



**AgEcon** SEARCH  
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

*The World's Largest Open Access Agricultural & Applied Economics Digital Library*

**This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.**

**Help ensure our sustainability.**

Give to AgEcon Search

AgEcon Search  
<http://ageconsearch.umn.edu>  
[aesearch@umn.edu](mailto:aesearch@umn.edu)

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*



# **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**

# The IF model

## Intensive Farming model

**A framework for modelling  
farm financial risk**

[www.grahamcentre.net](http://www.grahamcentre.net)

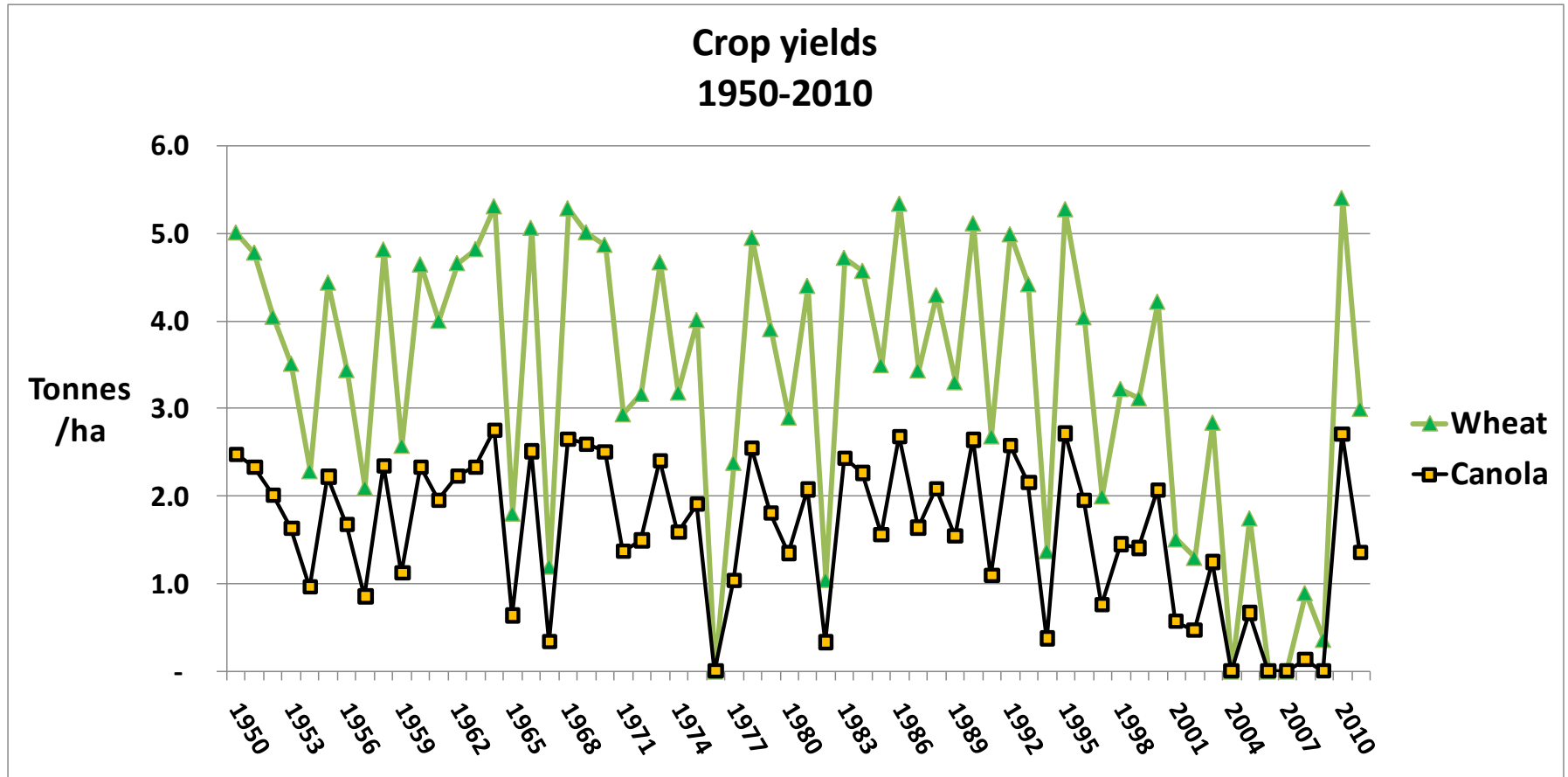
# The IF Model

## *Risk is uncontrolled variability*

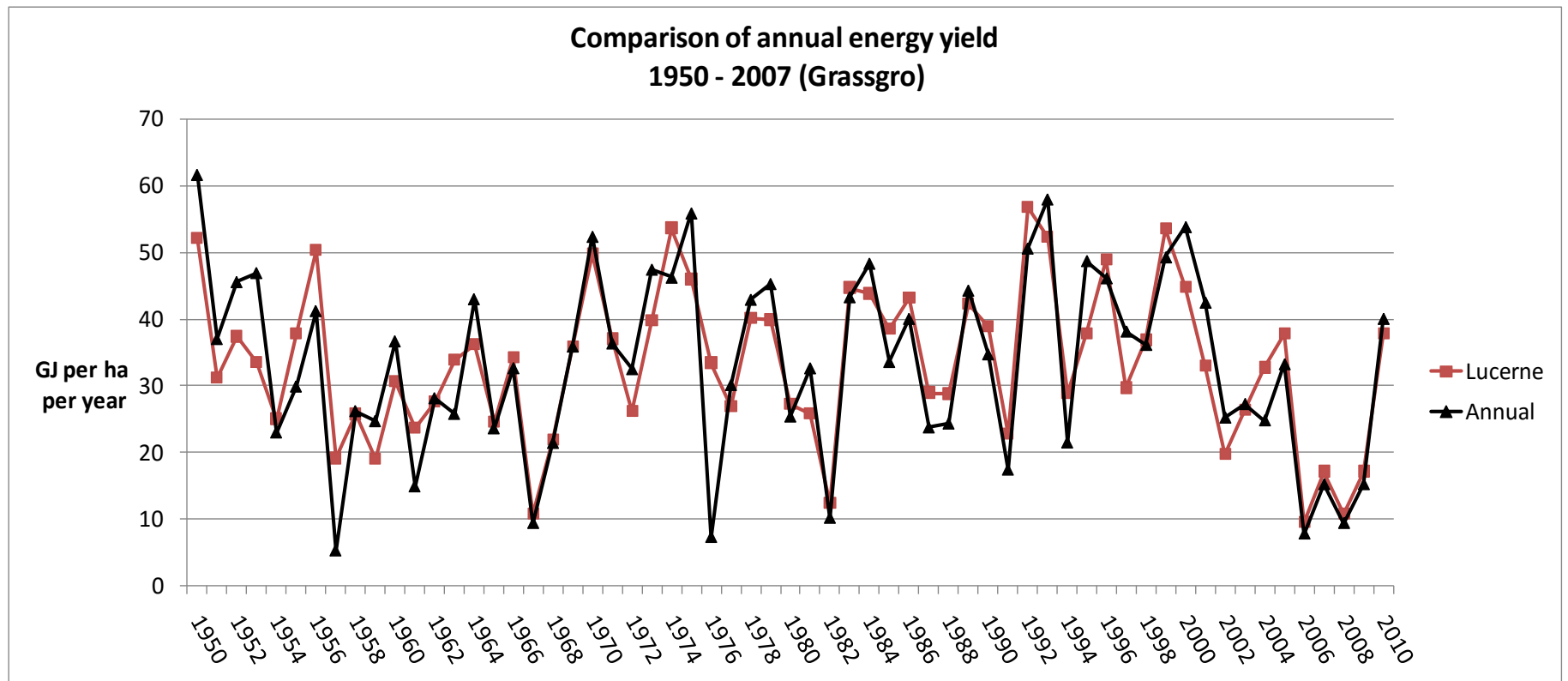
- Risk is an essential feature of farm management in Australia.
- Farmers have to manage extra-ordinary levels of variability, yet make decisions without knowing the financial risks involved.
- The IF model provides a framework and methodology for quantifying that risk.

# Long-term crop yield simulations

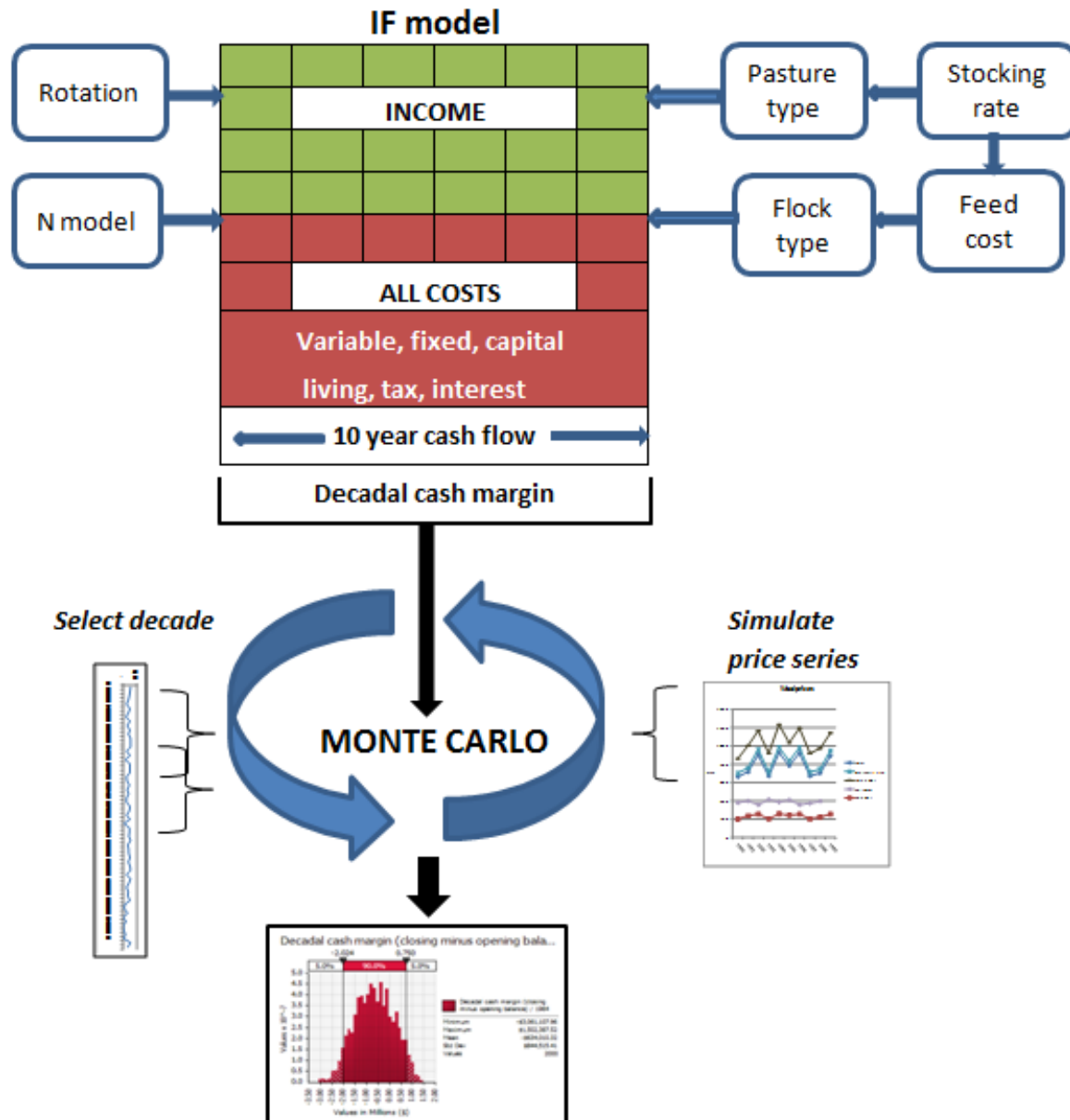
Correlated ( $r^2 > 0.85$ ) with local farm yields for 20 years



