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Winners and Losers: The Effect of Trade Openness on Chinese Regional Growth Disparities

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1. Introduction

Since the early 1990s, China has undergone extensive trade liberalisation, leading to a significant reduction in barriers to foreign trade and direct investment. Although these reforms are credited with fuelling economic growth, their distributional effects across provinces with diverse geographies and factor endowments are relatively unexplored. This aspect is crucial, as reforms were primarily aimed at coastal regions.

The traditional Heckscher-Ohlin model (HO) predicts that as a large developing country like China engages in international trade, the real returns to factors in which it is abundantly endowed, namely land and unskilled labour, are amplified. This enhancement in returns would translate into higher income for China's unskilled labourers and smallholder farmers. Given the higher concentration of these factors in the inland provinces as opposed to their coastal counterparts, we would expect the former to benefit more from international trade.

However, empirical evidence contradicts the model's predictions, showing a positive correlation between trade and wage inequality in developing countries (e.g., Freeman and Katz, 1995; Robbins, 1996; Hanson and Harrison, 1999; Orazio et al., 2004; Goldberg and Pavcnik, 2005). Yet, these studies focus on the wage component of income, which does not fully capture income inequality and overlooks the subnational impacts of national trade policies. Meanwhile, cross-country regression analyses (e.g., Spilimbergo et al., 1999; Dollar and Kraay, 2004; Anderson, 2005; Jakobsson, 2006) have been criticised for their lack of data compatibility and difficulty in controlling for institutional differences. To address these challenges, this paper focuses on variations across provinces within a single country—China. Using provincial-level data, we analyse how national trade openness generates divergent growth trajectories across provinces.

China is an appropriate case study due to its large sample size of 31 provinces and comprehensive data from 1992 to 2020. The country's centralised institutions and relative cultural homogeneity across regions help mitigate the omitted variable bias stemming from institutional differences. Our study differs from Han, Liu and Zhang (2010) by using trade

openness as a continuous treatment variable for an extended period, thus providing a more comprehensive picture of trade liberalisation's impact on provincial outcomes.

This paper does not investigate within-region inequality or trade's growth effects but focuses on the role of trade liberalisation in shaping China's inland-coastal inequality. We employ national-level trade openness as our regressor for provincial growth rates to circumvent issues of reverse causality as it is unlikely that national trade policy is dependent on the outcome of a particular province. Also, by interacting trade openness with provincial characteristics including geography and factor endowments, we explore how each province's capacity to benefit from national trade reforms varies.

The paper is structured as follows: Section 2 discusses China's trade liberalisation efforts and the differential exposure of coastal and inland regions. Section 3 outlines the data used and the empirical strategy. Section 4 concludes.

2. The Chinese Trade Liberalisation

Following paramount leader Deng Xiaoping's Southern Tour in 1992, China initiated a wave of trade liberalisation that transformed its economic landscape. In response to his speeches on the importance of "opening up", central and local governments reduced barriers to trade, which ushered in a surge in foreign direct investment (FDI), as shown in Fig. 1. The impetus for reforms grew as China applied for World Trade Organisation (WTO) membership in 1995. It carried out far-reaching trade liberalisation measures, including tariff reductions, dismantling of import substitution lists, and challenging the monopoly power of state trading enterprises. In Fig. 1, the weighted average tariff rate dropped from 32.2% in 1992 to 4.25% in 2006, with imports and exports as a proportion of GDP increasing significantly until the financial crisis.

The post-financial crisis era saw a substantial reversal of trade openness due to the spillover effects of the global trade slowdown. Although the impact on Chinese trade is relatively moderate — China's share of global exports continued to rise from 8% in 2006 to 14.7% in 2020

(UNCTAD, 2021) —the value of imports and exports as a proportion of GDP declined dramatically.

Fig. 2 demonstrates the disparity in exposure to trade liberalisation between coastal and inland provinces. Coastal provinces enjoyed more trade flows and FDI because of their geographical proximity to sea routes, as depicted in Fig. 3. They received preferential treatment from the central government through the Coastal Development Strategy, involving the establishment of special economic zones with flexible governmental measures and market-oriented policies to attract foreign investments (Zhou and Song, 2016). Between 1991 and 2004, 91.2% of trade and 84.7% of FDI were concentrated in coastal provinces (Fujita and Hu, 2001).

This paper investigates how these differences in exposure translate into provincial outcomes. We categorise provinces as inland or coastal as geography is exogenous to growth outcomes. This classification also addresses the renewed interest in China's inland-coastal inequality. Considering that the coastal regions attracting the most trade and investments are considerably richer initially, the extent to which inland-coastal growth rates diverged or converged due to trade liberalisation is crucial to overall inequality.

