Appendix K COMPETITIVENESS AND CONSTRAINTS ALONG THE VALUE CHAIN

K.1 Competitiveness and Comparative Advantage of Cambodian Rice

994. One of the major issues confronting the rice sector in Cambodia is in understanding its competitiveness relative to regional and international suppliers. If Cambodia has a comparative advantage in rice, albeit a latent one, then policymakers may wish to implement policies that promote this export potential.

995. Information from the World Bank (Fukase and Martin 2001) suggests that Cambodia may have a comparative advantage in rice production. Using the revealed comparative advantage (RCA) measure of Balassa[52], they find that Cambodia had a slight comparative advantage in rice using 1997 figures, though it should be noted that the RCA measures for Thailand and Viet Nam were much higher.

996. In order to measure the relative competitiveness and degree of comparative advantage for Cambodian rice, nominal protection coefficients (NPCs) and domestic resource costs (DRCs) can be computed. NPCs relate prices in the domestic market to a reference border, or world price (Tsakok 1990) to examine the level of price distortion in the economy. An NPC that is greater than 1 means that positive protection is afforded to producers and, consequently, consumers are taxed. An NPC that is less than 1 implies that producers are taxed at the expense of consumers. An NPC exactly equal to 1 means that price policy is neutral and does not adversely impact producers or consumers.

997. The border price is typically calculated at the official exchange rate, although when this is not at equilibrium, a shadow exchange rate should be used to capture the effects of an overvalued or undervalued exchange rate on the production present in an economy (Sadoulet and de Janvry 1995). The border price is also adjusted to take into account whether the product of interest is an import or export. If the product is an import, the c.i.f. import price should be adjusted by adding handling and transport costs from the border to market and subtracting marketing margins and transport costs from the farm level to the market (Tsakok 1990). If the product is an export, the f.o.b. export price should be adjusted by subtracting handling costs, marketing margins, and transportation costs from the port to the farm (Tsakok 1990).

998. In Cambodia, the official exchange rate is a floating exchange rate and is free of policy distortions. Thus, the exchange rate is not a source of protection on rice production. In addition, policy measures on rice are extremely limited, with only a tariff of just 7 percent on rice imports (Center for International Economics 2001). Nonetheless, significant gaps exist between domestic prices of rice and accepted international prices, due to high costs of production, poor infrastructure, and fragmented markets.

999. The costs of tradable and non-tradable inputs are calculated, and presented in Table 172 and Table 174 for dry season and wet season rice respectively. The prices of the tradable inputs are taken as the CIF prices in Kampong Cham, the main center for

[52] The revealed comparative advantage measure is the ratio of a country's exports of a commodity to the world's exports of that commodity divided by the ratio of a country's total exports to the world's total exports.

cross border trade in inputs from Vietnam[53]. This is relevant for inputs such as fertilizer and fuel.

1000. For dry season rice the total cost of inputs are calculated as 1,999 riel per kilo of rice; comprising 307 riel per kilo of tradable inputs and 792 riel per kilo for non-tradable inputs. The fact that non-tradable inputs comprise the vast bulk of the costs of production (72 percent of costs) indicates that there is little scope for reductions in costs through trade liberalization measures. Prices of fertilizer and fuel are actually below international price levels and receive some flow-on subsidy from Vietnam.

1001. The bulk of the costs in dry season rice production (64.7 percent) come from just three sources; farm labor (14.4 percent), farm fuel (15.2 percent), and profit margins (35.07 percent). Of the three, the easiest one to reduce is profit margins. Profit margins are reasonably healthy, indicating some scope for reduction in margins along chain without affecting the competitiveness of the industry. Farm fuel costs are difficult to reduce due to higher world prices and a relatively liberalized trading environment. In terms of reducing labor costs, this would increase machinery costs. In addition, there are other bigger issues to do with employment effects in a general equilibrium setting as well as regional effects which makes any policy attempting to reduce labor inputs difficult to implement.

1002. For wet season rice the total cost of inputs are calculated as 1,382 riel per kilo of rice; comprising 226 riel per kilo of tradable inputs and 1,156 riel per kilo for non-tradable inputs. The fact that non-tradable inputs comprise the vast bulk of the costs of production (83.6 percent of costs) indicates that there is little scope for reductions in costs through trade liberalization measures. Prices of fertilizer and fuel are actually below international price levels and receive some flow-on subsidy from Vietnam.

1003. The bulk of the costs in wet season rice production (73.38 percent) come from just three sources; farm labor (34.72 percent), other non-tradable farm materials (10.77 percent), and profit margins (27.89 percent). Of the three, the easiest one to reduce is profit margins. Profit margins are reasonably healthy, indicating some scope for reduction in margins along chain without affecting the competitiveness of the industry. Other farm materials are all those non-tradable inputs such as machinery, packaging, fees and charges, and fixed costs such as depreciation and land rental. These costs are difficult to reduce; particularly machinery, which is substitutable with labor; reducing machinery costs would increase labor costs which is the other significant input. In terms of reducing labor costs, this would increase machinery costs. In addition, there are other bigger issues to do with employment effects in a general equilibrium setting as well as regional effects which makes any policy attempting to reduce labor inputs difficult to implement.

1004. For the current study, NPCs for Cambodian rice are provided in Table 171 and Table 173 for dry season and wet season rice respectively during the 2005 season. The reference border prices are the prices for Thai rice, fob Bangkok, for 25 percent broken and Thai Jasmine rice.

1005. For dry season rice (mixed variety) the NPCs have been calculated relative to prices in Kampong Cham and Phnom Penh. The results indicate that the NPCs are less than 1, indicating, suggesting that government policies are providing a negative level of protection to producers.

[53] In addition, the main market were MAFFs Agricultural Marketing Office collects regular price information on agricultural inputs.

1006. For wet season rice (Phkar Khney) the results indicate NPCs ranging from 1.0 to 0.8 for Phnom Penh and Kampong Cham respectively. In the case of wet season rice government policies are relatively neutral to negative for producers.

1007. It is of interest to see how NPCs have changed over time. ACI (2002) calculated separate regional NPCs using the price of dry season rice from Takeo and wet season rice from Kampong Speu and Battambang. In all cases, the NPCs were much higher than 1, implying significant protection for producers in 2001-2002. Much of this protection, however, was due to poor infrastructure and limited markets than any policy-induced measures. It is clear that transportation infrastructure has vastly improved over the period 2001-2005 and that unofficial costs in inter-provincial transportation have all but disappeared.

1008. The DRC is an indicator of comparative advantage, measuring the ratio of value added from domestic, non-traded activities to the foreign exchange earned or saved from domestic production (Sadoulet and de Janvry 1995). The numerator of the measure is the sum of value added from domestic activities valued at market or shadow prices, while the denominator is the difference of the border price less value added from tradable inputs. A DRC with a value greater than 1 implies that production is inefficient and that foreign exchange would be better saved by importing the product rather than producing the product domestically, while a DRC less than 1 suggests comparative advantage and efficiency in production (Tsakok 1990).

1009. For dry season rice (mixed variety) the DRCs have been calculated relative to prices for 25 broken Thai white rice and Thai Jasmine (100 percent). The results indicate that the DRCs are less than 1 for both comparisons, ranging from 0.86 down to 0.57 for Phnom Penh comparisons for both types of Thai rice.

1010. For wet season rice (Phkar Khney) the results indicate DRCs ranging from 1.24 to 0.76 for Phnom Penh prices compared with 25 broken Thai white rice and Thai Jasmine (100 percent) respectively. The results indicate wet season rice is not competitive against medium quality Thai white rice but is competitive against Thai Jasmine rice.

1011. ACI (2002) found that Cambodian rice was competitive with 35 percent broken rice in 2001-2002. It is of interest to see how this has changed over time. Comparing the results from 2001 to 2005, it is clear that quality improvements have been made and while in 2001 Cambodian rice was competitive against 35 percent broken, it is now competitive against 25 percent broken in the case of dry season rice.