# Long-term pasture energy yields (after Grassgro)

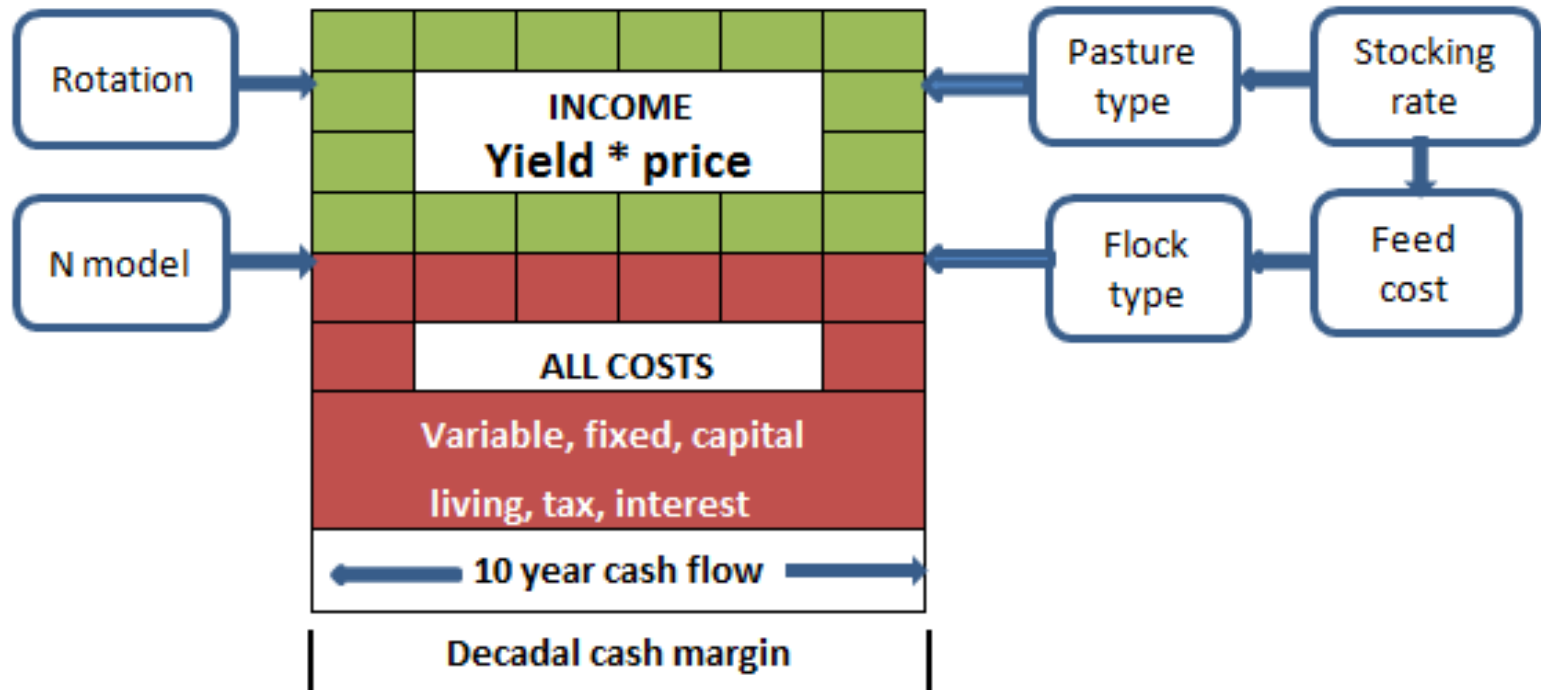


# BUSINESS PROCESS MODEL



## BUSINESS PROCESS MODEL

### The IF Model





# Cashflow template

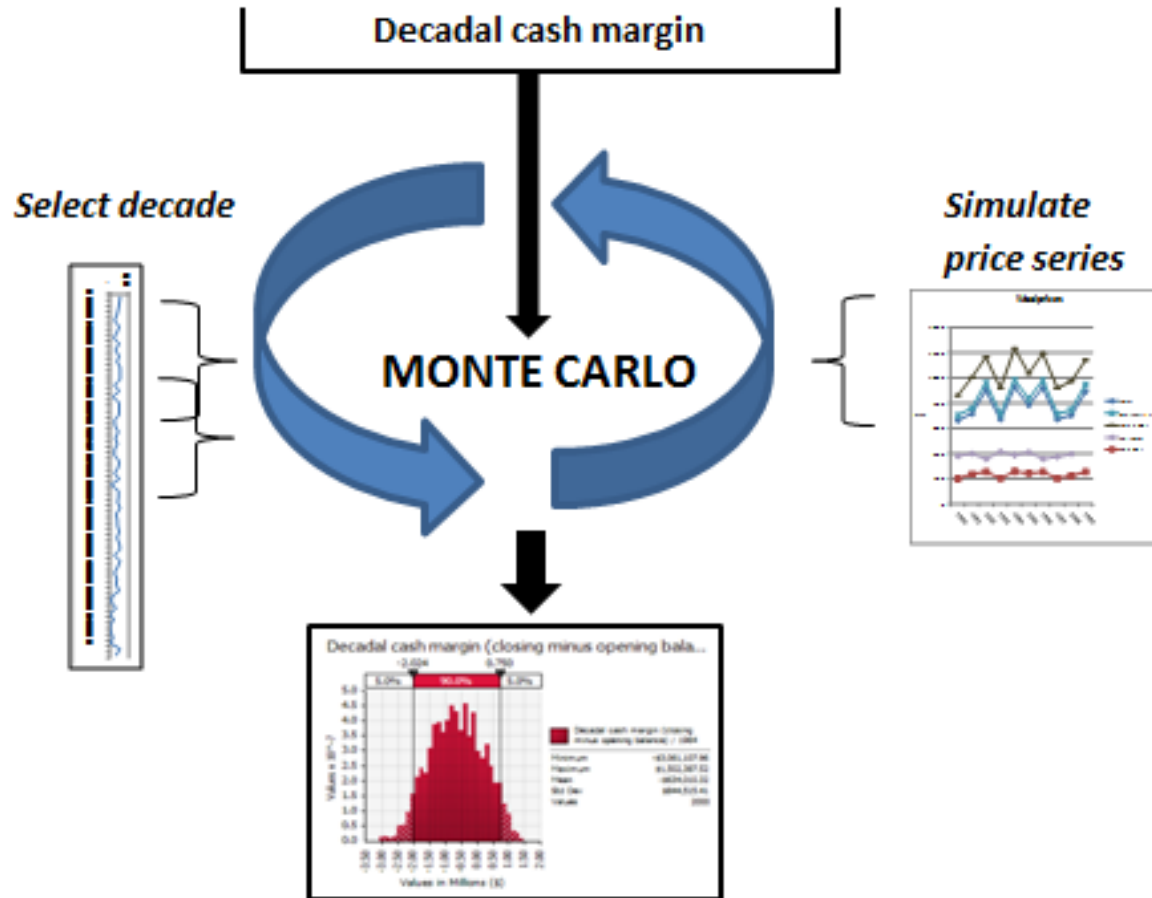
Every row automatically adjusts for variations in production and price

<b>CASH FLOW</b>												
<b>Gross Margin</b>	<b>Decade</b>	<b>1981</b>	<b>1982</b>	<b>1983</b>	<b>1984</b>	<b>1985</b>	<b>1986</b>	<b>1987</b>	<b>1988</b>	<b>1989</b>	<b>1990</b>	
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	
<b>Gross Margin</b>		<b>\$392,274</b>	<b>\$120,689</b>	<b>\$473,387</b>	<b>\$502,573</b>	<b>\$309,009</b>	<b>\$511,020</b>	<b>\$432,257</b>	<b>\$448,551</b>	<b>\$481,647</b>	<b>\$748,530</b>	
<b>Fixed costs</b>	<b>Budget</b>											
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	
<b>Total</b>	<b>\$168,699</b>	<b>\$169,305</b>	<b>\$146,384</b>	<b>\$150,775</b>	<b>\$155,299</b>	<b>\$159,958</b>	<b>\$164,321</b>	<b>\$168,932</b>	<b>\$173,607</b>	<b>\$178,816</b>	<b>\$184,180</b>	
<b>Capital</b>	<b>Base input</b>											
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	
<b>Total</b>	<b>\$80,000</b>	<b>\$111,904</b>	<b>\$111,954</b>	<b>\$110,404</b>	<b>\$105,160</b>	<b>\$175,759</b>	<b>\$203,264</b>	<b>\$299,711</b>	<b>\$138,438</b>	<b>\$282,086</b>	<b>\$150,173</b>	
<b>Total fixed costs</b>		<b>\$281,209</b>	<b>\$258,338</b>	<b>\$261,179</b>	<b>\$260,459</b>	<b>\$335,717</b>	<b>\$367,585</b>	<b>\$468,643</b>	<b>\$312,045</b>	<b>\$460,901</b>	<b>\$334,353</b>	
<b>EBIT</b>		<b>\$111,065</b>	<b>-\$137,648</b>	<b>\$212,208</b>	<b>\$242,114</b>	<b>-\$26,707</b>	<b>\$143,435</b>	<b>-\$36,386</b>	<b>\$136,506</b>	<b>\$20,746</b>	<b>\$414,178</b>	
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											
<b>Cashflow</b>	<b>\$0</b>	<b>\$99,730</b>	<b>-\$44,381</b>	<b>\$172,022</b>	<b>\$396,848</b>	<b>\$338,203</b>	<b>\$493,679</b>	<b>\$468,622</b>	<b>\$620,256</b>	<b>\$635,619</b>	<b>\$1,076,041</b>	
***				<b>Decadal cash margin (closing minus opening balance)</b>							<b>\$1,076,041</b>	

