14.772 -
Lecture 2 -
February 7, 2013 -

Robert M. Townsend -

Micro Founded Macro Models -

- Theoretical models tell well articulated, plausible stories of the impact of the financial sector on growth, inequality, poverty. But how do we know that these models match up to reality and can thus help us in the formulation of policy?

- This lecture shows how to estimate the key financial economic underpinnings of two well known, pre-existing models in the literature. The case study is Thailand but we extend this local within-country data and to data from other countries.

- We do this by fitting micro economic data to the choices that households and businesses make, thus delivering a subset of the key parameters. The remaining parameters are calibrated at plausible values, but typically using only subsets of the data, as with initial conditions. Then the model at all these imposed parameter values is simulated over time, and predicted paths of macro aggregates are compared to actual time paths in the data. Macro aggregates include growth, inequality, income, savings rates, and labor share of GDP, as well as key parts of each model, that is, the fraction of households running business or the fraction of households participating in the financial sector. Financial deepening is exogenous, imposed at observed values in one model, and endogenous, a key choice in the other.

Micro Founded Macro Models (cont.) -

- Each model lends itself to a quantification of the welfare gains from a policy intervention. In the model with an exogenous expansion of the financial sector, we can measure impact on winners as well as losers, as households may or may not shift occupations as access to credit and savings increases, and even when they do not shift, there are changes in investment on the intensive margin. The impact of financial deepening depends as well on endogenous wages and interest rates; eventually increasing wages have a huge impact on the relatively poor who do not start businesses but work for others. In the model with endogenous financial deepening, a government takeover of the banking system creates an inefficiency wedge which is associated with a clearly evident stagnation in growth rates. The welfare loses from this repression, and conversely the welfare gains from subsequent financial liberalization are quantified using the lens of the model.
- Though welfare gains as a fraction of wealth from financial liberalization can be quite large, the impact on subsequent growth can be small, if not negligible, as growth depends on the endogenous expansion of the financial system, which depends on investment in costly infrastructure. Likewise, time series and panel data generated from the model offer a stark warning that running cross-country regressions to assess the impact of finance on growth and inequality is treacherous if the data come from actual economies in transitions (not yet in steady state).
- The larger theme here, however, is not to promote these two models as the end of the story, but rather to promote the method of analytic attack. The models are relatively successful in Thailand, but fit less well in Mexico, especially during a devaluation and sudden stop. As it turns out, that outcome was predictable from the first step, from the ability the assumed key ingredients to fit the micro data. Indeed, one can take each of the models to local, village and regional data within Thailand, and deduce that the occupation choice model is reasonably successful, but the financial depending model does not take into the account the contrasting behavior of government vs. private sector financial service providers. The lecture ends with a comparison of the successes and failures of each model, hence directions for further research. Ultimately policy recommendations vary from one model to the next so it is important to find one that is approximately correct in both its micro and macro aspects.

"Growth and Inequality: Model Evaluation Based on an Estimation-Calibration Strategy" Jeong & Townsend, 2003 -

Our purpose is to understand growth and inequality. We do this through an evaluation of macro models that are explicit about micro underpinnings and impediments to trade. We use the explicit structure of the macro models to make exact numerical predictions for aggregate dynamics, the dynamics of key groups, and end-of-sample period income distributions, and we compare these predictions to those objects in the data from a given, selected country. In this sense, we take the theory seriously as in the calibration, real business cycle literature. However, the parameters of preferences, technology, and distribution of shocks that we use are neither arbitrarily chosen nor borrowed from other studies. Rather, we explicitly estimate the key parameters using the models' micro··"

Static Applied General Equilibrium: Dual Sector Model

- Bernhardt and Lloyed-Ellis (Restud 2000) and Gine and Townsend (2004)
  - Occupational choice: Farmers, Workers and Entrepreneurs
  - Given distribution of talent, i.e. fixed-cost of openning a firm $H(x)$ over $(0,1)$, distribution of inherited wealth $G(b)$
  - Farmers: $W = \gamma + b$
  - Workers: $W = w - v + b$
  - Entrepeneurs: $W = \max_{0 \leq l \text{ and } 0 \leq k \leq b - x} \{f(k,l) - wl - (k + x)\} + b$
  - A person with inherited wealth b and talent x chooses her profession to maximize W: $w > \underline{w} = v + \gamma$ then no one will be farmer. If $x \leq x^e(b,w)$ then she will become an entrepeneur, otherwise she will become a worker.

Static Applied General Equilibrium: Dual Sector Model

- Transition

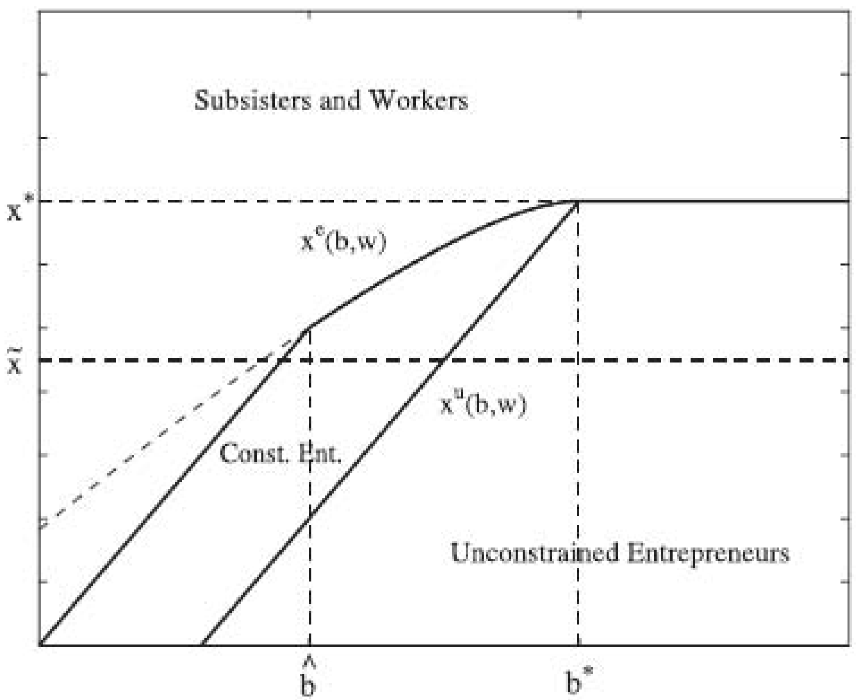


Fig. 1. Occupational choice map.

- General equilibrium:
  - $E(w) = \int H(x^e(b,w))\, G(db)$ and $L(w) = \int \int_0^{x^e(b,w)} l(b,x,w)\, H(dx)\, G(db)$
  - $E(w) + L(w) \leq 1$ with equality if $w > \underline{w}$.

LEB Model

- Model Economy

$$u(c_t, b_{t+1}) = c_t^{1-\varpi} b_{t+1}^{\varpi}$$

There are two kinds of production technologies. In traditional sector, everyone earns a safe subsistence return γ of a single consumption good. In modern sector, entrepreneurs hire capital k_t and labor l_t at each date t to produce the single consumption good according to a production function

$$f(k_t, l_t) = \alpha k_t - \frac{\beta}{2} k_t^2 + \xi l_t - \frac{\rho}{2} l_t^2 + \sigma l_t k_t.$$

For the rest of the article please visit: "Growth and Inequality: Model Evaluation Based on an Estimation-Calibration Strategy." by Hyeok Jeong and Robert M. Townsend. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2864508/#

Transitions

Bernhardt and Llloyed-Ellis: Rudimentary Dynamics

- Given W each person solves $\max_{C+B\leq W} U(C,B)$ this gives the bequest function $B(W)$
- $G_t(b) \Longrightarrow w_t \Longrightarrow G_{t+1}(b)$
- The phases of economic development
  - Phase 1 (the Dual Economy, $0 \leq t \leq \tau_1$) Wages remain at $\underline{w}$. Incomes and wealths grow in the first-order stochastic sense.
  - Phase 2 (the Transition, $\tau_1 \leq t \leq \tau_2$) Wages begin to rise, but income and wealths continue to grow in the first-order stochastic sense.
  - Phase 3 (Advanced Economic Development, $t \geq \tau_2$) Wages rise, and incomes and wealths grow in the second-order stochastic sense.
  - Phase 4 (Long Run) Wages converge and the distribution of incomes and wealths converage to unique limitting distributions which are independent of the initial distribution.

Incorporate Financial Sector
Gine and Townsend (2004)

- A fraction α of people have access to borrowing and lending, equilibrium interest rate R
  - Farmers: $W = \gamma + Rb$
  - Workers: $W = w - v + Rb$
  - Entrepeneurs: $W = \max_{0 \leq l \text{ and } 0 \leq k} \{f(k,l) - wl - R(k+x)\} + Rb$
  - If $x \leq \widetilde{x}(R,w)$ then she will become an entrepeneur, otherwise she will become a worker.
- General equilibrium (w, R) are such that
  - $S(w,R) = \alpha b$ and $D(w,R) = \alpha \int \int_0^{\widetilde{x}(R,w)} (k(R,w) + x) H(dx) G_1(db)$
  - $E(w) = \alpha \int H(\widetilde{x}(R,w)) G_1(db) + (1-\alpha) \int H(x^e(b,w)) G_2(db)$ and $L(w) = \alpha \int \int_0^{\widetilde{x}(R,w)} l(R,w) H(dx) G_1(db) + (1-\alpha) \int \int_0^{x^e(b,w)} l(b,x,w) H(dx) G_2(db)$
  - $D(w,R) \leq S(w,R)$ with equality if $R > 1$
  - $E(w) + L(w) \leq 1$ with equality if $w > \underline{w}$

Policy Impact
Gine and Townsend (2004) Thailand

INTERMEDIATION IMPACTS GROWTH , INTERMEDIATION, INEQUALITY, POVERTY, # FIRMS

Macro simulation: Credit Matters

Eventual diminishing Returns, BUT WE GET TFP

Investment will move too

Dynamics due to improved intermediation

$\eta = .026,\ \omega = .321,\ \gamma_{gr} = 0$

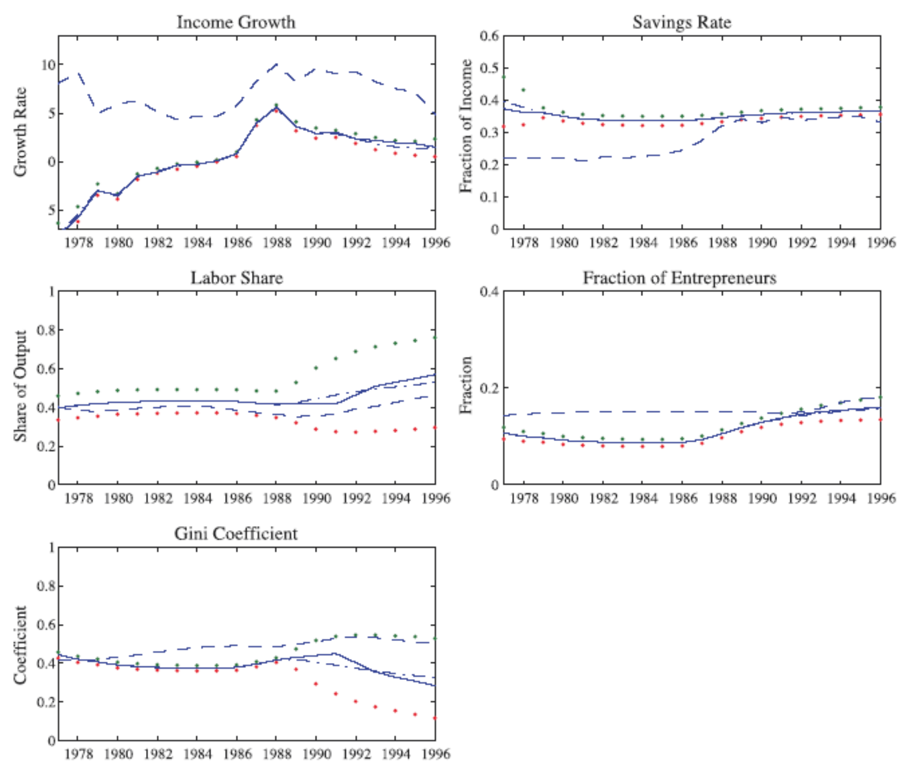


Fig. 3. Intermediated model (SES Data). Legend: – – (dash–dash) Thai economy, — (solid) simulation at estimated parameters, –· (dash–dot). Mean simulation,···(dot–dot) confidence intervals.