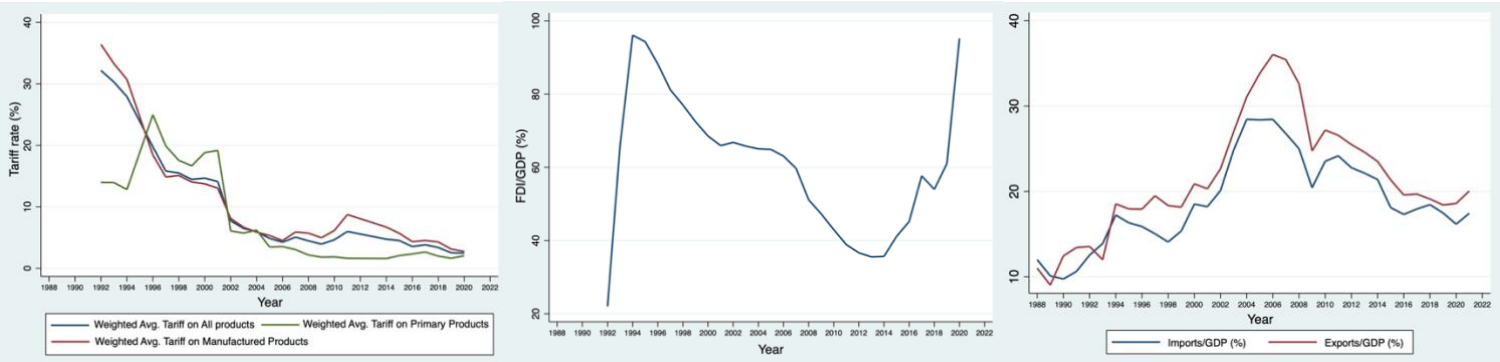

Fig. 1. Openness of the Chinese economy, 1992-2020. Trade and tariff data are extracted from the World Bank World Development Indicators and the Chinese Statistical Year Books. Chongqing is excluded from the FDI calculations due to missing data.

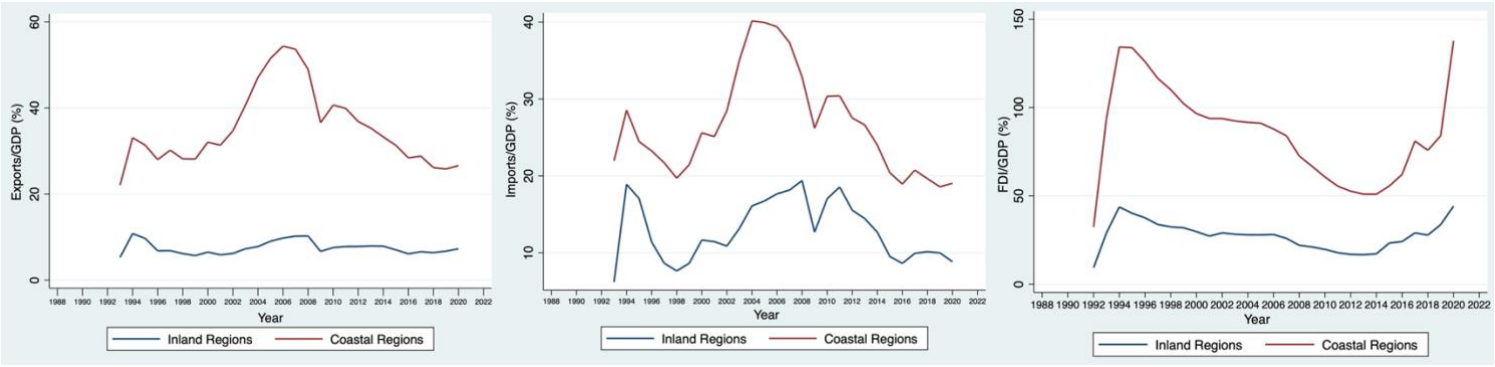

Fig. 2. Differential exposure to trade liberalisation between inland and coastal regions. Data is extracted from the Chinese Statistical Year Books. Chongqing (an inland province) is excluded from the calculations.

Fig. 3. Coastal provinces of China.

3. Empirical Analysis

Provincial and national-level variables are obtained from the Chinese Statistical Yearbooks and the World Bank World Development Indicators (WDI). The selection and measurement of control variables, including the method for addressing missing entries in provincial population data, are detailed in the appendix. We employ both incidence-based and outcome-based measures of trade openness, specifically, the GDP share of total trade (exports plus imports) and the weighted average tariff on manufactured products.

a. Overview of Inland-Coastal Inequality in China

Fig. 3 highlights a persistent disparity in higher education coverage and capital stock per capita between coastal and inland provinces throughout the examined period, indicating resource concentration in coastal areas. In contrast, inland provinces possess a growing advantage in irrigable land per capita. Despite the striking disparity in endowments, Fig. 4 shows similar GRP per capita growth rates for both regions from 1992-2020.

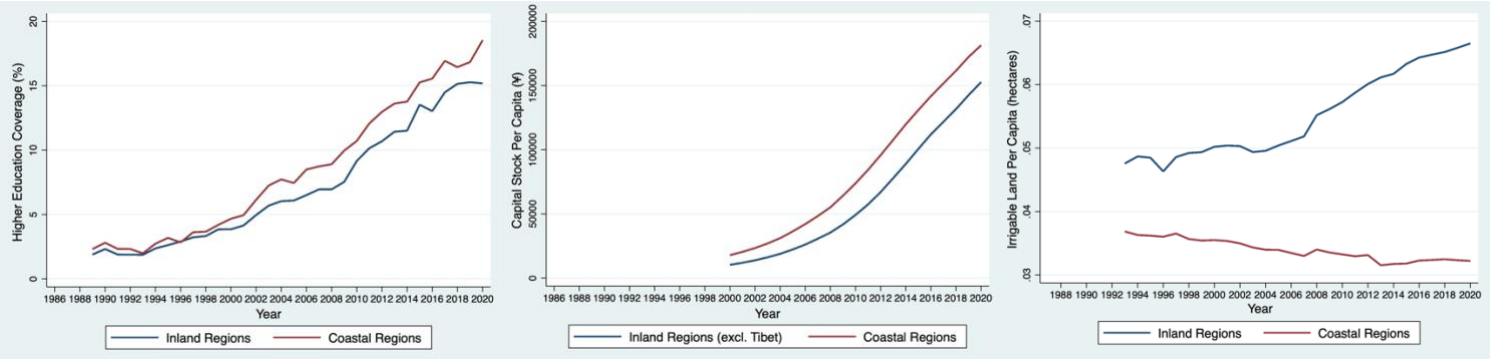

Fig. 3. Simple averages of factor endowments. Figures are aggregated over inland and coastal provinces respectively for each year. Owing to limitations in data availability, the data on capital stock is retrievable only from 2000 onwards, while Tibet has been excluded from the calculations.