1012. Table 175 to Table 178 present sensitivity analysis of changes in key parameters to the underlying NPCs and DRCs. Firstly, Table 175 shows the changes in NPCs due to a change in domestic retail prices. The price in Phnom Penh is taken as the indicator price. As noted in Table 171 and Table 173 and shown again in Table 175, the NPCs for dry and wet season rice are 0.91 and 1.0 respectively. The domestic price would have to increase by 10 percent for a neutral NPC (NPC=1) in the case of dry season rice, but would not have to change for wet season rice.

1013. Table 176 shows the changes in DRC due to changes in labor costs. In both dry season and wet season rice the base DRC is 1.00 (the benchmark rate) and therefore does not have to change. When comparing dry season and wet season rice against Thai white rice and Thai Jasmine, the base DRCs are 0.93 and 0.55 (dry season) and 1.24 and 0.76 (wet season) for Thai white rice and Thai Jasmine respectively. For dry season rice,

the labor costs would have to increase by 35 percent in order to make dry season rice uncompetitive against Thai white rice and increase by 390 percent in order to make it uncompetitive against Thai Jasmine. In contrast, labor costs for wet season rice would have to fall by 45 percent to become competitive against Thai white rice, and increase by 75 percent in order to become uncompetitive against Thai Jasmine.

1014. Table 177 shows the changes in DRC due to changes in farm level productivity (changes in yield). Yields would have to fall by 9 percent in order to make dry season rice uncompetitive against Thai white rice and fall by 53 percent to make it uncompetitive against Thai Jasmine rice. In contrast, yields of wet season rice would have to increase by 35 percent in order to make it competitive against Thai white rice, but fall by 30 percent to make it uncompetitive against Thai jasmine.

1015. Finally, Table 178 shows the changes in DRC due to changes in post-harvest technology. Milling recovery rates would have to fall by 11 percent to make dry season rice uncompetitive against Thai white rice and fall by 54 percent in order to make it uncompetitive against Thai Jasmine. In contrast, milling recovery rates of wet season rice would have to increase by 55 percent in order to be competitive against Thai white rice (an unfeasible 99 percent recovery rate), but could fall by 31 percent before being uncompetitive against Thai Jasmine.

1016. The NPC and DRC calculations and the sensitivity analysis points to several factors:

1. Dry season rice (mixed variety) is a competitor to Thai white rice both in terms of quality as well as relative costs of production. While dry season rice is highly competitive against Thai Jasmine rice, this is only on costs alone and Jasmine prices are higher because it fetches a premium on the world market.
2. Wet season rice (aromatic Phkar Khney) is uncompetitive in terms of price with Thai white rice, but is of comparable quality to Jasmine rice. Importantly, not only is it of comparable quality, but is highly competitive against Jasmine rice based on price competitiveness.
3. The competitiveness of dry season rice against Thai white rice is robust. Labor costs would have to increase by over 35 percent before the prices of the two rice types became equivalent. Furthermore, yields would have to decline by 9 percent before the performance and competitiveness of Thai white rice becomes and issue. Similarly, post harvest milling recovery rates could fall by 11 percent before Thai white rice became competitive against Cambodian dry season rice.
4. The competitiveness of aromatic wet season rice from Cambodia is high compared with Thai Jasmine rice, but is uncompetitive against Thai white rice. Labor costs would have to increase by over 75 percent before the prices of the two rice types (Phkar Khney and Thai Jasmine) became equivalent. Furthermore, yields would have to decline by 30 percent before the performance and competitiveness of Thai Jasmine becomes and issue. Similarly, post harvest milling recovery rates could fall by 31 percent before Thai Jasmine became competitive against Cambodian wet season aromatic rice.
5. Dry season rice from Cambodia should compete quality and price wise with Thai white rice, while wet season aromatic rice from Cambodia should compete against Thai Jasmine. The issue is how to market rice from Cambodia in order to gain a share of the world trade in rice.

Table 171 Calculation of NPCs and DRCs for Dry Season Rice in Cambodia - 2005

Dry Season Rice

Milling Recovery Rate Coefficients Used	**(%)**	**Rice (Y/N)**
Header Rice	42%	**1**
A1 Rice	22%	**1**
A2 Rice	0%	**0**
C1 Rice	0%	**0**
C2 Rice	0%	**0**
Fine Broken Rice	0%	**0**
Bran	11%	**0**
Husk	25%	**0**
Total	100%	

Exchange Rate (Riel/USD)	4,115.00
Average Yield (Kg/Hectare)	3,539.00
Milling Recovery Rate for "Rice"	64%

Tradable input costs

DAP

Quantity used (kg/ha)	50.00
Kg paddy produced	3,539.00
Conv paddy-rice	0.64
Kg rice produced	2,264.96
Quant fert per kg rice	0.02
Price of fert (USD/tonne) (based on cif Kampong Cham)	306.00
Price of fert (Riel/kg)	1,259.19
Value of fert per kg rice	**27.80**
Value of fert per kg paddy	**17.79**

Urea

Quantity used (kg/ha)	100.00
Kg paddy produced	3,539.00
Conv paddy-rice	0.64
Kg rice produced	2,264.96
Quant fert per kg rice	0.04
Price of fert (USD/tonne) (based on cif Kampong Cham)	301.00
Price of fert (Riel/kg)	1,238.62
Value of fert per kg rice	**54.69**
Value of fert per kg paddy	**35.00**

Phosphorous

Quantity used (kg/ha)	0.00
Kg paddy produced	3,539.00
Conv paddy-rice	0.64
Kg rice produced	2,264.96
Quant fert per kg rice	0.00
Price of fert (USD/tonne) (based on cif Kampong Cham)	272.00
Price of fert (Riel/kg)	1,119.28
Value of fert per kg rice	**0.00**
Value of fert per kg paddy	**0.00**

N-P-K Compound Fertilizer

Quantity used (kg/ha)	0.00
Kg paddy produced	3,539.00
Conv paddy-rice	0.64
Kg rice produced	2,264.96
Quant fert per kg rice	0.00
Price of fert (USD/tonne) (based on cif Kampong Cham)	319.00
Price of fert (Riel/kg)	1,312.69
Value of fert per kg rice	**0.00**
Value of fert per kg paddy	**0.00**

Pesticides and Herbicides

Non-tradable input costs

Transport (Net Costs)	Paddy Riel/Kg	Rice Riel/Kg
Farm-collector	10.00	6.40
Collector-mill	10.00	6.40
Mill-port	62.50	40.00
Total transport	**52.80**	

Labor (farm)

Total cost of labor (Riel/ha)	358,500
Kg paddy produced	3,539.00
Conv paddy-rice	0.64
Kg rice produced	2,264.96
Value labor per kg rice	**158.28**

Organic Fertilizer

Quantity used (kg/ha)	0.00
Kg paddy produced	3,539.00
Conv paddy-rice	0.64
Kg rice produced	2,264.96
Quant fert per kg rice	0.00
Price of fert (Riel/kg)	50.00
Value of fert per kg rice	**0.00**

Seeds

Total cost of seeds (Riel/ha)	112,500
Kg paddy produced	3,539.00
Conv paddy-rice	0.64
Kg rice produced	2,264.96
Value seeds per kg rice	**49.67**

Other Materials (farm), excluding fertilizer, pesticides and fuel

Total materials (irrigation, land prep)	235,000
Kg paddy produced	3,539.00
Conv paddy rice	0.64
Kg rice produced	2,264.96
Value materials per kg rice	**103.75**

Electricity (mill)

Total cost of electricity	0
Kg paddy produced	1,000.00
Conv paddy-rice	0.64
Kg rice produced	640.00
Value electricity per kg rice	**0.00**

Labor Costs (mill)

Total cost of labor	1,898
Kg paddy produced	1,000.00
Conv paddy-rice	0.64
Kg rice produced	640.00
Value labor per kg rice	**2.97**

Other Non-Labor Costs (mill), excluding fuel

Total cost of non-labor inputs	9,758.00
Kg paddy produced	1,000.00

Cost of pesticide (Riel/ha)	19,998.90
Kg paddy produced	3,539.00
Conv paddy-rice	0.64
Kg rice produced	2,264.96
Price of pesticide per kg rice	8.83
Price of pesticide (USD/ha)	4.86
Value of pesticide per kg rice	**8.83**
Value of pesticide per kg paddy	**5.65**

