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A framework for modelling financial risk in Southern Australia: the intensive farming (IF) model

Timothy Hutchings, *Meridian Agricultural Consulting* and *The Graham Centre (an alliance of Charles Sturt University & NSW DPI)*

Tom Nordblom, *Econ Research, Strategy & Policy Branch, NSW DPI* and *The Graham Centre*

Richard Hayes, *Agriculture NSW, NSW DPI* and *The Graham Centre*

Guangdi Li, *Agriculture NSW, NSW DPI* and *The Graham Centre*

John Finlayson, *John Finlayson Research Ltd, New Zealand*

Contributed paper, 60th AARES Annual Conf., Canberra, ACT, 2-5 February 2016

GRAHAM CENTRE
for Agricultural Innovation

The IF model

Intensive Farming model

A framework for modelling farm financial risk

www.grahamcentre.net

The IF Model

Risk is uncontrolled variability

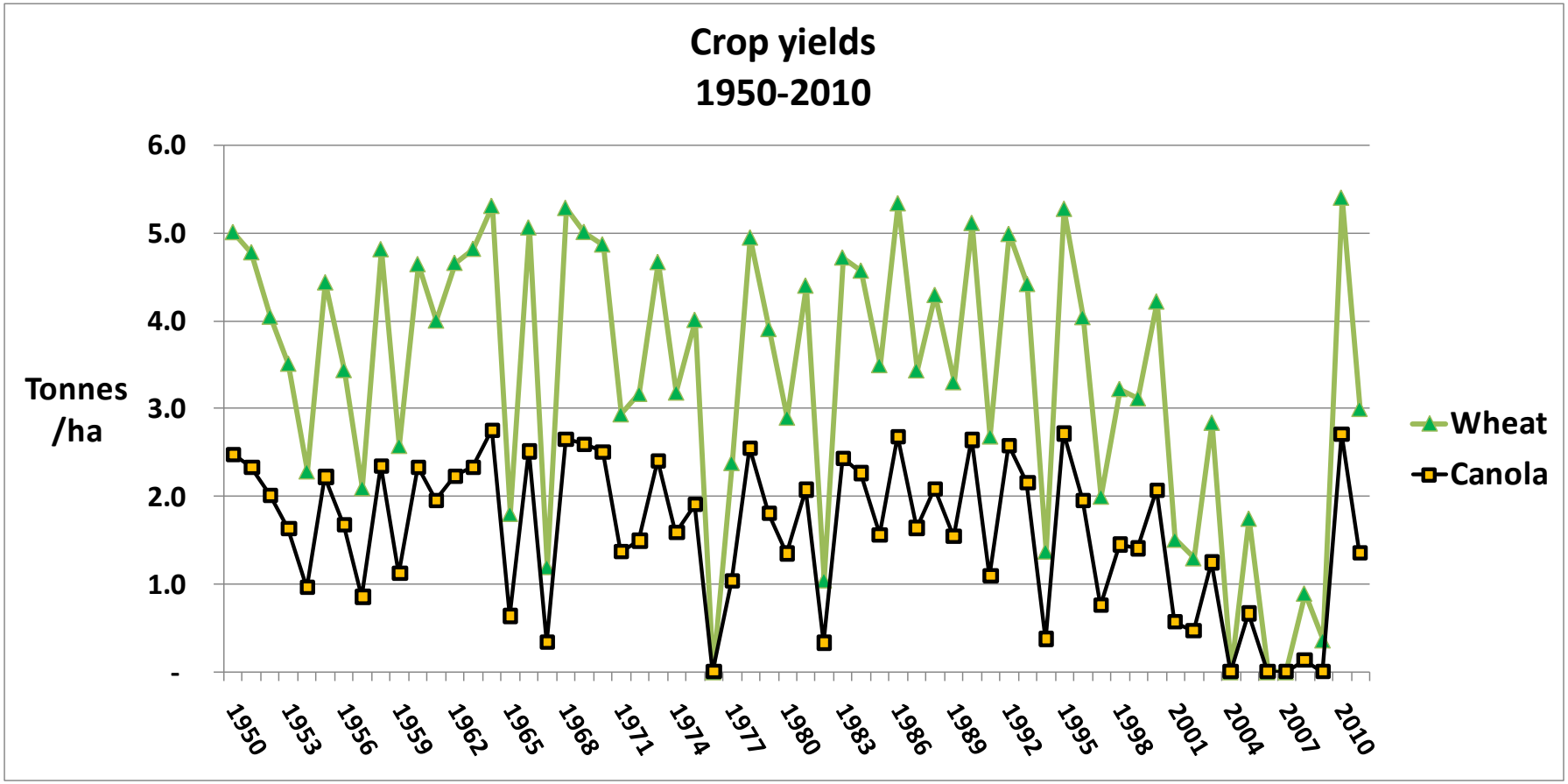
- Risk is an essential feature of farm management in Australia.

- Farmers have to manage extra-ordinary levels of variability, yet make decisions without knowing the financial risks involved.

- The IF model provides a framework and methodology for quantifying that risk.

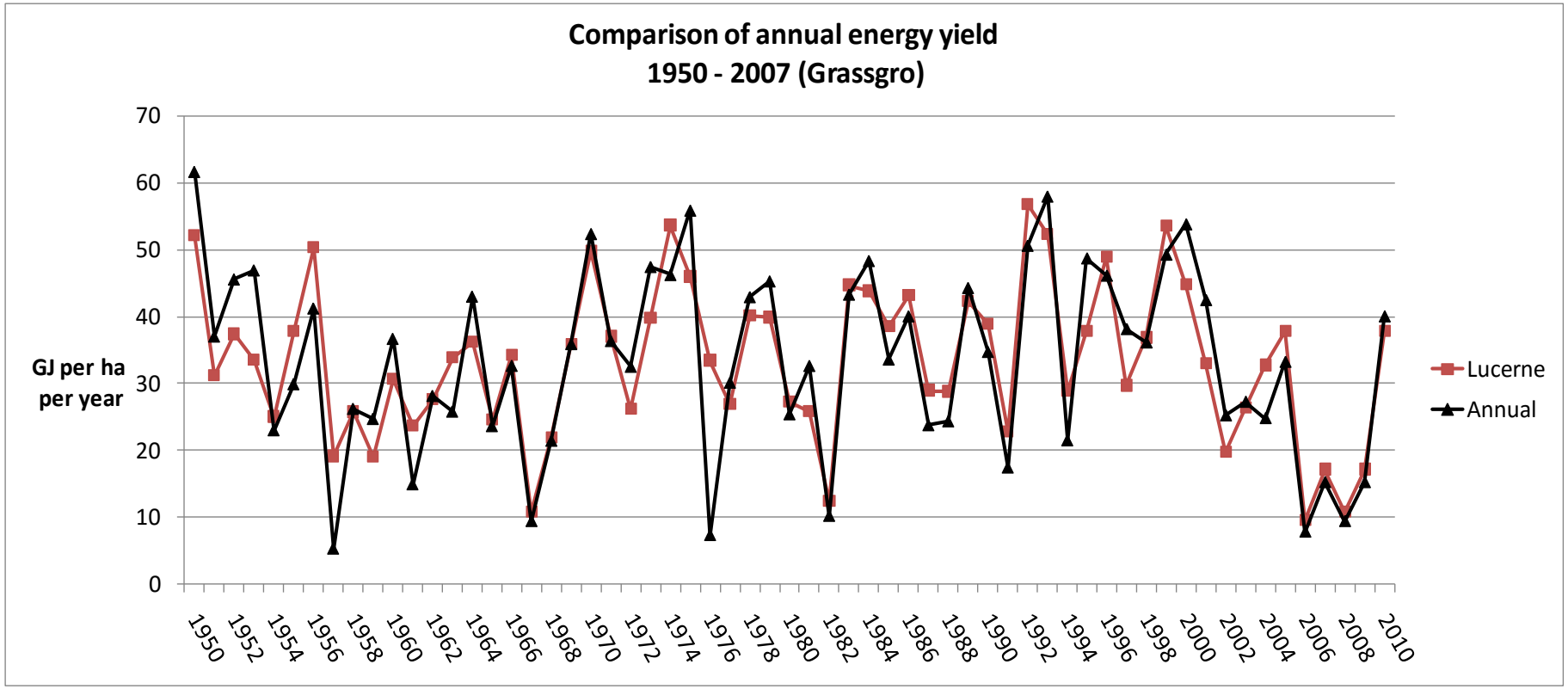
Long-term crop yield simulations

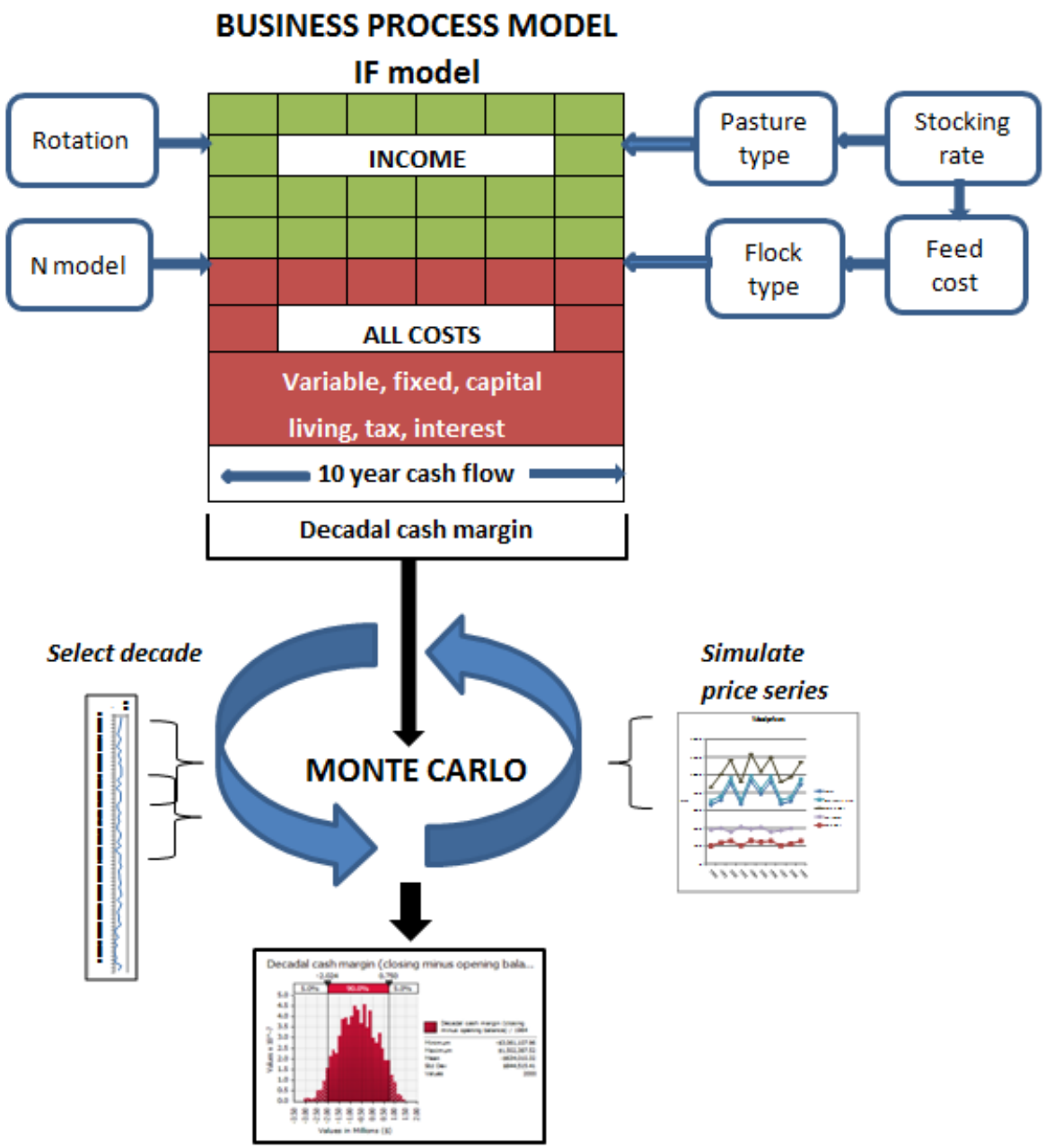
Correlated (r2 > 0.85) with local farm yields for 20 years

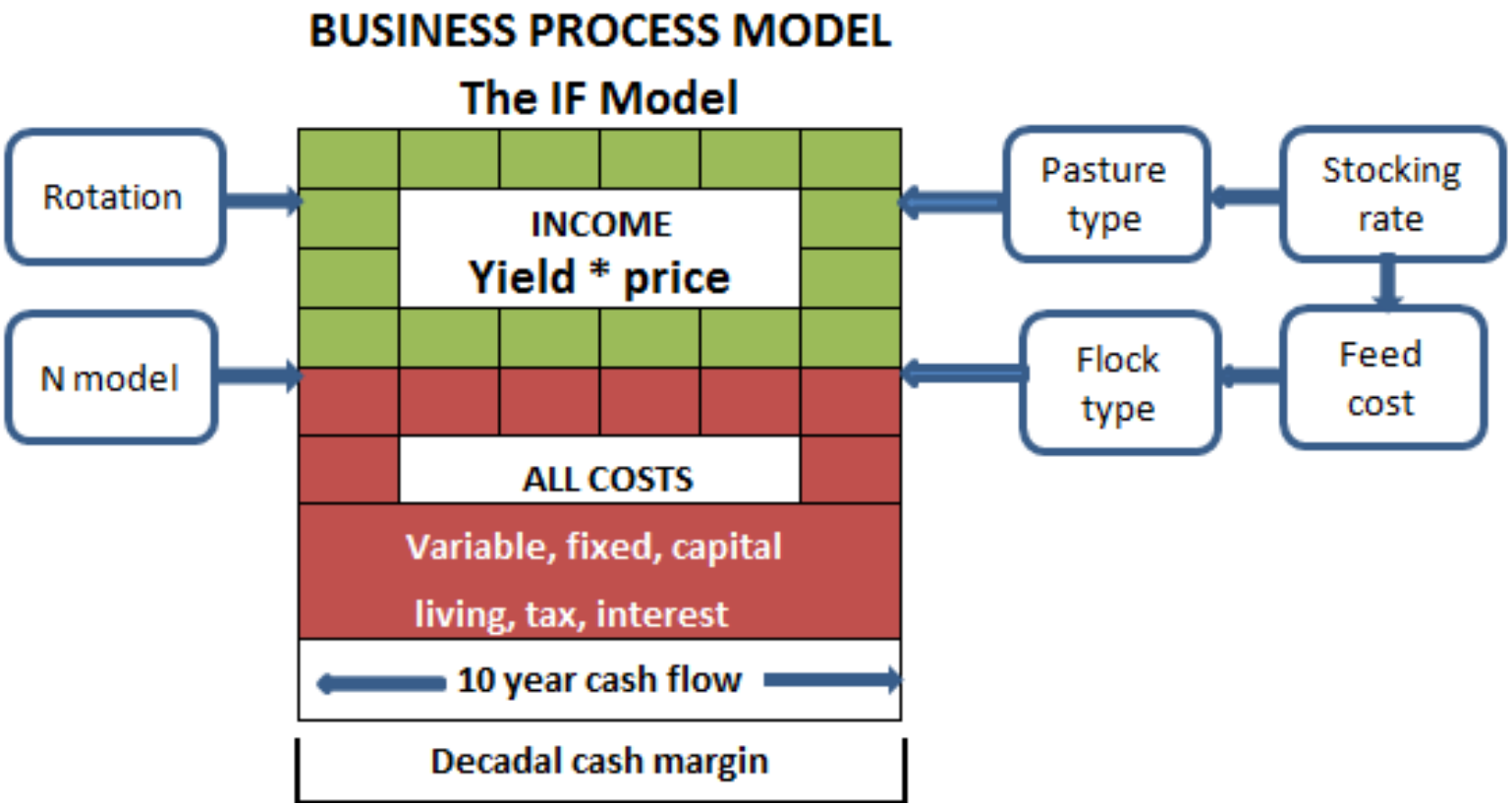


Long-term pasture energy yields

(after Grassgro)




