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# *Does Trade Drive Per Capita GDP Growth? Evidence from the Developing World*

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***Abstract.*** Trade is an important component of national income accounting. The GDP identity implies a positive relation between net export and GDP level, but the GDP identity does not establish causality. This paper plan to study the causal effect of trade on income growth using a panel data of 111 developing countries over 1970–2020. To address endogeneity, both ordinary least squares (OLS) and instrumental variable (IV) approaches are implemented, where the instrument is constructed by the average GDP of countries' top five trading members with air freight capacity to generate exogenous variation in trade exposure. The IV results indicate a not only positive but also significant effect of countries' trade on income: one-percentage-point increase in the trade growth raises GDP per capita by 0.11 percent over 1997–2020. These findings show a causal link between trade growth and economic growth, while leaving the underlying mechanisms—such as technology diffusion and capital accumulation—for future research.

***Keywords:*** trade, economic growth, instrumental variables

## 1. Introduction

Many research documents a robust positive association between trade and economic performance. From a national accounting perspective, trade enters directly into the GDP identity, so an increase in trade directly makes the GDP increase one by one. Meanwhile, a long-standing empirical literature —particularly that based on the gravity framework—emphasizes the tight positive relationship between countries' economic size and their bilateral trade flows. Despite this well-established correlation, the causal effect of trade on economic development remains unsettled. This issue is especially salient for developing countries, where trade expansion may generate aggregate gains while simultaneously inducing distributional tensions or structural adjustments.

A key challenge in identifying the causal impact of trade arises from endogeneity concerns. First, reverse causality is pervasive: higher-income economies tend to engage in more trade, while increased trade may in turn promote income growth. Second, omitted variable bias may arise if unobserved factors—such as institutional quality, geography, or policy regimes—are correlated with both trade intensity and economic performance, thereby contaminating ordinary least squares (OLS) estimates.

This paper addresses these identification challenges in two steps. We first use OLS, using a panel of 111 developing countries over the period 1970–2020, under the maintained assumption of no

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omitted variable bias. We then implement an instrumental variables (IV) strategy. Specifically, the instrument is constructed from the average GDP of a country's major trading members and air-freight capacity. This approach captures shifts in external demand and trade costs that are orthogonal to domestic economic conditions.

The empirical results point to a positive and significant causal effect of trade on economic development. IV estimates indicate that a one-percentage-point increase in trade openness raises GDP per capita by approximately 0.11 percent over the period 1997–2020. Notably, these magnitudes are smaller than the corresponding ordinary least regression estimates. Overall, the findings provide evidence that trade contributes to income growth in EMDEs. At the same time, the underlying mechanisms—such as productivity improvements, technology diffusion, and capital accumulation—are not directly identified in the empirical analysis and remain an important avenue for future research.

## 2. Literature review

Many research has successfully identified the causal effect of trade on economic performance by addressing endogeneity concerns. Early contributions employ geographic characteristics as instruments for trade. Seminal work by [1] uses distance, size, and landlocked status to construct instrumental variables for trade and finds that instrumental variable estimates of trade-growth's effect on GDP per capital are substantially larger than their ordinary least regression counterparts, suggesting sizeable gains from trade. These positive gains may result from productivity improvements through trade. Reference [2] shows that trade openness contributed significantly to economic growth in East Asia using similar identification strategies.

More recent studies refine causal inference by developing time-varying or historically grounded instruments. Reference [3] exploits variation in air transportation costs to construct a time-varying geography-based instrument, while [4] uses trade liberalization episodes as plausibly exogenous shocks to openness. Reference [5], in turn, leverages the historical expansion of railroads in colonial India to identify the impact of reduced trade costs. Despite differences in identification strategies, this literature generally converges on a positive causal effect of trade on income, operating through channels such as lower prices, improved market integration, and productivity gains.

However, this consensus is not without exceptions. A growing body of work highlights that the effects of trade may be heterogeneous and, in some contexts, adverse. Reference [6] documents substantial and persistent negative impacts of import competition on local labor markets in the United States, while [7] finds similar adjustment costs in developing economies. Reference [8] further emphasizes that aggregate gains from trade may coexist with significant distributional losses, complicating the welfare implications of increased openness. These findings suggest that the trade–growth nexus is not universally positive and may depend on country characteristics.

Against this backdrop, the existing literature reveals two key gaps. First, while much of the empirical evidence relies on either time-invariant geographic instruments or specific historical episodes, there remains a need for instruments that combine cross-country and time variation in a unified framework. Second, relatively less attention has been devoted to systematically examining the causal effect of trade in a broad sample of developing countries over a long time horizon. This is a crucial gap, as developing countries may be more vulnerable to trade-related shocks.

This paper successfully show the causal effect of trade on economic development in developing countries. Building on [9], an instrumental variable is constructed by interacting the average GDP of a country's top trading partners with air freight capacity, capturing exogenous variation in external demand and trade costs. Using panel data for 111 developing countries over 1970–2020, the paper

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shows that the results indicate a positive and statistically significant causal effect of trade on income, in both OLS and IV methods.

