exports

- **Aggregate Imports to be added:** To accurately gauge aggregate consumption, relying solely on the domestic product amount is inadequate. This is because some domestic

consumption involves imports, which are goods and services produced in foreign countries but consumed within the domestic territory. Therefore, it is crucial to include the aggregate of imports in GDP_{MP} to obtain a true measure of aggregate consumption. These aggregate imports form a component of GDAC and are paid for using foreign currency.

Aggregate Imports = Merchandise (Goods) Imports + Invisible (Services) Imports

- **Nominal GDAC and Real GDAC:** The measurement of GDAC, similar to GDP_{MP} , is done in both nominal and real terms. In nominal terms, it represents the total value of goods and services at their current prices. However, to calculate the real GDAC, adjustments are made for inflation based on a specific base year.

GROSS DOMESTIC AGGREGATE CONSUMPTION INDEX (GDAC INDEX):

i. Concept:

In the field of economics, there exists a strong correlation between production and consumption. These two concepts are intricately linked, as production is intended to satisfy consumption, and without production, consumption cannot occur. The GDAC index serves as a metric to quantify this relationship in terms of percentages. Specifically, the GDAC index calculates the percentage of GDAC in relation to GDP_{MP} . Essentially, this index reveals the proportion of domestic consumption in comparison to domestic production.

ii. Formula:

$$\text{GDAC INDEX} = \frac{\text{GDAC} \times 100}{GDP_{MP}}$$

iii. Interpretation of Expected Outcomes:

- **GDAC Index < 100 (Surplus Economy)**

If the GDAC Index falls below 100, it indicates that domestic consumption is lower than domestic production. This is a favourable indication for the economy; as it demonstrates that consumption is lower than output, fostering self-sufficiency as domestic production fulfils domestic consumption requirements. Moreover, the excess output can be exported, generating foreign exchange. Consequently, reliance on imports for domestic consumption diminishes, leading to a decrease in foreign exchange outflow. Such an economy is less susceptible to fluctuations in global business cycles, as the majority of the output is utilized within the domestic market. This type of economy can be characterized as an economy with a surplus.

- **GDAC Index = 100 (Par Economy):**

If the value of GDAC Index is equal to 100, it signifies that the domestic production is sufficient for the domestic consumption. This is a sign of a healthy economy as the consumption is equal to the output; it leads to the self-reliance as output is sufficient for domestic consumption and not dependent on the imports.

• **GDAC Index > 100 (Deficit Economy):**

When the GDAC Index exceeds 100, it indicates that domestic consumption surpasses domestic production/output. This imbalance is not indicative of a robust economy, as it results in a reliance on foreign output, i.e. imports, for domestic consumption. Moreover, it leads to a significant outflow of foreign exchange due to the necessity of foreign exchange for import payments.

The territory in this scenario is significantly impacted by the fluctuations in global business cycles, given that a large portion of domestic consumption relies on imported goods and services. Consequently, the domestic economy may encounter challenges stemming from demand and supply imbalances in the international market. Such a domestic territory could be classified as a deficit economy.

On the basis of the percentage measured, following categories can be outlined for further analysis of GDAC Index,

S.No.	Result of GDAC Index	Interpretation/ Category
1.	GDAC Index is < 90	Superior Condition
2.	GDAC Index is 90-100	Worthy Condition
3.	GDAC Index is 100-110	Distressing Condition
4.	GDAC Index is > 110	Risk Condition

Comprehensive Illustration of GDAC & GDAC INDEX

Country	GDP _{MP} (in million \$)	Aggregate Exports (in million \$)	Aggregate Imports (in million \$)	GDAC (in million \$)	GDAC Index (%)
A	5,000	500	1,500	6,000	120
B	10,000	1,500	2,500	11,000	110
C	15,000	2,000	1,500	14,500	96.67
D	20,000	4,000	1,500	17,500	87.5

Analysis

In the scenario of country A and B, the GDAC exceeds their GDP, resulting in GDAC

Indices above 100 (e.g. 120% and 110%). This suggests that both countries rely on imports for their domestic consumption. Additionally, the foreign exchange flow is negative for both nations due to higher imports than exports, making them deficit economies. Conversely, for country C and D, the GDAC is lower than their GDP, leading to GDAC Indices below 100 (e.g. 96.67% and 87.5%). This indicates that both countries are self-sufficient in terms of domestic consumption. Moreover, the foreign exchange flow is positive for both countries as exports surpass imports, classifying them as surplus economies.

