Financial Deepening and Economic Development in Nepal : A Forward Looking CGE Model with Financial Intermediation

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Research Questions

- Is it possible to construct a Multisectoral Forward Looking Dynamic General Equilibrium Model?
- What are the efficiency and redistribution impacts of liberalisation of the financial sector in Nepal?
- Do rural households gain more than urban households from liberalisation?

Main Characteristics of the Nepalese Economy

- **Low productivity, low income and widespread poverty**
- **High population growth rate**
- **High illiteracy and low level of human capital development**
- **Low level of capital accumulation**
- **Small open economy heavily influenced by a single neighbour in the South (prices, exchange rates, financial sector policies)**
- **Land-locked and high cost economy**
- **Under developed financial markets**

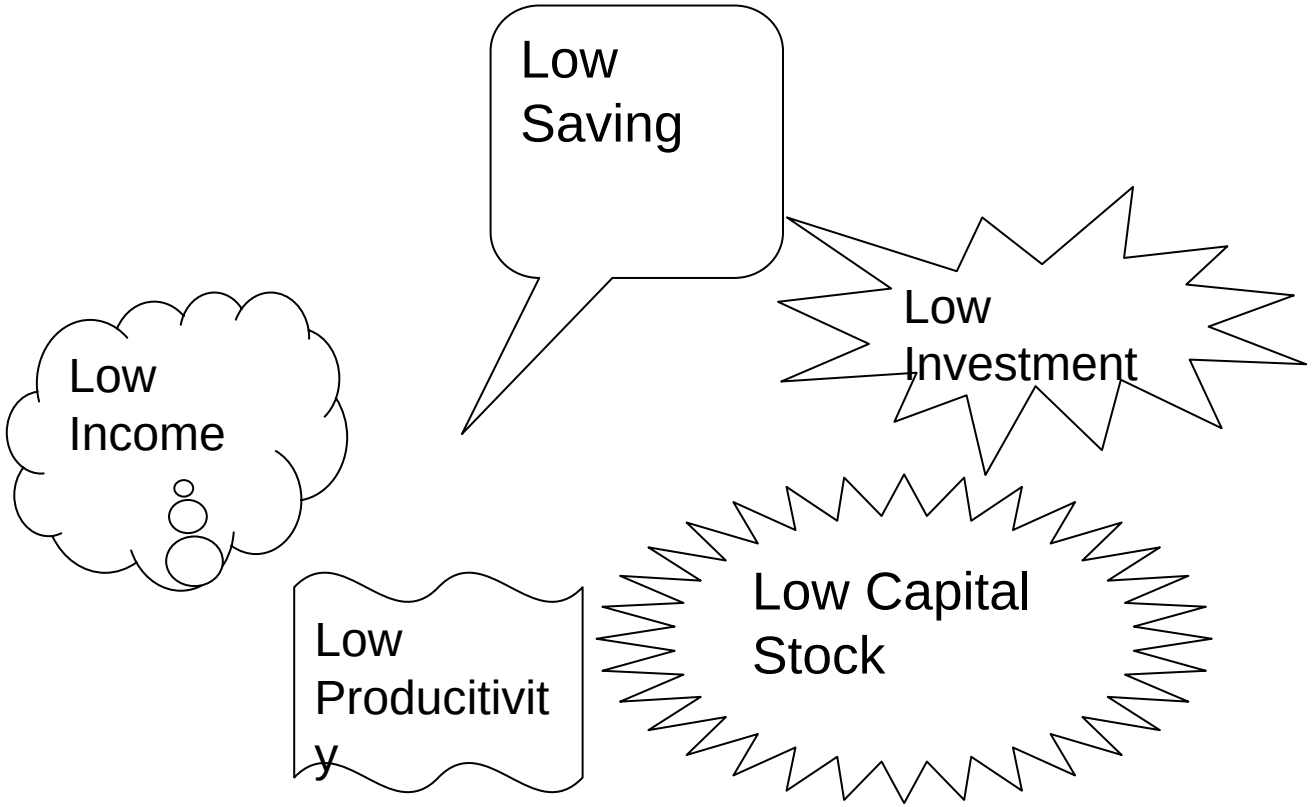
Sources of Financial Sector Distortions

- **Entry Barrier**
- **Credit Ceiling/Rationing**
- **Sector Specific Subsidies**
- **High Reserve Requirements**
- **Negative Real Interest Rate**
- **Control of Foreign Exchange**
- **Centralised Decision Making**
- **Directed credit to government**
- **Lack of autonomy for the Central Bank**

Sector Specific distortions

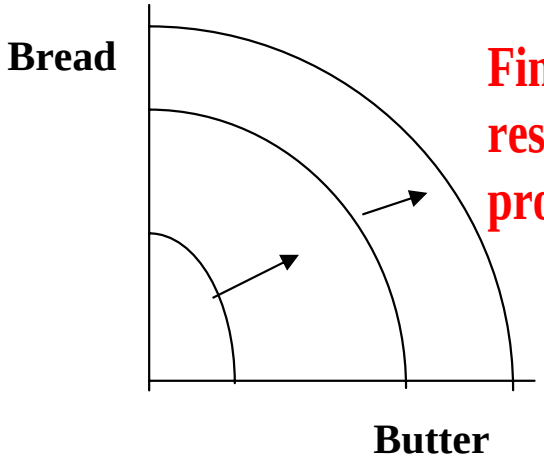
FOOD-CROP 0.591	**CASH-CROP 0.591**	**FOOD-PROC 0.591**	**TEXTILES 0.578**
CHEMICAL 0.536	**CAPITAL 0.424**	**TRANSPORT -0.047**	**ELECTRIC -0.157**
CONSTRUCT -0.336	**TOURISM 0.161**	**SERVICES 0.011**	**PUBLIC -1.118**

