Evaluating the Financial Systems of Emerging Market Economies

Applied General Equilibrium Development Economics

Robert M. Townsend

The Marschak Lecture
The Econometric Society
Bogota, Colombia
October 5th, 2007
Outline of the Lecture

- The importance of measurement, and actually doing it: from individuals to the national economy
- A Research Algorithm – Application: Thailand
- General Equilibrium CME Benchmark Standards: anomalies, but with some successes
- Policy Impact: financial institutions help move toward standard
- Salient Patterns in the Data: national, regional village, household
- Micro and Macro Decompositions: quasi-analytic, what is important
- Applied General Equilibrium Models: estimation, simulation
- Policy Analysis: welfare gains
- Anomalies: next steps
- Applied General Equilibrium Development Economics
Research Algorithm

MEASUREMENT:
COMMON MACRO/MACRO PLATFORM
AND ACTUALLY DOING IT
The national income accounts and the associated "circular flow" diagram envision little production in the household sector.

Even as constructed, non farm proprietary income has been large relative to other factor payments in the data. Nonfarm proprietary income still dominates corporate profits, for example.

Source: NESDB data series
The national income accounts are based on corporate financial accounts. These distinguish stocks in the balance sheets from cash flow, which is distinguished in turn from (accrued) income.

Table A2 Income Statement of Household A

<table>
<thead>
<tr>
<th>Month</th>
<th>5</th>
<th>6</th>
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<tr>
<td>Livestock</td>
<td>30,485</td>
<td>27,753</td>
<td>26,180</td>
<td>21,780</td>
<td>26,730</td>
<td>28,050</td>
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<td>Livestock Produce</td>
<td>28,985</td>
<td>27,753</td>
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<td>Fish and Shrimp</td>
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<td>Total Revenues</td>
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<td>227,495</td>
<td>192,110</td>
<td>204,625</td>
<td>212,785</td>
<td>309,080</td>
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<td>233,542</td>
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<td>Other Expenses</td>
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<td>Total Cost of Production</td>
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<td>181,187</td>
<td>192,665</td>
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<td>2,740</td>
<td>2,729</td>
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<td>2,794</td>
<td>2,735</td>
<td>2,180</td>
<td>2,798</td>
<td>2,786</td>
<td>2,775</td>
<td>2,763</td>
<td>2,751</td>
<td>2,740</td>
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<tr>
<td>Capital Gains</td>
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<tr>
<td>Capital Losses</td>
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<tr>
<td>Net Income</td>
<td>(22,684)</td>
<td>(12,889)</td>
<td>(2,945)</td>
<td>16,125</td>
<td>20,597</td>
<td>17,290</td>
<td>22,960</td>
<td>24,627</td>
<td>65,891</td>
<td>25,475</td>
<td>21,494</td>
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<td>9,362</td>
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<td>10,849</td>
<td>8,566</td>
<td>16,186</td>
<td>9,663</td>
<td>1,472</td>
<td>3,005</td>
<td>6,332</td>
<td>(2,399)</td>
<td>9,105</td>
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<tr>
<td>Savings</td>
<td>(31,719)</td>
<td>(22,251)</td>
<td>(11,090)</td>
<td>5276</td>
<td>12,031</td>
<td>1,104</td>
<td>13,296</td>
<td>23,155</td>
<td>62,886</td>
<td>19,143</td>
<td>23,892</td>
<td>1,278</td>
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</table>

[Source: Samphantharak and Townsend (2006)]
Village Level

Balance of Payment

Account Balance (% of Avg GDP)

Year

Trade
Current
Capital
Financial
Thai Research Project

This site contains a variety of databases for Thailand and a number of models that can be used to understand the Thai economy. These can be used as an integrated research and policy-making platform. The data include macroeconomic data on economic data from the Bank of Thailand and the National Economic and Social Development Board (NESDB). Intermediate between these institutions is the Community Development Department (CDD) and the Thailand National Statistical Office (NSO).

The main source readily available and easily accessible is the Thailand Database Archive for Research. This database is used to construct and estimate general equilibrium models with implications for trade and welfare across households and firms. The user can choose the appropriate degree of aggregation of the macroeconomic data, e.g. household, household, or country (province) level, or group (regional) level, thus enabling use of an accompanying Geospatial Information System.

