Economic Value of a Marginal Increase in Pregnancy Rate in Dairy Cattle

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Introduction

- 21-day pregnancy rate (# pregnant / # eligible for pregnancy in 21-day period) remains major measure of reproductive efficiency in dairy herds.
- Few recent studies reported economic value of marginal change in pregnancy rate.
- Objective: Estimate economic value of a marginal increase in 21-day pregnancy rate.

Determinants of Value of Pregnancy Rate

- Biological
  - Milk production, feed intake, service rate, probability of conception, abortion, involuntary culling, …
- Prices
  - Heifers, cull cows, calves, milk, feed, labor, …
- Management
  - Start and stop breeding policy, voluntary culling policy, availability of heifers, …

Methodology

- Define discrete cow states (28,620), combination of:
  - Level of milk yield (1 - 15), Lactation number (1 - 12), Month after calving (1 - 24), Month pregnant (0, 1 - 9)
- Each cow state has own revenues, costs, transition probabilities to other states
- Determine best (breeding and) replacement decision for each cow state (affect transition probabilities)
  - Solve by dynamic programming (DP)
- Calculate herd statistics based on performance and decision for each cow state, weighted by probability
  - Markov chain
- DairyVIP model: http://dairy.ifas.ufl.edu/tools

Some Key Assumptions

Minimum VWP: 2 months

Service rate: 43%

Prob. concept.: 40% reduces to 26% late in lactation

Prob. fetal loss: 8%

Cost / breeding: $15

Heifer price: $1600

Cull price: $0.74/kg

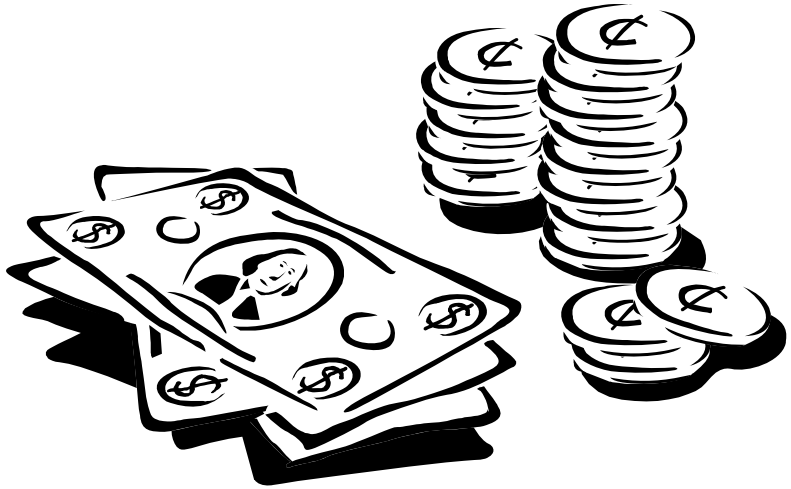
Milk price: $0.31/kg

Feed cost, wet: $0.20/kg DM

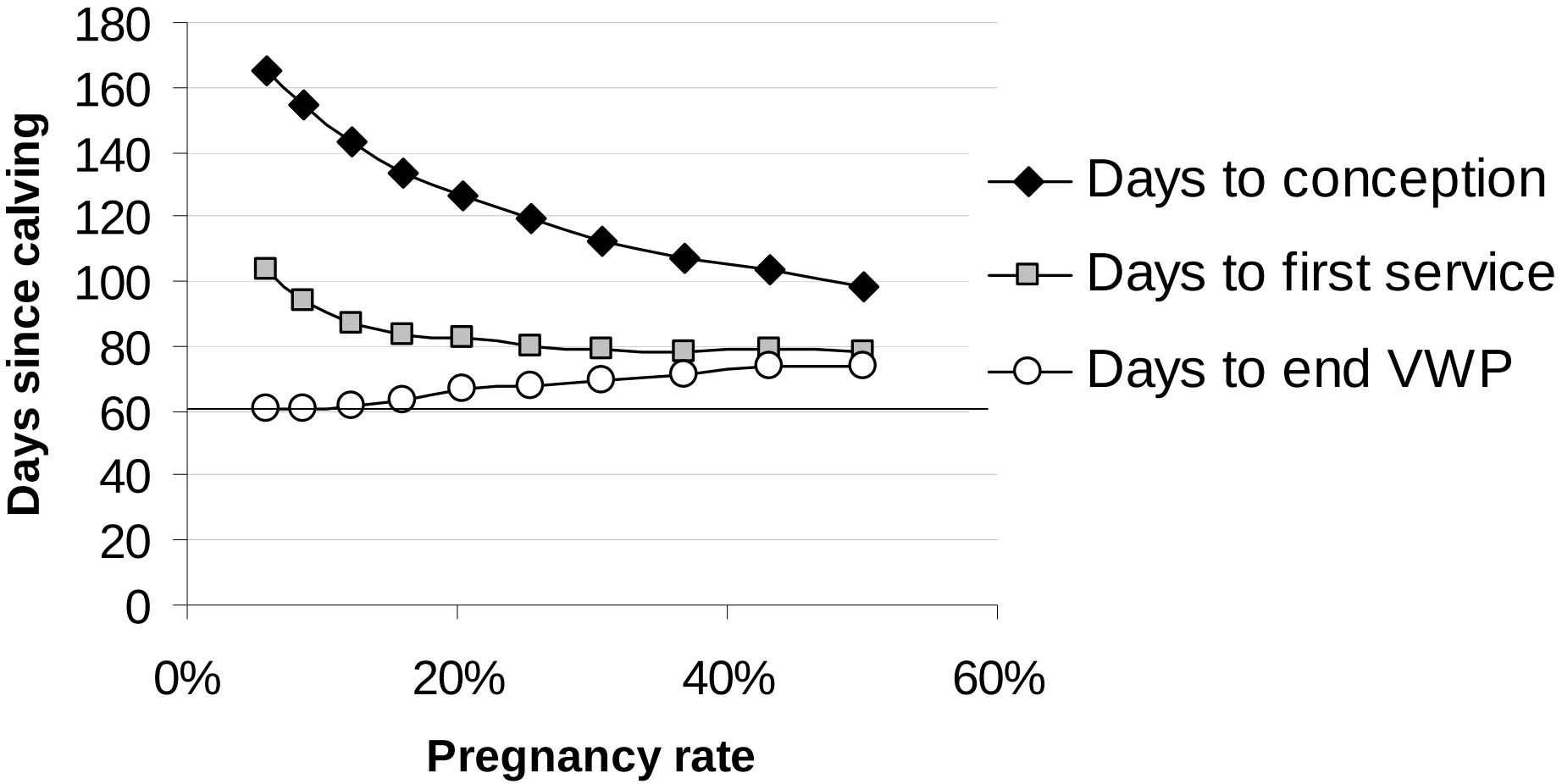
Lactation curves

Design

- Increase service rate and probability of conception similarly, from -15% to +30% with increments of 5%, to increase probability of pregnancy (pregnancy rate) and observe profit / slot / year.



Change in Days to "X"
Default assumptions



Plan A: adsa07.bio: steady state

Plan B: adsa07.bio: steady state

Year 1, per slot / year

DairyVIP 1.1

per slot / year

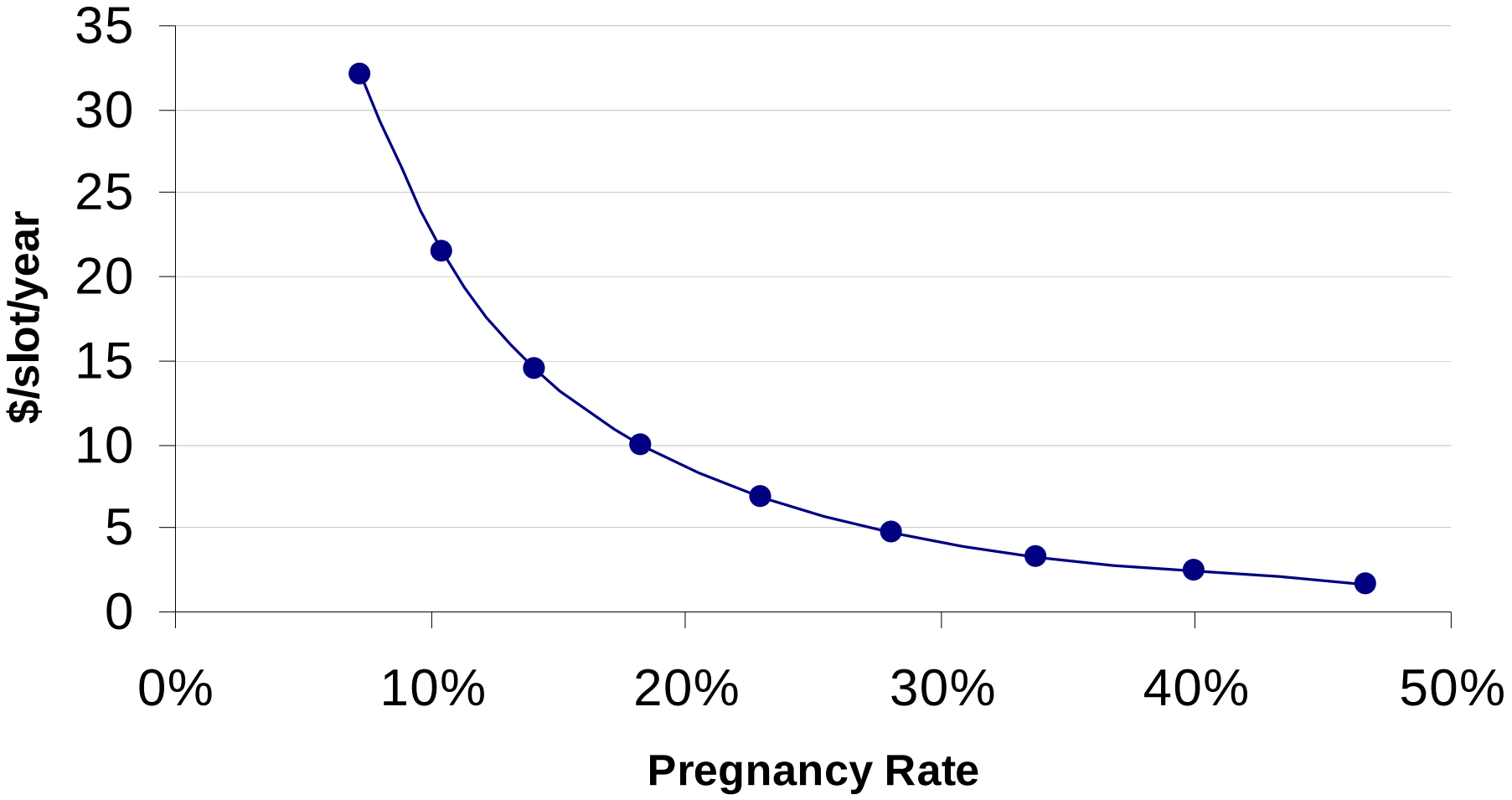
	plan A	plan B	plan B - A
milk sales	3544	3549	5
cow sales	123	107	-16
calf sales	210	212	2
total revenue	*3877*	*3868*	-9
feed cost	1572	1573	1
breeding supply cost	34	32	-2
heifer purchase cost	563	514	-50
veterinary cost	81	82	1
inv. culling loss	0	0	0
variable labor cost	417	415	-2
variable other cost	365	365	0
fixed labor cost	0	0	0
fixed other cost	456	456	0
total costs	*3488*	*3436*	-52
total profit	389	433	44
total fixed cost	456	456	0
revenue - var. cost	845	889	44
herd replacement costs	440	407	-33
breeding cost	34	32	-2
milk yield	11431	11449	18

