

Comparative Analysis of Price Behavior in Fresh Tomato Markets

With Special Reference to Zambia

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Prepared for conference on “Socio-Economic research in vegetable production and marketing in Africa”
Nairobi, Kenya
5-6 March, 2009

Roadmap

- Retail modernization
- Data and methods for price analysis
- Cross-country comparison of wholesale price behavior
- Retail price behavior in Zambia
- Wholesale-retail margins
- Conclusions and implications

Retail Modernization: The Supermarket Revolution

- Early expectations of supermarket takeover, even in Africa
 - In 2003: “... (supermarket) requirements will ... become those faced by the majority of farmers... in the next 5-10 years”
- Fueling concerns about exclusion of smallholders and small retailers
- And programmatic initiatives to help (mostly farmers)
- Lots of coverage in popular press
- And continued influence on thinking in many quarters

Retail Modernization: More Cautious Voices

- Goldman (2000) in Asia echoed by Ayieko et al in Kenya: “selective adoption” of supermarkets
- Coca-Cola (2003): “... small retailers (in Latin America) have a sustainable business model”
- Farina and Nunez (2005): Rising shares of independent supermarkets and traditional retailers compared to supermarket chains in Brazil
- Humphrey (2006): “the extent of transformation of retailing (in Africa)... is overestimated”.
- Tschirley and colleagues in Kenya and Zambia: low supermarket shares in FFV and tough challenges to grow them

Retail Modernization: More Cautious Voices (2)

- Minten (Madagascar, 2008): “... agriculture for local consumption in poor countries will be largely bypassed by the global food retail revolution.”
- Reardon and Timmer (2007): “considerable uncertainty about the rate at which the supermarket sector will grow” in SSA
- This more cautious view is born out by patterns in Zambia
 - 12 years after initial supermarket investment

Retail Modernization: Zambia

Retail outlet market shares for all FFV purchases by income quartile (Zambia)

Market group/Retail outlet	In come quartile 1	Income quartile 2	Income quartile 3	Income quartile 4
Open Air Market	0.67	0.70	0.62	0.53
Ka Sector	0.26	0.22	0.26	0.27
Grocer / Mini mart	0.002	0.002	0.009	0.037
Small Supermarkets	0.00	0.00	0.001	0.001
Large Independent supermarkets	0.00	0.00	0.00	0.01
Large Supermarket Chain	0.002	0.004	0.02	0.06
Butcher	0.00	0.00	0.00	0.00
Baker	0.00	0.00	0.00	0.00
Private household	0.01	0.02	0.02	0.02
Other Purchasing Channel	0.00	0.00	0.00	0.00
Own Production	0.02	0.03	0.05	0.06
Gift	0.02	0.02	0.02	0.02

Source: Food Security Research Project Urban Consumption Survey Data 2007 and 2008

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Retail Modernization: Summary

- Supermarket growth likely to be much slower in most African countries than some expected 5-8 years ago
- Though tipping points are possible ...
 - SSA has highest urban growth rate of any developing area
 - GDP growth 2000-05 2nd only to South Asia
 - Both favorable to supermarket growth, but a long way to go
- Systems will remain heterogeneous for decades to come
- “Traditional” sector will remain central
- So we need to understand this system much better

Data and Methods

- Daily tomato wholesale prices
 - Zambia – Lusaka, Soweto Market
 - United States of America – Chicago
 - Taiwan – Taipei
 - Costa Rica – San José
 - Sri Lanka – Colombo
- Daily tomato retail prices in Lusaka
 - Open air market and supermarkets

Data and Methods

□ Methods

- Comparison of tomato price variability and predictability in different countries
- Three different analyses
 - Coefficient of variation,
 - Conditional variance,
 - Distribution and relative size of negative and positive price prediction errors

Data and Methods

□ Coefficient of variation

- Used to measure price variability
- Simple measure of variation about the mean
 - Standard deviation/mean

Data and Methods

□ Conditional Variance

- Measure of price predictability
- First generate a prediction model

$$\hat{P}_t = \beta_0 + \beta_1 X_{1t} + \dots + \beta_{12} X_{12t} + \beta_{13} P_{t-1} + \beta_{14} T_t + u_t$$

- Use prediction error to compute conditional variance

$$\frac{\sum_{t=1}^{t=n} \left(\frac{P_t - \hat{P}_t}{P_t} \right)^2}{n} = \frac{\sum_{t=1}^{t=n} \left(\frac{u_t}{P_t} \right)^2}{n}$$