The larger goal of this web-based archive is to facilitate the integration of theory with measurement. Frequently the data a theorist might need to calibrate or estimate a model is not available in the single database on hand; hence the inclusion of multiple databases here. Frequently, the necessary data are not available at all. Also, existing surveys do not include variables critical to theoretical models. For example, until recently, there were no longitudinal data for Thailand. A key component of this website is a panel database derived from micro surveys designed from a theoretical perspective. This collection, known as the Townsend Thai Project, is available from this site. The other databases Related Thai Data are also available.

The project is funded primarily by US government foundations, specifically, the National Institute of Health (NIH) and the National Science Foundation (NSF), with Robert M. Townsend as principal investigator. Grants from the Ford Foundation, Mellon Foundation, and the University of Chicago are also gratefully acknowledged.

Papers and publications that use the data available in this archive and describe the details of the models are also available from this site, along with professional abstracts and executive summaries for policy makers. Additionally, a Theoretical Overview is available.

Robert Townsend’s Homepage | Thai Home | Contact Us
National Accounts Underlie Computable General Equilibrium Model

- But be careful about aggregated production function

- Households as Firms - Heaton, Lucas, Vissing-Jorgensen, DeNardi, Basseto

- Be careful about presumed household economies

- Caveats: the difficulty of measurement
  - Sectors
  - Services
  - Quality
  - Prices
  - Consumption versus investment
  - Gifts
Also on the wish list:  
Better Measurement

Combo Surveys of Firms and Owners
Research Algorithm continued...

Neoclassical Anomalies

• If markets and institutions were perfect and there were no policy distortions, then certain benchmark standards would be implied.

• From GE models of entire economy, but could be kinship group, local village, region for example.

• May work for consumption but not investment; some shocks and not others

• Looking at micro evidence for appropriate assumptions about market/institutional structure

• These diagnostics tests are relatively easy to do and can be part of a Financial Sector Evaluation
Relative to these benchmarks there are many anomalies in the Thai economy, even for those using formal credit and savings instruments

Many households and businesses appear to be constrained in occupation choice

Rates of Return Decline With Wealth for Constrained Business and are low for wealthy unconstrained. May hold cash and low return assets.

Poor households and SME enterprise are particularly vulnerable in consumption and investment to variation in income and cash flow

Evidence of Incomplete markets – rubber price shocks not covered
**IMPORTANT EXCEPTIONS:**

- Village as Arrow-Debreu economies, NY Markets are not
- Risk sharing in consumption – can estimate heterogeneity in risk aversion (with Schulhofer-Wohl, Chiappori)
- Investment not sensitive to cash flow though poor if in network (Samphantharak)
- Firms in family-related syndicate are also not credit constrained internally (Samphantharak)

**The Risk Sharing Equation**

\[
\Delta c_{t,t+1}^j = \beta_{t,t+1}^j D_{t,t+1}^j + \delta \Delta \bar{A}_{t,t+1}^j + \eta \Delta h_{t,t+1}^j
\]

\[
+ \mu J_{j6}^j + \xi \Delta Y_{t,t+1}^j + \nu \Delta Y_{t,t+1}^j X_{j96}^j + u_{t,t+1}^j
\]

\[
\frac{I_t^i}{k_t^i} = \beta_{t,t+1}^j D_{t,t+1}^j + \delta \Delta \bar{A}_{t,t+1}^j + \eta \Delta h_{t,t+1}^j + \mu J_{j6}^j + \xi \Delta Y_{t,t+1}^j + \nu \Delta Y_{t,t+1}^j X_{j96}^j + u_{t,t+1}^j
\]
IMPORTANT EXCEPTIONS

- Village as Arrow-Debreu economies, NY Markets are not
- Risk sharing in consumption – can estimate heterogeneity in risk aversion (with Schulhofer-Wohl, Chiappori)
- Investment not sensitive to cash flow though poor if in network (Samphantharak)
- Firms in family-related syndicate are also not credit constrained internally (Samphantharak)
Aggregation applied at subunits networks within village and related industrial conglomerates

Buriram (Bankrod)  Chachoengsao  Srisaket

[Family Networks in Villages. Source: Townsend Thai Data research with Samphantharak]

[Examples of Simple Group Structures. Source: Samphantharak (2003)]
RAINFALL IS COVERED

[Average Rainfall in Thailand. Source: Data from Thai Meteorological Department]
• Government program innovations and plausibly exogenous variation in access to intermediation have had nontrivial impacts on households and businesses.

