

On the Efficiency of the World Capital Allocation

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Introduction:

- ▶ **Basic Question:** How well are the factors of production allocated across countries?
 - ▶ Implications:
 - ▶ Global efficiency loss
 - ▶ Cross-country income differences
- ▶ **Models and data to distinguish**
 - ▶ Mobile/reproducible vs. fixed/exogenous.
 - ▶ Barriers/distortions vs. production function differences

Related Literature

- ▶ Dispersion in the marginal product of capital:
 - ▶ Lucas
 - ▶ Caselli and Freyer

- ▶ Cross-country reallocation of resources: e.g.
 - ▶ Burstein and Monge-Naranjo
 - ▶ Klein and Ventura
 - ▶ Gourinchas and Jeanne.

and many others...

Road Map

1. **Our Model**
2. **Measured Factor Rents**
3. **Results: MPKs across countries & overtime**
 - 3.1 *Decomposition.*
 - 3.2 *Observable policies:*
 - 3.2.1 *Financial Development.*
 - 3.2.2 *Openness.*
4. **Policy Counterfactuals**
5. **Conclusions**

The Model

- ▶ Countries: $j = 1, \dots, J$; Time periods, $t = 0, 1, 2, \dots$
- ▶ Output

$$Y_{j,t} = A_{j,t} F_{j,t} [h_{j,t} L_{j,t}, T_{j,t}, K_{j,t}]$$

- ▶ $F[\cdot]$ **HD1**, where:

- ▶ *exogenous*:

- ▶ $A_{j,t}$: TFP
- ▶ $h_{j,t} L_{j,t}$: Human capital corrected labor.
- ▶ $T_{j,t}$: Fixed Capital (natural resources, land, etc.)

- ▶ *endogenous*:

- ▶ $K_{j,t}$: Physical (reproducible & **mobile**) capital:
 $K_{j,t+1} = K_{j,t} (1 - \delta) + I_{j,t}$.

For counterfactuals:

► Output

$$Y_{j,t} = A_{j,t} (K_{j,t}^{\gamma_{j,t}} T_{j,t}^{1-\gamma_{j,t}})^{1-\theta_{j,t}} (h_{j,t} L_{j,t})^{\theta_{j,t}},$$

mobile capital share : $[1 - \theta_{j,t}] \gamma_{j,t}$.

fixed factors : $Z_{j,t} \equiv A_{j,t} T_{j,t}^{(1-\gamma_{j,t})(1-\theta_{j,t})} (h_{j,t} L_{j,t})^{\theta_{j,t}}$

► Preferences: $u_{j,t} = \sum_{s \geq t} \beta^{(s-t)} \left[L_{j,s} \frac{(c_{j,s})^{1-\sigma}}{1-\sigma} \right]$.

Marginal Product of Capital

- ▶ **Physical or real:**

$$RMPK_{j,t} = [1 - \theta_{j,t}] \gamma_{j,t} \frac{Y_{j,t}}{K_{j,t}}.$$

- ▶ **Nominal or value MPK:** Capital and output prices $P_{j,t}^Y$, $P_{j,t}^K$:

$$NMPK_{j,t} = [1 - \theta_{j,t}] \gamma_{j,t} \left[\frac{P_{j,t}^Y}{P_{j,t}^K} \frac{Y_{j,t}}{K_{j,t}} \right].$$

$P_{j,t}^Y$, $P_{j,t}^K \supseteq$ barriers, costs, frictions, etc.

- ▶ additional barriers/costs/frictions \implies dispersion in $NMPK_{j,t}$.

Measuring Output Shares of Non-Produced Capital

- ▶ **World Bank:** Measurement of Wealth Stocks

$$N_{j,t} = \sum_{\text{nat. res. } q} \left[\text{Rents}_{j,t,q} \sum_{s=0}^{T_q} \frac{(\mathbf{G}_{j,q})^s}{(1 + \mathbf{r}^*)^s} \right],$$

assumptions on PVs: $\mathbf{G}_{j,q}$, \mathbf{r}^* , T_q .