Data and Methods

□ Wholesale-retail margins

- Regression analysis with prais-winsten robust SEs
 - Correcting for serial correlation

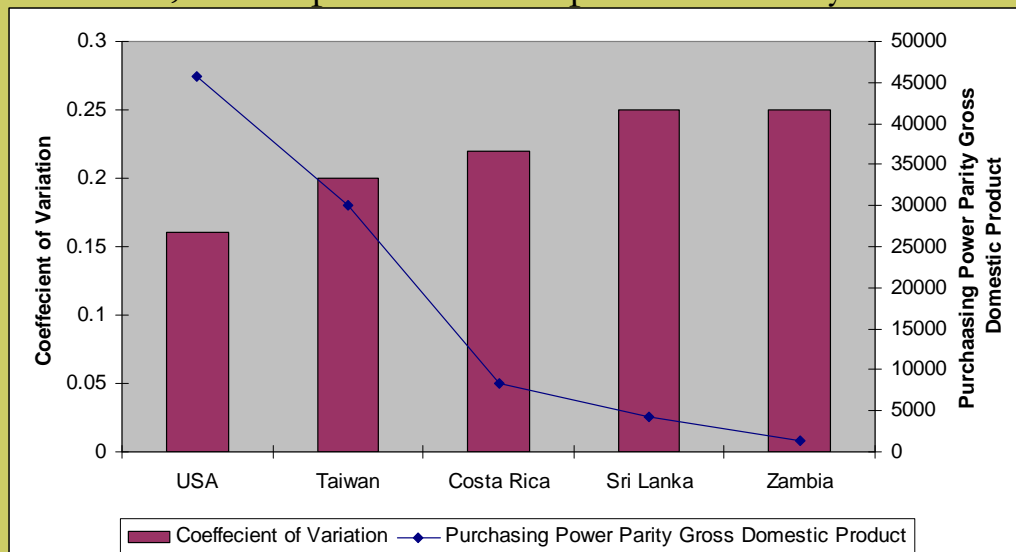
Price Variability & Predictability at Wholesale

Country	Purchasing Power Parity GDP	Coefficient of variation of prices	Conditional variance of prices	Ratio of mean absolute negative to positive price prediction errors
USA	45,790	0.16	127	1.1
Taiwan	30,126	0.20	329	1.4
Costa Rica	8,295	0.22	521	1.5
Sri Lanka	4,259	0.25	734	1.6
Zambia	1,359	0.25	731	1.7

- ❑ Negative correlation between indicators and the PPP GDP used as a proxy for market development
- ❑ Zambia and Sri Lanka have the least PPP GDP figures and high values for indicators, poorly developed markets

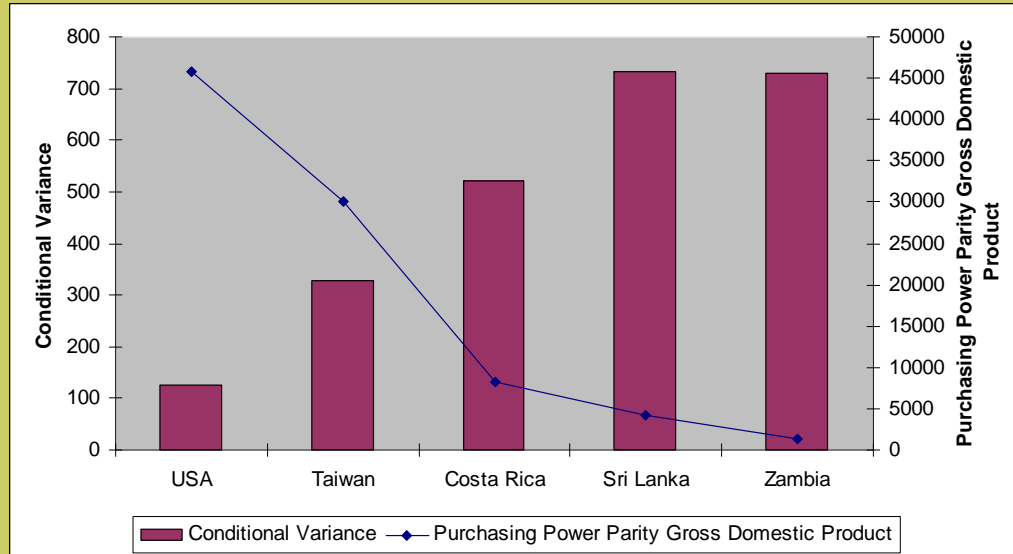
Coefficient of Variation

- Country with highest PPP GDP has the least coefficient of variation, and experiences less price variability