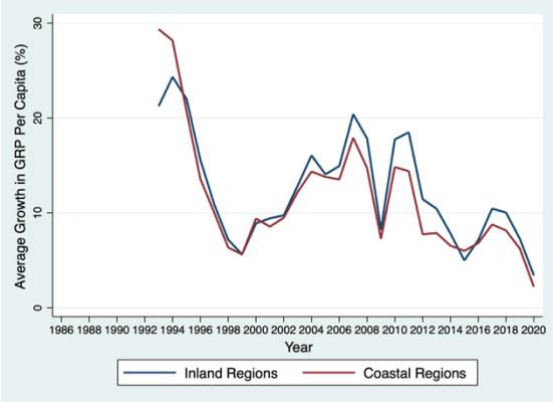

Fig. 4. Simple averages of provincial growth rates.

b. Identification Strategy

Our empirical strategy exploits the time variation arising from national-level trade policy and regional variation arising from differential exposure and endowments to study the divergent effect of trade on provincial growth rates. The baseline specification takes the following form:

$$\Delta \ln (GRP\_pc_{it}) = \beta_0 + B_1 Coastal_i + B_2 Openness_t + \beta_3 Coastal_i \times Openness_t + \varphi X_{it} + \delta Y_t + \varepsilon_{it}$$

where $\Delta \ln (GRP\_pc_{it})$ represents the change in GRP per capita. $Coastal_i$ is a dummy that equals 1 if province i belongs to the 11 coastal provinces indicated in Fig. 3. $Openness_t$ represents national trade openness. Due to China's highly centralised trade policy, guided by the Chinese Communist Party and implemented by central government agencies, trade openness is unlikely to depend on a specific province's growth rate.

The interaction term coefficient, β_3, captures the differential impact of trade openness on economic growth between inland and coastal provinces. If the HO model holds, β_3 should be negative, indicating that trade reduces inland-coastal inequality in China.

We include control variables for national characteristics, including GDP per capita growth, CPI inflation, arable land per capita, per capita gross capital formation, and higher education coverage, and provincial-level variables, like past period CPI inflation, log GRP per capita, irrigable land per capita, and higher education coverage. Robust standard errors are clustered at the provincial level.

Table 1

Regression results.

	Baseline				Alternative openness measure:		
					Using average tariff on manufactured products		
	No Controls	National controls	National & provincial controls		No Controls	National controls	National & provincial controls
	(1)	(2)	(3)		(4)	(5)	(6)
Coastal	0.039*** (0.014)	0.039 *** (0.014)	0.030** (0.013)	Coastal	-0.029*** (0.005)	-0.029*** (0.005)	-0.033*** (0.004)
Cn_openness	0.149*** (0.019)	0.081*** (0.029)	0.046 (0.030)	Cn_tariff	0.003*** (0.000)	-0.002*** (0.001)	-0.002** (0.001)
Coastal x Cn_openness	-0.109*** (0.031)	0.109*** (0.031)	-0.103*** (0.030)	Coastal x Cn_tariff	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)
Cn_GDP_pc_growth		-0.806*** (0.059)	0.871*** (0.057)	Cn_GDP_pc_growth		0.866*** (0.056)	0.872*** (0.048)
Cn_inflation		-0.001 (0.001)	-0.002*** (0.001)	Cn_inflation		-0.002* (0.001)	-0.002** (0.001)
Cn_land_pc		-0.295 (2.018)	-0.092** (0.034)	Cn_land_pc		2.312 (1.712)	3.162 (2.108)
Cn_capital_pc		0.000** (0.000)	0.000 (0.000)	Cn_capital_pc		0.000** (0.000)	0.000* (0.000)
Cn_higher_edu		-0.639** (0.283)	-0.185 (0.263)	Cn_higher_edu		-0.439 (0.286)	-0.208 (0.279)
Lag_inflation			0.088* (0.046)	Lag_inflation			0.033 (0.050)
Log_GRP_pc			0.015*** (0.004)	Log_GRP_pc			0.011*** (0.004)
Land_pc			-0.092** (0.034)	Land_pc			-0.118*** (0.039)
Higher_edu			-0.174*** (0.033)	Higher_edu			-0.147*** (0.026)
	Alternative exposure variable:				Sources of provincial growth divergences:		
	Using provincial per capita trade				Using factor endowments		
	No Controls	National controls	National & provincial controls		No Controls	National controls	National & provincial controls
	(7)	(8)	(9)		(10)	(11)	(12)
Log_trade_pc	0.0234*** (0.003)	0.023*** (0.003)	0.016*** (0.003)	Log_GRP_pc	-0.100*** (0.015)	0.036*** (0.008)	0.033*** (0.009)
Cn_openness	0.593*** (0.056)	0.526*** (0.057)	0.472*** (0.060)	Land_pc	-0.748* (0.399)	-0.357*** (0.113)	-0.369*** (0.105)
Log_trade_pc x Cn_openness	-0.061*** (0.007)	-0.061*** (0.007)	-0.059*** (0.007)	Higher_edu	-0.025 (0.044)	-0.128** (0.046)	-0.123** (0.045)
Cn_GDP_pc_growth		0.806*** (0.059)	0.834*** (0.056)	Log_GDP_pc x Cn_openness	0.190*** (0.039)	-0.068*** (0.021)	-0.063*** (0.022)
Cn_inflation		-0.001 (0.001)	-0.002** (0.001)	Land_pc x Cn_openness	1.537 (0.914)	0.735** (0.313)	0.753** (0.301)
Cn_land_pc		-2.946 (2.018)	2.829 (2.292)	Higher_edu x Cn_openness	-0.000 (0.002)	-0.006*** (0.001)	-0.005*** (0.001)
Cn_capital_pc		0.00 ** (0.00)	0.00 (0.00)	Cn_openness	-1.707*** (0.350)	0.660*** (0.197)	0.593*** (0.203)
Cn_higher_edu		-0.639** (0.283)	-0.309 (0.262)	Cn_GDP_pc_growth		0.841*** (0.062)	0.919*** (0.059)
Lag_inflation			0.052 (0.044)	Cn_inflation		-0.002** (0.001)	-0.003*** (0.001)
Log_GRP_pc			0.028*** (0.006)	Cn_land_pc		14.130*** (2.263)	2.359 (2.062)

