Comments on Frankel and Rose, "Estimating the Effects of Currency Unions on Trade and Output"

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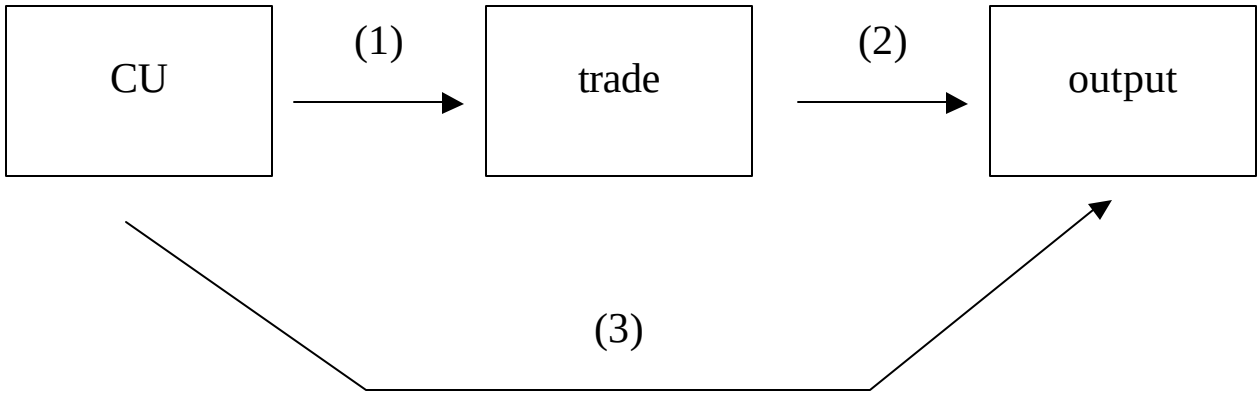
October 28, 2000

The Frankel-Rose hypothesis:



My comments will focus on claims (2) and (3)

Two questions on the econometrics:

1. Do outliers distort the findings?

2. Are exclusion restrictions satisfied for identification?

There are broader conceptual issues behind the second question in particular.

Outliers: Singapore and Hong Kong are clear outliers in the cross-national data set used by the authors.

Three tests:

1. "Ocular inspection":

Stem-and-leaf diagram of *pwtopen* :

```
0** | 13,15,19
0** | 21,22,22,22,25,25,27,27,33,33,34,35,35,35,36,38,39
0** | 41,42,43,43,43,43,43,45,45,46,46,47,47,48,49,49,49,50,50,51, ... (37)
0** | 60,60,60,61,61,62,64,65,65,65,65,67,69,69,69,70,71,73,73,74, ... (28)
0** | 81,83,88,89,90,90,93,96
1** | 04,05,07,08,13,15
1** | 23,24,28,29,30,35,37,37
1** | 42,44,45,54
1** | 72
1** | 94
2** |
2** |
2** |
2** | 63  <----------  HKG
2** |
3** |
3** |
3** |
3** | 73  <----------  SGP
```

Median value for *pwtopen* = 60
St. Dev. = 49

Openness values for Singapore and Hong Kong are 6.4 and 4.1 standard deviations above the median.

2. Hadi test for outliers in multivariate data:

Flags SGP and HKG as outliers in the data set used for levels regressions, and SGP, HKG, and SYC as outliers in the data set used for growth regressions.

3. Covariance-ratio test for influential observations

SGP and HKG produce the largest test statistics (1.7 and 1.3), and lie far beyond the cutoff suggested by Belsley, Kuh & Welsch (1980).

Exclusion restrictions and identification

For an instrument to be valid, it is not enough that it be exogenous.

It must also affect the outcome variable only through the variable that is instrumented.