# @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**

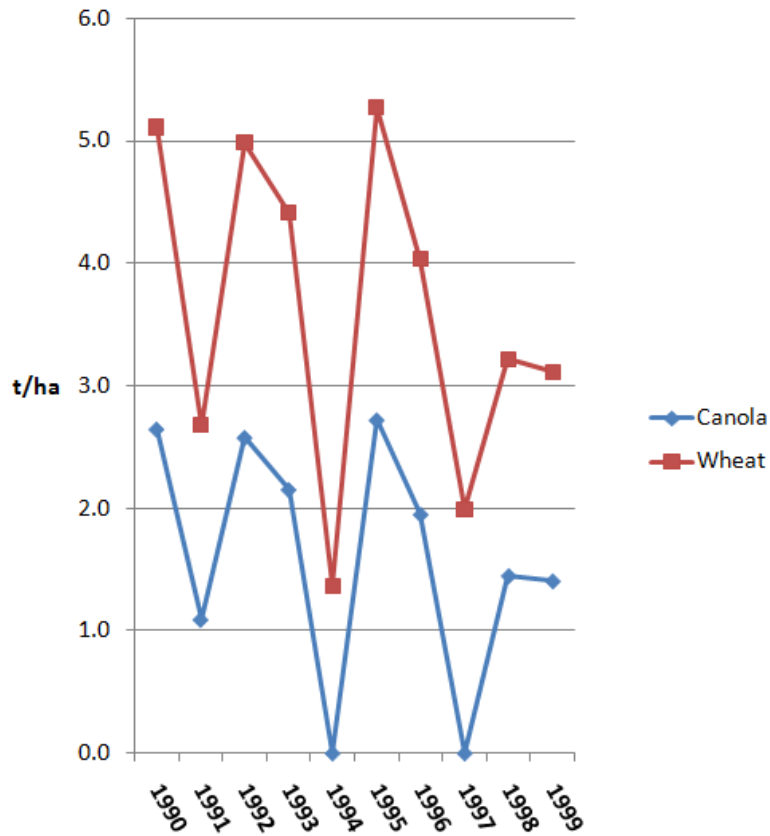
**Wagga Wagga region**

1950-2010

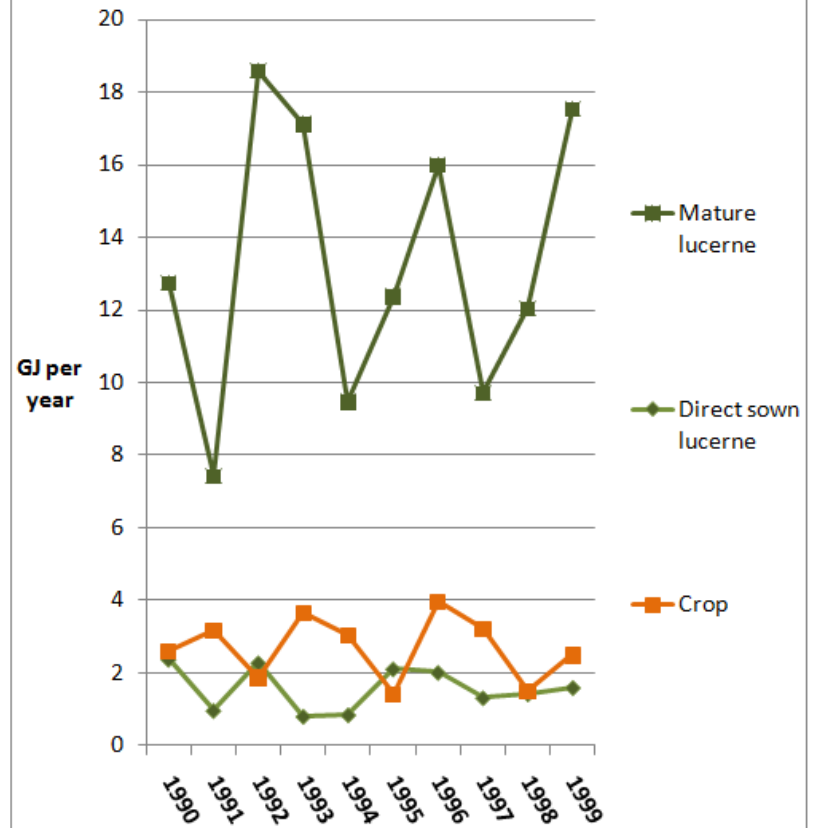
# Randomly selected decades 1950-2010

## Selected crop and pasture yields

### Crop yields



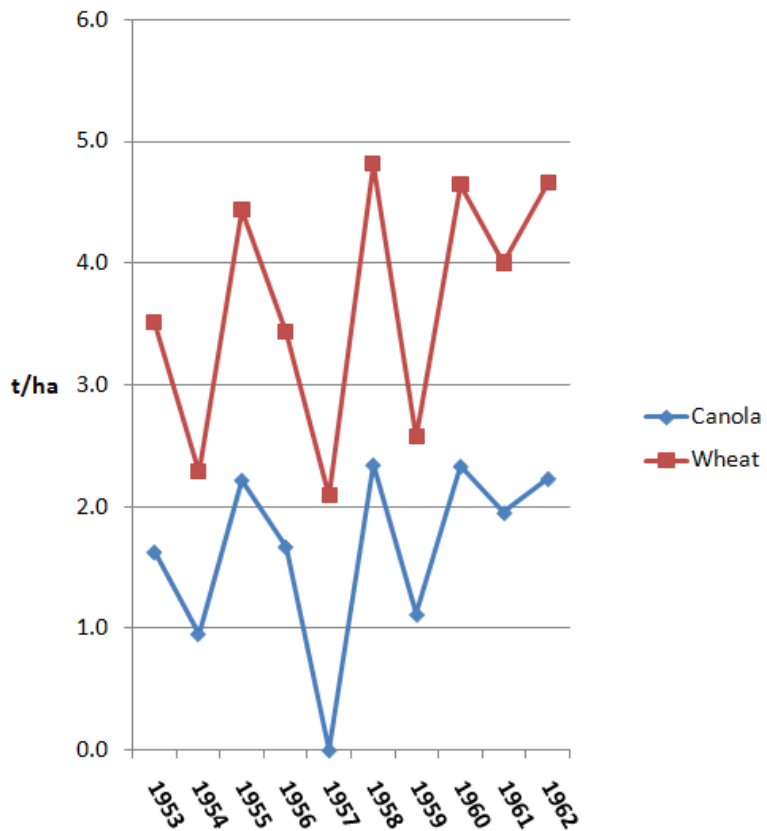
### Pasture energy yield



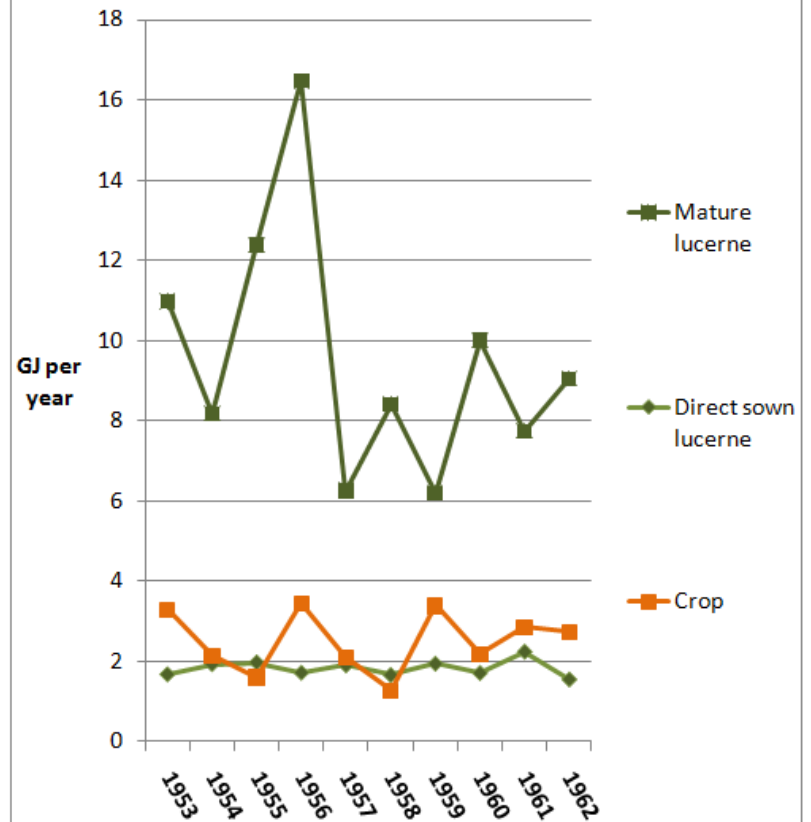
# Randomly selected decades 1950-2010

## Selected crop and pasture yields

### Crop yields



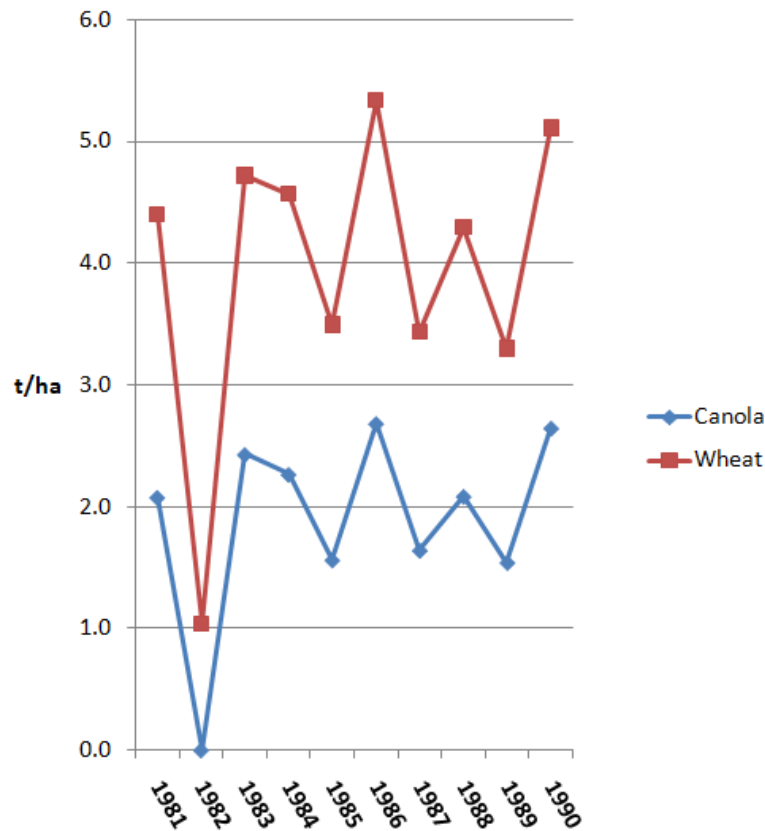
### Pasture energy yield



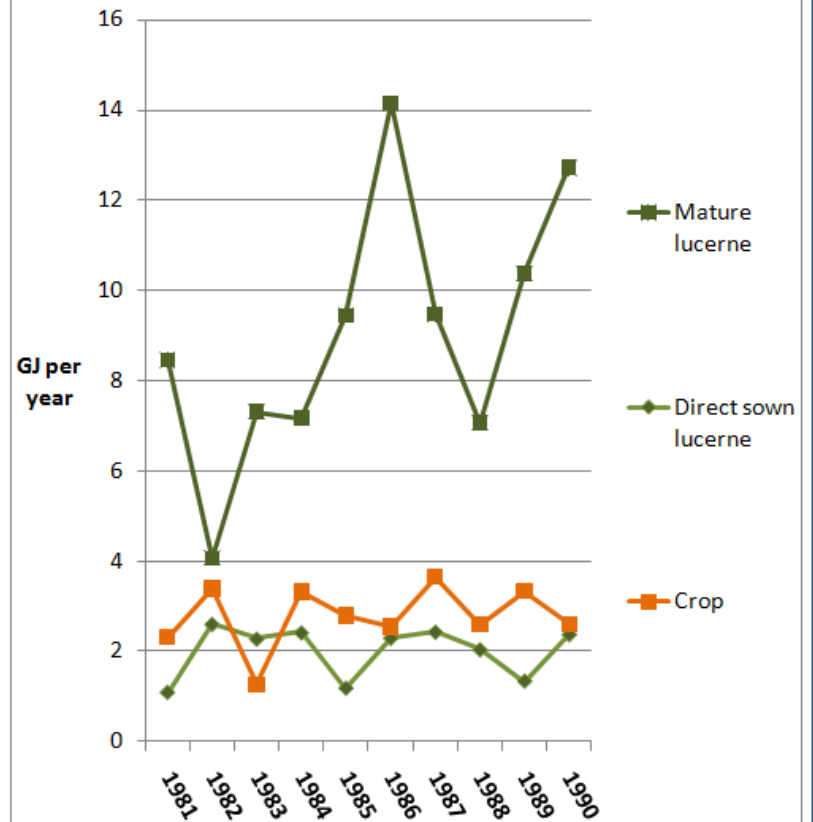
# Randomly selected decades 1950-2010

## Selected crop and pasture yields

Crop yields



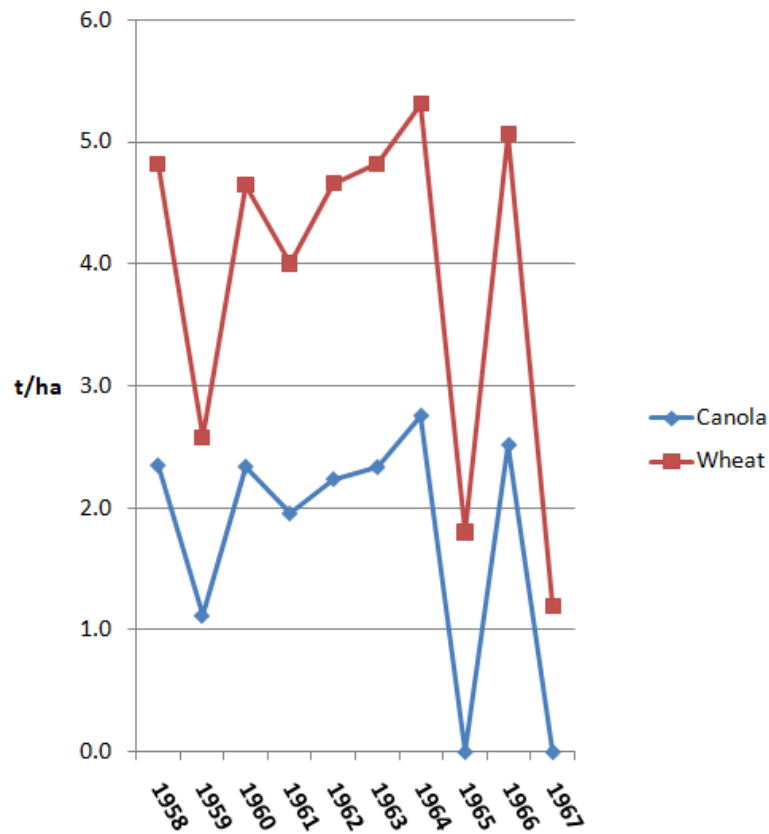
Pasture energy yield