	-0.083***		0.000***	0.00**
Land_pc	(0.029)	Cn_capital_pc	(0.000)	(0.00)
	-0.091**		-0.599**	-0.274
Higher_edu	(0.039)	Cn_higher_edu	(0.284)	(0.253)
				0.098**
		Lag_inflation		(0.043)

Notes: The dependent variable is change in log GRP per capita. All variables with "Cn" are national-level variables, while others are provincial-level variables. Regression coefficients are reported with robust standard errors, clustered at the provincial level, in parentheses.

*** Denotes significance at 1% level.
** Denotes significance at 5% level.
* Denotes significance at 10% level.

c. Results

Columns (1)–(3) of Table 1 reveal strong evidence that trade openness reduces inland-coastal inequality, with the interaction term significant at the 1% level. This indicates that coastal provinces benefit less from national trade liberalisation in terms of GRP per capita growth.

One possible explanation for this observed convergence could be the higher initial GRP per capita of coastal provinces. The Solow-Swan model suggests lower returns to capital and slower economic growth for these provinces. Our finding is still meaningful in this context as it compares the marginal benefit (measured by GRP per capita growth) between inland and coastal provinces originating from increased national trade openness.

Our finding is robust to the adoption of an alternative measure of trade openness – the weighted average tariff on manufactured products – (replacing $Openness_t$) in Columns (4)–(6), and the use of an alternative exposure variable – provincial per capita trade – (replacing $Coastal_i$) in columns (7)–(9).

In columns (10)–(12), we explore how factor endowments affect provinces' capacity to benefit from trade liberalisation by augmenting $Coastal_i$ with a vector of higher education coverage, log GRP per capita (proxy for capital per capita), and irrigable land per capita. Results indicate that provinces with more land, less human capital, and less physical capital benefit more, which corresponds to the relative endowments of inland provinces, as illustrated in Fig. 3. This lends support to the HO model.

4. Conclusion

Using Chinese provincial and national data from 1992-2020, this study examines the impact of trade liberalisation on inland-coastal growth rates, testing the HO model in a large, labour-abundant developing country context. Results show that trade openness reduces inland-coastal inequality, with inland provinces benefiting more from increased national trade openness. This finding aligns with the HO model and differs from some cross-country (e.g., Spilimbergo et al., 1999; Jakobsson, 2006) and single-country studies (e.g., Han, Liu, and Zhang, 2010). However, generalising results to other countries and time periods requires caution, considering China's unique economic context and potential shifts in relative endowments and economic structures.

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Appendix

1. *Sources of data*

Source	Variables used
Chinese Statistical Yearbooks – downloaded from the Chinese National Bureau of Statistics: https://data.stats.gov.cn/english/	• Provincial GRP • Provincial CPI inflation • Provincial irrigable land per capita • Provincial population • Provincial higher education coverage • Provincial value of exports and imports • National higher education coverage
World Bank World Development Indicators: https://databank.worldbank.org/source/world-development-indicators	• National Chinese GDP share of total trade (exports plus imports) • National weighted average tariff on manufactured products • National GDP • National arable land • National gross capital formation • National CPI inflation

2. *Measures of Trade Openness*

There are two forms of measurement for trade openness – *incidence-based measures*, which are policy or legal measures like tariffs, and *outcome-based measures*, which are based on the actual volume of trade (Spilimbergo et al., 1999). Calderón et al. (2005) pointed out that outcome-based measures of openness could better capture the structural characteristics of the economy, such as size, natural and social endowments, and public infrastructure. These measures reflect the economy's actual contact with international markets. The standard measure of outcome is the GDP share of total trade (exports plus imports).

