METHODS OF CALCULATING LAND INPUT IN TFP CALCULATIONS – THE CASE OF INDIA

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INDIA’S LARGE AGRICULTURAL SECTOR:
THE SIGNIFICANCE OF LAND

- Still provides livelihood to the largest section of people, many of them poor.
- Increasingly perceived as low paying - little appeal for the youth.
- Urbanizing and industrializing country.
- Land is scarce relative to the large population, - demand for food, housing and industries.
- Public interest in clean environment, resource depletion, climate change - new dimensions.
- Land - emerging as a critically contentious resource.
APPEARANCE AND DISAPPEARANCE GUIDELINES

- Assets in Balance Sheet (BS)- changes as flows (often Transactions) in Accounts
- Natural area changes- limited
- Changes in value seen as changes as volume
- Treatments of changes in associated assets, Land improvements, Land use, qualities, pure price as suggested
- Guide (EUOSTAT-OECD) based mostly on SNA 2008 and ESA 2010, limited guidance on classification, advised resort SEEA 2012
- Divergences between SNA 2008 and SEEA 2012, SEEA too fails to address all issues of environmental valuation (Gundimeda et al, 2005).
OBJECTIVE AND PLAN

- To explore the possibilities and ways of compiling data on land as an economic asset and stock in Indian agriculture.

- Plan:
  - Land as Economic asset and also resource, Guidance for uniformity (5-10)
  - India’s data resources, shortfalls, possibilities (11-15)
  - Proposal for Land stock valuation in Indian Agriculture (16-23)
  - Supplementary data for India’s Land valuation (24-28)
  - Complexities Interfaces, Desirable data (29-30)
  - Conclusion (31)
LAND AS ECONOMIC ASSET, NATURAL AND ENVIRONMENTAL RESOURCE

- Registration in the BS of the national accounts
- As economic asset-consists of ground, including the cover soil, associated surface waters, over which ownership rights are enforced and from which economic benefits can be derived by their owners by holding, using or allowing others to use them.
  - Flow of gain and store of wealth (S-O-W)
- Issues of environmental valuation-economic costs and benefits elsewhere
SPECIFICATION

• All territorial land owned by an Institution,
  ✓ at least the government
• Only with Economic benefits
  ✓ Remote inaccessible lands of no current econ use excluded
• For Leased land Lessee treated as the owner
  ✓ Lease is equivalent to sale under certain contracts
• Non-depreciable- no CCA
• Separate pure Land: as N-resource associated with other natural or manmade assets, as Econ asset L-improvement by man, Shift to higher value use, Quality rise due to neighborhood development (roads, parks, estates etc.)
  ✓ To classify elsewhere Associated structures, assets, resources, include Effect of Quality changes on L-value only if integral to the land
VALUATION OF LAND: PRICE, QUALITY AND USE

• Current market prices if available otherwise
  ✓ Use of proxy prices
  ✓ Using net present discounted value (NPV) of the expected flow of benefits
  ✓ Adjust for Land improvement, Quality, price rise

• Heterogeneity: Need for sound and accepted land classification by use-adjust

• Dissociate from value of associated resources or assets
  ✓ Use of indirect methods (Hedonic), also for heterogeneity
CLASSIFICATION: LACK OF INTERNATIONAL CONSENSUS

- Limited guidance
- SEEA 2012: Land cover and use, Utility of earlier SNAs
- Preferable for classification: four use groups
  - land underlying buildings and structures
  - land under cultivation
  - recreational land and associated surface water and
  - other land and surface water
LAND UNDER CULTIVATION

- Guide: Disaggregated into agricultural land, forestry land and surface water for aquaculture
  - Temporary and permanent crops
  - Permanent crops/orchards and plantations
  - Meadows and Pastures
  - Tilled and Fallow land (Farm building structures standing on these lands classified elsewhere)
  - Forest land (only for econ wood collections, Exclude value of Trees are grown naturally or by human intervention)
• Valuation most challenging aspect
• Store of Wealth (SOW), different rigid land laws
• Infrequent transaction, current market prices or reliable proxy prices not available,
• Data sources: Direct from Cadastral and registry (tax and other Administrative departments, collection sources (surveys and censuses) Remote sensing, Indirect including HRM
CASE OF INDIA

• Non-member with working relationships with OECD since 1995
• Fast globalizing economy - learning from and sharing experiences with OECD members, member of G-20, cooperates in creating robust and comparable database for internal monitoring, benchmarking performances, policy making and or participating.
• Culture: land perceived as a security and an inheritance, Government distribution of Ceiling land, restrictions on Sale and Lease of agricultural land, States have different land Laws
TRANSITION: LAND MARKET OPENING UP?