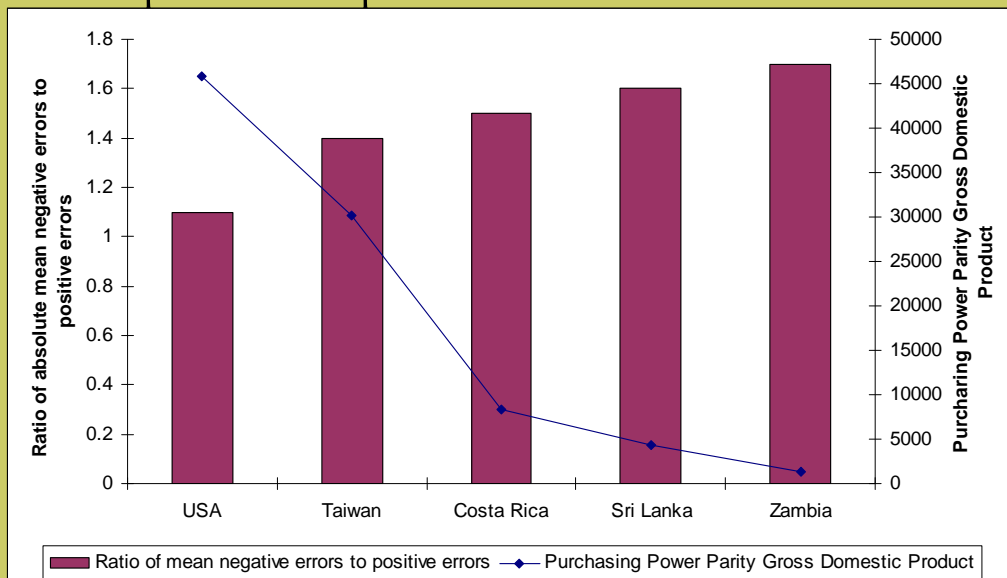
Conditional Variance

- Country with highest PPP GDP has the least conditional variance, and prices are more predictable