Ranking of the countries on the basis of GDAC index:

- Rank I - Country D
- Rank II - Country C
- Rank III - Country B
- Rank IV -Country A

COMPOUNDED ANNUAL GROWTH RATE (CAGR):

Formula: $P_x = P_o (1+r)$

FOR THE TEST OF HYPOTHESES:

Multiple Regression Analysis by Ordinary Least Square (OLS) Method:

$$y = a + bx$$

Here:

y = A dependent variable,

a = Alpha is the intercept of the least square,

b = Beta is the slope of the regression line/coefficient,

x = An independent variable,

For the computation of the values of 'a' and 'b', following two normal equations are used, which can be solved simultaneously by OLS Method:

$$\sum y = na + b \sum x$$

$$\sum xy = a \sum x + b \sum x^2$$

	$m - \mu$	t = Student's	t = test
ii. Student's t-Test:	$t = \frac{m - \mu}{s/\sqrt{n}}$	m = mean	μ = theoretical value
		n = variable set size	

ANALYSIS OF GDAC & GDAC INDEX OF TOP TEN GLOBAL ECONOMIES:

Top ten global economies are the major producer of all kind of goods and services with a huge volume of foreign trade also. The data belongs to the production and foreign trade of these countries can be taken as standard for maximum number of countries in the world.

**Table I : GDP_{MP}, Aggregate Imports, Aggregate Export of Top Ten Global Economies
(Year 2005 & 2022)**

Year 2005					
Country	GDP_{MP}	Imports (Goods)	Imports (Services)	Exports (Goods)	Exports (Services)
United States of America	13039200	924245.84	312225	1597293.89	378487
China	2290019	987882.12	83971	621032.14	78469
Japan	4831467	647644.43	139030	473195.37	102029
Germany	2848438	968125.65	209354	761384.12	166093
India	834217	109609.52	60636	1,36,552.00	52179
United Kingdom	2547665	363689.07	175919	4,88,334.24	254361
France	2198160	440471.54	133994	506570.83	156639
Russia	817717	254258.51	40471	128474.15	28845
Canada	1173505	362439.24	65950	307671.79	61506
Italy	1859244	348386.54	94751	381575.78	92016
Year 2022					
United States of America	25462725	2099473.07	696707	3207238.67	928530
China	17886331	3467359.145	465053	2277598.28	424056
Japan	4237528	809529.91	209555	814631.04	166695
Germany	4085681	1648733.73	459231	1627835.35	411761
India	3389689	457101.72	249522	640755.00	309374
United Kingdom	3081871	460760.14	317066	753096.15	494440
France	2780136	666667.79	285803	836165.61	337189
Russia	2244249	615406.82	70809	224136.42	49098
Canada	2137939	623549.49	136547	562486.88	123317
Italy	2012014	664808.75	134168	678837.01	124083
CAGR	4.14%	4.29%	4.73%	4.35%	5.12%

Source: International Monetary Fund (IMF) databank.

Analysis:

Over the past 18 years, there has been a noticeable rise in all the mentioned indicators for all ten countries (excluding Japan). The GDP's compound annual growth rate (CAGR) is the lowest among all the mentioned indicators. The CAGR for the import and export of goods is nearly the same. This suggests that during this period, the growth of merchandise exports and imports is equal to or higher than the GDP growth rate. On the other hand, the CAGR for the

export and import of services is significantly higher than the growth rate of goods. The exports of services have the highest CAGR during this period.

