Export Analysis of India and China

Impact of Macroeconomic Variables on the Exports of India and China

ECON F342: Applied Econometrics

Under the supervision of
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Abstract

India and China are significant players in the world economy, and their trade relations are strategically and historically crucial. In order to comprehend the influence of several macroeconomic factors on these two Asian behemoths' export performances, this research explores their export dynamics. Using an empirical approach, we use regression analysis to examine the complex link between exports and critical economic indicators. Using the extensive information, we examine different macroeconomic variables like GDP, Real Effective Exchange Rate, CPI, Debt Level etc. affect China's and India's export trends. We also examine the effects on their export trends of important events and policy choices. This study aims to offer essential insights into the dynamics of export trade in the context of these two dynamic economies through thorough analysis and interpretation, aiding policymakers, businesses, and researchers in making informed decisions and strategies.

Contents

SECTION I: INTRODUCTION

India and China, significant economic powers in Asia, share a long-standing trade history, evolving from ancient exchanges of goods like spices and textiles to encompass a broad spectrum of modern products and services. This study delves into the complex dynamics of their export patterns, aiming to discern the influence of macroeconomic factors on their export performances.

The remarkable growth in bilateral trade between India and China over the past decade underscores their pivotal role in shaping regional and global commerce. Between 2015 and 2022, their trade volume surged substantially, with an average annual growth rate of 12.87%, emphasizing their significance within the Asia Pacific Trade Agreement (APTA), where they actively promote cross-border trade and investment.

Subtle dependencies and difficulties, though, exist underlying this growth. China's competitive pricing has led to India's substantial reliance on imports from China, resulting in a persistent trade deficit contributing significantly to the overall deficit. In addition, this deficit is made worse by the depreciation of the Indian Rupee relative to the Chinese Yuan, which creates barriers to Indian exports. These barriers include political, administrative, and regulatory ones that still exist, which prevent the two countries from realizing their full trade potential.

This report endeavors to dissect the influence of various macroeconomic variables such as GDP, Real Effective Exchange Rate, CPI , Debt Level etc. on exports in India and China. A thorough analysis seeks to provide valuable insights into the export dynamics of these influential Asian economies, offering guidance to policymakers, businesses, and researchers. It seeks to open the door for improved trade cooperation and long-term, steady economic growth amongst these industry titans.

SECTION II: LITERATURE REVIEW

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1. Factors determining India's export performance by
K Sharma - Journal of Asian Economics, 2003 - Elsevier

About the Paper:
The article, authored by K. Sharma and published in the Journal of Asian Economics in 2003, investigates the factors influencing India's export performance. It aims to provide insights into the key determinants that shape India's export trends over a specific period.

Research Gap:
While Sharma's paper offers valuable insights into the factors influencing India's export performance, there may be gaps in understanding the changing dynamics of global trade and its impact on India's exports since 2003. Additionally, the paper does not account for recent shifts in trade policies, technological advancements, and geopolitical factors affecting India's export competitiveness.

Methodology:
The methodology involves a combination of econometric analysis and qualitative research. The author has used statistical techniques such as regression analysis to identify and analyze the relationship between India's exports and various macroeconomic variables such as GDP growth, exchange rates, inflation, trade policies, and global demand. Qualitative methods such as literature review and expert interviews have also been employed to provide contextual insights.

Conclusion:
In conclusion, Sharma's article sheds light on the multifaceted determinants of India's export performance, highlighting the importance of macroeconomic factors in shaping export trends. The findings suggest that policies aimed at promoting economic growth, maintaining exchange rate stability, and improving trade infrastructure are crucial for enhancing India's export competitiveness. However, the paper underscores the need for continuous monitoring and adaptation to evolving global economic dynamics to sustain long-term export growth and competitiveness.

2. Selected Macro – Economic Variables and its Impact on Chinese and Indian Exports by Rohit Singh Tomar, Dr. Deepika Singh Tomar

About the Paper:
The paper titled "Selected Macroeconomic Variables and its Impact on Chinese and Indian Exports" by Rohit Singh Tomar and Dr. Deepika Singh Tomar aims to analyze the influence of specific macroeconomic variables on the export performance of China and India. It likely provides a comparative study, examining how factors such as GDP growth, exchange rates, inflation, and trade policies affect the export dynamics of these two major Asian economies.

