Was Marx Right?
Development and Exploitation in 43 Countries, 2000-2014

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Objective

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To assess **Marx's hypotheses** about economic development at the **world level**

How?

Compute Marxist variables from **World Input-Output Database** (WIOD)

Compute **productive** and **unproductive activities** from WIOD

Create a **new panel dataset** for **43 countries** in the **2000-2014** period

Compare Marxist variables at the **global level** and at the **country level**

Compare results across **different productive-unproductive classifications**

Create a **software in R** that automates every step

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Marx

Marx

Axioms

Only productive human labor creates value in the capitalist mode of production

Labor time directly and indirectly required to reproduce (not produce) a commodity determines its value

Competition forces companies to adopt capital-intensive labor-saving technology

Corollary

Profit originates from surplus value, the unpaid productive labor share of value added

Value added = unpaid productive labor + paid productive labor

= surplus value + value of labor power

Rate of surplus value = surplus value / value of labor power

= unpaid productive labor / paid productive labor

= rate of exploitation of productive labor

Marx

Hypotheses

Capital-intensive labor-saving technology increases the organic composition of capital (OCC)

OCC = value of constant capital / value of labor power

= 'capital-productive labor' ratio in value terms

Capital-intensive labor-saving technology displaces productive labor, the source of surplus value

Average profit rate tends to fall

r = surplus value / constant capital = rate of surplus value / OCC

Because of capital-intensive labor-saving tech, the OCC tends to rise faster than the rate of surplus value

Companies need to increase the rate of surplus value to counteract the fall in the profit rate

Rate of surplus value tends to rise

Marx

Hypotheses (summary)

'Capital-productive labor' ratio (OCC) tends to rise

Exploitation rate of productive labor tends to rise

OCC tends to rise faster than the rate of exploitation of productive labor

Average profit rate tends to fall as countries develop

Empirical evidence

Marx was right at the world level, but subject to important modifications

Methodology

Methodology

World Input-Output Database (WIOD):

WIOD = WIOT + SEA for 43 countries from 2000 to 2014

WIOT = multi-country input-output matrices

= 2,474 rows by 2,687 columns for each year

SEA = country-level data on capital stock, wages, and employment

Convert the entire WIOD to Marxist variables in US dollars

Compute productive and unproductive activity from WIOT and SEA

Consolidate the transformed data into a **panel dataset** with 367 variables

For 43 countries + global aggregates

R software with 7,000 lines of code to automate all steps (R code will be posted on GitHub soon)

Methodology

Most difficult computations:

$$ValueAdded_{PA,i,t}^{WIOT,dollars} = TotalValue_{PA,i,t}^{WIOT,dollars} - Inputs\ from\ PA_{PA,i,t}^{WIOT,dollars}$$

$$NetIncome_{UA,i,t}^{WIOT,dollars} = GrossIncome_{UA,i,t}^{WIOT,dollars} - Inputs\ from\ UA_{UA,i,t}^{WIOT,dollars}$$

Two robustness tests:

First robustness test: 4 different classifications of productive and unproductive activity

Second robustness test: compute variables with and without adjustment for self-employment

Table 1: List of countries in the World
Input-Output Database (WIOD)

AUS	Australia	**ITA**	Italy
AUT	Austria	**JPN**	Japan
BEL	Belgium	**KOR**	South Korea
BGR	Bulgaria	**LTU**	Lithuania
BRA	Brazil	**LUX**	Luxembourg
CAN	Canada	**LVA**	Latvia
CHE	Switzerland	**MEX**	Mexico
CHN	China	**MLT**	Malta
CYP	Cyprus	**NLD**	Netherlands
CZE	Czech Republic	**NOR**	Norway
DEU	Germany	**POL**	Poland
DNK	Denmark	**PRT**	Portugal
ESP	Spain	**ROU**	Romania
EST	Estonia	**RUS**	Russia
FIN	Finland	**SVK**	Slovakia
FRA	France	**SVN**	Slovenia
GBR	UK	**SWE**	Sweden
GRC	Greece	**TUR**	Turkey
HRV	Croatia	**TWN**	Taiwan
HUN	Hungary	**USA**	USA
IDN	Indonesia	**ROW**	Rest of the world combined
IND	India		
IRL	Ireland		

Table 2: Summary of Productive and Unproductive Activities

Case 1 Baseline with knowledge rents	**Case 2** Baseline without knowledge rents	**Case 3** Conventional Marxism	**Case 4** Minimal unproductive activity
Productive Activities	**Productive Activities**	**Productive Activities**	**Productive Activities**
Agriculture, Fishing, Mining Manufacturing, Construction, Equipment repair Transportation, Telecommunications Energy supply, Water and waste treatment Productive services, Education, Health Trade margins (wholesale and retail)	Agriculture, Fishing, Mining Manufacturing, Construction, Equipment repair Transportation, Telecommunications Energy supply, Water and waste treatment Productive services, Education, Health Trade margins (wholesale and retail) Knowledge and information production	Agriculture, Fishing, Mining Manufacturing, Construction, Equipment repair Transportation, Telecommunications Energy supply, Water and waste treatment Productive services, Education, Health Knowledge and information production	Agriculture, Fishing, Mining Manufacturing, Construction, Equipment repair Transportation, Telecommunications Energy supply, Water and waste treatment Productive services, Education, Health Trade margins (wholesale and retail) Knowledge and information production Finance and insurance Real estate activities
Unproductive Activities	**Unproductive Activities**	**Unproductive Activities**	**Unproductive Activities**
Public administration, defense, social security Finance and insurance Real estate activities Knowledge and information production	Public administration, defense, social security Finance and insurance Real estate activities	Public administration, defense, social security Finance and insurance Real estate activities Trade margins (wholesale and retail) Advertising and market research Legal and accounting activities; activities of head offices; management consultancy activities Administrative and support service activities Other service activities	Public administration, defense, social security Activities of extraterritorial organizations and bodies
Excluded Activities	**Excluded Activities**	**Excluded Activities**	**Excluded Activities**
		Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use Activities of extraterritorial organizations and bodies	

Results

Results

Marx was right at the world level, but subject to important modifications

Evidence at the global level

World profit rate falls because the OCC rises faster than the rise in the rate of surplus value

Wage share of productive labor is constant from 2000 to 2014

Global relocation of value added and capital stock in productive activity towards China

Productive activity has risen in countries that gained weight in the global economy (China)

Unproductive activity has risen in countries that lost weight in the global economy (United States, Western Europe, and Japan)

Productive activity has grown faster than unproductive activity at the world level in terms of output, capital stock, and employment

Results

Evidence at the country level

OCC and rate of surplus value fall with economic development (real GDP per capita in dollars)

Because labor compensation is much higher in rich countries

Location-based inequality between countries dominates class-based inequality within countries

Profit rate does fall with economic development

But because of the rise in the capital stock tied up in unproductive activity

As countries develop, unproductive activity grows faster than productive activity in terms of output, capital stock, and employment

Despite the growth of unproductive activity within countries, the massive relocation of productive capital towards China ensures that productive activity grows faster than unproductive activity at the global level

Results

Robustness

2000-2014 is a period of high globalization and deep global value chains

China became a member of the WTO in 2001

Capitalism has become a truly global production system

Results are robust across 4 different classifications of productive and unproductive activities

Only the levels of the variables change across classifications, not their trends

Results are robust to the adjustment for self-employment

Thank You

Slides available at

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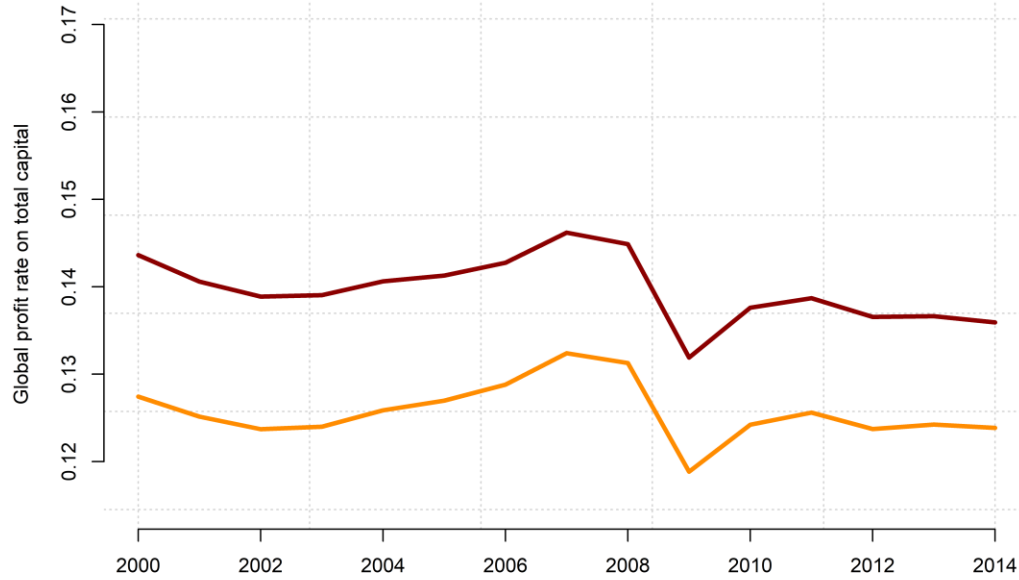# Appendix