Table II: GDP_{MP}, Gross Domestic Aggregate consumption (GDAC) and GDAC INDEX of Top Ten Global Economies (Year 2005 and 2022)

Year 2005				
Country	GDP_{MP} (in million \$)	GDAC (in million \$)	GDAC Index (%)	Rank
United States of America	13039200	12299890	94.33	II
China	2290019	2662371	116.26	IX
Japan	4831467	5042917	104.38	VI
Germany	2848438	3098441	108.78	VIII
India	834217	815732	97.78	IV
United Kingdom	2547665	2344578	92.03	I
France	2198160	2109416	95.96	III
Russia	817717	955127	116.80	X
Canada	1173505	1232716	105.05	VII
Italy	1859244	1828790	98.36	V
MEAN	3243963	3238997	102.97	
YEAR 2022				
United States of America	25462725	24123136	94.74	IV
China	17886331	19117089	106.88	IX
Japan	4237528	4275287	100.89	VI
Germany	4085681	4154049	101.67	VII
India	3389689	3146184	92.82	III
United Kingdom	3081871	2612161	84.76	I
France	2780136	2559252	92.05	II
Russia	2244249	2657230	118.40	X
Canada	2137939	2212232	103.47	VIII
Italy	2012014	2008071	99.80	V
MEAN	6731816	6686469	99.55	
CAGR	4.14%	4.11%		

Source Computations on the basis of International Monetary Fund (IMF) databank.

Analysis:**All Countries**

Over the past 18 years, there has been a noticeable upward trend in terms of GDP_{MP} and GDAC for all countries except Japan. GDP_{MP} has increased by 107.5% and GDAC by 106.4%, resulting in almost similar growth rates for both indicators. In 2005, five countries had deficit economies (GDAC Index > 100), but by 2022, this number had decreased to four countries. China and Russia were considered dicey in 2005, but in 2022, only Russia remains in that category. Both in 2005 and 2022, five countries had surplus economies (GDAC Index < 100), but there has been a significant decrease in the GDAC Index values. With the exception of Russia, the USA, and Italy, the GDAC Index of all other countries has shown improvement. The GDAC Index for the USA and Italy has remained relatively consistent, while for Russia, it has decreased significantly. The UK consistently had a better GDAC Index compared to other economies in both years. The average GDAC Index has decreased from 102.97% to 99.55%, indicating a reduced dependency on imports over the 18-year period.

**Table III: Country- wise Summary Analysis of GDAC and GDAC Index
(Year 2005 & 2022)**

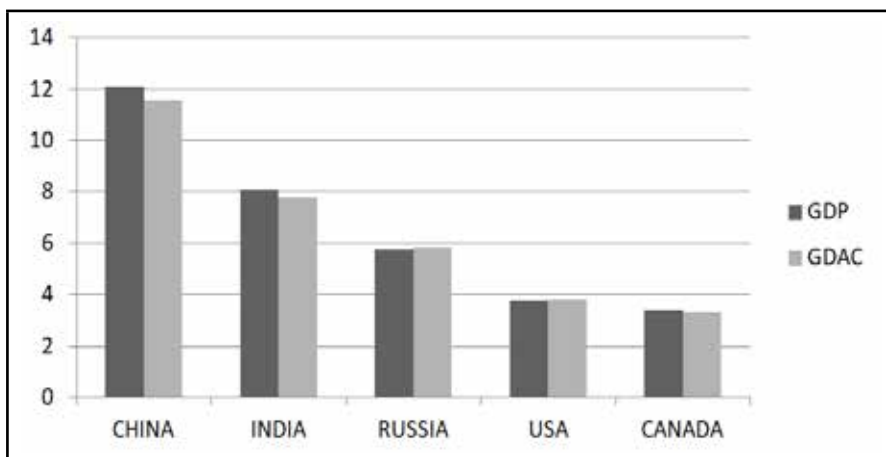
Country	2005	2022	Variation
1. United States of America			
GDP_{MP} (In mill \$)	13039200	25462725	12423525 (95.28%)
GDAC (In M \$)	12299890	24123136	11823246 (96.12%)
GDAC Index (In %)	94.33	94.74	0.41
Global Ranking (Based on GDAC Index)	II	IV	Decline
2. China			
GDP_{MP} (In mill \$)	2290019	17886331	15596312 (681.06%)
GDAC (In mill \$)	2662371	19117089	16454718 (618.04%)
GDAC Index (In %)	116.26	106.88	-9.38
Global Ranking (Based on GDAC Index)	IX	IX	No Variation
3. Japan			
GDP_{MP} (In M \$)	4831467	4237528	-593939 (-12.29%)
GDAC (In M \$)	5042917	4275287	-767630 (-15.22%)