[Intermediated Model (SES Data). Notes: . Source: Giné and Townsend (2004)]

Gine and Townsend (2004) Thailand

DISTRIBUTION OF GAINS

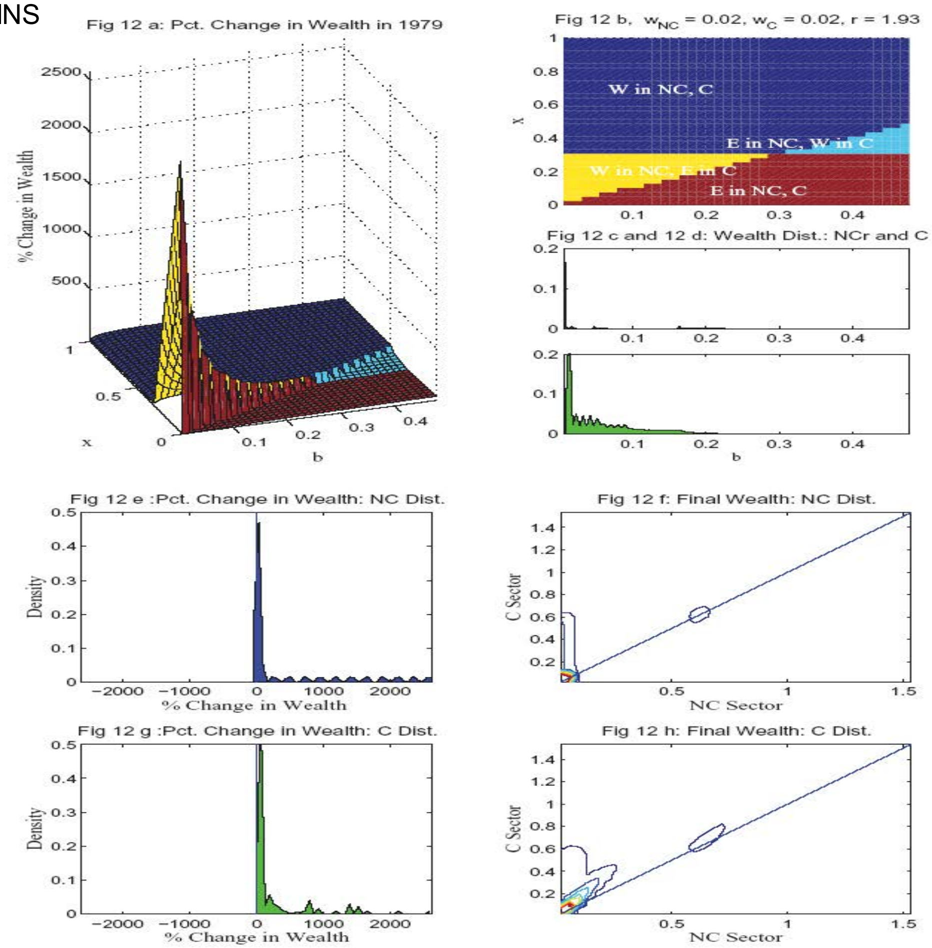
Gains depend on wealth and talent-need disb of each-
-
Rich hh sensitive to Interest rate, occupation choice

Not talented rich give up firms and save

Change in talent will change impact

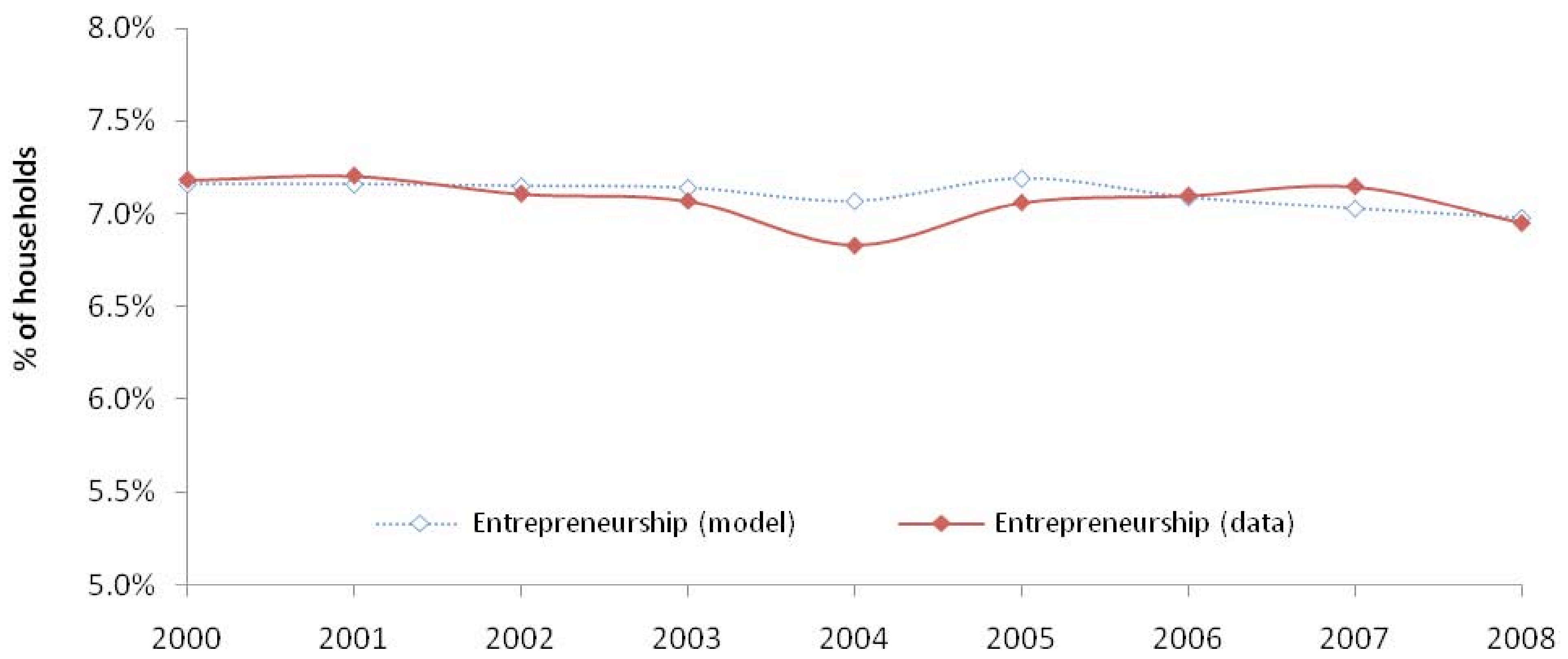
Poverty Reduction: Laudable Goal

Here it is Linked to macro growth



[Welfare Comparison in 1979 (Townsend Thai data) Source: Giné and Townsend (2004)]

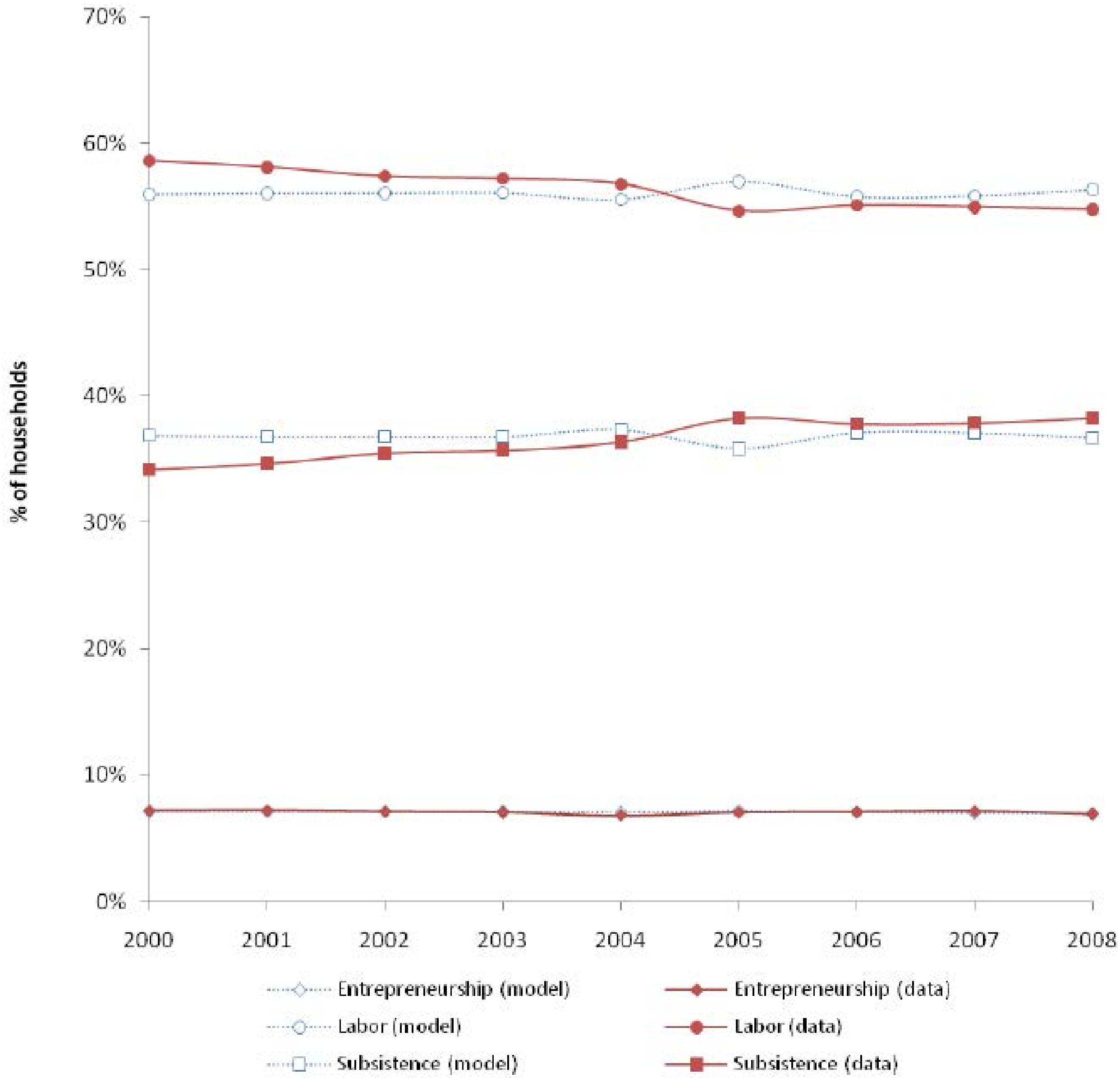
Figure 7.6.2.2 Data and model-predicted average entrepreneurship levels, 2000-2008 (metric #2)



Source: Own calculations, ENOE/ENEU

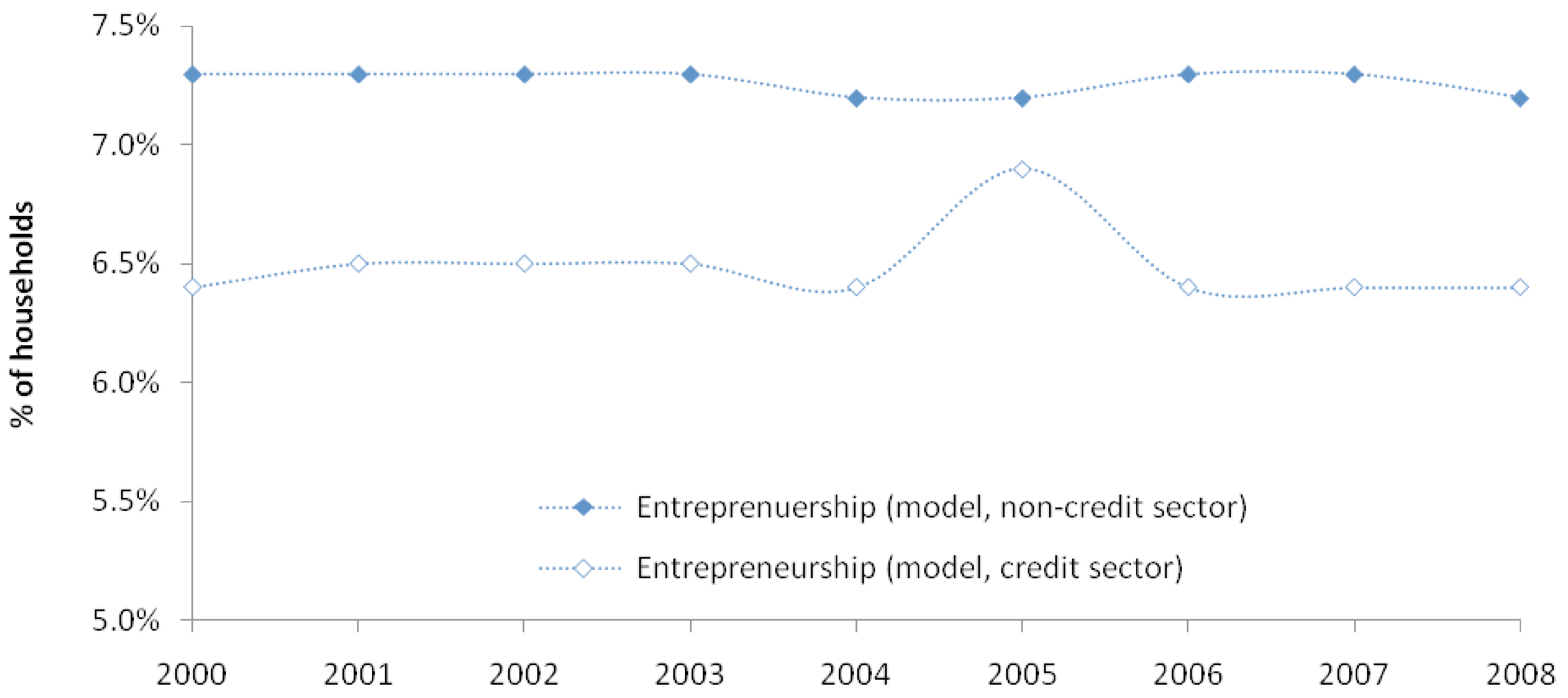
Once again, the model predicts a higher entrepreneurship rate for the sector of the economy without credit. The entrepreneurship rate for this sector dies not vary substantially, whereas the entrepreneurship rate for the credit-enabled sector does vary a great deal, and again, increases noticeably in 2005.

Figure 7.6.2.5 Occupational partitions from data and model, 2000-2008 (metric #2)



Source: Own calculations, ENOE/ENEU

Figure 7.6.2.3 Model-predicted entrepreneurship levels in credit- and non-credit sectors, 2000-2008 (metric #2)



Source: Own calculations, ENOE/ENEU

Transition

DSGE: Greenwood-Jovanovic (JPE 1990)

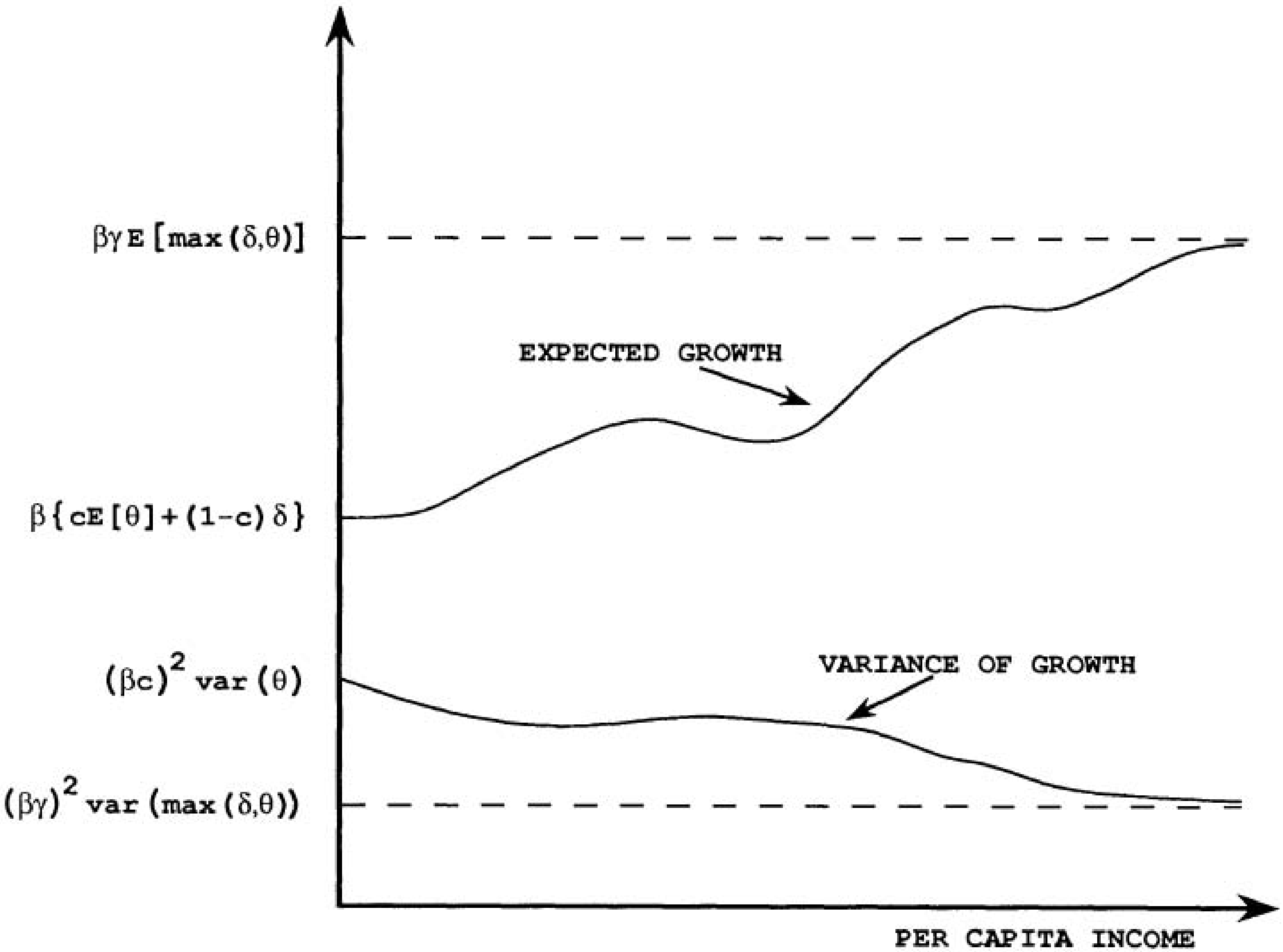


Fig. 1.—Empirical implications

DSGE: Greenwood-Jovanovic (JPE 1990)