BUSINESS PROCESS MODEL
IF model
Rotation
N model
INCOME
ALL COSTS
Variable, fixed, capital
living, tax, interest
10 year cash flow
Pasture type
Stocking rate
Flock type
Feed cost
Decadal cash margin
Select decade
MONTE CARLO
Simulate price series


BUSINESS PROCESS MODEL
The IF Model
Rotation
N model
INCOME
Yield * price
ALL COSTS
Variable, fixed, capital
living, tax, interest
10 year cash flow
Decadal cash margin
Pasture type
Stocking rate
Flock type
Feed cost

Cashflow template

Every row automatically adjusts for variations in production and price

CASH FLOW											
Gross Margin	**Decade**	**1981**	**1982**	**1983**	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**
Crop		$142,117	-$65,046	$191,623	$258,190	$205,169	$346,959	$218,237	$249,417	$253,922	$534,746
Sheep (Grassgro)		$287,797	$224,882	$322,476	$286,723	$147,874	$209,857	$261,647	$248,667	$279,240	$267,358
Pasture		-$37,640	-$39,146	-$40,712	-$42,340	-$44,034	-$45,795	-$47,627	-$49,532	-$51,514	-$53,574
Gross Margin		**$392,274**	**$120,689**	**$473,387**	**$502,573**	**$309,009**	**$511,020**	**$432,257**	**$448,551**	**$481,647**	**$748,530**
Fixed costs	**Budget**										
Fuel & Oil	$22,462	$22,462	$23,136	$23,830	$24,545	$25,281	$26,040	$26,821	$27,625	$28,454	$29,308
R&M	$20,188	$20,794	$21,418	$22,060	$22,722	$23,404	$24,106	$24,829	$25,574	$26,341	$27,131
Overhead	$67,326	$67,326	$69,346	$71,426	$73,569	$75,776	$78,049	$80,391	$82,802	$85,286	$87,845
Labour	$58,723	$58,723	$32,485	$33,459	$34,463	$35,497	$36,126	$36,891	$37,606	$38,734	$39,896
Lease	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Land interest	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total	$168,699	$169,305	$146,384	$150,775	$155,299	$159,958	$164,321	$168,932	$173,607	$178,816	$184,180
Capital	**Base input**										
Replacement		$27,904	$23,754	$17,794	$7,920	$73,657	$96,057	$187,143	$20,241	$157,979	$19,861
Land purchases		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Living	$80,000	$84,000	$88,200	$92,610	$97,241	$102,103	$107,208	$112,568	$118,196	$124,106	$130,312
Total	$80,000	$111,904	$111,954	$110,404	$105,160	$175,759	$203,264	$299,711	$138,438	$282,086	$150,173
Total fixed costs		**$281,209**	**$258,338**	**$261,179**	**$260,459**	**$335,717**	**$367,585**	**$468,643**	**$312,045**	**$460,901**	**$334,353**
		1981	**1982**	**1983**	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**
EBIT		$111,065	-$137,648	$212,208	$242,114	-$26,707	$143,435	-$36,386	$136,506	$20,746	$414,178
Tax		-$13,768	-$3,559	$0	-$26,968	-$40,186	$0	-$100	$0	-$20,887	$0
Cumulative balance		$97,297	-$41,478	$167,826	$387,169	$329,954	$481,638	$457,193	$605,128	$620,116	$1,049,796
Interest		$2,432	-$2,903	$4,196	$9,679	$8,249	$12,041	$11,430	$15,128	$15,503	$26,245
	Opening balance										
Cashflow	**$0**	**$99,730**	**-$44,381**	**$172,022**	**$396,848**	**$338,203**	**$493,679**	**$468,622**	**$620,256**	**$635,619**	**$1,076,041**

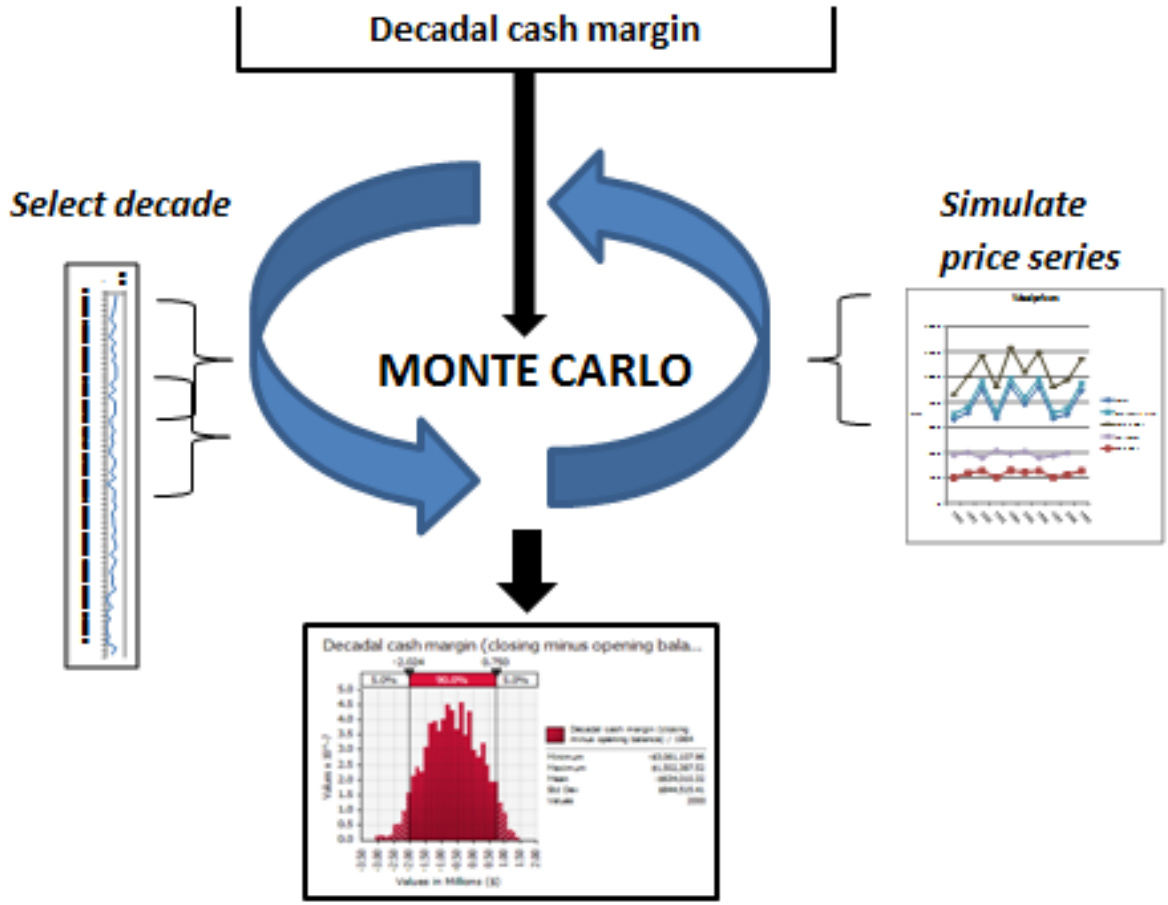
***

Decadal cash margin (closing minus opening balance) **$1,076,041**

@Risk Monte Carlo analysis

2,000 iterations

2,000 iterations give a variation between runs of <0.5%



Probability distributions

Modelling risk and variability

Yields X Price

=

Income – Variable costs

=

Gross Margin - Fixed & Capital costs (incl. Living costs)

=

EBIT - Tax & cumulative interest

=

Cashflow (Change in cash flow = Decadal cash margin)

Including risk in decision-making

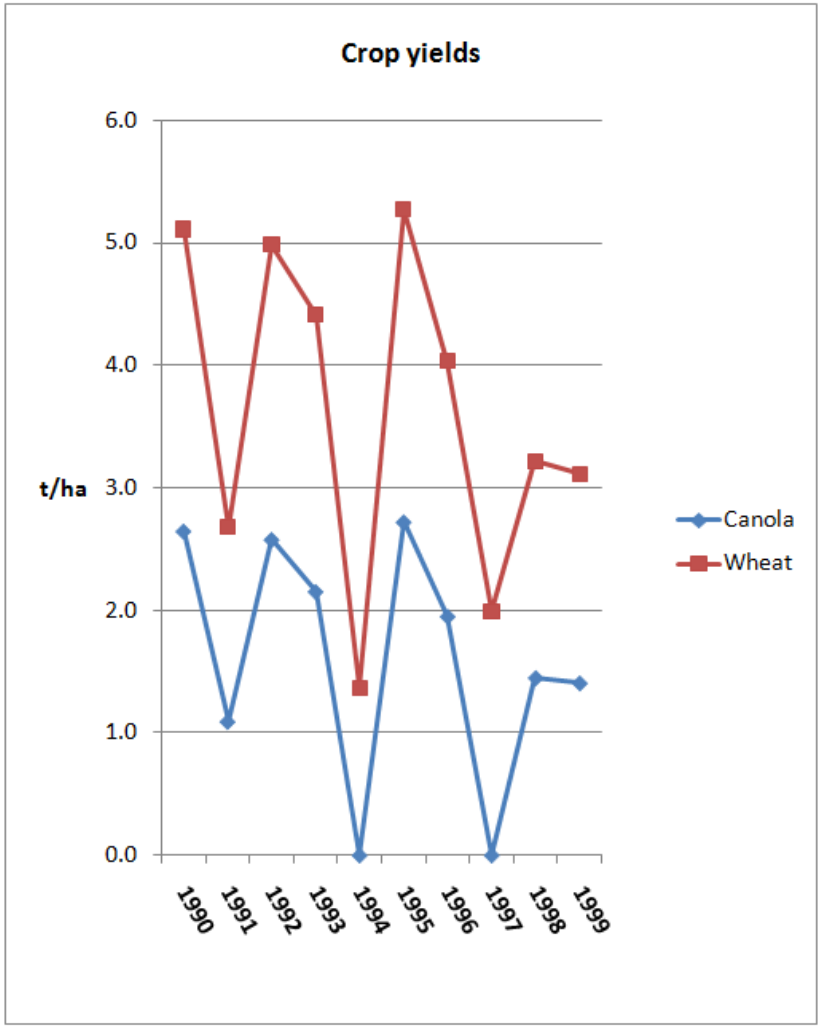
Production risk
Randomly selected decades

