Economics 270c

Graduate Development Economics

Professor Ted Miguel

Department of Economics

University of California, Berkeley

Economics 270c

Graduate Development Economics

Lecture 2 – January 27, 2009

Lecture 1: Introduction to Economics 270c

- Lecturer: Prof. Ted Miguel

  Email: emiguel@econ.berkeley.edu

  Office hours: Mondays 9-11am, Evans 647

Lecture 1: Introduction to Economics 270c

- Lecturer: Prof. Ted Miguel
  Email: emiguel@econ.berkeley.edu
  Office hours: Mondays 9-11am, Evans 647

- Course assistant: Jonas Hjort (hjort@econ.berkeley.edu)
  Extra sections: Friday 3:30-5pm, Evans 639
  Extra office hours: To be arranged with Jonas

Macroeconomic growth empirics

Lecture 1: Global patterns of economic growth and development (1/20)
Lecture 2: Inequality and growth (1/27)

The political economy of development

Lecture 3: History and institutions (2/3)
Lecture 4: Corruption (2/10)
Lecture 5: Patronage politics (2/17)
Lecture 6: Democracy and development (2/24)
Lecture 7: Economic Theories of Conflict (3/3) – Guest lecture by Gerard Padro
Lecture 8: War and Economic Development (3/10)

Human resources

Lecture 9: Human capital and income growth (3/17)
Lecture 10: Increasing human capital (3/31)
Lecture 11: Labor markets and migration (4/7)
Lecture 12: Health and nutrition (4/14)
Lecture 13: The demand for health (4/21)

Other topics

Lecture 14: Environment and development (4/28)
Lecture 15: Resource allocation and firm productivity (5/5)

Additional topics for the development economics field exam

-- Ethnic and social divisions
-- The Economics of HIV/AIDS

Macroeconomic growth empirics

Lecture 1: Global patterns of economic growth and development (1/20)

Lecture 2: Inequality and growth (1/27)

The political economy of development

Lecture 3: History and institutions (2/3)

Lecture 4: Corruption (2/10)

Lecture 5: Patronage politics (2/17)

Lecture 6: Democracy and development (2/24)

Lecture 7: Economic Theories of Conflict (3/3) – Guest lecture by Gerard Padro

Lecture 8: War and Economic Development (3/10)

Human resources

Lecture 9: Human capital and income growth (3/17)

Lecture 10: Increasing human capital (3/31)

Lecture 11: Labor markets and migration (4/7)

Lecture 12: Health and nutrition (4/14)

Lecture 13: The demand for health (4/21)

Other topics

Lecture 14: Environment and development (4/28)

Lecture 15: Resource allocation and firm productivity (5/5)

Additional topics for the development economics field exam

-- Ethnic and social divisions

-- The Economics of HIV/AIDS

- Prerequisites: Graduate microeconomics, econometrics

- Grading:
  Four referee reports – 40%
  Two problem sets – 20%
  Research proposal – 30%
  Class participation – 10%
  No final exam

- All readings are available online (see syllabus)

- Additional references on syllabus

- Prerequisites: Graduate microeconomics, econometrics
- Grading:
  Four referee reports – 40%
  → First referee report due in class next Tuesday (Feb. 3, 2009)

  Two problem sets – 20%
  Research proposal – 30%
  Class participation – 10%
  No final exam
- All readings are available online (see syllabus)
- Additional references on syllabus

Lecture 2 outline

(1) Course overview

(2) Theories of inequality and growth

(3) Forbes (2000)

(4) Non-parametric estimation

(5) Banerjee and Duflo (2003)

(1) Theories of inequality and growth

- Perotti (1996, *J. of Ec. Growth*) reviews major theories:

1. Investment in education (borrowing constraints)
   (Galor & Zeira 1993, Banerjee & Newman 1994)

2. Endogenous fiscal policy
   (Persson & Tabellini 1994, Alesina & Rodrik 1994)

3. Sociopolitical instability
   (Benhabib & Rustichini 1998, Acemoglu & Robinson 2001)

(1) Theories of inequality and growth

- Perotti (1996, *J. of Ec. Growth*) reviews major theories:

1. Investment in education (borrowing constraints)
   (Galor & Zeira 1993, Banerjee & Newman 1994)

2. Endogenous fiscal policy
   (Persson & Tabellini 1994, Alesina & Rodrik 1994)

3. Sociopolitical instability
   (Benhabib & Rustichini 1998, Acemoglu & Robinson 2001)

4. Fertility (Kremer & Chen 2003, de la Croix & Doepke 2003)

(1) Theories of inequality and growth

- Perotti (1996, *J. of Ec. Growth*) reviews major theories:

1. Investment in education (borrowing constraints)
   (Galor & Zeira 1993, Banerjee & Newman 1994)

2. Endogenous fiscal policy
   (Persson & Tabellini 1994, Alesina & Rodrik 1994)

3. Sociopolitical instability
   (Benhabib & Rustichini 1998, Acemoglu & Robinson 2001)

4. Fertility (Kremer & Chen 2003, de la Croix & Doepke 2003)
5. Worse institutional quality (Banerjee et al 2001, *JPE*)

(1) Banerjee et al (2001, *JPE*)

- Sugar producer cooperatives in Maharashtra, India
- India is world's largest sugar producer
- Study 100 cooperatives from 1971-1993

(1) Banerjee et al (2001, *JPE)*

- Sugar producer cooperatives in Maharashtra, India
- India is world's largest sugar producer
- Study 100 cooperatives from 1971-1993