- A model of financial participation
- Household j maximizes

$$E_0 \left[\sum_{t=0}^{\infty} \beta^t \ln \left(c_t^j \right) \right]$$

with three investment choices

- Riskless: i_{t-1} at the end of period $t-1$ yields δi_{t-1} in period t
- Risky: i_{t-1} at the end of period $t-1$ yields $\left(\theta_t + \epsilon_t^j \right) i_{t-1}$ in period t
- Financial intermediary: i_{t-1} at the end of period $t-1$ yields $r(\theta_t)\, i_{t-1}$ in period t, fixed-fee q
- Zero-profit condition for financial intermediaries implies

$$\begin{aligned} r(\theta_t) &= \gamma \max(\delta, \theta_t) \\ q &= \alpha \end{aligned}$$

DSGE: Greenwood-Jovanovic (JPE 1990)

- Value function of individual i

$$W(k_t) = \max_{s_t,\phi_t}\left\{\ln(k_t - s_t) + \beta\int \max\{\text{VNP},\text{VP}\}\, dF(\theta_{t+1})\, dG\left(\epsilon^j_{t+1}\right)\right\}$$

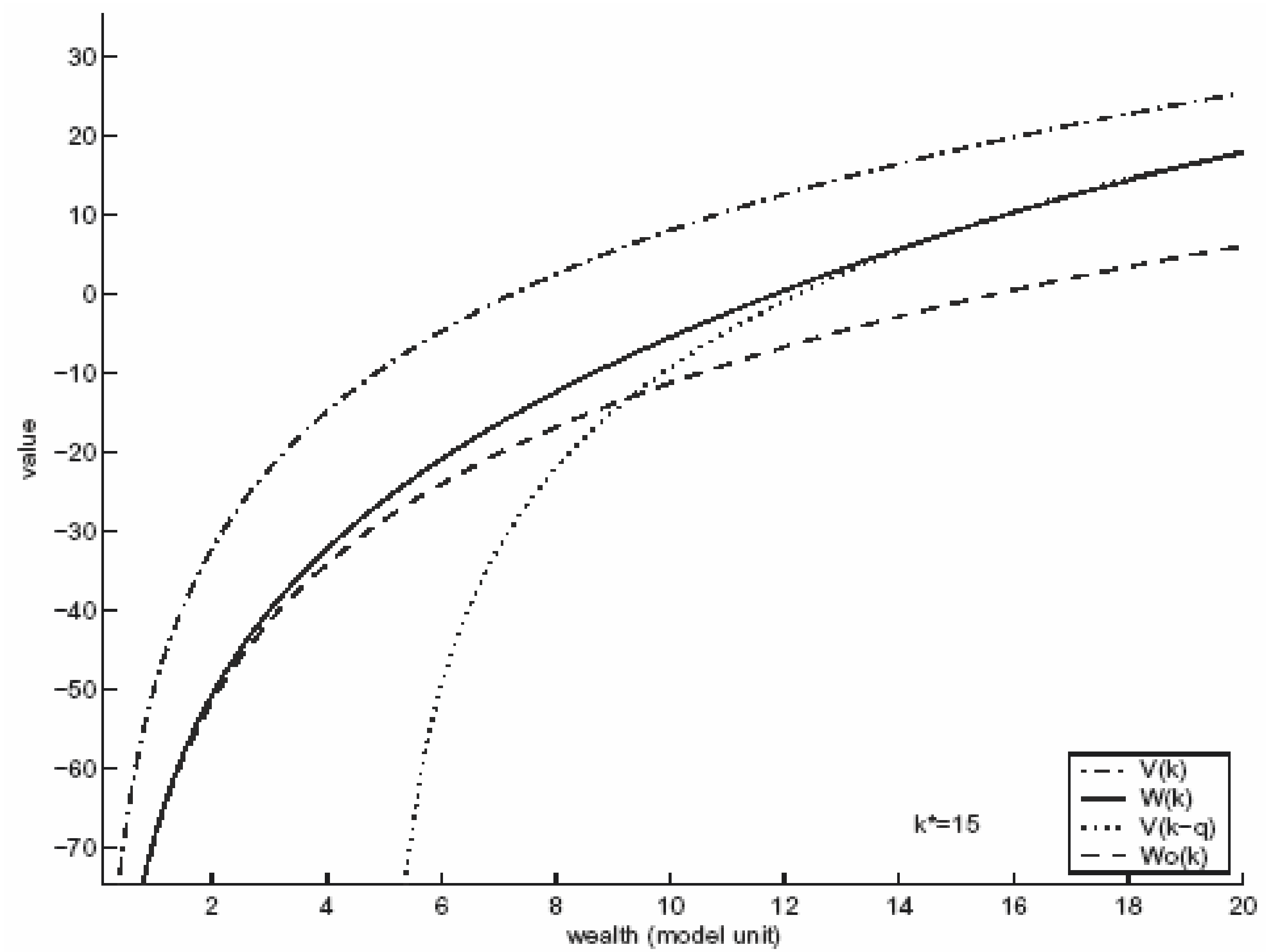
$$\text{VNP} = W\left(s_t\left(\phi_t\left(\theta_{t+1}+\epsilon^j_{t+1}\right)+(1-\phi_t)\,\delta\right)\right)$$

$$\text{VP} = V\left(s_t\left(\phi_t\left(\theta_{t+1}+\epsilon^j_{t+1}\right)+(1-\phi_t)\,\delta\right)-q\right)$$

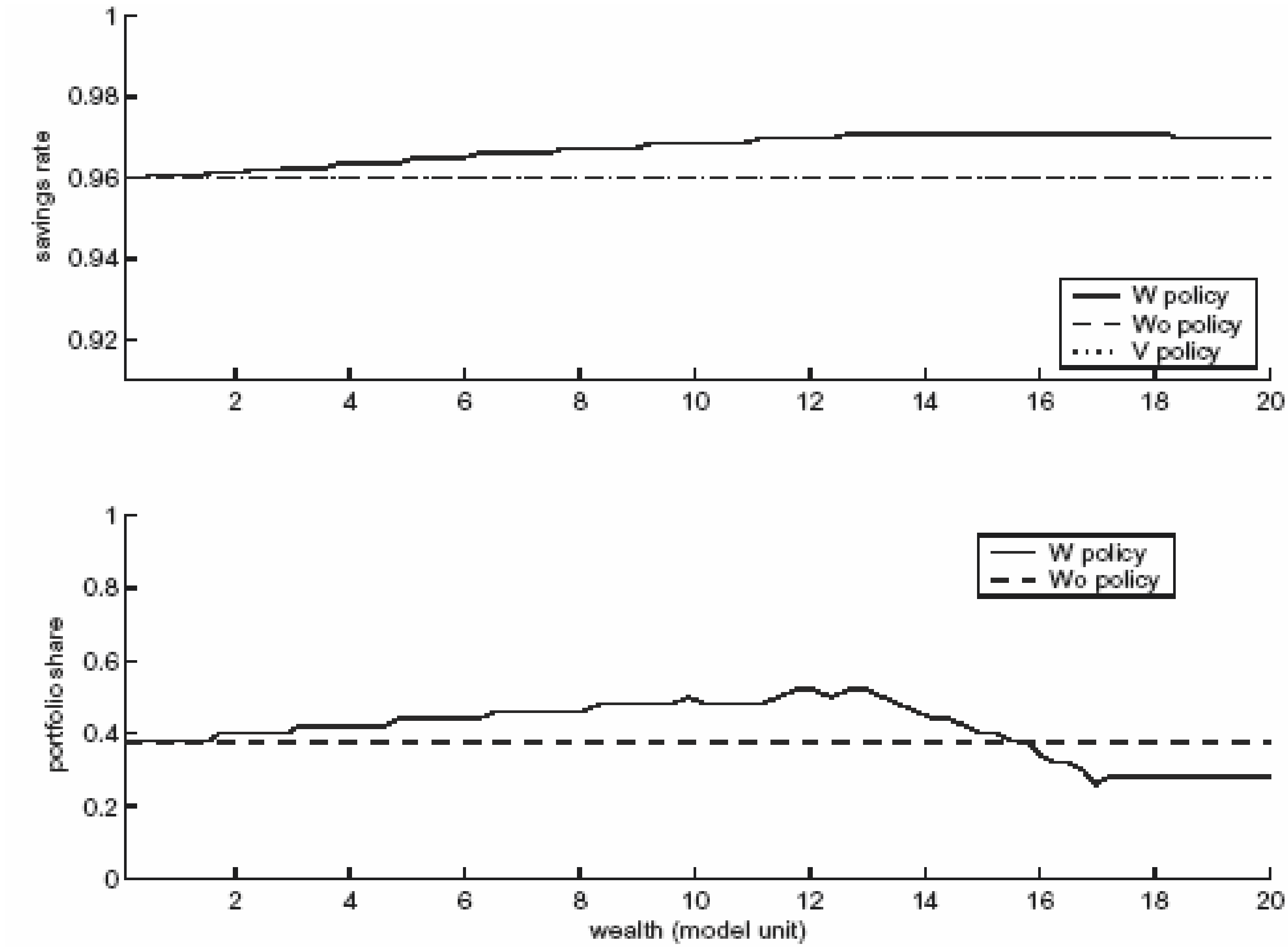
and $V(k_t) =$
$\max_{s_t}\left\{\ln(k_t - s_t) + \beta\int \max\{W(s_t r(\theta_{t+1})), V(s_t r(\theta_{t+1}))\}\, dF(\theta_{t+1})\right\}$

- Equilibrium: Set of value functions $v(k_t)$, $w(k_t)$, saving rules, $s(k_t)$ and $\phi(k_t)$ such that
  - choose to whether or not remain in the financial market $V(k_t) \gtrless W(k_t)$
  - choose to whether or not to stay indepedent $W(k_t) \gtrless V(k_t - q)$

Townsend and Ueda (Restud 2007)



Townsend and Ueda (Restud 2007)



GJ Model

- Model Economy

convert the capital investment i_{jt} at date t into a yield $y_{j,t+1}$ at date $t+1$. One technology yields a safe but relatively lower rate of return δ per unit capital and the other gives a risky rate of return $(\zeta_{t+1} + \epsilon_{j,t+1})$ with higher expected value, where ζ_{t+1} represents a common aggregate shock and $\epsilon_{j,t+1}$ an idiosyncratic shock specific to agent j. The aggregate shock ζ_{t+1} is governed by a time-invariant uniform distribution with support $[\underline{\zeta}, \overline{\zeta}]$, and the idiosyncratic shock $\epsilon_{j,t+1}$ is governed by a time-invariant uniform distribution with support $[-\overline{\epsilon}, \overline{\epsilon}]$ with $E(\epsilon_{j,t+1}) = 0$. Let $\eta_{j,t+1} = \zeta_{t+1} + \epsilon_{j,t+1}$ be the composite shock, and Ψ^{η} be its distribution function. GJ assume that the lower bound for the composite shock is positive, i.e., $\underline{\zeta} - \overline{\epsilon} > 0$.

$$E \sum_{t=0}^{\infty} \beta^t \frac{c_{jt}^{1-\sigma}}{1-\sigma}$$

Estimation

- Likelihood Function

$$d_{jt} = 1, \quad if\ v^1(k_{jt} - q) \geq v^0(k_{jt}) \tag{30}$$
$$= 0, \quad if\ v^1(k_{jt} - q) < v^0(k_{jt}).$$

$$d_{jt} = 1, \quad if\ k_{jt} \geq k^* \tag{31}$$
$$= 0, \quad if\ k_{jt} < k^*$$

There is no closed form solution for k^* because there are no analytic solutions to the dynamic programming in (25). However, from the formulation of the dynamic programs in (25) and (26), it is clear that k^* is a function of the underlying parameters of the GJ model, $\theta^{GJ} = (q, \delta, \beta, \sigma, \gamma, \underline{\zeta}, \overline{\zeta}, \overline{\epsilon})$,

$$k^* = k^*(\theta^{GJ}).$$

Estimation, cont. -

That is, the participation decision of a previously non-participating agent j at date t with wealth $k_{j,t-1}$ can be rewritten as

$$\begin{aligned} d_{jt} &= 1, \quad if\ \eta_{jt} \geq \eta^* \left(k_{j,t-1}, \theta^{GJ} \right) \\ &= 0, \quad if\ \eta_{jt} < \eta^* \left(k_{j,t-1}, \theta^{GJ} \right), \end{aligned} \tag{33}$$

where

$$\eta^* \left(k_{j,t-1}, \theta^{GJ} \right) \equiv \frac{1}{\phi \left(k_{j,t-1}, \theta^{GJ} \right)} \left[\frac{k^*(\theta^{GJ})}{i \left(k_{j,t-1}, \theta^{GJ} \right)} - (1 - \phi \left(k_{j,t-1}, \theta^{GJ} \right))\delta \right]. \tag{34}$$

The participation decision in (33) is stationary for a given wealth level because the composite technology shock η_{jt} is drawn from the time-invariant distribution. Thus once we solve the pair of functional equations in (28) and (29) to get k^* and the time-invariant policy functions ϕ and i, we can form a likelihood function in terms of model parameters θ^{GJ}.