## 3. Data

This paper uses an unbalanced panel dataset compiled by [10], which combines macroeconomic indicators from the World Bank's World Development Indicators (WDI) with bilateral trade data from the UN COMTRADE database. This paper restrict the sample to 111 developing countries over the period 1970–2020, excluding high-income countries. The used variables summary statistics are presented in Table 1.

### 3.1. Variable definitions and construction

The dependent variable is the log of GDP per capita (in current US dollars), which can proxy for economic development.

The main explanatory variable is an adjusted measure of trade openness. Following the empirical growth literature, this paper includes a set of standard control variables: (i) the investment ratio, measured by gross capital of GDP, to capture physical capital accumulation; (ii) secondary school enrollment, which proxies for human capital; and (iii) inflation, measured by the consumer price index (CPI, 2010 = 100), to account for macroeconomic stability. All variables are expressed in natural logarithms.

Table 1. Descriptive statistics: developing countries sample (1970-2020)

| Variable | Mean | SD | Min | Max | N |
|---|---|---|---|---|---|
| Log GDP per capita (current US$) | 7.500 | 1.218 | 4.368 | 10.755 | 2,432 |
| Log adjusted trade share | -2.857 | 1.609 | -11.430 | 1.423 | 2,432 |
| Log gross fixed capital formation (% of GDP) | 3.075 | 0.344 | 1.325 | 4.538 | 2,432 |
| Log secondary school enrollment (%) | 3.931 | 0.680 | 0.758 | 4.956 | 2,432 |
| Log CPI (2010=100) | 3.277 | 2.531 | -16.061 | 6.791 | 2,432 |
| Log exports to top 5 GDP | 21.162 | 0.995 | 16.568 | 23.052 | 2,432 |
| Log imports from top 5 GDP | 21.351 | 0.836 | 18.257 | 23.050 | 2,432 |
| Log distance to top 5 trading partners | 8.952 | 0.297 | 8.166 | 9.562 | 2,432 |
| Log air freight (lagged) | 3.201 | 2.416 | 5.809 | 9.689 | 2,432 |

Notes: Summary statistics for the estimation sample. All variables are in natural logs. The sample includes 2,432 observations from 111 EMDE countries over 1970–2020 (unbalanced panel).

#### 3.1.1. Core explanatory variable: adjusted trade share

Our main explanatory variable is trade openness, conventionally measured by the trade-to-GDP ratio —the sum of exports and imports divided by GDP. However, this standard measure is biased by the domestic economy size. To address this concern, this paper adopt the approach of [8] and construct an adjusted trade share:

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$$Tradeproxy = \left(\frac{Totaltrade}{GDP}\right) \times \left(\frac{Country'strade}{Worldtrade}\right) \tag{1}$$

where total trade refers to the sum of exports and imports of goods and services. The first term captures conventional trade intensity, while the second term scales it by the country's relative importance in global trade, thereby removing the size distortion. In all regressions, we use the natural logarithm of this adjusted measure.

#### 3.1.2. Control variables

To mitigate omitted variable bias, this paper follow the empirical growth literature and include a set of standard control variables. First, to capture physical capital accumulation, we use gross fixed capital formation as a percentage of GDP, denoted Investment, and take its natural logarithm. Second, we use the secondary school enrollment ratio to proxy human capital (% of total enrollment), also expressed in natural logs. Third, we account for macroeconomic stability by including the inflation rate, (2010 = 100), and take its natural logarithm in all regressions.

### 3.2. Instrumental variables and identification

Estimating the effect of trade on income is complicated by endogeneity arising from reverse causality and omitted variables. To address this concern, we employ an instrumental variables (IV) strategy that relies on external determinants of trade, following [10]. Their approach builds on the gravity literature, using exogenous geographic and trade-related measures to predict trade intensity, thereby satisfying both the relevance and exclusion restrictions.

#### 3.2.1. First-stage specification

The first-stage regression is specified as:

$$\begin{aligned} ln(TradeAdj)_{it} &= \gamma_i + \delta_t + \pi_1 ln(ExpTop5GDP)_{it} + \pi_2 ln(ImpTop5GDP)_{it} \\ &\quad + \pi_3 ln(DistTop5)_{it} + \pi_4 ln(Airfreight)_{i,t-1} \\ &\quad + \phi_1 ln(Invest)_{it} + \phi_2 ln(Human)_{it} + \phi_3 ln(Infl)_{it} + v_{it} \end{aligned} \tag{2}$$

Where variables $\ln(\text{ExpTop5GDP})it$ and $\ln(\text{ImpTop5GDP})it$denote the average GDP of the top five trade memebers,$\ln(\text{DistTop5})it$is the average distance to major trading partners, and $\ln(Airfreight)_{i,t-1}$is lagged air freight capacity.$X_{it}$ is the vector of control variables, while $\mu_i$ *and* $\lambda_t$represent country and time fixed effects. The predicted value$\ln(\text{TradeAdj})it$ is then used in the second-stage regression.