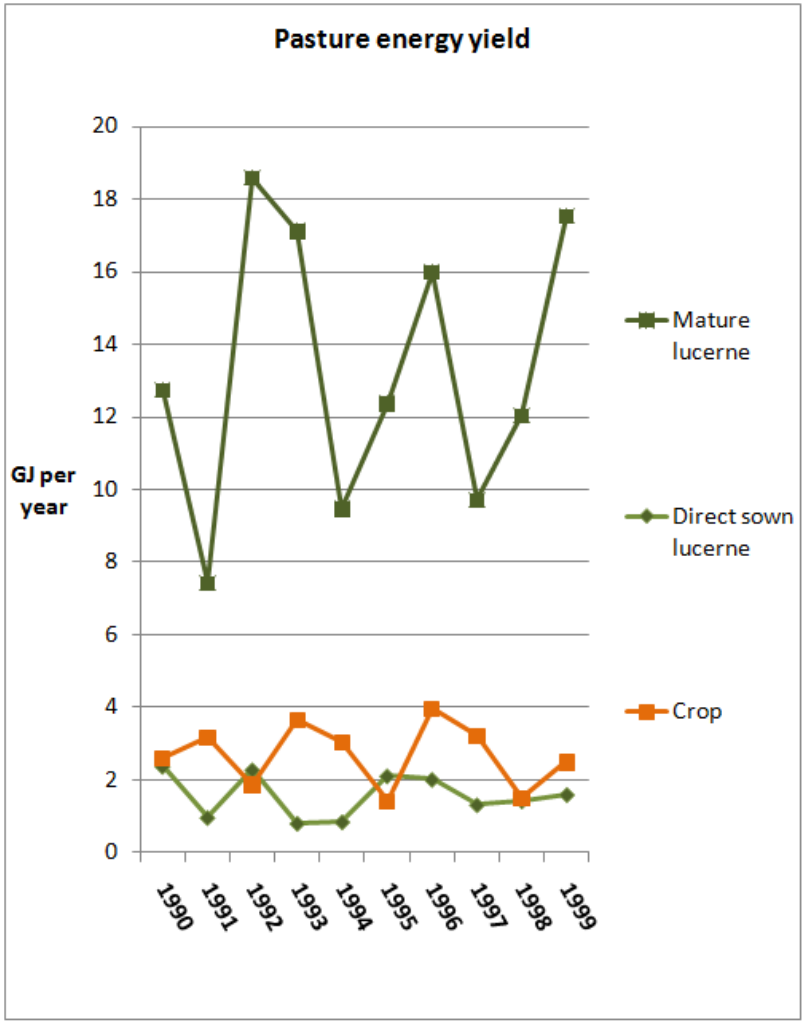
Wagga Wagga region

1950-2010

Randomly selected decades 1950-2010

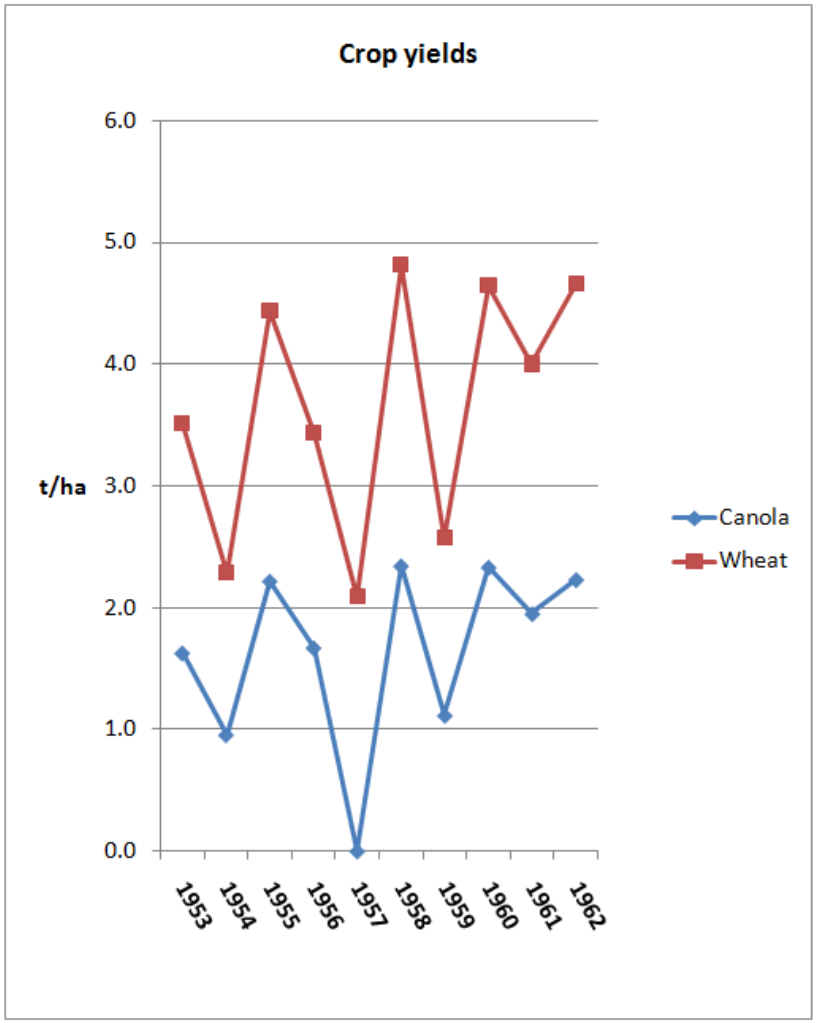
Selected crop and pasture yields

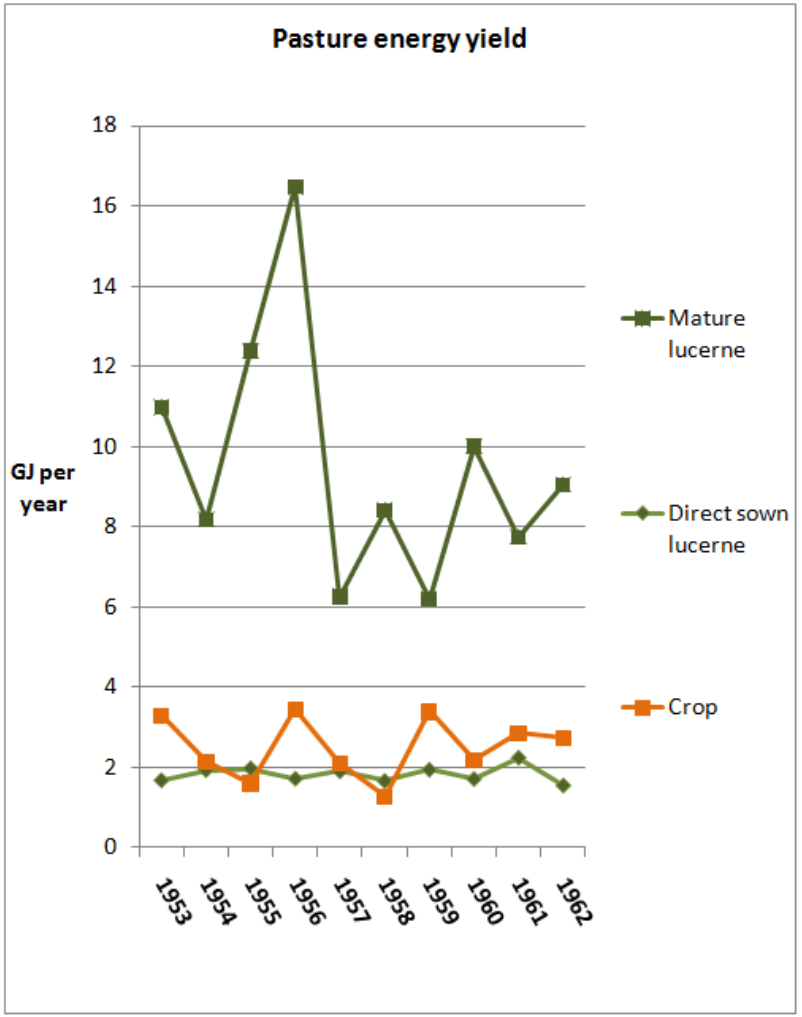




Randomly selected decades 1950-2010

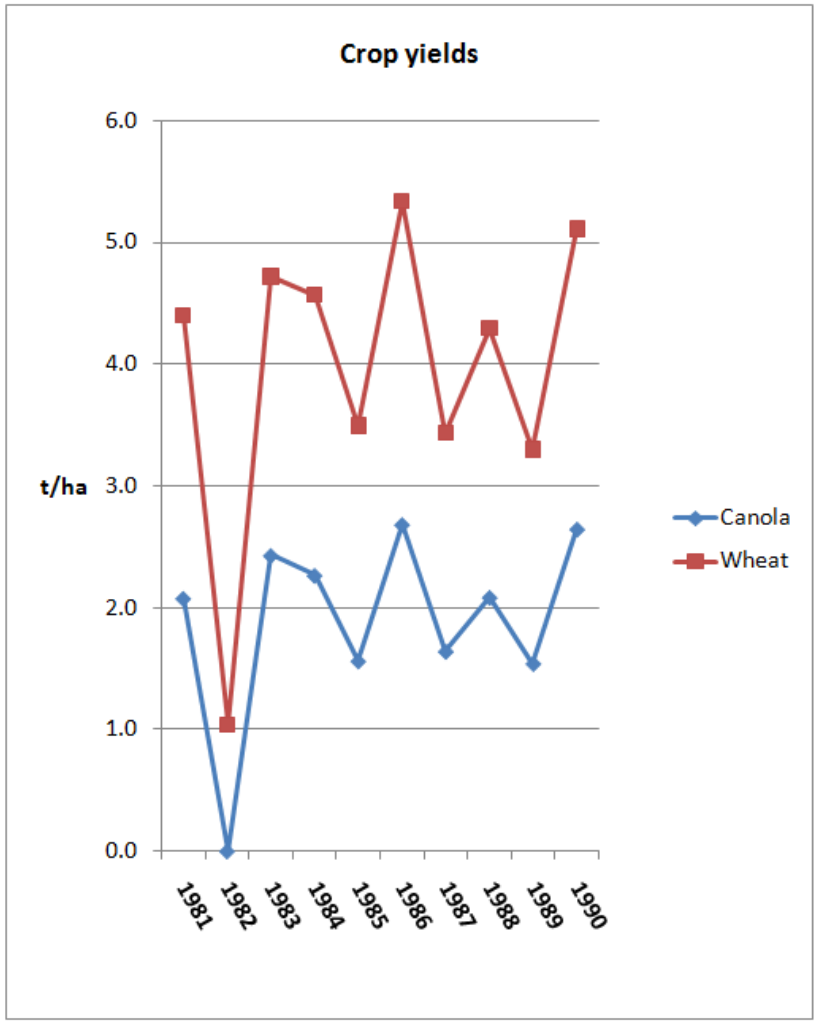
Selected crop and pasture yields

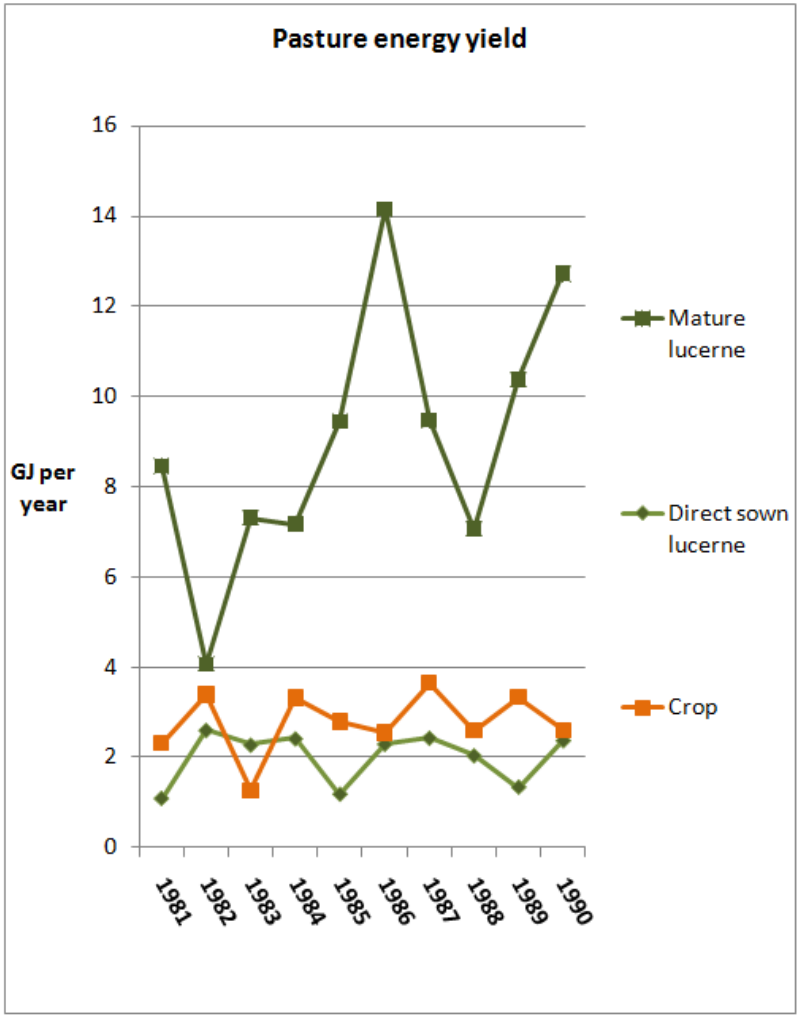




Randomly selected decades 1950-2010

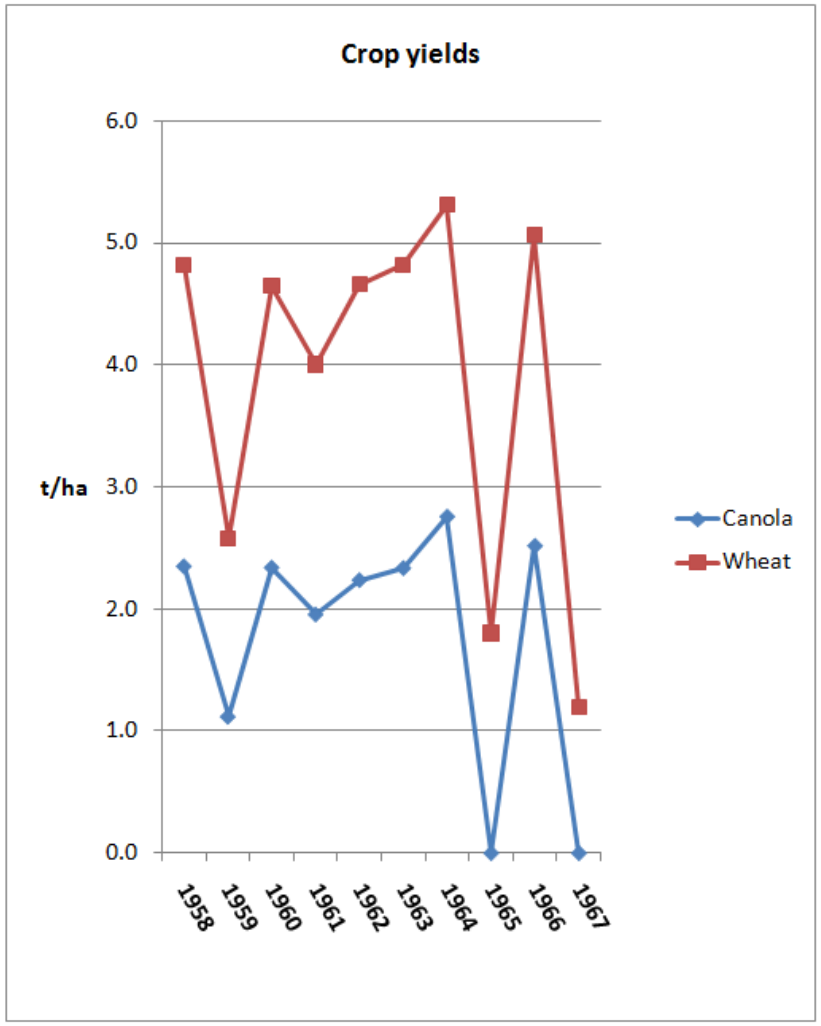
Selected crop and pasture yields

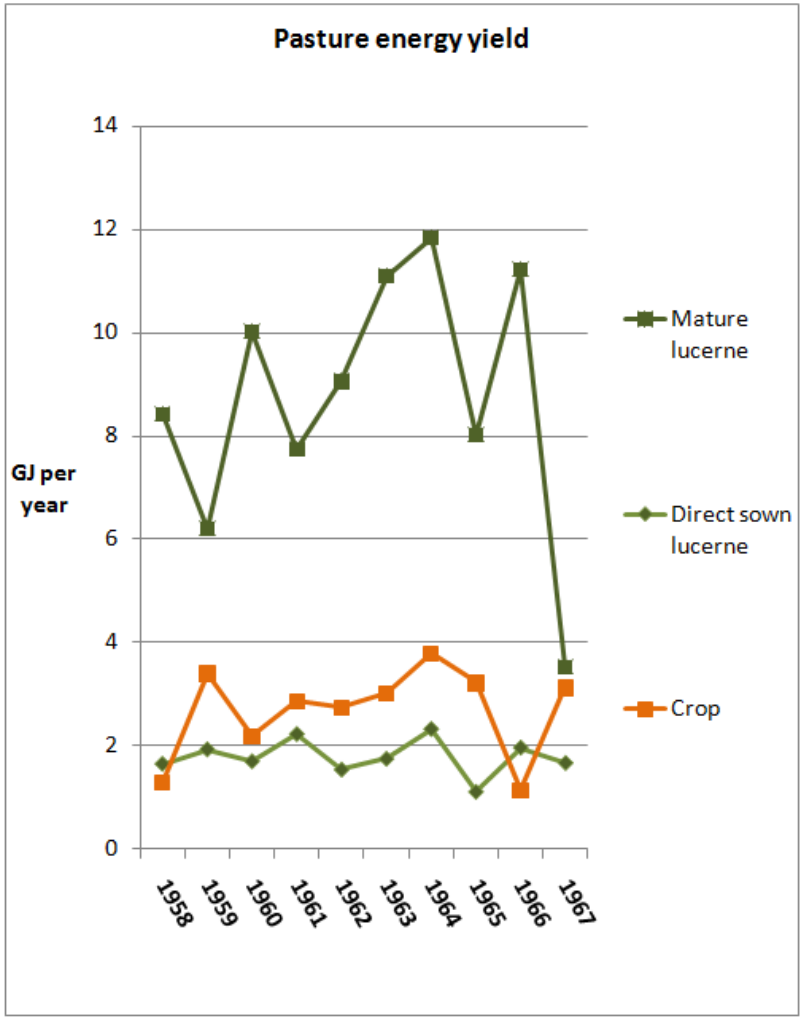




Randomly selected decades 1950-2010