Farm Fuel

Quantity used (liters/ha)	115.00
Kg paddy produced	3,539.00
Conv paddy-rice	0.64
Kg rice produced	2,264.96
Quant fuel per kg rice	0.05
Price of fuel (USD/liter)	0.80
Price of fuel (Riel/liter)	3,292.00
Value of fuel per kg rice	**167.15**
Value of fuel per kg paddy	**106.97**

Miller Fuel

Quantity used (liters/ X tonne of paddy)	6.43
Kg paddy produced	1,000.00
Conv paddy-rice	0.64
Kg rice produced	640.00
Quant fuel per kg rice	0.01
Price of fuel (USD/liter)	0.80
Price of fuel (Riel/liter)	3,292.00
Value of fuel per kg rice	**33.07**
Value of fuel per kg paddy	**21.17**

Collector Fuel

Quantity used (liters/ X tonne of paddy)	2.00
Kg paddy produced	1,000.00
Conv paddy-rice	0.64
Kg rice produced	640.00
Quant fuel per kg rice	0.003
Price of fuel (USD/liter)	0.80
Price of fuel (Riel/liter)	3,292.00
Value of fuel per kg rice	**10.29**
Value of fuel per kg paddy	**6.58**

Exporter Fuel

Quantity used (liters/ X tonne of paddy)	1.00
Kg paddy produced	1,000.00
Conv paddy-rice	0.64
Kg rice produced	640.00
Quant fuel per kg rice	0.002
Price of fuel (USD/liter)	0.80
Price of fuel (Riel/liter)	3,292.00
Value of fuel per kg rice	**5.14**
Value of fuel per kg paddy	**3.29**

TOTAL TRADABLE COSTS (RICE)	**306.96**
TOTAL TRADABLE COSTS (PADDY)	**196.46**

Conv paddy-rice	0.64
Kg rice produced	640.00
Value Other costs per kg rice	**15.25**

Labor (Exporter)

Total cost of labor	1,400
Kg paddy Exported	1,562.50
Conv paddy-rice	0.64
Kg rice Exported	1,000.00
Value labor per kg rice	**1.40**

Other Non-Labor Costs (Exporter)

Total cost of non-labor inputs	16679.00
Kg paddy produced	1,562.50
Conv paddy-rice	0.64
Kg rice produced	1,000.00
Value Other costs per kg rice	**16.68**

Profit Margins (Riel/kg Paddy)

Farmer	260.00
Collector	5.00

Profit Margins (Riel/kg Rice)

Miller	136.00
Exporter	80.00
Total Margins per kg rice	**385.60**

Labor (collector)

Total cost of labor	5,000
Kg paddy Collected	1,562.50
Conv paddy-rice	0.64
Kg rice Collected	1,000.00
Value labor per kg rice	**5.00**

Other Non-Labor Costs (collector)

Total cost of non-labor inputs	1,000
Kg paddy Collected	1,562.50
Conv paddy-rice	0.64
Kg rice Collected	1,000.00
Value Other costs per kg rice	**1.00**

TOTAL NT COSTS PER KG RICE	**792.40**
Total Costs per Kg Paddy	**1434.58**
Total Costs per Kg Rice	**1099.36**

NPCs/DRCs vis-à-vis World Price (RICE BASIS)				
Border price calculation	USD/ton		Conv. To Riel/kg	
fob price of Mixed Rice 25%, Sihanoukville	253	243	1041.095	
cif price of white rice 25%, Bangkok	268		1102.82	
cif price of Jasmine, Bangkok	411		1691.265	
Adjustment of FOB World prices	Mixed Rice		Thai White Rice	Thai Jasmine
FOB price (Riel/kg)	1,041.10		1102.82	1691.265
Port costs (Riel/kg)	25		25	25
Transport to Phnom Penh (Riel/kg)	30		30	30
Transport to Southern Provinces (Riel/kg)	40		40	40
Margins (sum of export, milling) (Riel/kg)	0.00		0.00	0.00
Adjusted FOB World price (Kampong Cham) (Riel/kg)	1,136.10		1,197.82	1,786.27
Adjusted FOB World price (Phnom Penh) (Riel/kg)	1,096.10		1,157.82	1,746.27
Domestic Retail Prices for Local Rice				
Kampong Cham price (Riel/kg)	950.00			
Phnom Penh price (Riel/kg)	1,000.00			
NPC calculations	Mixed Rice		Thai White Rice	Thai Jasmine
Kampong Cham price	***0.84***		***0.79***	***0.53***
Phnom Penh price	***0.91***		***0.86***	***0.57***
DRC calculations (rice basis)	Mixed Rice		Thai White Rice	Thai Jasmine
Kampong Cham	**0.96**		**0.89**	**0.54**
Phnom Penh	**1.00**		**0.93**	**0.55**

Table 172 Relative Importance of Tradable and Non-Tradable Costs for Dry Season Rice in Cambodia

Relative Importance of Costs		
Tradable input costs	**Riel/Kg Rice)**	**Percent**
DAP	27.80	2.53%
Urea	54.69	4.97%
Phosphorous	0.00	0.00%
N-P-K Compound Fertilizer	0.00	0.00%
Pesticides and Herbicides	8.83	0.80%
Farm Fuel	167.15	15.20%
Miller Fuel	33.07	3.01%
Collector Fuel	10.29	0.94%
Exporter Fuel	5.14	0.47%
TOTAL TRADABLE COSTS (RICE)	**306.96**	**27.92%**
Non-tradable input costs		
Transport (Net Costs)	52.80	4.80%
Labor (farm)	158.28	14.40%
Organic Fertilizer	0.00	0.00%
Seeds	49.67	4.52%
Other Materials (farm), excluding fertilizer, pesticides and fuel	103.75	9.44%
Electricity (mill)	0.00	0.00%
Labor Costs (mill)	2.97	0.27%
Other Non-Labor Costs (mill), excluding fuel	15.25	1.39%
Labor (Exporter)	1.40	0.13%
Other Non-Labor Costs (Exporter)	16.68	1.52%
Profit Margins (Riel/kg Rice)	385.60	35.07%
Labor (collector)	5.00	0.45%
Other Non-Labor Costs (collector)	1.00	0.09%
TOTAL NT COSTS PER KG RICE	**792.40**	**72.08%**
Total Costs per Kg Rice	**1,099.36**	**100%**

Table 173 Calculation of NPCs and DRCs for Wet Season Rice in Cambodia - 2005

Wet Season Rice

Milling Recovery Rate Coefficients Used	(%)	Rice (Y/N)
Header Rice	42%	1
A1 Rice	22%	1
A2 Rice	0%	0
C1 Rice	0%	0
C2 Rice	0%	0
Fine Broken Rice	0%	0
Bran	11%	0
Husk	25%	0
Total	100%	

Exchange Rate (Riel/USD)	4,115.00
Average Yield (Kg/Hectare)	1,725.00
Milling Recovery Rate for "Rice"	64%

Tradable input costs

DAP

Quantity used (kg/ha)	40.00	178463
Kg paddy produced	1,725.00	43.37
Conv paddy-rice	0.64	
Kg rice produced	1,104.00	
Quant fert per kg rice	0.04	
Price of fert (USD/tonne)	306.00	
(based on cif Kampong Cham)		
Price of fert (Riel/kg)	1,259.19	
Value of fert per kg rice	**45.62**	
Value of fert per kg paddy	**29.20**	

Urea

Quantity used (kg/ha)	50.00
Kg paddy produced	1,725.00
Conv paddy-rice	0.64
Kg rice produced	1,104.00
Quant fert per kg rice	0.05
Price of fert (USD/tonne)	301.00
(based on cif Kampong Cham)	
Price of fert (Riel/kg)	1,238.62
Value of fert per kg rice	**56.10**
Value of fert per kg paddy	**35.90**

Phosphorous

Quantity used (kg/ha)	0.00
Kg paddy produced	1,725.00
Conv paddy-rice	0.64
Kg rice produced	1,104.00
Quant fert per kg rice	0.00
Price of fert (USD/tonne)	272.00
(based on cif Kampong Cham)	
Price of fert (Riel/kg)	1,119.28
Value of fert per kg rice	**0.00**
Value of fert per kg paddy	**0.00**