Example:

True model: $y = \alpha + \beta\ size + \gamma\ trade + \delta\ stuff + u$

Estimated model: $y = \alpha' + \beta'\ size + \gamma'\ trade + v$

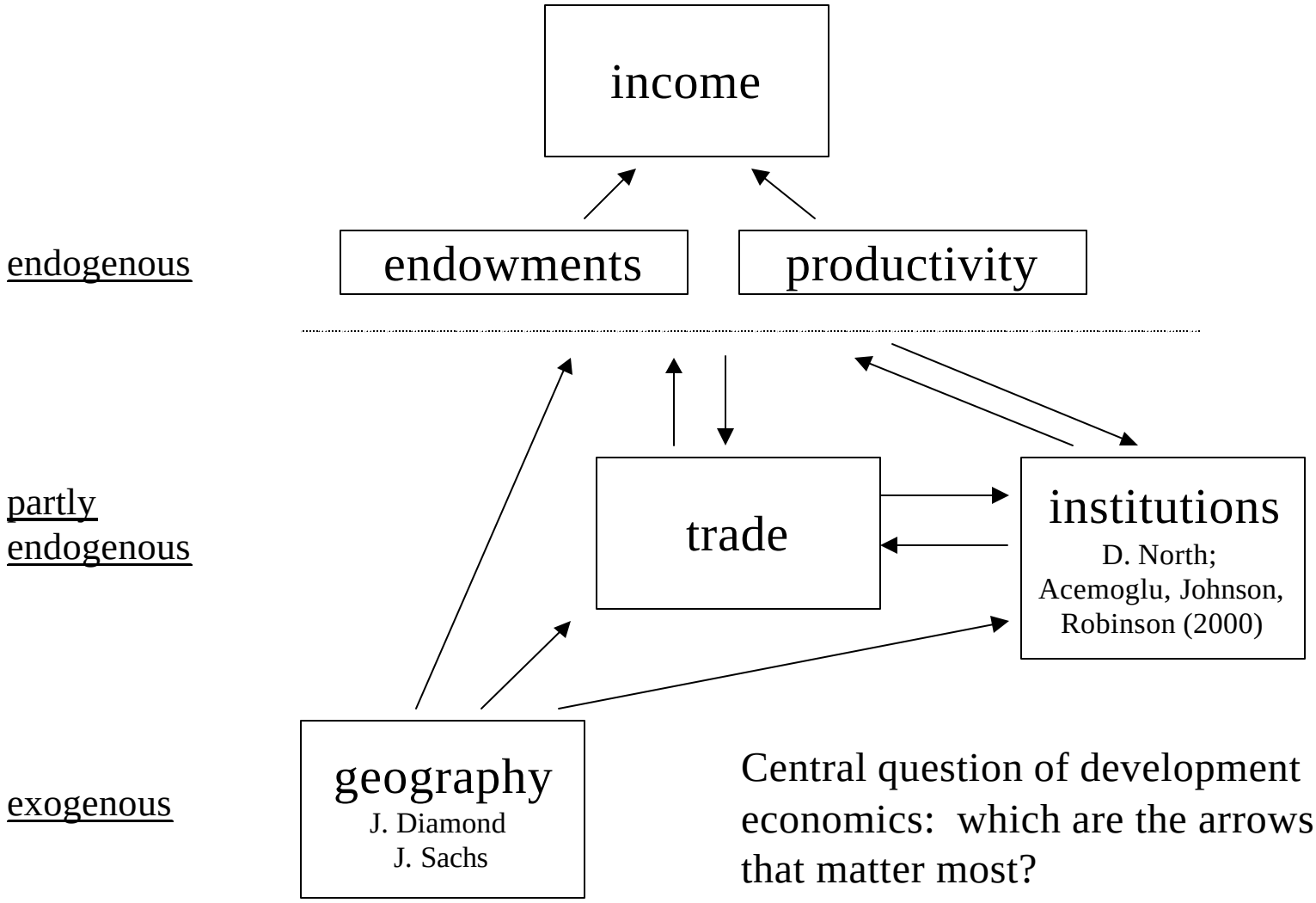
A valid instrument for *trade* must be uncorrelated with *stuff* (conditional on the other independent variables).

The earlier paper by Frankel-Romer (1999) does not pass this test (see Rodriguez and Rodrik, forthcoming).