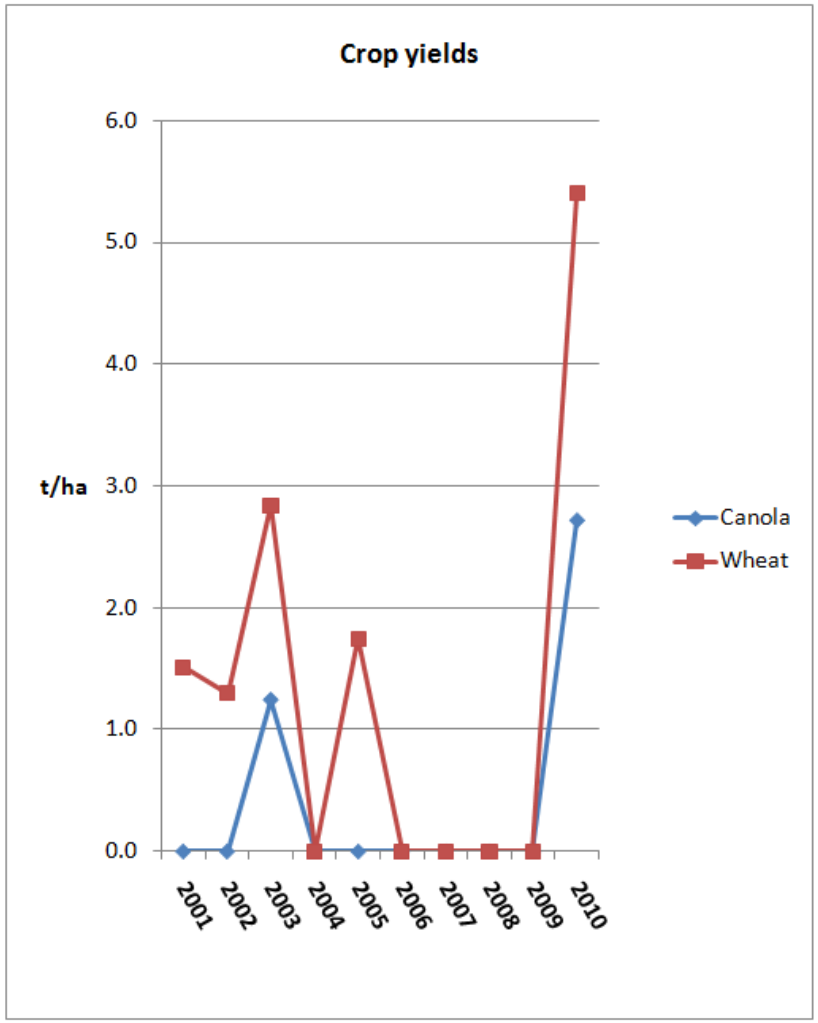
Selected crop and pasture yields

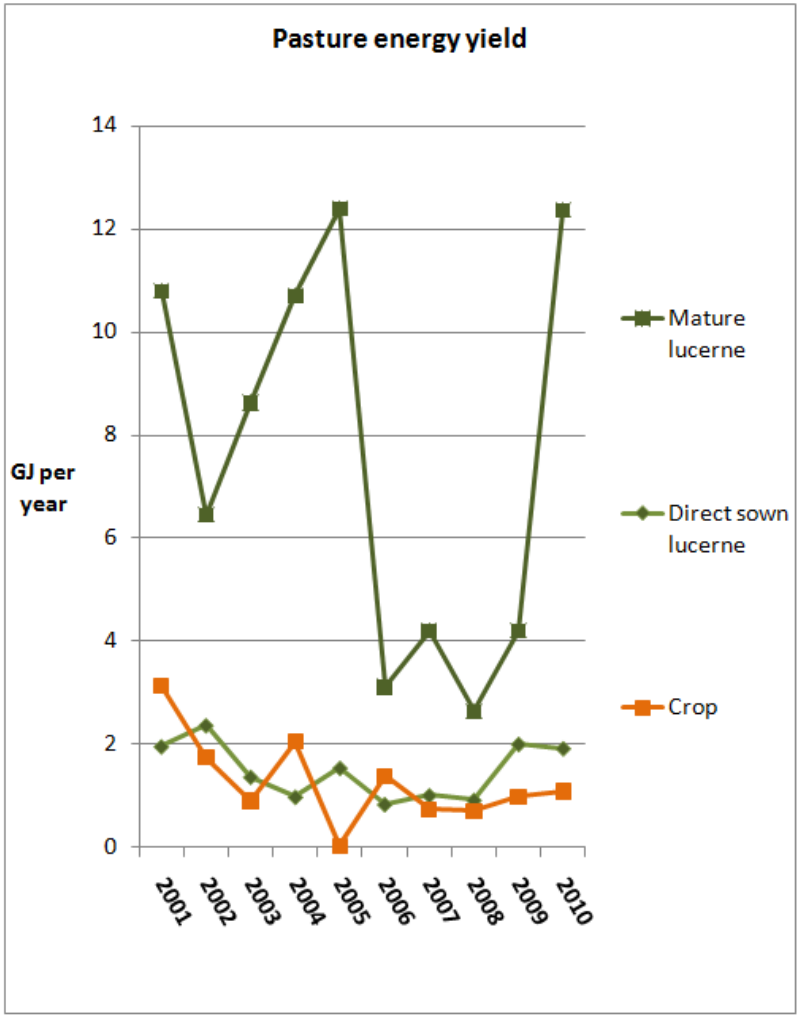




Randomly selected decades 1950-2010

Selected crop and pasture yields

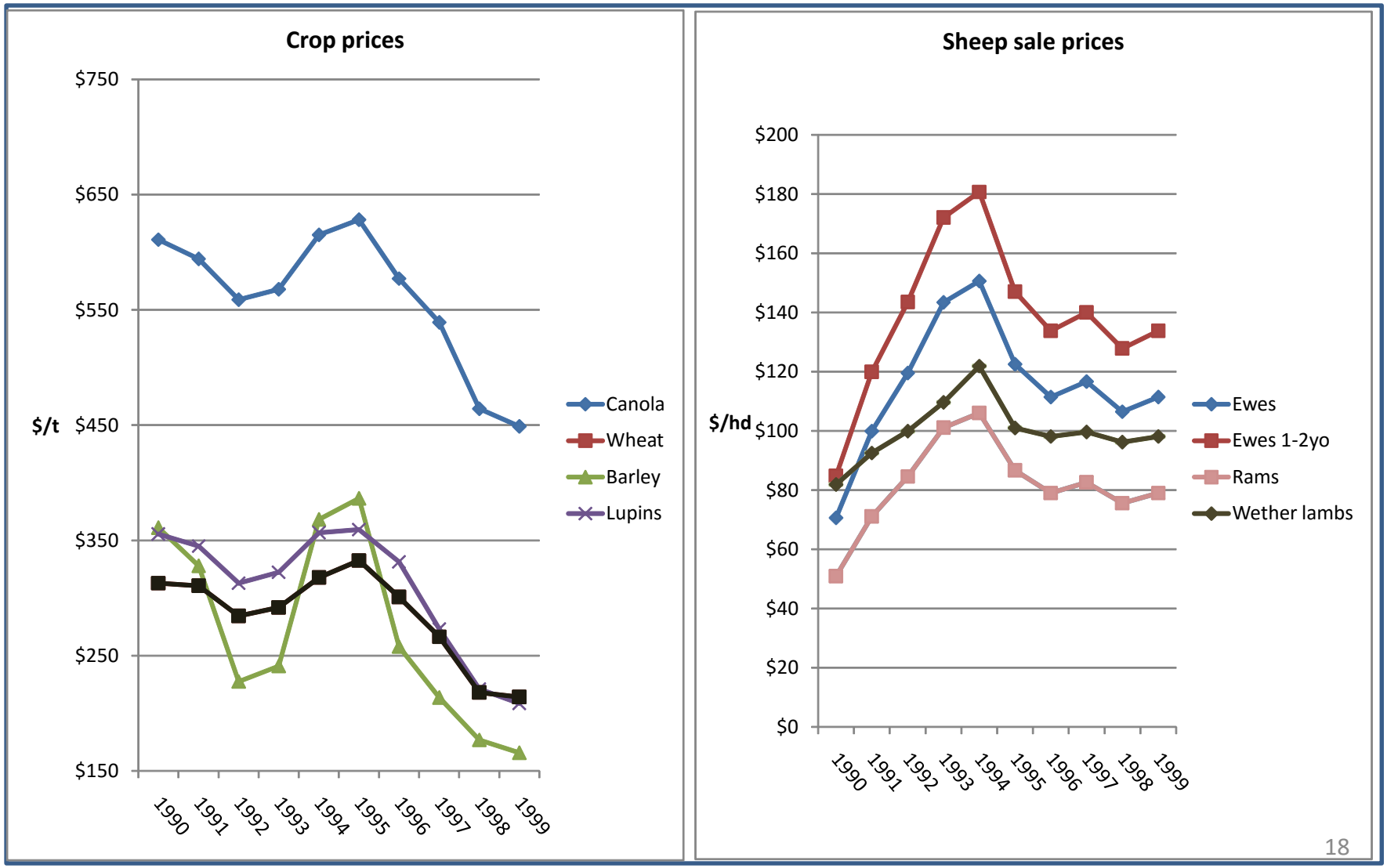




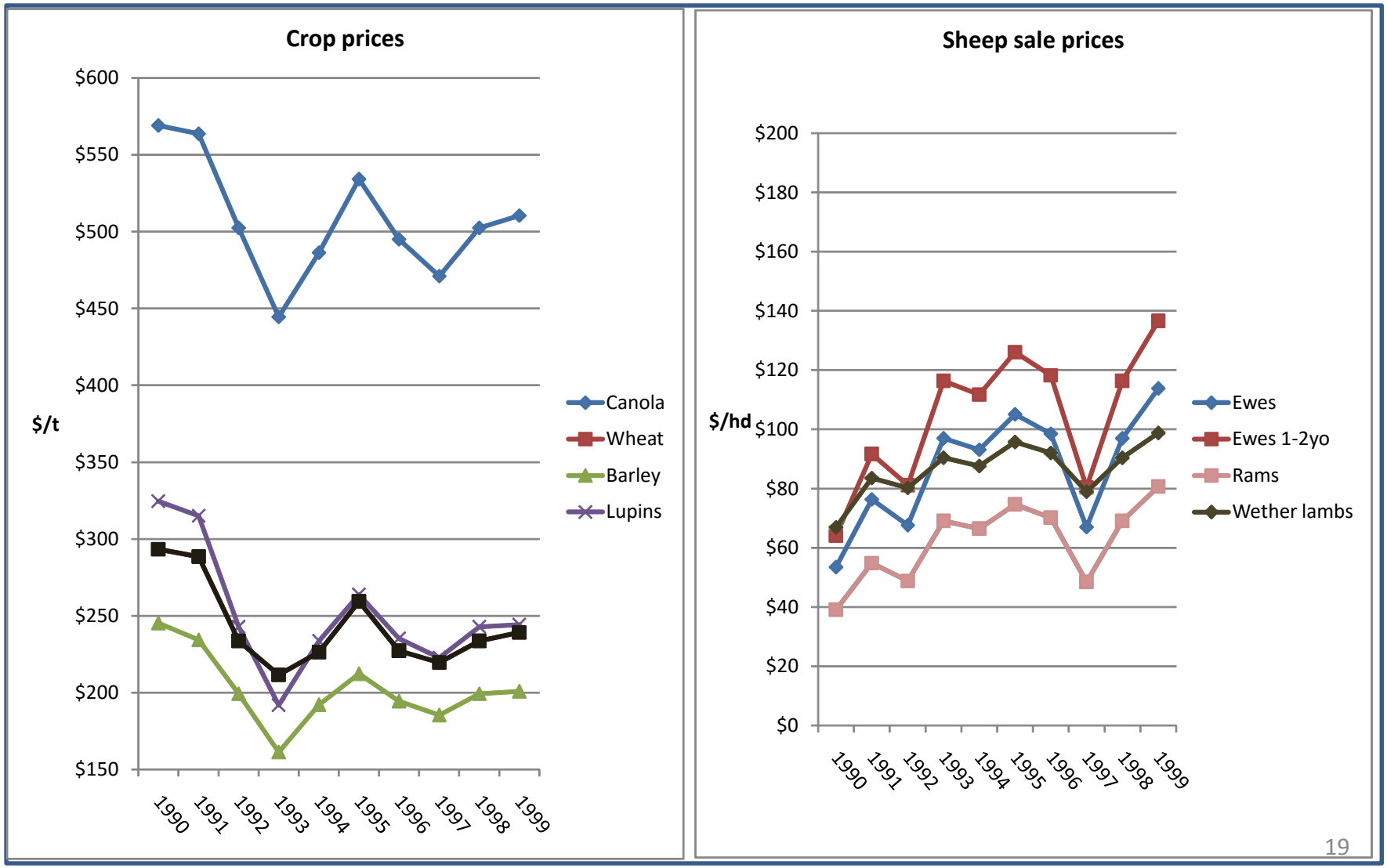
Price risk

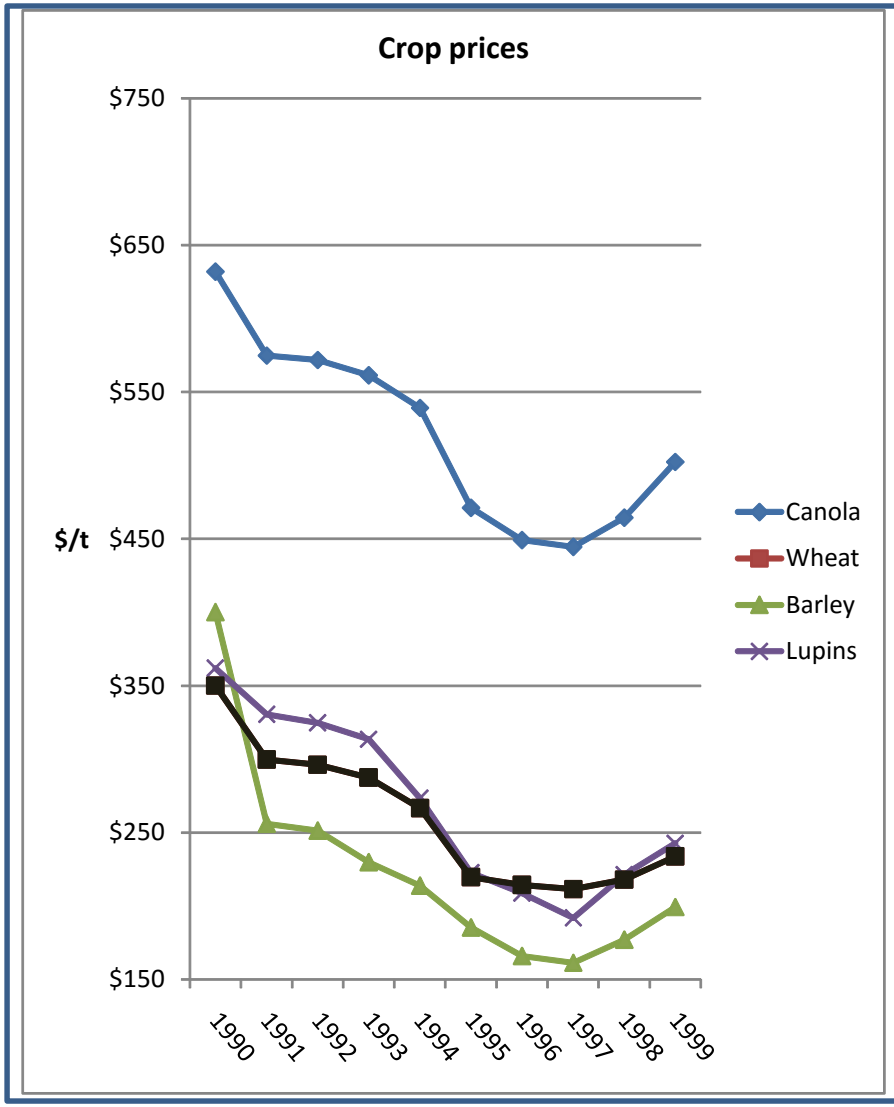
- **Simulated 10-year series**
- **Close match (r^2>0.95) with weekly price series for 2009-2013**

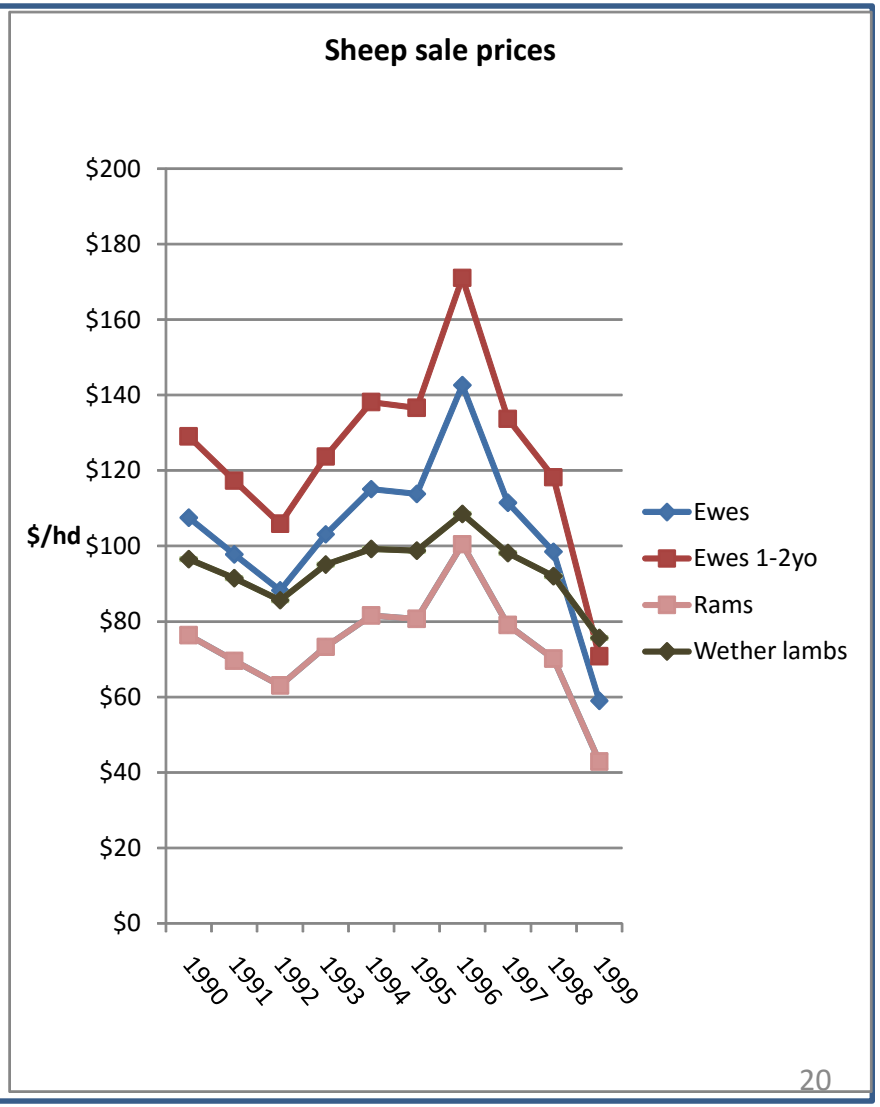
Examples of simulated price series for a range of crop and livestock commodities