To make our analysis as robust as possible we also use the weighted average tariff on manufacturing products as an incident-based measure of openness, following Edwards (1997). Due to the lack of availability of other established measures of openness, such as the Sachs and Warner Openness Index and the Average Black Market Premium for China during the period spanning 1992-2020, we confine ourselves to using solely these two measures.

3. Measurement of Provincial Population and Controls

Annual data for provincial population is accessible on the NBS site only from 2000 onwards. Prior to 2000, data is reported once every ten years. To address the missing entries for the period between 1991 and 1999, we employ the following formula:

$$pop_{i,t} = \left(\frac{pop_{i,2000}}{pop_{i,1990}}\right)^{\frac{t-1990}{10}} \times pop_{i,1990}$$

where $pop_{i,t}$ represents the population of province i at time t (i.e., $1991 \leq t \leq 1999$), $pop_{i,1990}$ denotes the population of province i in 1990, and $pop_{i,2000}$ signifies the population of province i in 2000. This formula assumes constant population growth rates for all provinces. Population affects the calculation of GDP per capita and our control variables.

Similarly, data for provincial capital stock is available only from 2000 onwards. Following Jakobsson (2006), we employ log GDP per capita as a proxy for the capital/labour ratio. On the other hand, land abundance is proxied by effective irrigation area, which measures cultivated land area that has a certain water source, relatively flat terrain, and matching irrigation facilities or equipment, and can be normally irrigated under normal conditions (NBS, n.d.). Furthermore, we use higher education coverage as a proxy for skills, measured by the proportion of total provincial population with higher education.

4. Regression Output

Variable name in Stata	Meaning

c_log_grp_pc	Change in log GRP per capita
coastal	Dummy to indicate coastal regions
china_openness	(Exports + Imports)/GDP for China
coastal_cn_openness	coastal*china_openness
china_tariff	Weighted average tariff rate on manufactured products
coastal_cn_tariff	coastal*china_tariff
china_inf	CPI inflation for China
china_gdp_pc_growth	Growth in GDP per capita for China
china__land_pc	Arable land per capita for China
china_capital_pc	Per capita gross capital formation for China
china_higher_edu	Higher education coverage for China
higher_edu	Provincial higher education coverage
land_pc	Provincial land per capita
log_grp_pc	Provincial log GRP per capita
lag_inflation	Provincial CPI inflation in the past period
higher_edu_cn_openness	higher_edu*china_openness
land_pc_cn_openness	land_pc*china_openness
capital_pc_cn_openness	log_grp_pc*china_openness
log_trade_pc	Log of provincial per capita trade
log_trade_pc_cn_openness	log_trade_pc*china_openness

Baseline regression without controls:

```
. reg c_log_grp_pc coastal_cn_openness china_openness coastal, vce(cluster province)

Linear regression                               Number of obs     =        868
                                                F(3, 30)          =      22.28
                                                Prob > F          =     0.0000
                                                R-squared         =     0.0411
                                                Root MSE          =     .06394

                                  (Std. err. adjusted for 31 clusters in province)
------------------------------------------------------------------------------
             |               Robust
  c_log_grp_pc |      Coef.   Std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
coastal_cn_openness |  -.108797   .0312629    -3.48   0.002    -.1726444   -.0449496
     china_openness |   .1490823   .0188829     7.90   0.000     .1105181    .1876464
           coastal |    .038757   .0136726     2.83   0.008     .0108338    .0666801
             _cons |   .0596217   .0080186     7.44   0.000     .0432456    .0759978
------------------------------------------------------------------------------
```

Baseline regression with national controls:

```
.  reg c_log_grp_pc coastal_cn_openness china_openness coastal china_inf china_gdp_pc_growth china_land_pc china_capital_pc china_higher_edu, vce(cluster province)

Linear regression                               Number of obs     =        868
                                                F(8, 30)          =     128.66
                                                Prob > F          =     0.0000
                                                R-squared         =     0.7626
                                                Root MSE          =      .0319

                                   (Std. err. adjusted for 31 clusters in province)
------------------------------------------------------------------------------
             |               Robust
c_log_grp_pc |      Coef.   Std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
coastal_cn_~s |   -.108797   .0313538    -3.47   0.002    -.1728299    -.044764
china_openness |   .0813925   .0285861     2.85   0.008     .0230118    .1397731
     coastal |    .038757   .0137123     2.83   0.008     .0107527    .0667613
   china_inf |   -.001027   .0008013    -1.28   0.210    -.0026635    .0006094
china_gdp_pc_~h |   .8061415   .0589367    13.68   0.000     .6857767    .9265063
china_land_pc |  -.2945846   2.017798    -0.15   0.885    -4.415478    3.826309
china_capital_pc |   2.45e-06   1.01e-06     2.43   0.021     3.90e-07    4.50e-06
china_higher_edu |  -.6385974   .2830187    -2.26   0.031    -1.216599    -.060596
       _cons |    .032968   .2062001     0.16   0.874    -.3881488    .4540848
------------------------------------------------------------------------------
```