	plan A	plan B	plan B - A
days to end VWP	63	66	3
days to first service	83	82	-1
days to conception	134	127	-7
days to last service	249	228	-20
calving interval (mo)	13.4	13.2	-0.2
open days	157	143	-13
pregnancy rate	16%	20%	4%
value of new pregnancy	263	209	-53
cost of pregnancy loss	541	511	-31
breeding cost / preg	40	35	-5
cost of extra day open	1.45	1.44	-0.01
overall cull rate	35%	32%	-3%
involuntary cull rate	16%	17%	1%
voluntary cull rate	19%	15%	-4%
days in milk	222	221	-1
value of cow	1202	1208	7
cull price	349	332	-17
dry cow feed cost / day	1.80	1.80	0.00
lact. cow feed cost / day	4.64	4.67	0.03
income over feed cost / day	5.40	5.42	0.01

Plan A: Default inputs

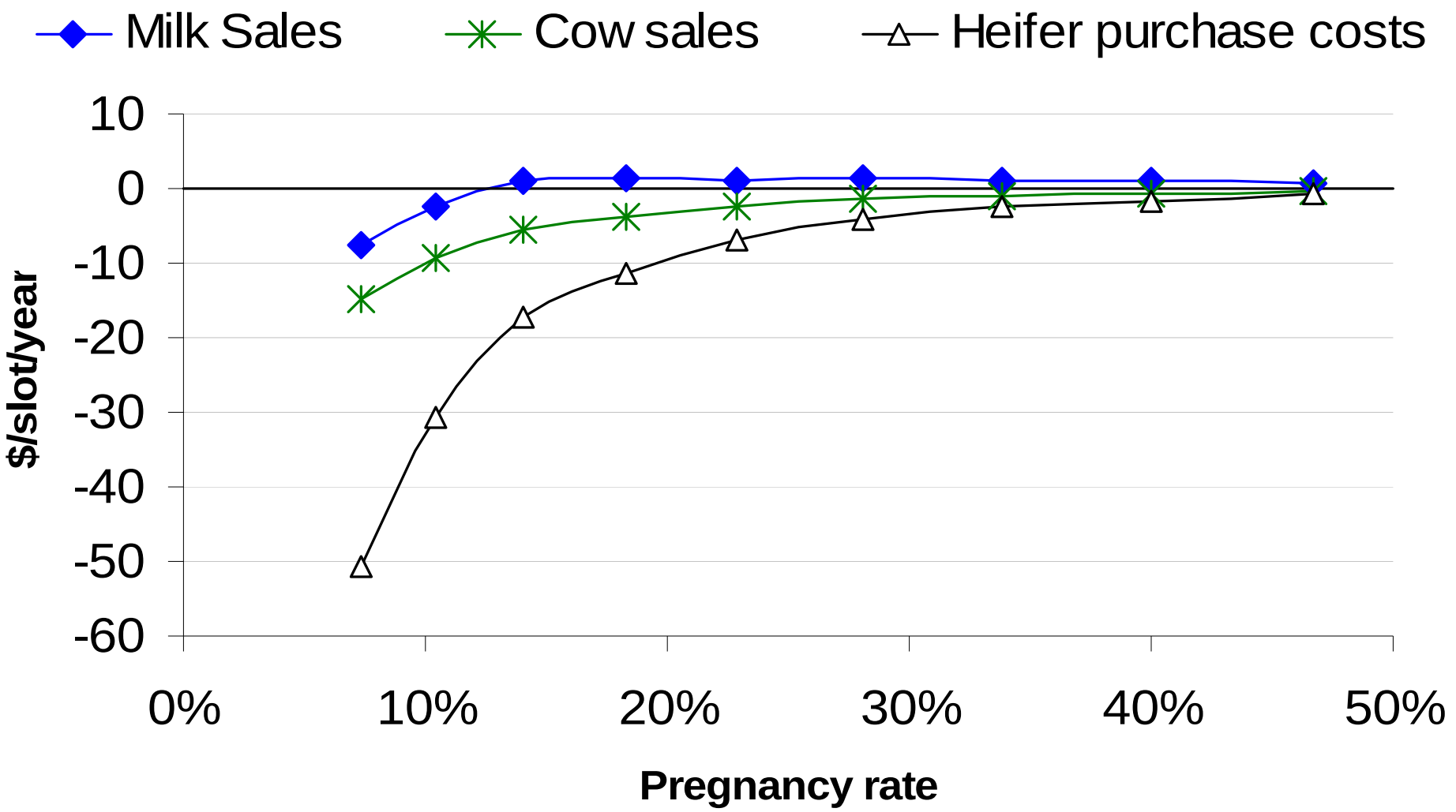
Plan B: Service rate +5%; Probability of Conception +5%