In forming the likelihood function, the unobservable aggregate shock ζ_t generates cross-sectional dependence over the individuals at a given date t. Thus we first consider a *conditional* likelihood function $L_t(\theta^{GJ}, \zeta_t)$ for a given aggregate shock ζ_t and then integrate the aggregate shock out to form an unconditional likelihood function, as follows.

Estimation, cont. -

Given a series of serially independent aggregate shocks $(\zeta_t)_{t=1}^{T}$, the likelihood function can be factorized into marginal likelihoods:

$$L(\theta^{GJ}, (\zeta_t)_{t=1}^{T}) = \prod_{t=1}^{T} L_t\left(\theta^{GJ}, \zeta_t\right). \tag{35}$$

Since the composite shock $\eta_{jt} = \epsilon_{jt} + \zeta_t$ is *i.i.d. conditional on* ζ_t, a conditional likelihood function $L_t\left(\theta^{GJ}, \zeta_t\right)$ at date t is given by:

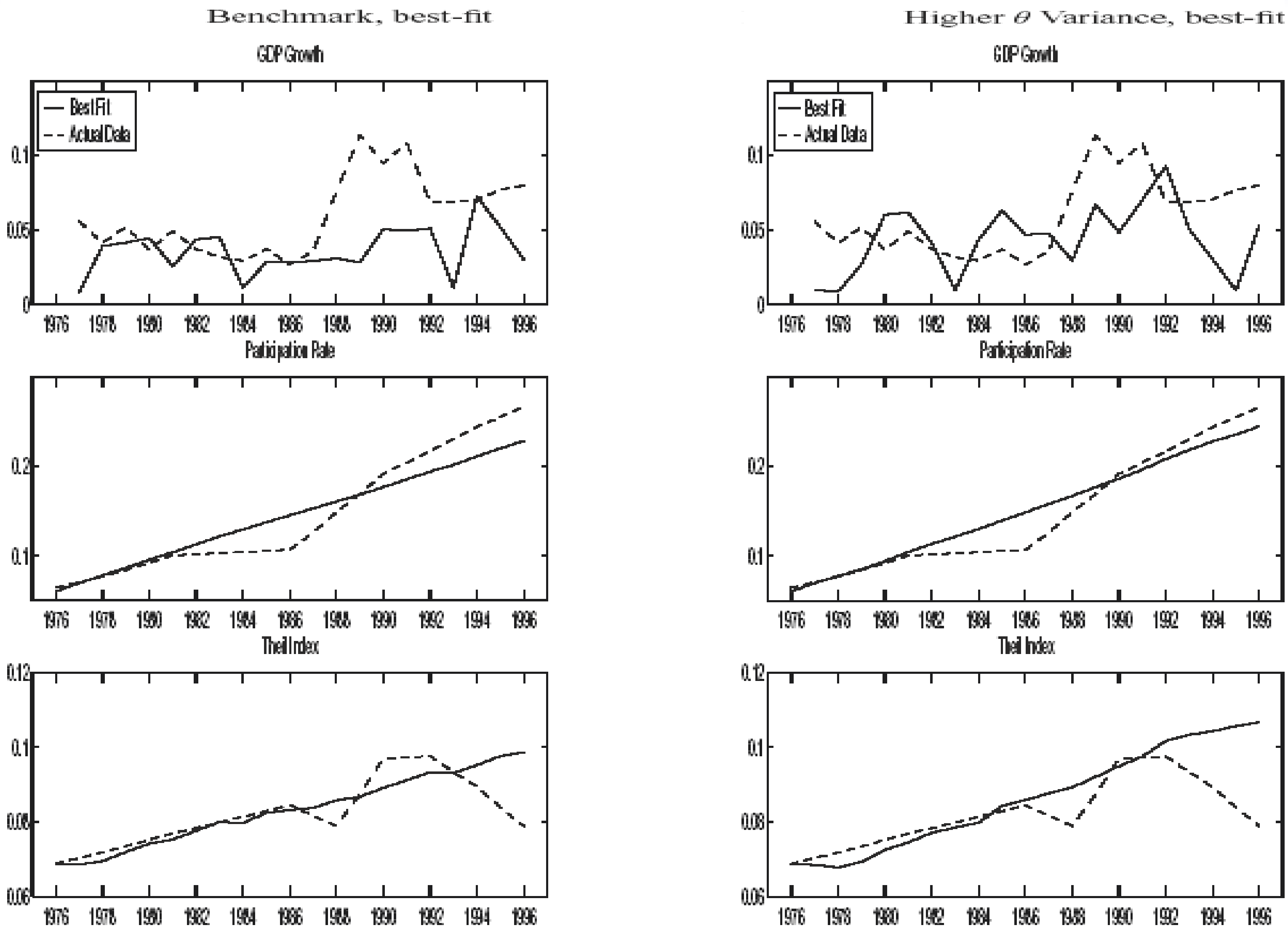
$$L_t\left(\theta^{GJ}, \zeta_t\right) = \prod_{j=1}^{n_t} [1 - \Pr(\epsilon_{jt} \leq \eta_{jt}^{*} - \zeta_t)]^{d_{jt}} [\Pr(\epsilon_{jt} \leq \eta_{jt}^{*} - \zeta_t]^{1-d_{jt}} \tag{36}$$

where $\eta_{jt}^{*} = \eta^{*}\left(k_{j,t-1}, \theta^{GJ}\right)$ in (34).

Table 4. Estimated GJ Parameters

q	γ	β	σ	δ	$\underline{\zeta}$	$\overline{\zeta}$	$\overline{\epsilon}$
0.5021	1	0.9627	0.9946	1.0479	1.0470	1.1905	0.9954
(0.0482)	(0.0000)	(0.0061)	(0.0926)	(0.0064)	(0.0451)	(0.0514)	(0.0355)

Townsend and Ueda (Restud 2007)



[Benchmark, best-fit (left-hand graphs) and Higher Variance, best-fit (right-hand graphs). Source: Townsend and Ueda (2005)]

Townsend & Ueda (2010) “Welfare Gains from Financial Liberalization,” *IER*

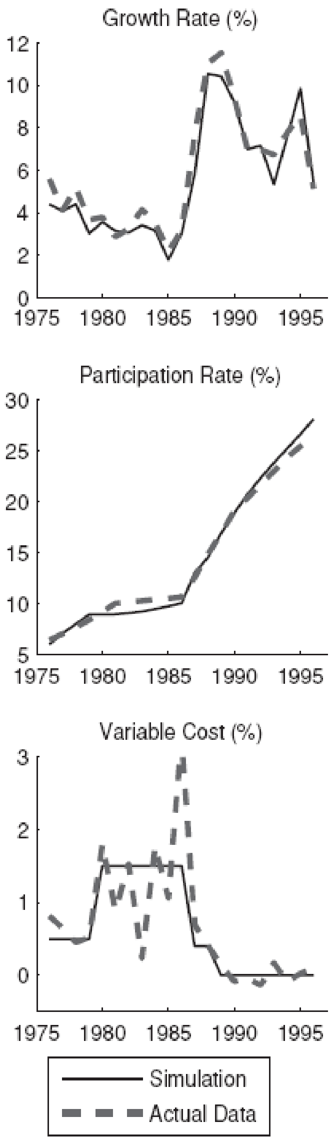


FIGURE 12

CHANGING VARIABLE COSTS

TABLE 2

GROWTH DIFFERENCE (%)

	1987–96 Growth Difference	Annualized Growth with Cost Reduction	Annualized Growth without Cost Reduction
Variable cost reduction	0.59	6.87	6.28
in 1987 (1.5% to 0%)	[0.96]	[4.41]	[3.45]
Entry cost reduction	−0.14	7.34	7.48
in 1987 (7 to 4.5 model unit)	[−0.26]	[4.48]	[4.74]

NOTE: Iterated shocks are used in the simulation. Numbers in brackets are the results of alternative simulation, using the expected value of shocks after 1987.

Townsend & Ueda, IMF WP/03/193, 2003 -

Table 2. Spurious Regression Results: Long-Run Effects

Estimation Method	1985 as initial period (1)	(2)	(3)	1980 as initial period (4)	(5)	(6)
Constant	3.5110	7.0600	12.7343	3.6189	8.3826	11.1520
	(11.8937)	(4.7252)	(11.7274)	(10.8625)	(3.9869)	(6.5943)
Financial Depth	4.7298		−36.0538	3.7519		−55.9250
	(1.7914)		(−31.0114)	(0.9869)		(−26.0722)
Inequality		−5.2447	−8.8110		−5.8565	−1.9792
		(−1.8188)	(−4.2517)		(−1.4235)	(−0.6003)
Initial GDP	0.4324	0.4284	4.2420	0.5488	1.8229	4.4722
	(1.0919)	(1.1932)	(15.3375)	(1.0689)	(3.3601)	(10.0040)
R^2	0.9863	0.9942	0.9970	0.9860	0.9959	0.9975

Notes: The dependent variable is 20-year average annual GDP growth, the same as per capita growth. Robust t-statistics are in parentheses.

Table 3. Spurious Regression Results: Medium-Term Effects

Estimation Method	1976–80 as initial period (1)	(2)	(3)	1981–85 as initial period (4)	(5)	(6)
Financial Depth	0.0599		0.6710	2.7300		1.9684
	(0.0230)		(0.2501)	(0.7645)		(0.5412)
Inequality		4.9854	5.4020		−11.2361	−10.3229
		(0.8192)	(0.8610)		(−1.2557)	(−1.1328)
GDP	−0.2008	−0.7181	−0.8326	−0.0342	1.4357	1.1718
	(−0.4596)	(−0.9936)	(−0.9728)	(−0.0557)	(1.2823)	(0.9574)
R^2	0.9601	0.9602	0.9602	0.9530	0.9530	0.9531

Notes: The dependent variable is 5-year average annual GDP growth, same as per capita growth. The independent variables are lagged variables. Robust t-statistics are in parentheses.

$$Growth_m = \alpha_0 + \alpha_1 FinancialDepth_m + \alpha_2 Gini_m + \alpha_3 Log(InitialGDP_m) + \nu_m. \quad (36)$$

Townsend & Ueda, *IER*, 2010 -

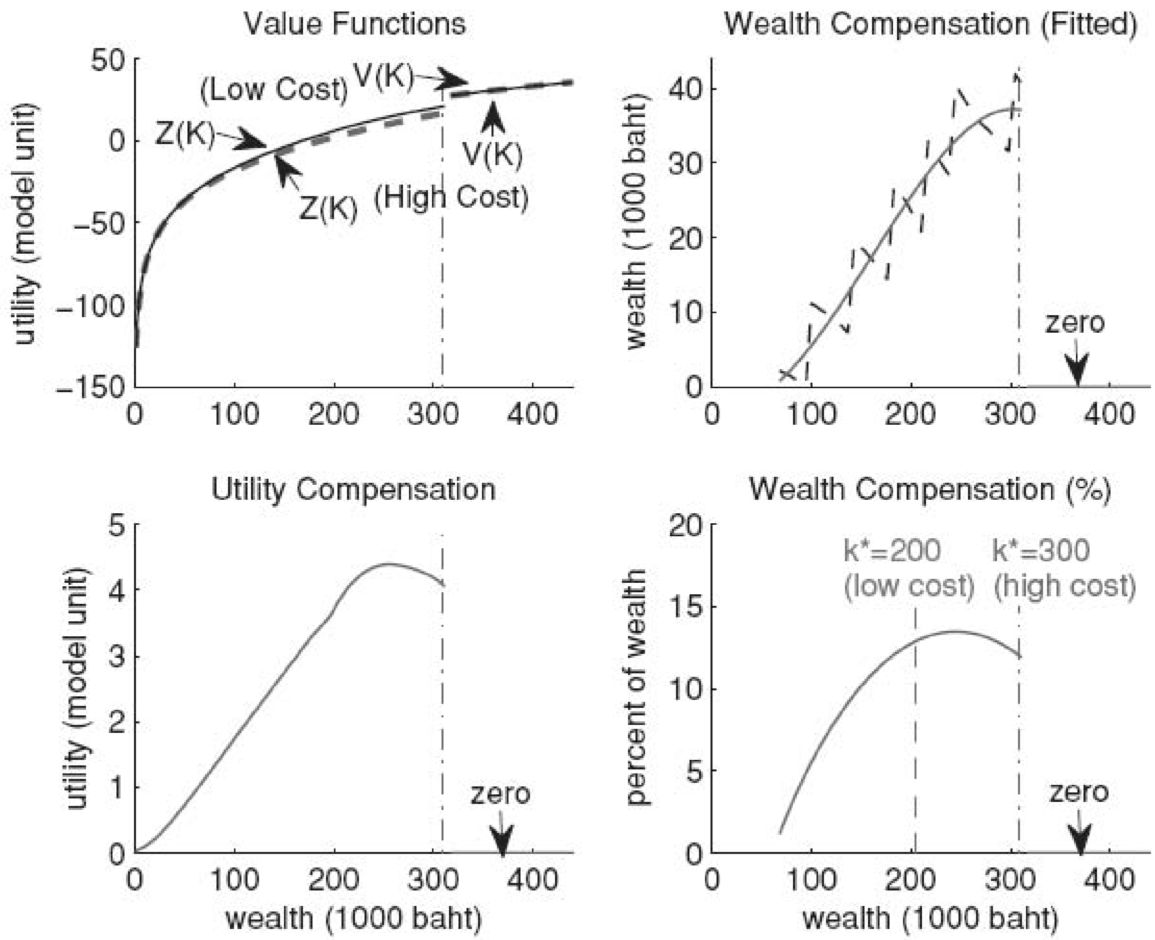
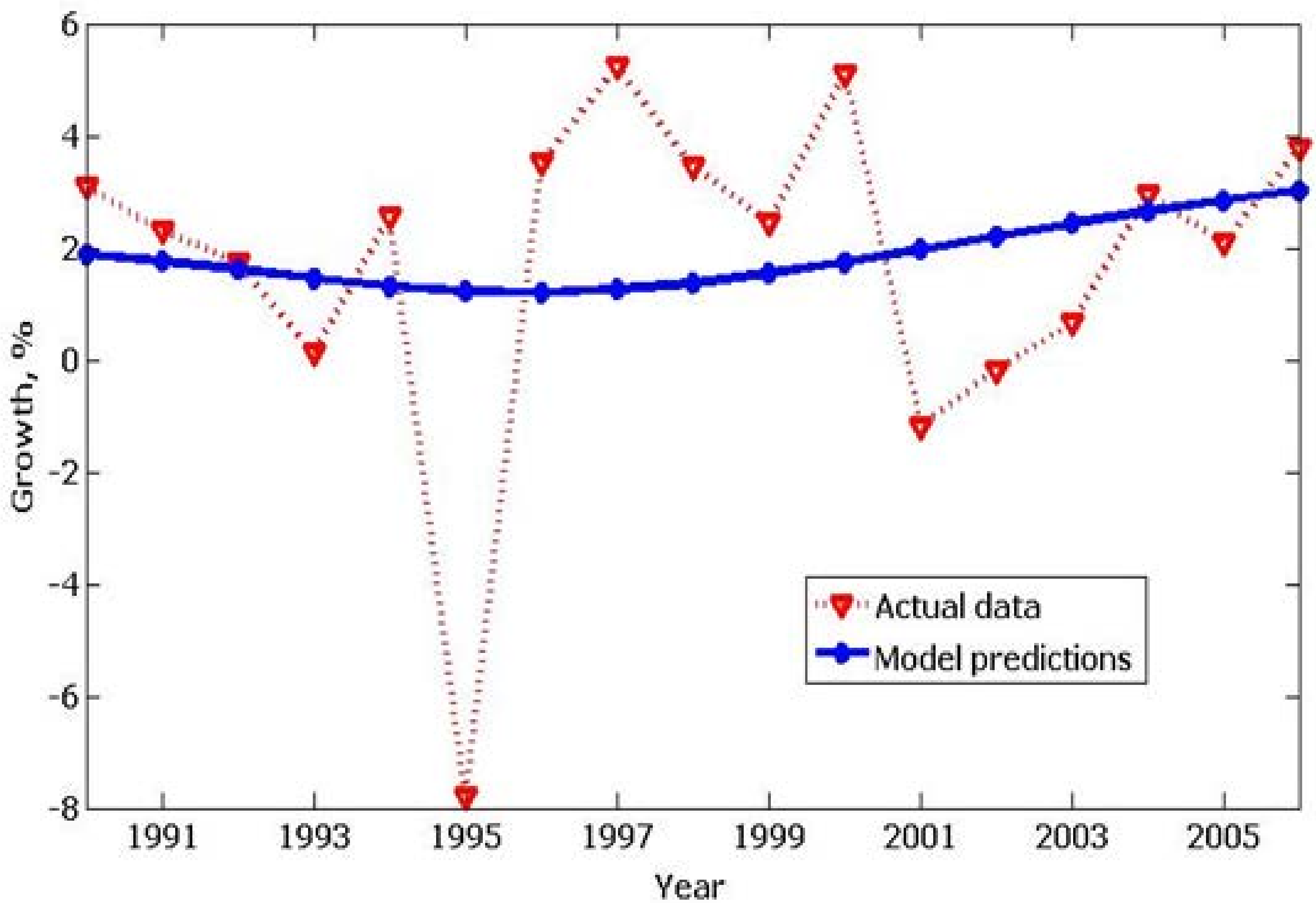