N-P-K Compound Fertilizer

Quantity used (kg/ha)	0.00
Kg paddy produced	1,725.00
Conv paddy-rice	0.64
Kg rice produced	1,104.00
Quant fert per kg rice	0.00
Price of fert (USD/tonne)	319.00
(based on cif Kampong Cham)	
Price of fert (Riel/kg)	1,312.69
Value of fert per kg rice	**0.00**
Value of fert per kg paddy	**0.00**

Pesticides and Herbicides

Cost of pesticide (Riel/ha)	0.00
Kg paddy produced	1,725.00

Non-tradable input costs

Transport (Net Costs)	Paddy Riel/Kg	Rice Riel/Kg
Farm-collector	10.00	6.40
Collector-mill	10.00	6.40
Mill-port	62.50	40.00
Total transport		**52.80**

Labor (farm)

Total cost of labor (Riel/ha)	530,000
Kg paddy produced	1,725.00
Conv paddy-rice	0.64
Kg rice produced	1,104.00
Value labor per kg rice	**480.07**

Organic Fertilizer

Quantity used (kg/ha)	0.00
Kg paddy produced	1,725.00
Conv paddy-rice	0.64
Kg rice produced	1,104.00
Quant fert per kg rice	0.00
Price of fert (Riel/kg)	50.00
Value of fert per kg rice	**0.00**

Seeds

Total cost of seeds (Riel/ha)	51,489
Kg paddy produced	1,725.00
Conv paddy-rice	0.64
Kg rice produced	1,104.00
Value seeds per kg rice	**46.64**

Other Materials (farm), excluding fertilizer, pesticides and fuel

Total materials (irrigation, land prep)	164,439
Kg paddy produced	1,725.00
Conv paddy rice	0.64
Kg rice produced	1,104.00
Value materials per kg rice	**148.95**

Electricity (mill)

Total cost of electricity	0
Kg paddy produced	1,000.00
Conv paddy-rice	0.64
Kg rice produced	640.00
Value electricity per kg rice	**0.00**

Labor Costs (mill)

Total cost of labor	1,898
Kg paddy produced	1,000.00
Conv paddy-rice	0.64
Kg rice produced	640.00
Value labor per kg rice	**2.97**

Other Non-Labor Costs (mill), excluding fuel

Total cost of non-labor inputs	9,758.00
Kg paddy produced	1,000.00
Conv paddy-rice	0.64
Kg rice produced	640.00

Conv paddy-rice	0.64
Kg rice produced	1,104.00
Price of pesticide per kg rice	0.00
Price of pesticide (USD/ha)	
Value of pesticide per kg rice	**0.00**
Value of pesticide per kg paddy	**0.00**

Farm Fuel

Quantity used (liters/ha)	25.53
Kg paddy produced	1,725.00
Conv paddy-rice	0.64
Kg rice produced	1,104.00
Quant fuel per kg rice	0.02
Price of fuel (USD/liter)	0.80
Price of fuel (Riel/liter)	3,292.00
Value of fuel per kg rice	**76.13**
Value of fuel per kg paddy	**48.72**

Miller Fuel

Quantity used (liters/ X tonne of paddy)	6.43
Kg paddy produced	1,000.00
Conv paddy-rice	0.64
Kg rice produced	640.00
Quant fuel per kg rice	0.01
Price of fuel (USD/liter)	0.80
Price of fuel (Riel/liter)	3,292.00
Value of fuel per kg rice	**33.07**
Value of fuel per kg paddy	**21.17**

Collector Fuel

Quantity used (liters/ X tonne of paddy)	2.00
Kg paddy produced	1,000.00
Conv paddy-rice	0.64
Kg rice produced	640.00
Quant fuel per kg rice	0.003
Price of fuel (USD/liter)	0.80
Price of fuel (Riel/liter)	3,292.00
Value of fuel per kg rice	**10.29**
Value of fuel per kg paddy	**6.58**

Exporter Fuel

Quantity used (liters/ X tonne of paddy)	1.00
Kg paddy produced	1,000.00
Conv paddy-rice	0.64
Kg rice produced	640.00
Quant fuel per kg rice	0.002
Price of fuel (USD/liter)	0.80
Price of fuel (Riel/liter)	3,292.00
Value of fuel per kg rice	**5.14**
Value of fuel per kg paddy	**3.29**

TOTAL TRADABLE COSTS (RICE)	**226.35**
TOTAL TRADABLE COSTS (PADDY)	**144.87**

Value Other costs per kg rice	**15.25**

Labor (Exporter)

Total cost of labor	1,400
Kg paddy Exported	1,562.50
Conv paddy-rice	0.64
Kg rice Exported	1,000.00
Value labor per kg rice	**1.40**

Other Non-Labor Costs (Exporter)

Total cost of non-labor inputs	16679.00
Kg paddy produced	1,562.50
Conv paddy-rice	0.64
Kg rice produced	1,000.00
Value Other costs per kg rice	**16.68**

Profit Margins (Riel/kg Paddy)

Farmer	260.00
Collector	5.00

Profit Margins (Riel/kg Rice)

Miller	136.00
Exporter	80.00
Total Margins per kg rice	**385.60**

Labor (collector)

Total cost of labor	5,000
Kg paddy Collected	1,562.50
Conv paddy-rice	0.64
Kg rice Collected	1,000.00
Value labor per kg rice	**5.00**

Other Non-Labor Costs (collector)

Total cost of non-labor inputs	1,000
Kg paddy Collected	1,562.50
Conv paddy-rice	0.64
Kg rice Collected	1,000.00
Value Other costs per kg rice	**1.00**

TOTAL NT COSTS PER KG RICE	**1156.35**
Total Costs per Kg Paddy	**1951.66**
Total Costs per Kg Rice	**1382.70**

NPCs/DRCs vis-à-vis World Price (RICE BASIS)

Border price calculation	USD/ton		Conv. To Riel/kg
fob price of Phkar Khney, Sihanoukville	323	243	1329.145

cif price of white rice 25%, Bangkok	268	1102.82	
cif price of Jasmine, Bangkok	411	1691.265	
Adjustment of FOB World prices	Phkar Khney	Thai White Rice	Thai Jasmine
FOB price (Riel/kg)	1,329.15	1102.82	1691.265
Port costs (Riel/kg)	25	25	25
Transport to Phnom Penh (Riel/kg)	30	30	30
Transport to Southern Provinces (Riel/kg)	40	40	40
Margins (sum of export, milling) (Riel/kg)	0.00	0.00	0.00
Adjusted FOB World price (Kampong Cham) (Riel/kg)	1,424.15	1,197.82	1,786.27
Adjusted FOB World price (Phnom Penh) (Riel/kg)	1,384.15	1,157.82	1,746.27
Domestic Retail Prices for Local Rice			
Kampong Cham price (Riel/kg)	1,137.00		
Phnom Penh price (Riel/kg)	1,386.25		
NPC calculations	Phkar Khney	Thai White Rice	Thai Jasmine
Kampong Cham price	***0.80***	***0.95***	***0.64***
Phnom Penh price	***1.00***	***1.20***	***0.79***
DRC calculations (rice basis)	Phkar Khney	Thai White Rice	Thai Jasmine
Kampong Cham	**0.97**	**1.19**	**0.74**
Phnom Penh	**1.00**	**1.24**	**0.76**

Table 174 Relative Importance of Tradable and Non-Tradable Costs for Wet Season Rice in Cambodia

