Simulation of price variation in the US beef industry: 1970-2009

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Introduction

- US is largest beef-producing country
- US cattle industry value: 31.8 billion (ERS 2009)
- Issues: change in beef demand; vertical concentration; disease outbreak (MCD)

  ⟹ price fluctuation of beef
- Another issue: uncertainty in agricultural sector in general and in particular in cattle industry

Objectives

- Analyze supply and demand of US beef 1970-2009
- Analyze by simulation how change in S&D over time affect beef price variation

Literature Review

- US beef industry severely hit by declining demand for nearly 2 decades (1982-98)
  - Decline of beef prices by 32% (1982-98)
  - Decline of per capita consumption by 10 lbs. (1982-98)
- Other factors of change in D&S are related to food safety concerns (MCD in 2003 in Canada and US) and changing preferences
- Change in feed prices (2008 corn price increase)

Model Specification

- Supply and demand equations
  - ⇨ equilibrium price
- Problem of endogeneity (two-way causality)
- Simultaneous Structural Econometric Model: Two Stage Least Square (2SLS)

Model Specification (cont'd)

Model has 5 Equations:

- Demand1 (domestic):

  Q_{do}=f(Pus, Pp, Pch, PCIus, Ddot-1, DUMm, T)

- Demand2 (export):

  Q_{ex}=f(Pus,Pme, Psk, Pjap, PCIjap, PCIme, QBc-m,
  QBj-sk, Qext-1, DUMm, T)

- Supply1 (domestic): Q_s=f(Pus, Csoym, Qst-1, T)

- Supply2 (imports):

  Q_{Imp}=f(Pus, QBc, QBm-sk-j, QBus, Qimpt-1, DUMm)

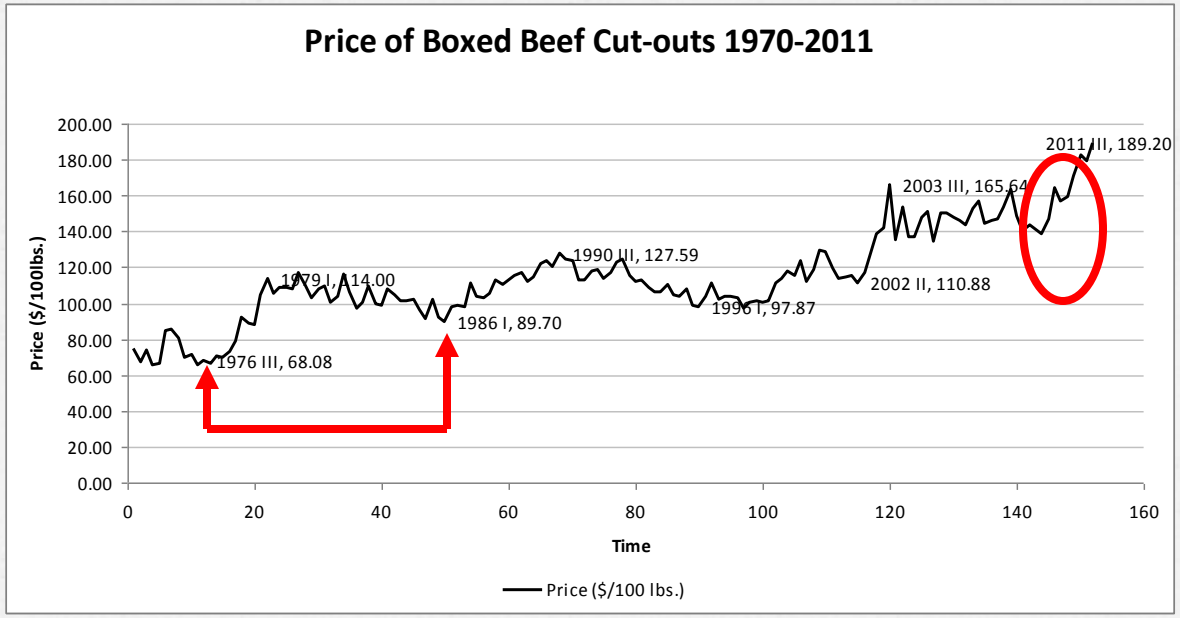
- Equilibrium price (Pus): $Q_s + Q_{Imp} = Q_{do} + Q_{ex}$