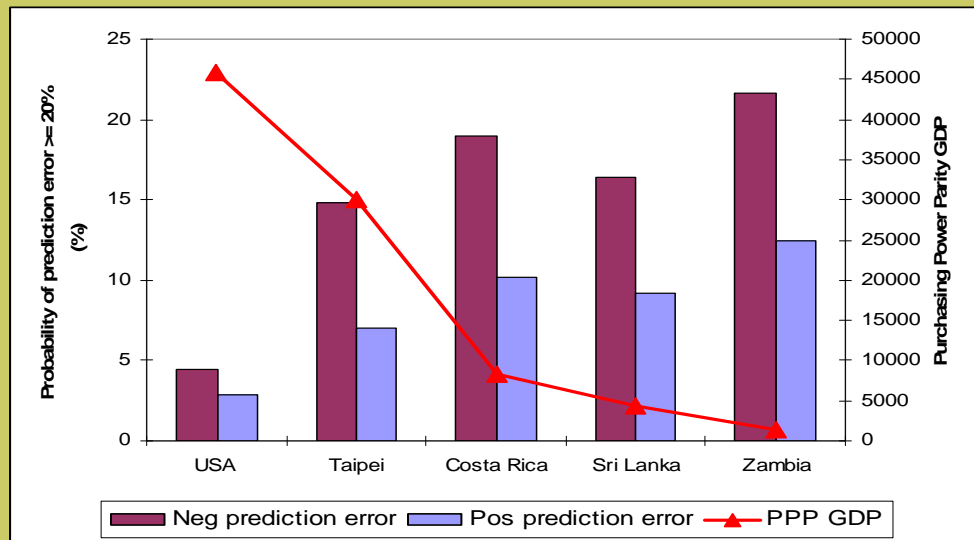
Ratio of Positive & Negative Errors

- Same pattern as previous two



Probability of Prediction Errors >20%

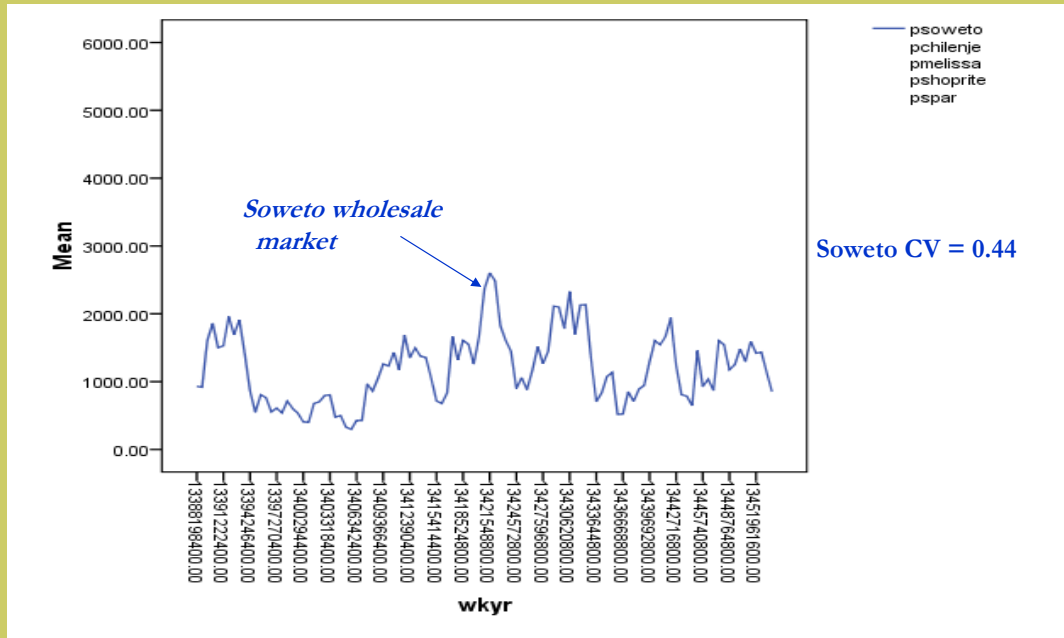
- Same broad pattern as others, though Sri Lanka looks better by this measure



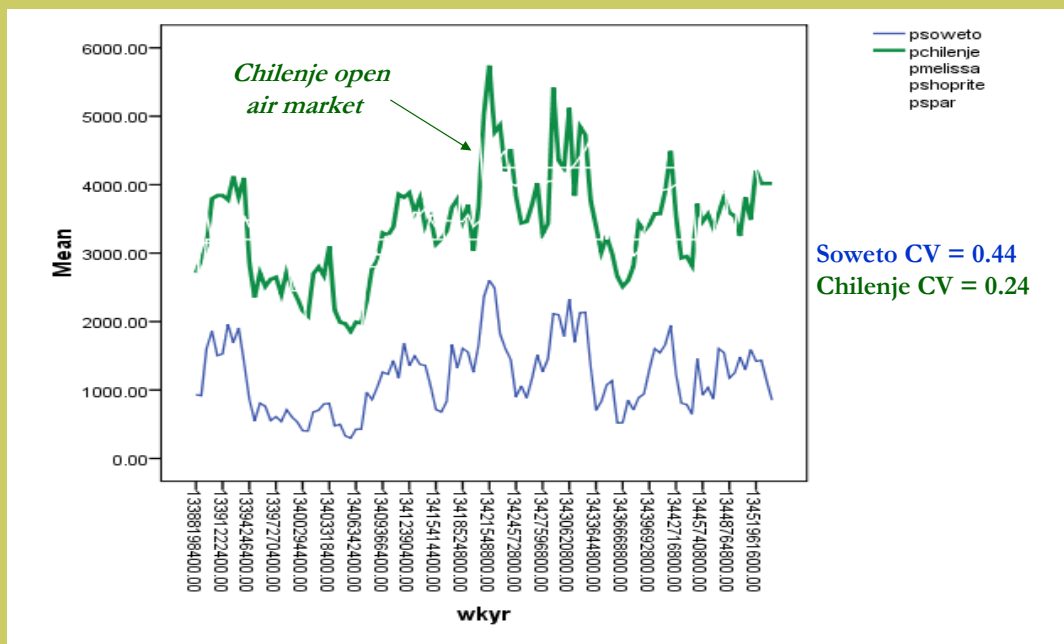
Wholesale Pricing: Summary

- Inverse relationship between PPP GDP and the three measures of analysis used
 - Prices less variable and more predictable in more developed markets
 - Unexpected price collapses more common than price rises, and this problem worse in least developed markets
- Countries with lower PPP GDP have less developed horticulture markets
 - Poor cold chain, poor market information, little contracting (all spot market)
- In all cases, Zambia is the worst performer
 - And most of the rest of SSA?