Value of 1 Percentage Unit Increase in Pregnancy Rate

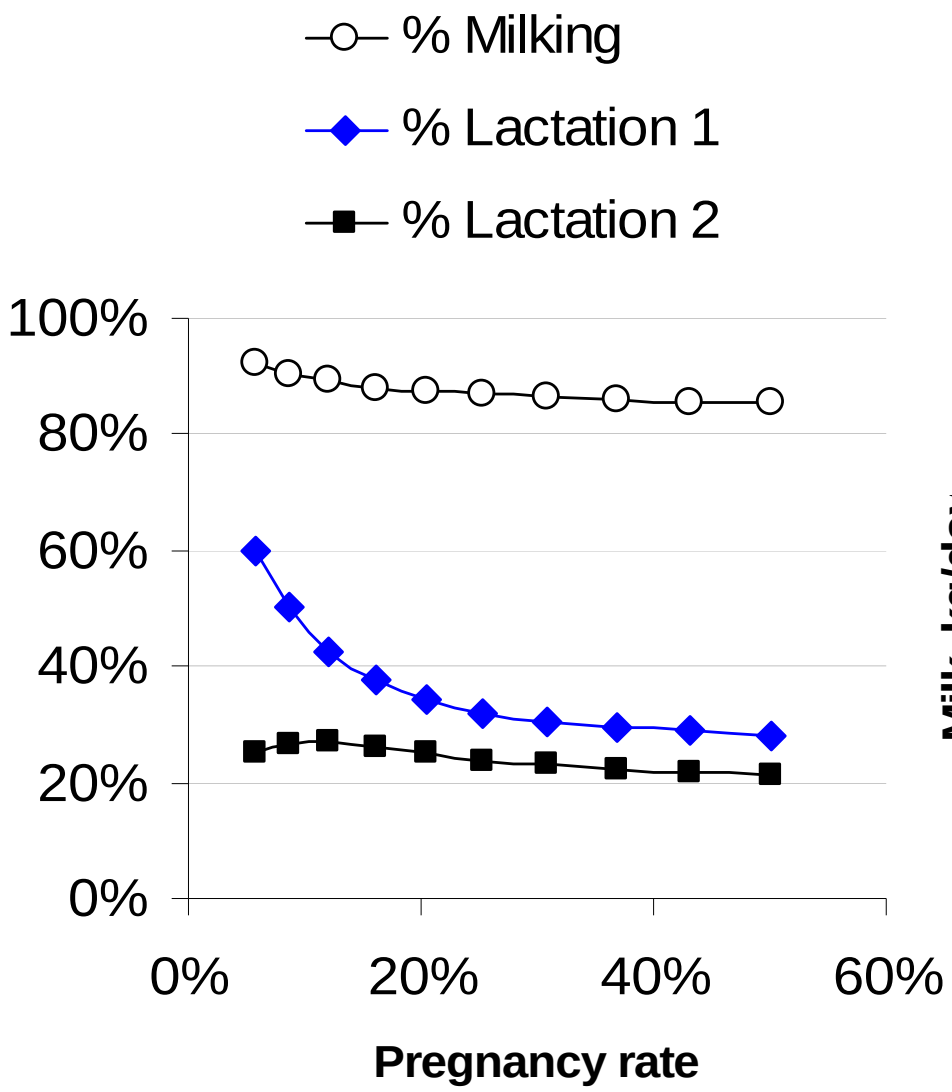


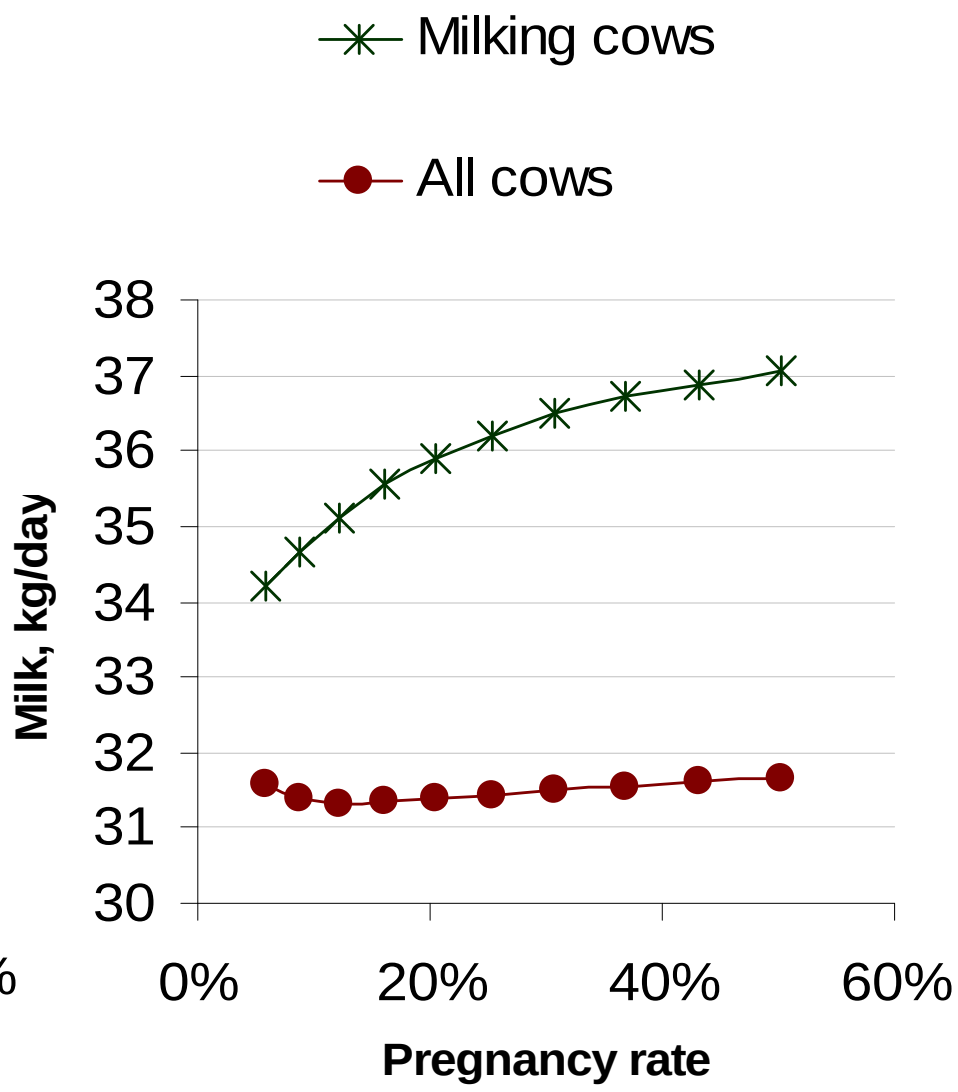
Change in Sales and Costs

with a 1-percentage Unit Increase in Pregnancy Rate