Data

- Most of data for S&D, imports and export were obtained from USDA/ERS/AMS websites
- PCI for US, Japan, Mexico, S. Korea and Canada were obtained from World Bank
- Own price is a wholesale price ($/100lbs.) of boxed beef cut-outs
- Data run from 1970-2009

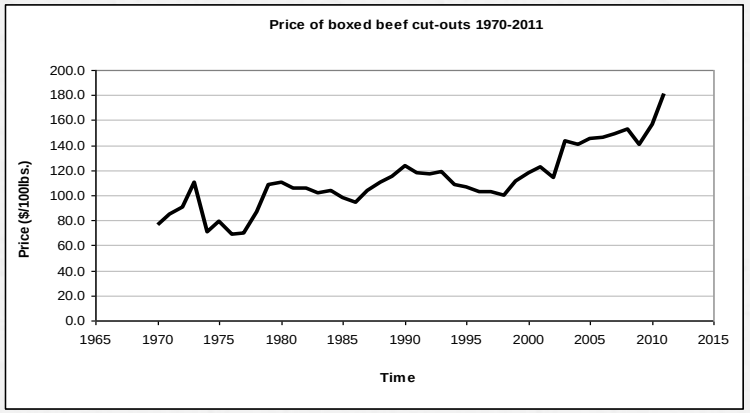
Results and Discussion

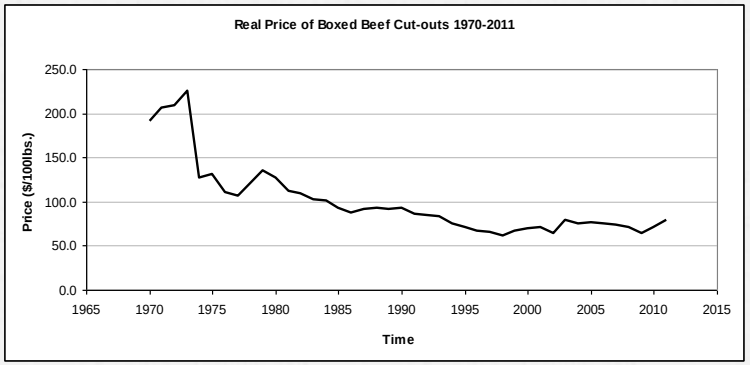
- Illustration of beef price variation over time



Results and Discussion

- Comparison of real and nominal boxed beef prices (1970-2011)





Results and Discussion

Supply equation estimation

	Intercept	P_{US}	Csoym	QS_{t-1}	T
Beta	55555.89622	33	-7.18040055	**0.78148443**	-26.21885
S.E.	45697.03034	0	3.781723067	0.14309713	24.28124
t-test	1.215744126	0	-1.89871136	5.46121671	-1.079798
Prob(t)	0.231994842	1	0.065640596	3.6493E-06	0.287413
Elasticity at Mean		0.14325718	-0.05680935	0.77620757	-2.111158
Variance Inflation Factor		6.57153369	5.581028488	1.0066794	1.916712

Restriction		33
S.D. Resids	1029.409539	
MAPE	3.402917286	
RBar^2	0.515881643	

Results and Discussion

Demand equation estimation

	Intercept	P_{US}	Ppork	Pchicken	PCI_{US}	QDo_{t-1}	DUM_M	T
Beta	210506.0468	**-40.6297344**	3.984963733	44.5594129	**0.550956**	**0.535952**	-9.00793	-100.9765
S.E.	153727.7984	11.85616513	16.00135384	28.4457909	0.249632	0.115867	577.6044	77.94886
t-test	1.369342754	-3.42688668	0.249039161	1.56646771	2.207073	4.625584	-0.015595	-1.295419
Prob(t)	0.180426587	0.001696042	0.804922039	0.12707594	0.034601	5.88E-05	0.987654	0.204443
Elasticity at Mean		-0.1875193	0.016948112	0.11201673	0.111071	0.533847	-1.94E-05	-8.644242
Variance Inflation Factor		6.867323409	6.793299943	11.4020453	50.91384	1.840976	1.332244	68.06377

