Agricultural Commodity Risk Management: Policy Options and Practical Instruments with Emphasis on the Tea Economy

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Outline of presentation

- Background and motivation
- Risks faced by rural households
- Risks in the tea economy
- Agricultural productivity and credit
- Constraints to expanding intermediate input use in agriculture
- The demand for commodity price insurance
- The demand for weather insurance
- Operationalizing the use of price and weather insurance
- Possibilities for the tea economy

Background and motivation: Some major questions relevant to agricultural land productivity and risk

- Is agricultural land productivity a factor in growth and poverty reduction?
- What are the factors affecting land productivity? Is risk a factor?
- Are there inefficiencies in factor use among smallholders? If yes in which markets? Why?
- Determinants of intermediate input demand and access to seasonal credit
- What are the impacts or risk at various segments of the value chain?

Background and Motivation: Uncertainty and Risk

- Small (and medium size) agricultural producers face many income and non-income risks
- Individual risk management and risk coping strategies maybe detrimental to income growth as they lead to low returns low risk activities. Considerable residual income risk and vulnerability
- Is there a demand for additional price and weather related income insurance in light of individual existing risk management strategies?
- Can index insurance crowd in credit and how?
- Is there a rationale for market based or publicly supported price and weather based safety nets
- What are appropriate institutional structures conducive to combining index insurance with credit?

Farmer Exposure to Risk. India

RISKS

- Natural disasters (80%)
- Crop related shocks (15%)

RESPONSES

- Additional borrowing (30%)
- Delay immediate payments (23%)
- Sale of assets (15%)
- Work off-farm (11%)

- Drops in income are 25% of annual income.

Farmer risk in Tanzania: Percentage of households affected by various shocks between 1999 and 2003, by region and status as cash crop grower or not

	Kilimanjaro		Ruvuma		Total
	Cash crop	no cash crop	cash crop	no cash crop	
Health					
Death	23.1	29.9	16.3	19	21.8
Illness	23.3	22.8	18.5	19.1	21
Climatic					
Drought	27.8	39.9	2.8	7.1	19.2
Excessive rains	4.3	11.5	4.2	2.2	5.4
Agricultural production					
Harvest loss	5.2	8.6	6.1	4.4	6
Livestock loss	5.1	8.5	3.1	5.4	5.3
Post harvest cereal loss	-	-	0.9	2.9	1.7
Economic					
Cash crop price shock	-	-	5.8	2.7	4.6
Cereal price shock	-	-	0.8	5.1	2.5
Unemployment	0.3	1.7	0.2	0	0.5
Property					
Theft	4.4	6.9	3.7	6.9	5.2
Fire/house destroyed	0.2	1.4	3	3.7	1.9
Land loss	0.2	0.9	0.2	0	0.3

Farmer risk in Ethiopia: The incidence of serious shocks 1999-2004

Type of shocks reported	%
Drought	47
Death of head, spouse or another person	43
Illness of head, spouse or another person	28
Inability to sell outputs or decreases in output prices	15
Pests or diseases that affected crops	14
Crime	13
Policy/political shocks (land redistribution, resettlement, arbitrary taxation)	7

Source: Data from Ethiopia Rural Household Survey

Household risk in agriculture can be enormous

- Average Coefficients of Variation in ICRISAT VLS
  - Total income: 40 percent (Ryan and Walker 1990)
  - Total farm profits: 127.5 percent (Rosenzweig and Binswanger)
  - Probably less in irrigated or high rainfall environments
  - But actual measurements are very rare because they require a long series of individual farm incomes and profits

But it is imperfectly correlated with the weather or price

- In ICRISAT VLS farm profits is related to the onset date of the monsoon, and (weakly) to the total number of rainy days,
  - But not to 4 other rainfall variables
- A one standard deviation delay in the onset date of the monsoon reduces crop profits by six percent
- (Some other data sets show somewhat higher correlations, but nowhere are they tight)

What are we worried about

- Impact of shocks on
  - Consumption, and especially food consumption, nutrition
  - Drawing down of productive assets, such as animals, land, natural resources
  - Becoming destitute and being stuck in a poverty trap
  - Famines
- Underinvestment in agricultural inputs, technology, sustainability, education
- Misallocation of investment into lower paying, but risk-reducing investments

Determinants of farmer behavior

- Small farmers are not excessively risk averse
  - Absolute or relative risk aversion are around one or less
  - They are only slightly higher for the poor than for the "rich"
- But internal discount rates are often enormous, especially for the poor

Liquidity and credit constraints may be more important determinants of behavior than risk aversion

Why the credit constraints?

- The poor typically can only borrow small amounts for short periods, (or in linked transactions)
  - They may be too poor to be reliable borrowers
  - They have no credible collateral
- Formal credit in rural areas is much more constrained than in urban areas
  - Because of heterogeneity of areas, plots of land, and the seasons
  - Because of the moral hazard
  - Because of seasonality
  - Because of covariance of risk
- Rural banking requires very high reserve ratios, or has to be done by banks with urban business
  - Microfinance has not overcome these problems

Risk and Rural Financial Markets

- Stylized features of low income, smallholder agriculture:
- Costs of acquiring & transmitting information high
- Strong informational asymmetries
- Multiple sources of risk, much of which is correlated across individuals
- These features result in endogenous market failures that militate against smallholders:
- Absence of conventional insurance contracts
- Supply Side Portfolio restrictions for ag loans
- Contractual restrictions (relatively high collateral requirements) → quantity rationing
- Also → risk rationing (demand side restrictions)

Why is it so hard to insure their crops?

- Because of heterogeneity of areas, plots of land, and the seasons
- Because of moral hazard
- Because of covariance of risk
- Because of low correlation between weather and income

It is very difficult to use stand alone crop insurance to secure the credit to farmers

How do people adjust ex-post to shocks?

1. Draw down stocks and savings
2. Increase labor supply (India)
3. Borrowing (Ghana)
4. Gifts and interest free loans (Philippines)
5. Selling of livestock
   - Selling of bullocks after weather shocks in ICRISAT VLS
   - For livestock in West Africa after drought, or Phillippines
   - In Bangladesh households in single households sell livestock in response to individual shocks
   - but those with neighbors do not need to do so
6. Selling of land: not in ICRISAT VLS but in Bangladesh
7. Temporary migration
   - In ICRISAT VLS (in response to weather shocks)
   - Not in China (in response to individual income shocks)

Ex-ante adjustments to reduce risks

CROP AND ENTERPRISE DIVERSIFICATION

BUILDUP OF STOCKS, SAVINGS AND ASSETS

COMPOSITION OF ASSETS

USE LESS INPUTS

SOCIAL SHARING ARRANGEMENTS

Buildup of assets

- In China households hold 25 percent of non-land assets in the form of liquid assets (cash and stocks)
  - But eliminating individual income risk would reduce liquid asset by only one percent
  - They hold liquid assets for other reasons than risk
- They also hold more productive (non-land) assets
  - productive assets may also serve a risk diffusion purpose

Composition of assets

- The wealthiest 20 percent have profit maximizing portfolios,
  - *They are already fully insured via their wealth or social ties*
- Poorer households are not able to hold profit-maximizing levels of liquid assets and bullocks
  - They sell bullocks to finance consumption in poor years
- Loss in profits is large: On average 20 percent, 35 percent for the poorest
- Nevertheless poor households have higher rates of return to their assets than rich ones