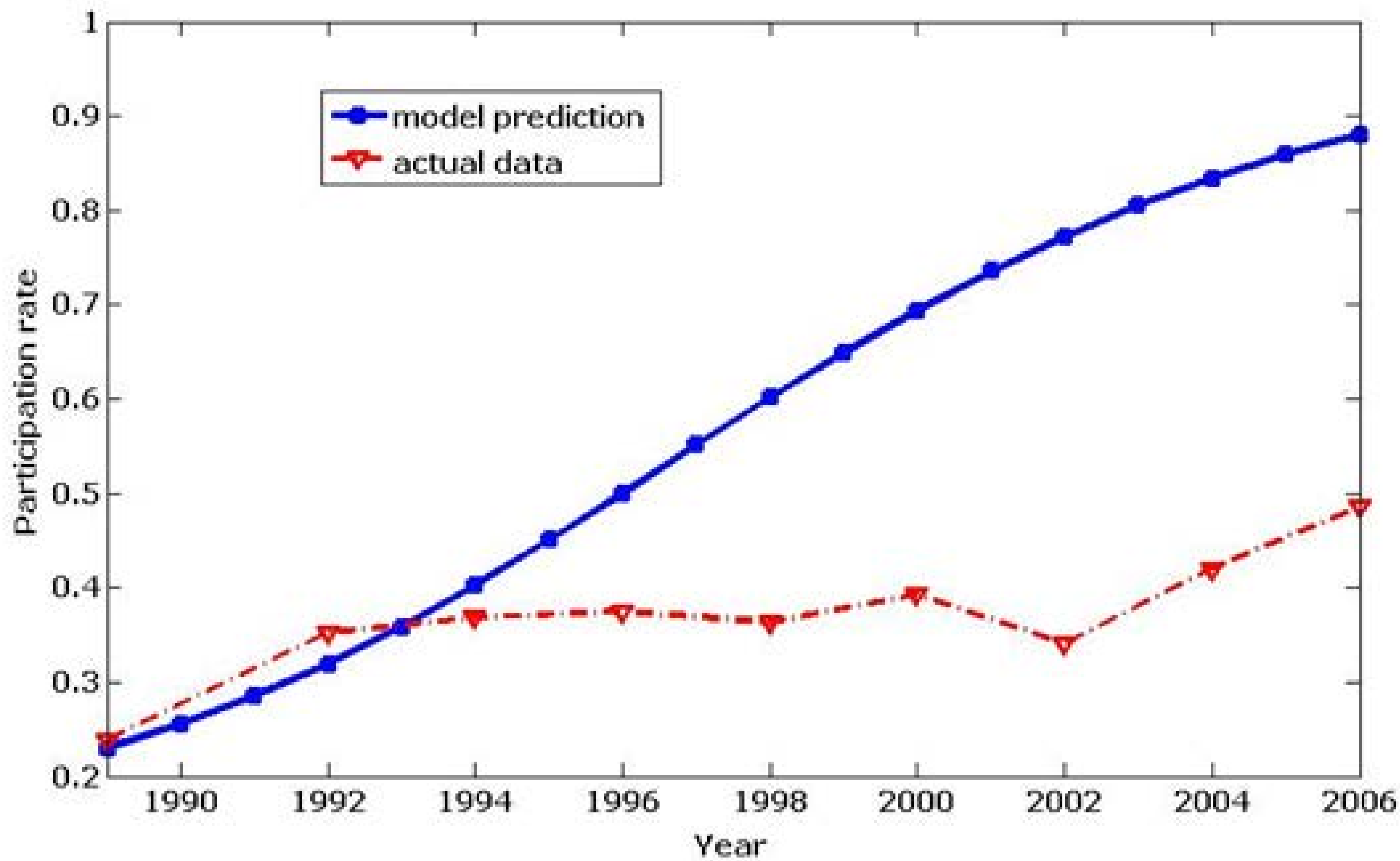
FIGURE 21

WELFARE GAINS FROM REDUCTION IN ENTRY COST, 100,000 TO 65,000 BAHT (7 TO 4.5 MODEL UNITS)

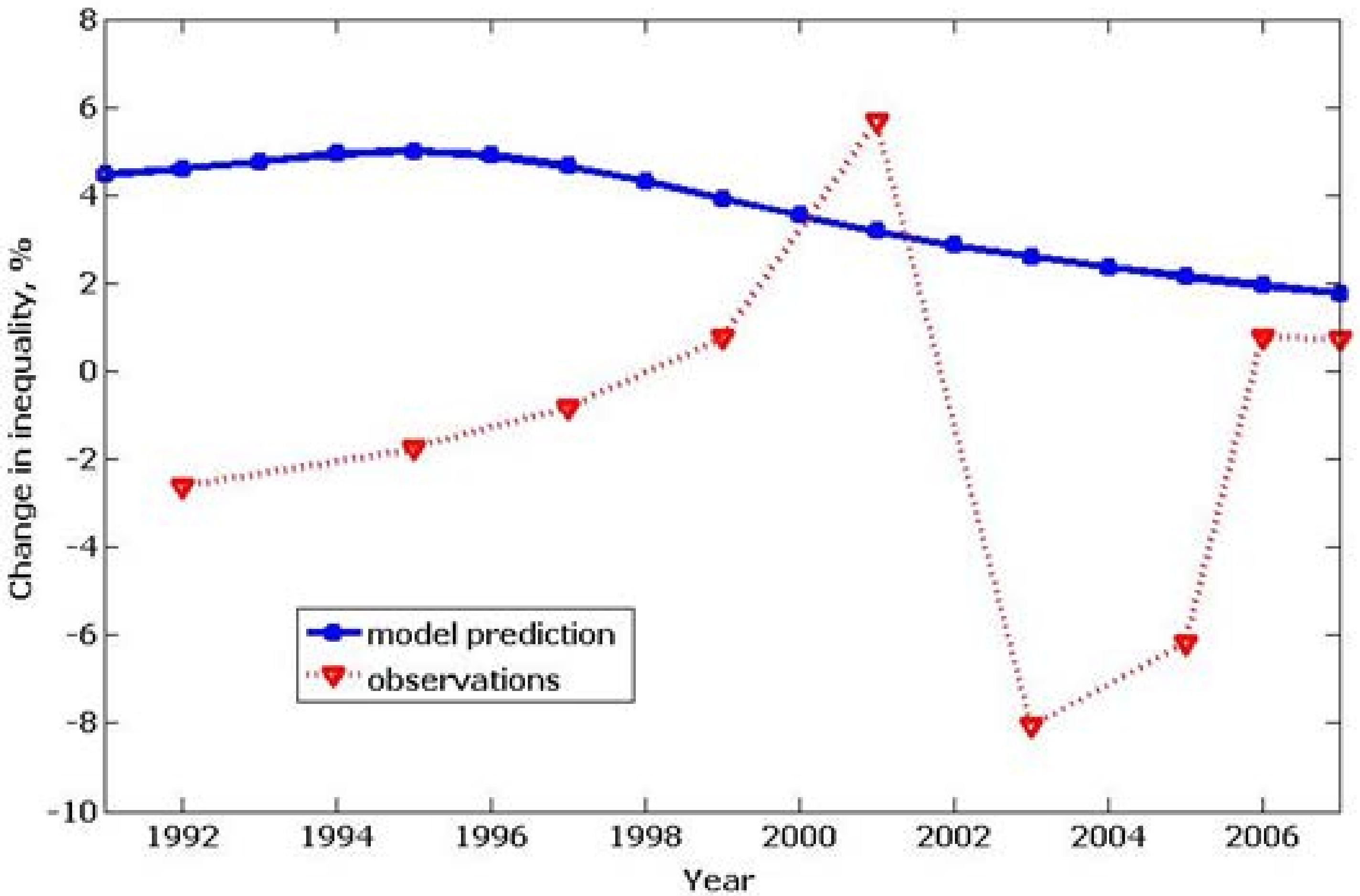
Mexico: GDP Growth, 1989-2006



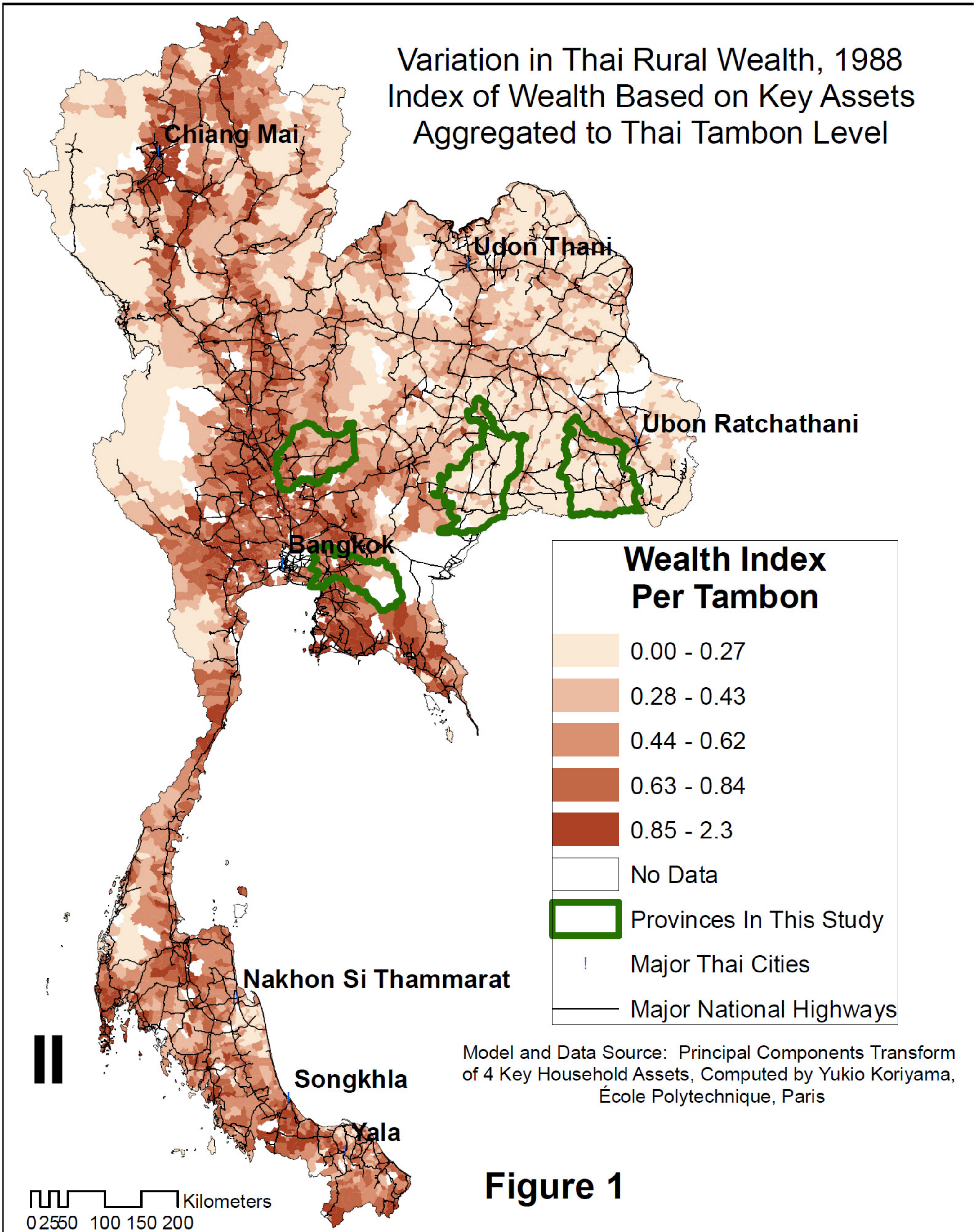
Mexico: Financial Participation, 1989-2006



Mexico: Change in Inequality, 1989-2006



Felkner, John and Robert M. Townsend (2009) "The Geographic Concentration of Enterprise in Developing Countries," Working Paper, University of Chicago.