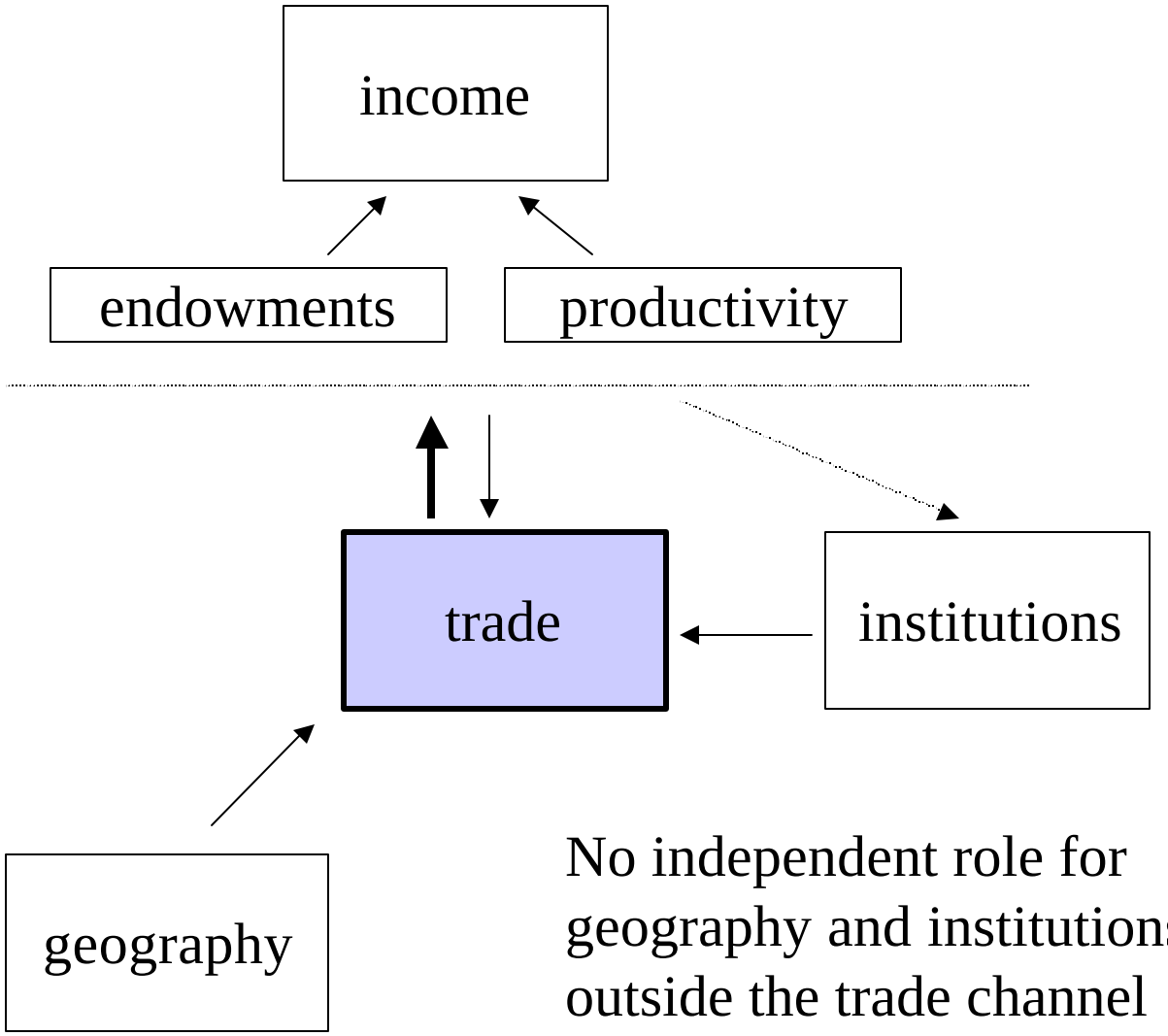
But what is *stuff*?

That is what development economics is about.