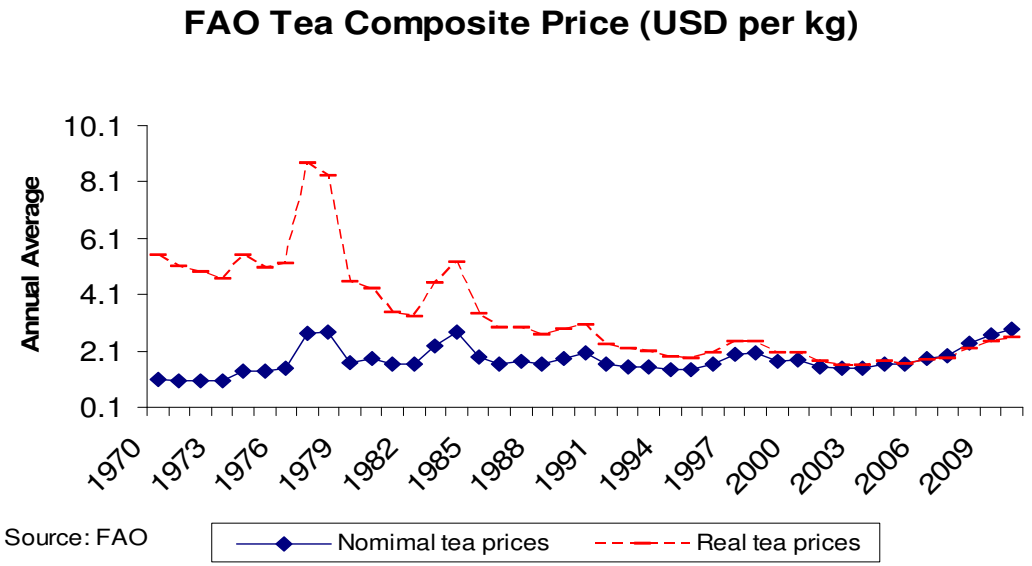
Lessons

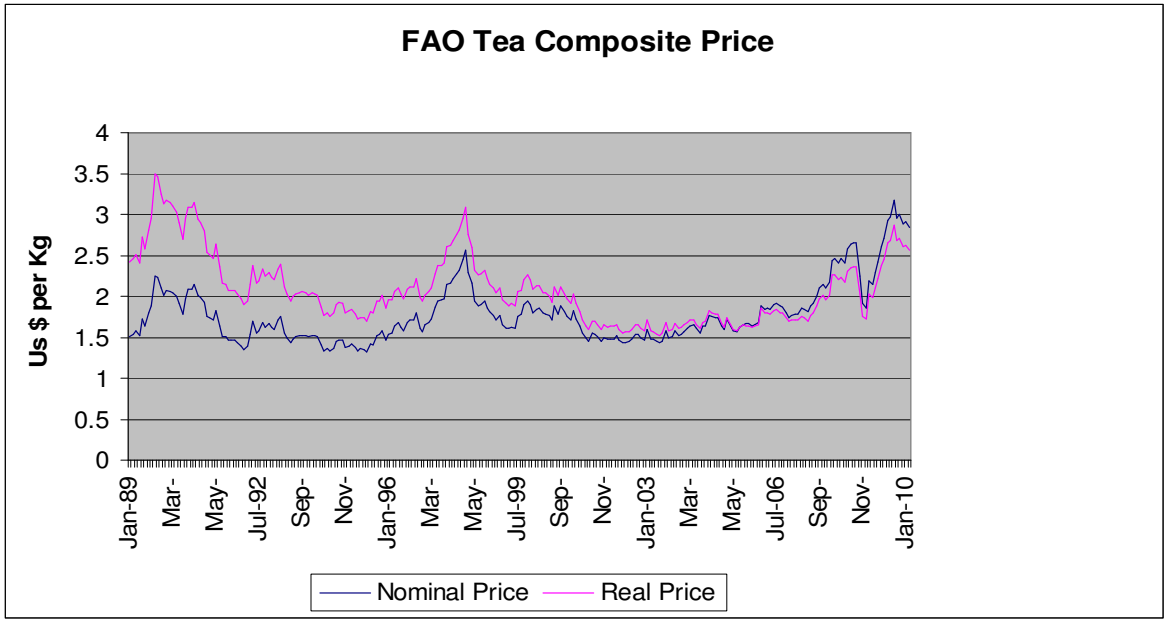
- Individual consumption is fairly well insured, but only partially so, and better for the “rich” than for the poor
- Food consumption may be even better insured
  - But not against systemic shocks
  - When social networks break down
- Insurance varies a lot by wealth
  - The poor are poorly insured
  - While the “rich” may be fully insured against individual and systemic shocks
- In high risk environments, the profit loss from adjustment to risks by the poor is likely to be high
- Covariant risks are much more difficult to insure

Implications

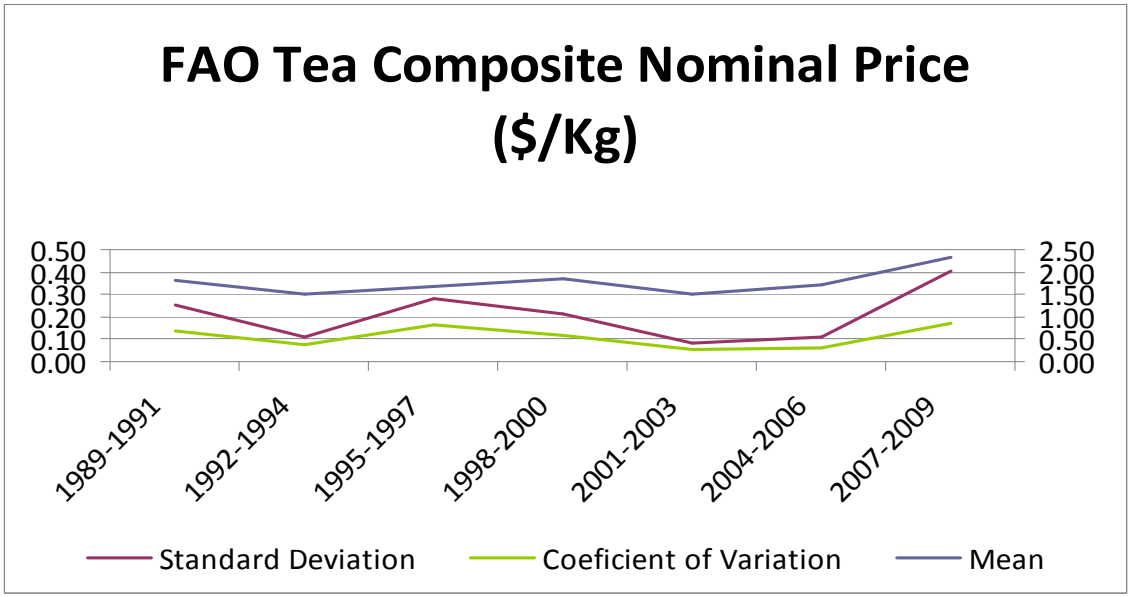
- Focus on systemic risks, such as weather, prices
- Do not worry so much about impact of risk on agricultural supply
  - Those who supply the most are already well insured
- Focus on risk reduction and mitigation for the poor
  - Including of course famines
- Focus on macro-economic risk reduction