## 4. Methods and results

### 4.1. Ordinary least squares

To examine the causal effect of trade on economic growth, this paper first estimate a baseline ordinary least squares (OLS) regression with individual and time fixed effects. The specification takes the folvlowing form:

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$$\begin{aligned}\ln(GDPpc)_{it} &= \alpha_i + \lambda_t + \beta_1 \ln(TradeAdj)_{it} + \beta_2 \ln(Invest)_{it} \\ &\quad + \beta_3 \ln(Human)_{it} + \beta_4 \ln(Infl)_{it} + \epsilon_{it},\end{aligned} \tag{3}$$

where i indexes countries and t indexes years.The terms$\alpha_i$ $and$ $\lambda_t$denote country and year fixed effects, respectively. The dependent variable is real GDP per capita, and$\ln(\mathrm{TradeAdj})$captures trade openness adjusted for country size and composition. Control variables include investment, human capital, and inflation. Robust standard errors are clustered at the country level throughout the analysis.

Column (1) of Table 2 presents the OLS results. The coefficient on$\ln(\mathrm{TradeAdj})$is positive and statistically significant: a 1% increase in the trade proxy is associated with a 0.194% increase in GDP per capita. While suggestive, these estimates may be biased due to potential reverse causality or omitted variable concerns.

## 4.2. Instrumental variables

To address the endogeneity of trade openness, this paper employs an instrumental variables (IV) approach. The first-stage regression is specified as:

$$\begin{aligned}ln(TradeAdj)_{it} &= \gamma_i + \delta_t + \pi_1 ln(ExpTop5GDP)_{it} + \pi_2 ln(ImpTop5GDP)_{it} \\ &\quad + \pi_3 ln(DistTop5)_{it} + \pi_4 ln(Airfreight)_{i,t-1} \\ &\quad + \phi_1 ln(Invest)_{it} + \phi_2 ln(Human)_{it} + \phi_3 ln(Infl)_{it} + v_{it}\end{aligned} \tag{4}$$

The instruments consist of the GDP-weighted shares of the country's top five export destinations and import origins, the average geographic distance to these partners, and the one-period lagged value of air freight volume. These variables capture exogenous variation in trade costs and foreign demand, satisfying the relevance condition.

The second-stage regression replaces the endogenous trade variable with its fitted value from the first stage:

$$\begin{aligned}\ln(GDPpc)_{it} &= \alpha_i + \lambda_t + \beta_1 \ln\left(\overline{TradeAdj}\right)_{it} + \beta_2 \ln\left(Invest\right)_{it} \\ &\quad + \beta_3 \ln(Human)_{it} + \beta_4 \ln(Infl)_{it} + \epsilon_{it},\end{aligned} \tag{5}$$

The relevance of the instruments is supported by a first-stage F- statistic, well above conventional thresholds for weak instrument concerns. Column (2) of Table 2 reports the IV (2SLS) results.

The IV estimate of$\ln\left(\overline{TradeAdj}\right)_{it}$remains positive and statistically significant, though smaller in magnitude (0.111) than its OLS counterpart. This attenuation is consistent with an upward bias in the OLS estimates due to endogeneity. The IV coefficient implies that a 10% increase in trade openness raises GDP per capita by approximately 1.1%. Regarding control variables, investment is not statistically significant in either specifi- cation. Human capital and inflation are insignificant in the OLS regression but become large and significant in the IV specification, suggesting that measurement error or omitted variables may attenuate their estimated effects in the baseline model.

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Table 2. Trade and growth: EMDE sample (1970-2020)

| | (1)<br>OLS | (2)<br>IV |
|---|---|---|
| ltrade adj | 0.194***<br>(0.0476) | 0.111***<br>(0.0159) |
| linvest | 0.0690 | -0.0272 |
| lhuman | (0.0668)<br>-0.0194 | (0.0511)<br>0.993*** |
| linfl | (0.0838)<br>0.00740 | (0.0336)<br>0.0460*** |
| Constant | (0.00745)<br>6.309***<br>(0.389) | (0.00666)<br>3.185***<br>(0.230) |
| Observations | 2,432 | 2,432 |
| R-squared | 0.864 | 0.594 |
| Number of id | 111 | |
| Country FE | YES | YES |
| Year FE | YES | YES |

Notes: Robust standard errors in paren-theses. Significance levels: *** pi0.01, ** pi0.05, * pi0.1. Regressions include coun- try and year fixed effects.

## 5. Conclusion

This paper restrict the sample to 111 developing countries over the period 1970–2020. This paper constructs instrumental variables by combining the mean GDP of the top trade members with air freight capacity, and use them to examine the causal effect of trade on economic development. The findings indicate that trade has a positive effect on GDP per capita in emerging economies. Specifically, the IV estimates show that a one-unit increase in the trade proxy is associated with a 0.11-unit increase in GDP per capita over the period 1997–2020.

While this paper successfully identifies causal effect of trade on GDP per capita, it does not explore the underlying mechanisms. Several potential channels have been discussed in the literature. For instance, [11] show that trade can induce resource reallocation across industries and drive less efficient firms out of the market, thereby improving aggregate productivity. Alternatively, the positive effect may operate through technology diffusion, as noted by [12], or through investment accumulation, as suggested by [4]. Investigating the exact channels remains an important avenue for future research.

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