GDAC Index (In %)	104.38	100.89	-3.49
Global Ranking (Based on GDAC Index)	VI	VI	No Variation
4. Germany			
GDP_{MP} (In M \$)	2848438	4085681	1237243 (43.44%)
GDAC (In M \$)	3098441	4154049	1055608 (34.07%)
GDAC Index (In %)	108.78	101.67	-7.11
Global Ranking (Based on GDAC Index)	VIII	VII	Improve
5. India			
GDP_{MP} (In M \$)	834217	3389689	2555472 (306.34%)
GDAC (In M \$)	815732	3146184	330452 (285.69%)
GDAC Index (In %)	97.78	92.82	-4.96
Global Ranking (Based on GDAC Index)	IV	III	Improve
6. United Kingdom			
GDP_{MP} (In M \$)	2547665	3081871	\534206 (20.97%)
GDAC (In M \$)	2344578	2612161	267583 (11.41%)
GDAC Index (In %)	92.03	84.76	-7.27
Global Ranking (Based on GDAC Index)	I	I	No Variation
7. France			
GDP_{MP} (In M \$)	2198160	2780136	581976 (26.48%)
GDAC (In M \$)	2109416	2559252	449836 (21.32%)
GDAC Index (In %)	95.96	92.05	-3.91
Global Ranking (Based on GDAC Index)	III	II	Improve
8. Russia			
GDP_{MP} (In M \$)	817717	2244249	1426532 (174.45%)

GDAC (In M \$)	955127	2657230	1702103 (178.21%)
GDAC Index (In %)	116.80	118.40	1.6
Global Ranking (Based on GDAC Index)	X	X	No Variation
9. Canada			
GDP_{MP} (In M \$)	1173505	2137939	964434 (82.18%)
GDAC (In M \$)	1232716	2212232	979516 (79.46%)
GDAC Index (In %)	105.05	103.47	-1.58
Global Ranking (Based on GDAC Index)	VII	VIII	Decline
10. Italy			
GDP_{MP} (In M \$)	1859244	2012014	152770 (8.22%)
GDAC (In M \$)	1828790	2008071	179281 (9.80%)
GDAC Index (In %)	98.36	99.80	1.44
Global Ranking (Based on GDAC Index)	V	V	No Variation

Source: Own Computations on the basis of International Monetary Fund (IMF) databank.

Figure I: Top Five Countries on the basis of CAGR of Gross domestic aggregate consumption ((GDAC) (from 2005 to 2022)



Source: Author on the basis of International Monetary Fund (IMF) databank.

TEST OF HYPOTHESES:

Regression analysis is one of standard statistical technique for the forecasting and the measurement of correlation. The main objectives for calculation of multiple regressions are:

- i. To describe and understand the relationship between two or more variables.
- ii. To forecast (predict) a new observation on the basis of available data.

As per first hypothesis we have to find out the degree of correlation/relationship between correlation between production (GDP_{MP}) and consumption (GDAC) of top ten global economies in the year 2005 and 2022. Therefore, for the testing of this hypothesis, regression analysis is an ideal tool.

T-test is an ideal statistical tool which is used when the data sets follow a normal distribution and have unknown variances. This test is applied as an inferential statistical tool to determine if there is a significant difference between the means of two groups and how they are related. In present study there is need to compare the two samples (GDAC of top ten global economies for the year 2005 and 2022). Thus for the comparison of variance, T-Test is applied in for the testing of second hypothesis:

(H1): “There is no significant correlation between Production (GDP_{MP}) and Consumption (GDAC) of top ten global economies in the year 2005 and 2022.”