Vicious Circle of poverty: Development Problem

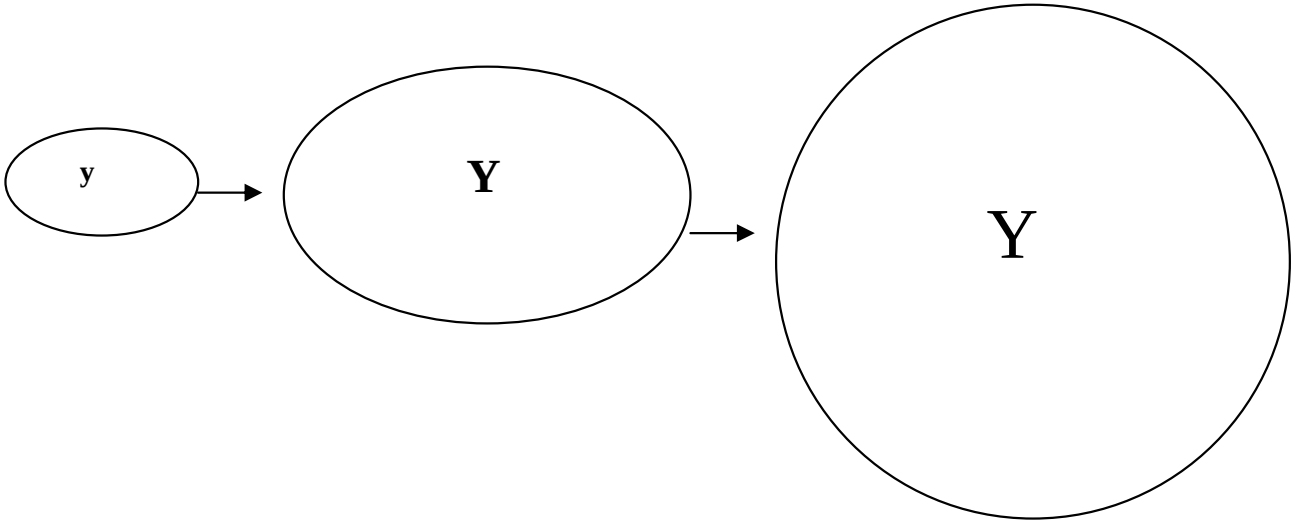


Economic Development

Process



Financial sector policy => More saving => More efficient allocation of resources => More investmetn => More capital stock => Higher productivity =>higher per capita income



Consumers:

- Urban and Rural Households with infinite lives
  - Utility each period
  - Welfare over the period
- Government
- Tourists
- Intermediaries in only in Blackhole Model

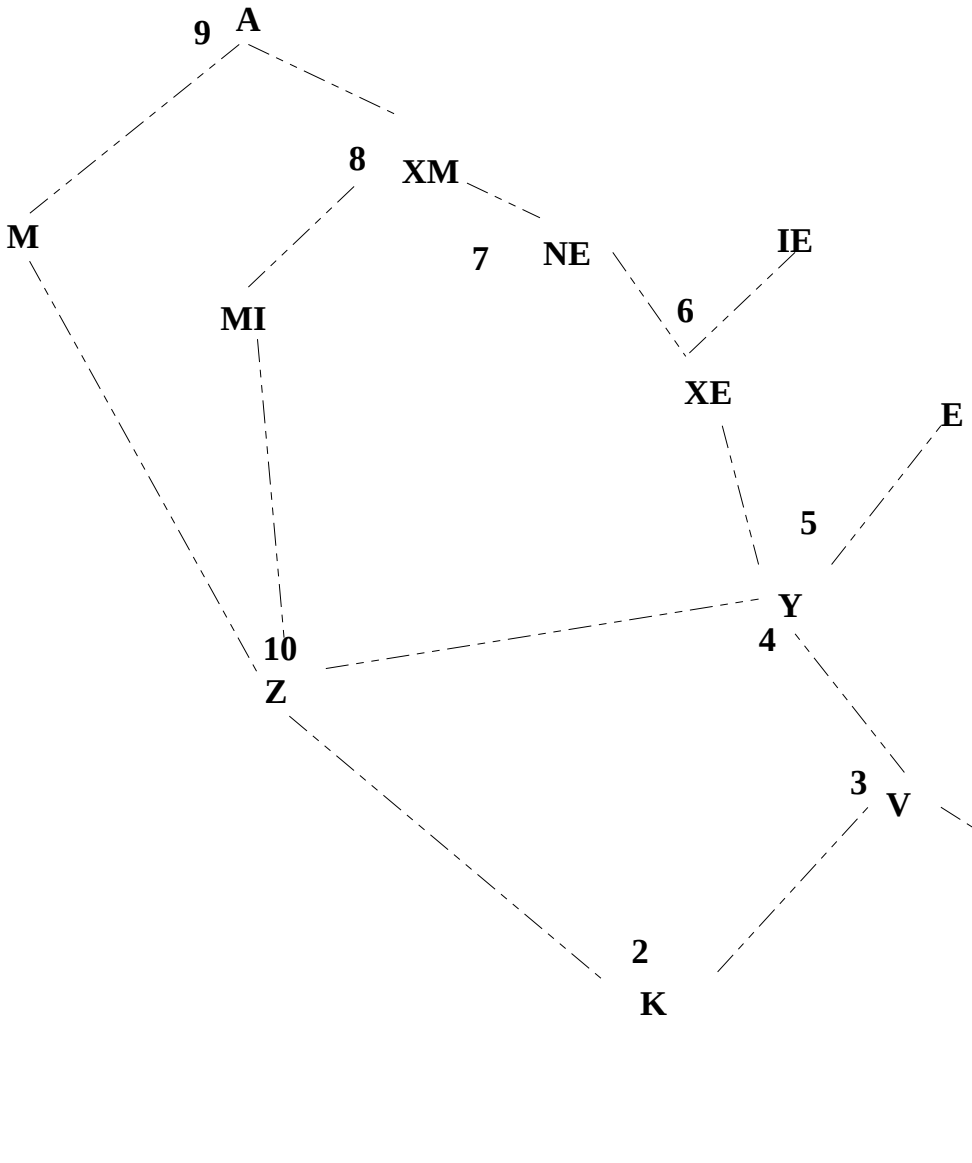
Producers:

- Investors: Capital and Investment goods
- Production Firms/Industry:
  - Goods and Services (11 Sectors)
  - Public Goods
  - Tourism

Traders:

- Exporters
  - Nepal-India Market
  - Third Countries
- Importers
  - Nepal-India Market
  - Third Countries

Nested Structure of Production In the Economy



Consumer's Problem and Demand

$$U(C_t^h) = \frac{\left(C_t^h\right)^{\frac{1}{1-\sigma}} - 1}{1-\sigma}$$

$$C_t^h = \left(\prod_{i=1}^{11} C_{i,t}^{\alpha_t^h}\right) \qquad U_t^h = \left(\frac{\prod_{i=1}^{11} C_{i,t}^{\alpha_t^h}}{1-\sigma}\right)^{1-\sigma}$$

$$\sum_{t=0}^{\infty} P_t C_t^h = \sum_t w_t^h L_t^h + M_o^h$$

$$\frac{C_{t+1}}{C_t} = \frac{\overline{C}_{t+1}}{\overline{C}_t}\left(\frac{P_t}{P_{t+1}}\right)^{\sigma}\left(\frac{\overline{P}_{t+1}}{\overline{P}_t}\right)^{\sigma} \qquad (1+g)(1+r)^{-\sigma}\left(\frac{P_t}{P_{t+1}}\right)^{\frac{1}{\sigma}}$$

Producer and Investor's Problem

$$\Pi^{y}_{j,t} = [(\theta^{x}_{j} PX^{1+\eta}_{j,t} + (1-\theta^{x}_{j}) PD^{1+\eta}_{j,t})]^{\frac{1}{1+\eta}} - \theta^{v} PV^{v}_{j} - (1-\theta^{v}) \sum_{j} a_{i,j} P_{i,t} \leq 0$$

$$\Pi^{I}_{j,t} = P^{k}_{t+1} - \sum_{i} P^{A}_{i,t} a^{I}_{i,j} \leq 0$$

$$\Pi^{k}_{j,t} = (1-\delta) P^{k}_{j,t+1} + r^{k}_{j,t} - P^{k}_{j,t} \leq 0$$

$$K_{j,t+1} = I_{j,t} + (1-\delta) K_{j,t}$$

$$I_{j,t} = (g + \delta_{j}) K_{j,t}$$

Armington Conditions for Trade

$$\Re_{i,,w,,t} = PE_{i,t}E_{i,t} + PXE_{i,t}XE - P_{i,t}Y_{i,t}$$

$$+ \Phi_{e,w,t}\left[Y_{i,t} - \Psi(\gamma_i E_{i,t}^{\chi_i} + (1-\gamma_{i\,i})XE_{i,t}^{\chi_i})^{\frac{1}{\chi_i}} \right]$$

$$Y_{i,t} = \Psi(\gamma_i E_{i,t}^{\chi_i} + (1-\gamma_{i\,i})XE_{i,t}^{\chi_i})^{\frac{1}{\chi_i}}$$

$$PD_{i,t}Y_{i,t} = PE_{i,t}E_{i,t} + PXE_{i,t}XE_{i,t}$$

Definition of a Competitive Equilibrium in the Economy

prices of composite commodities, $P_{i,t}$;