- Deep cultural and political dimensions, State subject
- Established system of collecting, recording and reporting data on land use and agriculture-
  - Historical roots-colonial and pre-colonial, GOI improved on legacy,
  - Land use and cropping pattern recorded, Price data more difficult: Land market has been very thin
  - Land sale market is attracting intense discussion due to increase demand coming from other sectors
  - Housing of poor, urbanization and industrialization-Development
- Land Law 2013- yet to be passed
- Compilation of agri-land value will be useful for policy purposes
  Demystifying the political economy logjams
Land use—Continuous advancement of protocol and dissemination in recent times—MOA, traditional method Patwari, sampling, small sample, econometrics, meteorology, RS even drones—FASAL, Uploading online, MOEFCC since 1997 also adds alternative and supplementary data—reconciliation, NSS, others (Agri Census, COC)
HISTORICAL ROOTS FOR DATA QUALITY AND LAWS

• Fairly strong system- varies by region- rooted in history
  1. Zamindari: (abolished now): weaker database possibly even poorer performance (Benerjee and Iyer, 2005)
  2. Raiyatwari: Linked government directly with the tillers
  3. Mahalwari: placed tax liability on village communities

• 2 and 3 records land holding by use, ownership and size methodically and historically.
• MOA publishes Land use data
DATA ON LAND VALUE/PRICE

• Relatively weak
  • Store of wealth, cultural aversion to sale, rigid laws against sale and lease, non-transparency, influence of Land agents, Incentive to under-state price,
• No official reporting - no incentive of recording, under state government
• Literature:
  1. NPV (Chakravarty, 2013) presumptions needed, possible underestimate as land S-O-W- speculation, land laws, No profitability by COC analysis, land held for subsistence needs, lack of other livelihood and inefficient market, and for future sale.
  2. Information collected from actual land sellers through survey (Ghatak and Mukherjee, 2012) for research
1. Mono/Multi Cropped (Seasonal): Rice, Wheat, Cereal, Oilseed, Pulses, Vegetables
2. Permanent Crops: Fruits, Palm, Cashewnut
3. Plantation Crops: Tea, Coffee, Spices
4. Perennial Crops: Sugarcane
1. Land Use Statistics (MoA)
2. Central Statistical Office, GoI.

Green Box: Cultivation
Blue Box: Other
Red Box: to be decided
Red Lines: Overlaps
IRRIGATION CLASSIFIED
(MINISTRY OF AGRICULTURE, INDIA)
FOREST
(CLASSIFIED BY CENTRAL STATISTICAL OFFICE, INDIA)

Forest

Department

Reserved

Protected

Unclassed

Ownership

Revenue

Corporate/Community

Private

Density

Very Dense

Dense

Open

Production of Woods
NSS data: Potential for valuation of existing land holdings and land under transaction.

• The National Sample Survey (NSS) of Debt and Investment: Unit household level data
• Rigorous and systematic, large nationwide sample with corresponding multipliers
• To derive imputed price at plot level- heterogeneous

•Info: Land type, attributes: residential structures, barns, sheds and gardens household characteristics
•Location: state-region code
•Region level data: CSO, MOEFCCC, IMD, Soil surveys etc

•Decennial AIDIS: Most recent survey is for 2013 in 70th round, N=220,000 (Rural=124000)
•Stratified multi-stage, fixed reference date transactions in ref period
•Excludes crops standing in the field and commodity stocks held.
•Assets held on the survey data other than those acquired in the reference period: Valued at prevailing market price of the locality in their existing states
•Assets acquired or disposed of in the reference period: Actual price of transaction
**LAND TYPE: NSS**