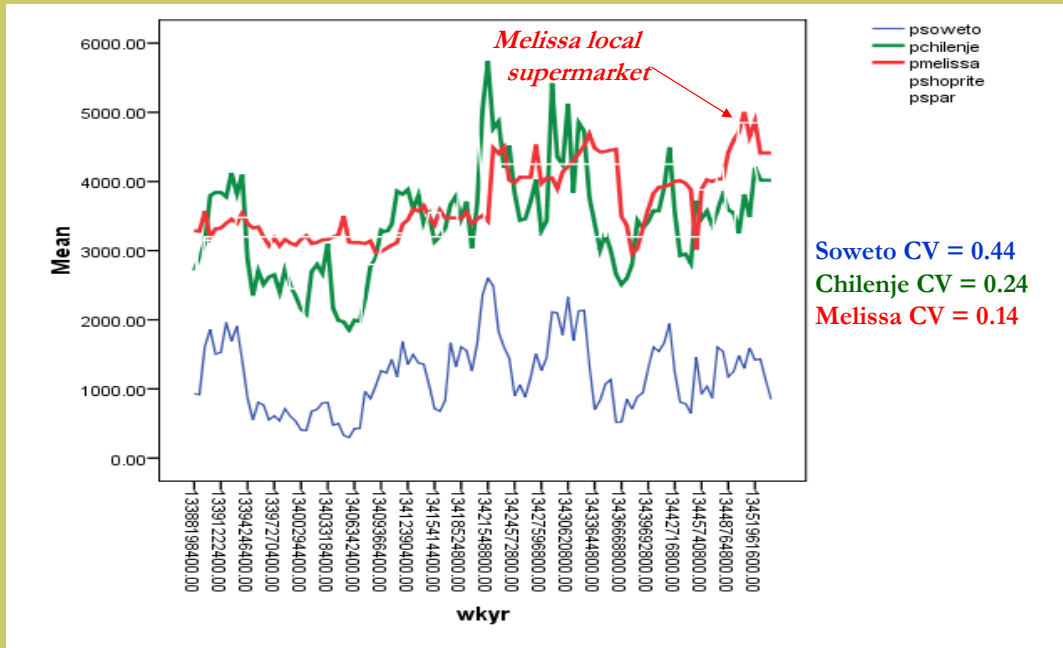
Retail Pricing



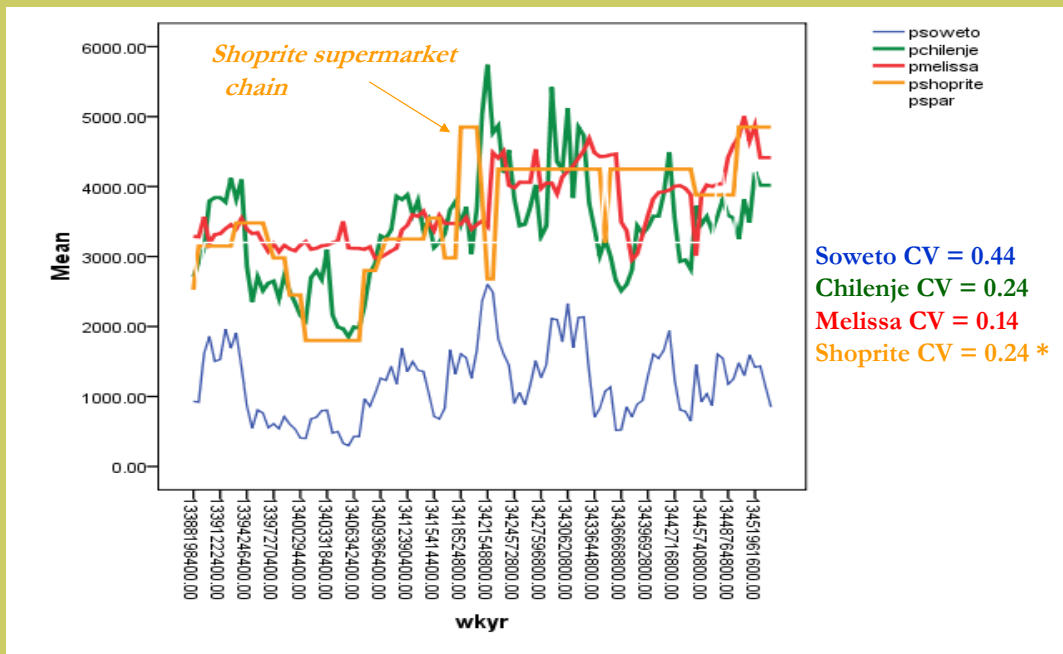
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