Prices of domestic goods sold in domestic markets, $PD_{i,t}$;

prices of exported commodities, $PX_{i,t}$;

prices of capital goods , $P^{k}_{j,t}$;

prices of terminal capital , $PTK_{j,t}$;

wage rates for each categories of labor, $w_{h,t}$;

prices of government services, PG_{t} ;

prices of provisions for tourism, PT_{t} ;

prices of transfer, PR_{t} ;

prices of consumption, PU_{t} ;

price of aggregate welfare, PW_{t} ;

price of foreign exchange, PFX_{t} ,

present value of foreign exchange, $PVPFX_{t}$;

rental rate of capital for each sector, $r_1^{k} : \mathrm{R}_{+} \rightarrow \mathrm{R}$, and

sequence of gross output, $Y_{i,t}$; total supply of commodities, $A_{i,t}$; sectoral capital stock, $K_{i,t}$; sectoral investment, $I_{i,t}$;

exports, $X_{i,t}$; government services, GOV_{t} ;

level of household utility from consumption, U_{t} ; and total welfare, W such that given these prices and commodities

i) households solve intertemporal utility maximization problems
ii) investors solve intertemporal profit maximization problem,
iii) markets for goods and services, labor , capital clear
iv) government constraint is satisfied
v) and balance of payments condition is fulfilled

Calibration of the Model

$$P_1^I = 1 = P_2^k = (1-r)P_1^k \Rightarrow P_1^k = \frac{1}{1-r}$$

$$\frac{P_{t+1}^k}{P_t^k} = (1-r) \qquad P_1^k = r_1^k + (1-\delta)(1-r)P_1^k$$

$$\frac{1}{1-r} = r_1^k + (1-\delta) \qquad V_1 = r_1^k K_1$$

$$K_1 = \frac{V_1}{\frac{r}{1-r} + \delta} \qquad \frac{I_1}{V_1} = \frac{\delta + g}{\frac{r}{1-r} + \delta} \qquad \frac{I_1}{V_1} = 1$$

$$g = \frac{r}{1-r} \qquad r = \frac{g}{1+g} \qquad \frac{I_1}{V_1} \neq 1$$

$$\delta_j = g\frac{V_j}{I_j - V_j} - \frac{r}{1-r}\frac{I_j}{I_j - V_j}$$

Calibration of the Model

$$P_1^k = r_1^k (1 - \tau_i) + (1 - \delta)(1 - r) P_1^k$$

$$r_1^k = \frac{1}{1 - \tau_j}\left[\frac{r}{1 - r} + \delta\right]$$

$$r_1^k = \frac{\bar{r}_j^k}{1 - \tau_j}$$

$$\frac{I_1}{V_1} = \frac{\delta + g}{\frac{r}{1 - r} + \delta}(1 - \tau_j)$$

$$\tau_j = 1 - \frac{\bar{r}_j^k}{\delta + g}\frac{I_j}{V_j}$$

Financial Distortions in the Benchmark

PARAMETER TAU	CALIBRATED SPREAD IN CAPITAL RENTS		
FOOD-CROP 0.591	CASH-CROP 0.591	FOOD-PROC 0.591	TEXTILES 0.578
CHEMICAL 0.536	CAPITAL 0.424	TRANSPORT -0.047	ELECTRIC -0.157
CONSTRUCT -0.336	TOURISM 0.161	SERVICES 0.011	PUBLIC -1.118