Research Gap:
While the paper offers insights into the impact of macroeconomic variables on Chinese and Indian exports, there may be gaps in understanding the nuanced differences between the two economies and their export sectors. Additionally, the study may not fully explore the implications of structural factors, such as technological capabilities, industrial composition, and institutional frameworks, on export performance.

Methodology:
The methodology involves econometric analysis, employing statistical techniques such as regression analysis or panel data modeling to assess the relationship between macroeconomic variables and exports in China and India. The authors utilize secondary data sources such as national statistical databases, international trade databases, and academic literature to construct datasets and conduct empirical analysis.

Conclusion:
In conclusion, the paper underscores the significance of macroeconomic factors in shaping the export trajectories of China and India. The findings suggest that while certain variables may have similar effects on exports in both countries, there may also be distinct differences attributable to varying economic structures and policy environments. The study highlights the importance of tailored policy interventions and strategic initiatives to enhance export competitiveness and sustain long-term economic growth in both China and India.

3. The Role of External Variables in the Chinese Economy ; Simulations from a Macroeconomic Model of China By Stephane Dées

About the Paper:
Stephane Dées' paper titled "The Role of External Variables in the Chinese Economy: Simulations from a Macroeconomic Model of China" explores the impact of external factors on the Chinese economy using a macroeconomic model. It aims to provide insights into how changes in global economic conditions, such as international trade, foreign direct investment, and exchange rates, influence China's economic performance.

Research Gap:
While Dées' paper offers valuable insights into the role of external variables in the Chinese economy, there may be gaps in understanding the dynamic interplay between domestic and external factors. Additionally, the study may not fully capture the effects of geopolitical tensions, global supply chain disruptions, and other non-economic factors on China's economic stability and growth prospects.

Methodology:
The methodology likely involves the development and calibration of a macroeconomic model specific to the Chinese economy. Dées may use techniques such as structural vector autoregression (SVAR) or dynamic stochastic general equilibrium (DSGE) modeling to simulate the effects of external variables on key economic indicators such as GDP growth, inflation, and employment. The model may be parameterized based on historical data and supplemented with scenario analyses to assess the resilience of the Chinese economy to external shocks.

Conclusion:
In conclusion, Dées' paper highlights the importance of external variables in shaping the economic trajectory of China. The simulations demonstrate how changes in global economic conditions can have significant implications for China's economic performance, highlighting the country's interconnectedness with the rest of the world. The study underscores the need for policymakers in China to adopt a forward-looking approach that considers both domestic and external factors in economic decision-making to ensure sustainable and resilient growth.

4. Bilateral Trade and Economic growth of China and India: A comparative study by Farooqui, Sibghat U.(2016)

About the Paper:
The paper examines the bilateral trade and economic growth between India and China.It also gives attention to the trade outcome and economic cooperation in future.The paper investigates the changes in import-export,terms of trade,total trade and trade openness.

Research Gap:
Most of the previous studies were related to FDI and growth and were theoretical in nature. This study incorporates macroeconomic variables and trade indices. It is more empirical in nature.

Methodology:
The data was collected from various sources such as UNCTAD, World Bank, Department of Industrial Policy and Promotion etc. Data independent t and f tests were undertaken. By applying various statistical methods, we conclude that China is India's leading trade partner. The results indicate the supremacy of China but India also elucidates the sign of prominent growing economies in the world.

Conclusion:
The study examines the key determinants of trade for India and China.It also analyzes the pre and post crisis analysis of trade partnerships which might have future implications for trade policy.The gravity model applied in the study for the period 2004-2013 indicates that India and China trade flows are mostly with geographically closer countries.

5. China and India: Openness, Trade and Effects on Economic Growth by Enrico Marelli, Marcello Signorelli (2011)

About the Paper:
This essay examines China's and India's economic development in light of their inclusion into the world economy. It starts by reviewing some basic facts about their recent economic growth, the most significant institutional changes that have been made especially regarding trade relations and how those changes have affected their economic development. It then suggests comparing the two nations' characteristics and patterns to provide a descriptive study of economic growth and trade specialization.