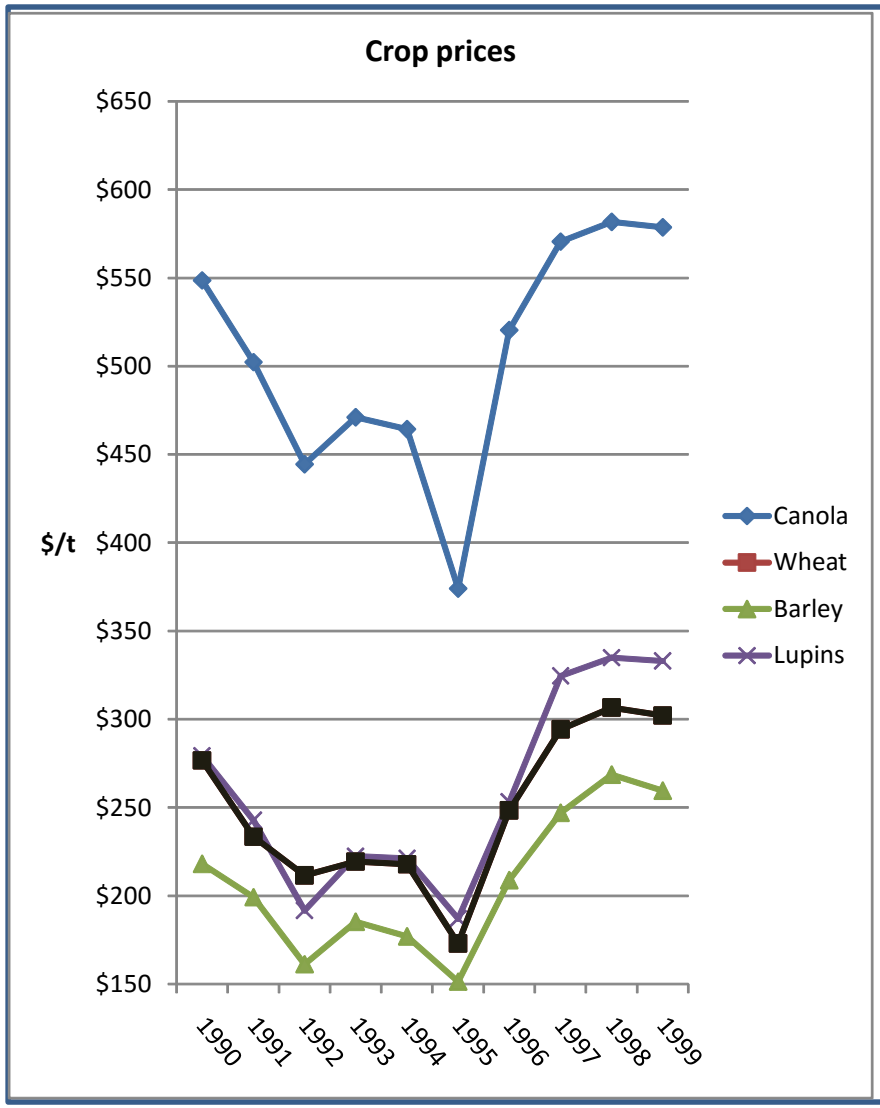


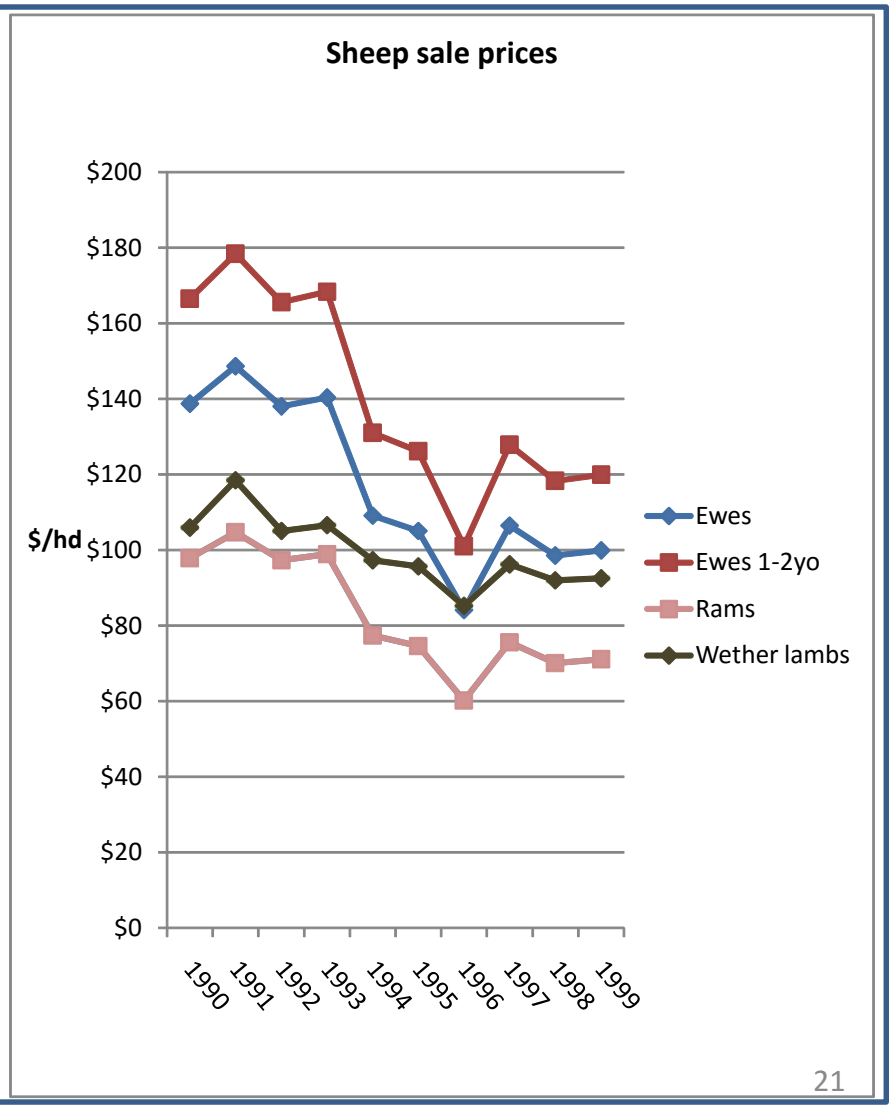
Simulated 10-year price series for crop and sheep commodities

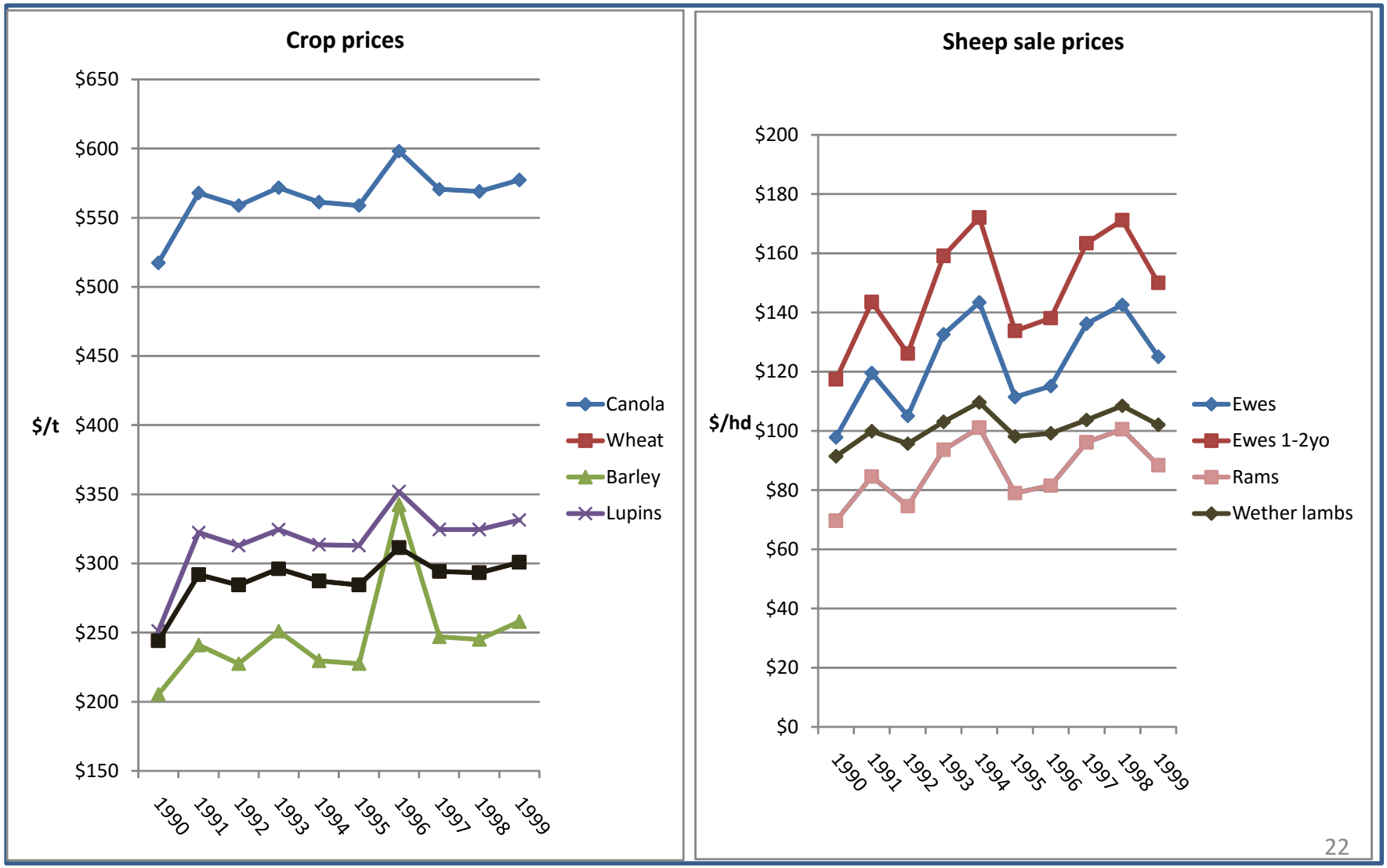



Crop prices
$750
$650
$550
$450
$350
$250
$150
$/t
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
Canola
Wheat
Barley
Lupins


Sheep sale prices
$200
$180
$160
$140
$120
$100
$80
$60
$40
$20
$0
$/hd
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
Ewes
Ewes 1-2yo
Rams
Wether lambs


Crop prices
$650
$600
$550
$500
$450
$/t
$400
$350
$300
$250
$200
$150
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
Canola
Wheat
Barley
Lupins


Sheep sale prices
$200
$180
$160
$140
$120
$/hd
$100
$80
$60
$40
$20
$0
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
Ewes
Ewes 1-2yo
Rams
Wether lambs


Crop prices
$650
$600
$550
$500
$450
$/t
$400
$350
$300
$250
$200
$150
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
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Sheep sale prices
$200
$180
$160
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$120
$/hd
$100
$80
$60
$40
$20
$0
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
Ewes
Ewes 1-2yo
Rams
Wether lambs

Modelling risk and variability

Yields X Price

=

Income – Variable costs

=

Gross Margin - Fixed & Capital costs (incl. Living costs)