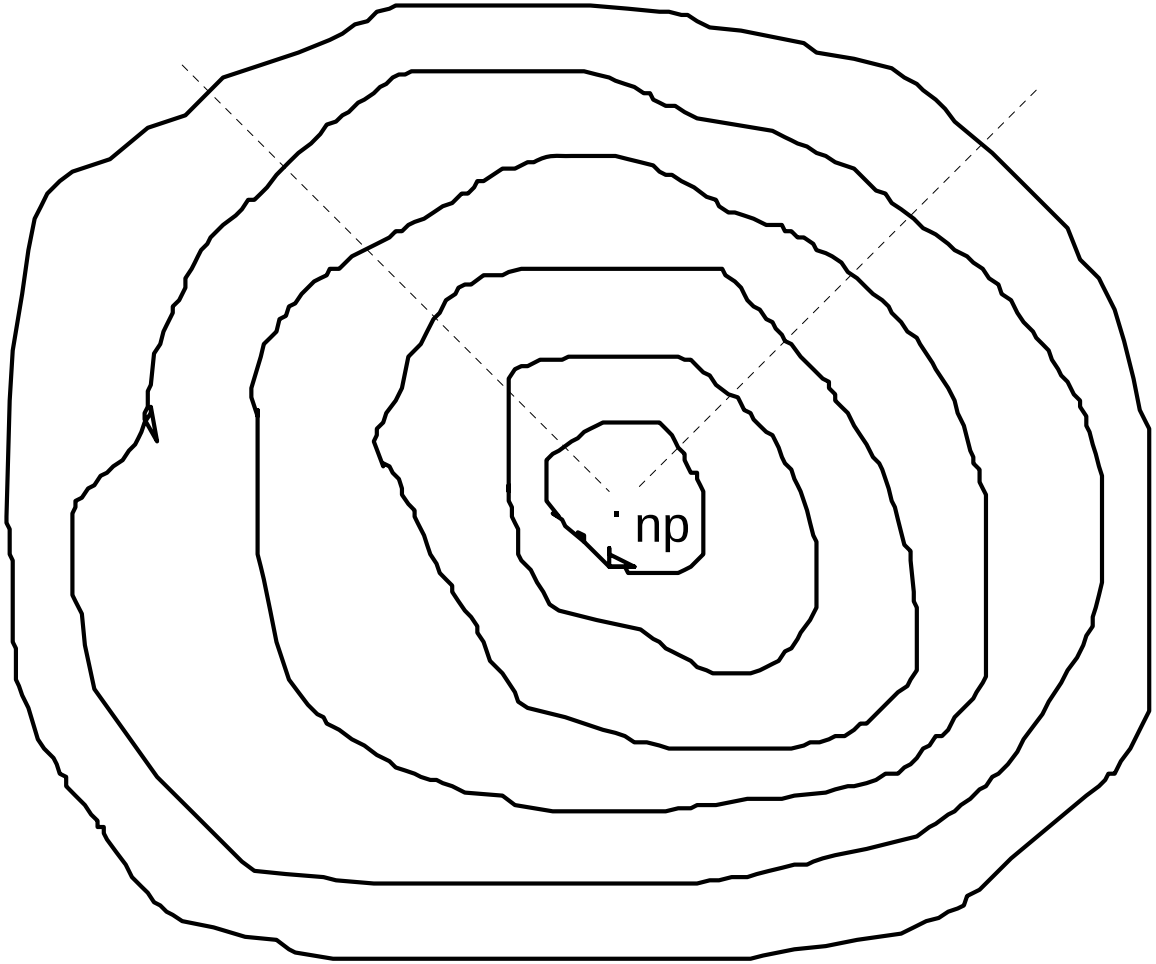
Path Algorithm: Basics

The PATH algorithm (Dirkse and Ferris 1994) uses pivotal techniques to construct a path $\boldsymbol{p^k(.)}$ paremeterized by $\boldsymbol{t}$, form the current point $\boldsymbol{x^k}$ to the Newton point x_N^k of th nonsmooth equation $\boldsymbol{F_b(x) = 0;\ F_b(x^*) = 0}$.

A Newton point x_N^k is given by $x_N^k = x^k + d^k$, where d^k is Newton direction. The next iterate in Newton process is determined by a linearsearch along this direction such that the new point [$x^{k+1} = x^k + \lambda d^k$] is chosen to satisfy some descent criteria in $\|F\|$ with the ultimate goal finding a point $\boldsymbol{x^*}$ such that $\|F(x^*)\| = 0$.

At this point also F($\boldsymbol{x^*}$) = 0. The watchdog stabilization technique is used to determine whether the path should be searched for a point $\boldsymbol{p^k(t)}$ satisfying monotone descent condition, if the Newton point should be accepted without searching the path

Path Algorithm: Piecewise-Linear Function to Newton Point (np)



Source:Dirkse and Ferris(1994:10).

Borrowing Lending Scenarios

$$\sum_{t=0}^{\infty} PV_t \left(\sum_{i=1}^{7} (PM_{i,t} * M_{i,t} - PE_{i,t} * E_{i,t}) * ER_t + \sum_{i=1}^{8} (PMI_{i,t} * MI_{i,t} - PIE_{i,t} IE_{i,t}) = 0 \right)$$

$$\sum_{t=0}^{\infty} PV_t \left(\sum_{i=1}^{7} (PM_{i,t} * M_{i,t} - PE_{i,t} * E_{i,t}) * ER_t + \sum_{i=1}^{8} (PMI_{i,t} * MI_{i,t} - PIE_{i,t} IE_{i,t}) = FS_t \right)$$

Blackhole Scenario

$$c_t (S_t - \Delta RA_t) = I_t$$

$$g = \left(\frac{Y_{t+1}}{Y_t} - 1\right) = \left(\frac{K_{t+1}}{K_t} - 1\right) = \frac{I_t}{K_t} - d = A_t^{\frac{1}{1-\theta}} \frac{c_t (S_t - \Delta RA_t) L_t^{\frac{\theta}{1-\theta}}}{Y_t^{\frac{1}{1-\theta}}} - d$$

Conditional Growth in the Blackhole Scenario

i) If the current inflow of saving is less than the changes in real assets ($S_t < \Delta RA_t$) economic growth will be negative.

ii) If changes in savings and changes in real assets are equal ($S_t = \Delta RA_t$) even then economy will retard at the rate of depreciation.

iii) Moreover economic growth will be negative even if the change in output brought about by net investment is less than the rate of depreciation in the model economy

$$\left(A_t^{\frac{1}{1-\theta}} \frac{c_t (S_t - \Delta RA_t) L^{\frac{\theta}{1-\theta}}}{Y_{i,t}^{\frac{1}{1-\theta}}} < d_i \right).$$

iv) The only condition for positive economic growth is $A_t^{\frac{1}{1-\theta}} \frac{c_t (S_t - \Delta RA_t) L^{\frac{\theta}{1-\theta}}}{Y_{i,t}^{\frac{1}{1-\theta}}} > d_i$

Conditional Growth in Non-Steady State Scenario

It is assumed that at the steady state all sectors grow at the same rate:

$$Y_{i,t+1} = (1 + g)\, Y_{i,t} \qquad (4.24')$$

Labor endowment, in terms of efficiency units, is equals $L_{0,}$ and is assumed to grow exogenously at the g.