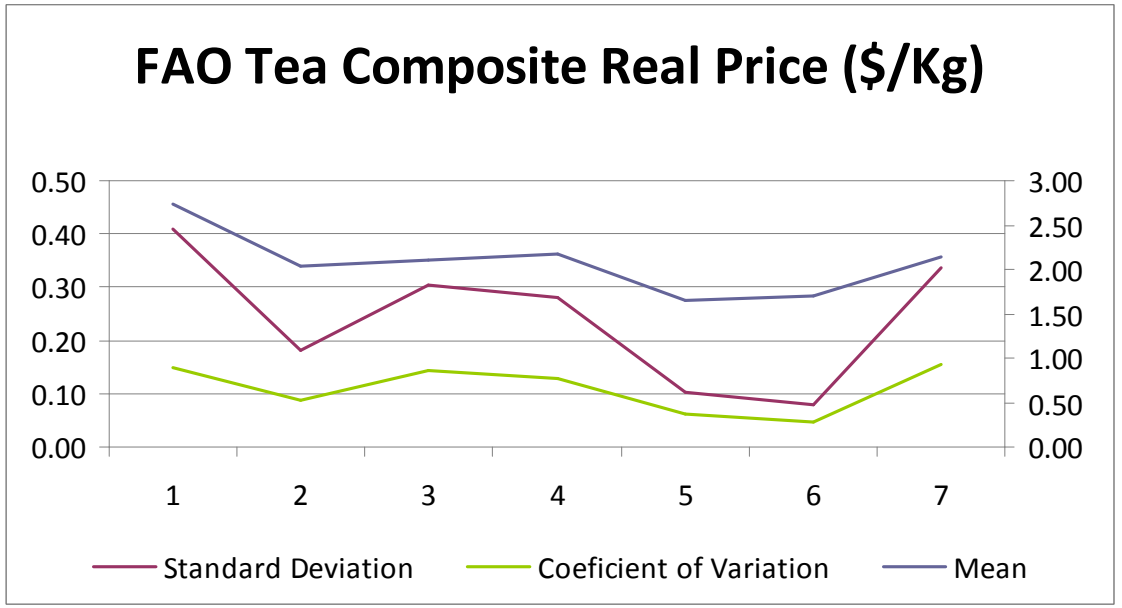
The Tea Economy. Global Price



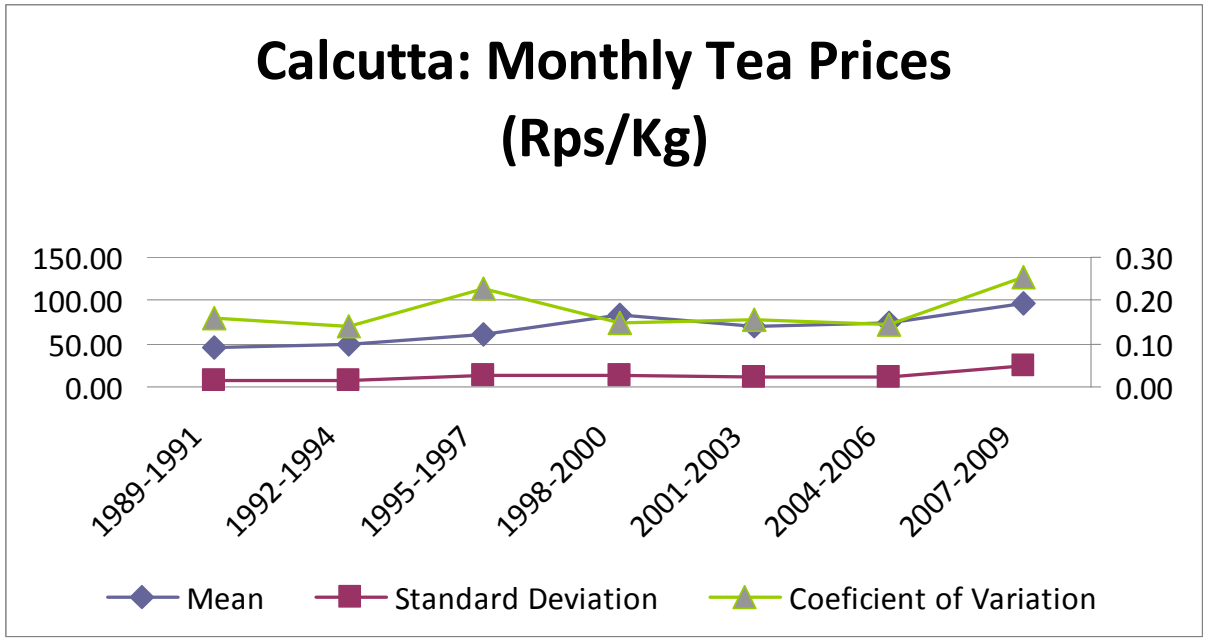


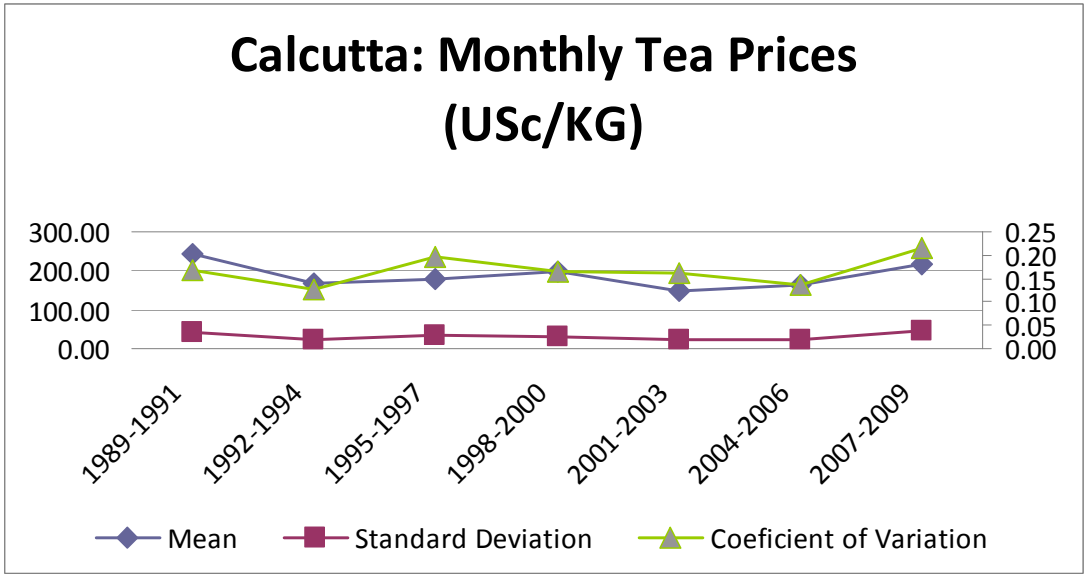
Tea global market price variability