All of development economics on one page

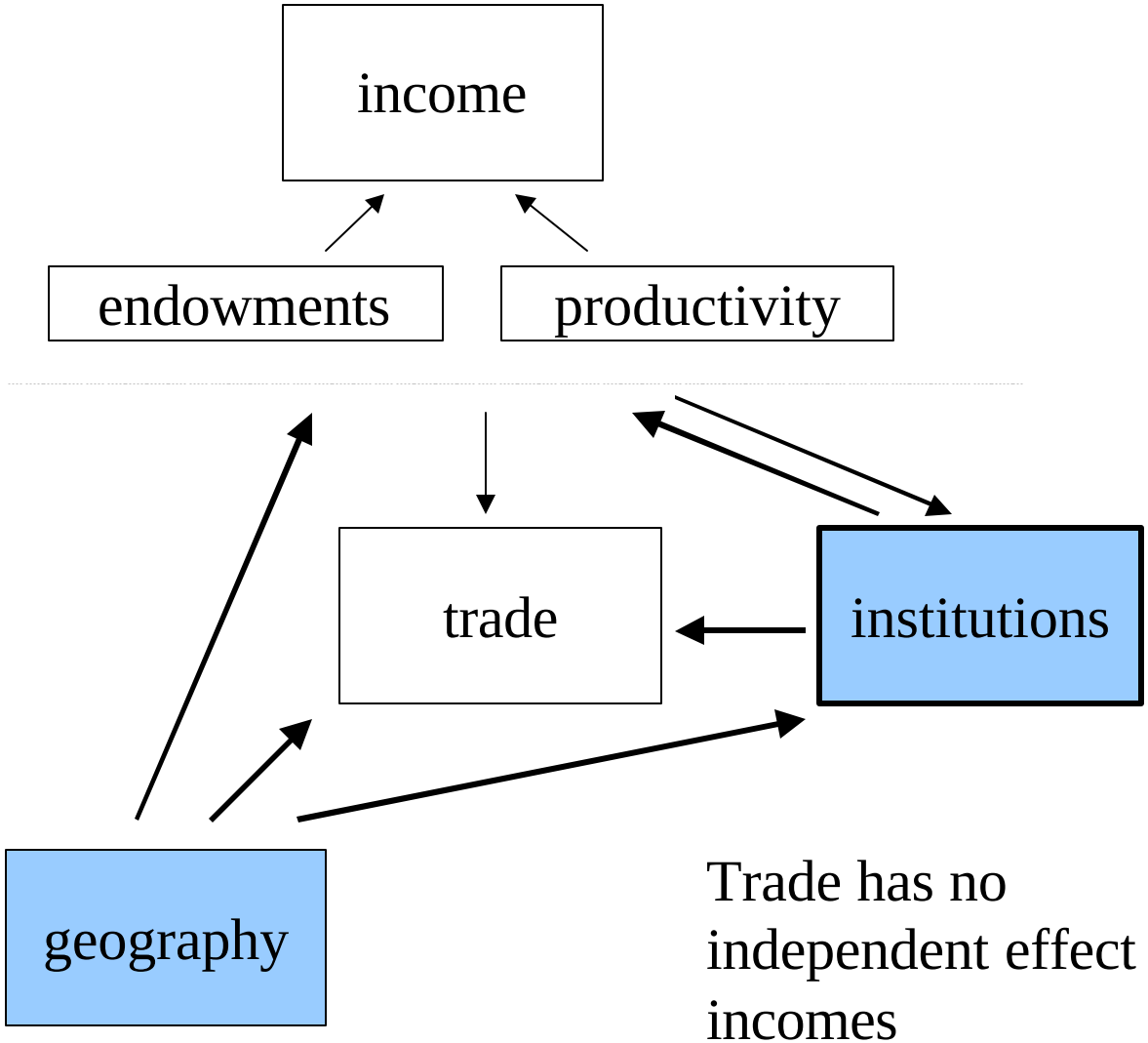


The implicit model in the Frankel-Rose paper



No independent role for geography and institutions, outside the trade channel

An alternative model



Trade has no independent effect on incomes

Embedding the Frankel-Rose regressions in this broader framework.

A. Levels regressions (cf. Table 2 in Frankel-Rose)

Dependent variable: log real GDP/capita in 1990

	Frankel-Rose specification*	Dropping HKG and SGP	Adding institutions and geography	Instrumenting for institutions as well**
	IV	IV	IV	IV
openness	**1.27**	**6.48**	0.18	-1.07
	(1.85)	**(2.27)**	(0.22)	(-0.90)
log population	**0.18**	**0.63**	0.00	-0.22
	(1.82)	**(2.28)**	(0.05)	(-1.46)
log area	0.02	0.14	-0.03	0.03
	(0.22)	(0.17)	(-0.41)	(0.22)
quality of institutions (ICRG index, 0-1 scale)			**2.43**	**3.26**
			(9.72)	**(3.31)**
distance from the equator			0.17	-0.55
			(0.30)	(-0.65)
Sub-saharan Africa			**-1.36**	**-1.22**
			(-5.32)	**(-3.63)**
Latin America			-0.16	-0.07
			(-0.58)	(-0.21)
East Asia			-0.31	0.35
			(-1.24)	(0.72)
number of obs.	107	105	89	50

t-statistics in parentheses (with robust standard errors). Significant coefficients are in bold.