• Often not simply an effect of wealth transfer

• Good financial institutions bring us back toward neoclassical standard

• Exploiting exogenous variation or likely instruments
The new one million baht village funds program seems to have increased consumption, profits from businesses, labor income, agricultural investment, and total borrowing above and beyond village fund credit, while raising default rates and lowering assets/savings.

Instrument is inverse number of households per village (with Kaboski)

\[
VFCR_{n,t} = \sum_{i=1}^{I} \delta_i X_{i,n,t} + \theta_t + \theta_n + \lambda_1 \text{invHH}_{t,n} + \lambda_2 \text{invHH}_{t,n} \times \chi_{t=2002} + \lambda_3 \text{invHH}_{t,n} \times \chi_{t=2003} + e_{n,t}
\]

(8.1.5)

\[
y_{n,t} = \sum_{i=1}^{I} \alpha_i X_{i,n,t} + \beta VFCR_{n,t-1} + u_{n,t}
\]

(8.1.3)
• Arguably, exogenous variation in villages funds by:
  • Policy (emergency services training, monitoring, pledged saving, collateral)
  • Type (rice bank, buffalo bank, production credit group, women’s groups)

• Implies variation in impact (asset accumulation, risk sharing, occupation choice, and reliance on money lenders).

• Variation is coming from ministries promoting different institutions and not tracking failures
### Alem Scorecard

Different lenders are different: plus depend on region/ time

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<tr>
<th>Lender</th>
<th>Consumption</th>
<th>Investment</th>
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<tbody>
<tr>
<td>Commercial Bank</td>
<td>Consumption → not helpful</td>
<td>Investment → helps overall and after crisis, “hurt” during</td>
</tr>
<tr>
<td>BAAC</td>
<td>Consumption → helps overall, NE, NE during crisis</td>
<td>Investment → hurts NE, Central after crisis, NE after crisis</td>
</tr>
<tr>
<td>Ag. Coop</td>
<td>Consumption → helps NE, NE after crisis</td>
<td>Investment → helps overall, Central, NE – but helps DURING but not after</td>
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<tr>
<td>PCG</td>
<td>Consumption → helps NE after, NE after</td>
<td>Investment → hurts overall, Central, NE, but helps DURING but not after, esp. Central</td>
</tr>
<tr>
<td>Informal Debt</td>
<td>Consumption → helps NE, after crisis, after NE</td>
<td>Investment → helps during NE, but pretty uniformly helps in Central</td>
</tr>
<tr>
<td>Rice</td>
<td>→ helps consumption in NE, not Central</td>
<td></td>
</tr>
</tbody>
</table>
Caveats

- General Equilibrium Effects - wages (treatment on non-treated)
- Instruments without Modeling - (with Sergio Urzua)
Salient Facts:
Macro: Growth, Inequality
Poverty, Financial Deepening
Growth has been relatively high for the past 50 years, but with a sharp drop in 1997 and the recession in the years of following the financial crisis. But the trend of long term industrialization dominates the data. Caveat: this is not Latin America or Africa
Inequality by almost all measures has been increasing since at least 1976, along with income, but unlike the growth of income, inequality peaks in 1992, with some backtracking for the crisis.
There has been a steady decrease in the fraction of poor and distance of the poor from the poverty line, with only a slight wobble in the crisis. However, in panel data poverty is shown to be a transient rather than chronic phenomenon, especially if income data are used.

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<td>0.446</td>
<td>0.365</td>
<td>0.307</td>
<td>0.256</td>
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<tr>
<td>Poverty Gap</td>
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<td>0.119</td>
<td>0.170</td>
<td>0.127</td>
<td>0.100</td>
<td>0.079</td>
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<td>FGT $P_2$</td>
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<td>0.085</td>
<td>0.060</td>
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</table>

[Summary Statistics of Income in Thai SES. Source: Jeong (2000)]
Financial deepening displays astounding trends relative to the U.S. There was repression. Then part of the increase starting in 1986 can be attributable to financial liberalization.