- The key decision facing cooperatives is the price (*p*) per kilo of sugar to pay out to farmers. All farmers legally must receive the same price
- Retained earnings should be used to invest in production infrastructure (e.g., crushing capacity, roads) but are sometimes diverted to other uses (e.g., religious temples, private schools, fraud) by the cooperative board
- Most producers want high producers, but elites may prefer low prices so they can misuse retained earnings

(1) Banerjee et al (2001, *JPE)*

- Model ideas:

  1. There are constraints on lump-sum side payments between cooperative members

  2. All members are paid the same price for sugar

  3. There are two types of agents in the model, small land owners (with S acres) and large land owners (with B>S acres). The ratio of small to large farmers is called β. They assume large land owners have disproportionate political power within the cooperative, so the vote share of the small farmers is $\lambda(\beta) < \beta$

(1) Banerjee et al (2001, *JPE)*

- Two theoretical effects:

  1. Rent-seeking effect: the more small farmers, the more small farmers to exploit. Increases in β

  2. Control shift effect: the more small farmers, the more control they have over the price. Increases in β

- At intermediate levels of inequality, there is a maximum distortion: prices are lowest and small farmers do worst.

- Impact on yields / efficiency?

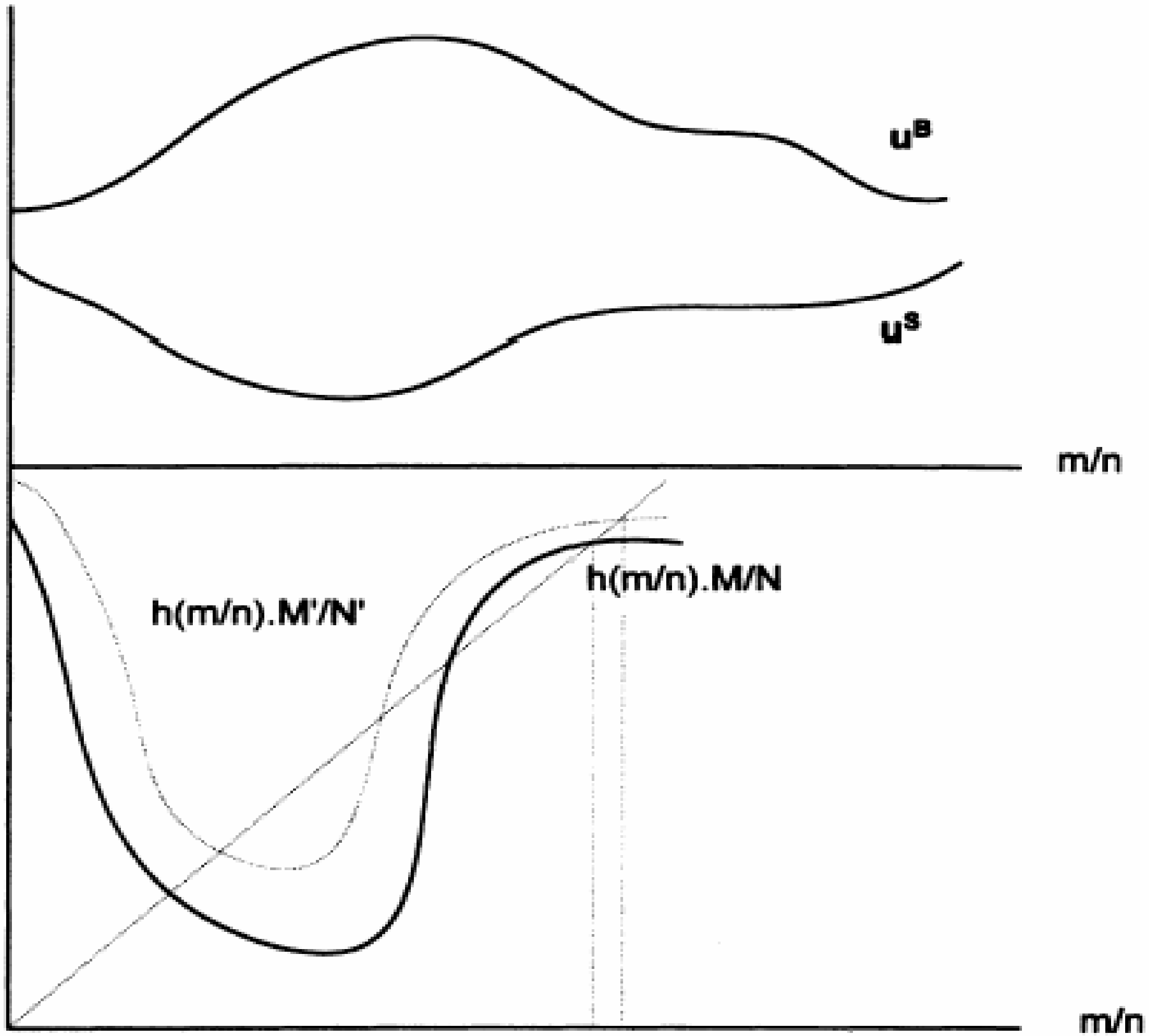


FIG. 1.—Grower payoffs and equilibrium participation rates

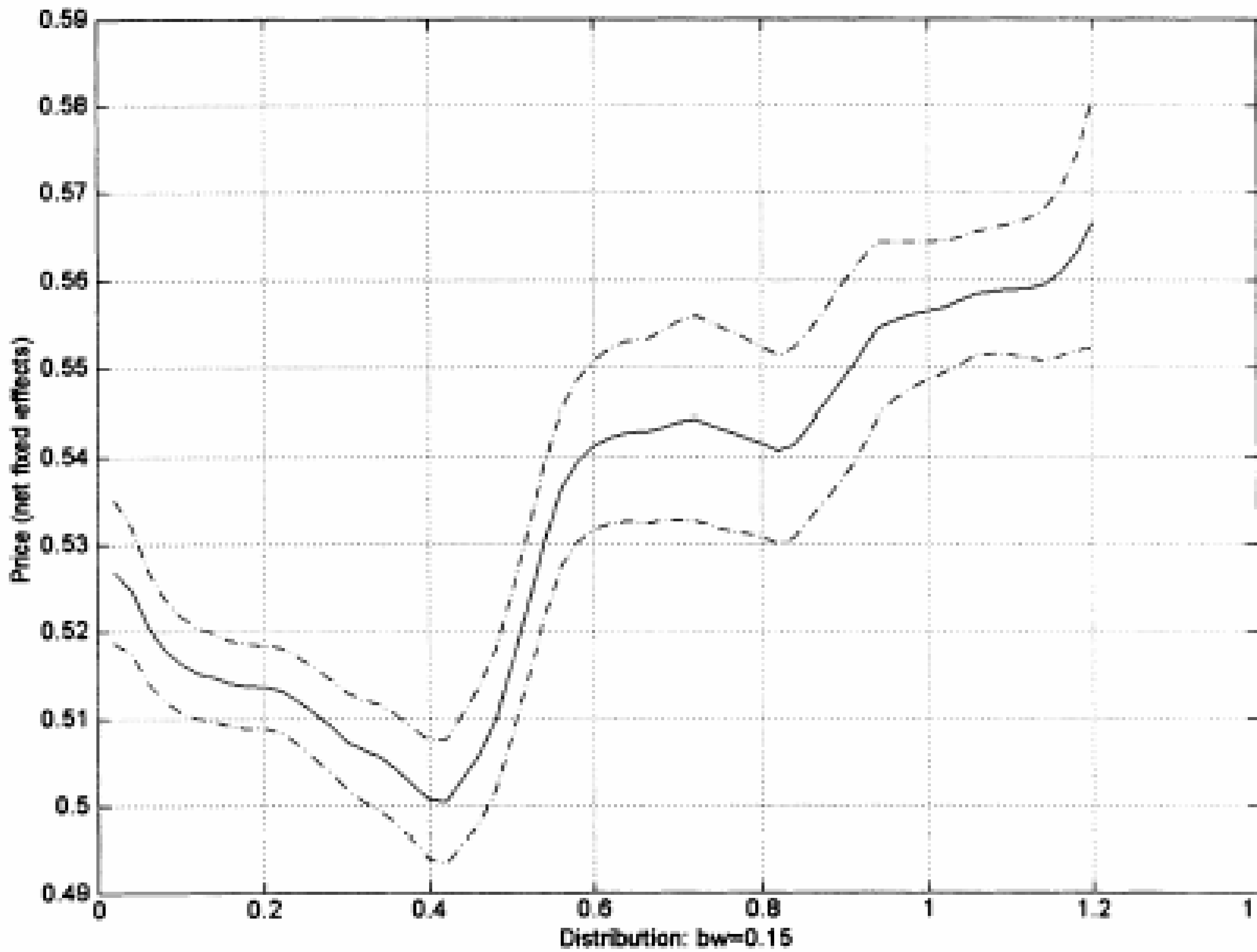


FIG. 4.—Estimated price-distribution relationship