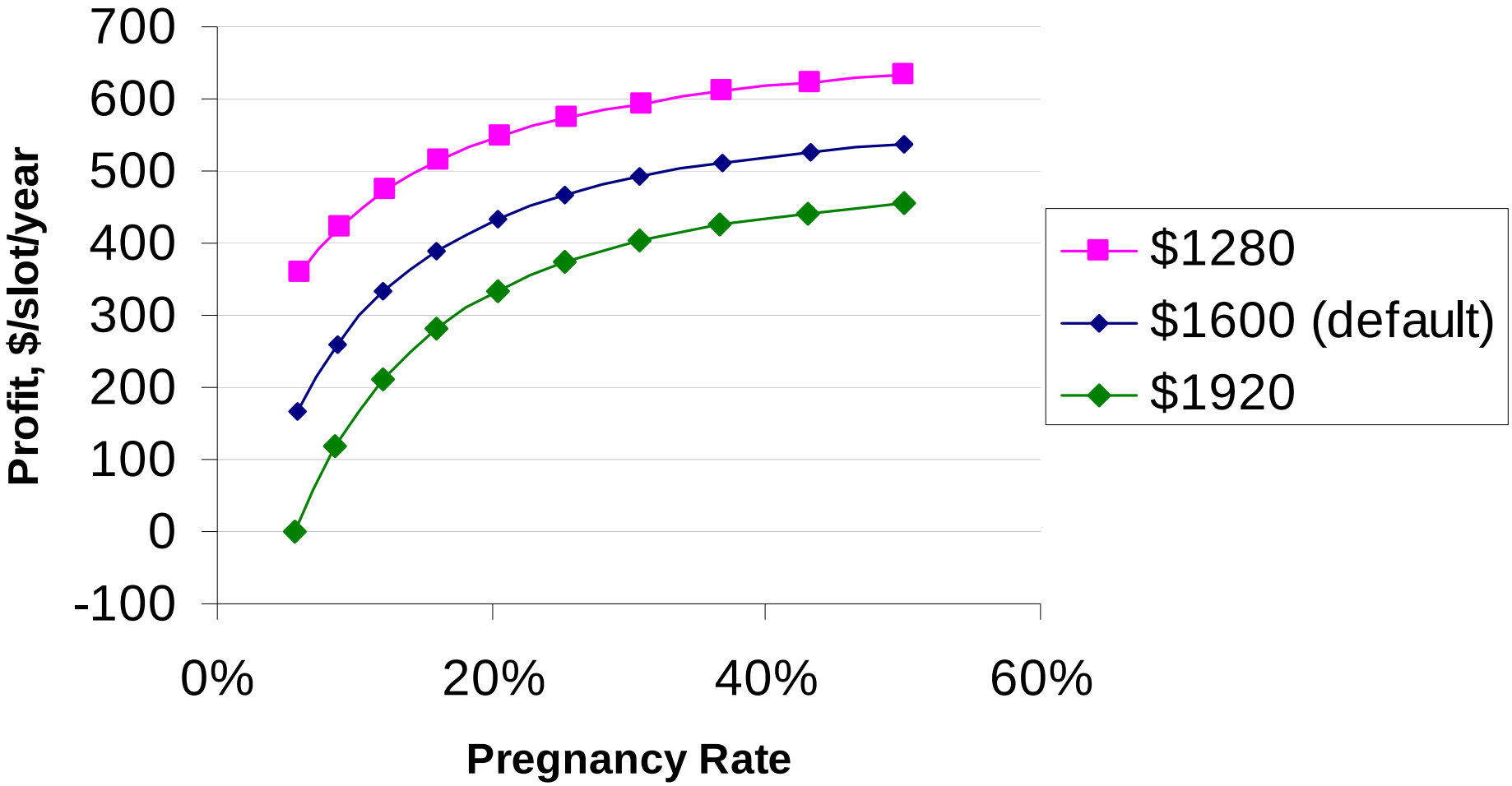


Herd Structure & Milk Production



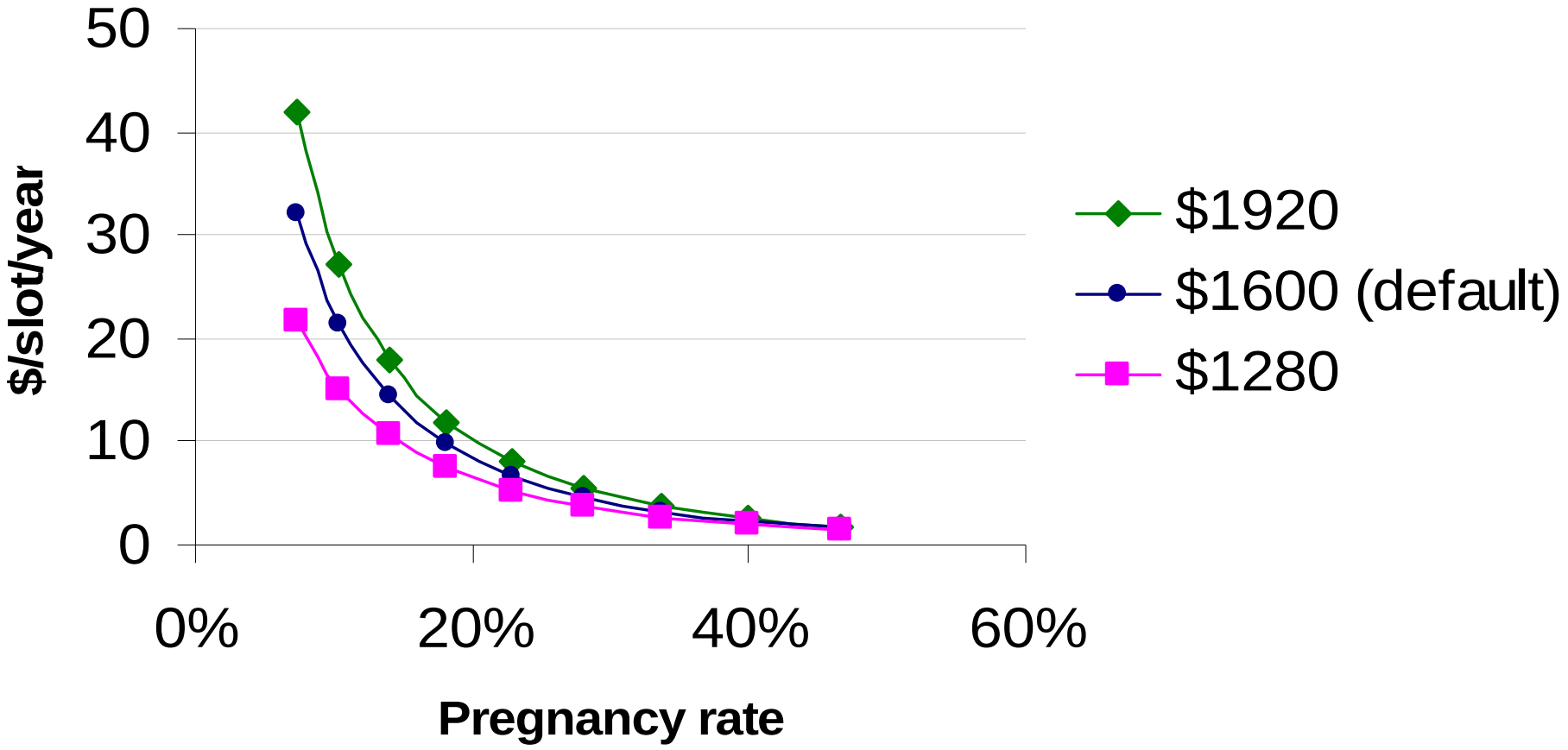


Effect of Heifer Price



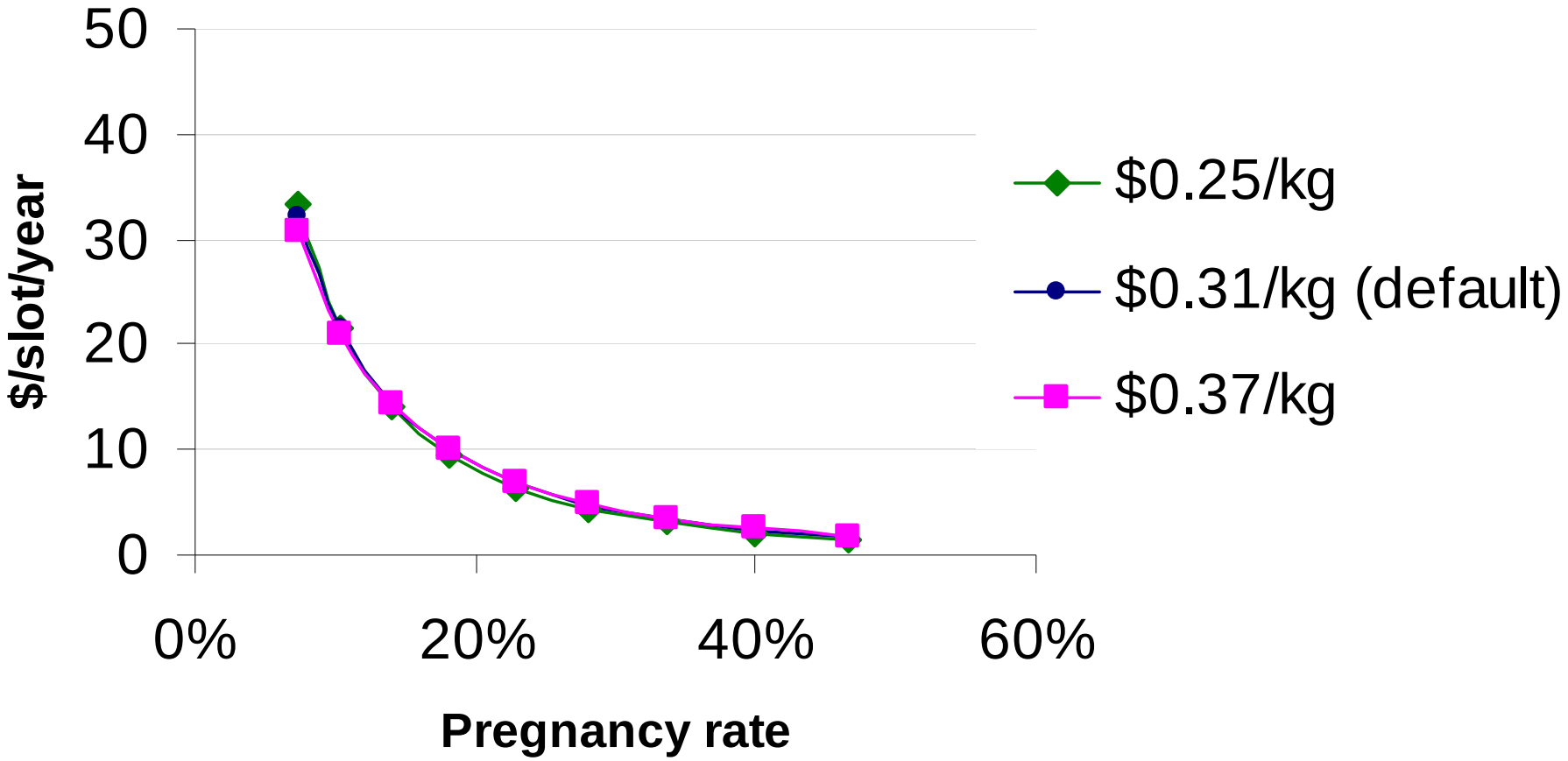
Effect of Heifer Price

Marginal Value of Pregnancy Rate