Natural Capital Stocks q

Energy resources	Croplands
Mineral resources	Pasture lands
Timber resources	Protected areas.
Non-timber forest resources	Urban land *

Measuring Output Shares of Non-Produced Capital

- ▶ **Caselli-Freyer:** Same Rate of Return between K and N .

$$[1 - \theta_{j,t}] \gamma_{j,t} = \frac{K_{j,t}}{N_{j,t} + K_{j,t}} \times [1 - \text{labor share}_{j,t}]$$

- ▶ Estimates for 1995/96.

- ▶ **Monge-Sanchez-Santaeulàlia:**

$$[1 - \theta_{j,t}] \gamma_{j,t} = \left[1 - \text{labor share}_{j,t} - \frac{\sum_{\text{nat. res. } q} [\text{Rents}_{j,t,q}]}{Y_{j,t}} \right]$$

- ▶ Based on the same World Bank rents
- ▶ No assumptions on PVs or rate of return of N and K
- ▶ For $t = 1970 - 2005$.
- ▶ With or without urban land as fixed capital.

Results

Figure: RMPKs over time

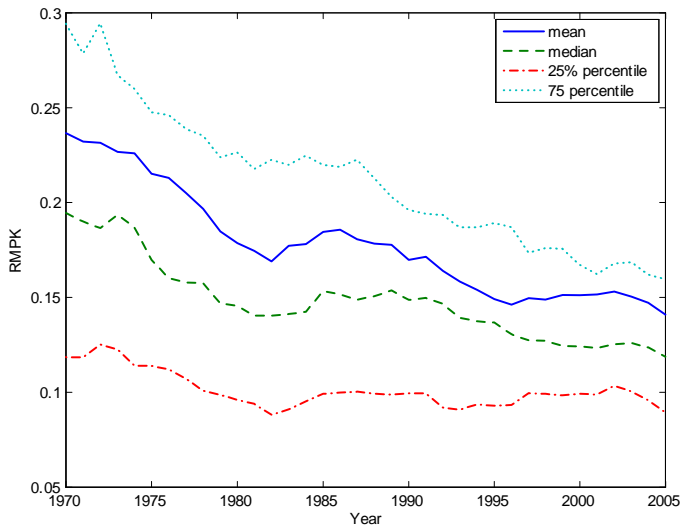


Figure: NMPKs over time

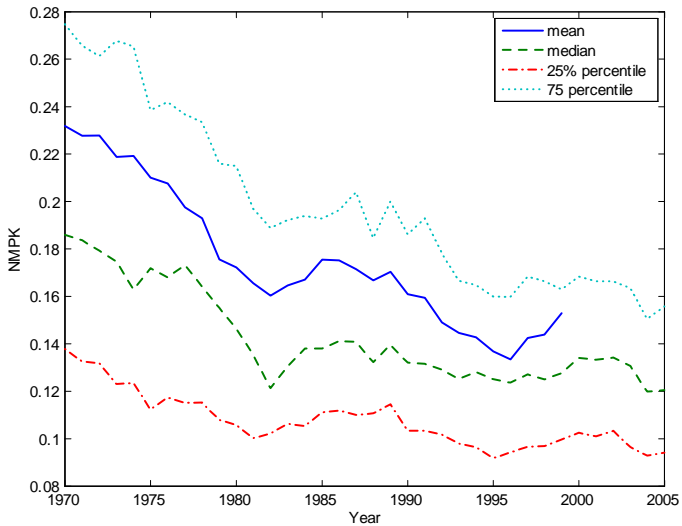
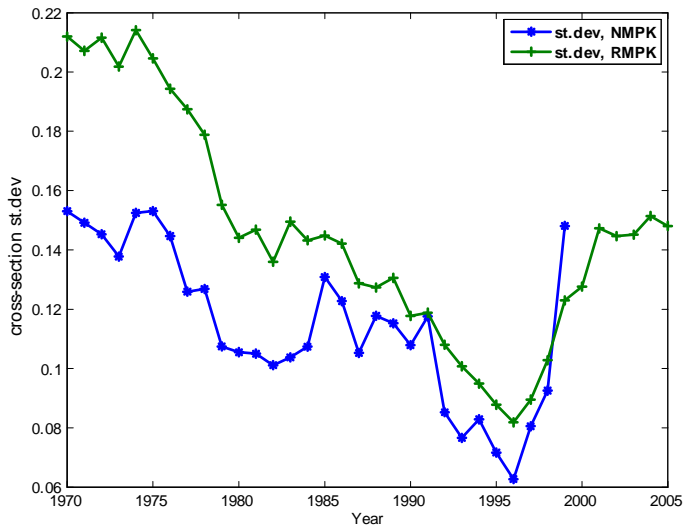