(1) Perotti (1996) empirical results

- Uses older income inequality data that may not be comparable across countries. Deininger and Squire's (1996) dataset became the standard
- His main finding: lagged income inequality is robustly associated with slower per capita income growth over 1960-1985. 1 s.d. increase in inequality

  → 0.6 percentage points faster per capita annual growth

- Which of the theoretical channels is key? He focuses first on the fiscal policy channel, and instruments for the average marginal tax rate using lagged inequality

(1) Perotti (1996) empirical results

- The second stage equation of interest is:

$$GROWTH_i = a + b(FISC)_i + cX_i + e_i$$

- The first stage equation is:

$$FISC_i = \alpha + \beta\,(INEQ)_i + \gamma\,(POP65)_i + \delta'\,X_i + \varepsilon_i$$

(1) Perotti (1996) empirical results

- The second stage equation of interest is:

$$GROWTH_i = a + b(FISC)_i + cX_i + e_i$$

- The first stage equation is:

$$FISC_i = \alpha + \beta\,(INEQ)_i + \gamma\,(POP65)_i + \delta'\,X_i + \varepsilon_i$$

- Is this a valid instrumental variable? Three conditions:

1. Relevance (a sufficiently strong first stage correlation)
2. Exogeneity (no reverse causality)
3. Exclusion (*INEQ* only affects *GROWTH* through *FISC*)

(2) Forbes (2000, *AER*)

- Uses the better quality Deininger and Squire dataset
- Unfortunately this reduces the sample from 67 down to 45 countries. No African countries in the sample

- The growth regression is:

$$(y_{it} - y_{i,\,t-1}) = b_1 INEQ_{i,\,t-1} + b_2 y_{i,\,t-1} + X_{i,\,t-1}{}' b_3 + \alpha_i + n_t + u_{it}$$