Data at the global level

Case 1 - Baseline with knowlege rents
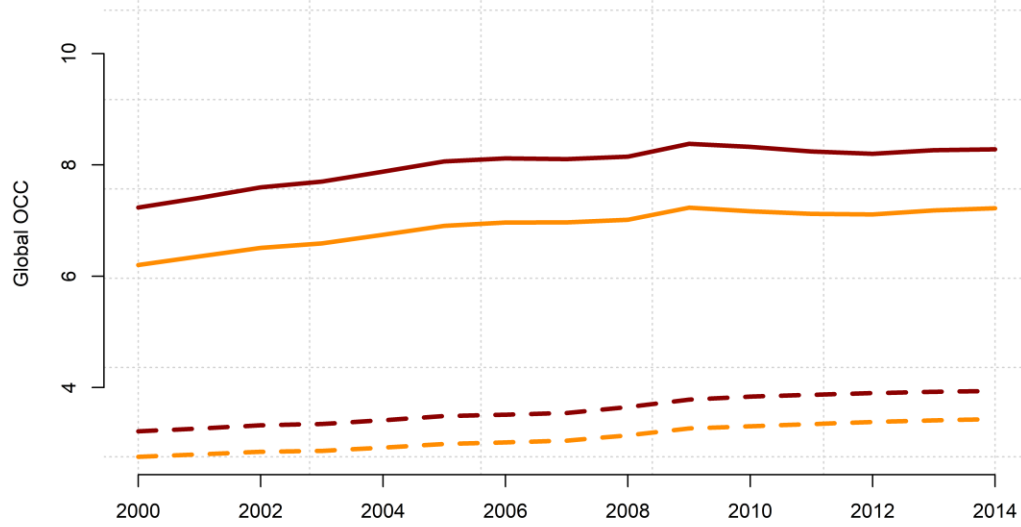
Case 2 - Baseline without knowledge rents
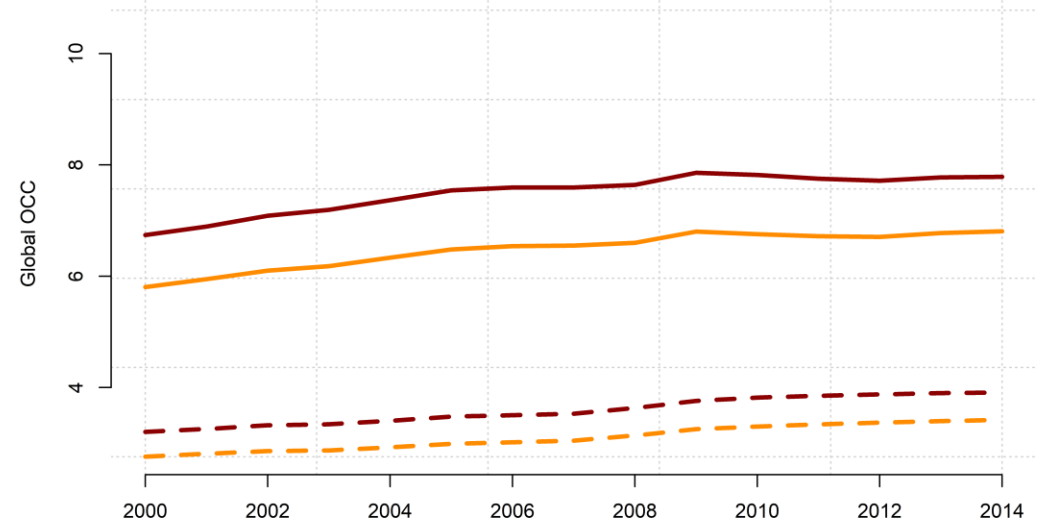
Case 3 - Conventional Marxism
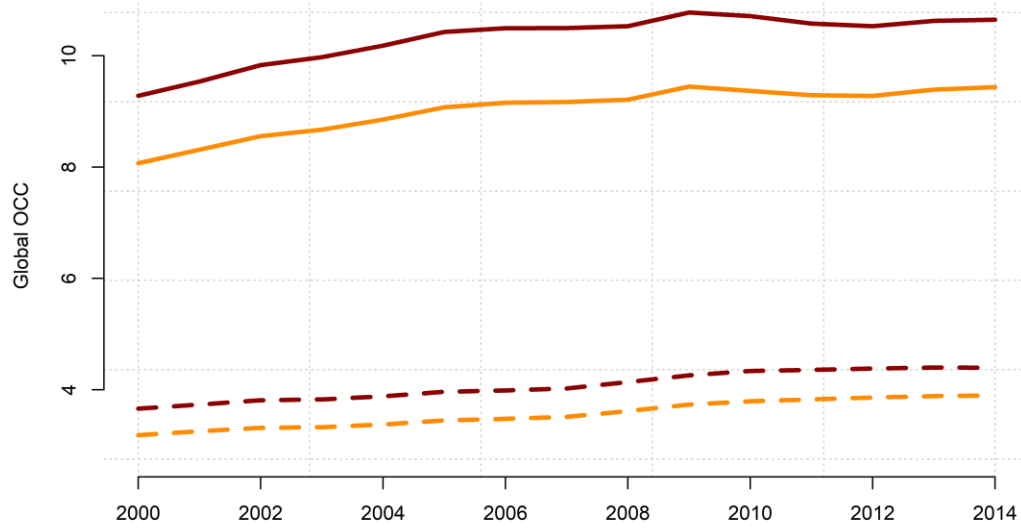
Case 4 - Minimal unproductive activity
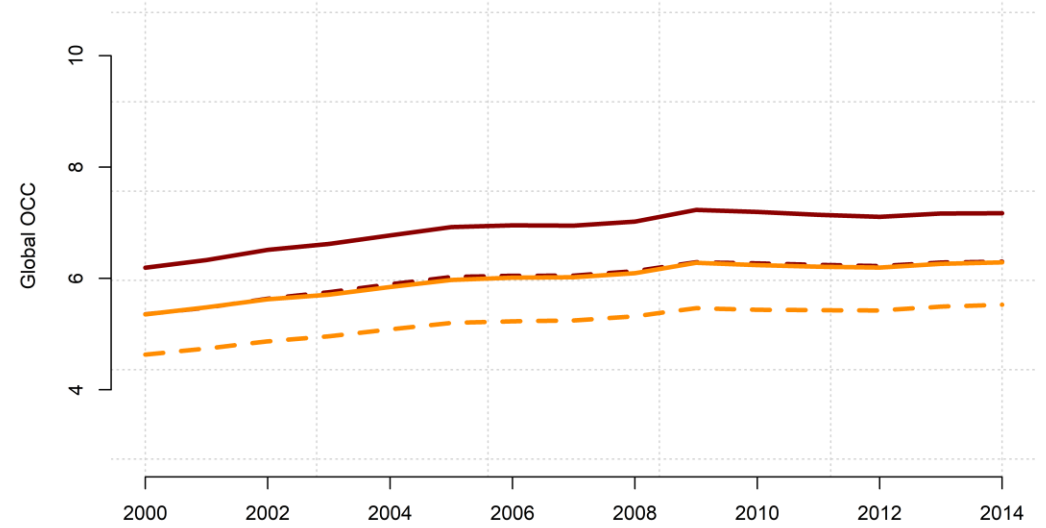
- - - Global OCC on productive capital: not adjusted for self-employment
- - - Global OCC on productive capital: adjusted for self-employment
──── Global OCC on total capital: not adjusted for self-employment
──── Global OCC on total capital: adjusted for self-employment
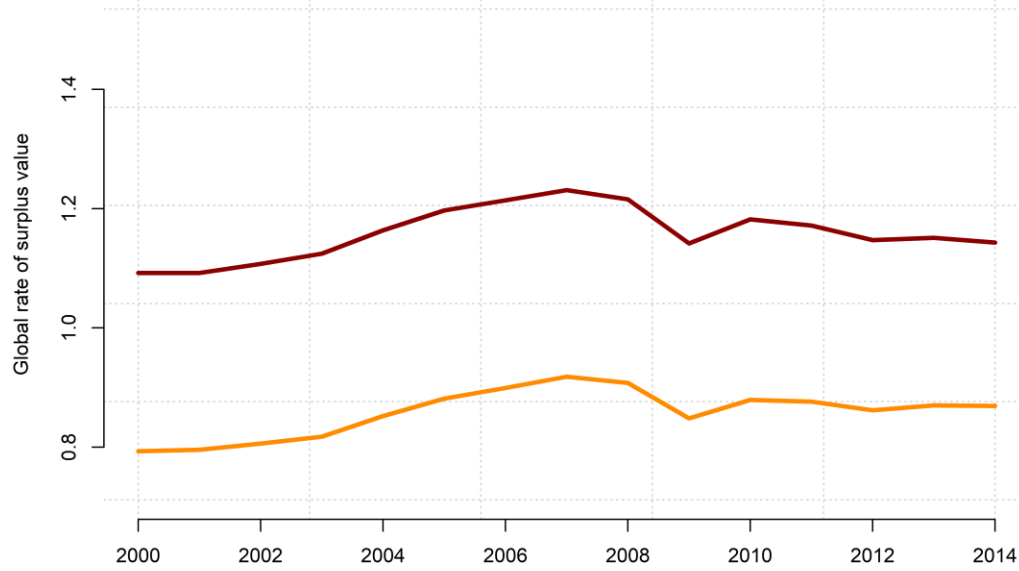
Case 1 - Baseline with knowlege rents