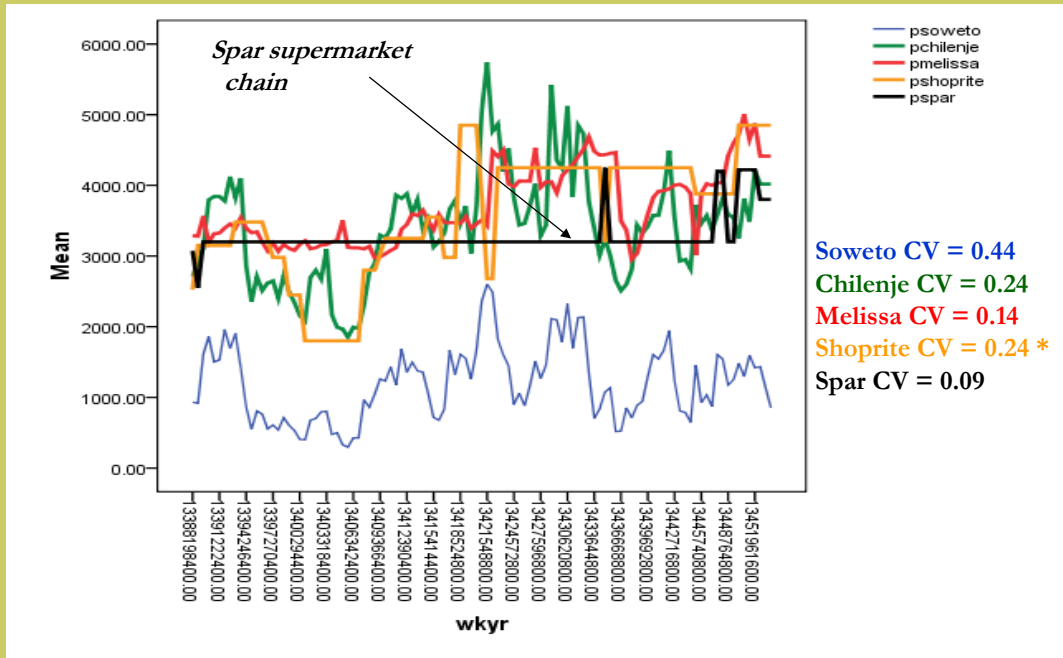
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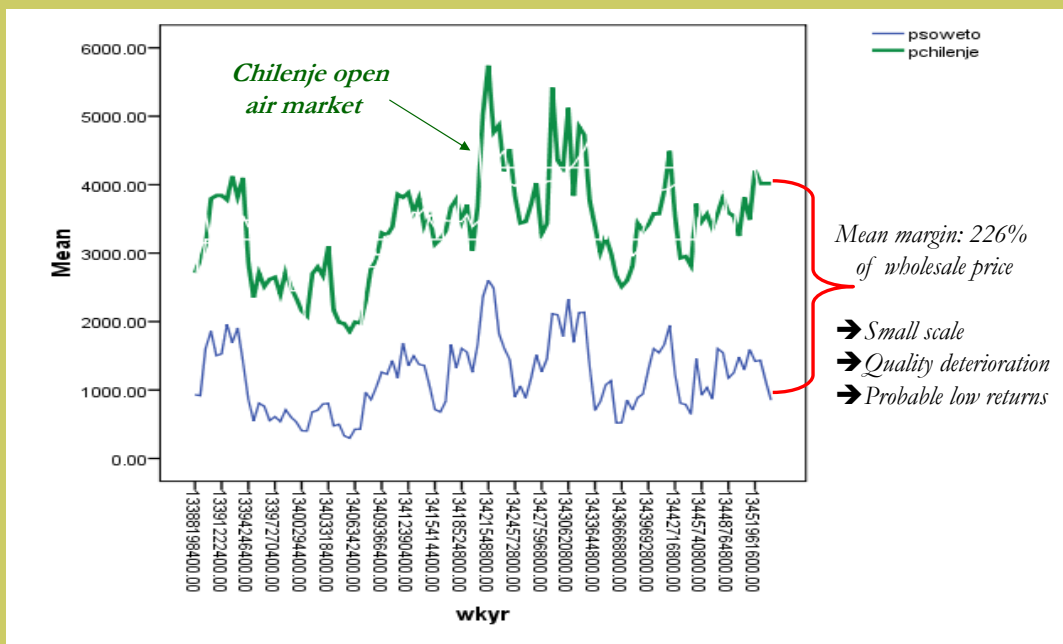
Retail Pricing