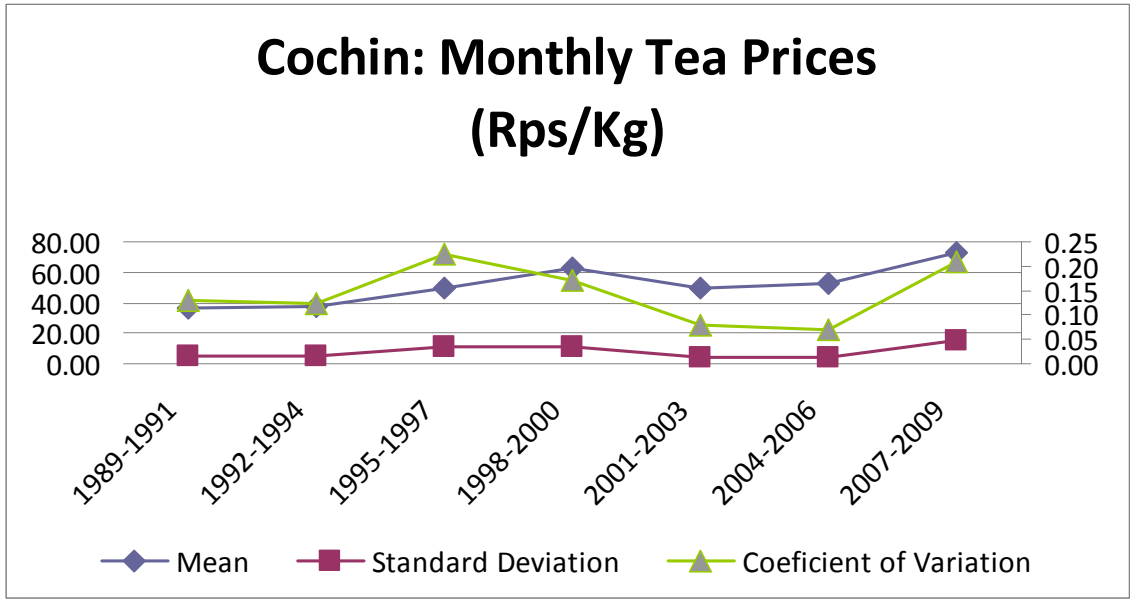


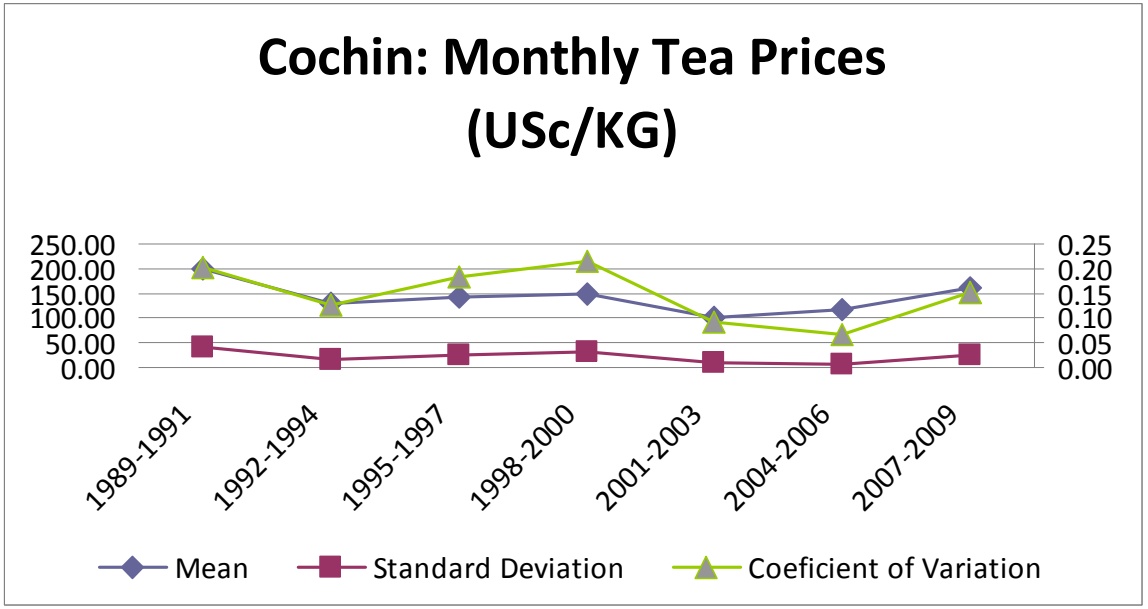
Tea. Calcutta auction price variability



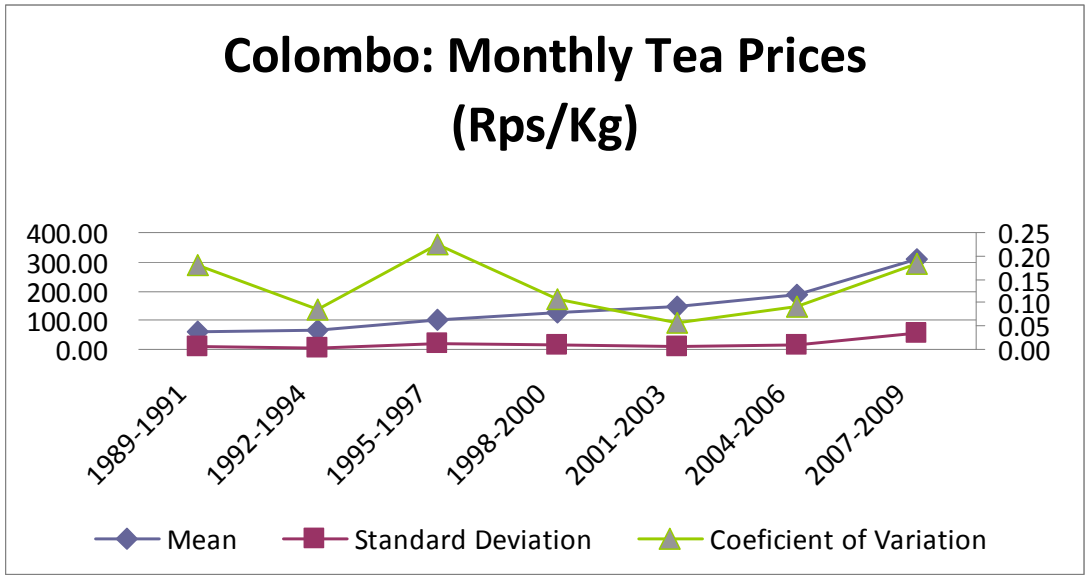


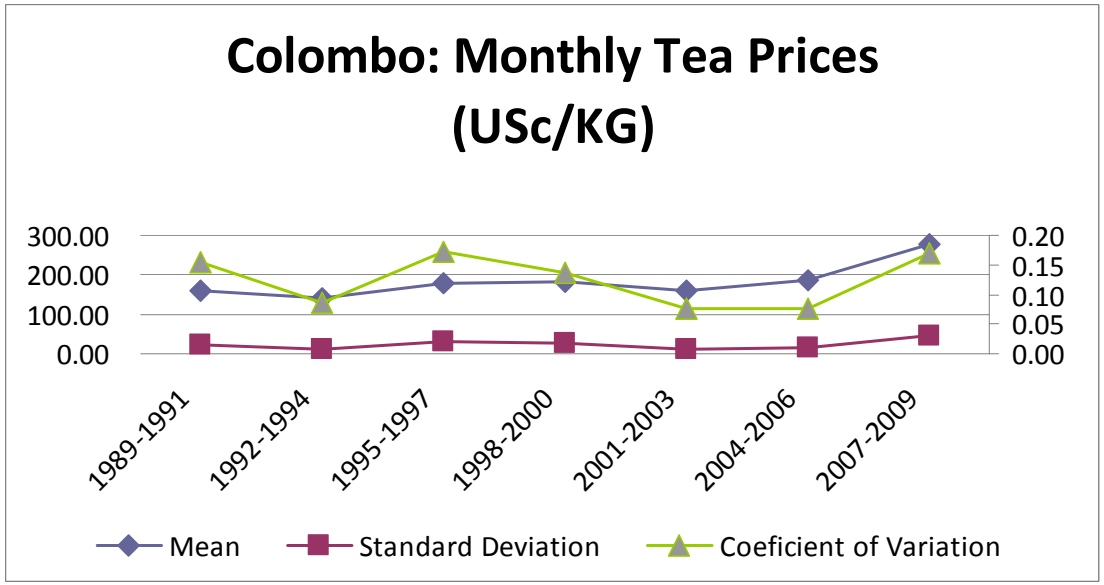