Figure: Evolution in the cross-section dispersion of MPKs



Decompositions

Observable Policies

Policy Regimes

- ▶ **Openness:** Sachs-Warner (and later refinements & extensions)
 - ▶ $\{0, 1\}$ indicator; $1 = \text{open} \iff$ **all of the following:**
 - ▶ low tariffs
 - ▶ low non-tariff trade barriers
 - ▶ low black-market premium
 - ▶ no socialist (a la Kornai)
 - ▶ no state monopoly of exports
- ▶ **Financial repression:** Financial intermediation.
 - ▶ Year-by-year quartiles of active-passive interest rates.

MPK across Policy Regimes: Overall averages, 1970-2005

Policy Regimes		RMPK		NMPK	
		Mean	Median	Mean	Median
Openness					
<i>Open</i>	<i>SW=1</i>	0.181	0.151	0.189	0.164
<i>Closed</i>	<i>SW=0</i>	0.291	0.229	0.255	0.197
Financial Repression					
<i>Quartile</i>	<i>Mean margin</i>				
1	0.03	0.192	0.141	0.250	0.163
2	1.62	0.163	0.139	0.178	0.154
3	3.20	0.177	0.158	0.179	0.165
4	5.51	0.219	0.165	0.229	0.150

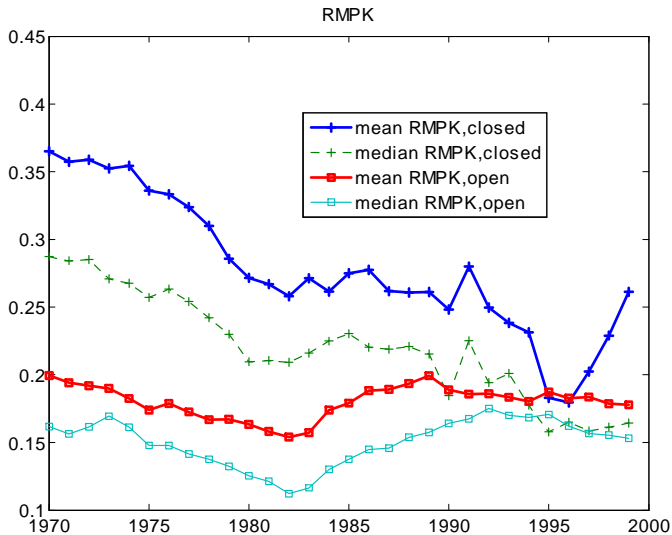


Figure: Openness and RMPKs over time