Relative Importance of Costs		
Tradable input costs	**Riel/Kg Rice)**	**Percent**
DAP	45.62	3.30%
Urea	56.10	4.06%
Phosphorous	0.00	0.00%
N-P-K Compound Fertilizer	0.00	0.00%
Pesticides and Herbicides	0.00	0.00%
Farm Fuel	76.13	5.51%
Miller Fuel	33.07	2.39%
Collector Fuel	10.29	0.74%
Exporter Fuel	5.14	0.37%
TOTAL TRADABLE COSTS (RICE)	**226.35**	**16.37%**
Non-tradable input costs		
Transport (Net Costs)	52.80	3.82%
Labor (farm)	480.07	34.72%
Organic Fertilizer	0.00	0.00%
Seeds	46.64	3.37%
Other Materials (farm), excluding fertilizer, pesticides and fuel	148.95	10.77%
Electricity (mill)	0.00	0.00%
Labor Costs (mill)	2.97	0.21%
Other Non-Labor Costs (mill), excluding fuel	15.25	1.10%
Labor (Exporter)	1.40	0.10%
Other Non-Labor Costs (Exporter)	16.68	1.21%
Profit Margins (Riel/kg Rice)	385.60	27.89%
Labor (collector)	5.00	0.36%
Other Non-Labor Costs (collector)	1.00	0.07%
TOTAL NT COSTS PER KG RICE	**1,156.35**	83.63%
Total Costs per Kg Rice	**1,382.70**	**100%**

Table 175 Sensitivity Analysis of NPC for Changes in Phnom Penh Prices

	Price	Base	Decrease in Domestic Price		Increase in Domestic Price		NPC=1
			10%	20%	10%	20%	Change in Domestic Price
Dry Season Rice	1000	0.91	0.82	0.73	1.0	1.09	+10%
Wet Season Rice	1,386.25	1.0	0.90	0.80	1.10	1.20	0%

Source: Study Team Calculations

Table 176 Sensitivity Analysis of DRC to Labor Costs – Phnom Penh Prices

	Base	Labor Cost Decrease		Labor Cost Increase		DRC=1
		10%	20%	10%	20%	Change in Labor Cost
Dry Season Rice	1.00	0.98	0.96	1.03	1.05	0%
vs. Thai White Rice	0.93	0.91	0.89	0.95	0.97	+35%
vs. Thai Jasmine	0.55	0.54	0.53	0.56	0.57	+390%
Wet Season Rice	1.00	0.96	0.91	1.04	1.08	0%
vs. Thai White Rice	1.24	1.19	1.14	1.29	1.35	-45%
vs. Thai Jasmine	0.76	0.73	0.70	0.79	0.83	+75%

Source: Study Team Calculations

Table 177 Sensitivity Analysis of DRC to Farm Productivity Changes – Phnom Penh Prices

	Base	Yield Decrease		Yield Increase		DRC=1
		10%	20%	10%	20%	Change in Yield
Dry Season Rice	1.00	1.09	1.20	0.94	0.89	0%
vs. Thai White Rice	0.93	1.01	1.11	0.87	0.83	-9%
vs. Thai Jasmine	0.55	0.59	0.63	0.52	0.50	-53%
Wet Season Rice	1.00	1.08	1.19	0.93	0.88	0%
vs. Thai White Rice	1.24	1.35	1.49	1.16	1.09	+35%
vs. Thai Jasmine	0.76	0.82	0.90	0.71	0.67	-30%

Source: Study Team Calculations

Table 178 Sensitivity Analysis of DRC to Post Harvest Productivity Changes – Phnom Penh Prices

	Base	Milling Recovery Decrease		Milling Recovery Increase		DRC=1
		10%	20%	10%	20%	Change in Milling Recovery (64%)
Dry Season Rice	1.00	1.07	1.18	0.96	0.92	0%
vs. Thai White Rice	0.93	0.99	1.08	0.89	0.86	-11% (57% recovery)
vs. Thai Jasmine	0.55	0.58	0.62	0.53	0.52	-54% (29% recovery)
Wet Season Rice	1.00	1.07	1.17	0.94	0.90	0%
vs. Thai White Rice	1.24	1.34	1.48	1.17	1.11	+55% (99% recovery)
vs. Thai Jasmine	0.76	0.81	0.88	0.72	0.69	-31% (44% recovery)

Source: Study Team Calculations

K.2 Quantifying Value Added Interventions along the Rice-Based Value Chain using CAMSEM

K.2.1 Introduction

1017. Multimarket models are policy tools that can be used to analyze a wide range of sectoral policy issues. Unlike partial equilibrium models, which typically focus on the dynamics in a single sector, multimarket models measure the interaction and interrelationships between markets in an economy (Goletti and Rich 1998). While lacking the sophistication of general equilibrium (e.g., CGE) models in incorporating macro-level effects of the economy, multimarket models are useful in their ability to analyze the impact of changes in public policy at a sectoral level. These policy changes can be traced to examine their effects on production, demand, household incomes, government revenue, international trade, and poverty levels.

1018. Multimarket models have been used extensively over the past two decades to analyze various elements of agricultural policy reform. In the 1980s, the World Bank developed multimarket models for Senegal, South Korea, and Cyprus to examine how changes in pricing policies, such as changes in the level of subsidies on rice and fertilizer, affected crop response, household demand, regional income, trade balances, and government revenues (Braverman and Hammer 1986; Braverman and Hammer 1986; Sadoulet and de Janvry 1995). In the early 1990s, multimarket analysis was used to measure the impact of policy reforms on household poverty. Dorosh, del Ninno, and Sahn, for instance, used a multimarket model to examine how food aid imports influenced poverty levels in Mozambique (Dorosh, Ninno et al. 1995); food aid was also studied with a multimarket model by Dorosh and Haggblade (Dorosh and Haggblade 1997).

1019. The level of sophistication in multimarket analysis has increased in recent years and has allowed practitioners to study a wider range of policy changes. Minot and Goletti use a spatial multimarket model to analyze how changes in government rice policy affected supply, demand, and household poverty at a regional level (Minot and Goletti 1998). Subsequent applications of this approach were used in a study of agricultural diversification in Viet Nam (Goletti and Rich 1998) and an analysis of agricultural policy options for income growth and poverty alleviation in Madagascar (Goletti and Rich 1998). The range of policies analyzed in these studies went beyond pricing policies. The Madagascar study, for example, looked at improvements in agricultural productivity and regional infrastructure improvement (Goletti and Rich 1998). A major innovation of the spatial approach was the use of mixed complementarity programming that allows the analyst to specify nonlinear supply and demand functions; previous spatial analyses required the use of linear equations, thus precluding the incorporation of sophisticated supply and demand systems, for example (Minot and Goletti 1998).

1020. In order to obtain some insights into the rice sector in Cambodia, a multimarket model (CAMSEM) was used for the analysis of agricultural policy issues in Cambodia. The model used was based on a multimarket model designed for policy analysis issues in Africa, which has the advantage of being a generic model that can be adapted to policy analysis in a multitude of environments (Rich and Lundberg 2002).

1021. It needs to be highlighted that the results obtained from this model are preliminary and should be interpreted with extreme caution. Data constraints limited the inputs to the model to basic production information and price information (Agricultural Marketing Office

2000; National Institute of Statistics 2001). Information on trade, consumption, and income are all estimated using from data in the national accounts and the 1999 socio-economic survey (National Institute of Statistics 1999; National Institute of Statistics 2001; National Institute of Statistics, Directorate General for Health [Cambodia] et al. 2001) or from analyst estimates. All elasticities are estimates based on past multimarket studies – no econometric work was conducted with this model. Demand elasticities are thus based loosely on multimarket models for Madagascar and Malawi (Lundberg and Rich 2002; Rich and Lundberg 2002). Therefore, further research will be necessary to devote more effort into obtain more accurate elasticities and data for input into the model. Despite these limitations, the model can at least provide some rudimentary guidance for the types of effects that may occur from alternative policies and investments.

K.2.2 Description and Specification of CAMSEM

1022. The product categories used in the model were as follows:

1. Dry season rice
2. Wet season rice
3. Coarse grains (defined for the model as maize)
4. Vegetables
5. Other food, defined as soybeans, cassava, and sweet potato
6. Livestock, defined as an aggregate of beef, pork, and poultry
7. Fish products
8. Fertilizer

1023. Four broad types of household groups were chosen in the model: urban non-poor, urban poor, rural poor and rural non-poor. The definition of these household groups was somewhat arbitrary; future research will aim at better defining these groups. For this model, “rich” groups were defined as the upper two income deciles, as defined in the 1999 socioeconomic survey. Poor groups were the remaining lower eight deciles. Only aggregate national income is reported given the limited data and time to accurately construct household accounts for these groups.