Case 2 - Baseline without knowledge rents
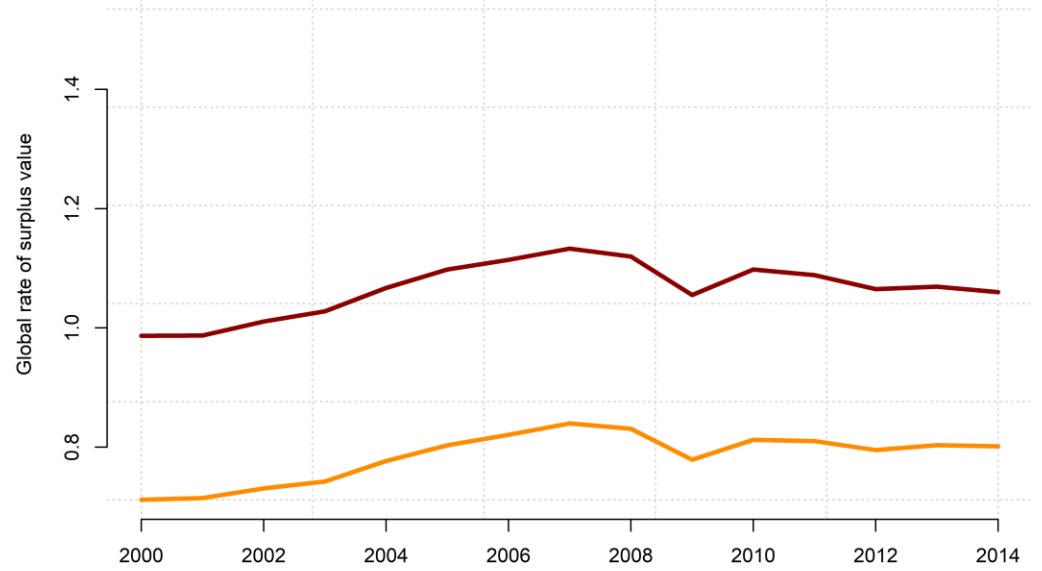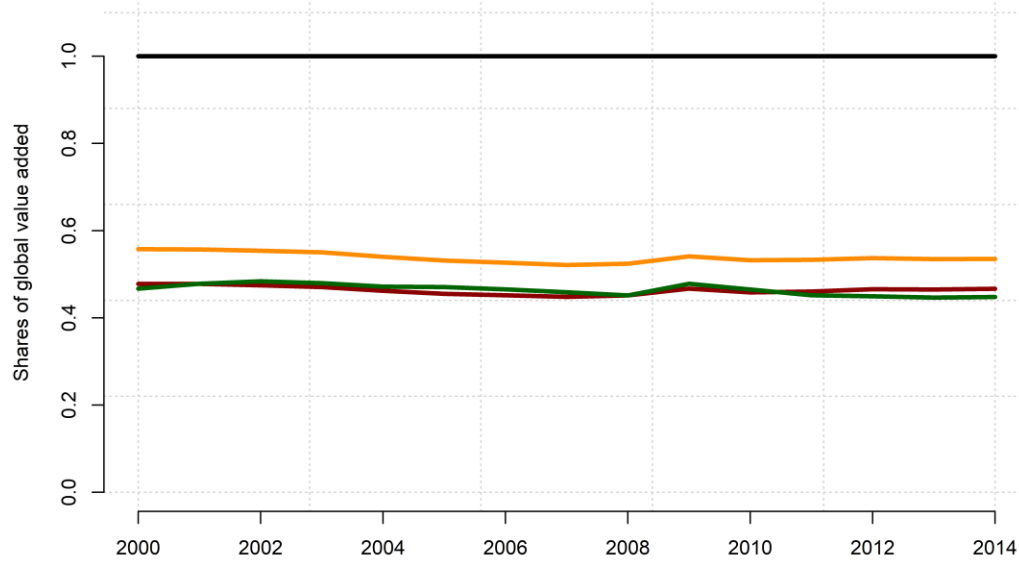
Case 3 - Conventional Marxism
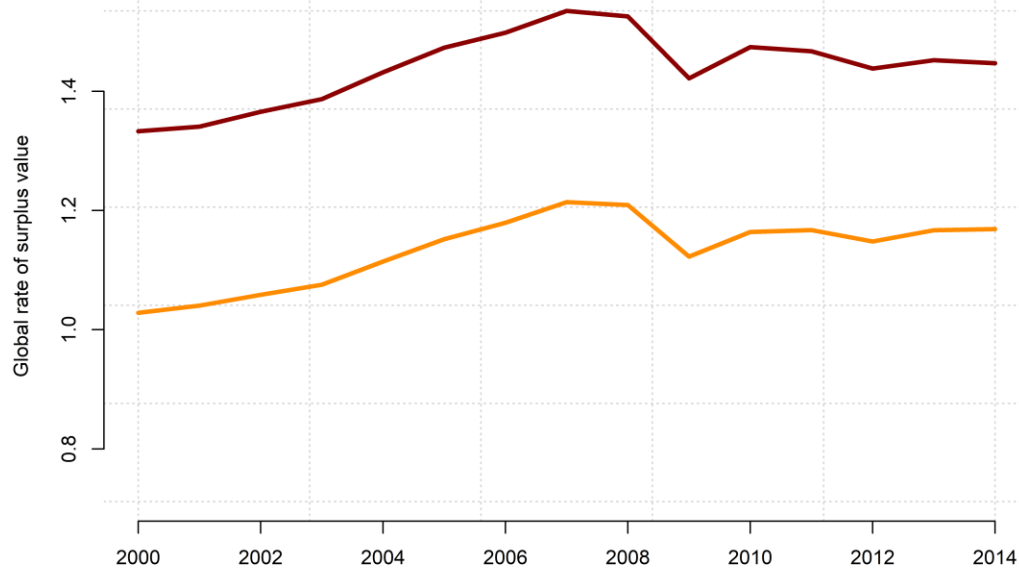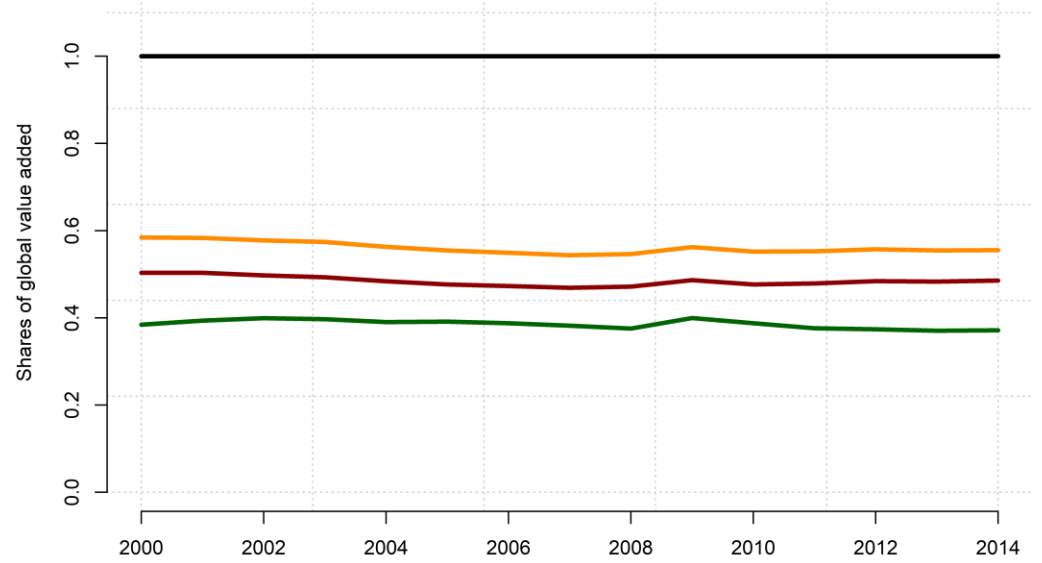
Case 4 - Minimal unproductive activity