Tea. Cochin auction price variability



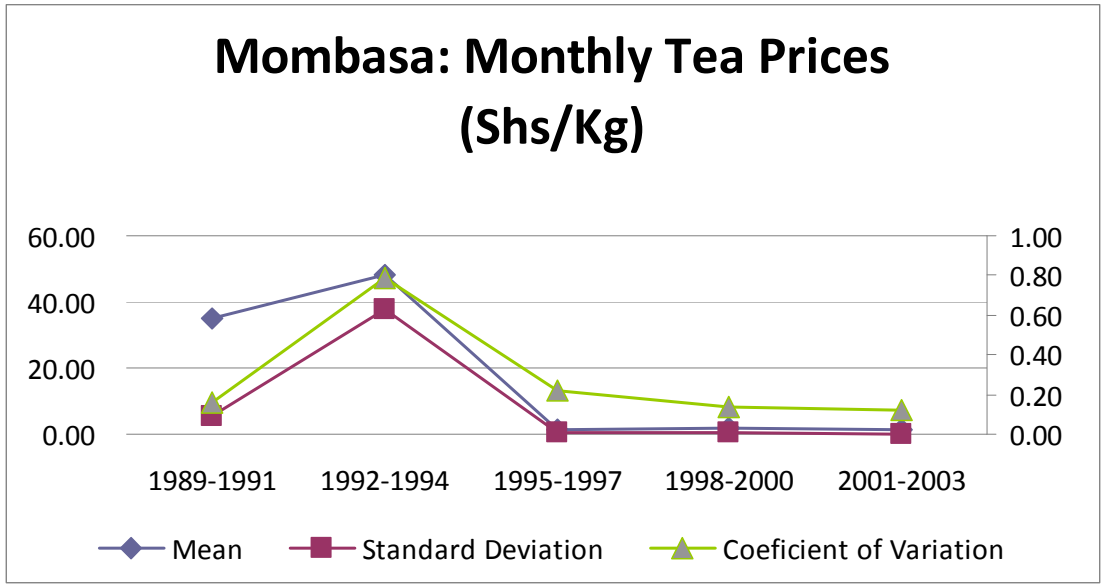


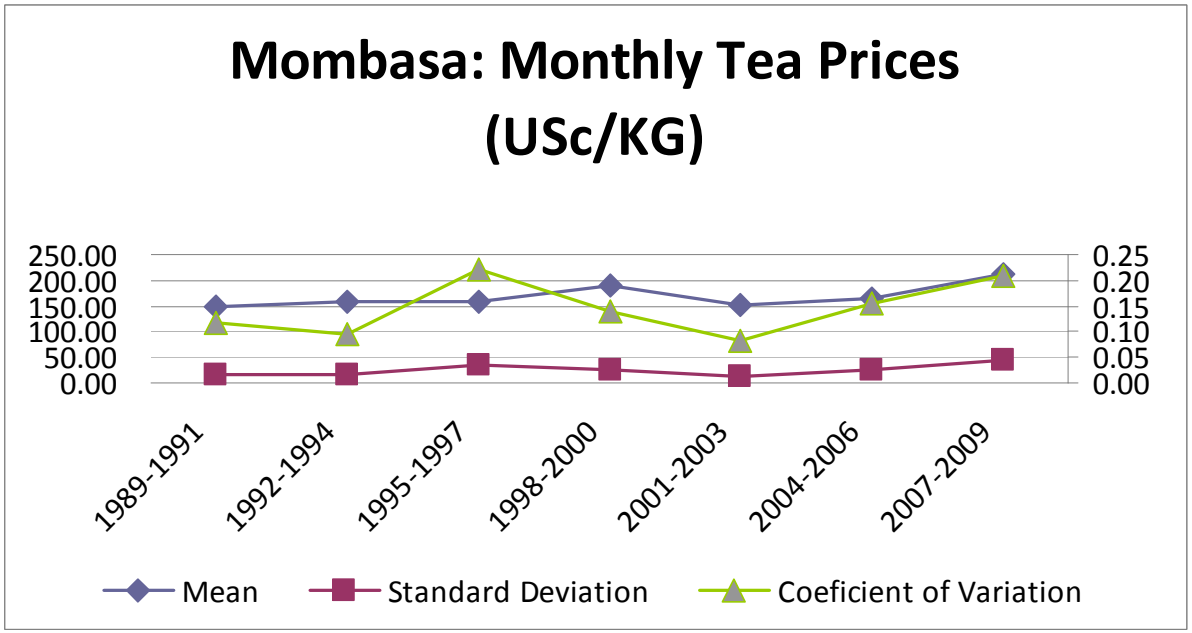
Tea. Colombo auction price variability



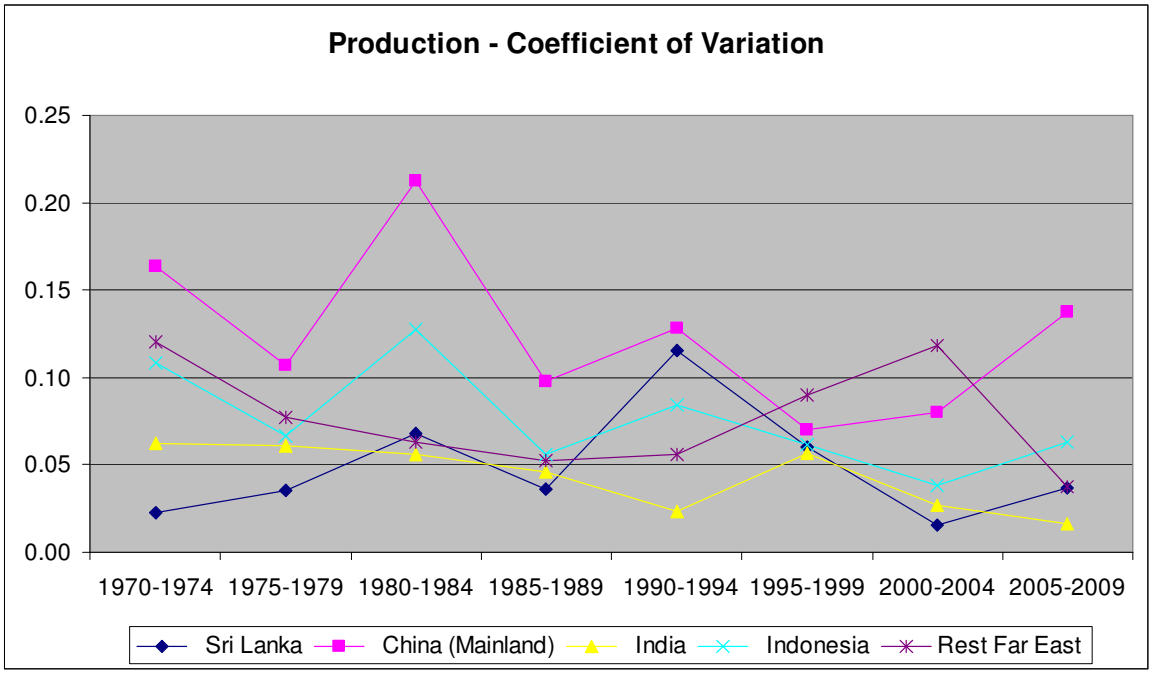