<table>
<thead>
<tr>
<th>Description</th>
<th>Include/Exclude</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seasonal crop area irrigated</td>
<td>(include)</td>
</tr>
<tr>
<td>Seasonal crop area unirrigated</td>
<td>(include)</td>
</tr>
<tr>
<td>Orchards and plantations</td>
<td>(include)</td>
</tr>
<tr>
<td>Area put to non-agricultural uses: water bodies (to decide, uses not specified)</td>
<td></td>
</tr>
<tr>
<td>Exclusively for non-farm business</td>
<td>(Exclude)</td>
</tr>
<tr>
<td>Other non-agricultural uses</td>
<td>(Exclude)</td>
</tr>
<tr>
<td>Residential area including house-site</td>
<td>(Exclude)</td>
</tr>
<tr>
<td>Other areas</td>
<td>(Exclude)</td>
</tr>
</tbody>
</table>

Source: NATIONAL SAMPLE SURVEY DATA FOR POSSIBLE USE
Unit Level Data of households 59th Round, Schedule 18.2: Debt and Investment Survey (January-December, 2003)
Location: State-wise/State-Region code identifying Districts
Sectors: Rural/Urban

Non-agricultural uses includes all land occupied by buildings, path etc. or under water (tanks, wells, canals etc.) and land put to other non-ag uses, **Water bodies**: All lands which are perennially under water is defined as water bodies- no crop is raised on them, Other **non-agricultural uses**, buildings, roads, railways, paths etc.
INFORMATION ON NSS DATA

• **Own Land: Before (fixed date before survey begins) and After Transaction**
  ✓ Area (Hectare) & Value (Rs.) (Value/Area = Price of Existing Land)

• **Acquisition of Land in reference period,**
  ✓ Area (Hectare) & Value (Rs.) (Value/Area = Price at transaction for buyer)

• **Disposal of land in reference period:**
  ✓ Area (Hectare) & Value (Rs.) (Value/Area = Price at transaction to seller)

• **Structures (fixed date before survey begins) and After Transaction**
  • *Residential building*
  • Building for farm business:
  • *Barn, Animal Shed, Farm house, other*
  • **Owned as on the date of survey**
    ✓ Area (Hectare) & Value (Rs.) (Value/Area = Price of Existing Land)
  • **Acquisition in reference period:** Purchased, Construction and improvement, otherwise acquired
    ✓ Area (Hectare) & Value (Rs.) (Value/Area = Price of Existing Land)
  • **Disposal in reference period:** Sold, Otherwise disposed off, discarded
    ✓ Area (Hectare) & Value (Rs.) (Value/Area = Price of Existing Land)

• **Socio-economic:** Household size, composition etc., Household’s data:
  ✓ Sample/Caste/Religion/Sector/District/State-region/Sub-region
HEDONIC REGRESSION MODEL (HRM)

\[ P_{ikt} = a_0 + a_{ik} + a_1 PC_{it} + a_2 HC_{iHt} + a_3 REC_{kt} + a_4 RSC_{kt} + a_5 RWC_{kt} + a_6 Z_{ikt} + u_{ikt} \]

- P = Land price for i-th plot, k-th region and t-th year
- Parameters are a, u is error (assumptions of model including spatial correlation)
- PC, HC are **plot level and household level** characteristics, REC, RSC and RWC are **region level** economic (incl infrastructure), soil and weather /climatic variables, Z other variables.
- FE/RE to be decided, time dummy/separate regression to be decided, **Q-adjusted Price index** as in literature (OECD/Ball et al (2008))

Interpolation of non-survey years method (**to be discussed**)
SUPPLEMENTARY SOURCES FOR HRM

• Climate Data (India Meteorological Department)
• Rainfall (Average)
  ✓ Region: State-wise/Station-wise/Met-wise
  ✓ Data: Weekly/Monthly (1990-2013)
• Temperature (Average)
  ✓ Region: State-wise/Station-wise/Met-wise
  ✓ Data: Weekly/Monthly (1990-2013)
• Soil Survey (Soil and Land Use Survey of India, Department of Agriculture, Cooperation and Family Welfare, Government of India)
  ✓ Rapid Reconnaissance Survey: Catchment-Wise/State-wise/Centre-wise
  ✓ Data available: Reported Area, Land Capability Class (I to Viii), Forest and Misc
    • River Basin wise
    • Indus, Ganges,-Catchments, Flood Prone map
  • Detailed Soil Survey: Catchment-Wise/State-wise/Centre-wise
    • Reported Area, Land Capability Class (I to Viii), Forest and Misc
• Soil Resource Mapping: District wise, Status Map
  ✓ Survey mapping of use (agri) slope, Depth, Erosion,
  ✓ Land Degraded Mapping
  ✓ Water Logging
  ✓ Jhuming (Shifting cultivation)
  ✓ Degradaded Land
SUPPLEMENTARY SOURCES FOR HRM