1024. There are five blocks of equations in the multimarket model: prices, supply, consumption, income, and equilibrium. The price block defines the relationships between producer prices and consumer prices in the domestic market and between world prices, border prices, and consumer prices. The supply block represents the domestic production of food crops, livestock, and non-agricultural production. The consumption block shows household demand for commodities, while the income block is defined as the sum of agricultural production and exogenous non-agricultural production. The equilibrium condition equates supply plus net imports to household and input demand plus feed consumption. A listing of the variables used in the model is shown in Table 179 and Table 180.

Table 179 Sets Used in CAMSEM

C	all commodities
I	all commodities less fertilizer
IM	importable commodities
IX	exportable commodities
F	food crops (dry season rice, wet season rice, maize, vegetables, and other food)
L	livestock
FI	fish production
H	households (urban non-poor, urban poor, rural poor, rural non-poor)

Table 180 Variables Used in CAMSEM

PC_c	Consumer price for commodity c
PP_c	Producer price for commodity c
$RMARG_c$	Margin from rest-of-world (ROW) to border for commodity c
$IMARG_c$	Margin from consumer area to border for commodity c
$MARG_c$	Margin from producing area to consuming area for commodity c
PM_{IM}	Border (import) price for commodity c
PX_{IX}	Border (export) price for commodity c
PW_c	World price for commodity c (fixed)
$PCWT_i$	Weighted share of national consumption of commodity I
tm_c	Import tariff on commodity c
te_c	Export tariff on commodity c
er	Exchange rate (fixed)
$SH_{h,f}$	Share of land allocated to household h for food crop, f
$YLD_{h,f}$	Crop yield of crop f obtained by household h
$SCR_{h,f}$	Household supply of crop f obtained by household h
SCR_f	Total supply of crop f
AREA	Total cultivated agricultural area (fixed)
$LOSS_f$	Loss and seed use for crop f
$CONV_f$	Conversion factor for crop f (e.g., from paddy to rice)
$SLV_{h,l}$	Household supply of livestock
SLV_l	Total supply of livestock
$SFI_{h,fi}$	Household supply of fish production
SFI_{fi}	Total supply of fish production
$DFERT_{h,f}$	Household demand for fertilizer
$DFERT_f$	Total demand for fertilizer
$HC_{h,i}$	Household demand of commodity i
$CONS_f$	Total demand for commodity i
YH_h	Total household income of household group h
$YHAG_h$	Total agricultural income of household group h
$YHNAG_h$	Total non-agricultural income of household group h (fixed)
$LT_{h,f}$	Land tax on crop f imposed on household h
$FEED_c$	Feed use of commodity c
M_c	Net imports of commodity c
$GOVIMP_c$	Net government imports of commodity c (fixed)

K.2.2.1 Price Block

1025. The price block is comprised of six equations that reflect the relationships between producer prices, consumer prices, and international prices. Producer prices (PP) are linked to consumer prices (PC) through an exogenously determined domestic marketing margin (MARG) that is commodity-specific. The domestic marketing margin reflects transportation and distribution costs incurred from the movement of commodities from producing to consuming areas. Changes in the domestic margin can proxy changes in transportation costs that arise from improvements in infrastructure, for instance.

$$PP_c = \frac{PC_c}{(1 + m\arg_c)}$$

1026. A price index is included that reflects changes in prices weighted by their share of consumption:

$$PINDEX = \sum_i PCWT_i * \frac{PC_i}{PC0_i}$$

1027. The next set of price relationships highlight the interaction of domestic markets with international markets. For non-tradable products, these equations do not enter the system. As a result, prices of non-tradable products are determined endogenously through the equilibration of domestic supply and demand. By contrast, the prices of tradable products are exogenously determined by the fixed world price, with net imports endogenously clearing the domestic market.

1028. For importable products, there are two relevant price relationships. First, the domestic consumer price is linked to the border price by way of an exogenously determined margin that reflects the transportation and distribution costs associated with the movement of the product from the border to the consuming area. Second, the border price is associated with the (fixed) world price, adjusted by the exchange rate and any tariffs applied to the product. Similarly for exports, the producer price is linked to the border price by way of a marketing margin and the border price is related to the world price, adjusting for the exchange rate and any export taxes applied on the product.

$$PC_{im} = PM_{im} * (1 + IMARG_{im})$$

$$PM_{im} = \overline{PW_{im}} * er * (1 + RMARG_{im}) * (1 + tm_{im})$$

$$PP_{ix} = \frac{PX_{ix}}{(1 + IMARG_{ix})}$$

$$PX_{ix} = \frac{\overline{PW_{ix}} * er}{(1 + RMARG_{ix}) * (1 + te_{ix})}$$

K.2.2.2 Supply Block

1029. There are ten equations in the supply block, with includes output supply and input demand. In the model, production of agricultural crops, livestock, and fish products, and demand for fertilizer are differentiated by household type. This specification allows for targeted simulations with respect to agricultural productivity and input use.

1030. For food crops, supply is determined by the quantity of land used for a particular commodity and its associated yield. It is assumed that land share and yield can vary by household type. The total amount of land under cultivation is kept fixed, representing short-run constraints of bringing new land into production. However, land can be reallocated among each food commodity depending on changes in relative prices. The share equation and yield equation are represented in a log-linear form as a function of prices, with the coefficients representing the price elasticities. The share equation is a

function of output prices only, while the yield equation is a function of both output and input prices. The elasticities used are often "guesstimates" based on previous research (e.g. (Goletti and Rich 1998)); however, these can be substituted with proper estimates of the supply parameters if data is available. Total supply is defined as the product of area, share, and yield, adjusted for losses and seed use and any related conversion factors (e.g., from paddy to rice).

$$\log(SH_{h,f}) = \alpha^{s}_{h,f} + \sum_{f} \beta^{s}_{h,f,ff} \log(PP_{ff})$$

$$\log(YLD_{h,f}) = \alpha^{y}_{h,f} + \beta^{y}_{h,f,f} \log(PP_{f}) + \gamma^{y}_{h,f,in} \log(PC_{in})$$

$$SCR_{h,f} = \overline{AREA} * SH_{h,f} * YLD_{h,f} * \overline{(1 - loss_{f})} * \overline{conv_{f}}$$

$$SCR_{f} = \sum_{h} SCR_{h,f}$$

1031. The supply of livestock and fish production is simply represented in log-linear form as a function of the associated output price. As with food crops, the supply of livestock and non-agricultural production will vary by household, with total supply determined by the sum of household production of these goods.

$$\log(SLV_{h}) = \alpha^{l}_{h} + \beta^{l}_{h,l,l} \log(PP_{l})$$

$$SLV = \sum_{h} SLV_{h}$$

$$\log(SFI_{h}) = \alpha^{fi}_{h} + \beta^{fi}_{h,fi,fi} \log(PP_{fi})$$

$$SFI = \sum_{h} SFI_{h}$$

1032. Likewise, fertilizer demand is a log-linear function of output prices and the price of fertilizer at the household level.

$$\log(DFERT_{h}) = \alpha^{f}_{h} + \sum_{f} \beta^{f}_{h,f,f,in} \log(PP_{f}) + \gamma^{f}_{h} \log(PC_{in})$$

$$DFERT = \sum_{h} DFERT_{h}$$

K.2.2.3 Consumption Block

1033. Two equations define consumer demand in the model. Consumer demand is differentiated by urban demand and rural demand, with total demand equal to the sum of demand. Urban and rural demands are specified as an Almost Ideal Demand System (AIDS) (Deaton and Muellbauer 1980).

$$\log(HC_{h,i}) = \alpha^{h}_{h,i} + \sum_{j} \beta^{h}_{h,i,j} \log(PC_{j}) + \gamma^{h}_{h,i} \log(YH_{h})$$

$$CONS_i = \sum_h HC_{h,i}$$

K.2.2.4 Income Block

1034. Two equations represent household income in the model. Agricultural income is the sum of crop income, livestock, and fish, less expenditures on fertilizer. Non-agricultural income is determined exogenously. Total income is the sum of agricultural and non-agricultural income, with non-agricultural income adjusted by the price index.

$$YHAG_h = \sum_f (PP_f * SCR_{h,f}) + (PP_l * SLV_{h,l}) + (PP_l * SFI_{h,fi}) - (PC_{in} * DFERT_{h,in}) - \sum_f \overline{AREA} * SH_{h,f}$$

$$YH_h = YHAG_h + \overline{YHNAG_h} * PINDEX$$

K.2.2.5 Market Clearing

1035. An equilibrium equation closes the system. Equilibrium is defined by setting total supply plus net imports (private and government) equal to household demand and exogenous consumption of food crops as animal feed.

$$SCR_f + SLV + SFI + M_c + GOVIMP_c = CONS_i + DFERT + \overline{FEED}_c$$

1036. In total, the model contains 23 equations, including a dummy objective function, omega, which is used to solve the model. The model was originally designed in GAMS using the NLP solver. However, the framework is potentially suitable for integration into Excel using the Solver feature.