Notes:
* This is almost the same as the results in col. 3 of Table 2 in FR. The differences have to do (presumably) with slight changes in the generation of the instrument.
** Additional instruments used are mortality rates of early colonial settlers and constraints on the executive in 1900, both from Acemoglu, Johnson, and Robinson (2000)

B. Growth regressions (cf. Table 2 in Frankel-Rose)

	Frankel-Rose specification*	Dropping HKG and SGP	Adding geography and institutions	Instrumenting for institutions as well**
	IV	IV	IV	IV
openness	**0.22**	0.29	0.15	-0.14
	(2.97)	(0.99)	(0.41)	(-0.18)
log population	**0.10**	**0.10**	0.01	-0.02
	(1.82)	**(2.63)**	(0.16)	(-0.22)
log area	**-0.06**	-0.05	-0.00	0.00
	(-2.02)	(-1.61)	(-0.08)	(0.06)
log initial income	**0.74**	**0.73**	**0.68**	**0.64**
	(12.72)	**(11.61)**	**(8.20)**	**(2.79)**
investment ratio	**0.013**	**0.013**	0.010	0.005
	(1.95)	**(1.96)**	(1.53)	(0.30)
population growth	-0.04	-0.04	-0.05	-0.12
	(-0.62)	(-0.66)	(-0.74)	(-1.27)
primary schooling	0.002	0.002	0.002	0.005
	(1.20)	(1.03)	(1.08)	(1.22)
secondary schooling	**0.007**	**0.001**	0.007	-0.007
	(2.83)	**(2.82)**	(0.27)	(-1.15)
quality of institutions			**0.59**	1.37
(ICRG index, 0-1 scale)			**(2.31)**	(1.10)
distance from the equator			-0.17	-0.45
			(-0.51)	(-0.95)
Sub-saharan Africa			**-0.55**	**-0.65**
			(-4.04)	**(-2.89)**
Latin America			**-0.30**	**-0.31**
			(-2.44)	**(-2.14)**
East Asia			0.04	0.07
			(0.32)	(0.25)
number of obs.	101	99	87	50

t-statistics in parentheses (with robust standard errors). Significant coefficients are in bold.

Notes:
* This is almost the same as the results in col. 7 of Table 2 in FR. The differences have to do (presumably) with slight changes in the generation of the instrument.
** Additional instruments used are mortality rates of early colonial settlers and constraints on the executive in 1900, both from Acemoglu, Johnson, and Robinson (2000)

Using the alternative instruments for trade (Tables A3-A5) produces very similar results:

1) In growth regressions, estimated coefficient on *trade* is no longer significant (t = 0.97) once HKG and SGP are dropped.

2) In levels regressions, estimated coefficient on *trade* turns negative once controls for institutional quality and geography are introduced.

How do these findings relate to the sensitivity tests reported in the paper?

Outliers: "[When we delete] observations for Luxembourg, Hong Kong, and Singapore from the output equation … in our preferred version of the IV estimation, the results are little affected." (p. 22)

> This is no longer true when controls for geography and institutions are added; nor is it true when *log area* is included, which is left out of the "preferred" specification even though its estimated coefficient is significant when included. (Whether *log area* is included or not makes no difference once geography and institutions are added in.)

Regional dummies: "…our finding is that continental dummies leave the coefficient on trade unchanged [in the growth regressions]." (p. 43)

> Once outliers (SGP and HKG) are excluded, adding continent dummies renders the coefficient on trade insignificant.

The direct effect of CU on output (Table 3)

Estimated coefficients on CU terms:

-1.17 x CU

+ 2.21 x (CU x real GDP of partners inside CU)

Plug in coefficients to estimate the output gain derived from CU membership for each of the CU members in the regression sample:

	d ln y
Benin	-1.17
Cameroon	-1.17
Chad	-1.17
Congo Rep.	-1.17
Cote d'Ivoire	-1.17
Gabon	-1.17
Guinea-Bissau	-1.17
Mali	-1.17
Panama	-0.17
Senegal	-1.16
Togo	-1.16

Taken at face value, Table 3 suggests all of the countries included in the regression sample were worse off for having been a member of a CU.