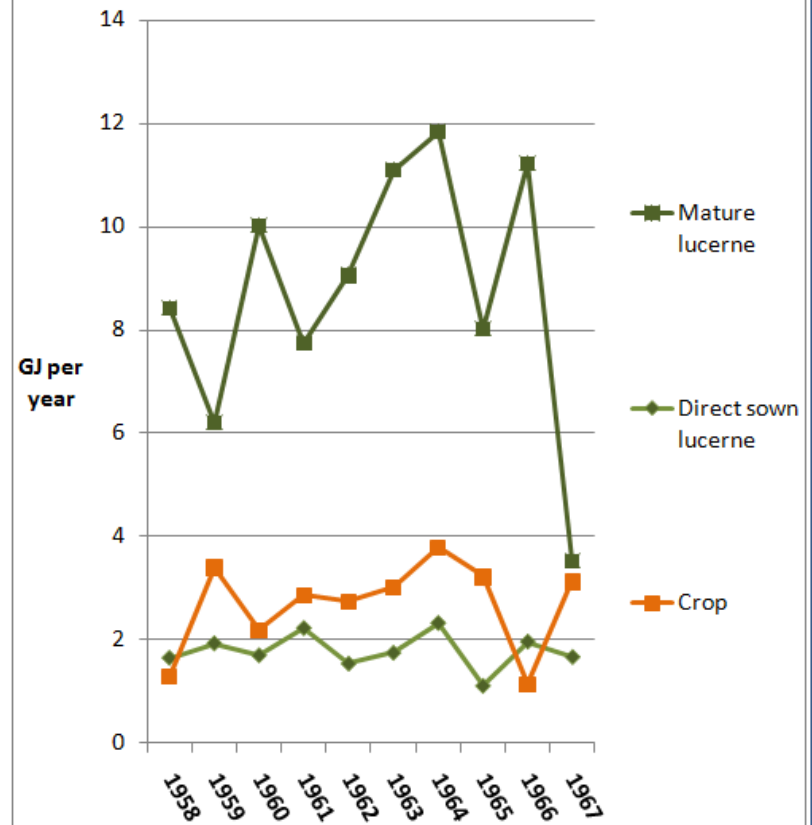
# Randomly selected decades 1950-2010

## Selected crop and pasture yields

### Crop yields



### Pasture energy yield

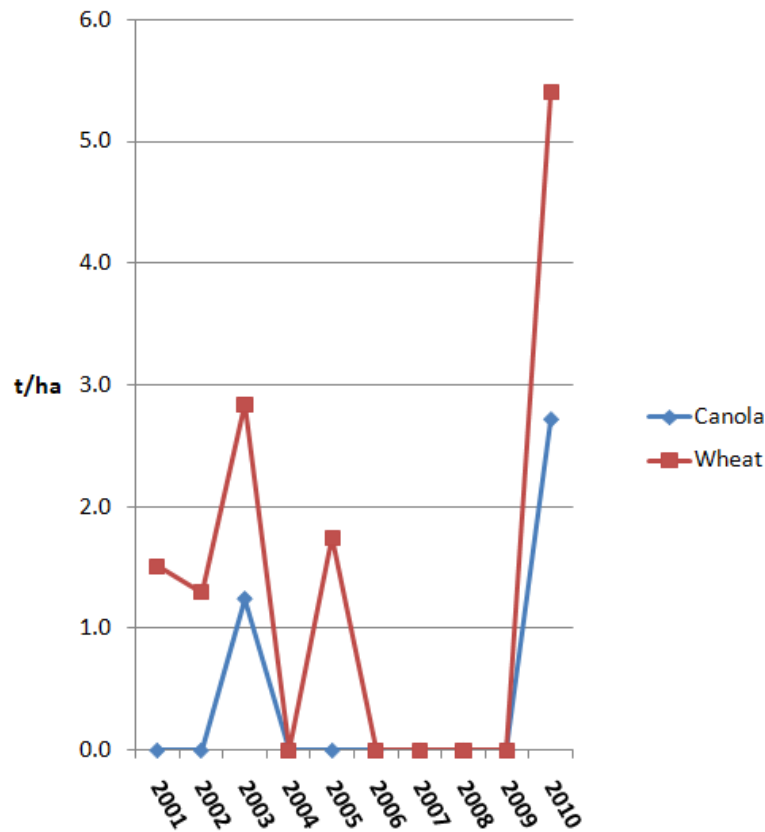




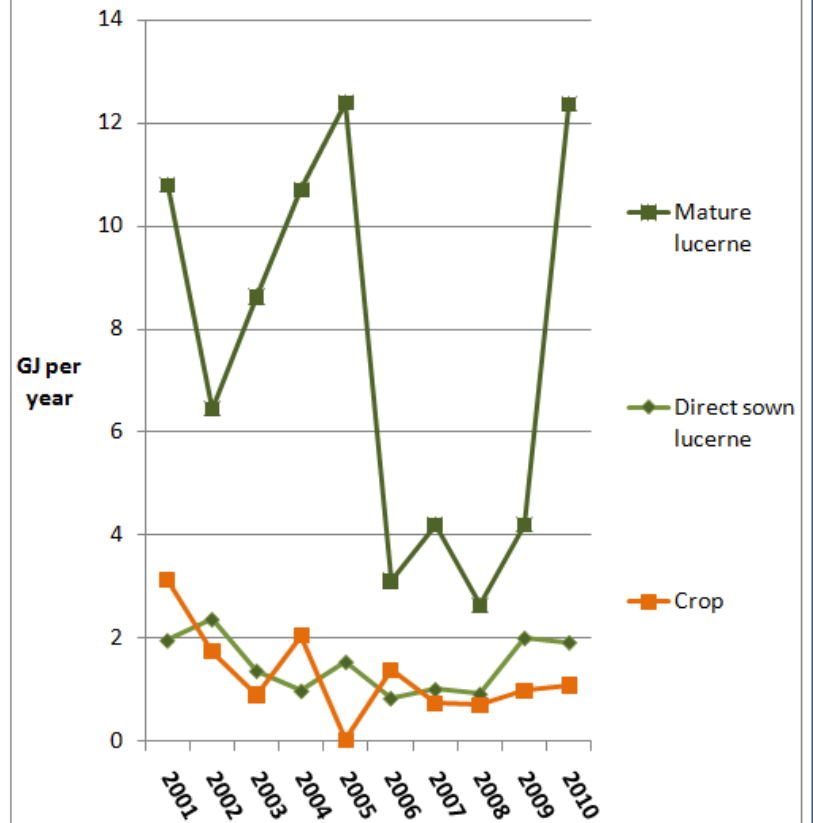
# Randomly selected decades 1950-2010

## Selected crop and pasture yields

### Crop yields



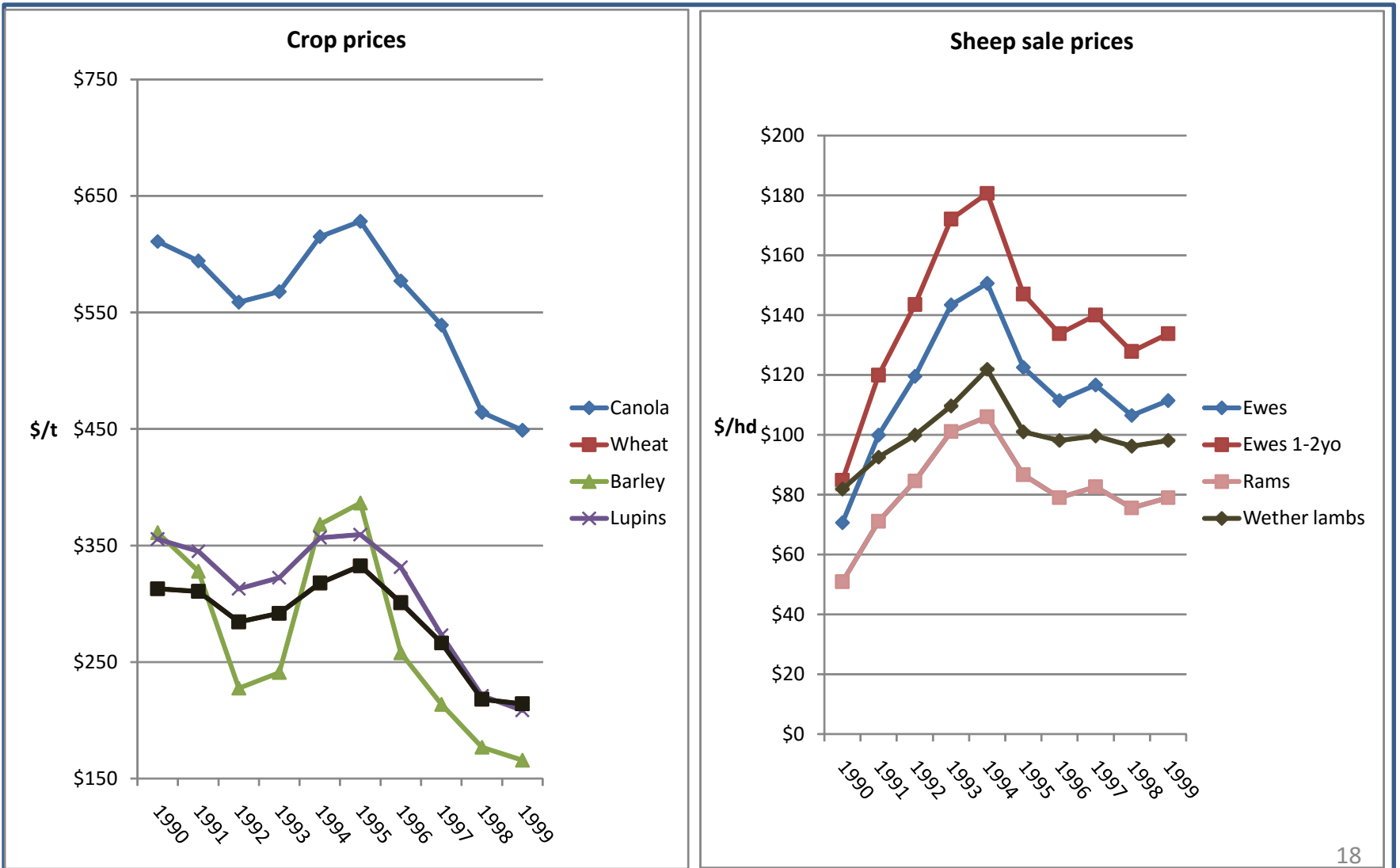
### Pasture energy yield



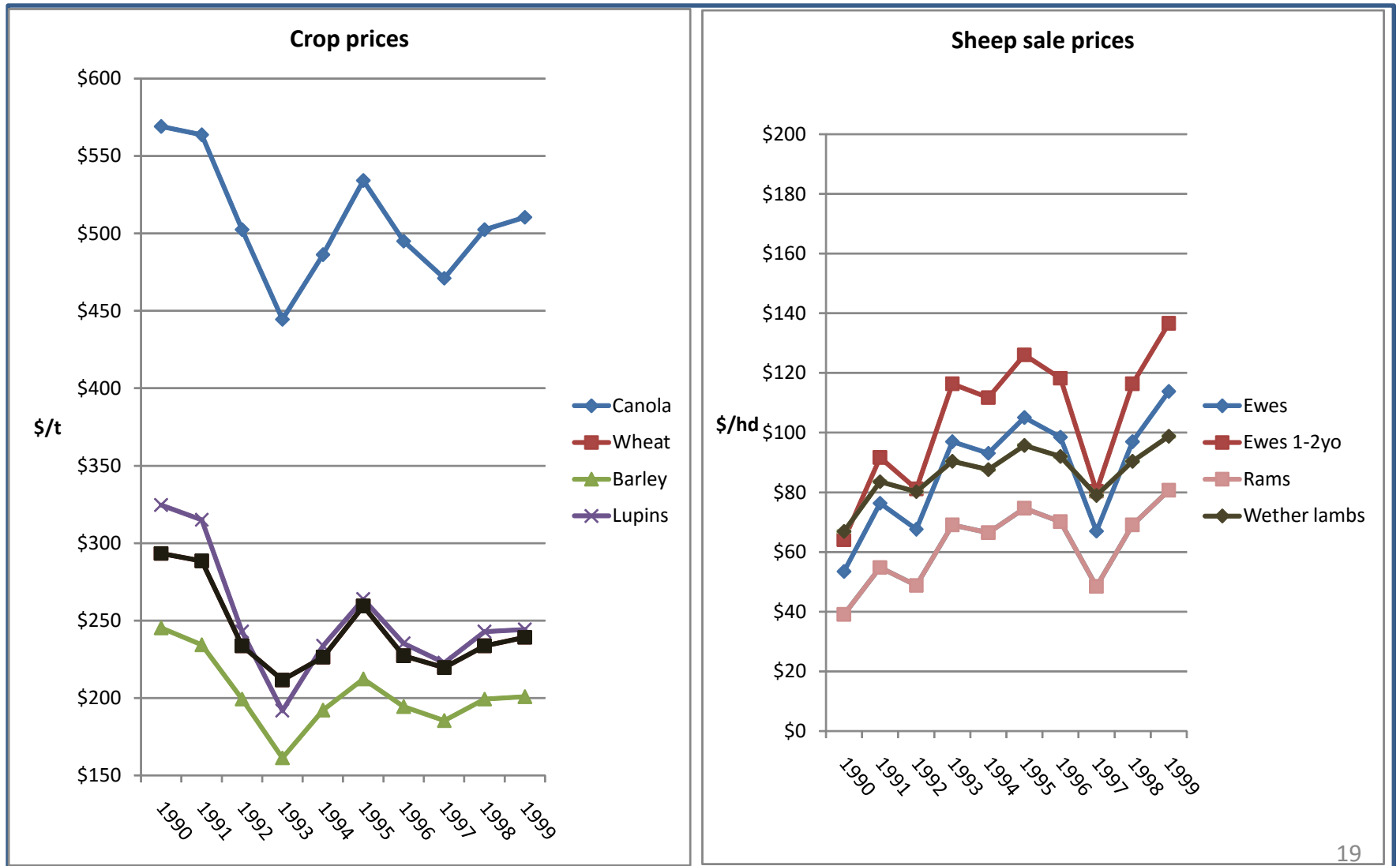
# Price risk

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

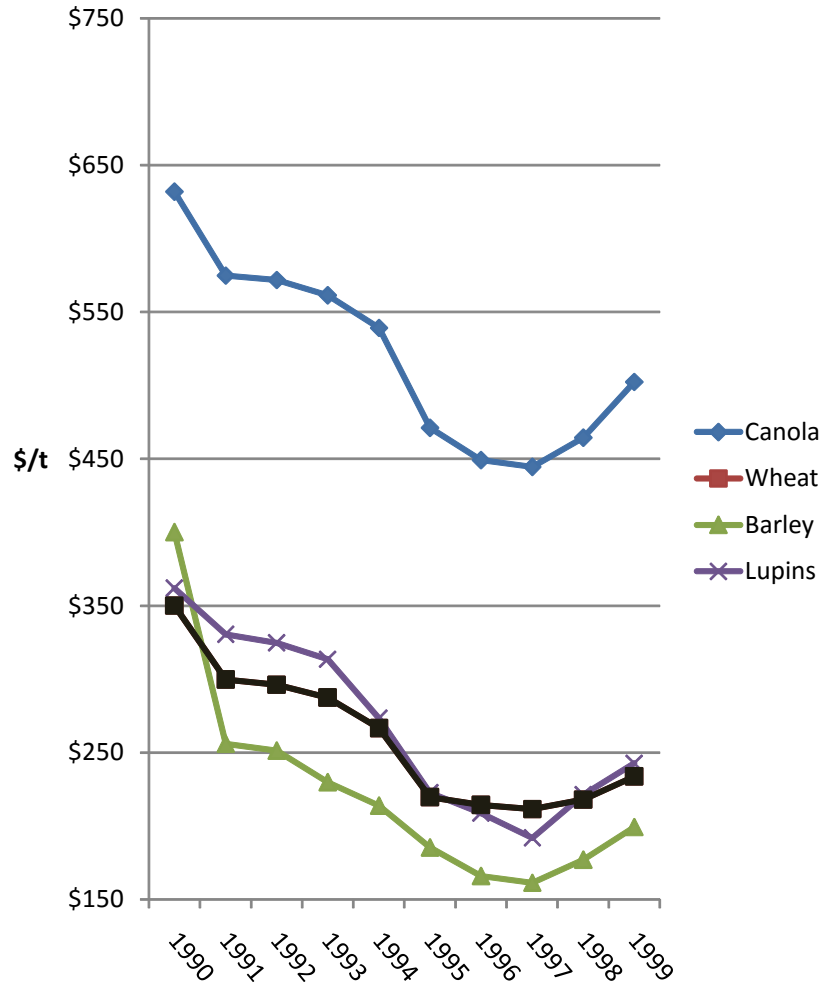
# Examples of simulated price series for a range of crop and livestock commodities



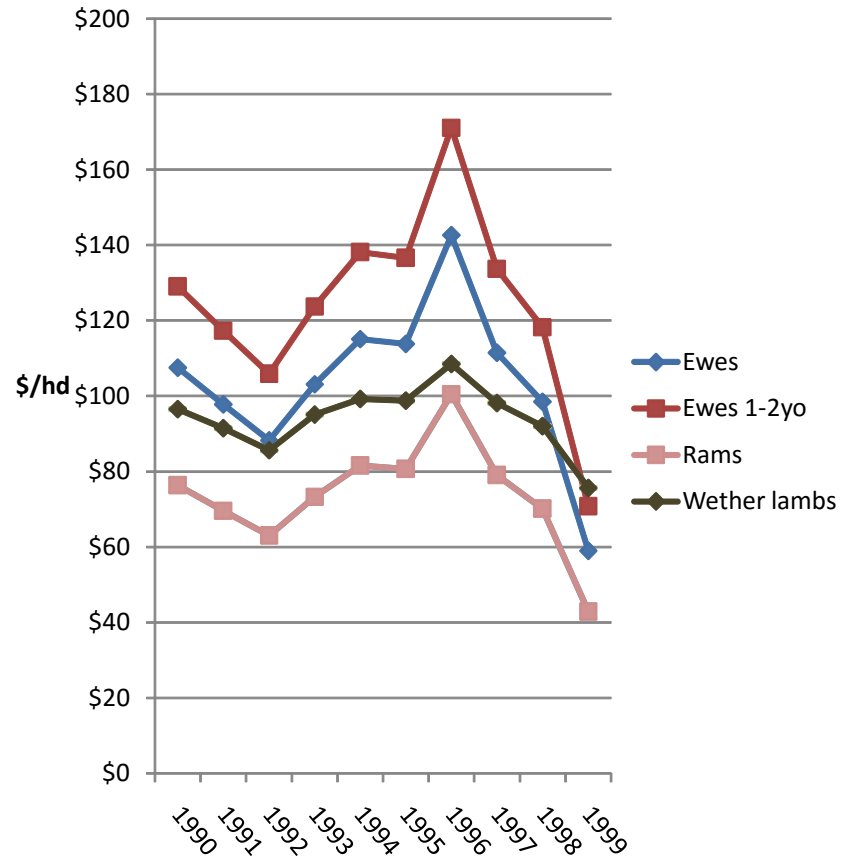
# Simulated 10-year price series for crop and sheep commodities