K.2.3 Policy Simulations

1037. In order to examine the effects of alternate policies and investments in the agricultural sector in Cambodia, several sets of simulations were conducted for each crop type. These fall into the basic areas of:

1. **Improvements in Agricultural Productivity**: This is the introduction of technologies (seeds, irrigation, fertilizer, etc.) which lead to a 20 percent increase in yields.

2. **Changes in Technology**: These include improvements in milling technology for rice which leads to the milling recovery ratios to increase, as well as a reduction in post harvest losses along the value chain.

3. **Improvements in Quality**: This simulates changes in practices which result in higher quality commodities being sold in the market. This is simulated though an increase in consumer prices for the same (unchanged) commodity which should hopefully flow through to increased farm gate prices.

4. **Improvements in Infrastructure**: These include reductions in the marketing margins between the farm gate and urban areas, as well as a reduction in the marketing margins between the farm and border areas. These simulate an improvement in road infrastructure, a reduction in transportation costs (more

efficient transportation, less unofficial costs), as well as an improvement in the marketing functions which lower transaction costs.

1038. Each of the individual simulations are outlined below:

1. Simulation 1: Changes in Agricultural Productivity
    a. 20 percent increase in yields of dry season rice
    b. 20 percent increase in yields of wet season rice
    c. 20 percent increase in yields of coarse grains (maize)
    d. 20 percent increase in yields of vegetables
    e. 20 percent increase in yields of other foods (soybeans, cassava, sweet potato)

2. Simulation 2: Changes in Processing Technology and Post Harvest Losses
    a. increase in milling recovery ratios for wet season (0.65 to 0.67) and dry season rice (0.63 to 0.65)
    b. reduction in post harvest losses for wet and dry season rice from 14% to 10%
    c. reduction in post harvest losses for coarse grains from 10% to 7%
    d. reduction in post harvest losses for vegetables from 10% to 7%
    e. reduction in post harvest losses for other food from 10% to 7%
    f. reduction in post harvest losses for fish from 10% to 7%

3. Simulation 3: Improvements in Quality - Increases in Price
    a. Increase in dry season rice consumer price by 20 percent
    b. Increase in wet season rice consumer price by 20 percent
    c. Increase in coarse grains consumer price by 20 percent
    d. Increase in vegetable consumer price by 20 percent
    e. Increase in other foods consumer price by 20 percent
    f. Increase in fish consumer price by 20 percent

4. Simulation 4: Changes in Marketing Margins
    a. Reduction in internal marketing margins for all commodities by 20 percent
    b. Reduction in marketing margins to port for all commodities by 20 percent

5. Simulation 5: Combining Rice and Vegetable interventions along the value chain
    a. 20 percent increase in yields of rice and vegetables
    b. increase in milling recovery ratios for wet season (0.65 to 0.67) and dry season rice (0.63 to 0.65)
    c. reduction in post harvest losses for wet and dry season rice from 14% to 10% and a reduction in post harvest losses for vegetables from 10% to 7%
    d. Increase in rice and vegetable consumer prices by 20 percent

K.2.4 Simulation Results

K.2.4.1 Simulation Results for Rice

K.2.4.1.1 Improvements in Productivity

1039. Two simulations related to productivity were conducted; these are summarized in Table 181 to Table 188. Prices for rice in both simulations do not change because they are linked to international prices; prices in other market change by marginal amounts; see

Table 181 and Table 185. A 20 percent increase in the productivity of dry season rice leads to an almost full 20 percent rise in dry season rice production; see Table 182. Consumption of dry season rice falls slightly (-0.5 percent), ostensibly due to substitution effects with other commodities. For instance, consumption of vegetables and livestock both increase by around 0.3 to 0.4 percent; see Table 182. There is also a slight increase in the consumption of wet season rice (0.55 percent). Fertilizer demand grows by just over 1 percent in this simulation. Since consumption is virtually unchanged, nearly the entire resultant surplus of dry season rice is exported, with dry season rice exports increasing by over 41 percent; see Table 183. Interestingly, wet season rice exports fall by 27 percent, as domestic consumption replaces a portion of wet season rice that was previously exported. Total income rises by 0.9 percent, though agricultural income increases by 1.85 percent; see Table 184.

1040. A 20 percent increase in the productivity of wet season rice leads to just over a 20 percent rise in wet season rice production; see Table 186, with resultant rises in livestock production of 14 percent. Most of the new surplus of wet season rice is exported, with consumption actually falling by around 1.4 percent (see Table 186). Consumers also substitute into from dry season rice, with increases in consumption of around 0.9 percent, in lieu of wet season rice and other food products. Fertilizer demand accelerates greatly in this scenario, increasing from 37,000 tonnes to 198,000 tonnes; see Table 186). Given the slight fall in domestic wet season rice consumption, the vast majority of the surplus is exported, leading to wet season rice exports of 448,000 tonnes (in rice equivalent); see Table 187. Such an investment has a slightly smaller income effect than the previous simulation – agricultural income rises by nearly 1.62 percent, with total income falling by 2.73 percent due to increased costs in fertilizer purchases and reductions in non-agricultural income; see Table 188.

Table 181 Increase in Agricultural Productivity of Dry Season Rice - Change in Prices

	Producer Price			Consumer Price		
Commodity	Base	New	% Change	Base	New	% Change
Dry Season Rice	653.85	653.85	0.00	850.00	850.00	0.00
Wet Season Rice	769.23	769.23	0.00	1000.00	1000.00	0.00
Maize	384.62	386.42	0.47	500.00	502.34	0.47
Vegetables	1153.85	1177.04	2.01	1500.00	1530.15	2.01
Livestock	5846.15	5922.54	1.31	7600.00	7699.30	1.31
Other Food	615.38	622.57	1.17	800.00	809.34	1.17
Fertilizer	615.38	615.38	0.00	800.00	800.00	0.00
Fish	3461.54	3461.54	0.00	4500.00	4500.00	0.00

Riel per kg
Other Food: Soybean, Cassava and Sweetpotato
Simulation: 20 percent increase in dry season rice yields

Table 182 Increase in Agricultural Productivity of Dry Season Rice - Change in Volumes

Commodity	Production			Consumption		
	Base	New	% Change	Base	New	% Change
Dry Season Rice	444.19	532.84	19.96	215.40	214.36	-0.49
Wet Season Rice	1829.88	1827.21	-0.15	1726.50	1735.98	0.55
Maize	163.05	163.12	0.04	154.90	154.97	0.04
Vegetables	152.47	152.90	0.28	144.84	145.28	0.30
Livestock	134.10	134.63	0.39	134.10	134.63	0.39
Other Food	177.44	177.75	0.18	168.60	168.88	0.16
Fertilizer	0.00	0.00	0.00	37.00	37.39	1.05
Fish	360.00	360.00	0.00	310.00	312.75	0.89

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: 20 percent increase in dry season rice yields

Table 183 Increase in Agricultural Productivity of Dry Season Rice - Change in Net Imports