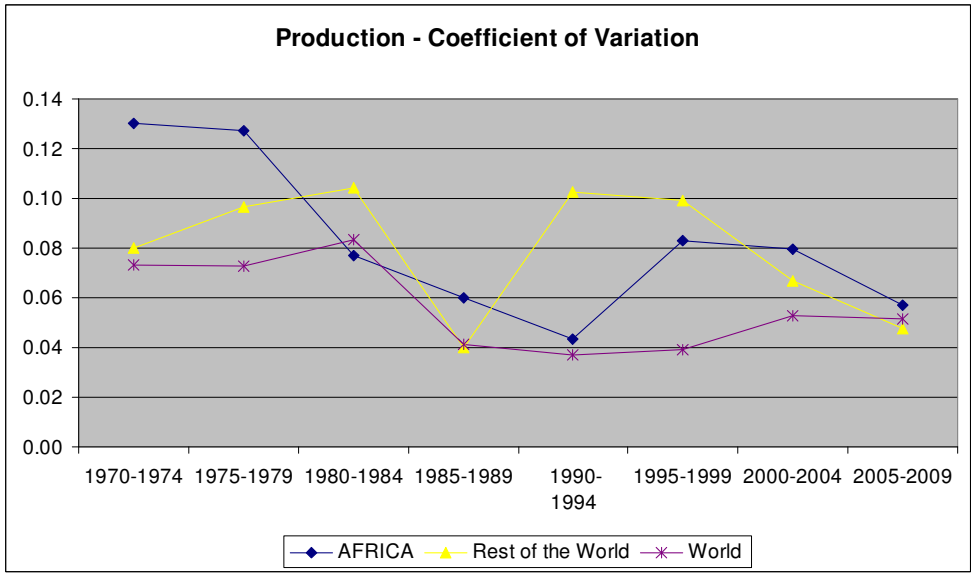
Tea. Mombassa auction price variability





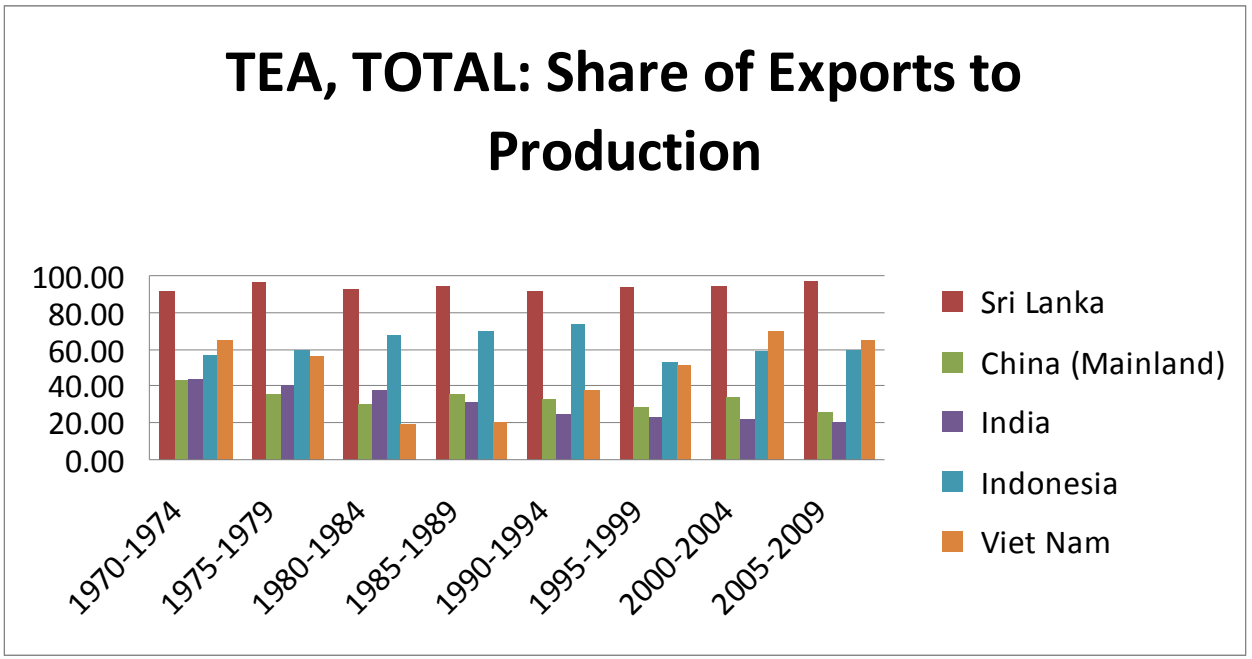
Tea. Coefficients of variation of production (5 year intervals)