(2) Forbes (2000, *AER*)

- Uses the better quality Deininger and Squire dataset
- Unfortunately this reduces the sample from 67 down to 45 countries. No African countries in the sample

- The growth regression is:

$$(y_{it} - y_{i,\,t-1}) = b_1 INEQ_{i,\,t-1} + b_2 y_{i,\,t-1} + X_{i,\,t-1}' b_3 + \alpha_i + n_t + u_{it}$$

- This can be re-written as:

$$y_{it} = b_1 INEQ_{i,\,t-1} + b_2^* y_{i,\,t-1} + X_{i,\,t-1}' b_3 + \alpha_i + n_t + u_{it}$$

- Problem: the lagged dependent variable with FE or RE. Also serial correlation in the errors could lead to bias

(2) Forbes (2000, *AER*)

- Arellano and Bond (1991) provide a potential solution: difference out the country FE, and then use lagged endogenous variables as instrumental variables in a GMM framework

- Re-writing the equation:

$$
\begin{aligned}
(y_{it} - y_{i,\,t-1}) = {} & b_1\,(INEQ_{i,\,t-1} - INEQ_{i,\,t-2}) \\
& + b_2^*(y_{i,\,t-1} - y_{i,\,t-2}) + (X_{i,\,t-1} - X_{i,\,t-2})'\,b_3 \\
& + (n_t - n_{t-1}) + (u_{it} - u_{i,t-1})
\end{aligned}
$$

TABLE 4—REGRESSION RESULTS: WHAT AFFECTS THE COEFFICIENT ON INEQUALITY?

Definitions and data set	Perotti[a] low quality	D&S[b] low quality[c]	D&S[b] low quality[c]	D&S[b] high quality	D&S[b] high quality	D&S[b] low quality[c]	D&S[b] high quality
Estimation and period	OLS 25-year (1)	OLS 25-year (2)	OLS 25-year (3)	OLS 25-year (4)	OLS 25-year (5)	Arellano & Bond 5-year (6)	Arellano & Bond 5-year (7)
Constant	−0.018	0.046	0.061	0.071	0.018		
	(0.013)	(0.027)	(0.026)	(0.030)	(0.031)		
Inequality	−0.118[a]	−0.0005	−0.0005	−0.0005	0.0002	−0.0001	0.0013
	(0.042)	(0.0002)	(0.0003)	(0.0003)	(0.0003)	(0.0001)	(0.0006)
Income	−0.002	−0.001	−0.002	−0.004	0.002	−0.053	−0.047
	(0.001)	(0.003)	(0.003)	(0.003)	(0.008)	(0.013)	(0.008)
Male Education	0.031	0.040	0.039	0.037	0.023	0.047	−0.008
	(0.008)	(0.008)	(0.008)	(0.009)	(0.007)	(0.014)	(0.022)
Female Education	−0.025	−0.035	−0.035	−0.034	−0.023	0.019	0.074
	(0.008)	(0.008)	(0.008)	(0.009)	(0.007)	(0.009)	(0.018)
PPP	−0.002	−0.0001	−0.0001	−0.0001	−0.0001	−0.0011	−0.0013
	(0.006)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
R^2	0.31	0.38	0.40	0.40	0.50		
Countries	67	63	45	45	45	45	45
Periods	1	1	1	1	5	5	5

Notes: Dependent variable is average annual per capita growth from 1970–1995. Standard errors are in parentheses. R^2 is the overall-R^2.

[a] Estimates reported in Perotti (1996). Variable definitions used by Perotti are different from those used in the rest of this paper. For example, *Inequality* is measured as the income share held by the middle class (a measure of equality) rather than by the gini coefficient (a measure of inequality) and I add the negative sign to facilitate comparisons. Also Perotti defines *Income* as initial income, whereas I use the log of initial income. Finally, I have translated Perotti's reported *t*-statistics into standard errors to facilitate comparison with my estimates in the rest of the table.

[b] D&S is the data set compiled by Deininger and Squire (1996) and used throughout this paper. Inequality is measured by the gini coefficient.

[c] Low-quality data is average inequality in the unabridged Deininger and Squire data set. This includes statistics accepted as high quality as well as those not accepted.

(3) Non-parametric regression methods

- What if linear specifications are not appropriate?
- Generalize OLS regression to:

$$y_i = h(x_i) + e_i$$

- We are interested in:

$$h(x) = E(y \mid x) = \int y \cdot f_C(y \mid x)\,dy$$

(3) Non-parametric regression methods

- What if linear specifications are not appropriate?
- Generalize OLS regression to:

$$y_i = h(x_i) + e_i$$

- We are interested in:

$$h(x) = E(y \mid x) = \int y \cdot f_C(y \mid x)\,dy = \int \frac{y \cdot f(y,x)}{f(x)}\,dy$$

(3) Non-parametric regression methods

(3) Non-parametric regression methods

- We can estimate the densities using a kernel approach
- For example, for a given bandwidth *h*, the estimated density is:

$$f^*(x) = \frac{\sum_{i=1}^{N} 1(-\frac{h}{2} < x - x_i < \frac{h}{2})}{Nh}$$

$$f^*(x) = \frac{\sum_{i=1}^{N} K\left(\frac{x - x_i}{h}\right)}{Nh}$$

- Various kernels are possible, including the uniform kernel, the Epanechnikov, Guassian, etc., and they generally yield similar results