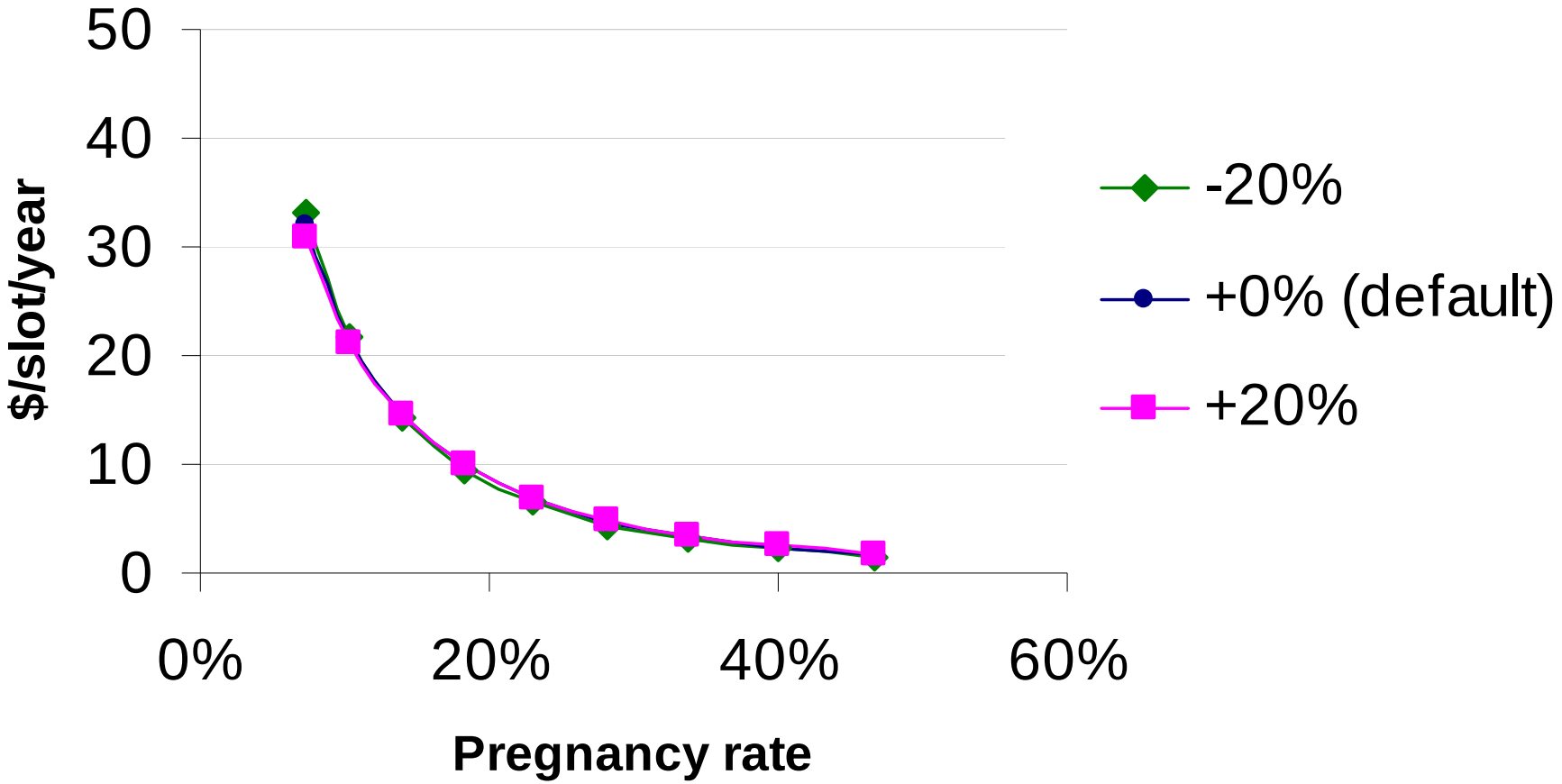
Effect of Milk Price

Marginal Value of Pregnancy Rate



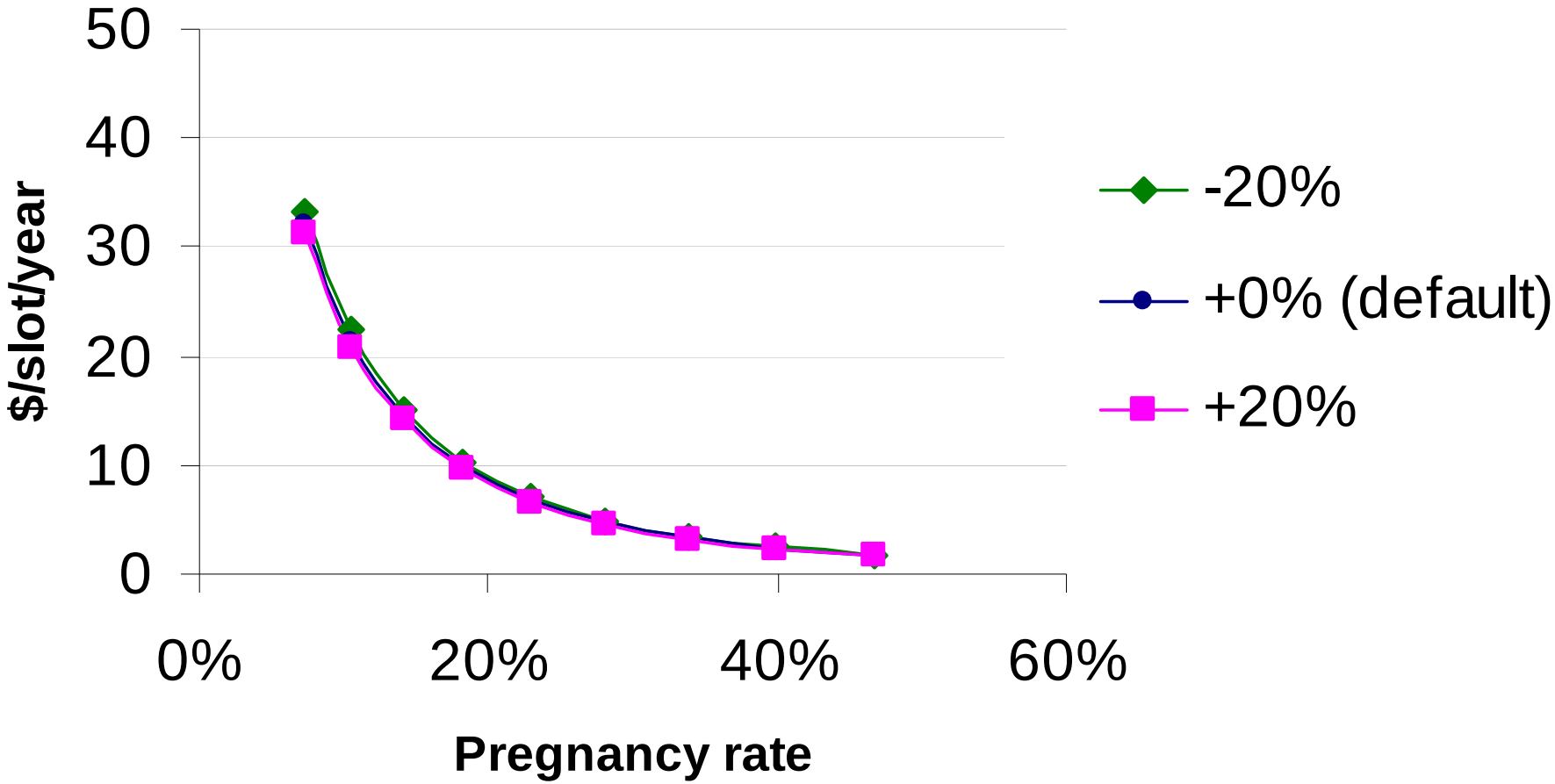
Effect of Milk Yield

Marginal Value of Pregnancy Rate



Effect of Forced Culling

Marginal Value of Pregnancy Rate



Summary

1. Improving pregnancy rate is worth more when pregnancy rate is low.
2. Improving pregnancy rate is worth more with higher heifer prices, less forced culling.
3. Greater milk yield and higher milk prices increased value of marginal change in pregnancy rate only when pregnancy rate was greater than 14%.
4. Effects of other inputs not yet evaluated.

Thank You

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