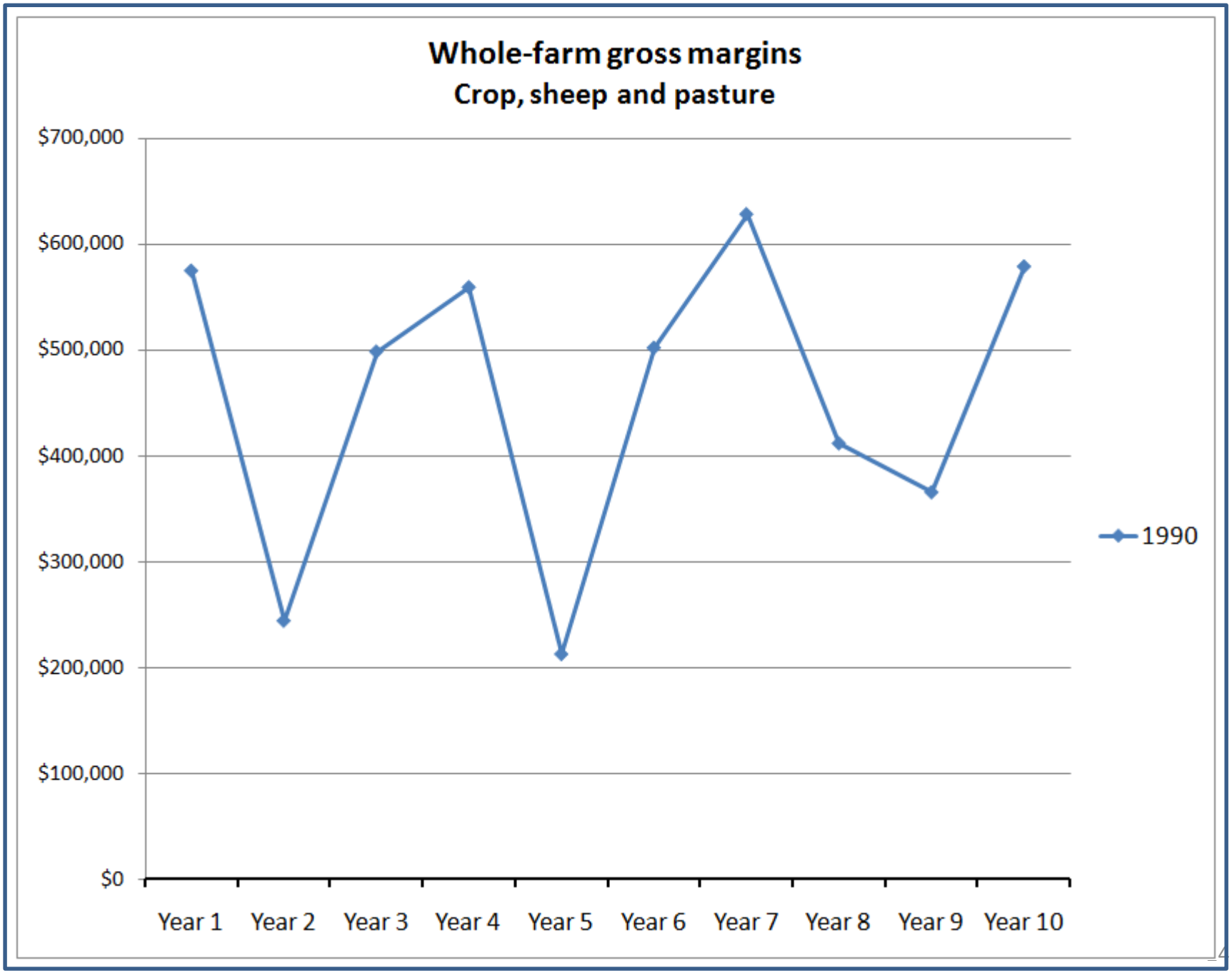
=

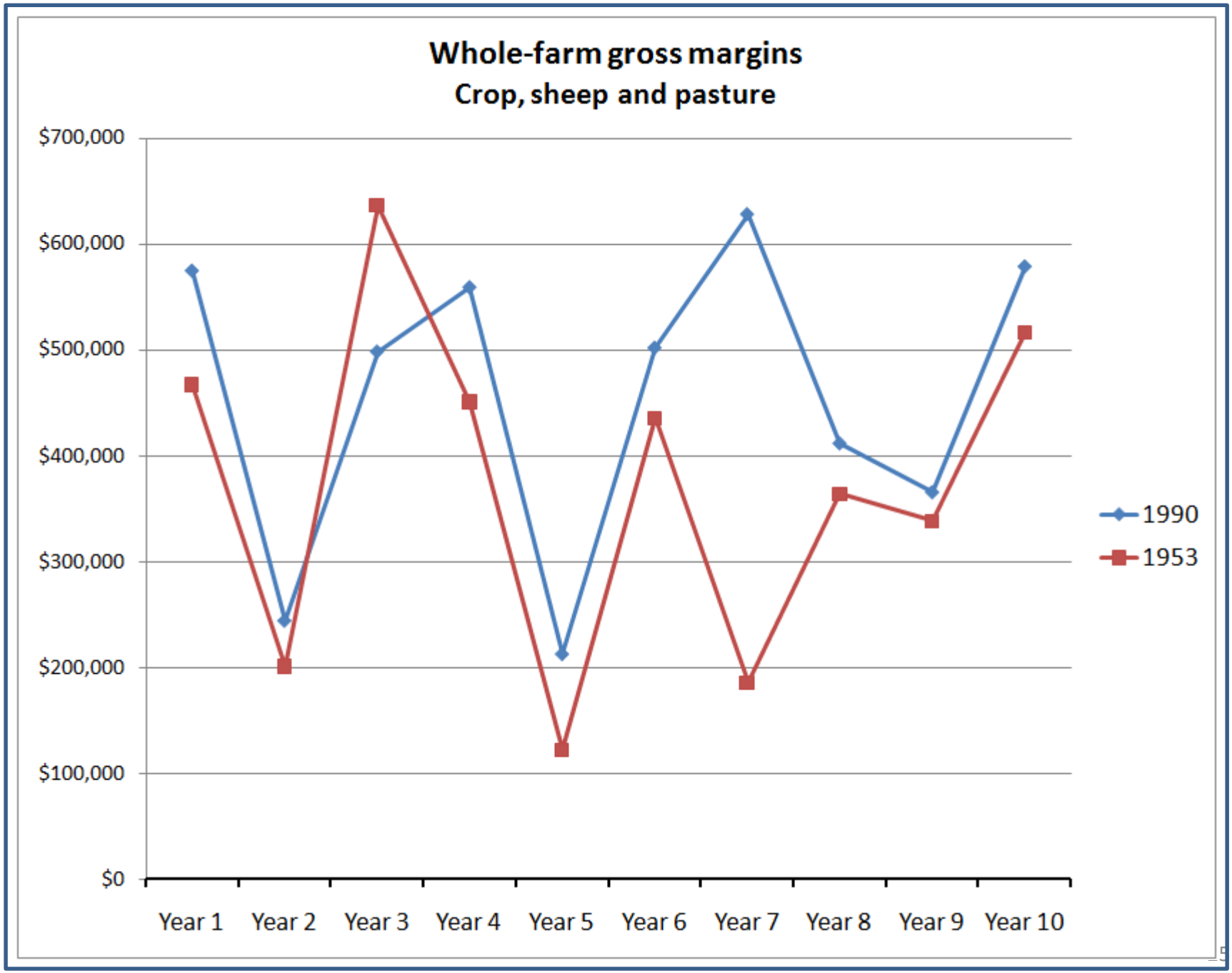
EBIT - Tax & cumulative interest

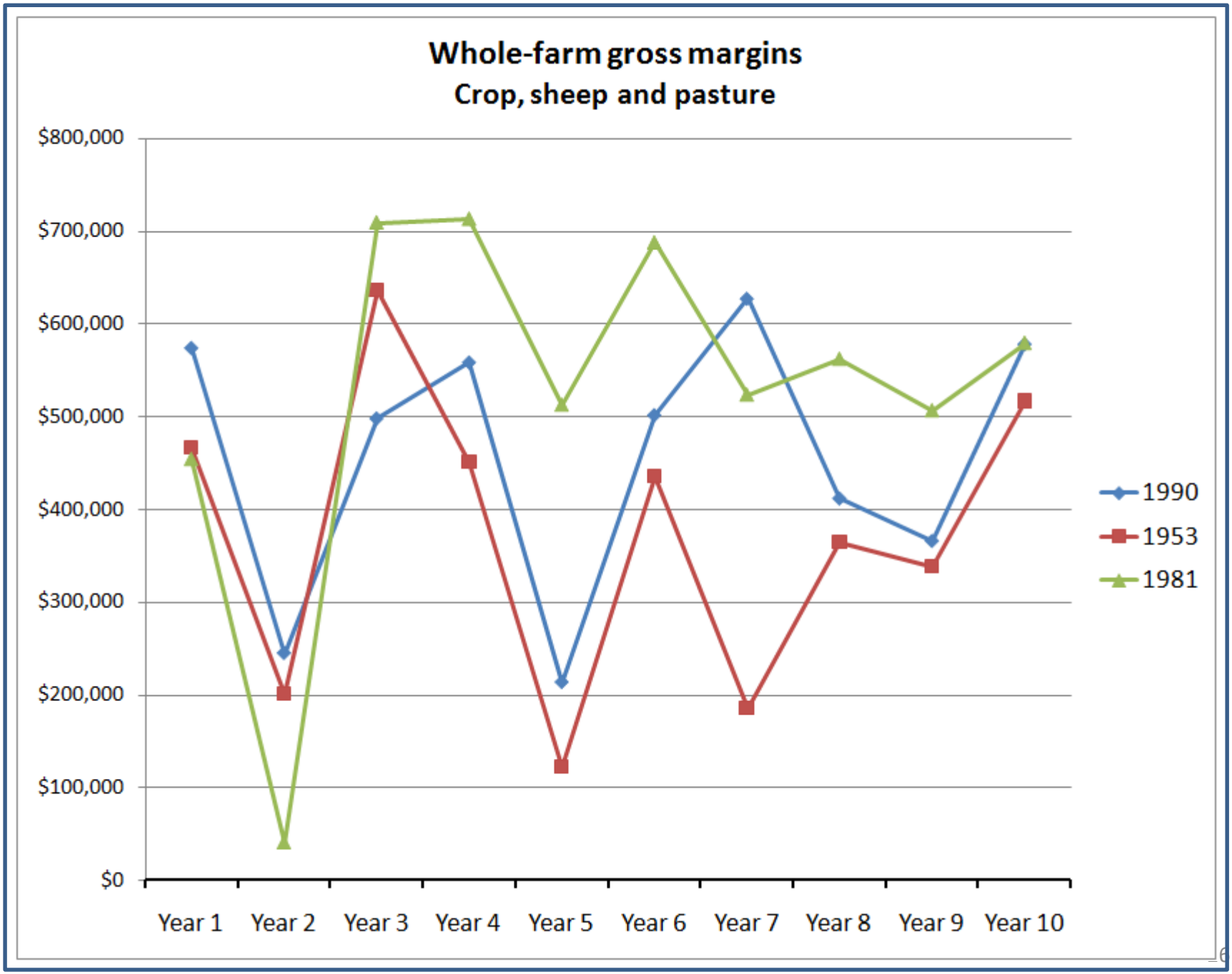
=

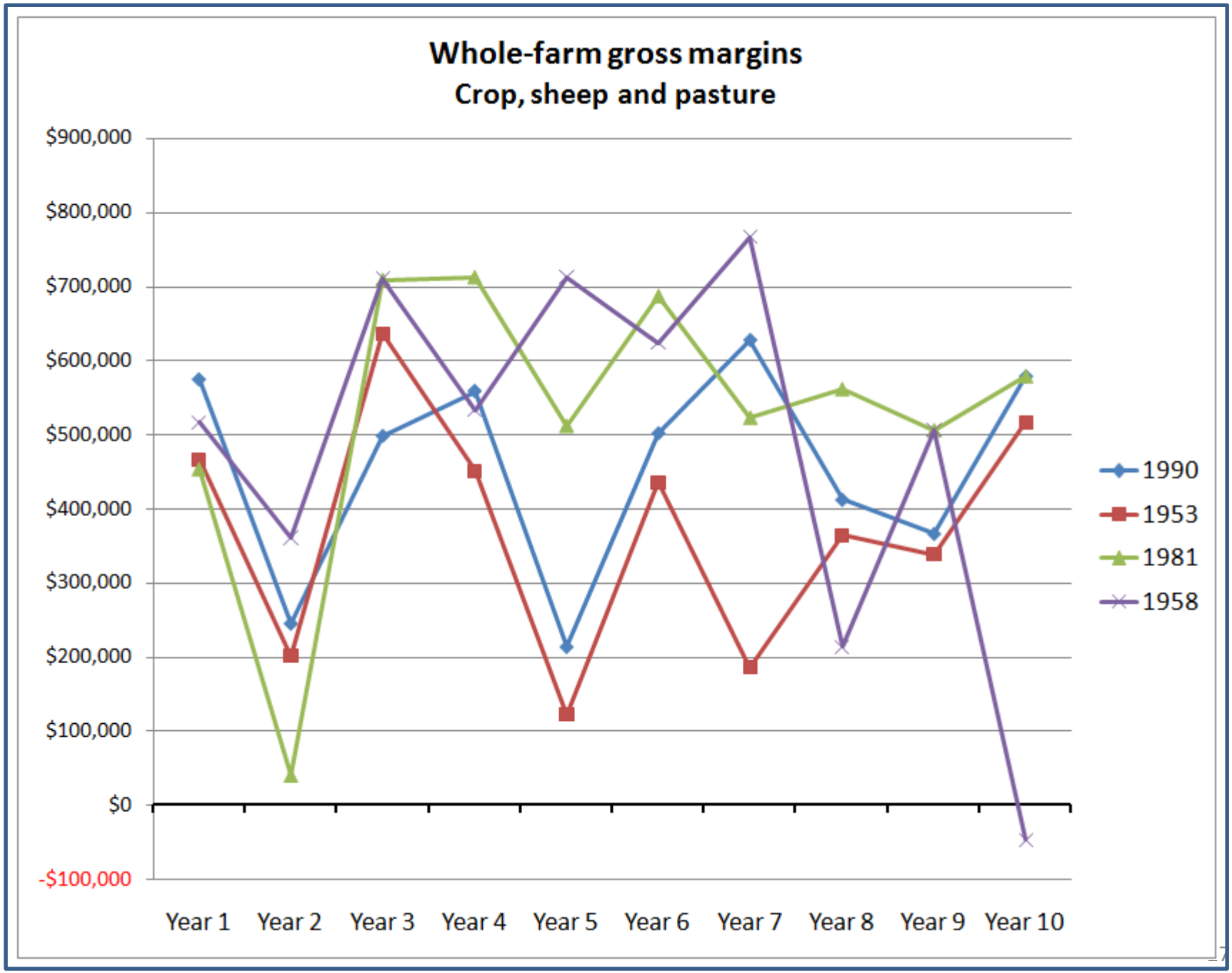
Cashflow (Change in cash flow = Decadal cash margin)

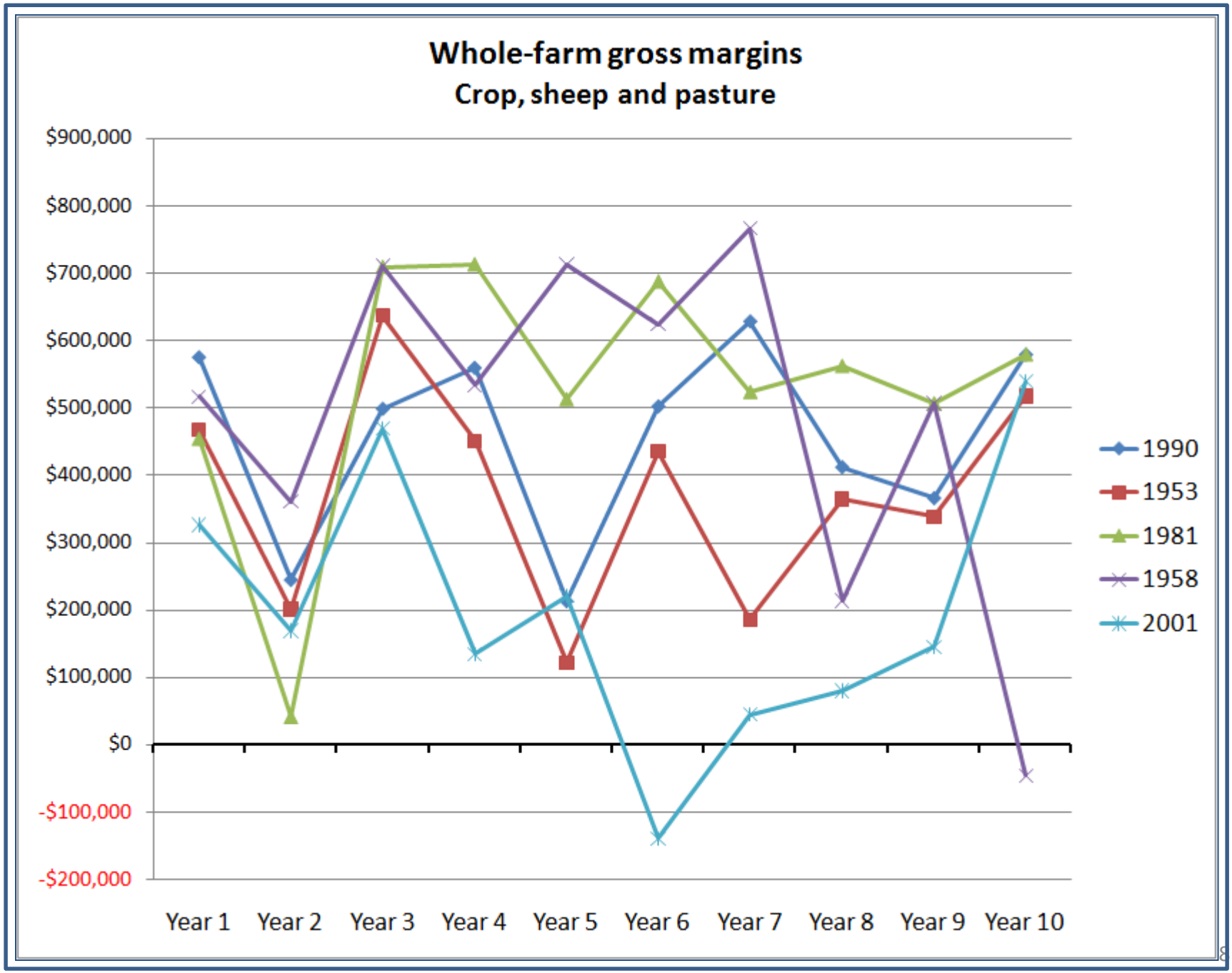
Including risk in decision-making


Whole-farm gross margins
Crop, sheep and pasture
$700,000
$600,000
$500,000
$400,000
$300,000
$200,000
$100,000
$0
Year 1
Year 2
Year 3
Year 4
Year 5
Year 6
Year 7
Year 8
Year 9
Year 10
1990


Whole-farm gross margins
Crop, sheep and pasture
$700,000
$600,000
$500,000
$400,000
$300,000
$200,000
$100,000
$0
Year 1
Year 2
Year 3
Year 4
Year 5
Year 6
Year 7
Year 8
Year 9
Year 10
1990
1953


Whole-farm gross margins
Crop, sheep and pasture
$800,000
$700,000
$600,000
$500,000
$400,000
$300,000
$200,000
$100,000
$0
Year 1
Year 2
Year 3
Year 4
Year 5
Year 6
Year 7
Year 8
Year 9
Year 10
1990
1953
1981


Whole-farm gross margins
Crop, sheep and pasture
$900,000
$800,000
$700,000
$600,000
$500,000
$400,000
$300,000
$200,000
$100,000
$0
-$100,000
Year 1
Year 2
Year 3
Year 4
Year 5
Year 6
Year 7
Year 8
Year 9
Year 10
1990
1953
1981
1958


Whole-farm gross margins
Crop, sheep and pasture
$900,000
$800,000
$700,000
$600,000
$500,000
$400,000
$300,000
$200,000
$100,000
$0
-$100,000
-$200,000
Year 1
Year 2
Year 3
Year 4
Year 5
Year 6
Year 7
Year 8
Year 9
Year 10
1990
1953
1981
1958
2001