(3) Non-parametric regression methods

- The choice of bandwidth is critical:

  Large bandwidth → more smoothing, less information

  Small bandwidth → potentially too much variation

- The "optimal bandwidth" minimized mean squared error (MSE = Var(B) + Bias(B)^2):

$$h^* = C\sigma N^{-1/5}$$

(3) Non-parametric regression methods

- The choice of bandwidth is critical:

  Large bandwidth → more smoothing, less information

  Small bandwidth → potentially too much variation

- The "optimal bandwidth" minimized mean squared error (MSE = Var(B) + Bias(B)^2):

$$h^* = C\sigma N^{-1/5}$$

- Non-parametric regression is data intensive

- A variant is locally weighted regression (i.e. Fan 1992), and this provides a slope $h'(x)$ at each point

(4) Banerjee and Duflo (2003)

- Recall the second stage equation in Forbes (2000)

$$(y_{it} - y_{i,\,t-1}) = b_1\,(INEQ_{i,\,t-1} - INEQ_{i,\,t-2}) + b_2^{*}(y_{i,\,t-1} - y_{i,\,t-2}) + (X_{i,\,t-1} - X_{i,\,t-2})' b_3 + (n_t - n_{t-1}) + (u_{it} - u_{i,t-1})$$

- In the first stage of the Forbes procedure, changes in inequality are regressed on lagged inequality:

$$(INEQ_{i,\,t-1} - INEQ_{i,\,t-2}) = c_1 INEQ_{i,\,t-3} + \text{other lags}$$

- Thus the reduced form looks like:

$$(y_{it} - y_{i,\,t-1}) = d_1\,(INEQ_{i,\,t-3}) + d_2(y_{i,\,t-3}) + (X_{i,\,t-3})' d_3 + (n_t - n_{t-1}) + \text{other error terms}$$

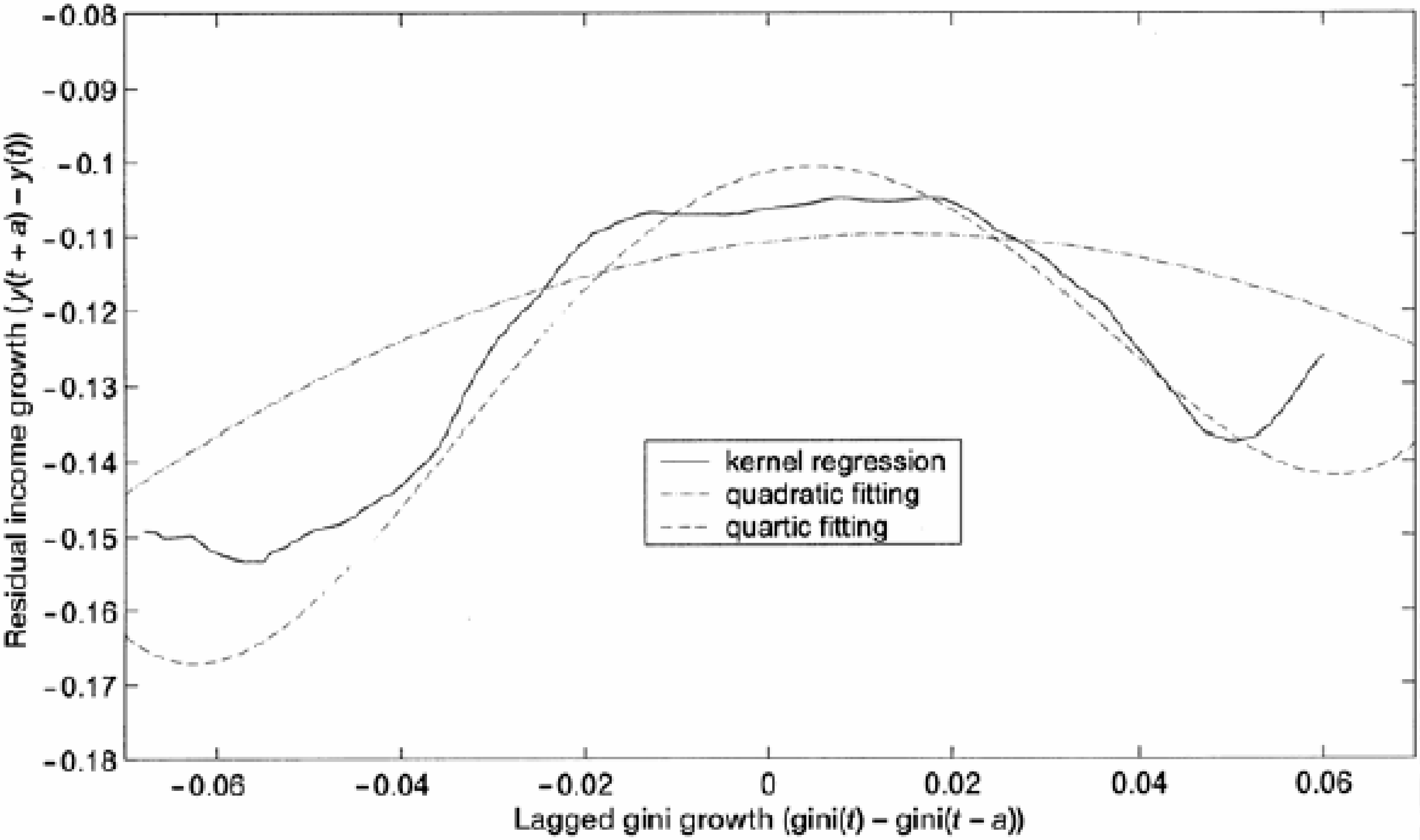


Figure 1. Relationship between income growth and lagged gini growth: partially linear model (Perotti variables).