— Not adjusted for self-employment
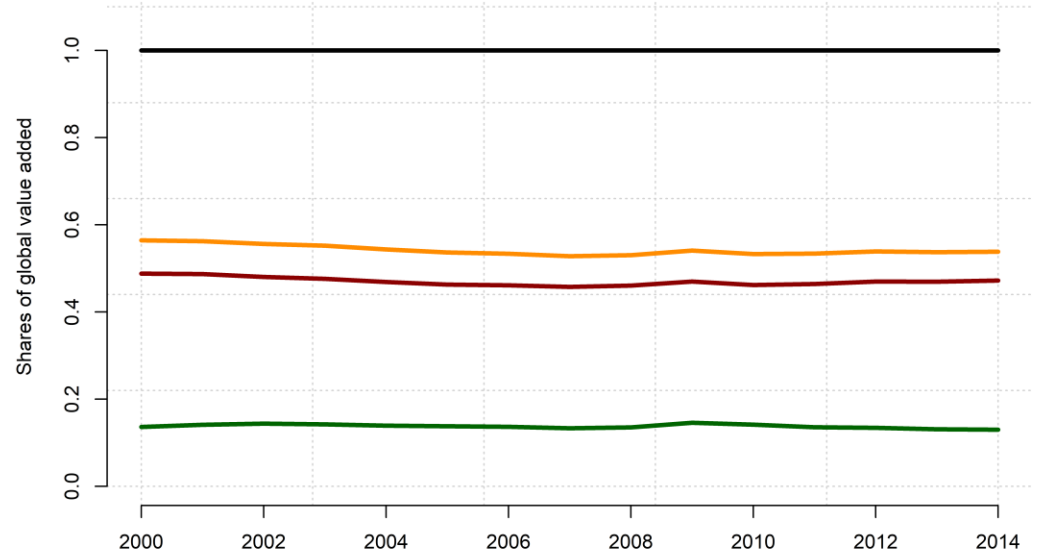— Adjusted for self-employment

Case 1 - Baseline with knowlege rents

Case 2 - Baseline without knowledge rents

Case 3 - Conventional Marxism

Case 4 - Minimal unproductive activity

Global profit rate on total capital
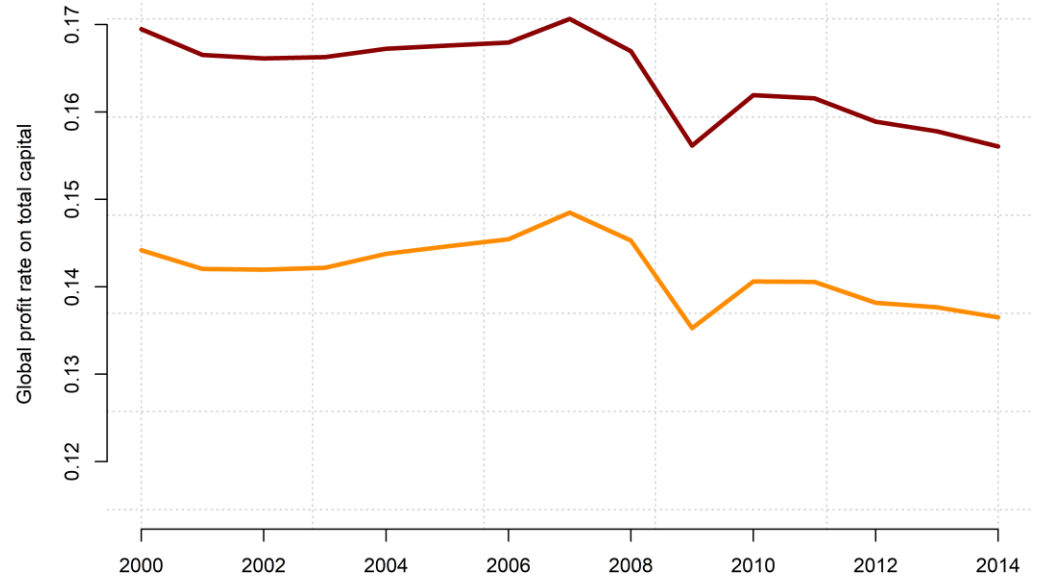
— Not adjusted for self-employment
— Adjusted for self-employment

Case 1 - Baseline with knowlege rents

Case 2 - Baseline without knowledge rents
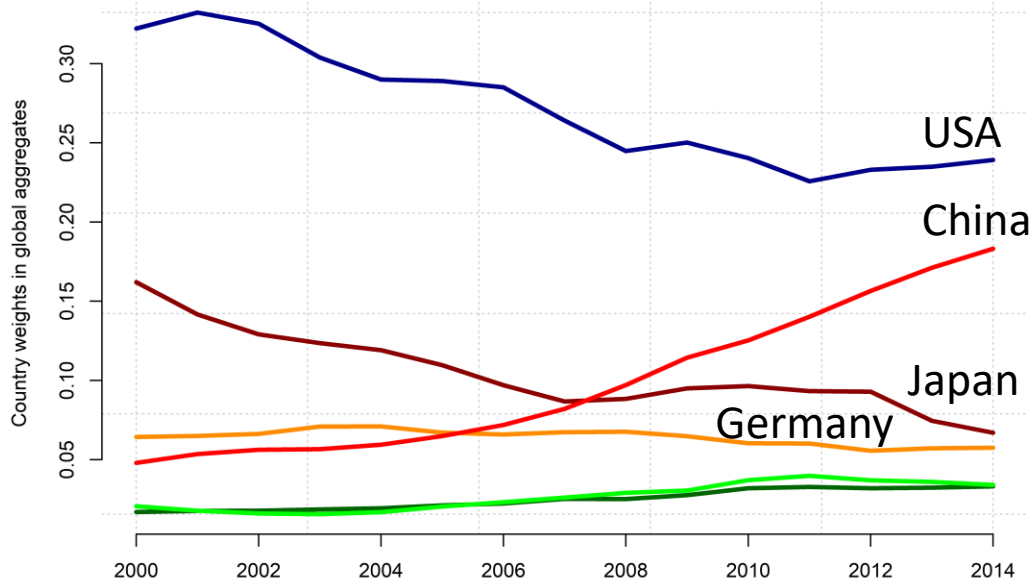
Case 3 - Conventional Marxism
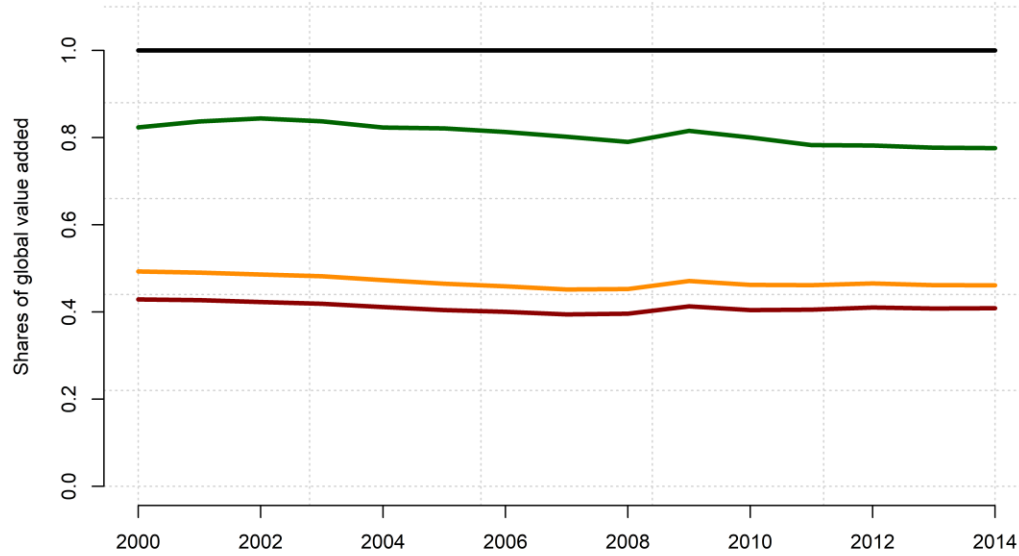
Case 4 - Minimal unproductive activity
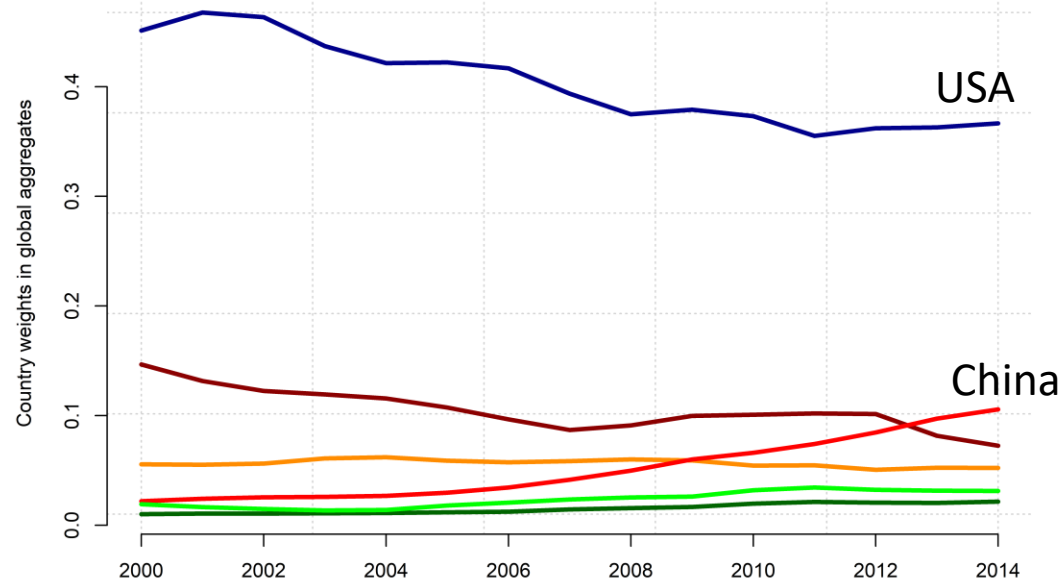
— Global value added of productive activity
— Global net income of unproductive ativity