[Macro Indicators of Financial Deepening in Thailand. Source: Jeong and Townsend (2005)]
Variation in Policy comes from this history

- Repression
- Liberalization
- Village funds of different ministries
- By the 1990's commercial bank regulation appears deficient and government transfers masked the distortion.
- Crisis and recession
- Post crisis, the government involvement in the financial sector has increased (million baht fund).
- BAAC debt moratorium
Salient Facts continued:

From Macro Back Toward Micro

Relative to Cross Country Comparisons
SES projected Income per capita  
(Quiltiles: 1992 level)
Lowest and Highest 20%
Figure 7 - Geographical distribution of the use of BAAC and commercial banks
Decompositions Quasi Analytic - Both Micro and Macro

- List of common factors/variables; financial intermediation is among

- Others are occupation choice, education, urbanization

- Caution: these are like correlations, but some causality was established earlier
Micro Kuznets decompositions

Increasing access/use of the formal sector along with high and increasing income differentials account for a nontrivial part of growth of per capita income and increasing inequality, albeit with other factors (Jeong thesis)

\[ \Delta \mu = \sum_k \bar{p}^k \Delta \mu^k + \sum_k \bar{\mu}^k \Delta p^k \]
### Table: Within- and Across-group Inequality

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<th>Within-group Inequality</th>
<th>Across-group Inequality</th>
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</table>

#### Equations

\[ WI = \sum_{k=1}^{K} p^k I^k \text{ and } AI = \sum_{k=1}^{K} p^k \log \left( \frac{\mu}{\mu^k} \right) \]

\[ \Delta WI = \sum_k p^k \Delta I^k + \sum_k I^k \Delta p^k \]

\[ \Delta AI = \sum_k p^k \left[ \frac{\mu^k}{\mu} - 1 \right] \Delta \ln \mu^k + \sum_k \left[ \frac{\mu^k}{\mu} - \ln \frac{\mu^k}{\mu} \right] \Delta p^k \]

[Decomposition of Inequality Change. Source: Jeong (2001)]

---

**Chapter 4 – Equations**

**Education then finance composition effect**

**Work more of income gaps**
- Macro, total factor productivity is largely explained,
- It is NOT an unmeasured residual aggregate shock
- Access-no access dichotomy is used- (with Hyeok Jeong)

\[
\begin{align*}
TFPG = & \text{TFPG} \_ SSR + \text{TFPG} \_ ACH + \text{TFPG} \_ OCCS + \text{TFPG} \_ FIN \\
TFPG \_ FIN = & \left[ \frac{s_{Y_2}}{Y_2} - \frac{s_{Y_1}}{Y_1} \right] p g_p
\end{align*}
\]
Importance

- Causes of growth and favorite sons/daughters:
  - FINANCIAL INTERMEDIATION
  - OCCUPATION CHOICE/INDUSTRIAIZATION
  - EDUCATION
  - URBANIZATION
  - TECHNOLOGY, OPENNESS?
  - INFRASTRUCTURE/INSTITUTIONS?
  - CORRUPTION, POLITICAL ECONOMY?

Caveat: unobserved heterogeneity, talent

GOAL: do all this in one economy
Algorithm continued
MODEL BUILDING BASED ON SALIENT PATTERNS, FACTORS

Applied General Equilibrium Models

• Thai economy as an integrated micro/macro system, with the choices of diverse individual agents aggregated up to explain macro variables.