Variation in Thai Rural Wealth, 1988
Index of Wealth Based on Key Assets
Aggregated to Thai Tambon Level
Chiang Mai
Udon Thani
Ubon Ratchathani
Bangkok
Nakhon Si Thammarat
Songkhla
Yala
Wealth Index
Per Tambon
0.00 - 0.27
0.28 - 0.43
0.44 - 0.62
0.63 - 0.84
0.85 - 2.3
No Data
Provinces In This Study
Major Thai Cities
Major National Highways
Model and Data Source: Principal Components Transform of 4 Key Household Assets, Computed by Yukio Koriyama, École Polytechnique, Paris
Kilometers
0 25 50 100 150 200

Figure 1

Village, Roads, Major Intersections and Amphoe District Center Locations

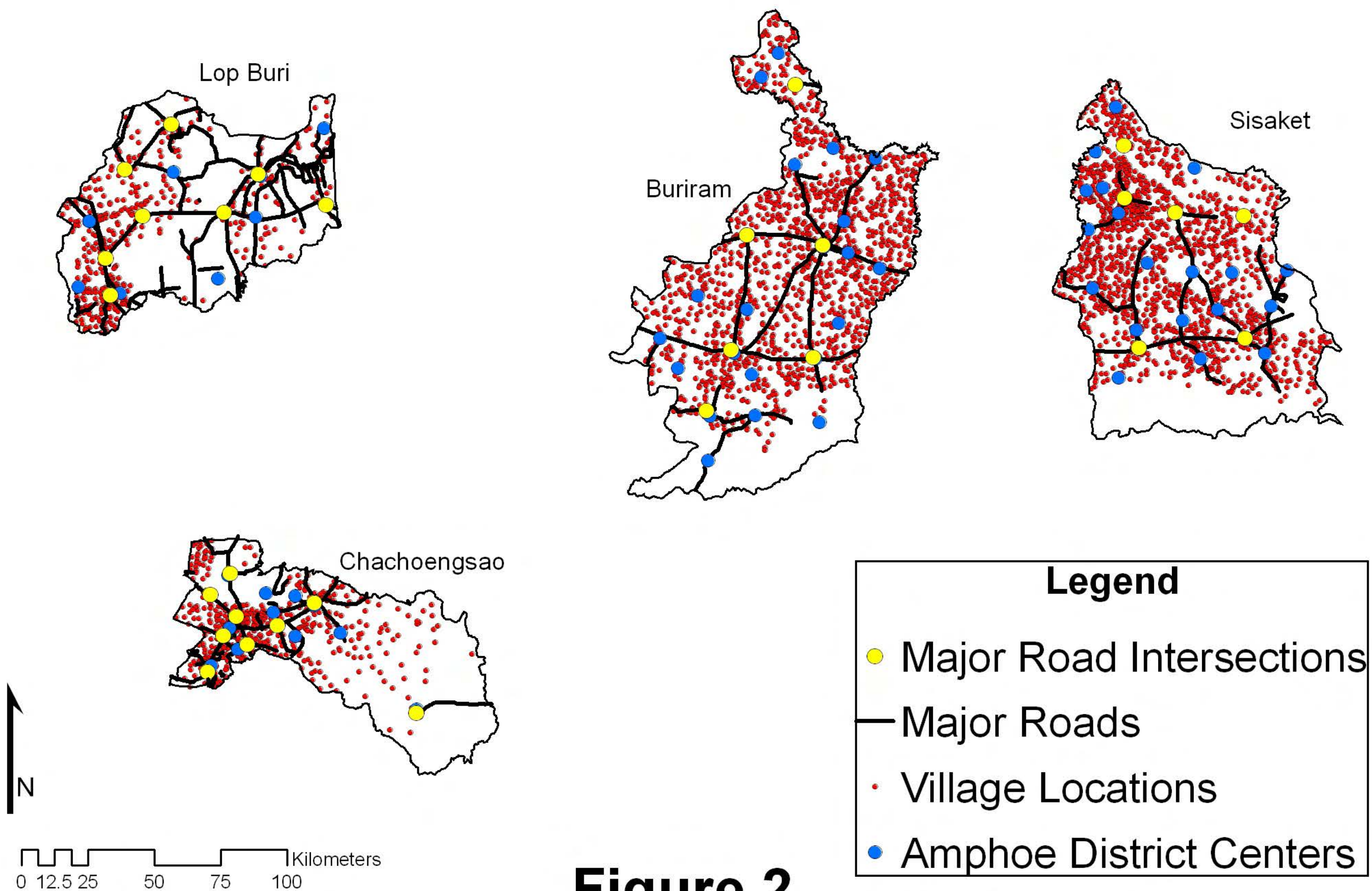
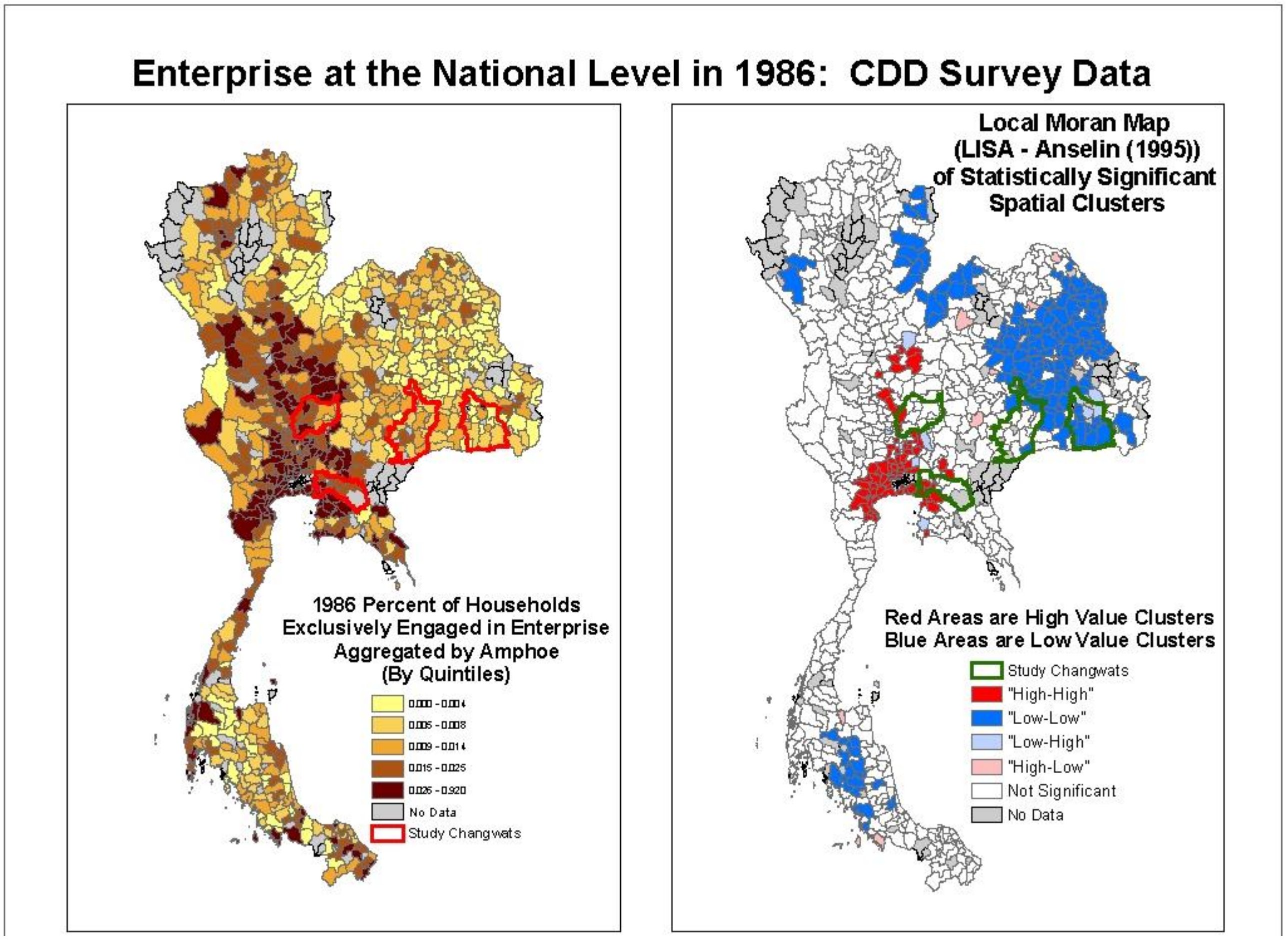


Figure 2


Enterprise at the National Level in 1986: CDD Survey Data
1986 Percent of Households
Exclusively Engaged in Enterprise
Aggregated by Amphoe
(By Quintiles)
0.000 - 0.004
0.005 - 0.008
0.009 - 0.014
0.015 - 0.025
0.026 - 0.920
No Data
Study Changwats
Local Moran Map
(LISA - Anselin (1995))
of Statistically Significant
Spatial Clusters
Red Areas are High Value Clusters
Blue Areas are Low Value Clusters
Study Changwats
"High-High"
"Low-Low"
"Low-High"
"High-Low"
Not Significant
No Data

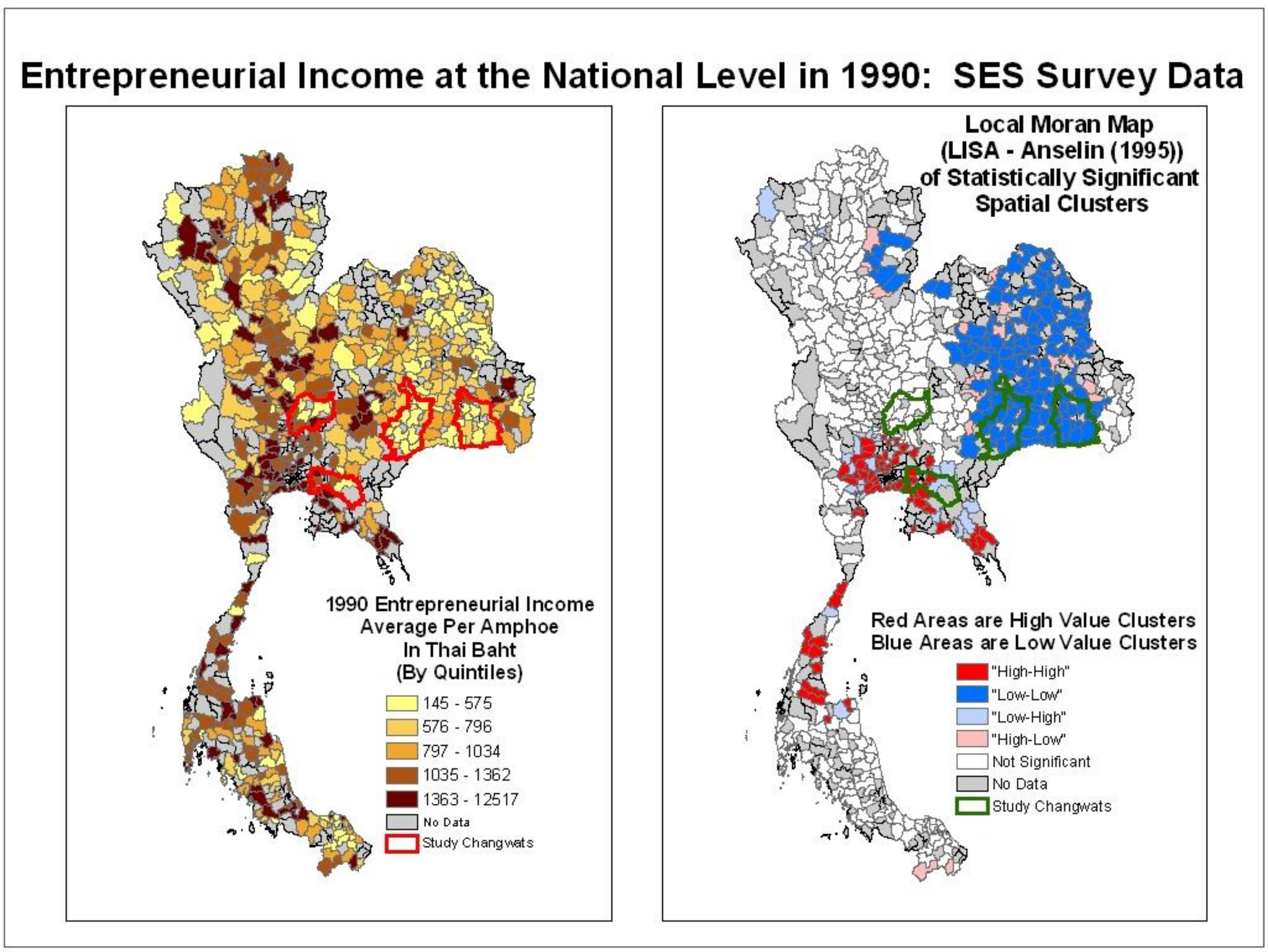

Entrepreneurial Income at the National Level in 1990: SES Survey Data
1990 Entrepreneurial Income
Average Per Amphoe
In Thai Baht
(By Quintiles)
145 - 575
576 - 796
797 - 1034
1035 - 1362
1363 - 12517
No Data
Study Changwats
Local Moran Map
(LISA - Anselin (1995))
of Statistically Significant
Spatial Clusters
Red Areas are High Value Clusters
Blue Areas are Low Value Clusters
"High-High"
"Low-Low"
"Low-High"
"High-Low"
Not Significant
No Data
Study Changwats