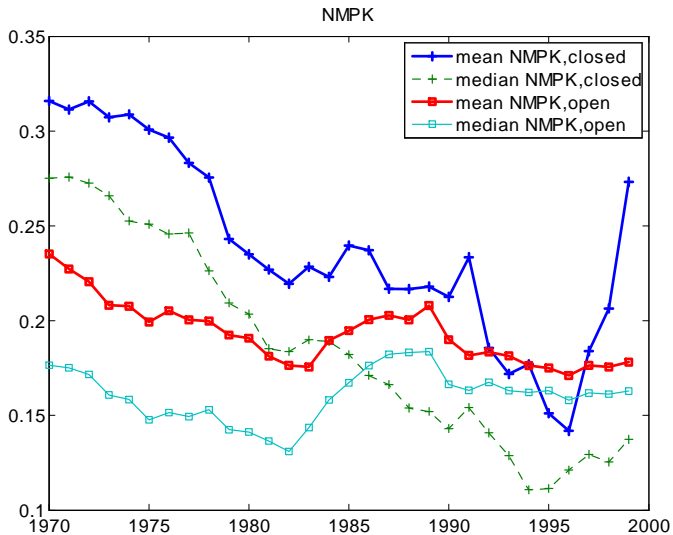


Figure: Openness and NMPKs over time

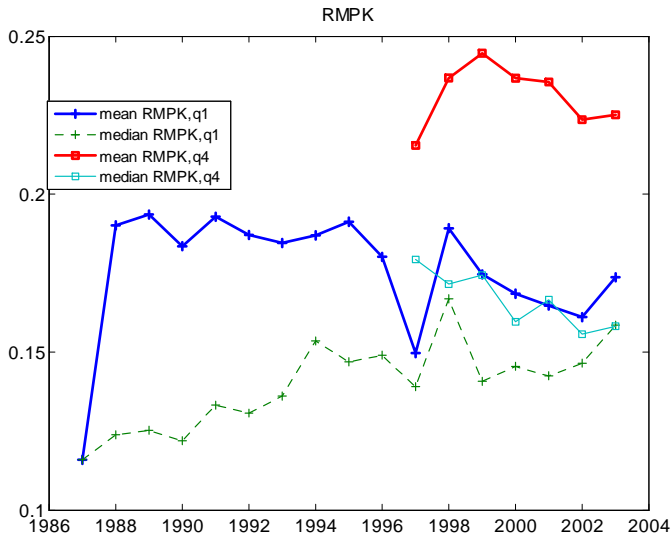


Figure: Financial Repression and RMPKs over time

NMPK

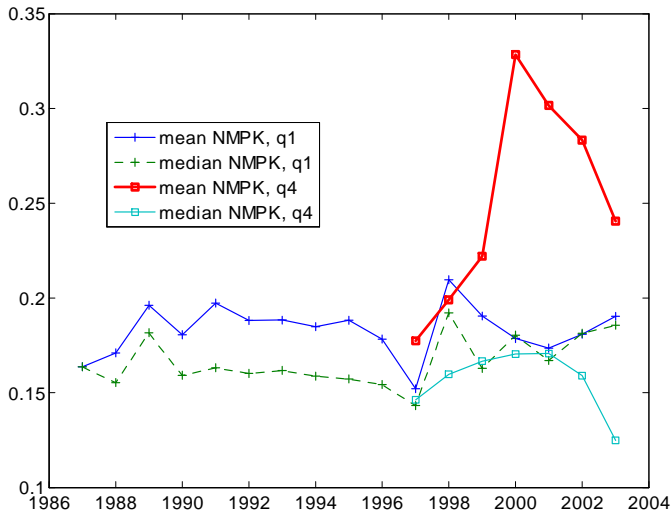


Figure: Financial Repression and NMPKs over time

In Sum:

- ▶ **Averages:** 1970-2005: Secular decline in MPKs

$$\text{increasing } \frac{K}{Y} > \left\{ \begin{array}{l} \text{declines in output labor shares} \\ \text{initial decline in non-reprod. share} \end{array} \right.$$

- ▶ **Dispersion:** 1970-2005: Large drop in cross-country MPK dispersion.
 - ▶ Surge after 1996!
- ▶ **Role of prices:** Trends in $P_{j,t}^Y$ and $P_{j,t}^K$ do not seem key.
- ▶ **Policy regimes:** Significant differences across countries with different policy regimes.

Counterfactuals

Counterfactuals

Removing all barriers: (including those driving $P_{j,t}^Y$, $P_{j,t}^K$):

$$\max_{\{K_{j,t}^*\}} \sum_{j=1}^J Y_{j,t} \quad \text{s.t.:} \quad \sum_{j=1}^J K_{j,t}^* = \sum_{j=1}^J K_{j,t}^O.$$

i.e. equalization of *NMPK*s.