Table IV: Multiple Regression Analysis by Ordinary Least Square (OLS) Method

Year 2005				
Dependent Variable		Production (GDP_{MP})		
Independent Variable		Consumption (GDAC)		
Sample		Top 10 Global Economies		
Included observations		10		
Multiple R		0.9981251		
R Square		0.9962537		
Adjusted R Square		0.9957854		
Standard Error		236072.58		
Variable	Coefficients	Standard Error	t Stat	P-value
a (Intercept)	-199786.4	105581.6235	-1.892245754	0.09509661
b (Slope)	1.0632145	0.023051037	46.12436951	0.00000005
Year 2022				
Dependent Variable		Production (GDP_{MP})		
Independent Variable		Consumption (GDAC)		
Sample		Top 10 Global Economies		
Included observations		10		

Multiple R		0.99685079		
R Square		0.9937115		
Adjusted R Square		0.99292544		
Standard Error		682233.878		
Variable	Coefficients	Standard Error	t Stat	P-value
a (Intercept)	-31547.101	287626.1	-0.10968	0.915364
b (Slope)	1.01149999	0.028449	35.55508	0.00000004

Source: Author on the basis of International Monetary Fund (IMF) databank.

Analysis:

i. R-square:

For both the years, the values of R-square or R-square adjusted are almost the same and express how much independent variables are predicting (impacting) dependent variables. In 2005, the value of R square is 0.996, so 99.6% of GDAC are predicting GDP_{MP}. On other side in 2022 the value of R- square is 0.993, so 99.3% of GDAC are predicting GDP_{MP}. The comparison of both the periods shows that, consumption (GDAC) (independent variable) has a higher degree of correlation with production (GDP_{MP}).

ii. P-Values:

For both the years, $P < 0.05$, for 2005 it is 0.00000005 and in case of 2022 it is 0.00000004. Following the Rule of Thumb which states that if the p-value is lesser than 5%, the relationship is said to be significant if it is greater than 5%, it is insignificant. It means there is a significant correlation between the Production (GDP_{MP}) and Consumption (GDAC).

iii. Regression Equation:

On substituting the results of the coefficients of a (intercept) and b (slope) in the regression equation ($y = a + bx$), it can be established that:

For 2005:

$$\text{GDP}_{\text{MP}} = -199786.4 + 1.0632145 (\text{GDAC})$$

It means when the GDAC in this year is \$ 100,00,000, then the amount of GDP_{MP} will be as under:

$$\text{GDP}_{\text{MP}} = -199786.4 + (1.0632145 * 100,00,000)$$

$$\text{GDP}_{\text{MP}} = -1,99,786 + 106,32,145$$

$$\text{GDP}_{\text{MP}} = \$ 104,32,359$$

For 2022:

$$\text{GDP}_{\text{MP}} = -31547.101 + 1.01149999 (\text{GDAC})$$

It means when the GDAC in this year is \$ 100,00,000 then the amount of GDP_{MP} will be as under:

$$GDP_{MP} = -31547.101 + (1.01149999 * 100,00,000)$$

$$GDP_{MP} = -31,547 + 101,14,999$$

$$GDP_{MP} = \$ 100,83,452$$

Now, to test the second hypothesis, p-value is calculated.

Table V: Students t- Test

Particulars	GDAC (2005)	GDAC (2022)
Sample Size (N)	10	10
Mean (X)	3238997.8	6686469.1
Variance	11653802678990.2	63899234952187.2
Degree of Freedom (DF)	18	
Significance Level	0.05	
T-Test Value	-1.2542	
p-value (Computed)	0.1168	
p-value (Critical)	0.05	
Result	0.1168 > 0.05 H2 is Accepted, as p > 0.05	

Source: Author's computation on the basis of International Monetary Fund (IMF) databank.

iv. Hypothesis Test Result:

The summary interpretation is that in the year 2005, GDP_{MP} was \$ 104.32 for every GDAC of \$ 100, but now in the year 2022, GDP_{MP} is \$ 100.83. In this way a minimal decrease of 3.34% is visible in the GDP_{MP} on GDAC for the comparative period.

So **H1** is rejected and alternative hypothesis **H2** is accepted as:

- **H1 (Correlation GDP_{MP} -GDAC):**

- **Rejected.** “There is a significant correlation between Production (GDP_{MP}) and Consumption (GDAC) of top ten global economies in the year 2005 and 2022.”