Figure 3

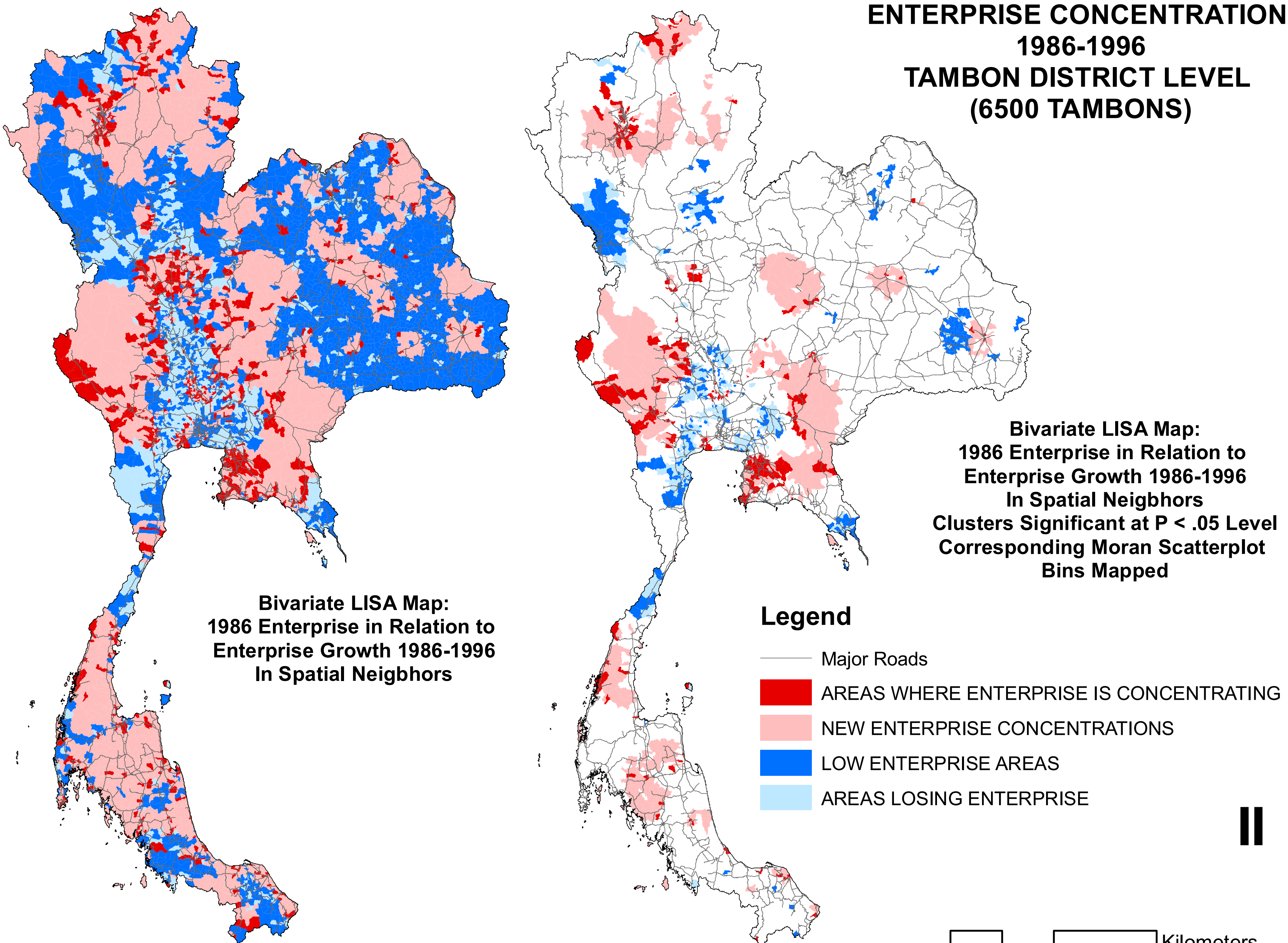
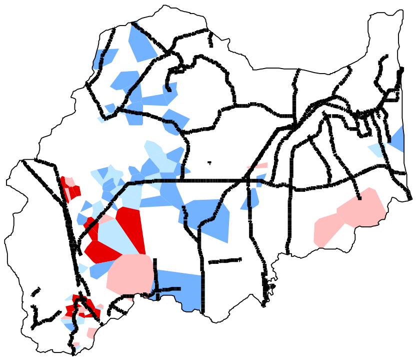
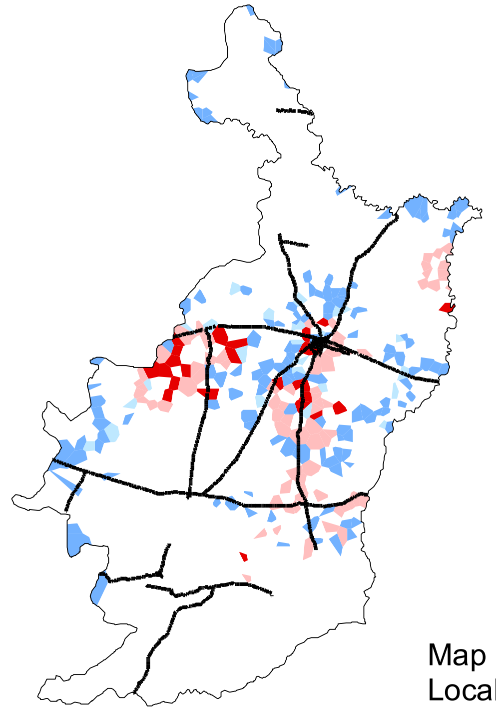
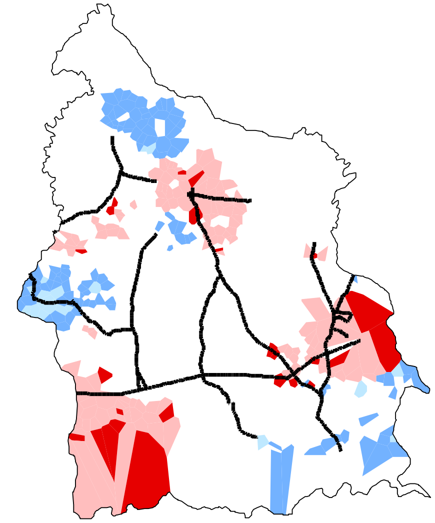

ENTERPRISE CONCENTRATION
1986-1996
TAMBON DISTRICT LEVEL
(6500 TAMBONS)
Bivariate LISA Map:
1986 Enterprise in Relation to
Enterprise Growth 1986-1996
In Spatial Neigbhors
Bivariate LISA Map:
1986 Enterprise in Relation to
Enterprise Growth 1986-1996
In Spatial Neigbhors
Clusters Significant at P < .05 Level
Corresponding Moran Scatterplot
Bins Mapped
Legend
Major Roads
AREAS WHERE ENTERPRISE IS CONCENTRATING
NEW ENTERPRISE CONCENTRATIONS
LOW ENTERPRISE AREAS
AREAS LOSING ENTERPRISE
II
Kilometers
0
90
180
360

Figure 4

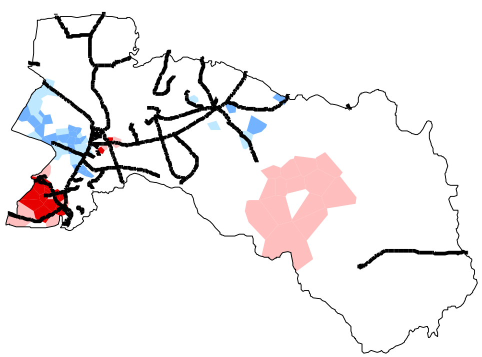






ENTERPRISE CONCENTRATION 1986-1996
BIVARIATE LISA MAP
STATISTICALLY SIGNIFICANT
CONCENTRATIONS (P < .1)

II



Legend

- AREAS WHERE ENTERPRISE IS CONTINUING TO CONCENTRATE
- NEW ENTERPRISE CONCENTRATIONS ARISING
- LOW ENTERPRISE AREAS
- AREAS LOSING ENTEPRISE
- Major Roads

Figure 6

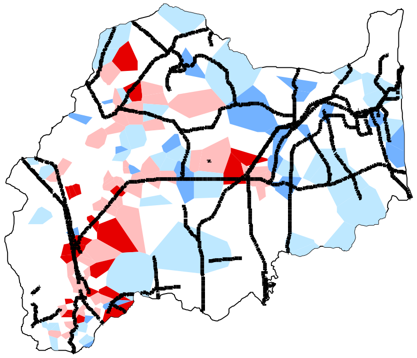
Map is an output from a bivariate Local Moran Index for 1532 villages, considering 1986 fraction in enterprise surrounded by 1986-1996 growth in fraction in enterprise

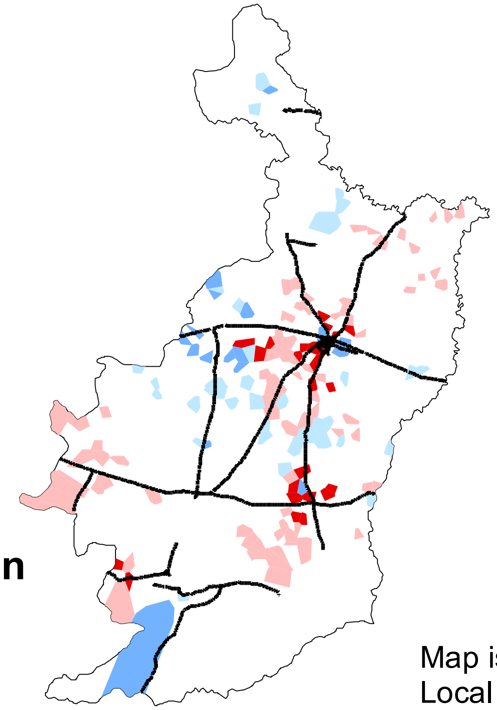
REDS are village with higher than average enterprise in 1986, surrounded by villages with higher than average growth in enteprise 1986-1996

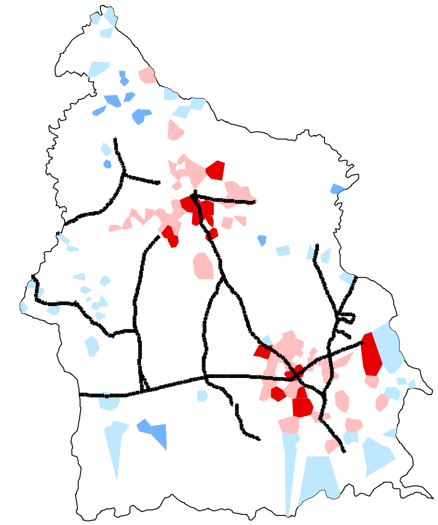
PINKS are villages with lower than average enteprise in 1986, surrounded by villages with higher than average enterprise growth 1986-1996

DARK BLUES are villages with lower than average enterprise in 1986, surrounded by villages with lower than average enterprise growth 1986-1996

LIGHT BLUES are villages with higher than average enterprise in 1986, surrounded by villages with lower than average enterprise growth 1986-1996



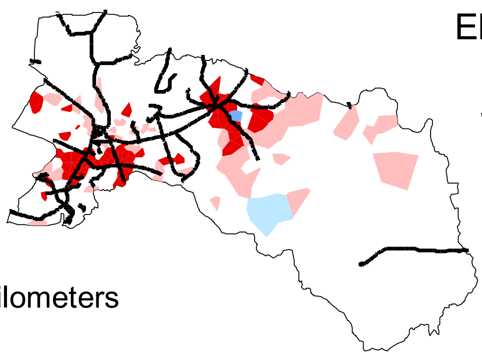




Primary Estimation:
Occupational Choice Structural Simulation
Spatial Model:
M Parameter Varies Across Space
Bivariate LISA Map 1986-1996

Map is an output from a bivariate Local Moran Index for 1532 villages, considering 1986 fraction in enterprise surrounded by 1986-1996 growth in fraction in enterprise

II



ENTERPRISE CONCENTRATION
1986-1996
STATISTICALLY SIGNIFICANT
CONCENTRATIONS
(P = .1 OR LESS)

REDS are village with higher than average enterprise in 1986, surrounded by villages with higher than average growth in enteprise 1986-1996

PINKS are villages with lower than average enteprise in 1986, surrounded by villages with higher than average enterprise growth 1986-1996

DARK BLUES are villages with lower than average enterprise in 1986, surrounded by villages with lower than average enterprise growth 1986-1996

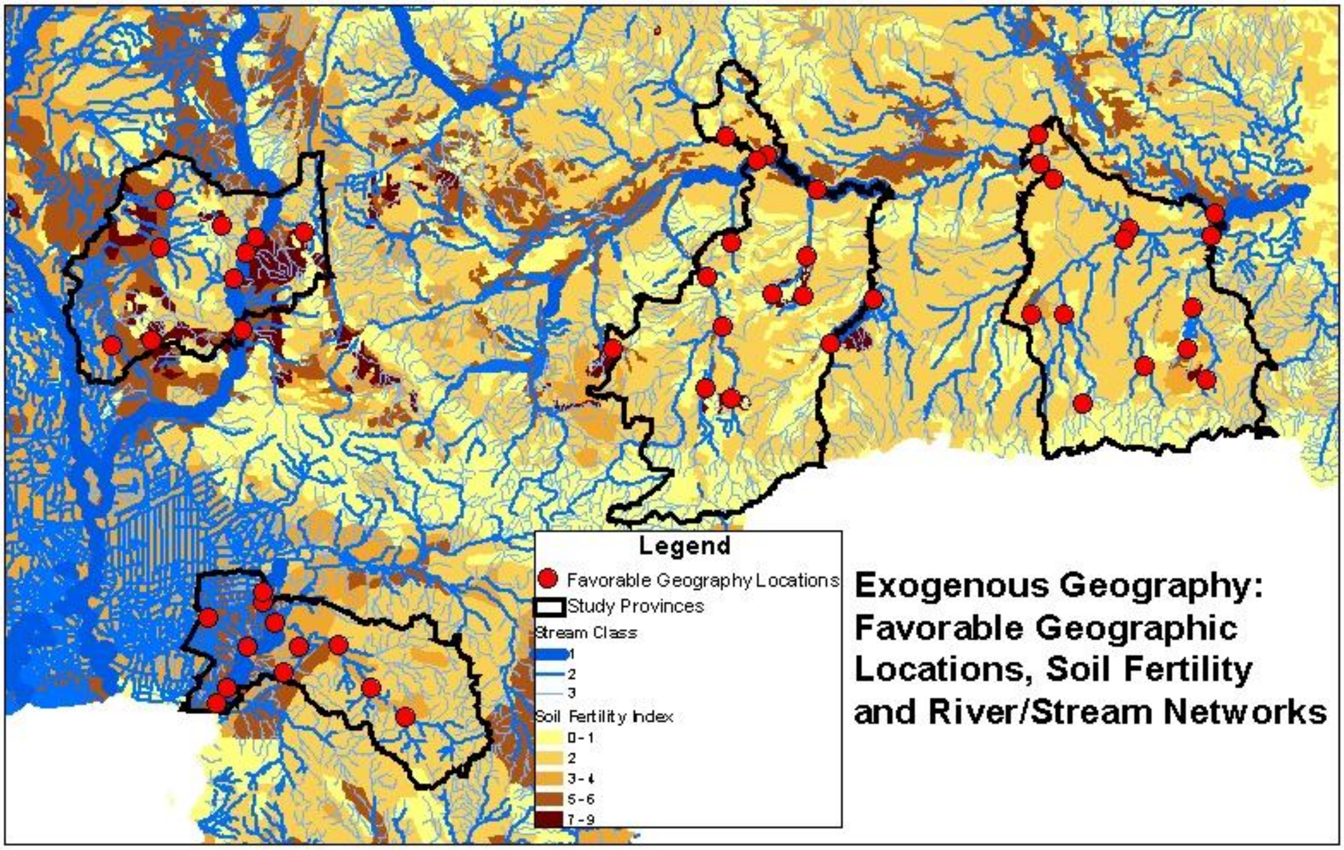
LIGHT BLUES are villages with higher than average enterprise in 1986, surrounded by villages with lower than average enterprise growth 1986-1996