Table 5. Non-linearity of the relationship between change in gini and growth in models based on first differences.

	Dependent Variable			
	$(y(t+a)-y(t))/a$		$(1/a^{*}[y(t+a)-y(\mathrm{GDP}(t)]^{*})$	
Control Variables	Perotti (1)	Barro (2)	Perotti (3)	Barro (4)
A. Linear assumption: OLS coefficient of $(\mathrm{gini}(t)-\mathrm{gini}(t-a))$				
$\mathrm{gini}(t)-\mathrm{gini}(t-a)$	0.298	0.158	0.36	0.17
	(0.18)	(0.068)	(0.18)	(0.07)
B. Piecewise linear assumption: OLS coefficients of $(\mathrm{gini}(t)-\mathrm{gini}(t-a))$				
if $\mathrm{gini}(t)-\mathrm{gini}(t-a)<0$	0.79	0.39	0.69	0.4
	(0.30)	(0.13)	(0.38)	(0.13)
if $(\mathrm{gini}(t)-\mathrm{gini}(t-a))\geq 0$	−0.3	−0.13	−0.49	−0.11
	(0.35)	(0.11)	(0.38)	(0.14)
C. Quartic specification				
F-test for non-linear terms jointly significant	2.21	3.37	2.55	3.3
	(0.09)	(0.02)	(0.059)	(0.02)
D. Quadratic specification				
$\mathrm{gini}(t)-\mathrm{gini}(t-a)$	0.23	0.13	0.311	0.15
	(0.18)	(0.067)	(0.19)	(0.66)
$(\mathrm{gini}(t)-\mathrm{gini}(t-a))^2$	−5.88	−3.24	−5.94	−3.28
	(3.39)	(1.26)	(3.43)	(1.23)
Number of observations	128	98	128	98

Note: Standard errors in parentheses; *a* is equal to 5 (5-year periods). For a list of control variables see note to Table 1. For a definition of residual growth, see the text.