— Global value of labor power (adj. for self-employment)
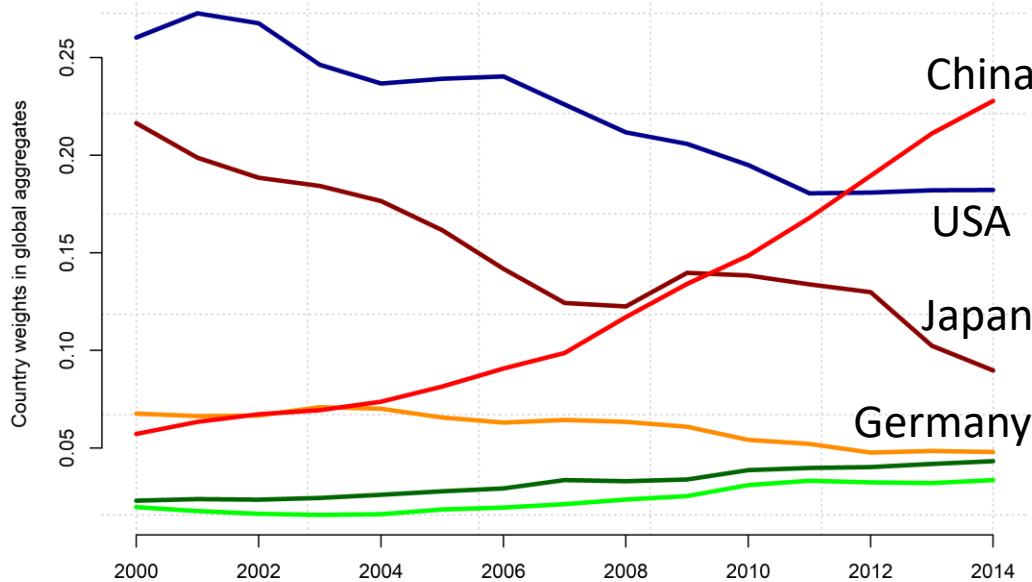— Global value of labor power (wage share of value added)
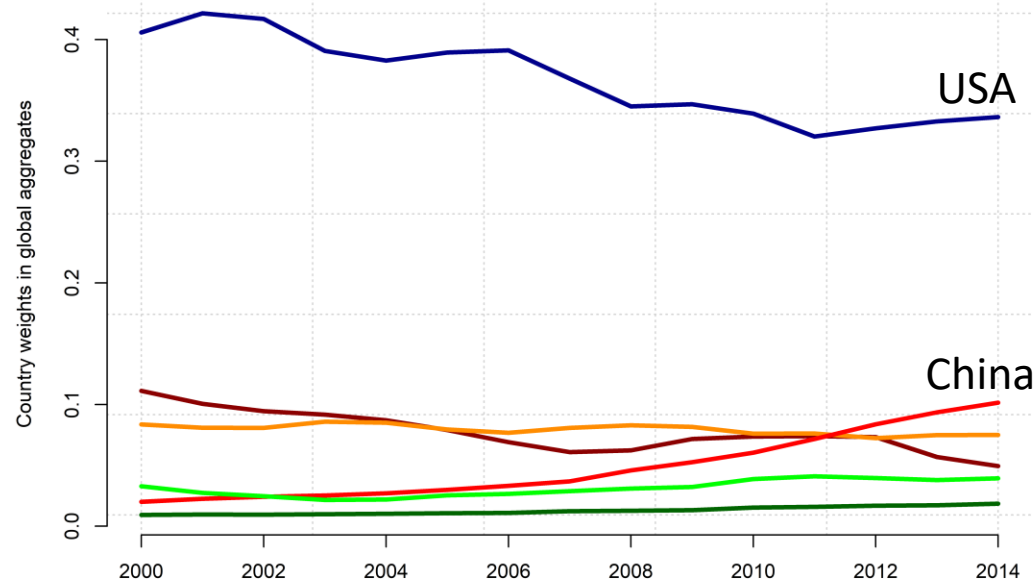
Value added in productive activities

Net income in unproductive activities

Capital stock in productive activities

Capital stock in unproductive activities

USA — Japan — Germany — China — India — Brazil

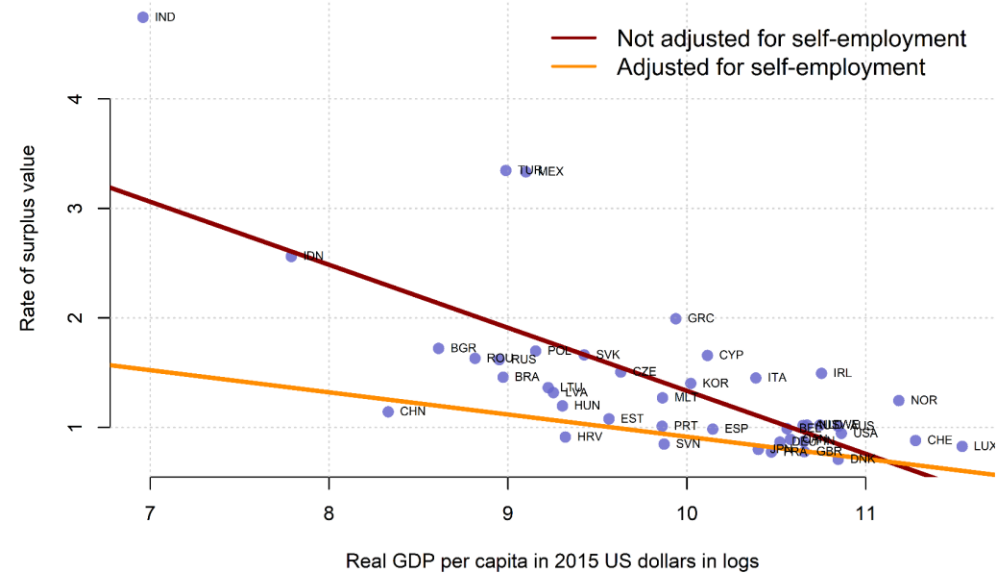**Table 3:** Global aggregates of Marxist variables regressed on linear time trend