S.D. Resids	616.9648173
MAPE	1.977695331
$RBar^2$	0.68724078

Results and Discussion

Export equation estimation

	Intercept	P_{US}	P_{ME}	P_{JAP}	P_{SK}	PCI_{JAP}	PCI_{ME}	Qex_{t-1}	DUM_M	T
Beta	-20064.1257	0.3547	-2.4767	0.0034	-0.0010	0.0062	-0.0063	**0.8492**	**-998.0496**	10.2344
S.E.	111307.5792	12.6562	13.0345	0.0442	0.0062	0.0238	0.1027	0.1813	332.5664	56.7921
't-test	-0.1803	0.0280	-0.1900	0.0765	-0.1576	0.2586	-0.0618	4.6846	-3.0011	0.1802
Prob(t)	0.8582	0.9778	0.8507	0.9396	0.8759	0.7979	0.9512	0.0001	0.0056	0.8583
Elasticity at Mean		0.0385	-0.0588	0.0423	-0.1104	0.1371	-0.0251	0.8109	-0.0505	20.6128
Variance Inflation Factor		37.5239	6.5729	5.9422	14.8730	41.3671	29.4917	9.6953	2.1178	173.2501

S.D. Resids	263.5507
MAPE	19.9010
RBar^2	0.8673

Results and Discussion

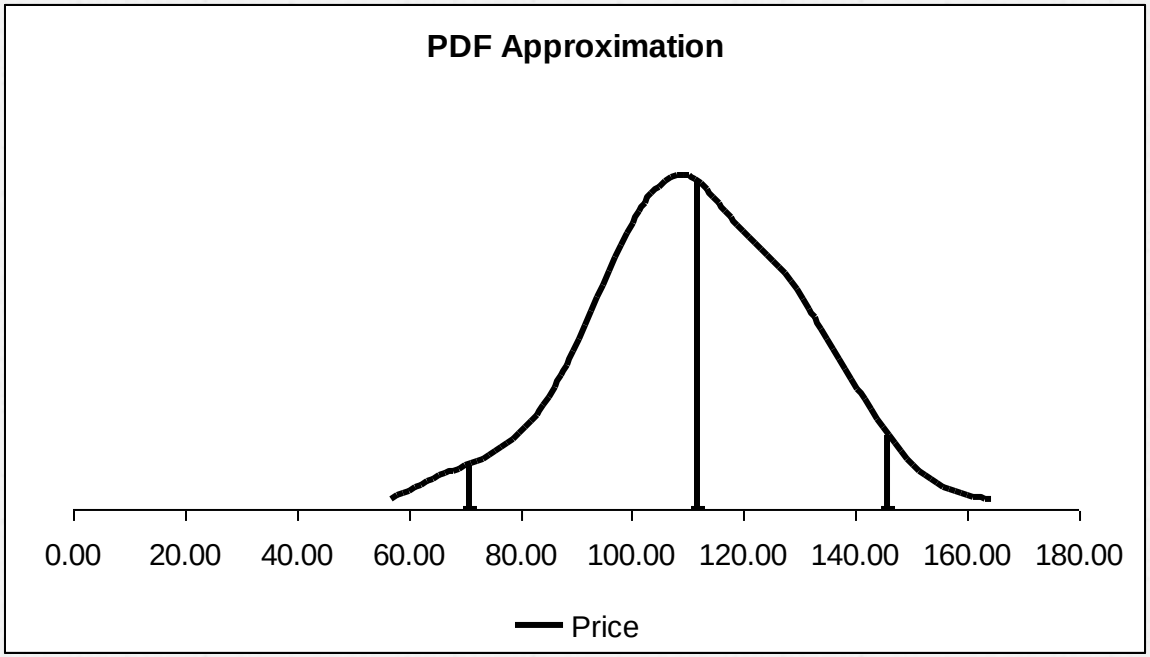
Import equation estimation

	Intercept	P_{US}	QB_{C}	$QB_{M\text{-}J\text{-}SK}$	QB_{US}	$QImp_{t-1}$	DUM_{M}	T
Beta	-37562.8869	**-9.04907**	**1.257787**	0.19086	**-0.1054**	**0.59964**	238.439	20.25164
S.E.	23983.7917	4.023676	0.358512	0.122182	0.0433	0.13265	154.855	12.62849
t-test	-1.566178	-2.24896	3.50836	1.562101	-2.4306	4.52062	1.53975	1.603647
Prob(t)	0.12714373	0.03153	0.001362	0.128101	0.0209	8E-05	0.13345	0.118618
Elasticity at Mean		-0.40804	0.568472	0.167488	-1.0734	0.59369	0.00501	16.93818
Variance Inflation Factor		10.4001	4.0882	5.423757	5.9991	5.33733	1.25912	23.49048