NOTE

- **Averages cannot represent reality**

Modelling risk and variability

Yields X Price

=

Income – Variable costs

=

Gross Margin - Fixed & Capital costs (incl. Living costs)

=

EBIT - Tax & cumulative interest

=

Cashflow (Change in cash flow = Decadal cash margin)

Including risk in decision-making

CASH FLOW											
Gross Margin	**Decade**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
Crop		$262,687	$46,063	$207,546	$178,042	-$34,549	$318,041	$193,025	$6,285	$114,675	$163,958
Sheep (Grassgro)		$335,134	$247,201	$344,305	$379,348	$246,014	$251,138	$315,029	$229,107	$199,132	$227,434
Pasture		-$37,640	-$39,146	-$40,712	-$42,340	-$44,034	-$45,795	-$47,627	-$49,532	-$51,514	-$53,574
Gross Margin		**$560,181**	**$254,118**	**$511,139**	**$515,049**	**$167,431**	**$523,384**	**$460,426**	**$185,859**	**$262,294**	**$337,818**
Fixed costs	**Budget**										
Fuel & Oil	$22,462	$22,462	$23,136	$23,830	$24,545	$25,281	$26,040	$26,821	$27,625	$28,454	$29,308
R&M	$20,188	$20,794	$21,418	$22,060	$22,722	$23,404	$24,106	$24,829	$25,574	$26,341	$27,131
Overhead	$67,326	$67,326	$69,346	$71,426	$73,569	$75,776	$78,049	$80,391	$82,802	$85,286	$87,845
Labour	$58,723	$58,723	$60,485	$62,299	$64,168	$66,093	$67,615	$69,270	$71,068	$73,201	$75,397
Lease	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Land interest	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total	$168,699	$169,305	$174,384	$179,615	$185,004	$190,554	$195,809	$201,310	$207,070	$213,282	$219,681
Capital	**Base input**										
Replacement		$27,904	$23,754	$17,794	$7,920	$73,657	$96,057	$187,143	$20,241	$157,979	$19,861
Land purchases		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Living	$80,000	$84,000	$88,200	$92,610	$97,241	$102,103	$107,208	$112,568	$118,196	$124,106	$130,312
Total	$80,000	$111,904	$111,954	$110,404	$105,160	$175,759	$203,264	$299,711	$138,438	$282,086	$150,173
Total fixed costs		**$281,209**	**$286,338**	**$290,019**	**$290,164**	**$366,313**	**$399,074**	**$501,022**	**$345,508**	**$495,368**	**$369,853**
		1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
EBIT		$278,972	-$32,220	$221,120	$224,885	-$198,882	$124,310	-$40,595	-$159,649	-$233,074	-$32,036
Tax		-$95,622	-$6,401	$0	-$36,348	-$49,227	$0	-$12,338	$0	$0	$0
Cumulative balance		$183,350	$149,312	$374,165	$572,055	$338,248	$471,015	$429,857	$280,955	$54,905	$24,242
Interest		$4,584	$3,733	$9,354	$14,301	$8,456	$11,775	$10,746	$7,024	$1,373	$606
	Opening balance										
Cashflow	**$0**	**$187,933**	**$153,045**	**$383,519**	**$586,357**	**$346,704**	**$482,790**	**$440,604**	**$287,979**	**$56,277**	**$24,848**
				Decadal cash margin (closing minus opening balance)						**$24,848**	

Decadal cash margin

CASH FLOW

Gross Margin	Decade	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962
Crop		$207,507	$71,401	$234,638	$219,916	-$6,986	$194,041	$12,659	$68,413	$146,536	$128,058
Sheep (Grassgro)		$203,856	$142,502	$161,984	$178,881	$135,773	$138,640	$160,592	$231,405	$153,052	$176,875
Pasture		-$37,640	-$39,146	-$40,712	-$42,340	-$44,034	-$45,795	-$47,627	-$49,532	-$51,514	-$53,574
Gross Margin		**$373,723**	**$174,757**	**$355,910**	**$356,457**	**$84,753**	**$286,886**	**$125,624**	**$250,285**	**$248,074**	**$251,359**
Fixed costs	**Budget**										
Fuel & Oil	$22,462	$22,462	$23,136	$23,830	$24,545	$25,281	$26,040	$26,821	$27,625	$28,454	$29,308
R&M	$20,188	$20,794	$21,418	$22,060	$22,722	$23,404	$24,106	$24,829	$25,574	$26,341	$27,131
Overhead	$67,326	$67,326	$69,346	$71,426	$73,569	$75,776	$78,049	$80,391	$82,802	$85,286	$87,845
Labour	$58,723	$58,723	$60,485	$62,299	$64,168	$66,093	$67,654	$69,392	$70,973	$73,102	$75,295
Lease	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Land interest	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total	$168,699	$169,305	$174,384	$179,615	$185,004	$190,554	$195,849	$201,433	$206,975	$213,184	$219,579
Capital	**Base input**										
Replacement		$27,904	$23,754	$17,794	$7,920	$73,657	$96,057	$187,143	$20,241	$157,979	$19,861
Land purchases		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Living	$80,000	$84,000	$88,200	$92,610	$97,241	$102,103	$107,208	$112,568	$118,196	$124,106	$130,312
Total	$80,000	$111,904	$111,954	$110,404	$105,160	$175,759	$203,264	$299,711	$138,438	$282,086	$150,173
Total fixed costs		**$281,209**	**$286,338**	**$290,019**	**$290,164**	**$366,313**	**$399,113**	**$501,144**	**$345,412**	**$495,269**	**$369,752**

		1953	1954	1955	1956	1957	1958	1959	1960	1961	1962
EBIT		$92,514	-$111,581	$65,891	$66,293	-$281,561	-$112,227	-$375,520	-$95,127	-$247,195	-$118,393
Tax		-$4,724	-$1,020	$0	-$6,482	-$4,646	$0	$0	$0	$0	$0
Cumulative balance		$87,790	-$22,616	$41,691	$102,544	-$181,098	-$306,002	-$702,942	-$847,275	#########	-$1,352,937
Interest		$2,195	-$1,583	$1,042	$2,564	-$12,677	-$21,420	-$49,206	-$59,309	-$80,765	-$94,706
	Opening balance										
Cashflow	**$0**	**$89,984**	**-$24,199**	**$42,734**	**$105,108**	**-$193,775**	**-$327,422**	**-$752,148**	**-$906,584**	**#########**	**-$1,447,643**

Decadal cash margin (closing minus opening balance) **-$1,447,643**

CASH FLOW

Gross Margin	Decade	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Crop		$142,117	-$65,046	$191,623	$258,190	$205,169	$346,959	$218,237	$249,417	$253,922	$534,746
Sheep (Grassgro)		$287,797	$224,882	$322,476	$286,723	$147,874	$209,857	$261,647	$248,667	$279,240	$267,358
Pasture		-$37,640	-$39,146	-$40,712	-$42,340	-$44,034	-$45,795	-$47,627	-$49,532	-$51,514	-$53,574
Gross Margin		**$392,274**	**$120,689**	**$473,387**	**$502,573**	**$309,009**	**$511,020**	**$432,257**	**$448,551**	**$481,647**	**$748,530**
Fixed costs	**Budget**										
Fuel & Oil	$22,462	$22,462	$23,136	$23,830	$24,545	$25,281	$26,040	$26,821	$27,625	$28,454	$29,308
R&M	$20,188	$20,794	$21,418	$22,060	$22,722	$23,404	$24,106	$24,829	$25,574	$26,341	$27,131
Overhead	$67,326	$67,326	$69,346	$71,426	$73,569	$75,776	$78,049	$80,391	$82,802	$85,286	$87,845
Labour	$58,723	$58,723	$32,485	$33,459	$34,463	$35,497	$36,126	$36,891	$37,606	$38,734	$39,896
Lease	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Land interest	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total	$168,699	$169,305	$146,384	$150,775	$155,299	$159,958	$164,321	$168,932	$173,607	$178,816	$184,180
Capital	**Base input**										
Replacement		$27,904	$23,754	$17,794	$7,920	$73,657	$96,057	$187,143	$20,241	$157,979	$19,861
Land purchases		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Living	$80,000	$84,000	$88,200	$92,610	$97,241	$102,103	$107,208	$112,568	$118,196	$124,106	$130,312
Total	$80,000	$111,904	$111,954	$110,404	$105,160	$175,759	$203,264	$299,711	$138,438	$282,086	$150,173
Total fixed costs		**$281,209**	**$258,338**	**$261,179**	**$260,459**	**$335,717**	**$367,585**	**$468,643**	**$312,045**	**$460,901**	**$334,353**

		1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
EBIT		$111,065	-$137,648	$212,208	$242,114	-$26,707	$143,435	-$36,386	$136,506	$20,746	$414,178
Tax		-$13,768	-$3,559	$0	-$26,968	-$40,186	$0	-$100	$0	-$20,887	$0
Cumulative balance		$97,297	-$41,478	$167,826	$387,169	$329,954	$481,638	$457,193	$605,128	$620,116	$1,049,796
Interest		$2,432	-$2,903	$4,196	$9,679	$8,249	$12,041	$11,430	$15,128	$15,503	$26,245
	Opening balance										
Cashflow	**$0**	**$99,730**	**-$44,381**	**$172,022**	**$396,848**	**$338,203**	**$493,679**	**$468,622**	**$620,256**	**$635,619**	**$1,076,041**

Decadal cash margin (closing minus opening balance) **$1,076,041**

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CASH FLOW

Gross Margin	Decade	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
Crop		$262,229	$48,706	$278,426	$249,936	$221,554	$80,716	$193,868	-$23,635	$153,056	-$56,439
Sheep (Grassgro)		$218,756	$175,481	$220,952	$226,236	$295,214	$343,396	$334,152	$272,935	$256,670	$161,933
Pasture		-$37,640	-$39,146	-$40,712	-$42,340	-$44,034	-$45,795	-$47,627	-$49,532	-$51,514	-$53,574
Gross Margin		**$443,345**	**$185,041**	**$458,666**	**$433,832**	**$472,735**	**$378,316**	**$480,393**	**$199,768**	**$358,212**	**$51,919**
Fixed costs	**Budget**										
Fuel & Oil	$22,462	$22,462	$23,136	$23,830	$24,545	$25,281	$26,040	$26,821	$27,625	$28,454	$29,308
R&M	$20,188	$20,794	$21,418	$22,060	$22,722	$23,404	$24,106	$24,829	$25,574	$26,341	$27,131
Overhead	$67,326	$67,326	$69,346	$71,426	$73,569	$75,776	$78,049	$80,391	$82,802	$85,286	$87,845
Labour	$58,723	$58,723	$60,485	$62,299	$64,168	$66,093	$67,634	$69,190	$70,992	$73,121	$57,815
Lease	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Land interest	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total	$168,699	$169,305	$174,384	$179,615	$185,004	$190,554	$195,828	$201,230	$206,993	$213,203	$202,099
Capital	**Base input**										
Replacement		$27,904	$23,754	$17,794	$7,920	$73,657	$96,057	$187,143	$20,241	$157,979	$19,861
Land purchases		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Living	$80,000	$84,000	$88,200	$92,610	$97,241	$102,103	$107,208	$112,568	$118,196	$124,106	$130,312
Total	$80,000	$111,904	$111,954	$110,404	$105,160	$175,759	$203,264	$299,711	$138,438	$282,086	$150,173
Total fixed costs		**$281,209**	**$286,338**	**$290,019**	**$290,164**	**$366,313**	**$399,092**	**$500,942**	**$345,431**	**$495,289**	**$352,272**
		1958	**1959**	**1960**	**1961**	**1962**	**1963**	**1964**	**1965**	**1966**	**1967**
EBIT		$162,136	-$101,297	$168,647	$143,668	$106,421	-$20,776	-$20,548	-$145,664	-$137,077	-$300,353
Tax		-$38,665	-$5,008	$0	-$28,940	-$9,822	-$8,449	$0	$0	$0	$0
Cumulative balance		$123,471	$20,252	$189,406	$308,869	$413,190	$394,295	$383,604	$247,530	$116,642	-$180,795
Interest		$3,087	$506	$4,735	$7,722	$10,330	$9,857	$9,590	$6,188	$2,916	-$12,656
	Opening balance										
Cashflow	**$0**	**$126,558**	**$20,759**	**$194,141**	**$316,591**	**$423,520**	**$404,152**	**$393,194**	**$253,718**	**$119,558**	**-$193,450**

Decadal cash margin (closing minus opening balance) **-$193,450**

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CASH FLOW

Gross Margin	Decade	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Crop		$10,648	-$27,914	$124,551	-$108,971	$60,737	-$108,971	-$95,657	-$70,530	-$108,971	$364,487
Sheep (Grassgro)		$166,043	$131,605	$128,893	-$3,111	$71,656	-$76,761	$6,865	$16,412	$70,272	$159,567
Pasture		-$37,640	-$39,146	-$40,712	-$42,340	-$44,034	-$45,795	-$47,627	-$49,532	-$51,514	-$53,574
Gross Margin		**$139,051**	**$64,546**	**$212,732**	**-$154,422**	**$88,359**	**-$231,526**	**-$136,420**	**-$103,650**	**-$90,212**	**$470,480**
Fixed costs	**Budget**										
Fuel & Oil	$22,462	$22,462	$23,136	$23,830	$24,545	$25,281	$26,040	$26,821	$27,625	$28,454	$29,308
R&M	$20,188	$20,794	$21,418	$22,060	$22,722	$23,404	$24,106	$24,829	$25,574	$26,341	$27,131
Overhead	$67,326	$67,326	$69,346	$71,426	$73,569	$75,776	$78,049	$80,391	$82,802	$85,286	$87,845
Labour	$30,723	$30,723	$3,645	$3,754	-$31,133	-$49,567	-$51,150	-$52,825	-$54,625	-$91,264	-$94,002
Lease	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Land interest	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total	$140,699	$141,305	$117,544	$121,070	$89,702	$74,893	$77,044	$79,215	$81,376	$48,817	$50,282
Capital	**Base input**										
Replacement		$27,904	$23,754	$17,794	$7,920	$73,657	$96,057	$187,143	$20,241	$157,979	$19,861
Land purchases		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Living	$80,000	$84,000	$88,200	$92,610	$97,241	$102,103	$107,208	$112,568	$118,196	$124,106	$130,312
Total	$80,000	$111,904	$111,954	$110,404	$105,160	$175,759	$203,264	$299,711	$138,438	$282,086	$150,173
Total fixed costs		**$253,209**	**$229,498**	**$231,474**	**$194,862**	**$250,653**	**$280,308**	**$378,927**	**$219,814**	**$330,903**	**$200,455**

		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
EBIT		-$114,158	-$164,952	-$18,742	-$349,284	-$162,293	-$511,835	-$515,346	-$323,464	-$421,115	$270,025
Tax		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Cumulative balance		-$114,158	-$287,101	-$325,940	-$698,040	-$909,196	#########	#########	#########	#########	-$3,128,329
Interest		-$7,991	-$20,097	-$22,816	-$48,863	-$63,644	-$103,927	-$147,276	-$180,228	-$222,322	-$218,983
	Opening balance										
Cashflow	**$0**	**-$122,149**	**-$307,198**	**-$348,756**	**-$746,903**	**-$972,840**	#########	#########	#########	#########	**-$3,347,312**

Decadal cash margin (closing minus opening balance) **-$3,347,312**

NOTE

- **A strongly positive gross margin can be associated with large whole farm losses**

Modelling risk and variability

Yields X Price

=

Income – Variable costs

=

Gross Margin - Fixed & Capital costs (incl. Living costs)

=

EBIT - Tax & cumulative interest

=

Cashflow (Change in cash flow = Decadal cash margin)

