How Does Trade Impact Human Development?

Alexander Merdian-Tarko

Bachelor Thesis Seminar on International Trade and Economic Integration (E322)
Summer Term 2016
Peter Eppinger and Wilhelm Kohler

July 6, July

Overview

Felbermayr and Gröschl (2013)

- Research question: Does trade openness increase per capita income?
- 1950 to 2008 panel data analysis
- Comparison of fixed effects regressions and instrumental variable (2SLS) regressions
- Results: Significant positive effect of trade openness on per capita income.

Instrumental Variable Strategy

- Equation (4) of Felbermayr and Gröschl (2013):

$$\ln \bar{y}_\tau^i = \beta OPEN_\tau^i + \pi \ln POP_\tau^i + \sum_{s \leq \tau} \chi_s D_s^i + \nu^i + \nu_\tau + \varepsilon_\tau^i$$

- Estimating equation with OLS is problematic: Endogenous independent variable (in this case $OPEN_\tau^i$)
- $OPEN_\tau^i$ is likely to be correlated with ε_τ^i
- Reasons:
  1. Reverse causality (β biased upwards)
  2. $OPEN_\tau^i$ likely to be a noisy proxy for the true role of trade in the determination of per capita income (β biased downwards)
  3. Omitted variable bias

Instrumental Variable Approach

- Solution: Instrumentation
- Replace endogenous independent variable $OPEN_\tau^i$ with variable that is
  1. exogenous (not correlated with the error term)
  2. relevant (correlated with the endogenous independent variable)
- It is oftentimes difficult to find an appropriate instrument
- Relevance: Can be tested statistically
- Exogeneity: Cannot be tested statistically (Economic theory)

Felbermayr and Gröschl's (2013) Instrument

- Starting point: Natural disasters affect countries' trade flows and have time variation.
  1. They are relevant.
  2. They are exogenous.
- Regression of bilateral trade openness on variables that are truly exogenous to *domestic* GDP per capita
- Exogenous variables: Natural disasters in *foreign* countries and interaction terms of these disasters in *foreign* countries with bilateral geographic variables and population
- Key identifying assumption: *Foreign* natural disasters, bilateral geographic variables, and population have no effect on *domestic* GDP per capita other than through openness.
- Instrument for observed trade openness: Constructed trade openness Ω_τ^i

Motivation

- Idea: There is more to standard of living than only income.
- Important other factors, such as health and education
- Measure for human development: The Human Development Index (HDI)
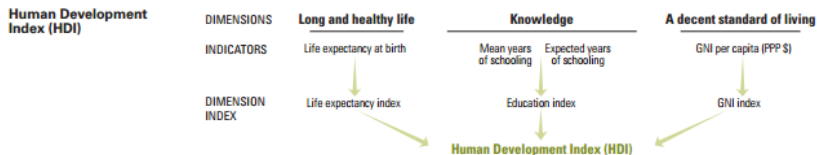- Research question: How does trade openness impact human development?

The Human Development Index

- Not economic growth alone relevant for human development, but also other aspects (i.e., health and education)
- Published annually in United Nations Development Programme's Human Development Reports since 1990
- HDI still does not present a full picture of human development
- Other aspects have to be taken into consideration for a more complete picture as well (inequalities, poverty, human security, empowerment, etc.)

The Human Development Index

- Summary measure of average achievement in key dimensions of human development
- Key dimensions: Long and healthy life, being knowledgeable, and having a decent standard of living
- Geometric mean of normalized indices for each of the three dimensions
- Max: 1; Min: 0

Figure: Composition of the Human Development Index *(Source: United Nations Development Programme Human Development Reports)*

Human Development Index (HDI)			
DIMENSIONS	**Long and healthy life**	**Knowledge**	**A decent standard of living**
INDICATORS	Life expectancy at birth	Mean years of schooling Expected years of schooling	GNI per capita (PPP $)
DIMENSION INDEX	Life expectancy index	Education index	GNI index
		Human Development Index (HDI)	

The Human Development Index

Country	GDP per capita	HDI
Croatia	13475	0.818
Kuwait	43594	0.816
Vietnam	2052	0.666
South Africa	6484	0.666
Moldova	2239	0.693
Papua New Guinea	2268	0.505
Romania	10000	0.793
Gabon	10772	0.684