Dependent variable	Case 1 Baseline with Knowledge Rents	Case 2 Baseline without Knowledge Rents	Case 3 Conventional Marxism	Case 4 Minimal Unproductive Activity
Rate of surplus value	0.0037	0.0055**	0.0079**	0.0051**
Rate of surplus value [adj. for self-employment]	0.0054**	0.0065***	0.0096***	0.0062***
Organic composition of capital (productive capital)	0.0572***	0.0556***	0.0579***	0.0647***
Organic composition of capital (total capital)	0.0701***	0.0715***	0.087***	0.0674***
Unproductive composition of capital (unproductive capital)	0.0128	0.016	0.029*	0.0027*
Organic composition of capital (productive capital) [adj. for self-employment]	0.053***	0.0512***	0.0552***	0.0611***
Organic composition of capital (total capital) [adj. for self-employment]	0.0685***	0.0684***	0.0874***	0.0642***
Unproductive composition of capital (unproductive capital) [adj. for self-employment]	0.0155*	0.0171**	0.0322**	0.0031**
Rate of profit on total capital	-0.0008***	-0.0006**	-0.0004*	-0.0009***
Rate of profit on productive capital	-0.004***	-0.003***	-0.003***	-0.0012***
Rate of profit on total capital [adj. for self-employment]	-0.0004*	-0.0003	-0.0002	-0.0005**
Rate of profit on productive capital [adj. for self-employment]	-0.0029***	-0.002**	-0.0021**	-0.0007***
Net income of unproductive activity over the value added of productive activity	-0.0022***	-0.0016***	-0.0047***	-0.0006**
Ratio of knowledge rents to net income of unproductive activity	-0.0008***		-0.0003***	
Capital stock: unproductive to productive ratio	-0.0155***	-0.0121***	-0.0142***	-0.0012***
Persons engaged: unproductive to productive ratio	0.0026***	0.0022***	0.0066***	0.0007***
Number of employees: unproductive to productive ratio	-0.0004***	-0.0006***	-0.0006	-0.001***
Employee compensation: unproductive to productive ratio	-0.0025***	-0.0014***	-0.0039***	-0.001***
Labor compensation: unproductive to productive ratio [adj. for self-employment]	-0.0018***	-0.0009***	-0.0028***	-0.0007**

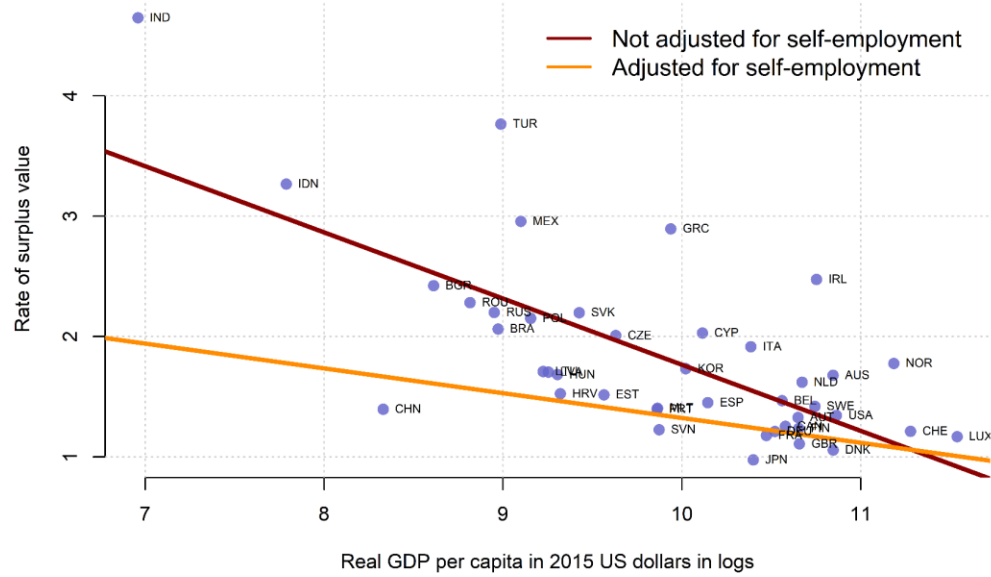# Data at the country level

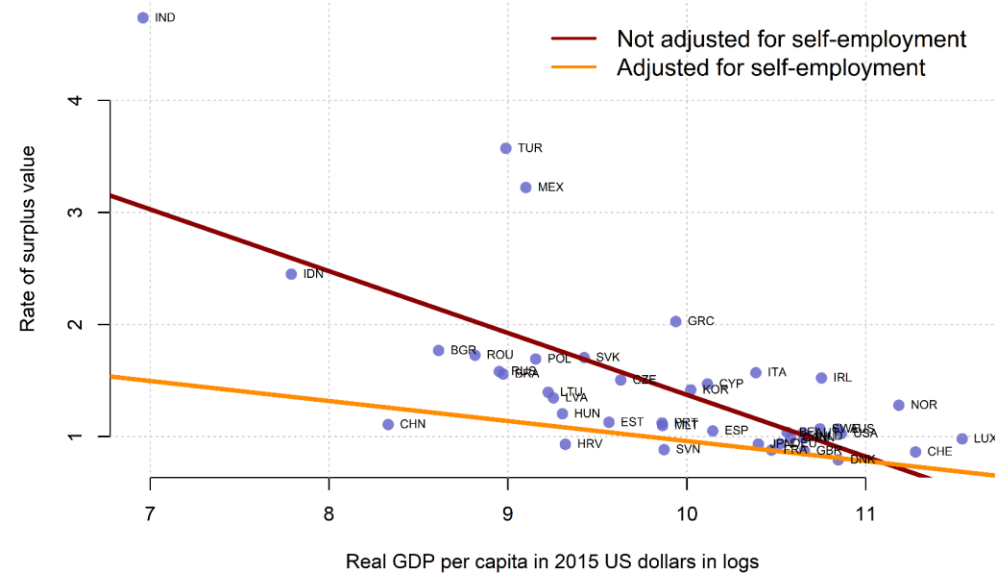**Case 1 - Baseline with knowlege rents**
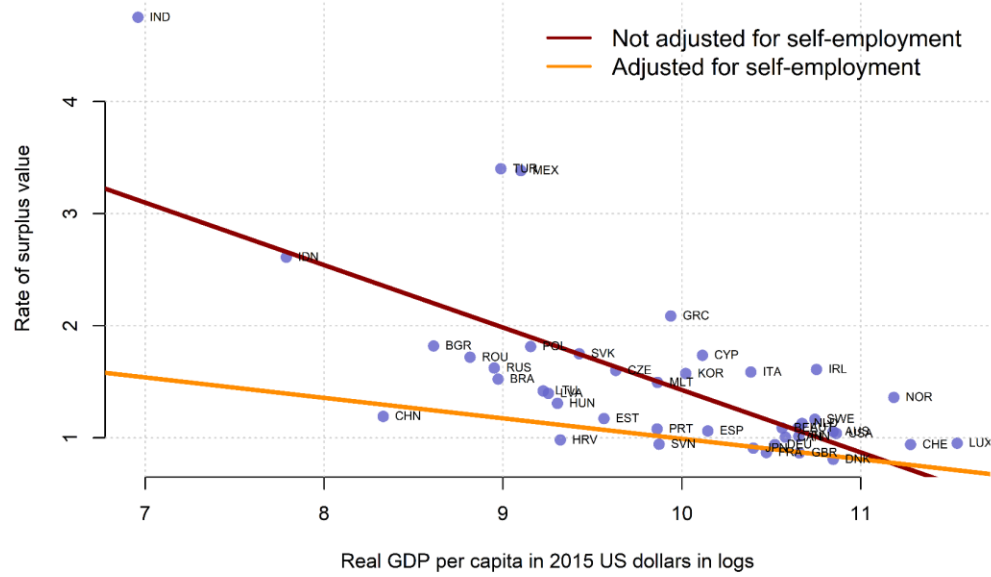
Case 2 - Baseline without knowledge rents