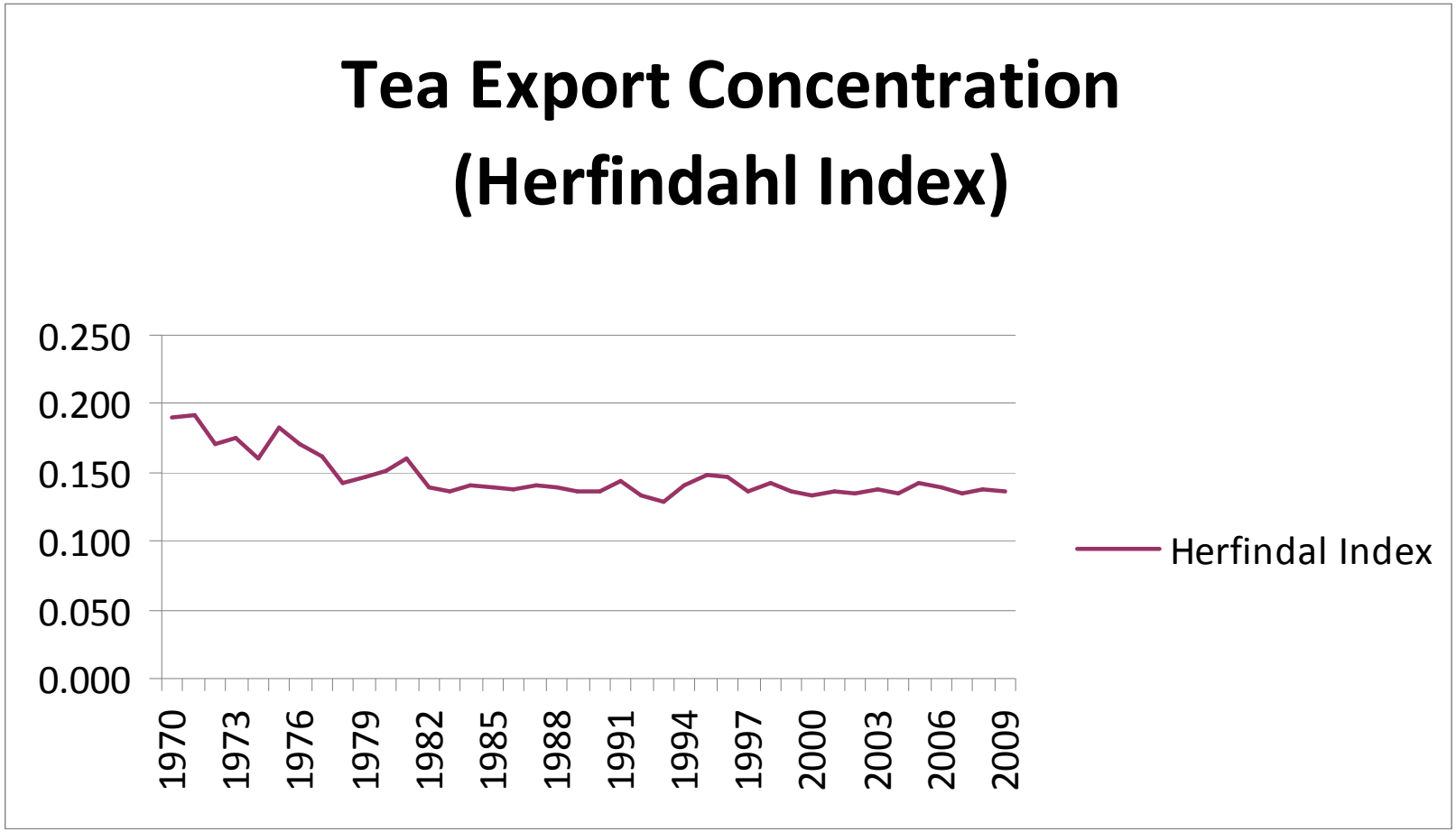


Tea. Share of exports to total production: Main exporters

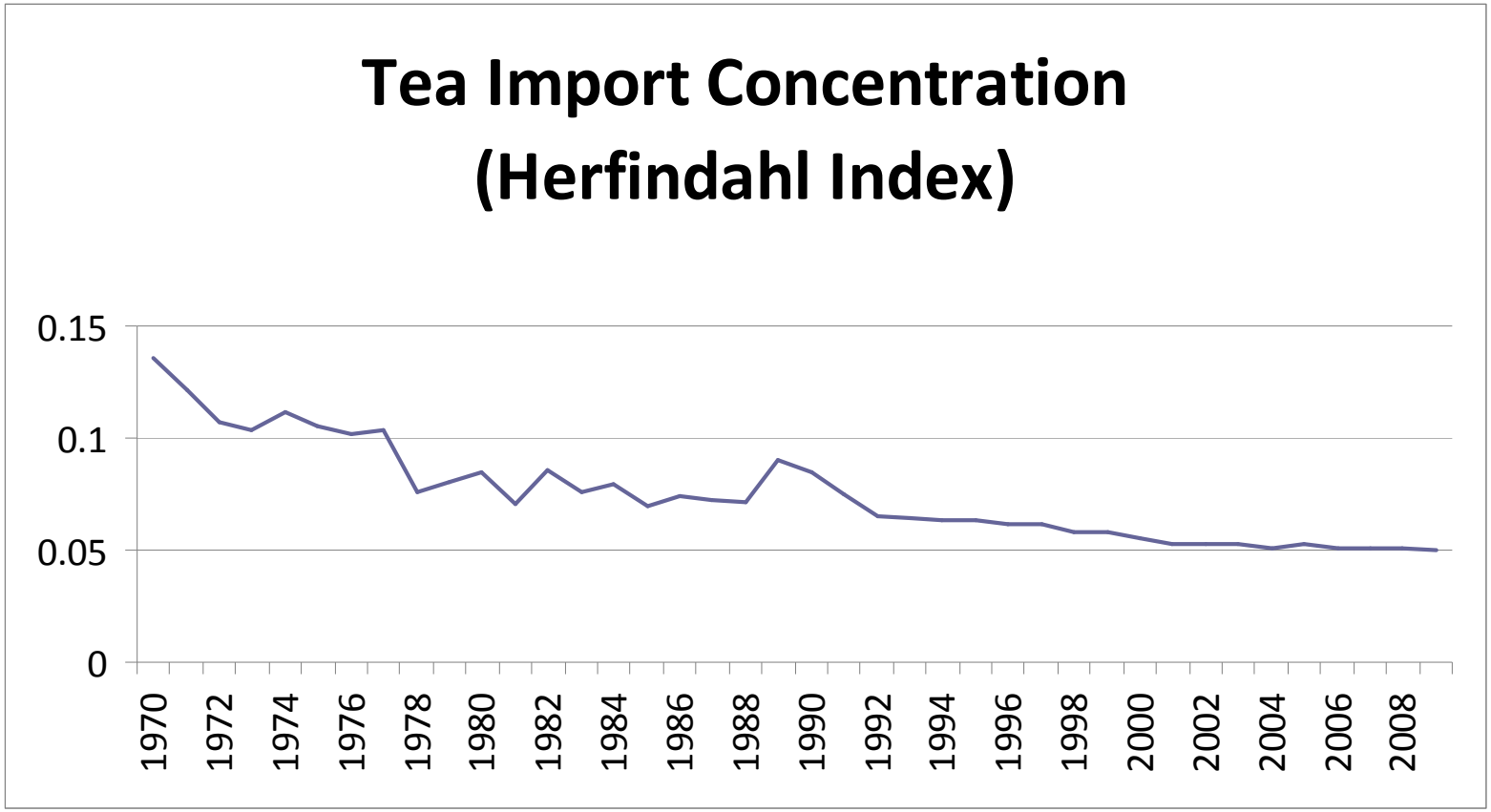
	1970-1974	1975-1979	1980-1984	1985-1989	1990-1994	1995-1999	2000-2004	2005-2009
FAR EAST	55.94	51.42	46.55	44.36	40.49	37.53	40.26	35.09
Sri Lanka	92.07	95.98	93.05	94.94	92.18	93.36	94.74	97.01
China (Mainland)	42.90	35.63	30.59	35.59	33.07	28.54	34.03	26.13
India	44.05	40.18	37.63	31.07	24.55	22.79	22.44	20.25
Indonesia	57.23	59.34	68.27	69.45	73.36	52.81	58.77	59.95
Viet Nam	65.48	56.29	18.94	19.88	37.90	51.22	69.41	65.03
Rest Far East	50.37	50.63	50.36	40.49	34.19	30.68	19.62	13.67
AFRICA	84.57	84.93	79.08	80.39	81.04	85.42	87.54	86.26
Rest of the World	15.93	13.28	16.49	17.55	18.45	21.76	23.09	27.05
World	**51.16**	**47.06**	**43.72**	**43.15**	**42.02**	**42.18**	**45.08**	**41.51**



World tea trade: Concentration of exports



World tea trade: Concentration of import markets



Tanzania: Agricultural household vulnerability to price and weather shocks is high but portion due to covariate shocks varies by region

	Number of hhs	Mean vulnerability	Proportion of consumption variance due to covariate factors	Pc expenditures
		Kilimanjaro		
ALL	191,585	0.23	0.15	200.59
Non Poor	128,414	0.15	0.14	251.98
Poor	63,171	0.40	0.15	97.75
		Ruvuma		
ALL	173,932	0.54	0.71	152.24
Non Poor	77,021	0.40	0.67	232.05
Poor	96,911	0.66	0.73	89.04

Source: Sarris and Karfakis (2006)

Tanzania. Interest in minimum price coffee insurance among coffee producing households

4a. Kilimanjaro

		Round 2		
		No	Yes	Total
Round 1	No	22,454	22,772	45,226
	Yes	19,976	38,843	58,819
	Total	42,430	61,615	104,045

4b. Ruvuma

		Round 2		
		No	Yes	Total
Round 1	No	3,959	3,198	7,157
	Yes	12,962	31,183	44,145
	Total	16,921	34,381	51,302

Summary statistics of the predicted value of WTP for coffee minimum price insurance in Kilimanjaro.

	400 Tsh minimum price contract		
	No of hh's	Average WTP	St. Dev.
WTP (Tsh)	63,803	67.93	26.98
WTP (Share of 400Tsh min. price)	63,803	16.98	6.75
	600 Tsh minimum price contract		
	No of hh's	Average WTP	St. Dev.
WTP (Tsh)	58,619	74.32	28.29
WTP (Share of 600Tsh min. price)	58,619	12.39	4.71
	800 Tsh minimum price contract		
	No of hh's	Average WTP	St. Dev.
WTP (Tsh)	60,116	113.85	40.62
WTP (Share of 800Tsh min. price)	60,116	14.23	5.08

Summary statistics of the predicted value of WTP for coffee minimum price insurance in Ruvuma.