Table: GDP per capita (in current US dollars, 2014) and HDI (2014) *(Source: United Nations Development Programme's Human Development Report 2015; World Bank's World Development Indicators database 2016)*

Trade and Human Development over Time

Figure: Growth of World HDI from 1980 to 2014 *(Source: United Nations Development Programme HDR Data Tools 2015)*

*World HDI is the mean of all countries' HDI in a given year.
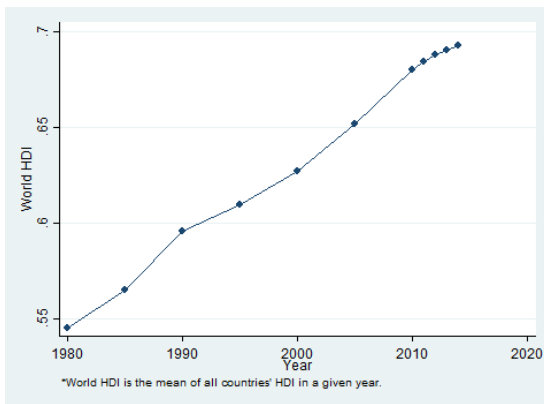
Trade and Human Development over Time

Figure: Growth of Trade in per cent of GDP from 1960 to 2014 *(Source: World Bank's World Development Indicators database 2016)*

Empirical Strategy
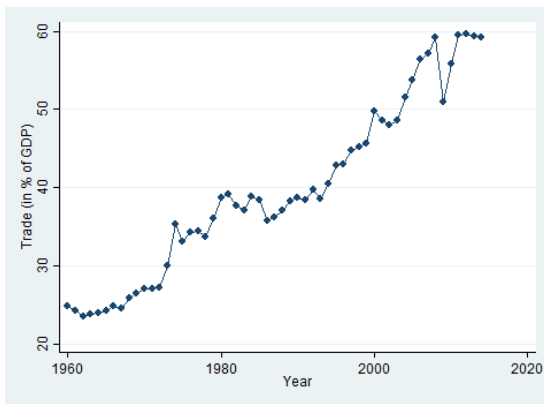
- Ambition: Replication of Felbermayr and Gröschl's (2013) strategy with some modifications.
- Make use of their instrument for predicted trade openness (Constructed openness Ω_τ^i)
- HDI as the dependent variable instead of per capita income
- 1976 to 2010 panel data analysis (shorter period due to data restrictions)
- Comparison of fixed effects regressions and instrumental variable (2SLS) regressions

Empirical Strategy - Instrumental Variable Strategy

- Main regression equation:

$$hdi^i = \beta_1 open_\tau^i + \beta_2 \ln pop_\tau^i + \beta_3 largedisaster_\tau^i$$
$$+ \beta_4 largedisaster_{\tau-1}^i + \nu^i + \nu_\tau + \varepsilon_\tau^i$$

- Slightly modified Felbermayr and Gröschl's (2013) equation (1)
- Equation originates from Frankel and Romer (1999)
- Problems estimating equation with OLS
  1. Serial correlation
  2. Noisy proxy
  3. Omitted variable bias
- Instrumentation solves these issues

Empirical Strategy - 2SLS Regression

- Two-Stage Least Squares regression (OLS regression in both stages)
- Idea: Replace the endogenous independent variable x in the original model with an exogenous variable z to get consistent OLS estimates:
  1. First stage: OLS regression of $open_i^\tau$ on all instrumental variables (preferred instruments: $predictedopen_\tau^i$ and $predictedopen_{\tau-1}^i$); save the fitted values.
  2. Second stage: OLS regression of the original model with the fitted values (for $predictedopen_\tau^i$ and $predictedopen_{\tau-1}^i$) obtained from the first stage instead of using $open_i^\tau$.