Baseline regression with national and provincial controls:

```
. reg c_log_grp_pc coastal_cn_openness china_openness coastal higher_edu log_grp_pc land_pc lag_inflation china_inf china_gdp_pc_growth china_land_pc china_capital_pc chi
> na_higher_edu, vce(cluster province)

Linear regression                               Number of obs     =        858
                                                F(12, 30)         =     181.87
                                                Prob > F          =     0.0000
                                                R-squared         =     0.7834
                                                Root MSE          =     .03027

                                   (Std. err. adjusted for 31 clusters in province)
------------------------------------------------------------------------------
             |               Robust
c_log_grp_pc |      Coef.   Std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
coastal_cn_~s |  -.1033775   .0296842    -3.48   0.002    -.1640008   -.0427542
china_openness |   .0457824   .0297105     1.54   0.134    -.0148946    .1064594
     coastal |   .0295241   .0130371     2.26   0.031     .0028987    .0561495
  higher_edu |  -.1741277   .0327192    -5.32   0.000    -.2409492   -.1073061
  log_grp_pc |   .0153023   .0041567     3.68   0.001     .0068132    .0237914
     land_pc |  -.0921121   .0338504    -2.72   0.011    -.1612438   -.0229804
lag_inflation |   .0877573    .046492     1.89   0.069    -.007192    .1827066
   china_inf |  -.0024813   .0007744    -3.20   0.003    -.0040628   -.0008999
china_gdp_pc_~h |   .8706836   .0571995    15.22   0.000     .7538666    .9875005
china_land_pc |   1.477623   2.224651     0.66   0.512    -3.065722    6.020967
china_capital_pc |   8.98e-07   9.87e-07     0.91   0.370    -1.12e-06    2.91e-06
china_higher_edu |  -.1849338   .2625153    -0.70   0.487    -.7210617     .351194
       _cons |  -.2648663   .2385927    -1.11   0.276    -.7521376     .222405
------------------------------------------------------------------------------
```

Alternative openness measure (average tariff on manufactured products) without controls:

```
. reg c_log_grp_pc coastal_cn_tariff china_tariff coastal, vce(cluster province)

Linear regression                               Number of obs     =        775
                                                F(3, 30)          =     246.32
                                                Prob > F          =     0.0000
                                                R-squared         =     0.2618
                                                Root MSE          =     .05585

                                   (Std. err. adjusted for 31 clusters in province)
------------------------------------------------------------------------------
             |               Robust
c_log_grp_pc |      Coef.   Std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
coastal_cn_~f |   .0022477   .0003631     6.19   0.000     .0015061    .0029892
china_tariff |   .0033062    .000252    13.12   0.000     .0027915    .0038209
     coastal |  -.0287269    .004958    -5.79   0.000    -.0388525   -.0186012
       _cons |   .0892097   .0038125    23.40   0.000     .0814234    .0969959
------------------------------------------------------------------------------
```

Alternative openness measure (average tariff on manufactured products) with national controls:

```
.  reg c_log_grp_pc coastal_cn_tariff china_tariff coastal china_inf china_gdp_pc_growth china_land_pc china_capital_pc china_higher_edu, vce(cluster provin

Linear regression                               Number of obs     =        775
                                                F(8, 30)          =     219.82
                                                Prob > F          =     0.0000
                                                R-squared         =     0.7773
                                                Root MSE          =     .03077

                                   (Std. err. adjusted for 31 clusters in province)
------------------------------------------------------------------------------
             |               Robust
c_log_grp_pc | Coefficient  std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
coastal_cn_~f |   .0022477   .0003643     6.17   0.000     .0015037    .0029916
china_tariff |  -.0021046   .0005285    -3.98   0.000    -.0031839   -.0010253
     coastal |  -.0287269   .0049742    -5.78   0.000    -.0388855   -.0185682
   china_inf |  -.001643   .0008117    -2.02   0.052    -.0033007    .0000147
china_gdp_p~h |    .866421    .055544    15.60   0.000      .752985    .9798569
china_land_pc |   2.31186   1.712089     1.35   0.187    -1.184692    5.808412
china_capit~c |  2.26e-06   9.14e-07     2.47   0.019     3.92e-07    4.12e-06
china_higher~u |  -.4392944   .2858047    -1.54   0.135    -1.022985    .1443967
       _cons |  -.171315   .1672477    -1.02   0.314    -.5128804    .1702503
------------------------------------------------------------------------------
```

Alternative openness measure (average tariff on manufactured products) with national and provincial controls:

```
. reg c_log_grp_pc coastal_cn_tariff china_tariff coastal higher_edu log_grp_pc land_pc lag_inflation china_inf china_gdp_pc_growth china_land_pc china_capital_pc china_h
> igher_edu, vce(cluster province)

Linear regression                               Number of obs     =        767
                                                F(12, 30)         =     220.04
                                                Prob > F          =     0.0000
                                                R-squared         =     0.7945
                                                Root MSE          =     .02945

                                   (Std. err. adjusted for 31 clusters in province)
------------------------------------------------------------------------------
             |               Robust
c_log_grp_pc | Coefficient  std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
coastal_cn_~f |   .0020693   .0003205     6.46   0.000     .0014147    .0027239
china_tariff |  -.0015952   .0005894    -2.71   0.011    -.0027989   -.0003914
     coastal |  -.0328282   .0037812    -8.68   0.000    -.0405504    -.025106
  higher_edu |  -.1467536   .0259056    -5.66   0.000    -.1996598   -.0938474
  log_grp_pc |   .0111916   .0040036     2.80   0.009     .0030152     .019368
     land_pc |   -.117527    .038646    -3.04   0.005    -.1964527   -.0386012
lag_inflation |   .0332388   .0504977     0.66   0.515    -.0698913    .1363689
   china_inf |  -.0021982   .0008586    -2.56   0.016    -.0039517   -.0004447
china_gdp_p~h |   .8717392   .0482074    18.08   0.000     .7732866    .9701919
china_land_pc |   3.162032   2.108495     1.50   0.144    -1.144089    7.468154
china_capit~c |  1.58e-06   9.10e-07     1.74   0.092    -2.77e-07    3.44e-06
china_higher~u |  -.2084468   .2785365    -0.75   0.460    -.7772943    .3604006
       _cons |  -.3528833   .2172805    -1.62   0.115    -.7966293    .0908627
------------------------------------------------------------------------------
```