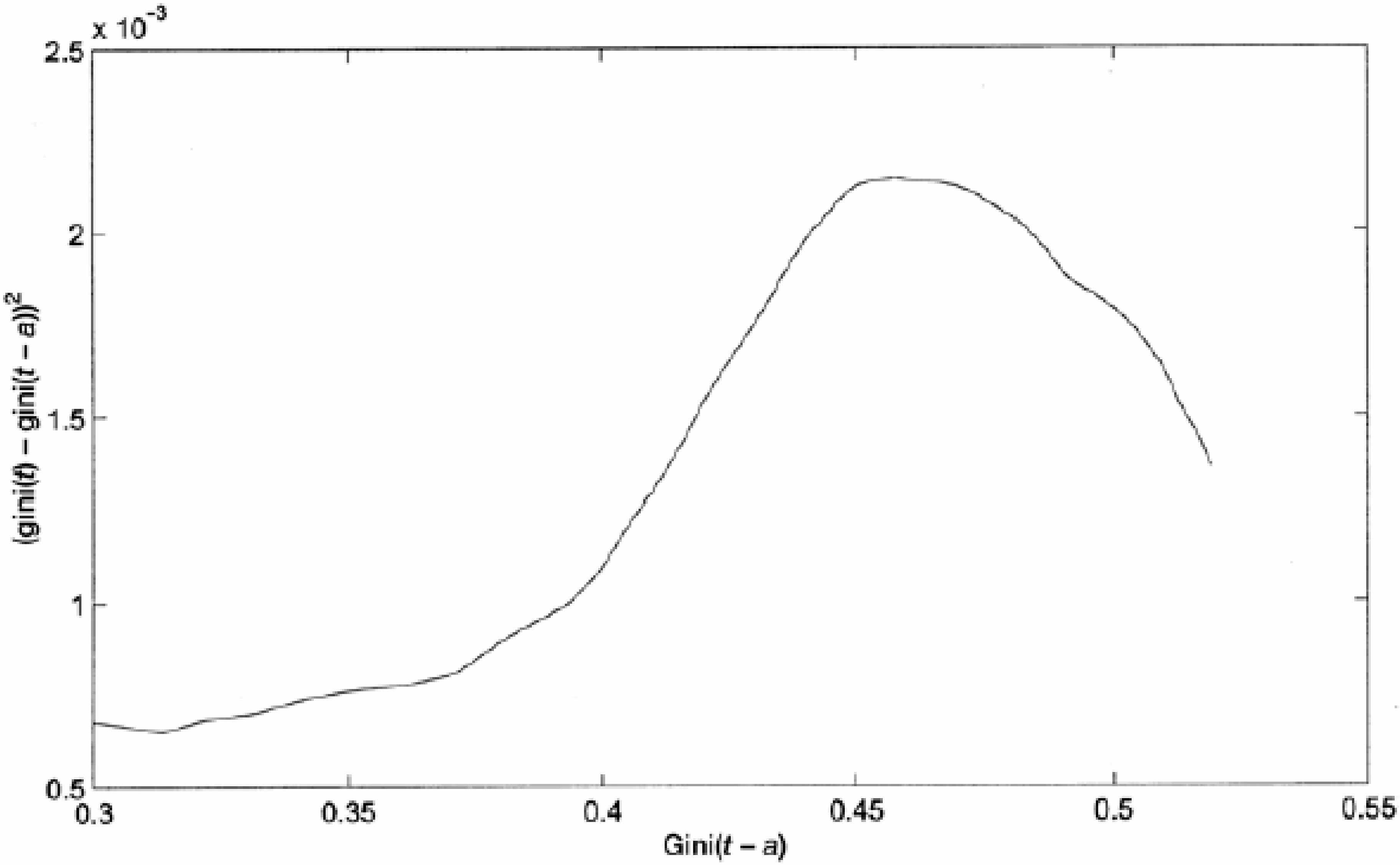


Figure 3. Relationship between gini and square of gini changes.

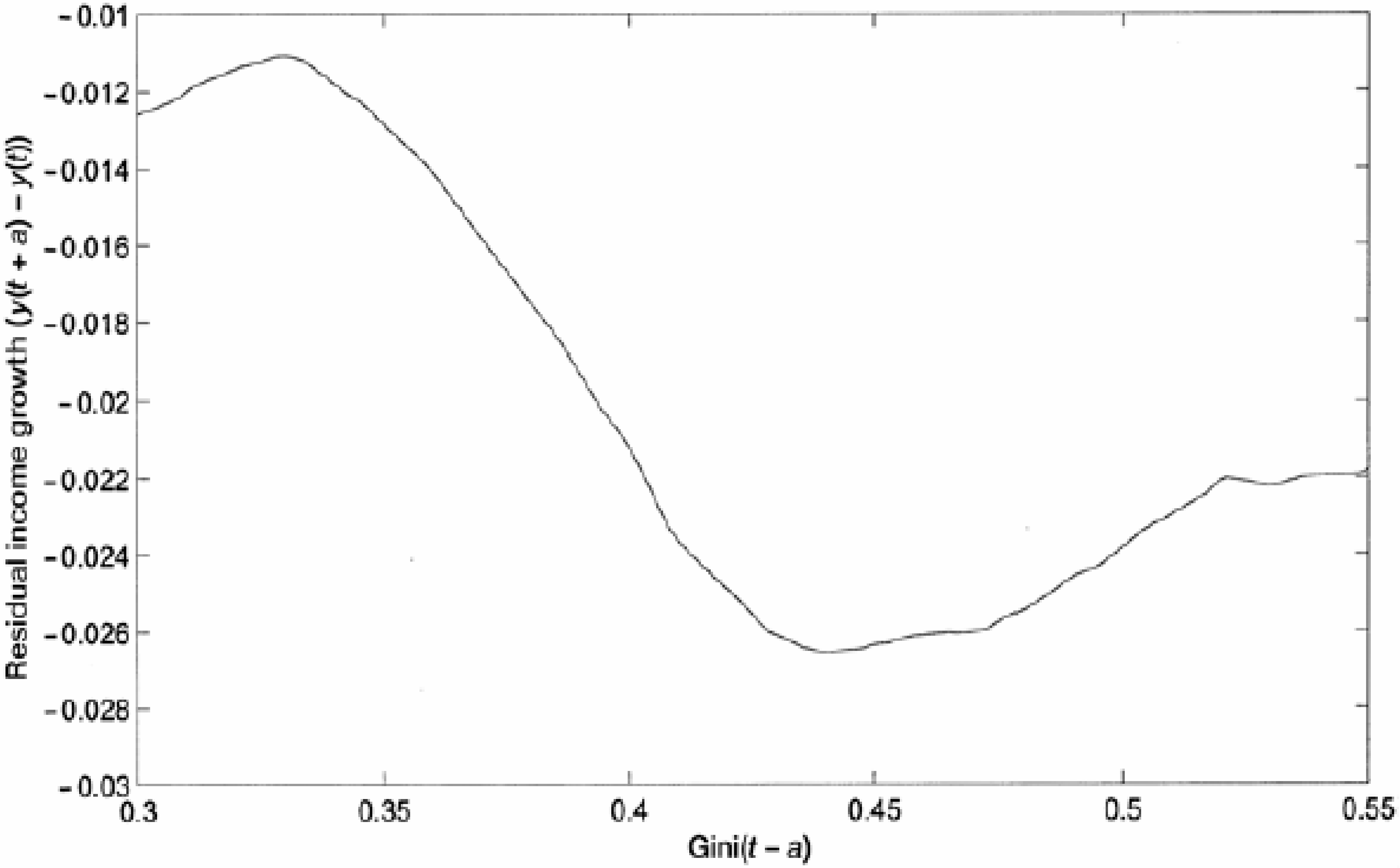


Figure 4. Reduced form, with Perotti variables.

Table 4. Estimation of the reduced form model.