$$L_t = L_0(1+g)^t \quad (4.24'')$$

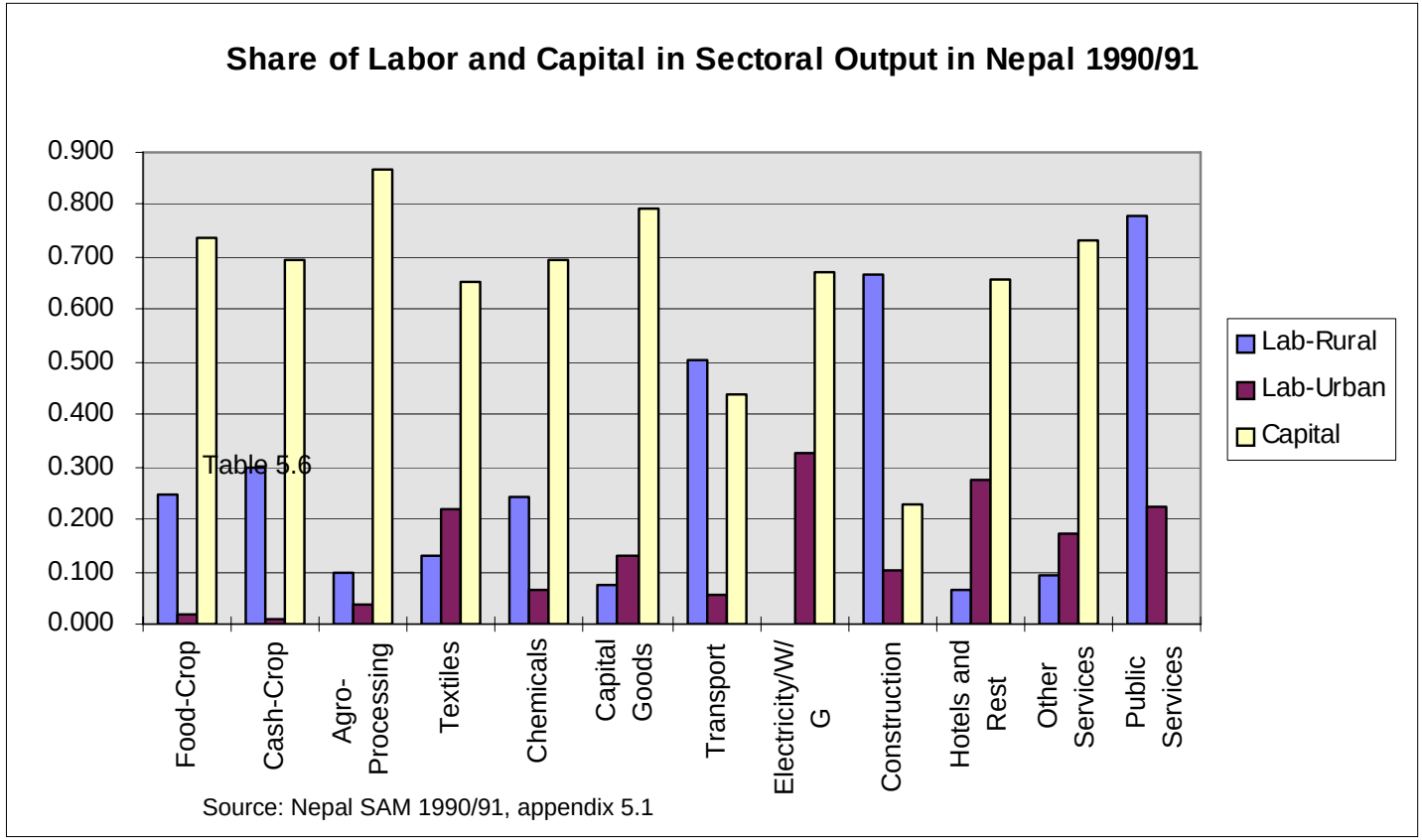
If the urban labor force grows twice the rate of steady state growth rate and the land grows at one third of the steady state growth.

Summary of Structure of the Scenarios

Table 6.1 Models and Assumptions

Name of the Model	Model Assumptions
Base-line Model	Calibrated assuming a steady state equilibrium in the base-year
Complete Market Model (CAPFLOW)	Steady state growth rate across all sectors; Unrestricted capital flows to close the BOP gap; Exogenous interest rates;
Incomplete Market Model (BOPCON)	Steady state growth rates across all sectors Period by period BOP constraint
Non-steady state model (NONSS)	Free flows of capital and exogenous interest rates; Land grows ate 1/3 of the steady state growth rate; Urban labor grows 2 times the rate of steady state growth rate
Blackhole intermediation cost model (BKLHOLE)	Period by period BOP constraint; Steady state growth path; Real cost of financial intermediation, i.e., part of savings are converted into the unproductive assets e.g. accumulation of foreign exchange.