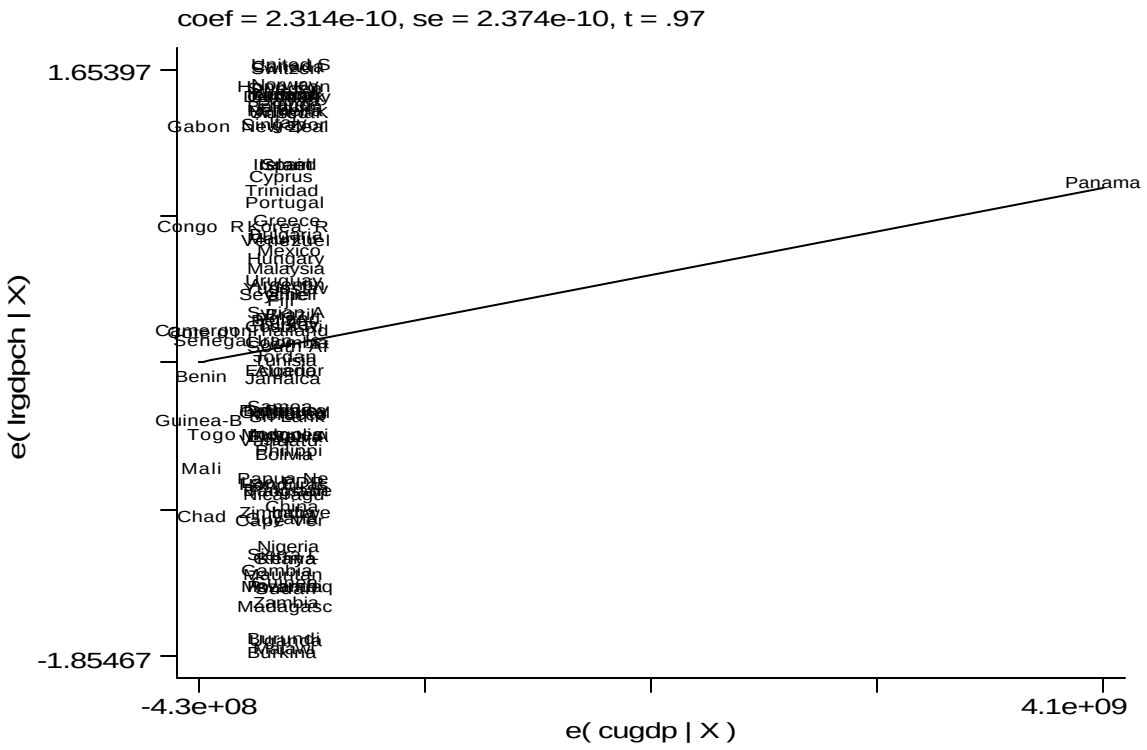
But good reasons not to take Table 3 at face value:

Panama a huge outlier (see partial scatter plot)

Inclusion of regional dummies renders coefficients on all the CU terms completely insignificant.

Which still leaves the question: does CU affect output or not?

Partial scatter plot of inner product term against incomes
(Table 3, col. 3)