Retail Pricing



Wholesale – Retail Margins



Wholesale – Retail Margins

Prais-Winsten AR(1) regression -- iterated estimates


Number of obs= 274
 F(16, 258) = 193.48
 Prob > F = 0.0000
 R-squared = 0.6486
 Root MSE = .62836

marginpct	Semi-robust Coef.	Std. Err.	t	P>t	[95% Conf. Interval]
Psweto	-.0018517	.0001424	-13.00	0.000	-.0021322 - .0015713
month1	-.2173628	.2039856	-1.07	0.288	-.6190516 .184326
...
month12	.0307263	.2402314	0.13	0.898	-.4423377 .5037904
Monday	-.1764224	.0828116	-2.13	0.034	-.3394951 -.0133497
Wednesday	-.1589982	.0819723	-1.94	0.054	-.3204182 .0024218
Trend	.0014193	.0006665	2.13	0.034	.0001069 .0027318
_cons	4.294494	.2806052	15.30	0.000	3.741925 4.847062
rho	.2355049				

Wholesale – Retail Margins

Prais-Winsten AR(1) regression -- iterated estimates

*Estimating margin
 as % of wholesale price*



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Prais-Winsten AR(1) regression -- iterated estimates

In % terms, retailers absorb price instability

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Wholesale – Retail Margins

Linear regression

Number of obs = 274
 F(16, 258) = 401.32
 Prob > F = 0
 R-squared = 0.2472
 Root MSE = 426.22

Estimating margin in absolute terms

margin	Semi-robust Coef.	Std. Err.	t	P>t	[95% Conf. Interval]
psoweto	-0.054657	0.0833172	-0.66	0.512	-0.21872 0.1094119
month1	-77.81808	133.9362	-0.58	0.562	-341.565 185.9293
.....					
month12	62.85135	142.8731	0.44	0.66	-218.495 344.1973
daywk2	-82.7702	61.80068	-1.34	0.182	-204.468 38.92778
daywk4	-76.23559	56.38157	-1.35	0.178	-187.262 34.79108
time	2.799304	0.4579393	6.11	0	1.897529 3.701078
_cons	1860.538	128.2787	14.5	0	1607.931 2113.144

Wholesale – Retail Margins

Linear regression	Number of obs	=	274
	F(16, 258)	=	401.32
	Prob > F	=	0
	R-squared	=	0.2472
	Root MSE	=	426.22

Constant absolute margin

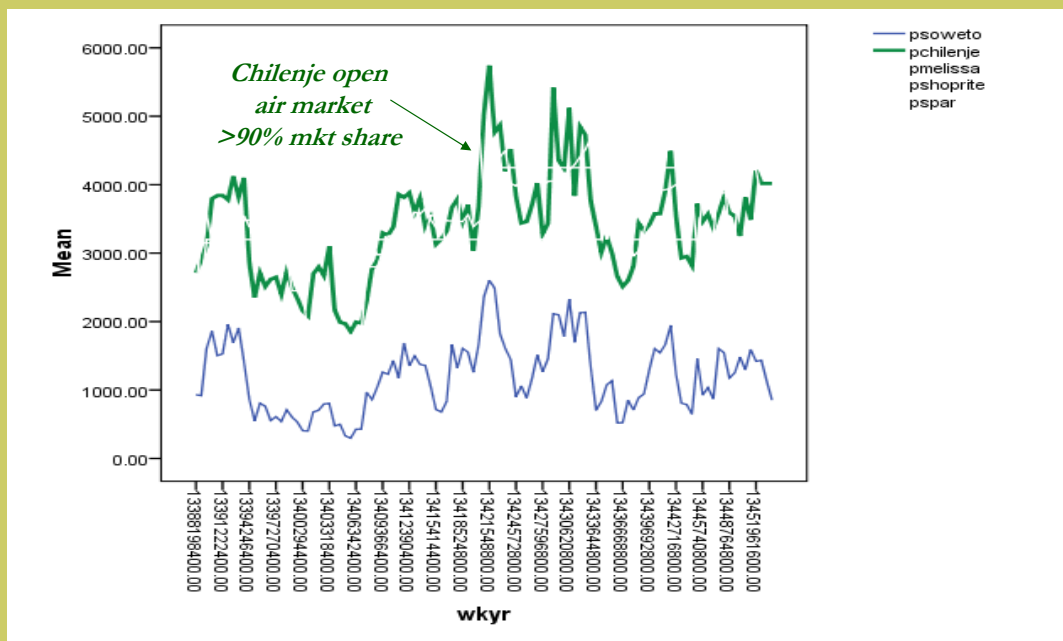
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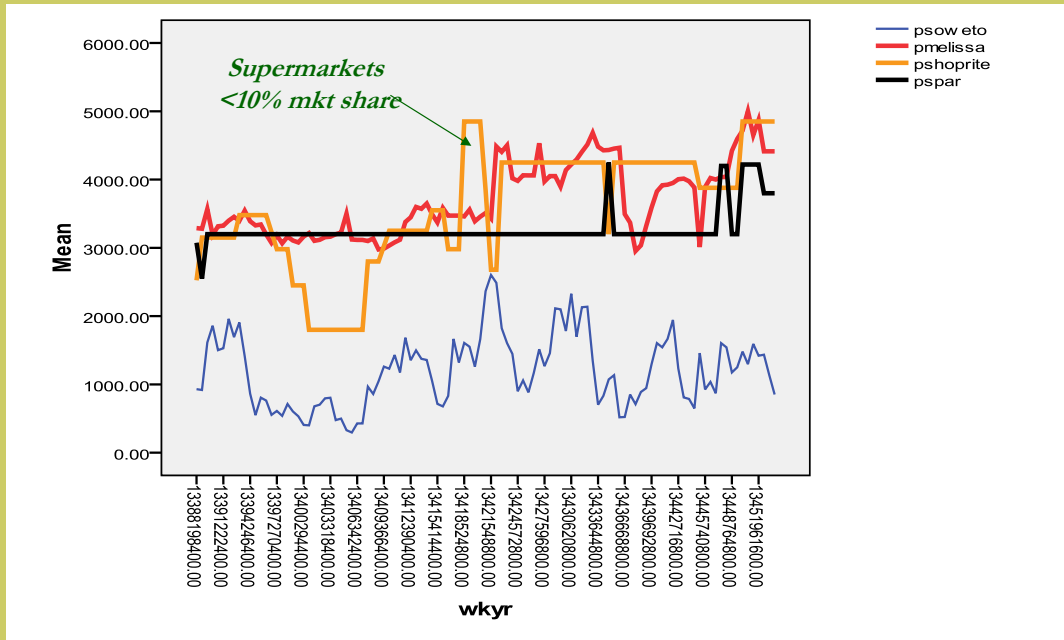
Wholesale-Retail Pricing: Summary