Case 3 - Conventional Marxism

Case 4 - Minimal unproductive activity

Case 1 - Baseline with knowlege rents

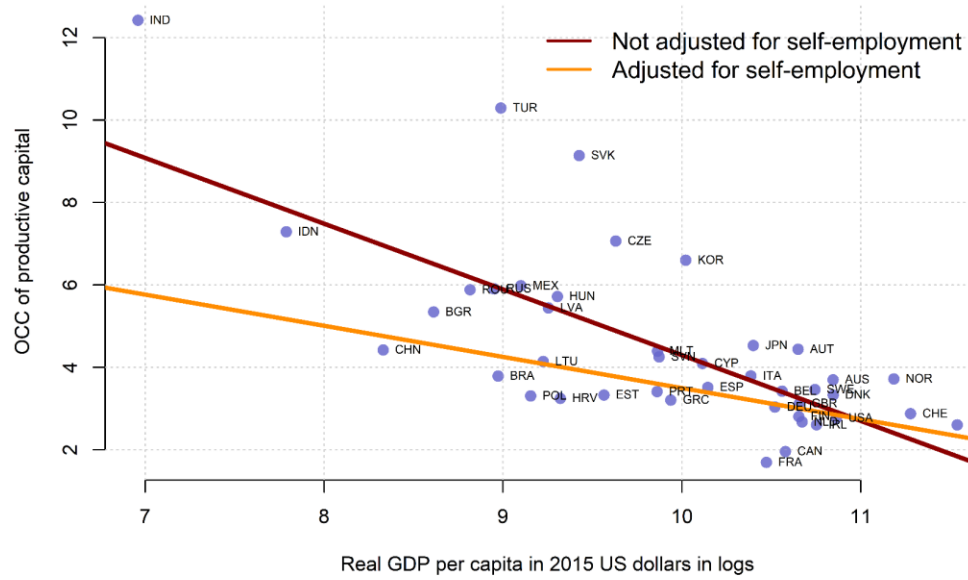**Case 2 - Baseline without knowledge rents**
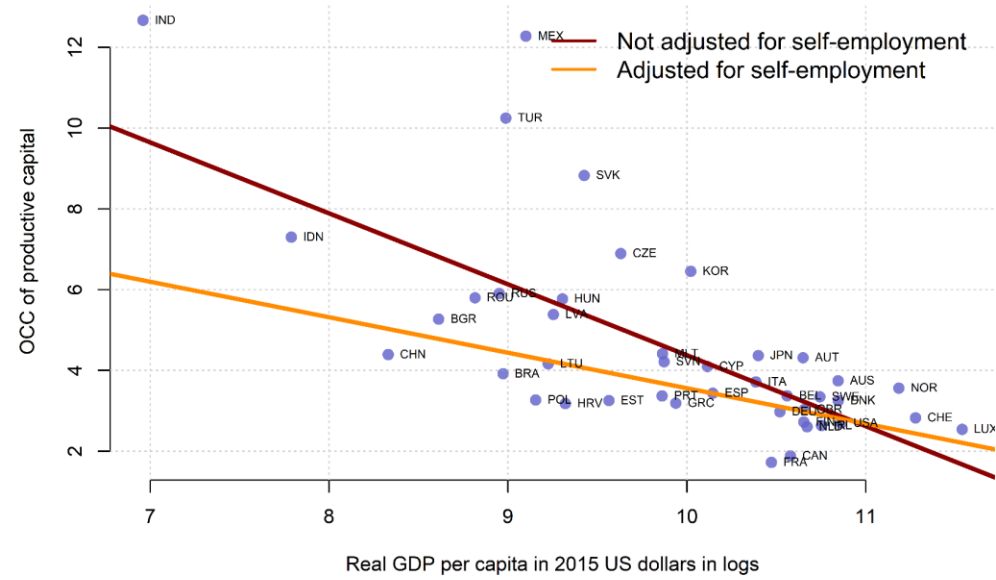
Case 3 - Conventional Marxism
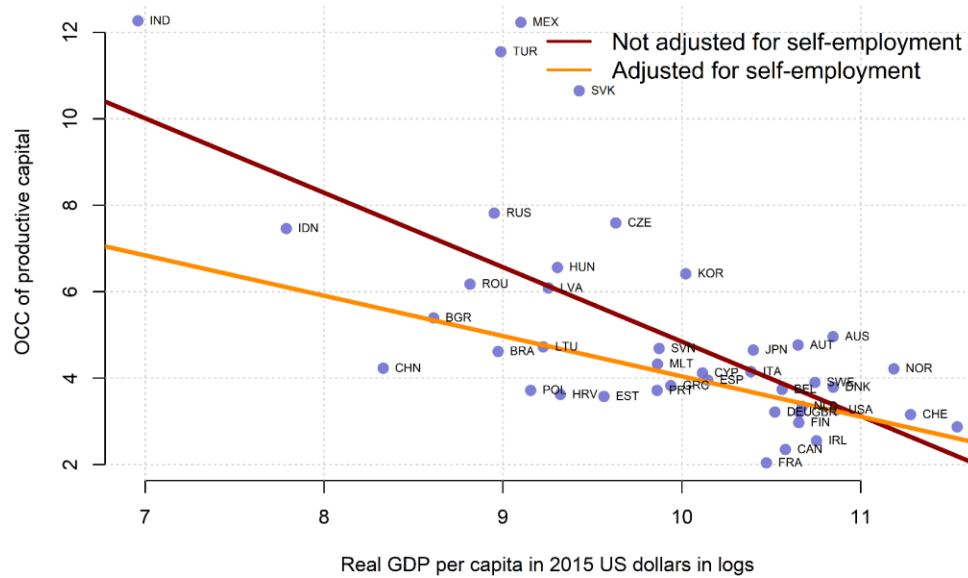
Case 4 - Minimal unproductive activity
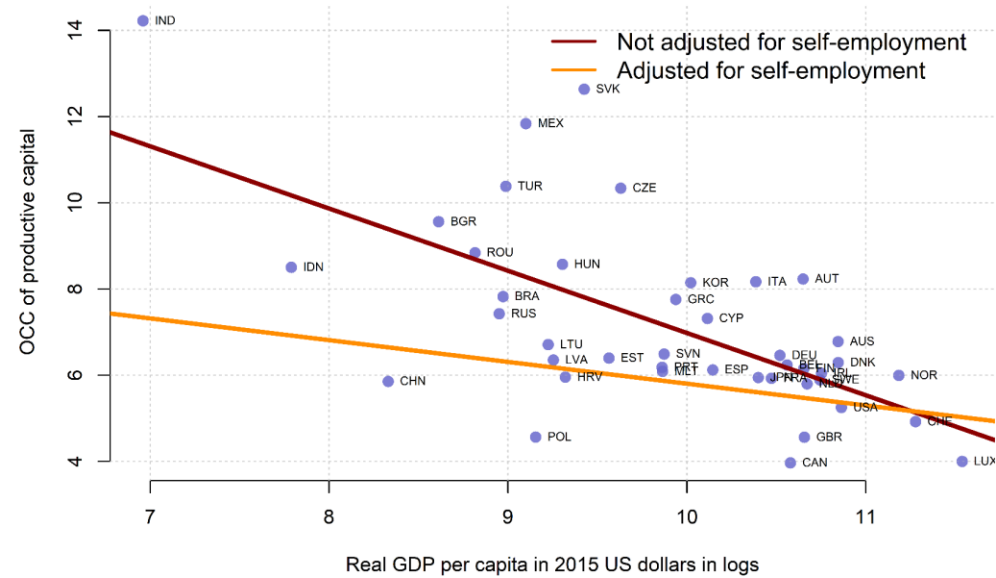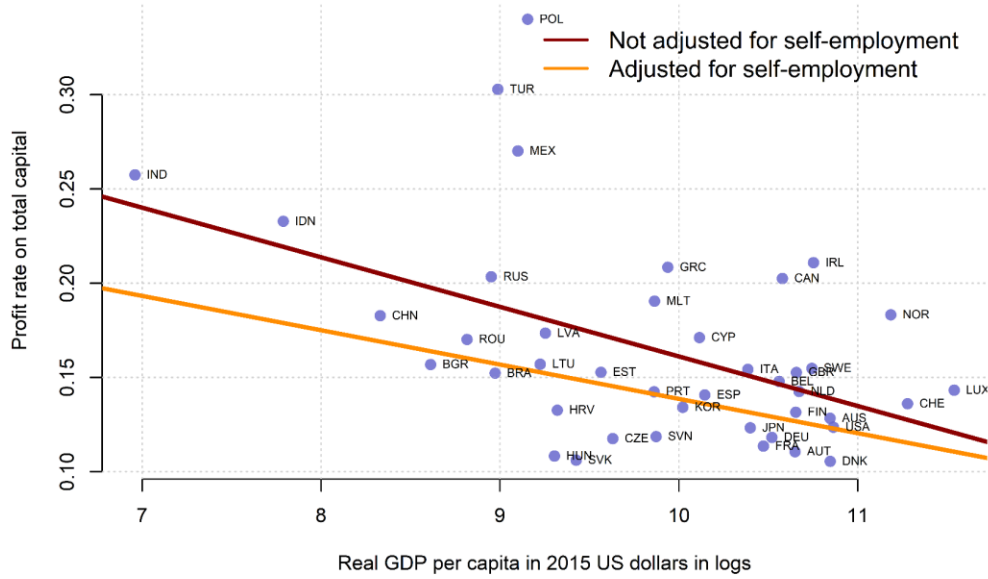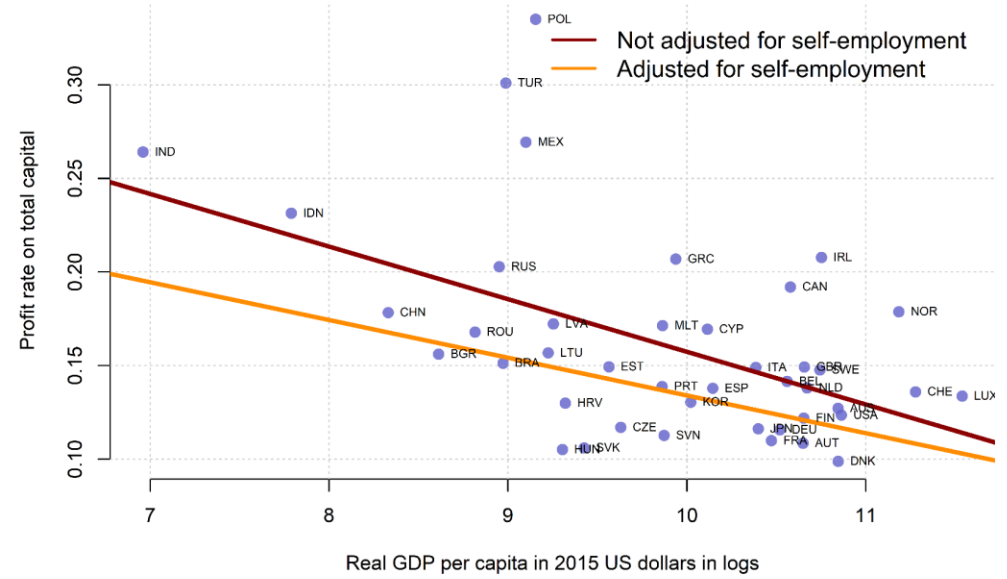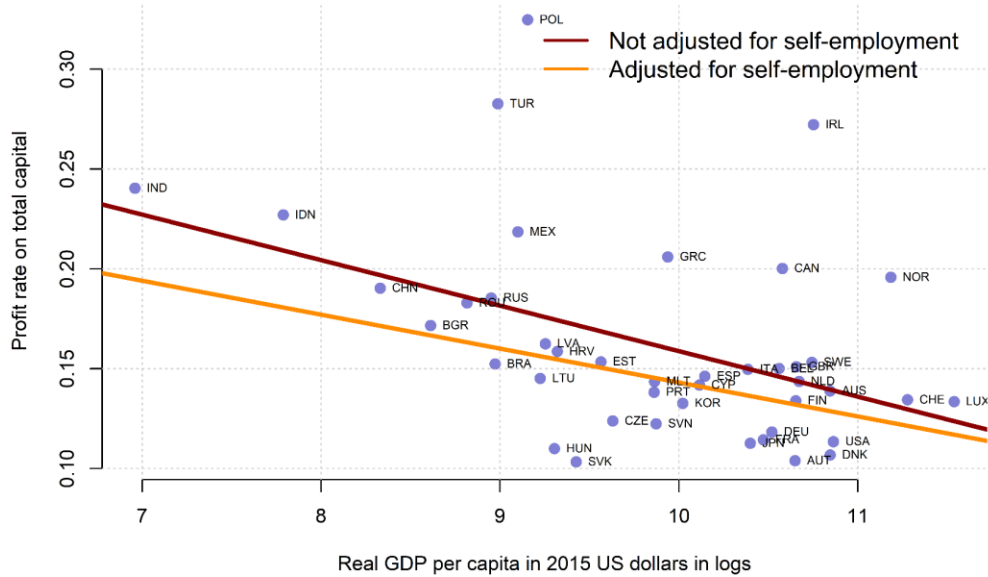
Case 1 - Baseline with knowlege rents