Empirical Strategy - 2SLS Regression

- First stage:

$$open_\tau^i = \beta_1 predictedopen_\tau^i + \beta_2 predictedopen_{\tau-1}^i + \beta_3 \ln pop_\tau^i +$$
$$\beta_4 largedisaster_\tau^i + \beta_5 largedisaster_{\tau-1}^i + \nu^i + \nu_\tau + \varepsilon_\tau^i$$

- Second stage:

$$hdi^i = \beta_1 open_\tau^i + \beta_2 \ln pop_\tau^i + \beta_3 largedisaster_\tau^i$$
$$+\beta_4 largedisaster_{\tau-1}^i + \nu^i + \nu_\tau + \varepsilon_\tau^i$$

Regression Analysis

- Three country samples: MRW (93), MRW Intermediate (72), and Full (160) (Mankiw et al., 1992)
- Comparison of fixed effects and IV (2SLS) regressions
- HDI in 5-year intervals from 1980 to 2010 (lagged effect)
- Other variables: 5-year averages from 1976 to 2008
- Exploiting the panel dimension of the data:
    - Country-fixed effects: In order to control for time-invariant observed and unobserved country-specific characteristics.
    - Period-fixed effects: Period dummies in order to control for common period effects.

First Stage

Table: First stage (1976-2008; fixed-effects estimates; 5-year averages)

Dependent variable: Observed openness $open^i_\tau$

	MRW (N=602) (1)	MRW I (N=473) (2)	Full (N=908) (3)
$predictedopen^i_\tau$	0.9628217***	0.8543296**	0.3207436**
	(0.3779759)	(0.3677294)	(0.1361839)
ln pop^i_τ	-29.8676***	-24.65107**	-22.28071**
	(8.255401)	(9.999021)	(10.7907)
$largedisaster^i_\tau$	0.4119091	-0.4342901	0.5113597
	(0.7201711)	(0.5665044)	(0.7343078)
$largedisaster^i_{\tau-1}$	-0.5348332	-0.3902068	-0.2797638
	(0.8182177)	(0.7906113)	(0.6479704)
Countries	93	72	160
R^2	0.61	0.72	0.44

Note: ***, **, * denote significance at the 1%, 5%, and 10% level, respectively.

Second Stage I

Table: Trade Openness and Human Development (1976-2010; fixed-effects estimates; 5-year averages)

Dependent variable: Human Development Index
Instruments: Predicted trade openness and lag of predicted trade openness

	MRW (N=603)		MRW I (N=473)	
	(1) FE	(2) 2SLS	(3) FE	(4) 2SLS
$open_\tau^i$	0.00000529	0.0001703	0.0001721	0.0002985
	(0.0001466)	(0.0004257)	(0.0001479)	(0.0004168)
ln pop_τ^i	-0.0330722*	-0.0274976	-0.0236143)	-0.020327
	(0.0184042)	(0.0226307	0.0196002	(0.0216893)
$largedisaster_\tau^i$	-0.0027311	-0.0027168	-0.0049979**	-0.0048797**
	(0.0025255)	(0.0024588)	(0.002155)	(0.0021763)
$largedisaster_{\tau-1}^i$	0.0005018	0.0005915	0.0021426	0.0021952
	(0.0027455)	(0.0026655)	(0.00286)	(0.0028011)
Countries	93	93	72	72
R^2	0.833	0.832	0.869	0.868

Note: ***, **, * denote significance at the 1%, 5%, and 10% level, respectively.

Second Stage II

Table: Trade Openness and Human Development (1976-2010; fixed-effects estimates; 5-year averages)

Dependent variable: Human Development Index
Instruments: Predicted trade openness and lag of predicted trade openness

	Full (N=908)	
	(5) FE	(6) 2SLS
$open_\tau^i$	0.0001131	-0.0000908
	(0.0000873)	(0.0005007)
$\ln pop_\tau^i$	-0.0187322	-0.0237221
	(0.0122398)	(0.01661103)
$largedisaster_\tau^i$	0.0011019	0.001182
	(0.0016311)	(0.0016465)
$largedisaster_{\tau-1}^i$	0.0027099*	0.002659*
	(0.0015632)	(0.0015951)
Countries	160	160
R^2	0.847	0.843

Note: ***, **, * denote significance at the 1%, 5%, and 10% level, respectively.

Assessing the Instrument's Performance

- Instrument performance:
    1. Partial R^2 (MRW: 0.56; MRW I: 0.65; Full: 0.42)
    2. F-Test on the excluded instruments (MRW: 13.86; MRW I: 12.73; Full: 5.55)
    3. Stock and Yogo (2005) weak ID Test critical values:
        1. 10% critical value: 16.38
        2. 15% critical value: 8.96
        3. 20% critical value: 6.66
        4. 25% critical value: 5.53
    4. Staiger and Stock (1997) threshold: 10

Figure: Table 4 of Felbermayr and Gröschl (2013)

Table 4
Openness and real GDP per capita (1950–2008) (fixed-effects estimates, 5-year averages).