Regression Equation (2022):

$$GDP_{MP} = -31,547 + 1.011 \times GDAC$$

- **H2 (GDAC Change 2005–2022):**

- **Accepted.** “There is no significant change in Consumption (GDAC) of top ten global economies for the year 2005 and 2022.” (p = 0.1168 > 0.05).

MAJOR FINDINGS & CONCLUSION

On the basis of the above analysis and hypotheses testing, following are the major findings of this research study:

- The Gross Domestic Aggregate Consumption (GDAC) represents the overall expenditure on goods and services consumed within a country's borders. These products and services can be either domestically produced, bought using the local currency, or imported from foreign countries with payments made in foreign exchange.
- The GDAC Index represents the proportion of GDAC calculated using GDP_{MP} . Essentially, this index reflects the percentage of domestic consumption in relation to domestic production.
- When the GDAC Index falls below 100, it indicates a self-reliant or surplus economy where domestic consumption is lower than domestic production. Conversely, a GDAC Index exceeding 100 suggests a dependency or deficit economy with domestic consumption surpassing domestic production.
- The initial hypothesis test reveals a strong correlation (99%) between GDP and GDAC, indicating that GDAC can be used as an independent variable to predict GDP as the dependent variable. On the other hand, the second hypothesis test shows no significant change in the consumption levels of the top ten global economies from 2005 to 2022.
- In 2005, there were five countries classified under the category of deficit economies (GDAC Index > 100), but this number has decreased to four countries in 2022. Specifically, China and Russia were among the deficit economies in 2005, with Russia also being categorized as risky in 2002. Interestingly, both 2005 and 2022 witnessed five countries classified as surplus economies (GDAC Index < 100), but the GDAC Index value has significantly decreased. The mean GDAC Index has dropped from 102.97% to 99.55%, indicating a notable decrease in dependency on imports over the span of 18 years.
- Between 2005 and 2022, there was a notable increase in consumption levels across all economies, with the growth rate closely mirroring that of GDP. However, it is important to note that the growth rates varied among countries. China, India, and Russia emerged as the top three economies in terms of Compound Annual Growth Rate (CAGR) for Gross Domestic Product at Constant Prices (GDAC), while the European economies, namely the UK, France, and Italy, found themselves at the bottom three positions. Interestingly, Japan stood out as the only country experiencing a negative growth rate for both GDP and GDAC.

GDAC may become a useful method to determine the consumption level of a domestic territory as well a specific region. It can also be used as a tool to compute the living standard of residents in a domestic territory. In the present study it is effectively used for the comparison and measurement of correlation between production and consumption. The GDAC Index is an appropriate method to determine self-reliance or dependence level of a country on the imports

for domestic consumption. So GDAC is all-inclusive concept for the better understanding of the empirical relationship between the output, foreign trade and consumption level with a logical approach.

In conclusion, one can state that GDAC effectively measures domestic consumption, including imports and excluding exports. The GDAC Index is a useful tool to assess an economy's self-reliance. A strong link exists between GDP and GDAC, with GDAC capable of predicting GDP. Most economies reduced import dependency over 18 years, except Russia. China, India, and Russia led in GDAC growth, while Japan lagged.

GDAC provides a comprehensive framework for analyzing consumption, production, and foreign trade dynamics. It serves as a valuable tool for policymakers to evaluate economic self-reliance and design strategies for sustainable growth. GDAC offers a multifaceted approach to understanding and analyzing economic dynamics within domestic territories. It serves as a valuable method for assessing consumption levels and computing the living standards of residents, providing insights into the overall economic well-being of a region. GDAC emerges as a robust framework for comprehensively understanding and analyzing economic activities within domestic territories. By measuring consumption levels, assessing living standards, and exploring correlations between production and consumption, GDAC offers valuable insights into economic dynamics. Its ability to gauge a country's self-reliance on imports further enhances its utility, providing policymakers with critical information to formulate effective economic strategies. Moreover, GDAC's role in elucidating the empirical relationships between output, foreign trade, and consumption underscores its importance in guiding economic policies towards sustainable growth and stability. As economies evolve and global interdependencies deepen, GDAC stands out as a crucial tool for navigating the complexities of modern economic landscapes, offering clarity and strategic direction for sustainable development.

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