Case 2 - Baseline without knowledge rents

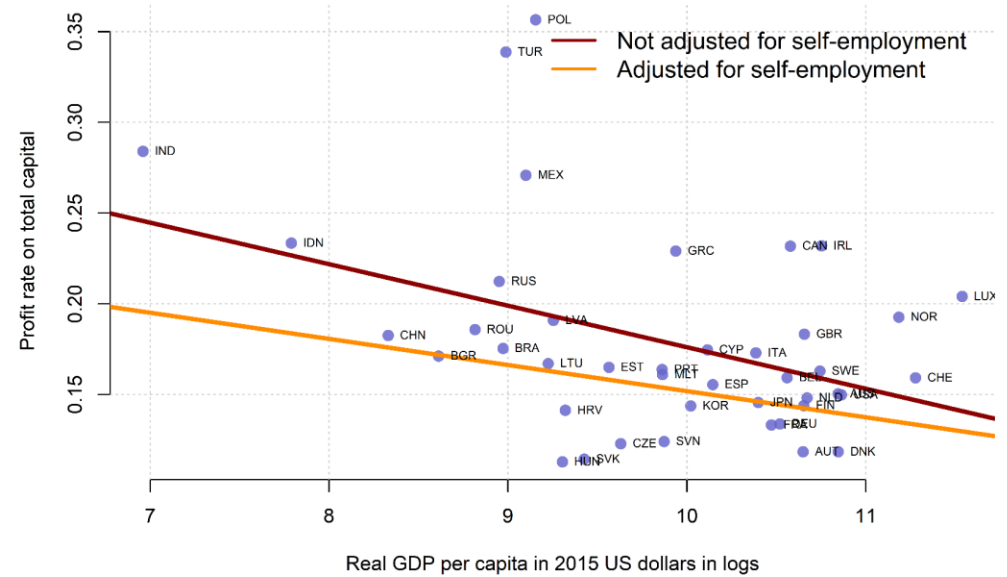Case 3 - Conventional Marxism

Case 4 - Minimal unproductive activity

Table 4: Cross-country Marxist variables regressed on log of real GDP per capita in US dollars

Dependent variable	Case 1 Baseline with Knowledge Rents		Case 2 Baseline without Knowledge Rents		Case 3 Conventional Marxism		Case 4 Minimal Unproductive Activity	
	Pooled OLS	Panel fixed effects: between	Pooled OLS	Panel fixed effects: between	Pooled OLS	Panel fixed effects: between	Pooled OLS	Panel fixed effects: between
Rate of surplus value	-0.548***	-0.557***	-0.566***	-0.576***	-0.537***	-0.55***	-0.543***	-0.552***
Rate of surplus value [adj. for self-employment]	-0.179***	-0.182***	-0.199***	-0.202***	-0.2***	-0.206***	-0.176***	-0.179***
Organic composition of capital (productive capital)	-1.558***	-1.595***	-1.718***	-1.757***	-1.68***	-1.722***	-1.429***	-1.445***
Organic composition of capital (total capital)	-1.59***	-1.605***	-1.652***	-1.665***	-1.542***	-1.566***	-1.655***	-1.668***
Unproductive composition of capital (unproductive capital)	-0.031	-0.01	0.066	0.092	0.138	0.155	-0.226***	-0.223**
Organic composition of capital (productive capital) [adj. for self-employment]	-0.736***	-0.756***	-0.857***	-0.879***	-0.907***	-0.933***	-0.504***	-0.505**
Organic composition of capital (total capital) [adj. for self-employment]	-0.439***	-0.437	-0.523***	-0.52*	-0.413***	-0.419	-0.58***	-0.578**
Unproductive composition of capital (unproductive capital) [adj. for self-employment]	0.297***	0.319	0.334***	0.359*	0.494***	0.514*	-0.076***	-0.073
Rate of profit on total capital	-0.026***	-0.026***	-0.028***	-0.028***	-0.022***	-0.023***	-0.022***	-0.023***
Rate of profit on productive capital	0.005	0.005	0.003	0.004	0.02***	0.021	-0.025***	-0.025***
Rate of profit on total capital [adj. for self-employment]	-0.018***	-0.018***	-0.02***	-0.02***	-0.017***	-0.017**	-0.014***	-0.014*
Rate of profit on productive capital [adj. for self-employment]	0.011***	0.012	0.009***	0.01	0.025***	0.026	-0.015***	-0.015**
Net income of unproductive activity over the value added of productive activity	0.09***	0.09***	0.068***	0.069***	0.102***	0.102***	0.007***	0.007
Ratio of knowledge rents to net income of unproductive activity	0.022***	0.021**			0.001***	0.001		
Capital stock: unproductive to productive ratio	0.306***	0.318***	0.302***	0.313***	0.392***	0.404***	-0.002	-0.002
Persons engaged: unproductive to productive ratio	0.042***	0.042***	0.025***	0.025***	0.129***	0.128***	0.01***	0.01**
Number of employees: unproductive to productive ratio	0.03***	0.03***	0.015***	0.015**	0.118***	0.117***	0.002	0.002
Employee compensation: unproductive to productive ratio	0.026***	0.027**	0.007**	0.007	0.076***	0.075***	-0.014***	-0.014**
Labor compensation: unproductive to productive ratio [adj. for self-employment]	0.031***	0.031***	0.011***	0.011	0.061***	0.059**	-0.008***	-0.009

Thank You

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