Removing barriers to capital reallocation (keeping $P_{j,t}^Y$, $P_{j,t}^K$):

$$\max_{\{K_{j,t}^*\}} \sum_{j=1}^J P_{j,t}^Y Y_{j,t} \quad \text{s.t.:} \quad \sum_{j=1}^J P_{j,t}^K K_{j,t}^* = \sum_{j=1}^J P_{j,t}^K K_{j,t}^O.$$

i.e. equalization of *NMPK*s

Figure: Policy Counterfactuals: Global Output Gains

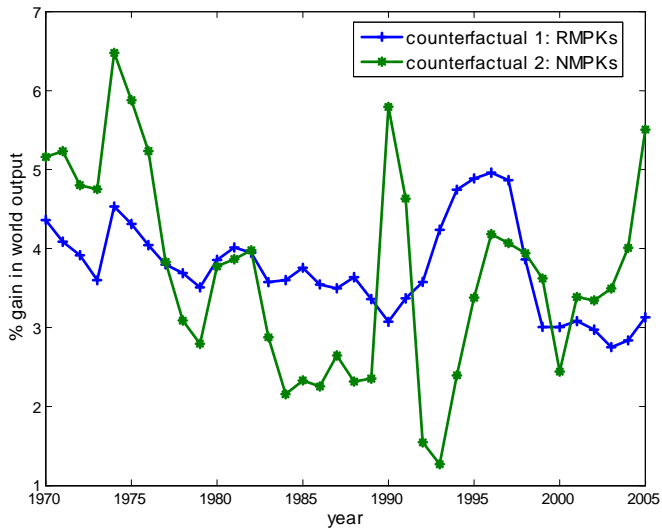
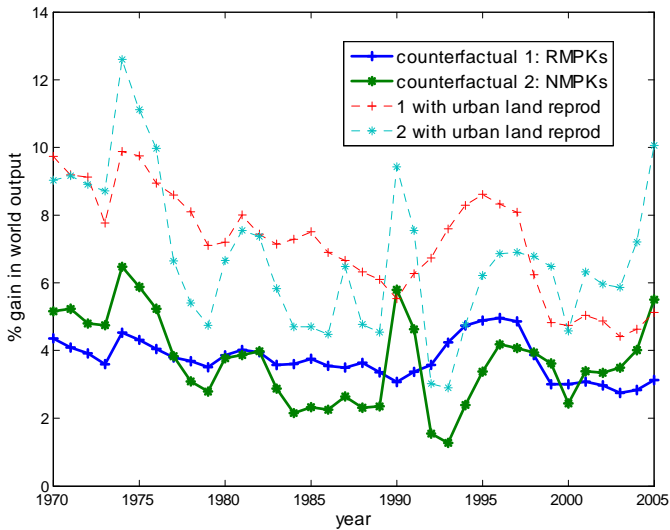


Figure: Global Gains under different assumptions on Urban Land



In Sum:

- ▶ Movement towards higher efficiency since 1970.
- ▶ Yet, large degree of inefficiency: 4-10% global output.
- ▶ Role of prices: $P_{j,t}^Y$ and $P_{j,t}^K$ do not seem the key factor.