Research Gap:
There is a gap in understanding the specific mechanisms through which trade openness affects economic growth in China and India. The gap can be filled by exploring the causal relationships between trade liberalization, exports, imports, foreign direct investment (FDI), productivity growth, and overall economic growth.

Methodology:
The study utilizes econometric techniques, such as panel data analysis to empirically investigate the relationship between trade openness and economic growth in China and India. It uses macroeconomic data from sources such as the World Bank, IMF, and national statistical agencies to construct relevant variables for analysis.

Conclusion:
In conclusion, this study examines the "recent miracle" of economic growth in China and India, particularly emphasizing the institutional reforms implemented in the last three decades that have increased the two nations' "openness." As we saw in the empirical part, both countries have had recent strong economic growth and increased trade and openness to the rest of the world, including merchandise trade and foreign direct investment.

SECTION III: DATA AND METHODOLOGY

The dataset consists of exports and several other macroeconomic variables such as GDP, Imports, REER, CPI etc of India and China from 2004 first quarter to 2022 last quarter. Quarterly data was taken as most variables are calculated quarterly in these two countries. It was collected from various sources such as .

We created country dummies, and treated the countries as cross sections which have been observed over the aforementioned period.

First model:

$\ln(\text{EXPORTS}) = \beta_0 + \beta_1 * \ln(\text{GDP}) + \beta_2 * \text{REER} + \beta_3 * \text{CPI} + \beta_4 * \text{DEBT} + \beta_5 * \ln(\text{Imports}) + \alpha_1 * (\text{ID\_Dummy}) + \alpha_2 * (\text{QUARTERS})$

VIF was calculated for the model and GDP was showing extremely high multicollinearity. This may be attributed to the fact that imports are a component of GDP. So in order to avoid this issue we have taken the ratio of Imports to GDP in order to make our final model.

Final Model:

$\mathbf{\ln(\text{EXPORTS}) = \beta_0 + \beta_1 * \ln(\text{imp\_to\_gdp}) + \beta_2 * \text{REER} + \beta_3 * \text{CPI} + \beta_4 * \text{DEBT} + \alpha_1 * (\text{ID\_Dummy}) + \alpha_2 * (\text{QUARTERS})}$

where imp_to_gdp = Imports/GDP

Panel data can be fitted into Fixed effects and Random effects models. We use the Hausman test to choose the best model. The model was also checked for time fixed effects and then the cross sectional dependence test using BPLM test.

Dependent variable:

- **Total Exports**

    We have taken exports as the dependent variable in our model. Here we are trying to find the impact of various macroeconomic variables like Imports to GDP ratio, REER, CPI, Debt on the exports of a nation. We have then taken the natural logarithm (ln) of Exports in order to get a better approximation of the changes of the variable.

Independent variables:

- **Imports to GDP**

    The ratio of imports to GDP is inversely related to the trade balance. A higher ratio indicates a larger share of imports relative to the size of the economy, which can lead to a trade deficit if exports do not match or exceed the level of imports. We take the natural logarithm (ln) of the Imports to GDP ratio in an attempt to measure its bilateral trade effectively. Simply, it's a better approximation as it changes multiplicatively than additively, so analysis on a logarithmic scale is helpful.

- **Real Effective Exchange Rate (REER)**

    REER measures the value of a country's currency relative to a weighted average of other currencies, adjusted for inflation. A higher REER indicates an appreciation of the currency making exports relatively more expensive for foreign buyers, while a lower REER indicates a depreciation, making exports relatively cheaper.

- **Consumer Price Index (CPI)**

    CPI reflects changes in the overall level of consumer prices within a country. When CPI rises, it indicates inflationary pressures, which may lead to higher production costs for exporters, potentially leading to lower exports. Changes in CPI can influence consumer purchasing power and demand for goods and services including export.

- **International Debt**

  The level of debt a country holds affects its ability to service debt obligations. High levels of debt may lead to significant debt servicing costs, including interest payments. When a significant portion of government revenue is allocated to debt servicing, it can limit the resources available for the export industry. Here we have taken the amount outstanding due within one year of International debt securities for the non-financial corporations sector as a variable to measure debt.