• Start with dual models (perfectly intermediated sector vs. financial autarky)
With Xavier Giné
Parameters Estimated with Micro data
Macro simulation: Credit Matters

Eventual diminishing Returns, BUT WE GET TFP

Investment will move too

Dynamics due to improved intermediation

[Intermediated Model (SES Data). Notes: \( \eta = .026, \omega = .321, \gamma_{gr} = 0 \). Source: Giné and Townsend (2004)]

A model of occupation choice WITH EXOGENOUS FINANCIAL DRIVER and occupation choice explains well the upturn in the Thai economy at the time of a financial liberalization
The general equilibrium effect of price changes from financial liberalization can cause losses for existing firms that use unskilled labor.
FINANCIAL DEEPENING

With Kenichi Ueda
A model with endogenous financial access delivers observed long term trends but not that upturn - not a stationary time series

Need to take into account financial policy intervention

Benchmark, best-fit (left-hand graphs) and Higher $\theta$ Variance, best-fit (right-hand graphs). Source: Townsend and Ueda (2005)
Figure 1. Use of Savings

[Use of savings. Source: Townsend and Ueda (2007)]
Be careful about difference and differences
Growth and welfare are not synonymous

[Welfare gains from reduction of marginal costs (left) and from reduction in entry costs (right). Source: Townsend and Ueda (2007)]
From Macro to Regional
[1996 GJ Access Index Simulation Differences. Source: Felkner and Townsend (2004)]
[Financial Deepening Simulation - $k^*$ Defined by Actual Wealth Distribution and Participation Rate. Source: Felkner and Townsend (2004)]
Down to Household-Level Anomalies

THAI ECONOMY

MODEL ECONOMY

[ Source: Jeong and Townsend (2005)]
Moving beyond Dual Sector Models
Endogenous Wealth Creation Alleviates Constraints (Karaivanov, Buera and Shin)
Simple borrowing limits
With Joe Kaboski
Village fund with particular obstacle
Adding Impediments to Trade and Distinguishing Work with Paulson, Karaivanov, Ahlin,

Choices are shown to be constrained by real obstacles to trade. There seems to be MORAL HAZARD in entrepreneurial effort and project choice.

A further example is MONITORING by joint liability borrowers. There seems to ADVERSE SELECTION, the exclusion of safer customers from the loan market.

There seem to be LIMITED COMMITMENT problems, with loan size limited by collateral or wealth, and a tendency for strategic default limited by unofficial sanctions.
- Dynamic Mechanism Design
- The Pareto frontier
- With Alex Karaivanov

Fig. 6 – Pareto Frontiers, full depreciation baseline, $\rho=0$, $k=0.5$

Autarky value = 32.817
Table 6 - Model Comparisons Using Data on Consumption Smoothing \((c,q)\) benchmark is Moral Hazard, \(n=1000\)

**Incomplete depreciation \((\delta = 5\%)\), low measurement error \((\gamma_{\text{me}} = 0.1 \times \text{gridmax})\)**

<table>
<thead>
<tr>
<th>Model</th>
<th>Vuong Test Z-stats</th>
<th>LL value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MH</td>
<td>n.a.</td>
<td>-2561.3</td>
</tr>
<tr>
<td>FI</td>
<td>5.157***(MH)</td>
<td>-2597.4</td>
</tr>
<tr>
<td>B</td>
<td>7.256***(MH), 3.963***(FI)</td>
<td>-2646.4</td>
</tr>
<tr>
<td>S</td>
<td>8.750***(MH), 6.320***(FI), 4.059***(B)</td>
<td>-2682.4</td>
</tr>
<tr>
<td>A</td>
<td>13.52***(MH), 12.11***(FI), 16.35***(B), 12.81***(S)</td>
<td>-2793.6</td>
</tr>
</tbody>
</table>

**Incomplete depreciation \((\delta = 5\%)\), high measurement error \((\gamma_{\text{me}} = 0.5 \times \text{gridmax})\)**

<table>
<thead>
<tr>
<th>Model</th>
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</tr>
</thead>
<tbody>
<tr>
<td>MH</td>
<td>n.a.</td>
<td>-2715.8</td>
</tr>
<tr>
<td>FI</td>
<td>2.105***(MH)</td>
<td>-2724.7</td>
</tr>
<tr>
<td>B</td>
<td>1.633(draw), -0.791(draw)</td>
<td>-2721.4</td>
</tr>
<tr>
<td>S</td>
<td>2.240***(MH), 0.743(draw), 1.592(draw)</td>
<td>-2729.7</td>
</tr>
<tr>
<td>A</td>
<td>3.087***(MH), 2.066***(FI), 2.989***(B), 1.151(draw)</td>
<td>-2735.7</td>
</tr>
</tbody>
</table>