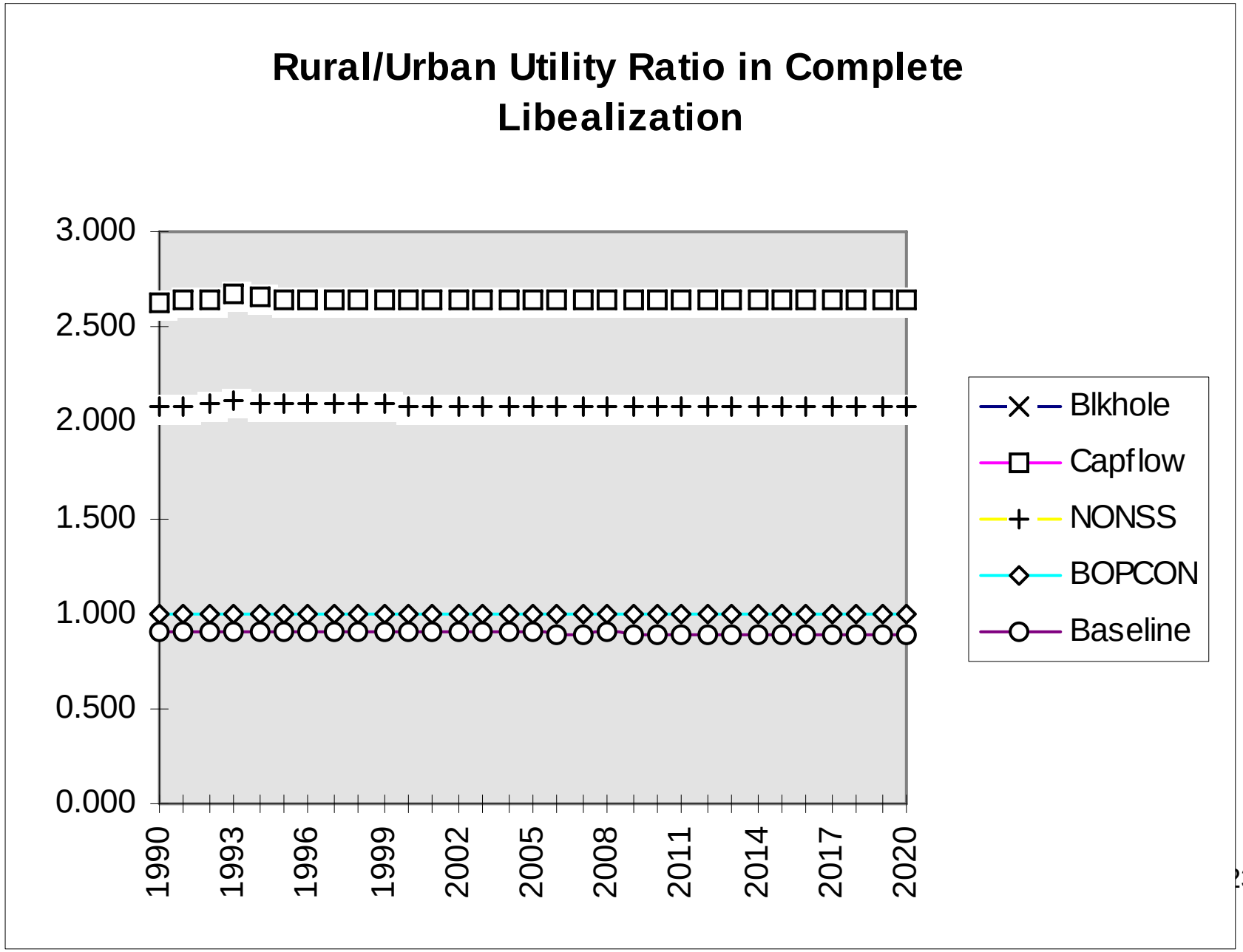
Base Year Parameters from Nepal SAM, 1991



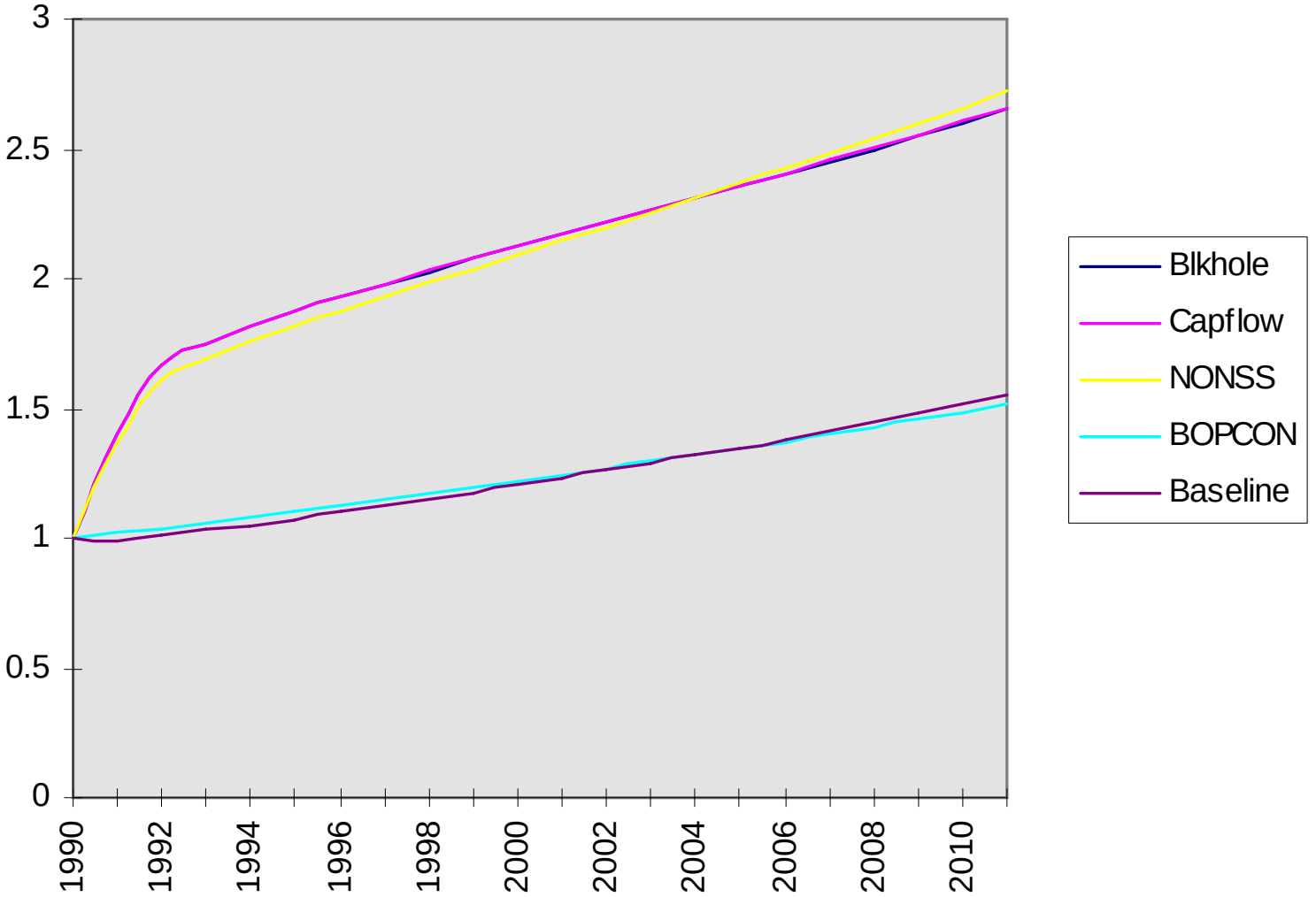
Base year Ratios	Urban	Rural
Saving to income	0.1515	0.0132
Income tax rate	0.0206	0.0208
Net transfer abroad to income	0.1298	0.0
Remittance to income	0.0565	0.0266
Capital income to total income	0.5250	0.6053