- No meaningful price difference between retail channels
- Traditional retailers charge a constant margin
 - In absolute terms, they fully pass wholesale price variability through to consumers
- Modern channels *avoid* variability
 - *More stable prices to farmers as well as consumers*

Wholesale-Retail Pricing: Summary

- ❑ Modern channels have much higher market shares in Latin America, areas of SE Asia, and of course developed countries
- ❑ So the very high price variability and uncertainty in traditional wholesale markets of Zambia (and likely the rest of SSA) is accentuated by high market shares of these traditional channels





Conclusions and Implications

- “Traditional” sector will dominate for many years
 - Though supermarkets are likely to grow
 - Heterogeneous systems
- Woefully inadequate investment
 - Physical facilities
 - Cold chain
 - Market information
 - Grades & standards
- Frequently dysfunctional management

Conclusions and Implications

- Price instability a major issue for farmers
 - Accentuated by reliance on traditional channels
- We need a better comparative understanding of the functioning of these channels across countries
 - Standard descriptions of structure and behavior
 - Standard performance indicators
- Link these performance indicators to programmatic interventions
 - E.g., why does Sri Lanka seem to perform better than expected?
 - What explains (presumed) differential performance across African countries?

Thank you!

Description of data

Country	Market Name	Frequency	Time period	Basis of price/Differentiation	Basis of price/Differentiation used in analysis	Cold Chain
Costa Rica	San José	3 times a week (M,W,F)	82 months (January 2000 to October 2007)	Differentiation by three quality grades	Chose the highest grade quality	Some cold storage in wholesale market; not clear how developed full cold chain is.
Taiwan	Taipei	Daily excluding Monday	83 months (January 2000 to November 2007)	Differentiation by color, size and grade	Chose the large, red tomatoes of standard grade	Likely to have a full cold chain
USA	Chicago	Daily excluding Sat and Sun	82 months (January 2000 to October 2007)	Differentiation by origin, size, color, variety and grade	Chose item size 5X6S and mature green variety	Full cold chain
Sri Lanka	Colombo	Daily	46 months (January 2004 to October 2007)	Differentiation by variety only	Chose Thilina variety	No cold chain
Zambia	Lusaka (Soweto)	3 times a week (M,W,F)	19 months (January 2007 to July 2008)	Some informal differentiation by grade for a wide range of varieties	Chose standard quality grade	No cold chain