- **ID_Dummy**

  We have taken an ID dummy variable to distinguish between India and China. 0 identifies China whereas 1 identifies India.

- **Quarters**

  We have taken Quarters as our time variable which helps us analyze the exports of India and China across various quarters from 2004-01-01 to 2022-12-01.

SECTION IV: REGRESSION

Fixed Effect Model

```
. xtreg EXPORTS imp_to_gdp REER CPI DEBT, fe

Fixed-effects (within) regression              Number of obs      =       152
Group variable: ID_DUMMY                       Number of groups   =         2

R-sq:   within  = 0.8913                        Obs per group: min =        76
        between = 1.0000                                       avg =      76.0
        overall = 0.9700                                       max =        76

                                                F(4,146)           =    299.41
corr(u_i, Xb)  = 0.8673                         Prob > F           =    0.0000
```

EXPORTS	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
imp_to_gdp	26.66243	2.162617	12.33	0.000	22.38835	30.93651
REER	.0259859	.0025195	10.31	0.000	.0210065	.0309653
CPI	.0114748	.0007968	14.40	0.000	.0098999	.0130496
DEBT	.0000182	5.54e-06	3.28	0.001	7.22e-06	.0000291
_cons	-.3044686	1.919853	-0.16	0.874	-4.098762	3.489825

sigma_u	.32198612	
sigma_e	.16101048	
rho	.79996538	(fraction of variance due to u_i)

```
F test that all u_i=0:      F(1, 146) =     10.40               Prob > F = 0.0016
```

- **Imports to GDP Ratio (ln(imp_to_gdp))**: The model suggests a very strong positive relationship between the ratio of imports to GDP and exports for India and China. A 1% increase in the imports to GDP ratio is associated with an approximately 26.66% increase in exports. This could indicate that as these economies import more, they might also produce and export more, possibly due to the importation of intermediate goods that are then used in the production of export goods.

- **Real Effective Exchange Rate (REER)**: The positive coefficient of the REER implies that an appreciation of the real exchange rate (which could mean that the

currency is stronger compared to a basket of other currencies, after adjusting for inflation) is associated with an increase in exports. This is somewhat counterintuitive, as a stronger currency typically makes exports more expensive for foreign buyers. However, it may reflect that a stronger REER is indicative of stronger economic fundamentals in these countries, which could enhance export performance.

- **Consumer Price Index (CPI)**: The positive relationship here suggests that higher consumer prices, which can be indicative of inflation, are associated with a slight increase in exports. This could be because inflation is associated with greater economic activity, or it might reflect that producers are able to pass on higher domestic prices to foreign buyers, although the effect is relatively small.

- **Debt Level (DEBT)**: The marginal positive effect of debt on exports could suggest that as India and China take on more debt, perhaps for investment in infrastructure or production capacities, this may lead to an increase in exports, albeit the effect is very small.

- **Fixed Effects and Time Period**: The fixed effects are capturing the idiosyncratic characteristics of India and China that do not change over time or are constant within each country over the period studied. The high R-squared values suggest that the model is explaining a large portion of the variation in exports for these countries over the 15-year period.

- **Statistical Significance and Model Fit**: The model is statistically significant, as indicated by the F-test, meaning that the macroeconomic variables included in the model collectively have a significant impact on exports. The high R-squared values, especially within R-squared, confirm that the model fits the within-country variations in the export data well.

- In conclusion, the model provides evidence that for India and China, imports to GDP ratio, real effective exchange rate, consumer price index, and debt levels are important determinants of exports. The fixed effects methodology allows for the control of unobserved heterogeneity that could bias the results if not accounted for. The high R-squared values signify that the model is a good fit for the data, explaining much of the variation in exports for these two countries over the period studied.