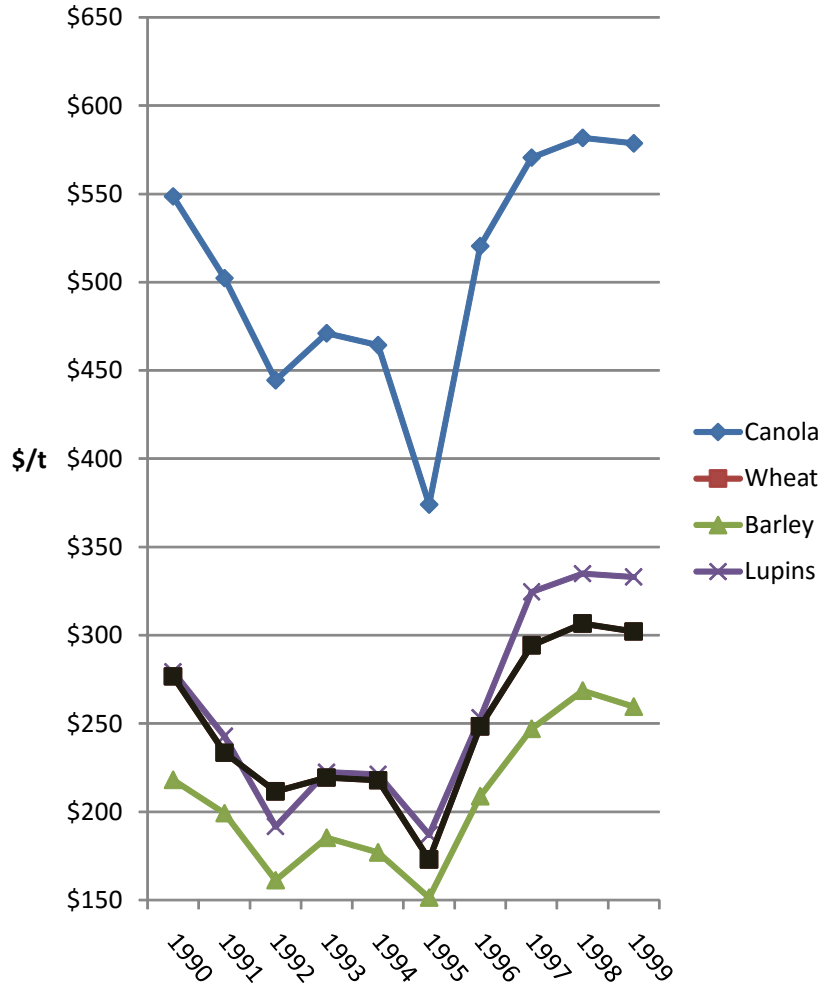
**Crop prices**



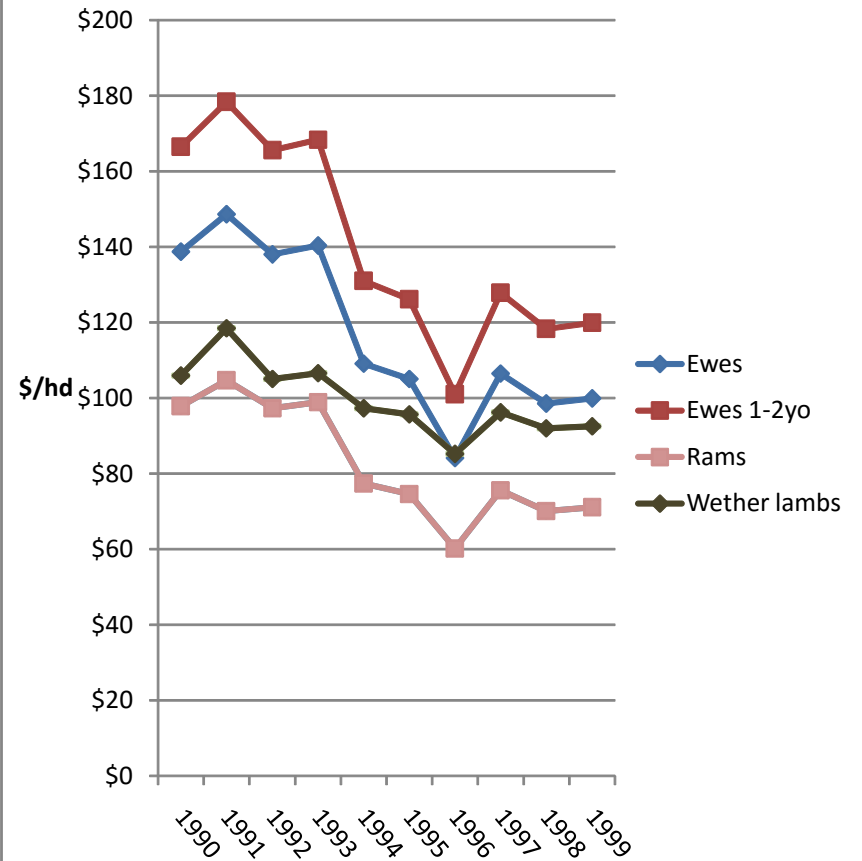
**Sheep sale prices**



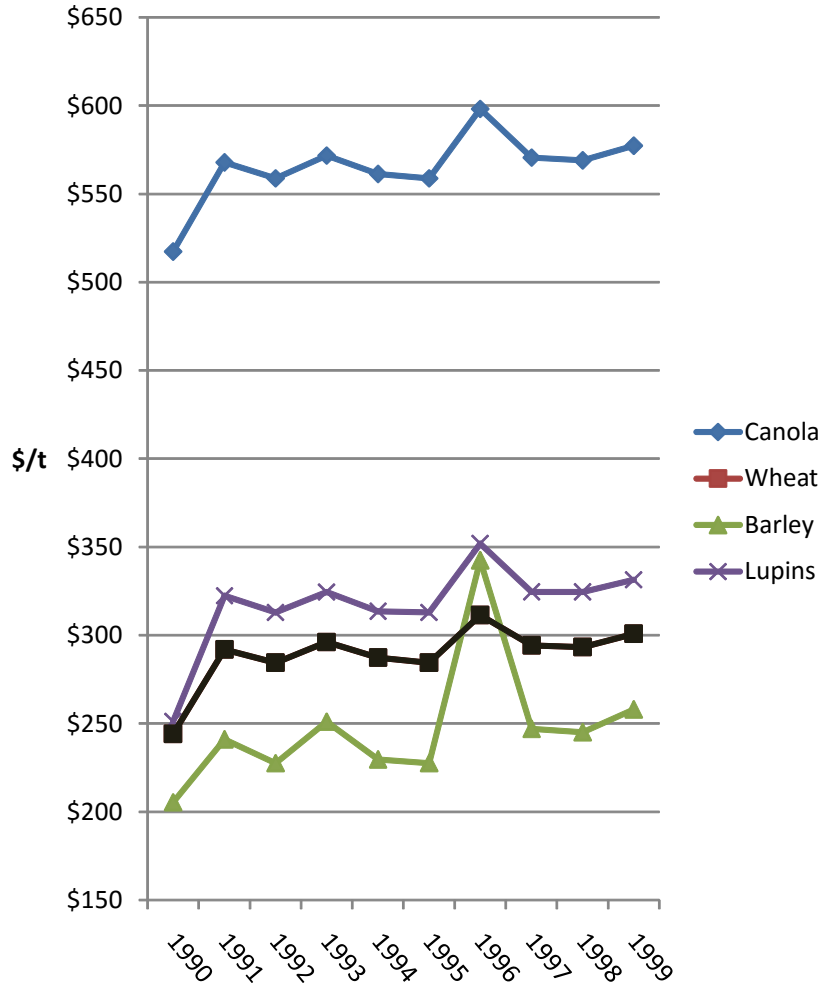
**Crop prices**



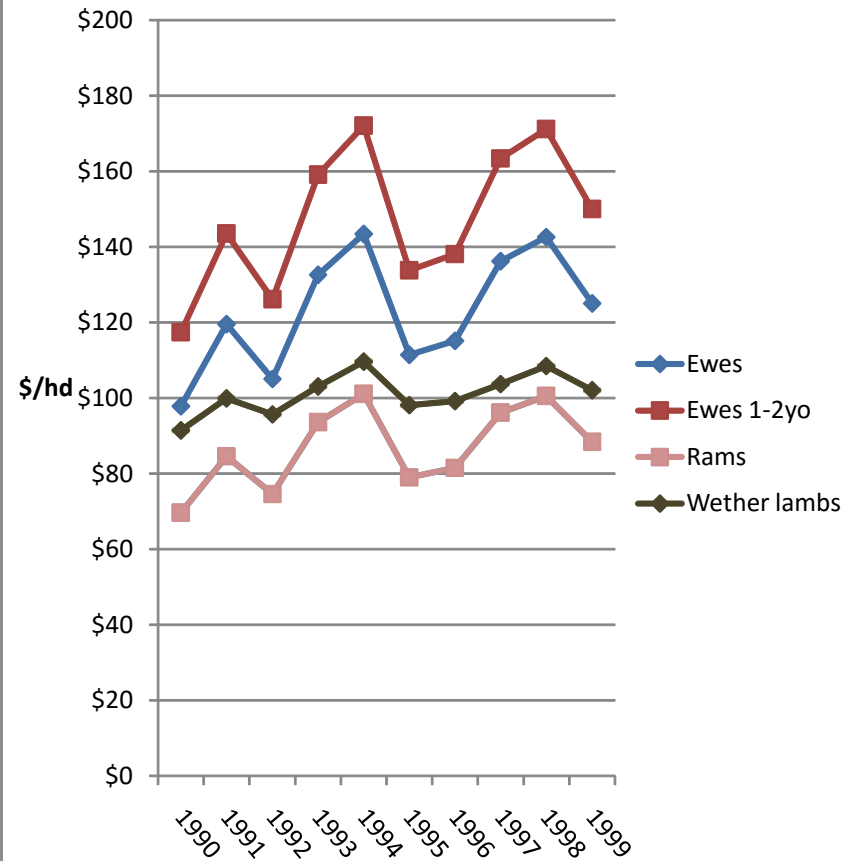
**Sheep sale prices**



**Crop prices**



**Sheep sale prices**



## Modelling risk and variability

Yields X Price

=

Income – Variable costs

=

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

=

EBIT - Tax & cumulative interest

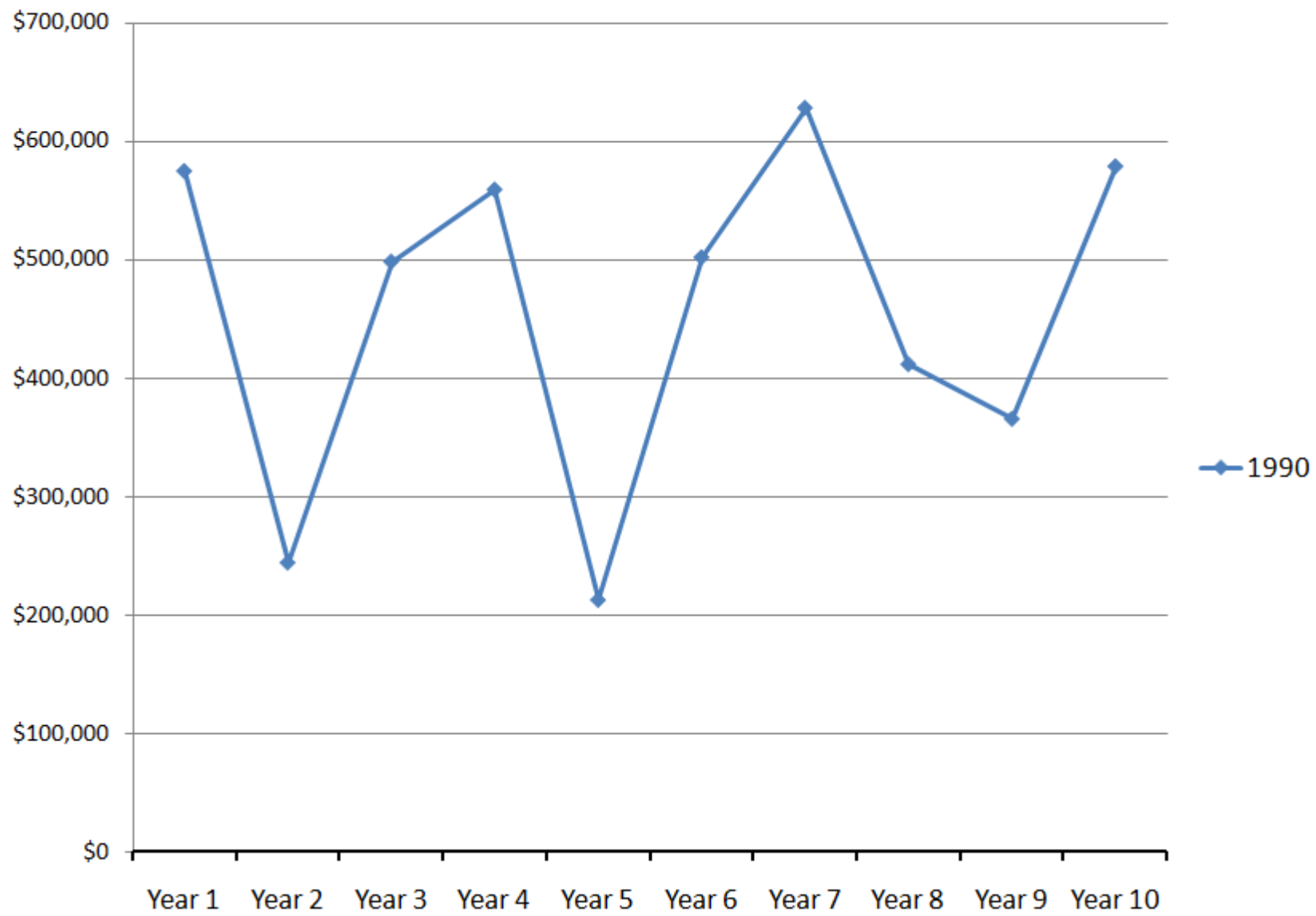
=

Cashflow (Change in cash flow = Decadal cash margin)