	400 Tsh minimum price contract		
	No of hh's	Average WTP	St. Dev.
WTP (Tsh)	46,002	23.01	11.61
WTP (Share of 400Tsh min. price)	46,002	5.75	2.90
	600 Tsh minimum price contract		
	No of hh's	Average WTP	
WTP (Tsh)	45,759	44.70	16.19
WTP (Share of 600Tsh min. price)	45,759	7.45	2.69
	800 Tsh minimum price contract		
	No of hh's	Average WTP	St. Dev.
WTP (Tsh)	45,563	74.05	21.53
WTP (Share of 800Tsh min. price)	45,563	9.25	2.69

Conclusions and policy implications. Demand for price insurance

- There seems to be considerable variability in prices received for the main cash crops and incomes.
- This induces considerable interest in minimum price insurance.
- Instability variables contribute positively to the demand for price insurance, while the existence of coping mechanisms contributes negatively, as expected.
- Large estimated values of individual WTP for coffee and cashew nut price insurance. Higher in Kilimanjaro than Ruvuma
- Considerable welfare benefits (net of costs) of minimum price insurance.
- Market based price insurance viable (premiums comparable to option prices in organized exchanges)

Reasons for which households indicated they were not interested in rainfall (or drought) insurance

Why not interested in drought insurance? (% out of total households in the region)	
Kilimanjaro	
I cannot pay any amount for rainfall	29.28
I am short of funds in the period before planting	1.98
I have other pressing cash needs in the period before planting	1.15
Declines in rainfall do not hurt me too much	4.70
I have other means of covering losses due to bad rainfall	0.82
Major declines in rainfall do not occur too often	0.94
Other	14.32
% of households not interested	53.19
Total number of households	**182,775**
Ruvuma	
I cannot afford to pay any amount	20.71
I am short of funds in the period before planting	0.78
I have other pressing cash needs in the period before planting	0.46
Declines in rainfall do not hurt me too much	17.32
I have other means of recovering losses due to bad rainfall	0.21
Major droughts do not occur too often	20.20
Other	3.48
NA	2.44
% of households not interested	65.60
Total number of households	**161,619**

India. ICICI Rainfall Insurance 2003-6. Survey Results

Why did households buy?

	Frequency by reason no.			
	1st	2nd	3rd	average
Security/risk reduction	139	53	20	40.1%
Need harvest income	25	62	12	15.6%
Advice from progressive farmers	17	28	12	8.8%
High payout	9	27	11	6.8%
Other trusted farmers purchased	16	11	16	6.3%
Low premium	17	10	6	5.7%

India. ICICI Rainfall Insurance 2003-6. Survey Results

Why did households not buy?

	Frequency by reason no.			
	1st	2nd	3rd	average
Do not understand product	45	59	11	24.9%
No cash / credit to pay premium	58	21	11	21.4%
Rain gauge too far away	38	39	9	19.0%
Too expensive	32	23	7	14.1%
No castor, groundnut	13	6	1	4.9%

Kilimanjaro. Welfare benefits and cost of rainfall insurance (1/3 rainfall reduction)

	Premium value (000Tsh/acre)	Acres insured	Number of households	Total premium (million sh)	Premium as share of crop sales	Consumer surplus (million sh)	Consumer surplus as share of crop sales	Acres cultivated
				24000tsh contact				
At mean WTP	3.40	109,947	64,467	373.95	2.40	760.21	4.87	208,118
At mean WTP+1 SD	8.46	52,129	28,811	441.15	5.52	325.45	4.07	97,829
At AFP	8.00	66,669	28,811	533.35	5.62	325.45	3.43	114,677
				41000sh contract				
At mean WTP	4.33	90,569	56,580	392.43	2.67	1067.93	7.26	194,063
At mean WTP+1 SD	11.56	54,899	28,070	634.75	7.23	509.47	5.81	101,737
At AFP	13.00	46,799	23,565	608.38	7.96	435.98	5.70	88,774
				66000sh contract				
At mean WTP	6.31	85,230	56,815	537.82	3.49	1512.40	9.82	192,017
At mean WTP+1 SD	17.25	50,898	26,161	878.17	9.06	713.84	7.36	98,996
At AFP	21.00	33,089	18,219	694.87	10.08	554.36	8.04	63,481
Total number of households/acres			182,834					504,152

Ruvuma. Welfare benefits and cost of rainfall insurance (1/3 rainfall reduction)

	Premium value (000Tsh/acre)	Acres insured	Number of households	Total premium (million sh)	Premium as shareof crop sales	Consumer surplus (million sh)	Consumer surplus as share of crop sales	Acres cultivated
				20000tsh contact				
At mean WTP	0.18	23,798	9,780	4.35	0.09	80.26	1.63	93,264
At mean WTP+1 SD	1.14	17,134	6,857	19.61	0.51	60.30	1.58	66,201
At AFP	3.00	12,251	4,122	36.75	1.65	34.04	1.52	40,913
				35000sh contract				
At mean WTP	0.33	27,660	11,483	9.08	0.16	113.58	2.02	84,915
At mean WTP+1 SD	1.87	17,449	8,177	32.55	0.74	79.38	1.80	54,366
At AFP	5.30	7,401	3,189	39.23	2.33	35.65	2.12	20,406
				58000sh contract				
At mean WTP	0.35	24,277	9,599	8.45	0.17	147.62	3.05	83,331
At mean WTP+1 SD	2.24	16,536	6,100	37.00	0.94	112.44	2.85	42,481
At AFP	8.50	7,901	2,829	67.16	3.41	56.24	2.85	17,833
Total number of households/acres			162,722					1,216,465

Conclusions and policy implications; Weather insurance

- Interest in rainfall insurance higher in Kilimanjaro, a richer and more exposed to rainfall shocks region
- Vulnerability contributes negatively to the demand for insurance, while the existence of self insurance coping mechanisms contribute positively or negatively, depending on the type of mechanism.
- Considerable demand for weather insurance in Kilimanjaro and higher for contracts paying out when decline in rainfall is 10% below normal. Weak demand in Ruvuma.
- In Kilimanjaro average WTP is about 30-55 percent of actuarially fair premium. In Ruvuma average WTP only 5-18 percent of actuarially fair premium.
- At the actuarially fair value, about 10-18 percent of all rural households in Kilimanjaro would insure about 28000-87000 acres (about 6-17 percent of total land cultivated) resulting in a consumer surplus or benefit to society of more than 300 million Tsh or 300 thousand US dollars.
- For Ruvuma at actuarially fair prices, participation would be to less than 10 percent of households, insuring about 30 percent of their cultivated land.
- Stand alone market based weather insurance not easily commerically viable.
- Provision of subsidised weather insurance could reduce considerably the vulnerability of poor households

Practical risk management instruments and the tea economy

- Smallholders are willing to pay for insurance, but how?
- Could be implicitly included in the cost of formal loans from banks
- Banks could provide the price insurance, so as to recover the loans, and reinsure the risk with market based instruments or over the counter risk management instruments (options)
- Index based weather insurance could also be provided through banks, as part of their lending programs.
- Challenges: basis risk, adequate data for actuarial calculations, size of market, existence of other publicly supported revenue insurance and safety net programs, potential size of losses
- Can price and index weather index insurance be applied efficiently in tea producing countries? Depends on risk exposure along the tea value chain and country context.
- Is price and weather insurance better than long distance or forward contracts? The latter may be first step to managing risks better in the tea economy

THANK YOU