**Complete depreciation \((\delta = 100\%)\), low measurement error \((\gamma_{\text{me}} = 0.1 \times \text{gridmax})\)**

<table>
<thead>
<tr>
<th>Model</th>
<th>Vuong Test Z-stats</th>
<th>LL value</th>
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</thead>
<tbody>
<tr>
<td>MH</td>
<td>n.a.</td>
<td>-2729.6</td>
</tr>
<tr>
<td>FI</td>
<td>4.693***(MH)</td>
<td>-2768.8</td>
</tr>
<tr>
<td>B</td>
<td>6.856***(MH), 2.943***(FI)</td>
<td>-2811.4</td>
</tr>
<tr>
<td>S</td>
<td>9.616***(MH), 5.958***(FI), 5.636**(B)</td>
<td>-2860.2</td>
</tr>
<tr>
<td>A</td>
<td>17.18***(MH), 14.14***(FI), 17.11***(B), 19.18****(S)</td>
<td>-3096.3</td>
</tr>
<tr>
<td>UC</td>
<td>3.308***(MH), -1.67*(UC), -5.09****(UC), -6.40***(UC), -16.5**(UC)</td>
<td>-2754.2</td>
</tr>
</tbody>
</table>

**Complete depreciation \((\delta = 100\%)\), high measurement error \((\gamma_{\text{me}} = 0.5 \times \text{gridmax})\)**

<table>
<thead>
<tr>
<th>Model</th>
<th>Vuong Test Z-stats</th>
<th>LL value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MH</td>
<td>n.a.</td>
<td>-2790.6</td>
</tr>
<tr>
<td>FI</td>
<td>0.857(draw)</td>
<td>-2793.0</td>
</tr>
<tr>
<td>B</td>
<td>2.009**(MH), 1.646*(FI)</td>
<td>-2801.9</td>
</tr>
<tr>
<td>S</td>
<td>4.923***(MH), 4.560***(FI), 4.793**(B)</td>
<td>-2845.1</td>
</tr>
<tr>
<td>A</td>
<td>6.664***(MH), 6.113***(FI), 7.100**(B), 5.077**(S)</td>
<td>-2884.7</td>
</tr>
<tr>
<td>UC</td>
<td>1.345(draw), 0.680(draw), -0.77(draw), -4.15**(UC), -6.24**(UC)</td>
<td>-2797.5</td>
</tr>
</tbody>
</table>

**NOTES:**
*** = 1%, ** = 5%, * = 10% two-sided significance level; the better fitting regime is in the parentheses;
"draw" denotes the tested regimes cannot be statistically distinguished from each other relative to the data.
More Work on the Supply Side - Industrial Organization

With Sergey Mityakov and Juliano Assuncao
Other Related Efforts

- There are relatively few contributions of this kind, and practically none in developing countries.
- **Banerjee and Duflo**: cross-country growth dynamics and TFP pioneered by Lucas among others are hard to reconcile with an aggregated production function, that is, as if the neoclassical framework were assumed to cover the micro data.
- Build toward a new micro-founded model with a small number of alternative technologies and varying fixed costs.
- They view their contribution as a preliminary attempt but of interest precisely because there are few other studies and almost none which combine micro estimates with endogenous growth and inequality dynamics.
- Clearly progress can be made:
  - **Heckman, Cameron, and Taber** study wage dynamics and inequality in dynamic general equilibrium models estimated with US data
  - **Cagetti and DeNardi** study entrepreneurial wealth in inequality in the U.S. with structural g.e. models.
  - Some of the asset pricing literature is solidly in this tradition (**Hansen, Cochrane, Singleton, Lucas**).
  - Real business cycle literature
  - International Trade
Applied General Equilibrium Development Economics

- The whole may be greater than the sum of the parts
- There is relatively little work in development that combines micro economics and macro economics
- Relatively little work that combines both theory and data
- Both the micro and macro data are put into a common framework for measurement
- Various theories can be rejected in the data (fathering further rounds of iterative research agenda)
- Modified and new theories which link growth, inequality, poverty, and financial deepening.
- Research to assess and quantity the heterogeneous impact of financial policy change at the level of households and firms while being consistent with the facts of growth, inequality, and poverty.