Entering CU variable in my preferred output specification

Dependent variable: log real GDP/capita in 1990

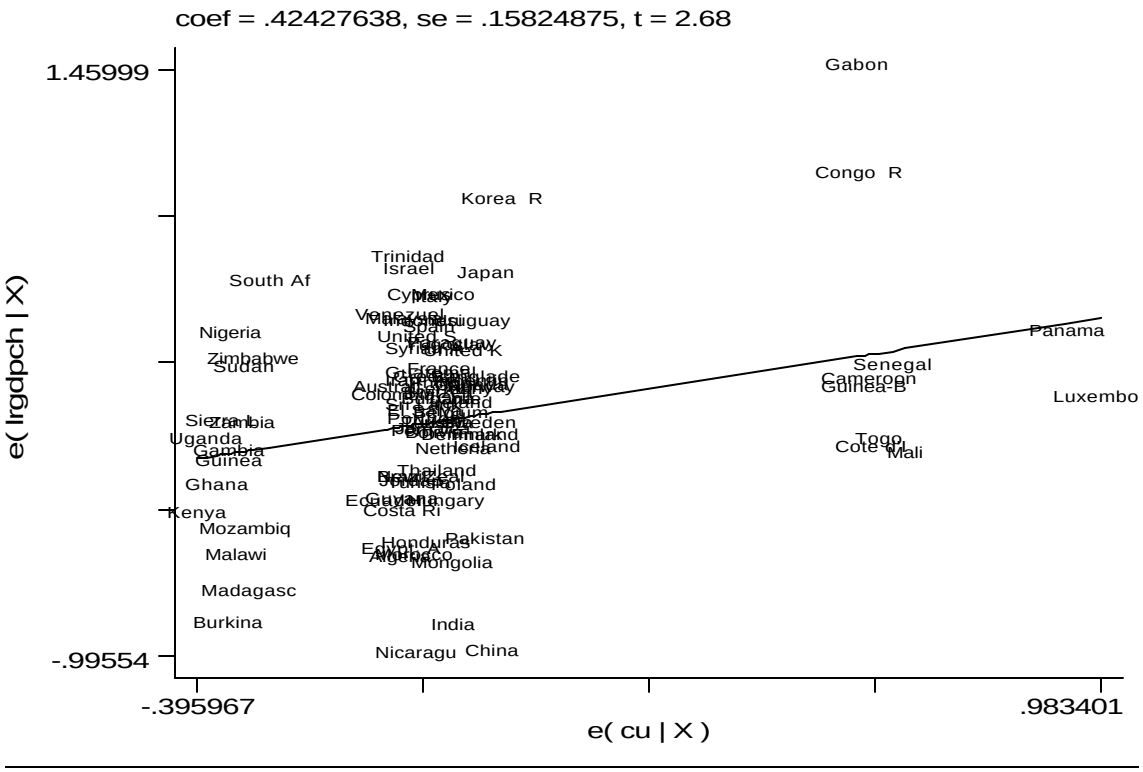
	preferred specification	adding openness	adding inner product term w/ real GDP of CU partners	Instrumenting for institutions*
	OLS	OLS	OLS	IV
quality of institutions (ICRG index, 0-1 scale)	**2.41** **(10.86)**	**2.40** **(10.72)**	**2.43** **(10.80)**	**3.55** **(5.00)**
distance from the equator	0.25 (0.52)	0.25 (0.53)	0.27 (0.56)	0.03 (0.04)
Sub-saharan Africa	**-1.48** **(-7.19)**	**-1.48** **(-7.20)**	**-1.51** **(-7.05)**	**-1.14** **(-4.56)**
Latin America	-0.17 (-0.96)	-0.17 (-0.93)	-0.17 (-0.92)	0.28 (1.34)
East Asia	-0.31 (-1.19)	-0.31 (-1.19)	-0.31 (-1.17)	0.19 (0.53)
CU dummy	**0.42** **(2.44)**	**0.42** **(2.39)**	**0.50** **(2.18)**	**0.59** **(2.46)**
openness		0.02 (0.14)		
inner product of CU and real GDP of CU partners			-2.81e-11 (-0.50)	
number of obs.	91	91	90	50

t-statistics in parentheses (with robust standard errors). Significant coefficients are in bold.

Notes:
* Instruments used are mortality rates of early colonial settlers and constraints on the executive in 1900, both from Acemoglu, Johnson, and Robinson (2000)

CU dummy has an independent positive "effect" on output, but there is no indication that the effect operates through trade. The estimated effect is both statistically and quantitatively significant. See scatter plot.

Partial scatter plot of income against CU dummy
(from column 1 of table on previous page):



Bottom line

- Need to embed tests of trade-income relationship in a broader framework, to properly identify the effects of trade.

- Once that is done, quality of institutions and geographic variables typically trump trade, yielding little evidence that trade has an independent "causal" effect on incomes.

- My preferred reduced-form regressions for income produce some evidence that membership in a CU is associated with higher levels of income (of around 40 percent), but there is no evidence that the operative channel is trade.

- Cross-national regressions tend to be generically non-robust. Question is not whether there exists some specification which makes the results go away, but which of the specifications under consideration are theoretically and econometrically more appropriate.