Random Effect Model

```
. xtreg  EXPORTS imp_to_gdp REER CPI DEBT i.QUARTER, re

Random-effects GLS regression              Number of obs     =        152
Group variable: ID_DUMMY                   Number of groups  =          2

R-sq:  within  = 0.9614                     Obs per group: min =        76
       between = 1.0000                                    avg =       76.0
       overall = 0.9929                                    max =         76

                                            Wald chi2(79)     =   10036.91
corr(u_i, X)    = 0 (assumed)               Prob > chi2       =     0.0000
```

EXPORTS	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
imp_to_gdp	31.50504	.7825733	40.26	0.000	29.97122	33.03886
REER	-.0013857	.0039539	-0.35	0.726	-.0091352	.0063637
CPI	-.0041976	.0020318	-2.07	0.039	-.0081798	-.0002154
DEBT	-.0000125	9.01e-06	-1.39	0.164	-.0000302	5.12e-06
_cons	-1.671931	.9203753	-1.82	0.069	-3.475834	.1319711
sigma_u	0					
sigma_e	.09710682					
rho	0	(fraction of variance due to u_i)				

- **beta1*ln(imp_to_gdp):** This coefficient represents the elasticity of exports with respect to imports as a percentage of GDP (imp_to_gdp). The coefficient is positive (31.50504) and highly significant (p-value < 0.001), indicating that a 1% increase in imports to GDP ratio is associated with approximately a 31.51% increase in exports, all else being equal.

- **beta2*REER:** This is the coefficient for the real effective exchange rate (REER). It has a small and statistically insignificant negative coefficient (-0.0013857, p-value 0.726), suggesting that changes in REER do not have a strong and statistically significant impact on exports in this model.

- **beta3*CPI**: This coefficient is for the consumer price index (CPI), a measure of inflation. The negative coefficient (-0.041976) that is statistically significant (p-value 0.039) implies that a 1% increase in CPI is associated with a 4.20% decrease in exports, all else being equal.

- **beta4*DEBT**: This represents the coefficient for debt. It has a very small and statistically insignificant negative coefficient (-0.0000125, p-value 0.164), suggesting that there isn't a strong or significant relationship between debt levels and exports according to this model.

- **ID_DUMMY**: This is the group variable used in the random-effects model to account for unobserved heterogeneity between the two countries. Since there are only two groups (India and China), this dummy variable distinguishes between the two.

- The R-squared values indicate how well the independent variables explain the variation in the dependent variable. With values of 0.9614 (within), 1.0000 (between), and 0.9929 (overall), the model has very high explanatory power.

- Wald chi2: The Wald test statistic (10036.91) and its associated p-value (0.0000) suggest that the model as a whole is statistically significant.

- **sigma_u**: This represents the standard deviation of the random effects (u_i) across the groups (in this case, India and China). It is estimated to be 0, which indicates that there is no variation between the two countries that isn't captured by the observed variables in the model.

- **sigma_e**: This is the estimated standard deviation of the error term (e) within the groups. It is 0.09710682, which suggests there is some level of variation within the groups that is not explained by the model.

- **rho**: This is the intraclass correlation coefficient, which measures the proportion of the total variability in the dependent variable that is due to the variation between groups. Since sigma_u is 0, rho is also 0, indicating that there is no correlation in exports between the groups that is not already explained by the observed variables.

- In summary, the model suggests that there is no significant unexplained between-group variability, and the variance in the dependent variable (exports) is primarily within the groups, not between them. This could imply that the differences between India and China regarding the relationship between exports and the included macroeconomic variables are already captured by the variables included in the model.

Hausman Test

```
                    b = consistent under Ho and Ha; obtained from xtreg
          B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

            chi2(77) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                   =          74.02
          Prob>chi2 =       0.5751
          (V_b-V_B is not positive definite)
```

Hypothesis Set:

H0: Covariance(Xit, Uit) = 0 ∀ i,t Random effects model is consistent and efficient.
Ha: Covariance(Xit, Uit) ≠ 0 for at least one i and t Fixed effects model is consistent and efficient.

The Hausman test statistic (chi-square) is 74.02 with a p-value of 0.5751. This suggests that we can not reject the null hypothesis of the Hausman test at the 5% significance level. The Hausman test does not reject the random effects model. The Hausman test assumes that the unobserved factors influencing exports of India and China are random.

SECTION V: DIAGNOSTICS

MULTICOLLINEARITY TEST (VIF Test)

If the VIF, i.e. the Variance Inflation Factor is less than 10 then we can say that there is no multicollinearity in the system.

```
. vif
```

Variable	VIF	1/VIF
REER	4.43	0.225961
imp_to_gdp	2.89	0.346425
DEBT	1.99	0.501660
CPI	1.89	0.528041
Mean VIF	2.80	

Here, we can see that all variables have a VIF less than 10 so none of the variables are correlated to one another.