Including risk in decision-making



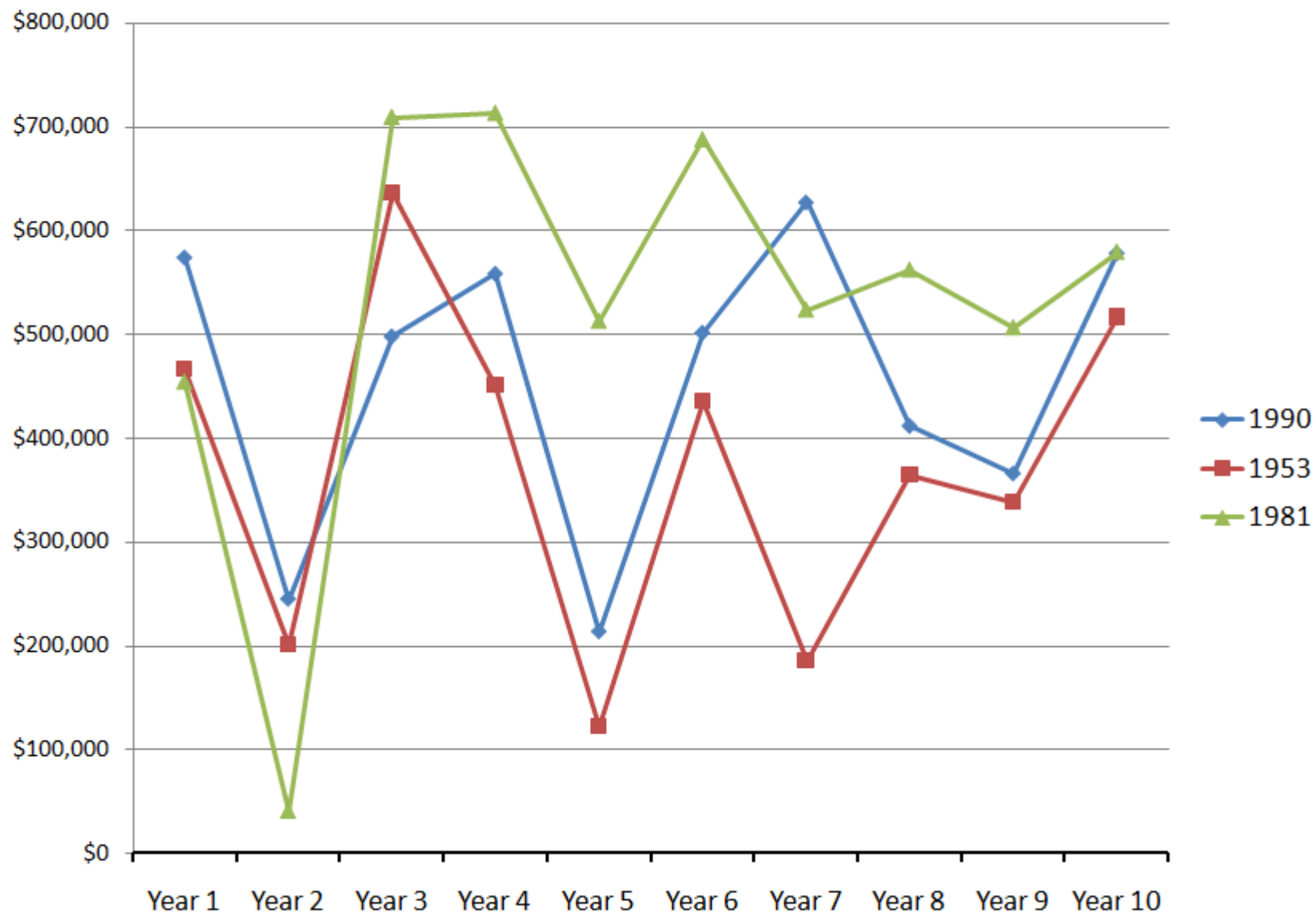
## Whole-farm gross margins Crop, sheep and pasture



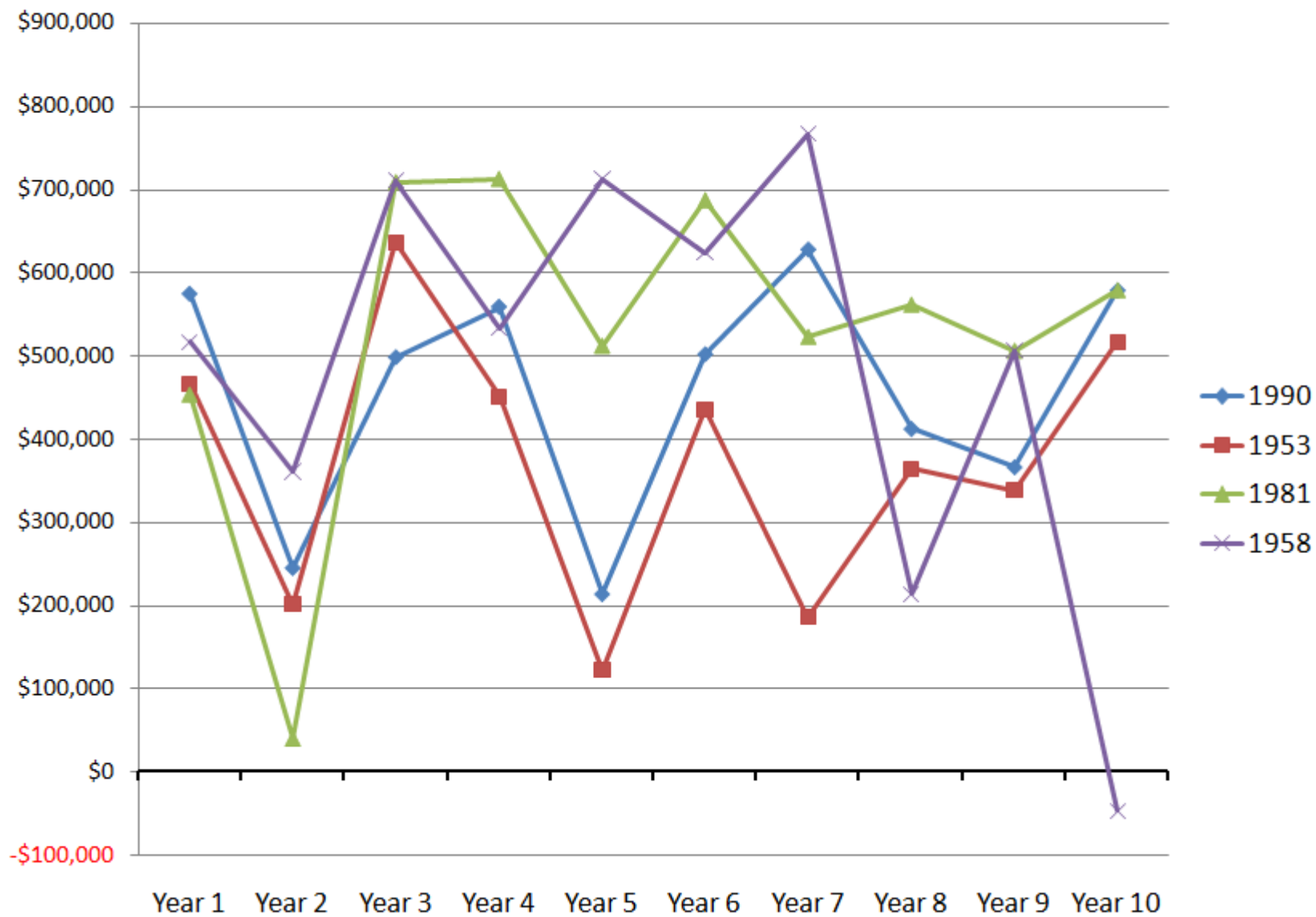
# Whole-farm gross margins Crop, sheep and pasture



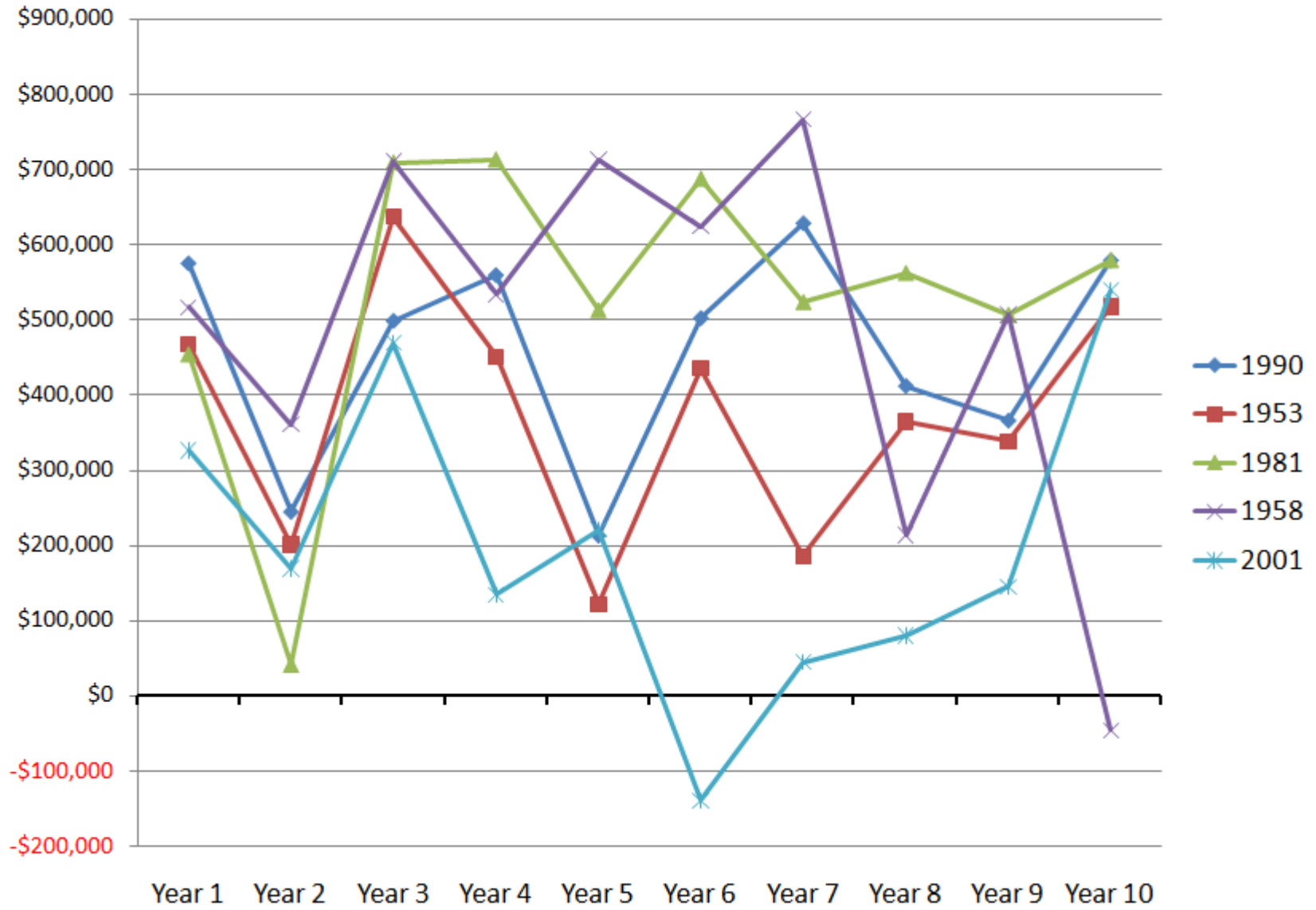
## Whole-farm gross margins Crop, sheep and pasture