Alternative exposure variable (provincial per capita trade) without controls:

```
. reg c_log_grp_pc log_trade_pc_cn_openness china_openness log_trade_pc, vce(cluster province

Linear regression                               Number of obs     =        868
                                                F(3, 30)          =      63.07
                                                Prob > F          =     0.0000
                                                R-squared         =     0.0505
                                                Root MSE          =     .06362

                                   (Std. err. adjusted for 31 clusters in province)
------------------------------------------------------------------------------
             |               Robust
c_log_grp_pc | Coefficient  std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
log_trade_p~s |  -.0607865   .0068239    -8.91   0.000    -.0747228   -.0468501
china_openness |   .5932514   .0558309    10.63   0.000     .4792294    .7072734
log_trade_pc |   .0234233   .0029045     8.06   0.000     .0174915     .029355
       _cons |  -.1126566   .0233892    -4.82   0.000    -.1604236   -.0648895
------------------------------------------------------------------------------
```

Alternative exposure variable (provincial per capita trade) with national controls:

```
. reg c_log_grp_pc log_trade_pc_cn_openness log_trade_pc china_openness china_inf china_gdp_pc_growth china_land_pc china_capital_pc china_higher_edu, vce(cluster provinc
> e)

Linear regression                               Number of obs     =        868
                                                F(8, 30)          =     124.10
                                                Prob > F          =     0.0000
                                                R-squared         =     0.7720
                                                Root MSE          =     .03127

                                   (Std. err. adjusted for 31 clusters in province)
------------------------------------------------------------------------------
             |               Robust
  c_log_grp_pc |      Coef.   Std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
log_trade_pc_cn_openness |  -.0607865   .0068438    -8.88   0.000    -.0747633   -.0468096
          log_trade_pc |   .0234233   .0029129     8.04   0.000     .0174743    .0293723
        china_openness |   .5255617   .0569246     9.23   0.000     .4093061    .6418172
             china_inf |   -.001027   .0008013    -1.28   0.210    -.0026635    .0006094
    china_gdp_pc_growth |   .8061415   .0589367    13.68   0.000     .6857767    .9265063
          china_land_pc |  -.2945848   2.017798    -0.15   0.885    -4.415478    3.826309
       china_capital_pc |   2.45e-06   1.01e-06     2.43   0.021     3.90e-07    4.50e-06
       china_higher_edu |  -.6385973   .2830188    -2.26   0.031    -1.216599   -.0605959
                  _cons |  -.1393103   .2060308    -0.68   0.504    -.5600814    .2814609
------------------------------------------------------------------------------
```

Alternative exposure variable (provincial per capita trade) with national and provincial controls:

```
.  reg c_log_grp_pc log_trade_pc_cn_openness china_openness log_trade_pc higher_edu log_grp_pc land_pc lag_inflation china_inf china_gdp_pc_growth china_land_pc china_cap
> ital_pc china_higher_edu, vce(cluster province)

Linear regression                               Number of obs     =        858
                                                F(12, 30)         =     134.87
                                                Prob > F          =     0.0000
                                                R-squared         =     0.7901
                                                Root MSE          =      .0298

                                   (Std. err. adjusted for 31 clusters in province)
------------------------------------------------------------------------------
             |               Robust
  c_log_grp_pc |      Coef.   Std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
log_trade_pc_cn_openness |  -.0594101   .0071932    -8.26   0.000    -.0741006   -.0447195
        china_openness |   .4719239   .0596552     7.91   0.000     .3500917    .5937562
          log_trade_pc |   .0156888    .003377     4.65   0.000     .0087921    .0225855
            higher_edu |  -.0908774   .0387268    -2.35   0.026    -.1699681   -.0117867
            log_grp_pc |   .0277722    .005863     4.74   0.000     .0157983    .0397462
               land_pc |  -.0828834   .0293209    -2.83   0.008    -.1427646   -.0230022
          lag_inflation |    .052328   .0440696     1.19   0.244    -.0376741    .1423302
             china_inf |  -.0018451   .0007345    -2.51   0.018    -.0033452    -.000345
    china_gdp_pc_growth |   .8337632   .0555078    15.02   0.000     .7204011    .9471252
          china_land_pc |   2.829288   2.292186     1.23   0.227    -1.851981    7.510556
       china_capital_pc |   4.52e-07   9.54e-07     0.47   0.639    -1.50e-06    2.40e-06
       china_higher_edu |  -.3092854   .2623811    -1.18   0.248    -.8451392    .2265683
                  _cons |  -.6097057   .2481667    -2.46   0.020     -1.11653   -.1028817
------------------------------------------------------------------------------
```