	Dependent Variable: $(y(t+a)-y(t))/a$					
	Perotti			Barro		
	(1)	(2)	(3)	(4)	(5)	(6)
$g(t-a)$	−0.047	0.77	−0.033	−0.043	−0.21	−0.10
	(0.076)	(0.66)	(0.082)	(0.039)	(0.21)	(0.043)
$g(t-a)^2$		−0.94			0.26	
		(0.81)			(0.27)	
Control variables	$X(t)$	$X(t)$	$X(t-a)$	$X(t)$	$X(t)$	$X(t-a)$

	Dependent Variable: Change in Gini Coefficient			
	Perotti		Barro	
	$g(t)-g(t-a)$	$(g(t)-g(t-a))^2$	$g(t)-g(t-a)$	$(g(t)-g(t-a))^2$
	(7)	(8)	(9)	(10)
$g(t-a)$	−0.087	0.0067	−0.25	0.0076
	(0.038)	(0.0025)	(0.066)	(0.0038)
Control variables	$X(t-a)$	$X(t-a)$	$X(t-a)$	$X(t-a)$

Note: Coefficient obtained using random effect specifications.
Standard errors in parentheses; a is equal to 5 (5-year periods).
Control variables: $X(t)$ stands for control variable not lagged.
$X(t-a)$ stands for control variables lagged one period (5 years).
For a list of control variables see note to Table 1.

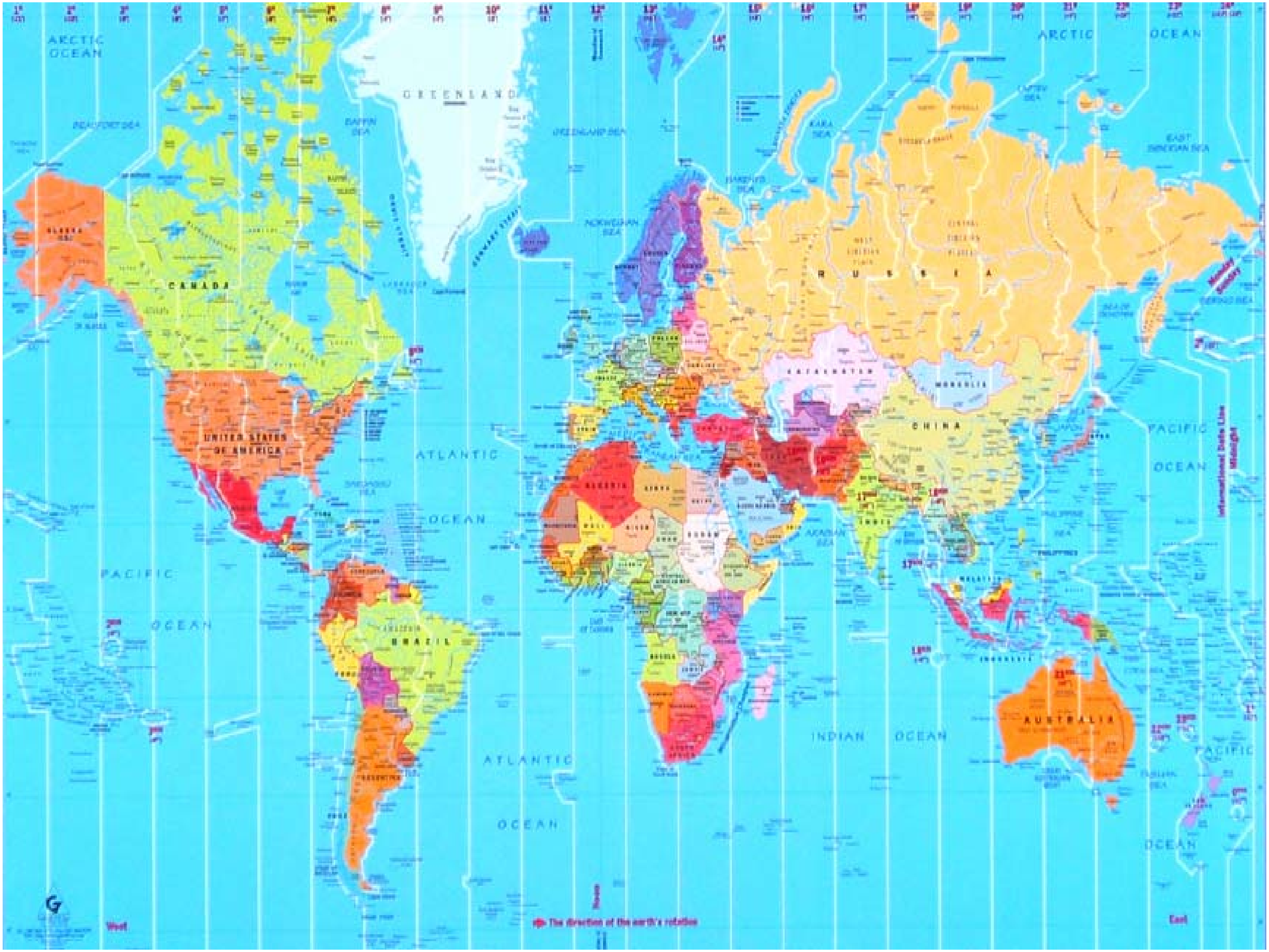
Whiteboard #1

Whiteboard #2

Whiteboard #3

Whiteboard #4

Whiteboard #5


ARCTIC OCEAN
ARCTIC
OCEAN
GREENLAND
CANADA
UNITED STATES OF AMERICA
RUSSIA
KAZAKHSTAN
MONGOLIA
CHINA
INDIA
ALGERIA
SUDAN
BRAZIL
INDONESIA
AUSTRALIA
ATLANTIC
OCEAN
ATLANTIC
OCEAN
PACIFIC
OCEAN
PACIFIC
OCEAN
PACIFIC
OCEAN
INDIAN OCEAN
International Date Line Midnight
West
East
The direction of the earth's rotation