Including risk in decision-making

Static and dynamic budgeting

Conventional static budget

Av. prices

Av. yields

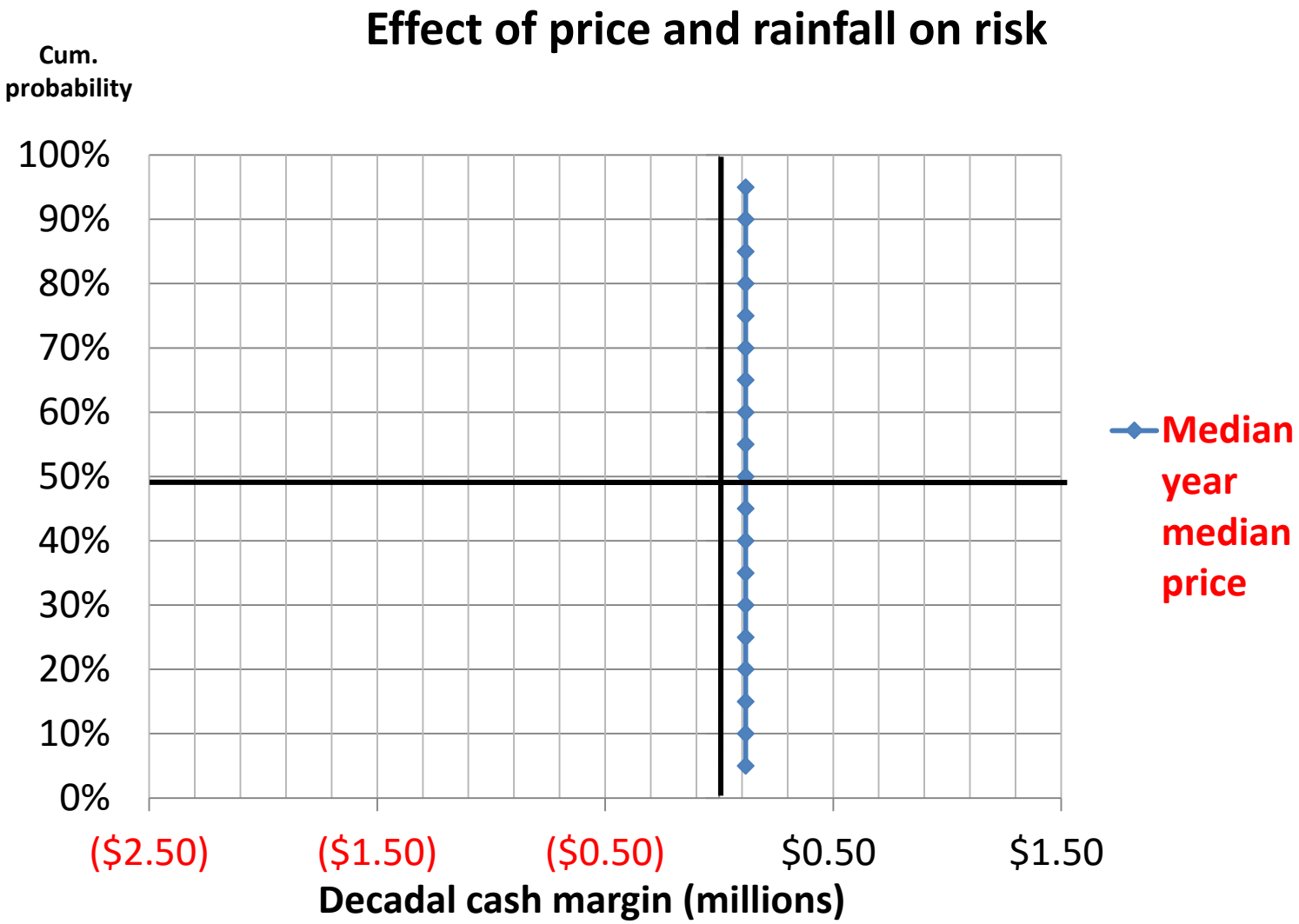
One year

80% equity

Gross Margin		Average
Crop		$215,598
Sheep (Grassgro)		$256,359
Pasture		-$37,640
Gross Margin		**$434,316**
Fixed costs	**Budget**	
Fuel & Oil	$22,462	$22,462
R&M	$20,188	$20,794
Overhead	$67,326	$67,326
Labour	$58,723	$58,723
Lease	$0	$0
Land interest	$0	$0
Total	$168,699	$169,305
Capital	**Base input**	
Replacement		$27,904
Land purchases		$0
Living	$80,000	$84,000
Total	$80,000	$111,904
Total fixed costs		**$281,209**
		Average
EBIT		$153,107
Tax		-$34,263
Cumulative balance		-$760,120
Interest		-$53,208
	Opening balance	
Cashflow	**-$878,964**	**-$813,328**
	$65,636	

Conventional static budgeting

Static = unresponsive to risk



Conventional static budget

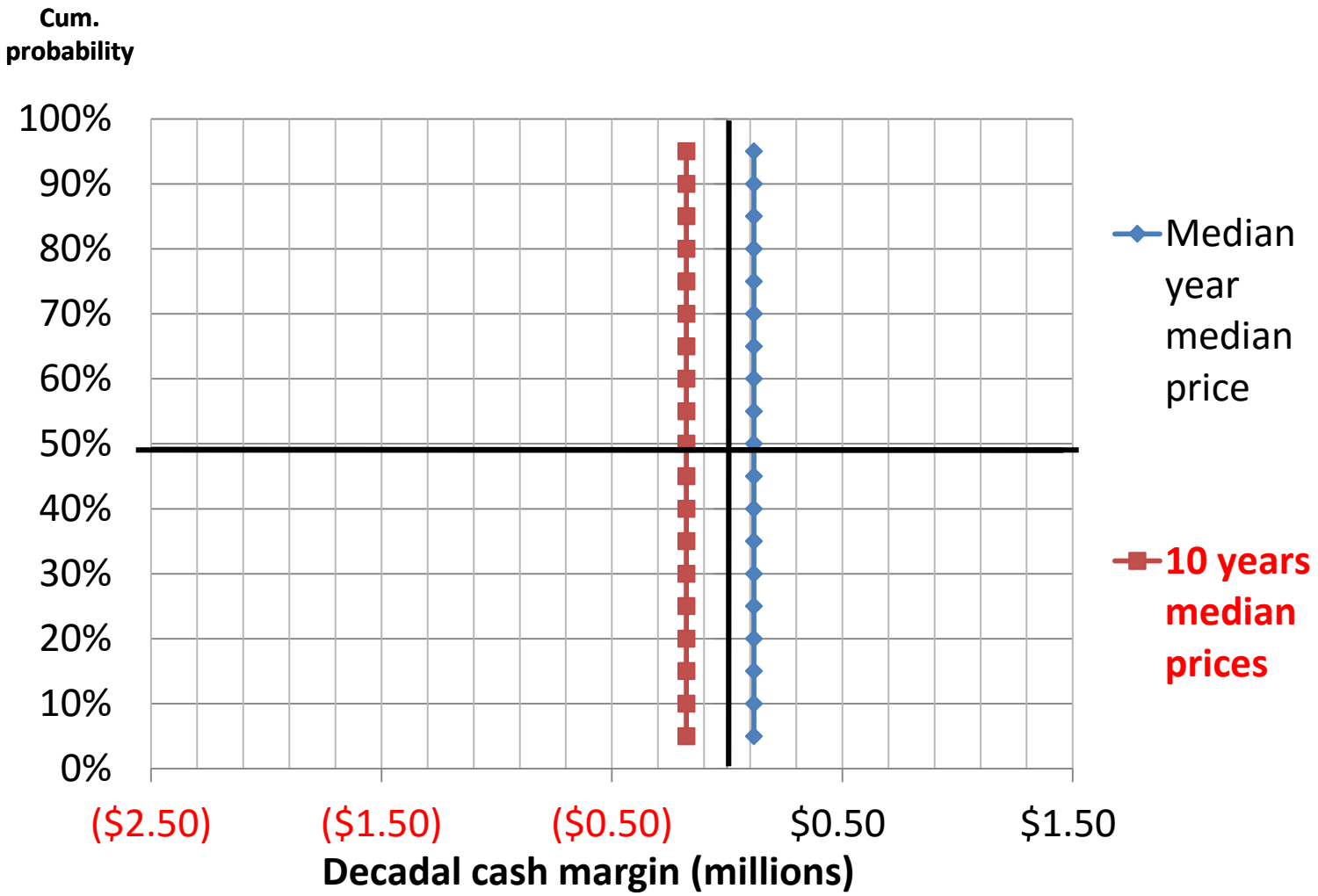
Av. prices, av. yields, 10 years, 80% equity

Gross Margin		Average	Average	Average	Average	Average	Average	Average	Average	Average	Average
Crop		$215,598	$212,900	$210,490	$207,984	$205,377	$202,666	$199,847	$196,915	$193,866	$190,695
Sheep (Grassgro)		$256,359	$248,739	$246,165	$243,488	$240,704	$237,808	$234,797	$231,665	$228,408	$225,021
Pasture		-$37,640	-$39,146	-$40,712	-$42,340	-$44,034	-$45,795	-$47,627	-$49,532	-$51,514	-$53,574
Gross Margin		**$434,316**	**$422,493**	**$415,943**	**$409,131**	**$402,047**	**$394,679**	**$387,017**	**$379,048**	**$370,760**	**$362,141**
Fixed costs	**Budget**										
Fuel & Oil	$22,462	$22,462	$23,136	$23,830	$24,545	$25,281	$26,040	$26,821	$27,625	$28,454	$29,308
R&M	$20,188	$20,794	$21,418	$22,060	$22,722	$23,404	$24,106	$24,829	$25,574	$26,341	$27,131
Overhead	$67,326	$67,326	$69,346	$71,426	$73,569	$75,776	$78,049	$80,391	$82,802	$85,286	$87,845
Labour	$58,723	$58,723	$60,485	$62,299	$64,168	$66,093	$67,547	$68,912	$70,720	$72,841	$75,027
Lease	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Land interest	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total	$168,699	$169,305	$174,384	$179,615	$185,004	$190,554	$195,742	$200,952	$206,721	$212,923	$219,311
Capital	**Base input**										
Replacement		$27,904	$23,754	$17,794	$7,920	$73,657	$96,057	$187,143	$20,241	$157,979	$19,861
Land purchases		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Living	$80,000	$84,000	$88,200	$92,610	$97,241	$102,103	$107,208	$112,568	$118,196	$124,106	$130,312
Total	$80,000	$111,904	$111,954	$110,404	$105,160	$175,759	$203,264	$299,711	$138,438	$282,086	$150,173
Total fixed costs		**$281,209**	**$286,338**	**$290,019**	**$290,164**	**$366,313**	**$399,006**	**$500,664**	**$345,159**	**$495,009**	**$369,483**
		Average	**Average**	**Average**	**Average**	**Average**	**Average**	**Average**	**Average**	**Average**	**Average**
EBIT		$153,107	$136,155	$125,924	$118,967	$35,734	-$4,327	-$113,647	$33,889	-$124,248	-$7,342
Tax		-$34,263	-$2,926	-$9,420	-$2,356	-$1,904	$0	$0	$0	$0	$0
Cumulative balance		-$760,120	-$680,099	-$611,202	-$537,374	-$541,160	-$583,368	-$737,851	-$755,611	-$932,753	-$1,005,388
Interest		-$53,208	-$47,607	-$42,784	-$37,616	-$37,881	-$40,836	-$51,650	-$52,893	-$65,293	-$70,377
	Opening balance										
Cashflow	**-$878,964**	**-$813,328**	**-$727,706**	**-$653,986**	**-$574,990**	**-$579,041**	**-$624,204**	**-$789,500**	**-$808,504**	**-$998,045**	**-$1,075,765**

Decadal cash margin (closing minus opening balance) **-$196,801**

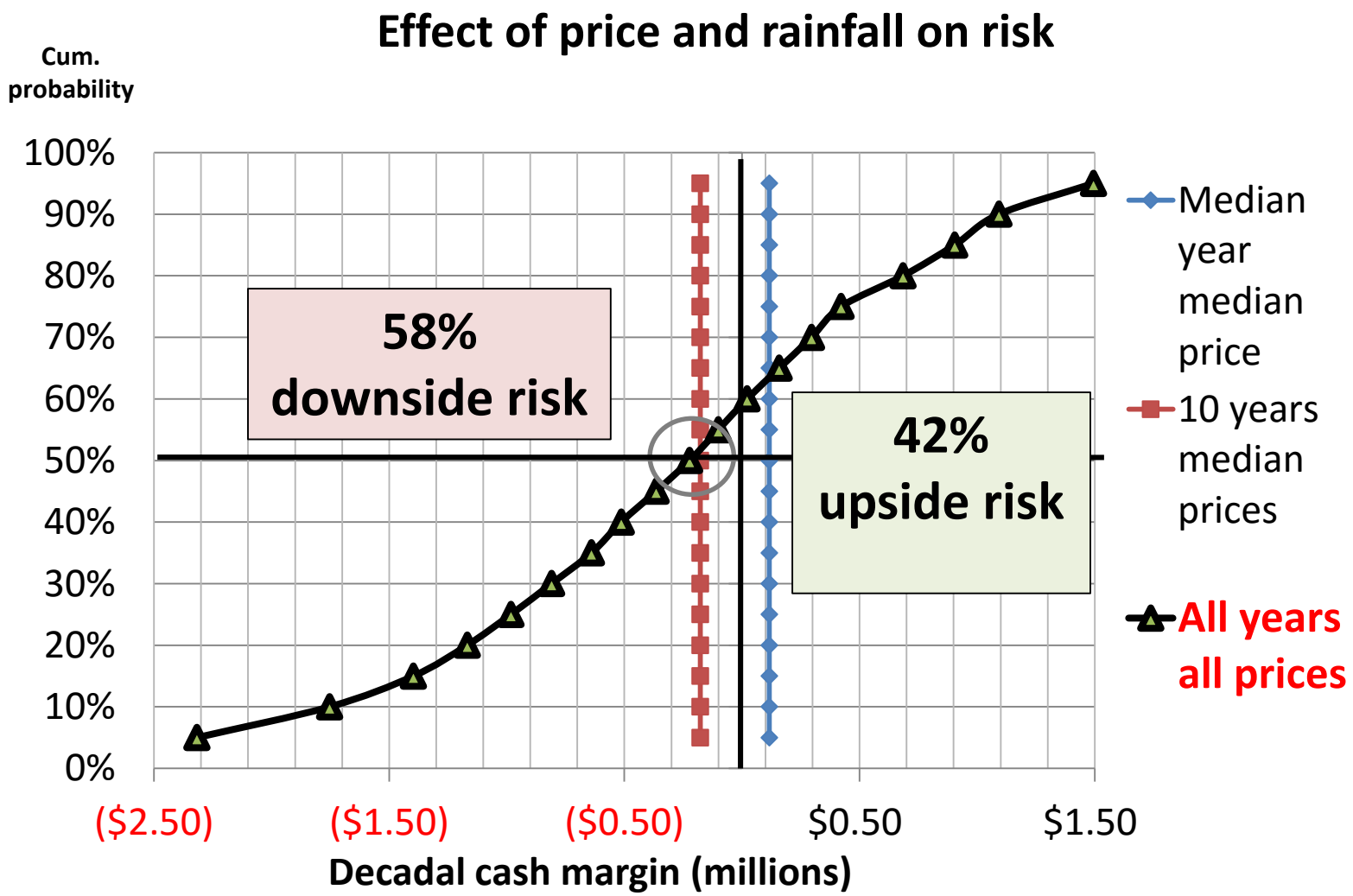
Conventional static budgeting, 10 years

Shows effects of inflation on costs



Dynamic budgeting for risk

Dynamic = responds to risk



~40% higher risk of a loss than a surplus

Conclusions

These results apply to a representative farm in the Wagga region of southern New South Wales, where 64% of all farms have areas less than 1,000 ha. and equities are less than 80%.

- **The results show the importance of modelling the <u>whole farm</u> accounts**

  Gross margins only include ~30% of costs

- **Important to include variability**

  Risk is the defining feature of Australian agriculture

  Static budgets do not allow for the effect of compounding interest on debt.

  The effects of yields and price variability is multiplicative

- **Dynamic budgeting can be used to compare and quantify the resilience and viability of farms and farming systems**

- **Dynamic budgeting is no more predictive than static budgeting, but it can be used to flag the need for change.**

This paper concludes that conventional budgets could encourage sub-optimal, and even loss-making farming practices and should be replaced with whole-farm, long-term, dynamic budgeting systems, which allow for the natural variability of key inputs.