• Soil data (Alternative): (Fertilizer Association of India)
• Normal Land
• Area (in hectare) of Different type of Soil in India
• Infrastructure: (Central Statistics Office, Government of India)
• Road Density, Electricity
• Demographic (Statistical Abstract of India, Census of India)
• Economy, SGDP by industry, Population density, Education (Literacy)
INDIA
Soil Map

LEgend
- Red Sandy Soils
- Red Loamy Soils
- Red and Yellow Soils
- Laterite Soils
- Sub Mountain Soils
- Desert Soils
- Grey and Brown Soils
- Black Soils
- Mixed Red and Black Soils
- Mountain Soils
- Alluvial Soils
- Teral Soils
- Skelettal Soils
- Glaciers.

Map not to Scale
Copyright © 2010 www.mapsofindia.com
Last Updated on 15th Feb 2010
### Alternative Data NSS (Not in value):
#### 59th Round, Schedule 18.1:
Land and Livestock Holdings Survey (January- December, 2003)

<table>
<thead>
<tr>
<th>Soil Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand</td>
</tr>
<tr>
<td>Loam</td>
</tr>
<tr>
<td>Slit</td>
</tr>
<tr>
<td>Light Clay</td>
</tr>
<tr>
<td>Heavy Clay</td>
</tr>
<tr>
<td>Others</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Kind of Possession</th>
</tr>
</thead>
<tbody>
<tr>
<td>Owned and possessed</td>
</tr>
<tr>
<td>Leased-in</td>
</tr>
<tr>
<td>Leased-out</td>
</tr>
<tr>
<td>Otherwise possessed</td>
</tr>
<tr>
<td>Operated during kharif but neither owned nor possessed on the date of survey</td>
</tr>
</tbody>
</table>

**Land Area (Hectare)**
OFFICIAL DATA SOURCES

- Agri-Census: MOA, 5 yearly info on land use by tenancy/ownership/irrigation- no value
- Land use stat: MOA, yearly geographic/reported area by econ and non-econ use- no Value
- Area under principal crops: MOA yearly, cropping pattern, kharif, rabi, zayad (seasonal), perennial, orchards irrigation, multiple cropping, No value
- Area under forests, water, land use, land degradation: MOEFCC, CWC etc yearly, details on forest ownership, regulation, density, land degradation, waterlogging, aquaculture drought-prone, floods damages etc.
- Prices: MOA
- Inflation, Infrastructure, GDP etc economic: CSO and others
- Laws: State Land Forest laws, Websites, literature etc
RESOLUTION: SUGGESTIONS

- Valuation on Forests, Grasslands, Tree lands, Water bodies (mostly community owned, non-saleable)
- Water-bodies ambiguity on ownership, lease and coverage for fishery
- Valuation of trees, grass (NPV??), subsoil assets (Biota, G-water)
- Ecological impact of econ values: grassland forests (Organic, biomass, feed, floods, sediments) interface with tourism (price as input not factored), Biofuel (Ethanol Jatropha), Cover crops, land disturbance, carbon N2O, methane emissions from farming practices, effect of non econ use.
- Inclusions: Ponds, tanks and lakes and brackish water, continental shelf in water surface (?), irrigated by sources and unirrigated land as differing qualities, classify as Seasonal: cereals, oilseeds, fibres, pulses, Perennial: sugarcane for sugar and ethanol, Permanent: orchards, certain nuts, palms, Plantation: tea, coffee, spices.
- Fallow: With seasonal crop also left unsown, current and other fallow, culturable wastes have value, Ecological depends on cover crop policy, tillage, water management. Forest type
CONCLUSION

• India now aims for high inclusive and clean economic growth

• Estimating TFP in agriculture using sound methods consistent with theory and comparable with global standards would be a remarkable step forward in the statistical annals of India’s data base. An alternative series of TFP after adjustment for environmental effects treating also CC as another dimension should be initiated as a process at the earliest.

• Present data protocol will allow initiation but estimate may be improved over time with more data collection.
THANK YOU