S.D. Resids	170.143035
MAPE	6.35776075
RBar^2	0.86654826

Results and Discussion

Price distribution after simulation



Results and Discussion

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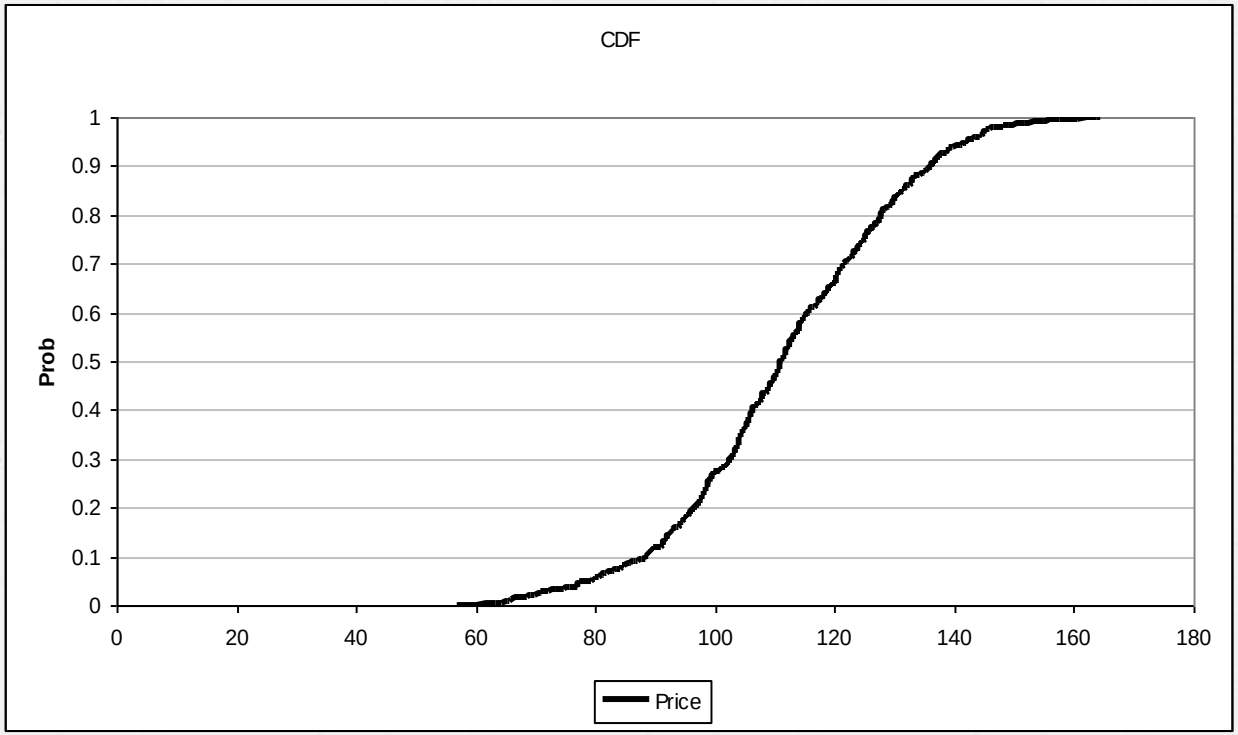

Conclusions

Summary table of price simulation

Variable	Mean	StDev	CV	Min	Max
Price ($/100 lbs.)	111.496253	18.95757733	17.0028829	56.975117	164.2966174

CDF

x1-value	140
Prob(X<=x1)	0.940315736
x2-value	120
Prob(X<=x2)	0.661582133
x3-value	100
Prob(X<=x3)	0.274437206
x4-value	80
Prob(X<=x4)	0.058093818
x5-value	60
Prob(X<=x5)	0.004001969

THANK YOU!!

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