Conclusion of the Study

1. Liberalization favors the rural households than the urban households as reflected in the higher welfare index for rural households in comparison to the welfare index of urban households. In this sense liberalization redistributes resources from urban to rural households.
2. The redistribution of welfare occurs through the effect of liberalization in wage increases. The wages of unskilled labor increase greater than the wages of skilled labor.
3. Liberalization equalizes rates of return across the sectors. This insures efficiency in the allocation of resources.
4. The efficiency in allocation causes more increase in capital stock of the sectors that were more repressed before the liberalization started. It causes a reduction or a slower growth of capital stock in sectors that used to be subsidized before repression. Ultimately all sectors return to steady state growth rate of the economy.
5. The expansion in capital stock allows production to expand accordingly. Output expansion is greater in sectors that were repressed heavily before the liberalization.
6. The modeling exercise done in this chapter shows that it is possible to develop a well disaggregated general equilibrium model to explain inter-temporal behavior of households and producers and to study the effects of economy-wide and sector specific policy issues aimed at increasing efficiency and welfare in the economy.


Rural/Urban Utility Ratio in Complete Libealization
3.000
2.500
2.000
1.500
1.000
0.500
0.000
1990
1993
1996
1999
2002
2005
2008
2011
2014
2017
2020
Blkhole
Capflow
NONSS
BOPCON
Baseline

Capital Stock In Food-Crops Sector under Different Model Assumptions: Partial Liberalization



Capital Stock in Food-Crop Sector Under Different Model Assumptions

	Blkhole	Capflow	NONSS	BOPCON	Baseline
1990	1	1	1	1	1
1991	1.403	1.406	1.365	1.02	0.99
1992	1.671	1.671	1.613	1.04	1.008
1993	1.745	1.746	1.691	1.061	1.029
…	..	..	..	..	
2008	2.5	2.505	2.538	1.428	1.447
2009	2.55	2.555	2.599	1.457	1.481
2010	2.6	2.605	2.66	1.486	1.516
2011	2.651	2.656	2.723	1.516	1.552

Ratio of Utility Level of Rural Households to Utility Level of Urban Households

	Partial Liberalization				
	Blkhole	Capflow	NONSS	BOPCON	Baseline
1990	1.532	1.472	1.271	1.000	0.895
1991	1.541	1.481	1.279	1.000	0.896
1992	1.547	1.487	1.286	1.000	0.896
1993	1.544	1.484	1.283	1.000	0.896
..	..	..	..	..	..
2020	1.533	1.474	1.262	1.000	0.890
2021	1.000	1.000	1.000	1.000	1.000
2022	1.000	1.000	1.000	1.000	1.000
2023	1.000	1.000	1.000	1.000	1.000
2024	1.000	1.000	1.000	1.000	1.000
2025	1.000	1.000	1.000	1.000	1.000

Ratio of Utility Level of Rural Households to Utility Level of Urban Households

Complete Liberlaization

	Blkhole	Capflow	NONSS	BOPCON	Baseline
1990	2.631	2.631	2.078	1.000	0.895
1991	2.642	2.642	2.089	1.000	0.896
1992	2.648	2.648	2.098	1.000	0.896
..	..	..	.	..	..
2023	1.000	1.000	2.080	1.000	1.000
2024	1.000	1.000	2.078	1.000	1.000
2025	1.000	1.000	2.078	1.000	1.000

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