## Whole-farm gross margins Crop, sheep and pasture



# Whole-farm gross margins Crop, sheep and pasture



## **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

<b>CASH FLOW</b>												
<b>Gross Margin</b>	<b>Decade</b>	<b>1990</b>	<b>1991</b>	<b>1992</b>	<b>1993</b>	<b>1994</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>	<b>1998</b>	<b>1999</b>	
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	
<b>Gross Margin</b>		<b>\$560,181</b>	<b>\$254,118</b>	<b>\$511,139</b>	<b>\$515,049</b>	<b>\$167,431</b>	<b>\$523,384</b>	<b>\$460,426</b>	<b>\$185,859</b>	<b>\$262,294</b>	<b>\$337,818</b>	
<b>Fixed costs</b>	<b>Budget</b>											
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	
<b>Total</b>	<b>\$168,699</b>	<b>\$169,305</b>	<b>\$174,384</b>	<b>\$179,615</b>	<b>\$185,004</b>	<b>\$190,554</b>	<b>\$195,809</b>	<b>\$201,310</b>	<b>\$207,070</b>	<b>\$213,282</b>	<b>\$219,681</b>	
<b>Capital</b>	<b>Base input</b>											
Replacement	\$27,904	\$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	\$0	
Living	\$80,000	\$84,000	\$88,200	\$92,610	\$97,241	\$102,103	\$107,208	\$112,568	\$118,196	\$124,106	\$130,312	
<b>Total</b>	<b>\$80,000</b>	<b>\$111,904</b>	<b>\$111,954</b>	<b>\$110,404</b>	<b>\$105,160</b>	<b>\$175,759</b>	<b>\$203,264</b>	<b>\$299,711</b>	<b>\$138,438</b>	<b>\$282,086</b>	<b>\$150,173</b>	
<b>Total fixed costs</b>	<b>\$281,209</b>	<b>\$286,338</b>	<b>\$290,019</b>	<b>\$290,164</b>	<b>\$366,313</b>	<b>\$399,074</b>	<b>\$501,022</b>	<b>\$345,508</b>	<b>\$495,368</b>	<b>\$495,368</b>	<b>\$369,853</b>	
<b>EBIT</b>		<b>\$278,972</b>	<b>-\$32,220</b>	<b>\$221,120</b>	<b>\$224,885</b>	<b>-\$198,882</b>	<b>\$124,310</b>	<b>-\$40,595</b>	<b>-\$159,649</b>	<b>-\$233,074</b>	<b>-\$32,036</b>	
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											
<b>Cashflow</b>	<b>\$0</b>	<b>\$187,933</b>	<b>\$153,045</b>	<b>\$383,519</b>	<b>\$586,357</b>	<b>\$346,704</b>	<b>\$482,790</b>	<b>\$440,604</b>	<b>\$287,979</b>	<b>\$56,277</b>	<b>\$24,848</b>	
										<b>Decadal cash margin (closing minus opening balance)</b>		<b>\$24,848</b>

**Decadal cash margin**





<b>CASH FLOW</b>												
<b>Gross Margin</b>	<b>Decade</b>	<b>1953</b>	<b>1954</b>	<b>1955</b>	<b>1956</b>	<b>1957</b>	<b>1958</b>	<b>1959</b>	<b>1960</b>	<b>1961</b>	<b>1962</b>	
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	
<b>Gross Margin</b>		<b>\$373,723</b>	<b>\$174,757</b>	<b>\$355,910</b>	<b>\$356,457</b>	<b>\$84,753</b>	<b>\$286,886</b>	<b>\$125,624</b>	<b>\$250,285</b>	<b>\$248,074</b>	<b>\$251,359</b>	
<b>Fixed costs</b>	<b>Budget</b>											
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	
<b>Total</b>	<b>\$168,699</b>	<b>\$169,305</b>	<b>\$174,384</b>	<b>\$179,615</b>	<b>\$185,004</b>	<b>\$190,554</b>	<b>\$195,849</b>	<b>\$201,433</b>	<b>\$206,975</b>	<b>\$213,184</b>	<b>\$219,579</b>	
<b>Capital</b>	<b>Base input</b>											
Replacement	\$27,904	\$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	\$0	
Living	\$80,000	\$84,000	\$88,200	\$92,610	\$97,241	\$102,103	\$107,208	\$112,568	\$118,196	\$124,106	\$130,312	
<b>Total</b>	<b>\$80,000</b>	<b>\$111,904</b>	<b>\$111,954</b>	<b>\$110,404</b>	<b>\$105,160</b>	<b>\$175,759</b>	<b>\$203,264</b>	<b>\$299,711</b>	<b>\$138,438</b>	<b>\$282,086</b>	<b>\$150,173</b>	
<b>Total fixed costs</b>	<b>\$281,209</b>	<b>\$286,338</b>	<b>\$290,019</b>	<b>\$290,164</b>	<b>\$366,313</b>	<b>\$399,113</b>	<b>\$501,144</b>	<b>\$345,412</b>	<b>\$495,269</b>	<b>\$495,269</b>	<b>\$369,752</b>	
		<b>1953</b>	<b>1954</b>	<b>1955</b>	<b>1956</b>	<b>1957</b>	<b>1958</b>	<b>1959</b>	<b>1960</b>	<b>1961</b>	<b>1962</b>	
<b>EBIT</b>		\$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											
<b>Cashflow</b>	<b>\$0</b>	<b>\$89,984</b>	<b>-\$24,199</b>	<b>\$42,734</b>	<b>\$105,108</b>	<b>-\$193,775</b>	<b>-\$327,422</b>	<b>-\$752,148</b>	<b>-\$906,584</b>	#####	<b>-\$1,447,643</b>	
										<b>Decadal cash margin (closing minus opening balance)</b>		<b>-\$1,447,643</b>

<b>CASH FLOW</b>											
<b>Gross Margin</b>	<b>Decade</b>	<b>1981</b>	<b>1982</b>	<b>1983</b>	<b>1984</b>	<b>1985</b>	<b>1986</b>	<b>1987</b>	<b>1988</b>	<b>1989</b>	<b>1990</b>
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
<b>Gross Margin</b>		<b>\$392,274</b>	<b>\$120,689</b>	<b>\$473,387</b>	<b>\$502,573</b>	<b>\$309,009</b>	<b>\$511,020</b>	<b>\$432,257</b>	<b>\$448,551</b>	<b>\$481,647</b>	<b>\$748,530</b>
<b>Fixed costs</b>	<b>Budget</b>										
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
<b>Total</b>	<b>\$168,699</b>	<b>\$169,305</b>	<b>\$146,384</b>	<b>\$150,775</b>	<b>\$155,299</b>	<b>\$159,958</b>	<b>\$164,321</b>	<b>\$168,932</b>	<b>\$173,607</b>	<b>\$178,816</b>	<b>\$184,180</b>
<b>Capital</b>	<b>Base input</b>										
Replacement	\$27,904	\$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	\$0
Living	\$80,000	\$84,000	\$88,200	\$92,610	\$97,241	\$102,103	\$107,208	\$112,568	\$118,196	\$124,106	\$130,312
<b>Total</b>	<b>\$80,000</b>	<b>\$111,904</b>	<b>\$111,954</b>	<b>\$110,404</b>	<b>\$105,160</b>	<b>\$175,759</b>	<b>\$203,264</b>	<b>\$299,711</b>	<b>\$138,438</b>	<b>\$282,086</b>	<b>\$150,173</b>
<b>Total fixed costs</b>	<b>\$281,209</b>	<b>\$258,338</b>	<b>\$261,179</b>	<b>\$260,459</b>	<b>\$335,717</b>	<b>\$367,585</b>	<b>\$468,643</b>	<b>\$312,045</b>	<b>\$460,901</b>	<b>\$334,353</b>	
		<b>1981</b>	<b>1982</b>	<b>1983</b>	<b>1984</b>	<b>1985</b>	<b>1986</b>	<b>1987</b>	<b>1988</b>	<b>1989</b>	<b>1990</b>
<b>EBIT</b>		\$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										
<b>Cashflow</b>	<b>\$0</b>	<b>\$99,730</b>	<b>-\$44,381</b>	<b>\$172,022</b>	<b>\$396,848</b>	<b>\$338,203</b>	<b>\$493,679</b>	<b>\$468,622</b>	<b>\$620,256</b>	<b>\$635,619</b>	<b>\$1,076,041</b>
<b>Decadal cash margin (closing minus opening balance)</b>										<b>\$1,076,041</b>	

<b>CASH FLOW</b>											
<b>Gross Margin</b>	<b>Decade</b>	<b>1958</b>	<b>1959</b>	<b>1960</b>	<b>1961</b>	<b>1962</b>	<b>1963</b>	<b>1964</b>	<b>1965</b>	<b>1966</b>	<b>1967</b>
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
<b>Gross Margin</b>		<b>\$443,345</b>	<b>\$185,041</b>	<b>\$458,666</b>	<b>\$433,832</b>	<b>\$472,735</b>	<b>\$378,316</b>	<b>\$480,393</b>	<b>\$199,768</b>	<b>\$358,212</b>	<b>\$51,919</b>
<b>Fixed costs</b>	<b>Budget</b>										
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	\$75,815
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
<b>Total</b>	<b>\$168,699</b>	<b>\$169,305</b>	<b>\$174,384</b>	<b>\$179,615</b>	<b>\$185,004</b>	<b>\$190,554</b>	<b>\$195,828</b>	<b>\$201,230</b>	<b>\$206,993</b>	<b>\$213,203</b>	<b>\$202,099</b>
<b>Capital</b>	<b>Base input</b>										
Replacement	\$27,904	\$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	\$0
Living	\$80,000	\$84,000	\$88,200	\$92,610	\$97,241	\$102,103	\$107,208	\$112,568	\$118,196	\$124,106	\$130,312
<b>Total</b>	<b>\$80,000</b>	<b>\$111,904</b>	<b>\$111,954</b>	<b>\$110,404</b>	<b>\$105,160</b>	<b>\$175,759</b>	<b>\$203,264</b>	<b>\$299,711</b>	<b>\$138,438</b>	<b>\$282,086</b>	<b>\$150,173</b>
<b>Total fixed costs</b>	<b>\$281,209</b>	<b>\$286,338</b>	<b>\$290,019</b>	<b>\$290,164</b>	<b>\$366,313</b>	<b>\$399,092</b>	<b>\$500,942</b>	<b>\$345,431</b>	<b>\$495,289</b>	<b>\$352,272</b>	
		<b>1958</b>	<b>1959</b>	<b>1960</b>	<b>1961</b>	<b>1962</b>	<b>1963</b>	<b>1964</b>	<b>1965</b>	<b>1966</b>	<b>1967</b>
<b>EBIT</b>		\$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										
<b>Cashflow</b>	<b>\$0</b>	<b>\$126,558</b>	<b>\$20,759</b>	<b>\$194,141</b>	<b>\$316,591</b>	<b>\$423,520</b>	<b>\$404,152</b>	<b>\$393,194</b>	<b>\$253,718</b>	<b>\$119,558</b>	<b>-\$193,450</b>
<b>Decadal cash margin (closing minus opening balance)</b>										<b>-\$193,450</b>	

<b>CASH FLOW</b>											
<b>Gross Margin</b>	<b>Decade</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>
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
<b>Gross Margin</b>		<b>\$139,051</b>	<b>\$64,546</b>	<b>\$212,732</b>	<b>-\$154,422</b>	<b>\$88,359</b>	<b>-\$231,526</b>	<b>-\$136,420</b>	<b>-\$103,650</b>	<b>-\$90,212</b>	<b>\$470,480</b>
<b>Fixed costs</b>	<b>Budget</b>										
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
<b>Total</b>	<b>\$140,699</b>	<b>\$141,305</b>	<b>\$117,544</b>	<b>\$121,070</b>	<b>\$89,702</b>	<b>\$74,893</b>	<b>\$77,044</b>	<b>\$79,215</b>	<b>\$81,376</b>	<b>\$48,817</b>	<b>\$50,282</b>
<b>Capital</b>	<b>Base input</b>										
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
<b>Total</b>	<b>\$80,000</b>	<b>\$111,904</b>	<b>\$111,954</b>	<b>\$110,404</b>	<b>\$105,160</b>	<b>\$175,759</b>	<b>\$203,264</b>	<b>\$299,711</b>	<b>\$138,438</b>	<b>\$282,086</b>	<b>\$150,173</b>
<b>Total fixed costs</b>		<b>\$253,209</b>	<b>\$229,498</b>	<b>\$231,474</b>	<b>\$194,862</b>	<b>\$250,653</b>	<b>\$280,308</b>	<b>\$378,927</b>	<b>\$219,814</b>	<b>\$330,903</b>	<b>\$200,455</b>
		<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>
<b>EBIT</b>		<b>-\$114,158</b>	<b>-\$164,952</b>	<b>-\$18,742</b>	<b>-\$349,284</b>	<b>-\$162,293</b>	<b>-\$511,835</b>	<b>-\$515,346</b>	<b>-\$323,464</b>	<b>-\$421,115</b>	<b>\$270,025</b>
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										
<b>Cashflow</b>	<b>\$0</b>	<b>-\$122,149</b>	<b>-\$307,198</b>	<b>-\$348,756</b>	<b>-\$746,903</b>	<b>-\$972,840</b>	#####	#####	#####	#####	<b>-\$3,347,312</b>
<b>Decadal cash margin (closing minus opening balance)</b>										<b>-\$3,347,312</b>	