OMITTED VARIABLE BIAS TEST

The Ramsey RESET Test is used to check for omitted variable bias.

```
. estat ovtest

Ramsey RESET test using powers of the fitted values of EXPORTS
        Ho:  model has no omitted variables
                  F(3, 144) =      14.01
                  Prob > F =      0.0000
```

The result shows that the probability of the calculated F value is close to zero and lesser than the critical value, so the null hypothesis is rejected and hence at least one significant variable is omitted.

TEST FOR TIME FIXED EFFECTS

The null hypothesis is that there are no time fixed effects and so all the dummy variables' coefficients will be zero.

```
. xtreg  EXPORTS imp_to_gdp REER CPI DEBT i.QUARTER, fe

Fixed-effects (within) regression              Number of obs       =       152
Group variable: ID_DUMMY                       Number of groups    =         2

R-sq:  within  = 0.9808                         Obs per group: min =        76
       between = 1.0000                                        avg =      76.0
       overall = 0.3194                                        max =        76

                                                F(79,71)            =     45.86
corr(u_i, Xb)  = 0.1642                         Prob > F            =    0.0000
```

EXPORTS	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
imp_to_gdp	1.964968	3.486948	0.56	0.575	-4.987809	8.917745
REER	-.0018854	.0027905	-0.68	0.501	-.0074494	.0036787
CPI	-.0009035	.0014841	-0.61	0.545	-.0038628	.0020558
DEBT	.0000127	7.01e-06	1.81	0.074	-1.28e-06	.0000267

```
     F( 75,     71) =     4.41
         Prob > F =    0.0000
```

The p-value here is close to zero and less than the critical value, so we reject the null hypothesis. This means that there is a significant difference in the dependent variable EXPORTS over the different time periods.

TESTING FOR CROSS-SECTIONAL DEPENDENCE USING BREUSCH PAGAN LM TEST OF INDEPENDENCE

The null hypothesis in the B-P/LM test of independence is that residuals across entities are not correlated i.e. there is no cross-sectional dependence.

```
. xttest2

Correlation matrix of residuals:

                    __e0          __e1
      __e0 │    2.544356
      __e1 │   -.5825802      1.240602


           __e0        __e1
  __e0    1.0000
  __e1   -0.3279     1.0000

Breusch-Pagan LM test of independence: chi2(1) =      8.172, Pr = 0.0043
Based on 76 complete observations over panel units
```

As the P value of the statistic is less than the critical value, the null hypothesis can be rejected. This means that cross-sectional dependence exists to an extent in this model.

SECTION VI: CONCLUSION

The purpose of the analysis in this report was to understand the relationship between macroeconomic variables and the export performance of India and China. Using regression analysis and the study of various economic indicators, we aim to provide an overview of the dynamics of export trade in these two influential Asian economies.

The results show that several macroeconomic factors play an important role in the export trends of both. India and China. In particular, the ratio of imports to GDP appeared as a strong determinant of exports, indicating that when these countries import more, they tend to produce and export more. In addition, the real effective exchange rate (REER) showed a positive relationship with exports, suggesting that a stronger currency relative to other currencies can improve export performance.

However, the analysis also revealed the complexity of exports and certain specific relationships among variables. For example, although higher consumer prices (CPI) were associated with some growth in exports, the effect was relatively small. Debt also showed a marginally positive effect on exports, suggesting a possible relationship between debt levels and export performance, although the effect was not significant.

Using random effects models allowed us to control for unobserved effects, heterogeneity and provided an overview of differences in export data within the country. Random model had high explanatory power, indicating that the included macroeconomic variables thas a significant impact on exports.

Overall, this analysis provides valuable information for policy makers, businesses and researchers seeking to understand and navigate the complexities of India's export dynamics and in China. By considering the impact of macroeconomic variables, stakeholders can make informed decisions and formulate strategies to promote

sustainable economic growth and strengthen business cooperation between these two dynamic economies.

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