Comparison with Caselli & Freyer

Figure: MPKs, Caselli-Freyer vs. MSS, 1996

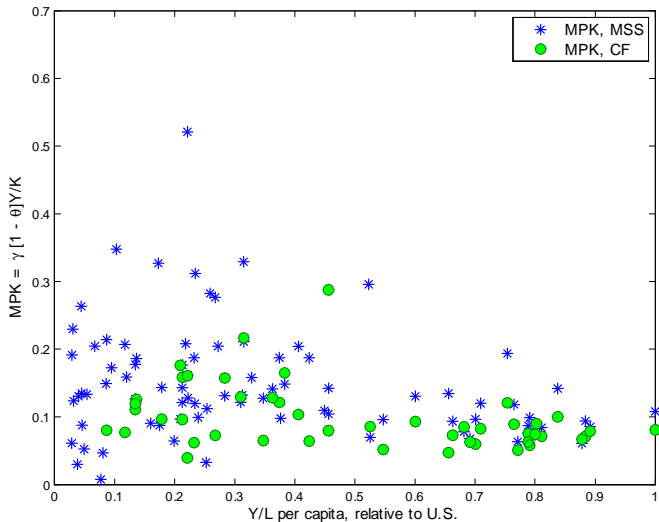


Figure: Reproducible Capital Output Shares, 1996

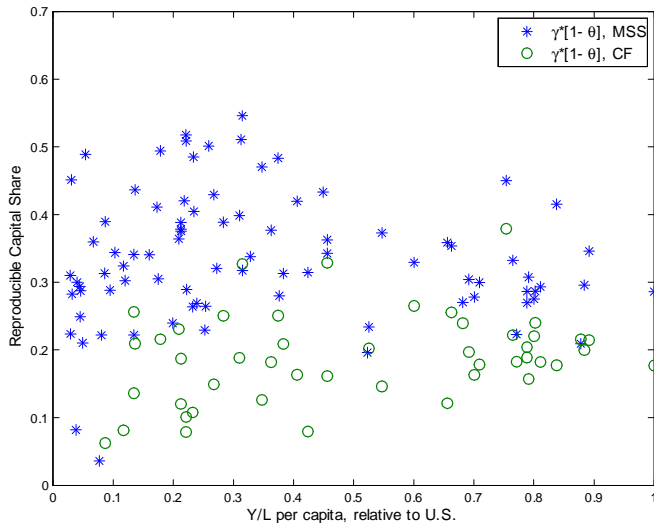


Figure: Capital-Output Ratios, 1996

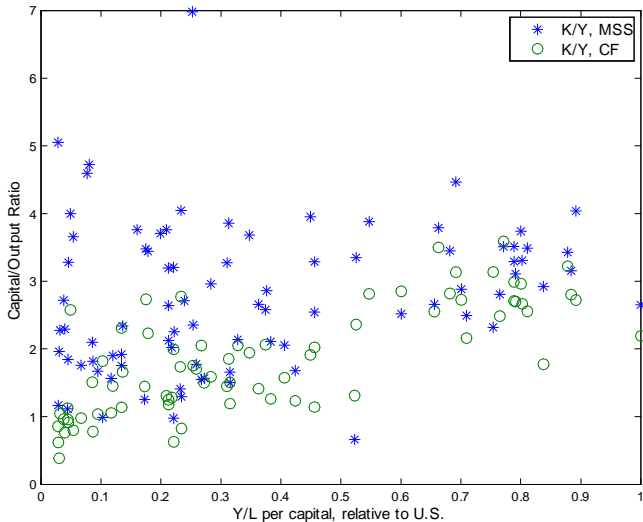
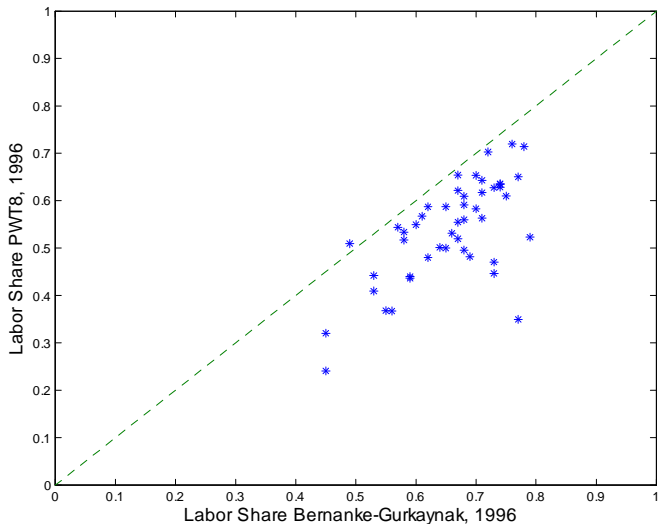


Figure: Labor Shares: PWT8 vs. Bernanke and Gurkaynak, 1996



Conclusions

- ▶ Changes in the efficiency of the allocation of capital.
 - ▶ Strong trend since 1970 towards higher efficiency.
- ▶ Yet, significant efficiency losses seem to remain: 4-10% global output.
- ▶ Ongoing work:
 - ▶ Country level implications.
 - ▶ Measured distortions/barriers, e.g. openness, financial development, etc.
 - ▶ Dynamics.