## **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

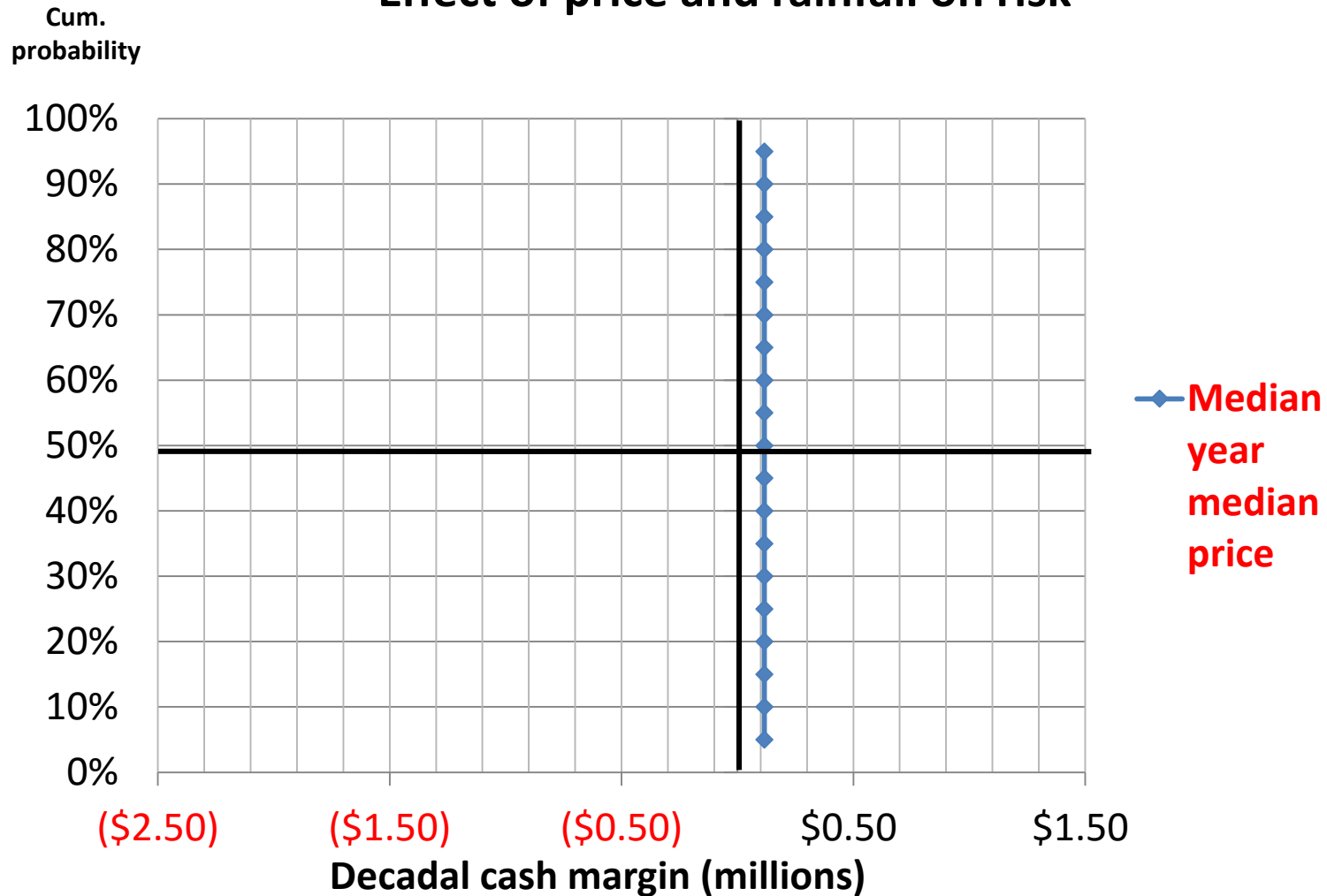
80% equity

<b>Gross Margin</b>		<b>Average</b>
Crop		\$215,598
Sheep (Grassgro)		\$256,359
Pasture		-\$37,640
<b>Gross Margin</b>		<b>\$434,316</b>
<b><u>Fixed costs</u></b>	<b><u>Budget</u></b>	
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
<b>Total</b>	<b>\$168,699</b>	<b>\$169,305</b>
<b><u>Capital</u></b>	<b><u>Base input</u></b>	
Replacement		\$27,904
Land purchases		\$0
Living	\$80,000	\$84,000
<b>Total</b>	<b>\$80,000</b>	<b>\$111,904</b>
<b>Total fixed costs</b>		<b>\$281,209</b>
		<b><u>Average</u></b>
<b>EBIT</b>		<b>\$153,107</b>
Tax		-\$34,263
Cumulative balance		-\$760,120
Interest		-\$53,208
	Opening balance	
<b>Cashflow</b>	<b>-\$878,964</b>	<b>-\$813,328</b>
		<b>\$65,636</b>

# Conventional static budgeting

**Static = unresponsive to risk**

## Effect of price and rainfall on risk





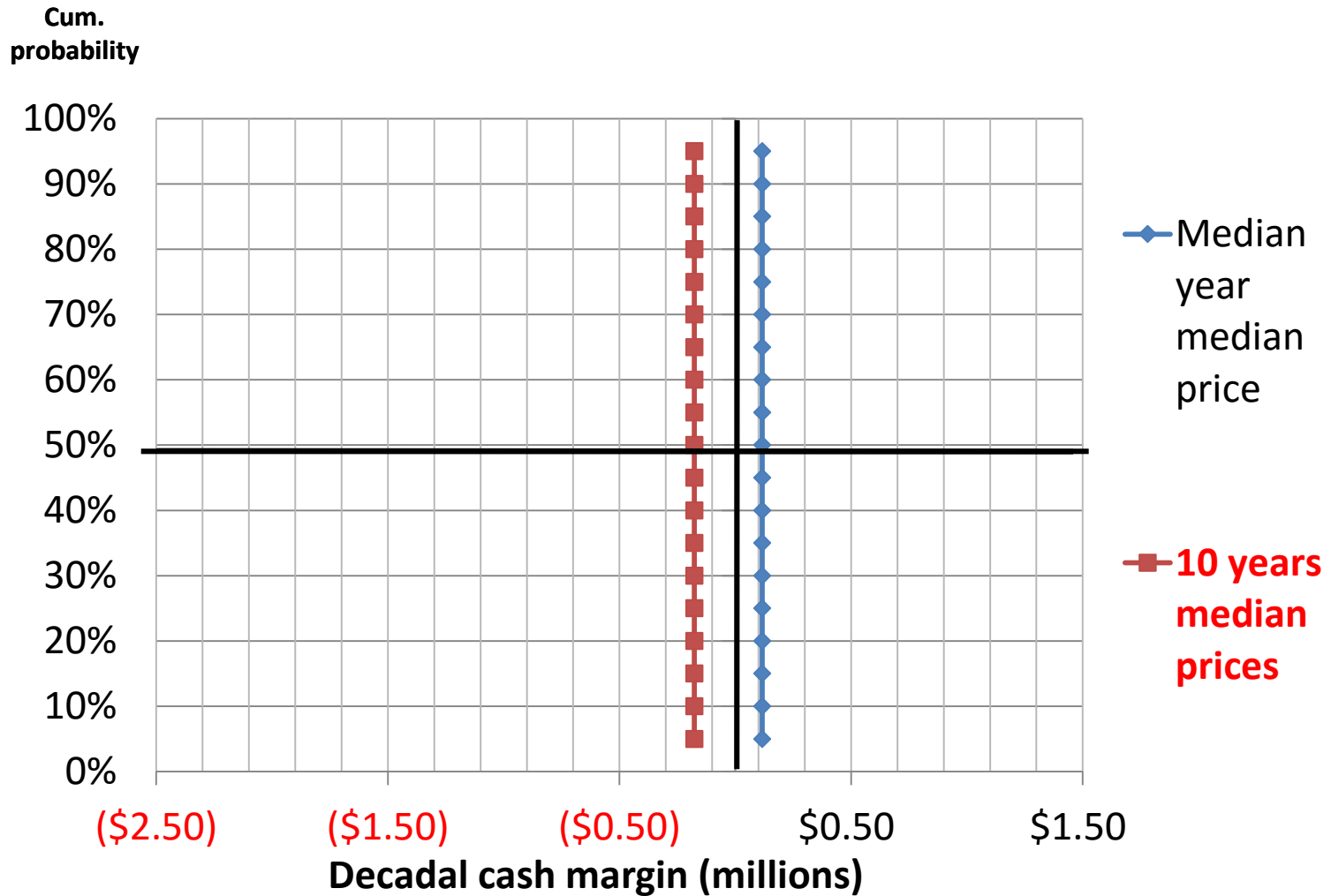
# Conventional static budget

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

<b>Gross Margin</b>		<b>Average</b>	<b>Average</b>	<b>Average</b>	<b>Average</b>	<b>Average</b>	<b>Average</b>	<b>Average</b>	<b>Average</b>	<b>Average</b>	<b>Average</b>
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
<b>Gross Margin</b>		<b>\$434,316</b>	<b>\$422,493</b>	<b>\$415,943</b>	<b>\$409,131</b>	<b>\$402,047</b>	<b>\$394,679</b>	<b>\$387,017</b>	<b>\$379,048</b>	<b>\$370,760</b>	<b>\$362,141</b>
<b>Fixed costs</b>	<b>Budget</b>										
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
<b>Total</b>	<b>\$168,699</b>	<b>\$169,305</b>	<b>\$174,384</b>	<b>\$179,615</b>	<b>\$185,004</b>	<b>\$190,554</b>	<b>\$195,742</b>	<b>\$200,952</b>	<b>\$206,721</b>	<b>\$212,923</b>	<b>\$219,311</b>
<b>Capital</b>	<b>Base input</b>										
Replacement	\$27,904	\$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	\$0
Living	\$80,000	\$84,000	\$88,200	\$92,610	\$97,241	\$102,103	\$107,208	\$112,568	\$118,196	\$124,106	\$130,312
<b>Total</b>	<b>\$80,000</b>	<b>\$111,904</b>	<b>\$111,954</b>	<b>\$110,404</b>	<b>\$105,160</b>	<b>\$175,759</b>	<b>\$203,264</b>	<b>\$299,711</b>	<b>\$138,438</b>	<b>\$282,086</b>	<b>\$150,173</b>
<b>Total fixed costs</b>	<b>\$281,209</b>	<b>\$286,338</b>	<b>\$290,019</b>	<b>\$290,164</b>	<b>\$366,313</b>	<b>\$399,006</b>	<b>\$500,664</b>	<b>\$345,159</b>	<b>\$495,009</b>	<b>\$369,483</b>	
<b>EBIT</b>	<b>Average</b>	<b>Average</b>	<b>Average</b>	<b>Average</b>	<b>Average</b>	<b>Average</b>	<b>Average</b>	<b>Average</b>	<b>Average</b>	<b>Average</b>	<b>Average</b>
	\$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	\$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	
Cashflow	Opening balance										
	-\$878,964	-\$813,328	-\$727,706	-\$653,986	-\$574,990	-\$579,041	-\$624,204	-\$789,500	-\$808,504	-\$998,045	-\$1,075,765
		<b>Decadal cash margin (closing minus opening balance)</b>									<b>-\$196,801</b>

# Conventional static budgeting, 10 years

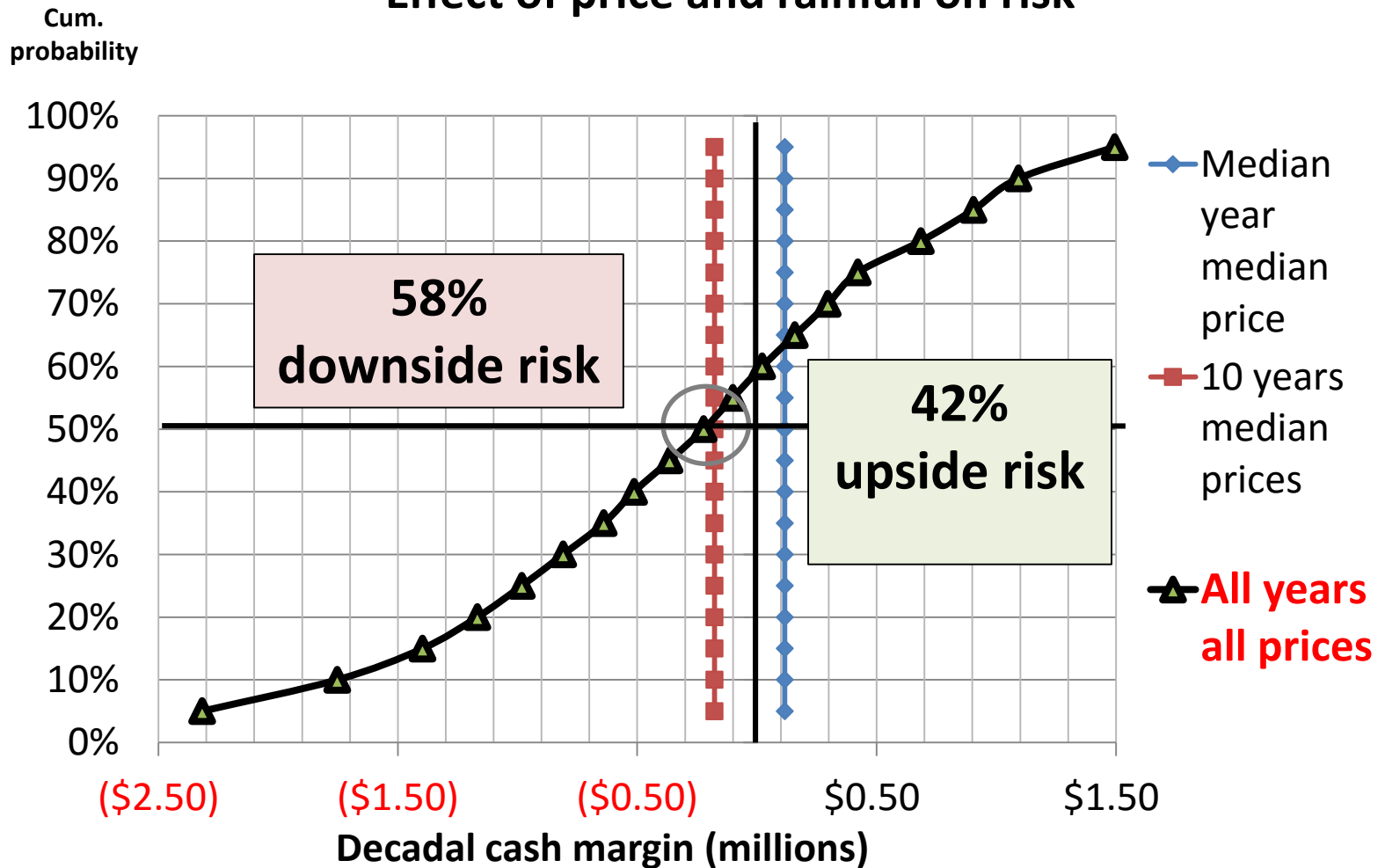
**Shows effects of inflation on costs**



# Dynamic budgeting for risk

Dynamic = responds to risk

## Effect of price and rainfall on risk



## 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 whole farm 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.**