Dependent variable: ln real GDP per capita
Dependent variable (First-stage): observed openness
Instruments: constructed openness (Ω_τ^i, $\Omega_{\tau-1}^i$)

Sample	MRW ($N=919$)		MRW intermediate ($N=736$)		Full ($N=1312$)	
Estimation method	FE	2SLS	FE	2SLS	FE	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)
$OPEN_\tau^i$	0.554***	1.245***	0.635***	1.268***	0.404***	1.763***
	(0.12)	(0.18)	(0.12)	(0.16)	(0.09)	(0.49)
ln POP_τ^i	−0.689***	−0.651***	−0.608***	−0.585***	−0.590***	−0.500***
	(0.10)	(0.11)	(0.10)	(0.11)	(0.10)	(0.13)
D_τ^i	0.003	−0.011	−0.017	−0.031	0.097**	0.074
	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)	(0.05)
$D_{\tau-1}^i$	−0.043	−0.077**	−0.054	−0.081**	0.040	−0.006
	(0.03)	(0.04)	(0.03)	(0.04)	(0.03)	(0.05)
Fixed effects						
Country	Yes	Yes	Yes	Yes	Yes	Yes
Period	Yes	Yes	Yes	Yes	Yes	Yes
Elasticity of income with respect to trade evaluated						
At mean	0.33	0.74	0.38	0.76	0.28	1.23
At median	0.29	0.64	0.33	0.66	0.24	1.06
Countries	94	94	72	72	162	162
R^2	0.944	0.933	0.956	0.949	0.923	0.861
Partial R^2		0.18		0.21		0.04
F-Test on excl. instrument		31.41		34.55		6.99
Stock-Yogo weak ID test		19.93		19.93		6.66
Hansen p-value		0.85		0.88		

Results of Felbermayr and Gröschl (2013)

- Significant positive effect of trade openness on GDP per capita
- Significant negative effect of population of GDP per capita
- Contemporaneous and lagged large natural disasters have no significant effect on GDP per capita
- First stage diagnostics:
    1. Partial R^2 (MRW: 0.18; MRW I: 0.21; Full: 0.04)
    2. F-Test on the excluded instruments (MRW: 31.41; MRW I: 34.55; Full: 6.99)
    3. Hansen p-value (MRW: 0.85; MRW I: 0.88)

Conclusion

- No significant effect of trade openness on human development
- Instrument does not perform perfectly well in the human development context
- Possible explanation: HDI captures three dimension (health, education, and income)
- Instrument performs well for income dimension (as shown by Felbermayr and Gröschl, 2013), but not for the dimensions of health and education
- Further testing, modifying the model, or changing the specifications

References

- Eppinger, P., Potrafke, N., 2015. Did Globalisation Influence Credit Market Deregulation? The World Economy, doi: 10.1111/twec.12282.

- Felbermayr, G. J., Gröschl, J. K., 2013. Natural Disasters and the Effect of Trade on Income: A New Panel IV Approach. European Economic Review, 58, 1, 18-30.

- Frankel, J., Romer, D., 1999. Does trade cause growth? American Economic Review 89(3), 379-399.

- Mankiw, N., Romer, D., Weil, D., 1992. A contribution to the empirics of economic growth. Quarterly Journal of Economics 107 (2), 407-437.

- Schaffer, M. E., 2010. xtivreg2: Stata module to perform extended IV/2SLS, GMM and AC/HAC, LIML and k-class regression for panel data models.
  http://ideas.repec.org/c/boc/bocode/s456501.html

References

- Staiger, D., Stock, J., 1997. Instrumental variables regression with weak instruments. Econometrica 65(3), 557-586.
- Stock, J., Yogo, M., 2005. Testing for Weak Instruments in Linear IV Regression. Cambridge University Press, pp. 80-108.
- Wooldridge, J. M., 2013. Introductory Econometrics: A Modern Approach, Fifth Edition. Copyright 2013, 2009 South–Western, Cengage Learning.

The End