Regressions with factor endowments (skills, land, and capital) without controls:

```
. reg c_log_grp_pc higher_edu land_pc log_grp_pc higher_edu_cn_openness land_pc_cn_openness capital_pc_cn_openness china_openness, vce(cluster province)

Linear regression                               Number of obs     =        861
                                                F(7, 30)          =     145.50
                                                Prob > F          =     0.0000
                                                R-squared         =     0.3096
                                                Root MSE          =     .05366

                                   (Std. err. adjusted for 31 clusters in province)
------------------------------------------------------------------------------
             |               Robust
  c_log_grp_pc |      Coef.   Std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
          higher_edu |  -.0245096   .0443604    -0.55   0.585    -.1151055    .0660864
             land_pc |  -.7480054    .398869    -1.88   0.071    -1.562604    .0665937
          log_grp_pc |  -.1003491   .0147679    -6.80   0.000    -.1305092    -.070189
higher_edu_cn_openness |  -.0003911   .0018708    -0.21   0.836    -.0042117    .0034295
   land_pc_cn_openness |   1.536997   .9135228     1.68   0.103    -.3286652     3.40266
capital_pc_cn_openness |   .1902771   .0389394     4.89   0.000     .1107523    .2698019
        china_openness |  -1.706731   .3500593    -4.88   0.000    -2.421648    -.991815
                  _cons |   1.035652   .1334282     7.76   0.000     .7631553    1.308149
------------------------------------------------------------------------------
```

Regressions with factor endowments (skills, land, and capital) with national controls:

```
. reg c_log_grp_pc higher_edu land_pc log_grp_pc higher_edu_cn_openness land_pc_cn_openness capital_pc_cn_openness china_openness china_inf china_gdp_pc_growth china_high
> er_edu china_capital_pc china_land_pc, vce(cluster province)

Linear regression                               Number of obs     =        861
                                                F(12, 30)         =      82.29
                                                Prob > F          =     0.0000
                                                R-squared         =     0.7619
                                                Root MSE          =     .03161

                                   (Std. err. adjusted for 31 clusters in province)
------------------------------------------------------------------------------
             |               Robust
c_log_grp_pc |      Coef.   Std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
  higher_edu |  -.1272348   .0460647    -2.76   0.010    -.2213114   -.0331582
     land_pc |  -.3565183   .1132979    -3.15   0.004    -.5879034   -.1251331
  log_grp_pc |   .0361529   .0080508     4.49   0.000     .0197109    .0525949
higher_edu_cn_openness |  -.0055096   .0010456    -5.27   0.000    -.0076449   -.0033743
land_pc_cn_openness |    .735059   .3131571     2.35   0.026     .0955069    1.374611
capital_pc_cn_openness |  -.0683753   .0212275    -3.22   0.003    -.1117276   -.0250231
china_openness |   .6595071   .1971821     3.34   0.002     .2568075    1.062207
   china_inf |  -.0017622   .0007901    -2.23   0.033    -.0033759   -.0001485
china_gdp_pc_growth |   .8408524   .0616042    13.65   0.000     .7150399     .966665
china_higher_edu |  -.5985793   .2836048    -2.11   0.043    -1.177777   -.019381
china_capital_pc |   3.09e-06   8.84e-07     3.50   0.001     1.29e-06    4.89e-06
china_land_pc |   2.132411   2.033757     1.05   0.303    -2.021075    6.285898
       _cons |  -.5058471    .222921    -2.27   0.031    -.9611126   -.0505817
------------------------------------------------------------------------------
```

Regressions with factor endowments (skills, land, and capital) with national and provincial controls:

```
. reg c_log_grp_pc higher_edu land_pc log_grp_pc higher_edu_cn_openness land_pc_cn_openness lag_inflation capital_pc_cn_openness china_openness china_inf china_gdp_pc_gro
> wth china_higher_edu china_capital_pc china_land_pc, vce(cluster province)

Linear regression                               Number of obs     =        854
                                                F(13, 30)         =     110.82
                                                Prob > F          =     0.0000
                                                R-squared         =     0.7731
                                                Root MSE          =     .03095

                                   (Std. err. adjusted for 31 clusters in province)
------------------------------------------------------------------------------
             |               Robust
c_log_grp_pc |      Coef.   Std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
  higher_edu |  -.1228257   .0452782    -2.71   0.011    -.2152962   -.0303552
     land_pc |  -.3687842   .1053349    -3.50   0.001    -.5839068   -.1536616
  log_grp_pc |   .0327252   .0085318     3.84   0.001     .0153009    .0501494
higher_edu_cn_openness |  -.0049268   .0009828    -5.01   0.000    -.006934   -.0029195
land_pc_cn_openness |   .7534548   .3011034     2.50   0.018     .1385195     1.36839
lag_inflation |   .0980513   .0432259     2.27   0.031     .0097723    .1863303
capital_pc_cn_openness |  -.0632234   .0217581    -2.91   0.007    -.1076595   -.0187873
china_openness |   .5926527   .2025902     2.93   0.006     .1789084    1.006397
   china_inf |  -.0032895   .0008027    -4.10   0.000    -.0049288   -.0016503
china_gdp_pc_growth |   .9191771   .0592113    15.52   0.000     .7982515    1.040103
china_higher_edu |  -.2743846    .252794    -1.09   0.286    -.7906589    .2418897
china_capital_pc |   2.11e-06   8.90e-07     2.37   0.025     2.88e-07    3.92e-06
china_land_pc |   2.358788   2.061865     1.14   0.262    -1.852102    6.569678
       _cons |  -.5077737   .2265281    -2.24   0.033    -.9704057   -.0451417
------------------------------------------------------------------------------
```