Kilometers
0 10 20 40

Legend

- AREAS WHERE ENTERPRISE IS CONTINUING TO CONCENTRATE
- NEW ENTERPRISE CONCENTRATIONS ARISING
- LOW ENTERPRISE AREAS
- AREAS LOSING ENTERPRISE
- Major Roads

Figure 10


Legend
Favorable Geography Locations
Study Provinces
Stream Class
1
2
3
Soil Fertility Index
0 - 1
2
3 - 4
5 - 6
7 - 9
Exogenous Geography:
Favorable Geographic
Locations, Soil Fertility
and River/Stream Networks

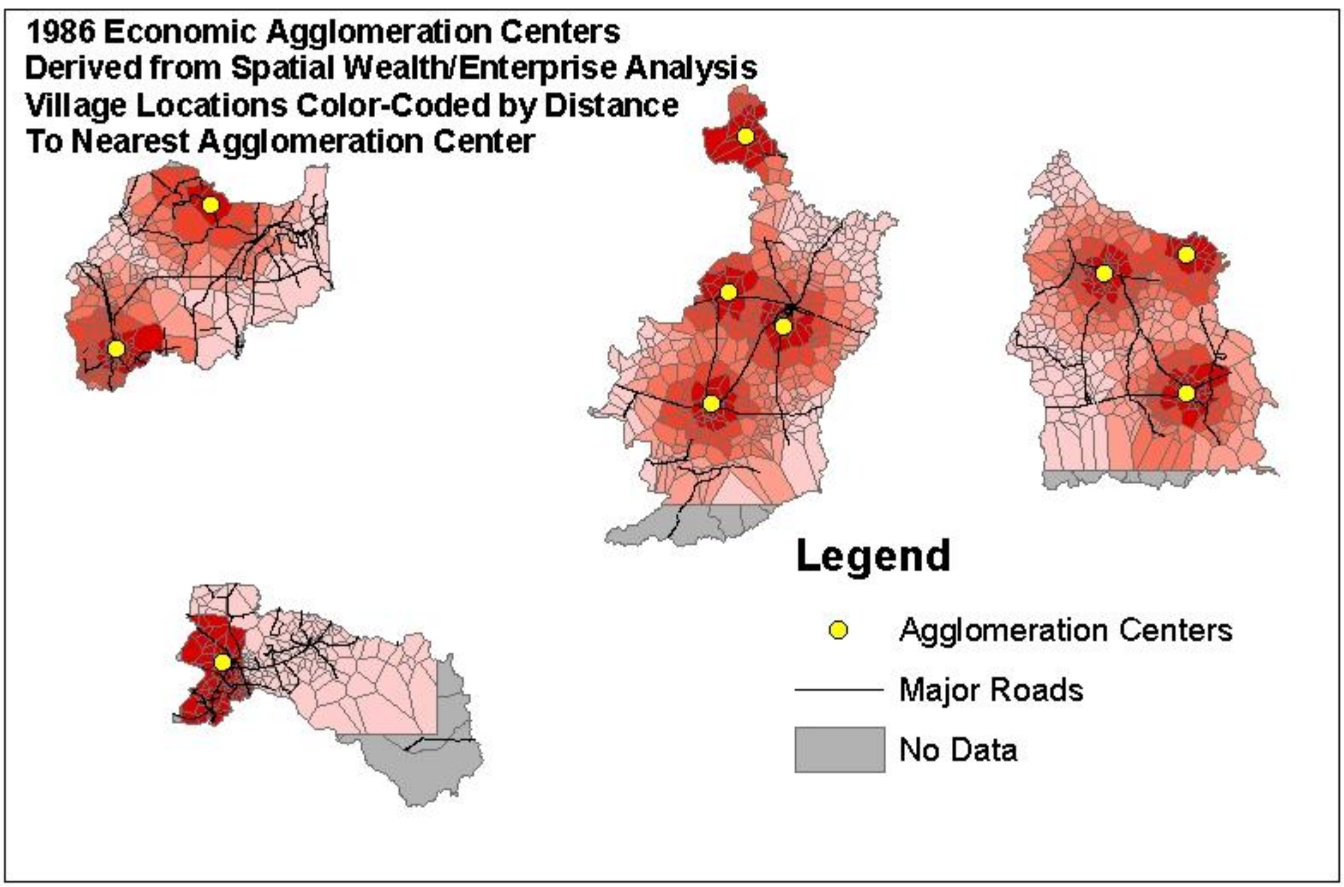

1986 Economic Agglomeration Centers
Derived from Spatial Wealth/Enterprise Analysis
Village Locations Color-Coded by Distance
To Nearest Agglomeration Center
Legend
Agglomeration Centers
Major Roads
No Data

Figure 7

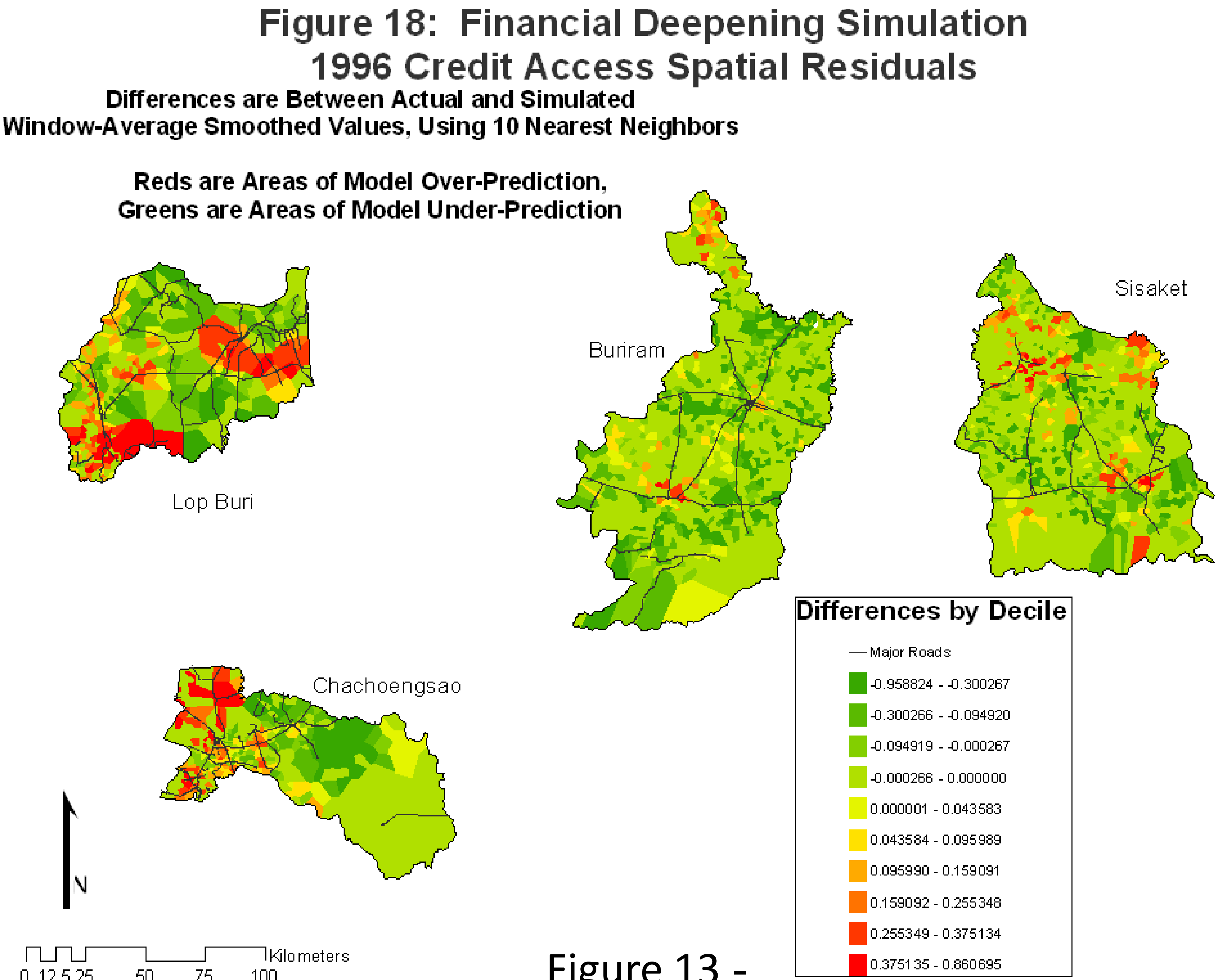


Figure 18: Financial Deepening Simulation
1996 Credit Access Spatial Residuals
Differences are Between Actual and Simulated
Window-Average Smoothed Values, Using 10 Nearest Neighbors
Reds are Areas of Model Over-Prediction,
Greens are Areas of Model Under-Prediction
Lop Buri
Buriram
Sisaket
Chachoengsao
N
0 12.5 25 50 75 100
Kilometers
Differences by Decile
Major Roads
-0.958824 - -0.300267
-0.300266 - -0.094920
-0.094919 - -0.000267
-0.000266 - 0.000000
0.000001 - 0.043583
0.043584 - 0.095989
0.095990 - 0.159091
0.159092 - 0.255348
0.255349 - 0.375134
0.375135 - 0.860695

Figure 13 -

"Growth and Inequality: Model Evaluation Based on an Estimation-Calibration Strategy" Jeong & Townsend, 2003 -

We find that the LEB occupation choice model captures reasonably well the observed patterns of aggregate income growth, in particular the sharp rise in income growth during the 1988-1992 period. This is accomplished without aggregate shocks. However, the underlying driving factor is a modification of the LEB model, which allows an exogenous expansion of an intermediated sector and consequent occupation shifts. The model also captures the inverted U-shaped Kuznets curve as observed in the data, via an eventually increasing wage, and hence a decrease in occupational income gap. The GJ model with endogenous financial deepening provides a reasonable fit to overall growth and inequality change at aggregate level, and fits the level of aggregate inequality better than the modified LEB model. On the other hand, GJ is missing the non-linear patterns of average income growth and expansion of the financial sector, and also the eventual downturn of aggregate inequality in the data.

"Growth and Inequality: Model Evaluation Based on an Estimation-Calibration Strategy" Jeong & Townsend, 2003 -

Both LEB and GJ correctly predict as in the data the existence of income differentials between key sub-groups, i.e., entrepreneurs vs. workers/subsisters and participants vs. non-participants in the financial sector. Also both models predict as in the data that population shifts from the low-income subgroups to high-income subgroups contribute to income growth and changing inequality. But both models exaggerate these composition effects and also exaggerate the income divergence/convergence effects on inequality change, as the income gaps between subgroups in both models are too large.

Jeong, Hyeok and Robert M. Townsend (2003) “"Growth and Inequality: Model Evaluation Based on an Estimation-Calibration Strategy," with Hyeok Jeong,” IEPR WP #5-10.

A.3 Summary Table

1. LEB

1.1. Aggregate Dynamics

Success	Failure/Anomaly
Trends and movements of income level	
Movements of income growth rate	Initial high growth
Inequality movements	Lower inequality level overall
Increasing population share of entrepreneurs	Lower level of population share of entrepreneurs
Direction of changes in population composition	Population size ordering (too few non-participant entrepreneurs too many participant entrepreneurs)
Higher fraction of entrepreneurs in the financial	
sector	
Financial expansion onto growth (especially the upturn of late 1980's)	

1.2. Subgroup Dynamics

Success	Failure/Anomaly
Income of non-participant workers increases (though less than in the data)	Incomes of all three other categories decrease
	Missing co-movements of growth rates across occupation groups before 1992
Capturing occupational income gap	Gap is too large
	Non-participant entrepreneurs earn higher income than participant entrepreneurs
	Missing the surge of income of participant entrepreneurs in late 80's and subsequent increase of income of non-participant entrepreneurs
	Subgroup inequality levels are too low
	Higher inequality among participants than non-participants
	Inequality among participants decreases
	Missing divergence between participant and non-participant groups
	Fail to relate movements of aggregate income growth and inequality to growth patterns of the richest group, the participant entrepreneurs

1.3. Decomposition

Success	Failure/Anomaly
Capturing compositional effects on growth and inequality change	Too large orders of magnitude
Signs of all effects on inequality change are right (Increase in subgroup inequality and decrease in income gap via convergence)	Too large orders of magnitude (Due to too large occupational income gap)
Adding financial expansion helps decomposition effects to be closer to data	But not good enough and exogenous addition of financial sector creates other anomalies

1.4. Shape of Income Distribution

Success	Failure/Anomaly
	Fail to predict overall shape of income distribution
	Spike at the low end hence missing income variation among the poor
	Missing the extremely rich

2. GJ

1.1. Aggregate Dynamics

Success	Failure/Anomaly
Trend and level of average income	Not capturing movements (stagnation and then upturn after 1986)
Trend and level of inequality	Not capturing movements (downturn after 1992) and over-predicts the increase
Trend and level of financial expansion	Missing nonlinear pattern of expansion (surge after 1986)

1.2. Subgroup Dynamics

Success	Failure/Anomaly
Average income of participants increases	Average income of non-participants stays constant
	Missing co-movement of growth rates before 1992
Income gap between participants and non-participants (LEB anomaly solved)	Gap is too large
Higher growth rates of participants than non-participants, hence diverging income levels between them (LEB anomaly solved)	Missing catch-up of non-participants after 1992
Inequality within participants increases (LEB anomaly solved)	Too low subgroup inequality
	Fail to relate movements of aggregate patterns of growth and inequality to the growth patterns of the richest group, participant entrepreneurs

1.3. Decomposition

Success	Failure/Anomaly
Capturing compositional effects on growth	Too large orders of magnitude
and inequality change	
Signs of across-group inequality effects are right	Wrong signs of within-group inequality effects
	Too large across-group inequality

1.4. Shape of Income Distribution

Success	Failure/Anomaly
Overall shape of income distribution	
	Missing middle class
	Over-predicting poverty
	Missing the extremely rich