Commodity	Net Imports		
	Base	New	% Change
Dry Season Rice	-215.40	-305.15	41.67
Wet Season Rice	-50.00	-36.33	-27.34
Maize	0.00	0.00	0.00
Vegetables	0.00	0.00	0.00
Livestock	0.00	0.00	0.00
Other Food	0.00	0.00	0.00
Fertilizer	37.00	37.39	1.05
Fish	-50.00	-47.25	-5.49

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: 20 percent increase in dry season rice yields

Table 184 Increase in Agricultural Productivity of Dry Season Rice - Changes in Income

Income	Total Income		
	Base	New	% Change
Total Income	12112.10	12220.18	0.89
Urban Non-Poor	1983.41	1991.60	0.41
Urban Poor	2338.79	2348.45	0.41
Rural Non-Poor	2415.55	2454.57	1.62
Rural Poor	5374.34	5425.57	0.95
Agricultural Income	4046.39	4121.18	1.85
Rural Non-Poor	2023.19	2060.59	1.85
Rural Poor	2023.193	2060.588	1.85

Billion Riel
Simulation: 20 percent increase in dry season rice yields

Table 185 Increase in Agricultural Productivity of Wet Season Rice - Change in Prices

Commodity	Producer Price			Consumer Price		
	Base	New	% Change	Base	New	% Change
Dry Season Rice	653.85	653.85	0.00	850.00	850.00	0.00
Wet Season Rice	769.23	769.23	0.00	1000.00	1000.00	0.00
Maize	384.62	378.28	-1.65	500.00	491.76	-1.65
Vegetables	1153.85	1089.39	-5.59	1500.00	1416.21	-5.59
Livestock	5846.15	4608.33	-21.17	7600.00	5990.83	-21.17
Other Food	615.38	597.30	-2.94	800.00	776.49	-2.94
Fertilizer	615.38	615.38	0.00	800.00	800.00	0.00
Fish	3461.54	3461.54	0.00	4500.00	4500.00	0.00

Riel per kg
Other Food: Soybean, Cassava and Sweetpotato
Simulation: 20 percent increase in wet season rice yields

Table 186 Increase in Agricultural Productivity of Wet Season Rice - Change in Volumes

Commodity	Production			Consumption		
	Base	New	% Change	Base	New	% Change
Dry Season Rice	444.19	444.65	0.10	215.40	217.34	0.90
Wet Season Rice	1829.88	2205.32	20.52	1726.50	1702.02	-1.42
Maize	163.05	162.79	-0.16	154.90	154.64	-0.17
Vegetables	152.47	151.23	-0.81	144.84	143.61	-0.85
Livestock	134.10	153.00	14.09	134.10	153.00	14.09
Other Food	177.44	176.65	-0.45	168.60	167.77	-0.49
Fertilizer	0.00	0.00	0.00	37.00	198.07	435.31
Fish	360.00	360.00	0.00	310.00	303.06	-2.24

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: 20 percent increase in wet season rice yields

Table 187 Increase in Agricultural Productivity of Wet Season Rice - Change in Net Imports

Commodity	Net Imports		
	Base	New	% Change
Dry Season Rice	-215.40	-213.99	-0.65
Wet Season Rice	-50.00	-448.41	796.81
Maize	0.00	0.00	0.00
Vegetables	0.00	0.00	0.00
Livestock	0.00	0.00	0.00
Other Food	0.00	0.00	0.00
Fertilizer	37.00	198.07	435.31
Fish	-50.00	-56.94	13.89

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: 20 percent increase in wet season rice yields

Table 188 Increase in Agricultural Productivity of Wet Season Rice - Changes in Income

Income	Total Income		
	Base	New	% Change
Total Income	12112.10	11781.80	-2.73
Urban Non-Poor	1983.41	1886.12	-4.91
Urban Poor	2338.79	2224.07	-4.91
Rural Non-Poor	2415.55	2428.98	0.56
Rural Poor	5374.34	5242.63	-2.45
Agricultural Income	4046.39	4111.74	1.62
Rural Non-Poor	2023.19	2055.87	1.62
Rural Poor	2023.193	2055.869	1.62

Billion Riel
Simulation: 20 percent increase in wet season rice yields

K.2.4.1.2 Improvements in Technology

1041. The next two simulations examined the effect of improvements in milling technology on the rice sector in Cambodia. The first of these simulations looked at improving the milling recovery rate for rice. In this simulation, the recovery rate for dry season rice was increased from 63 percent to 65 percent, while the recovery rate for wet season rice was increased from 65 percent to 67 percent. The results are summarized in Table 189 to Table 192.

1042. In this scenario, as before, there are no price effects on rice due to the rice price being linked to world markets; see Table 189. Production of both wet season and dry season rice rise by around 3 percent as a result of such an investment; see Table 190.

Consumption of wet season rice increases marginally (0.5 percent), while consumption of dry season rice falls by a similar amount; see Table 190. As in the previous two simulations, most of the surplus is exported, with wet season exports doubling to almost 100,000 tonnes, while dry season rice exports rising by just 7 percent; see Table 191. Income effects in this scenario are small, however – total income rises by just 0.81 percent, with agricultural income rising by 1.67 percent; see Table 192.

Table 189 Improvements in Milling Technology for Rice - Change in Prices

	Producer Price			Consumer Price		
Commodity	Base	New	% Change	Base	New	% Change
Dry Season Rice	653.85	653.85	0.00	850.00	850.00	0.00
Wet Season Rice	769.23	769.23	0.00	1000.00	1000.00	0.00
Maize	384.62	386.24	0.42	500.00	502.11	0.42
Vegetables	1153.85	1174.78	1.81	1500.00	1527.22	1.81
Livestock	5846.15	5915.16	1.18	7600.00	7689.71	1.18
Other Food	615.38	621.89	1.06	800.00	808.45	1.06
Fertilizer	615.38	615.38	0.00	800.00	800.00	0.00
Fish	3461.54	3461.54	0.00	4500.00	4500.00	0.00

Riel per kg
Other Food: Soybean, Cassava and Sweetpotato
Simulation: Improvement in milling recovery ratios for dry season (0.63 to 0.65) and wet season rice (0.65 to 0.67)

Table 190 Improvements in Milling Technology for Rice - Change in Volumes

	Production			Consumption		
Commodity	Base	New	% Change	Base	New	% Change
Dry Season Rice	444.19	458.14	3.14	215.40	214.46	-0.44
Wet Season Rice	1829.88	1883.69	2.94	1726.50	1735.07	0.50
Maize	163.05	163.11	0.04	154.90	154.96	0.04
Vegetables	152.47	152.86	0.26	144.84	145.24	0.27
Livestock	134.10	134.58	0.35	134.10	134.58	0.36
Other Food	177.44	177.72	0.16	168.60	168.85	0.15
Fertilizer	0.00	0.00	0.00	37.00	37.35	0.96
Fish	360.00	360.00	0.00	310.00	312.48	0.80

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: Improvement in milling recovery ratios for dry season (0.63 to 0.65) and wet season rice (0.65 to 0.67)

Table 191 Improvements in Milling Technology for Rice - Change in Net Imports

	Net Imports		
Commodity	Base	New	% Change
Dry Season Rice	-215.40	-230.36	6.95
Wet Season Rice	-50.00	-93.73	87.46
Maize	0.00	0.00	0.00
Vegetables	0.00	0.00	0.00
Livestock	0.00	0.00	0.00
Other Food	0.00	0.00	0.00
Fertilizer	37.00	37.35	0.96
Fish	-50.00	-47.52	-4.96

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: Improvement in milling recovery ratios for dry season (0.63 to 0.65) and wet season rice (0.65 to 0.67)

Table 192 Improvements in Milling Technology for Rice - Changes in Income

Income	Total Income		
	Base	New	% Change
Total Income	12112.10	12209.75	0.81
Urban Non-Poor	1983.41	1990.81	0.37
Urban Poor	2338.79	2347.51	0.37
Rural Non-Poor	2415.55	2450.80	1.46
Rural Poor	5374.34	5420.63	0.86
Agricultural Income	4046.39	4113.96	1.67
Rural Non-Poor	2023.19	2056.98	1.67
Rural Poor	2023.193	2056.981	1.67

Billion Riel
Simulation: Improvement in milling recovery ratios for dry season (0.63 to 0.65) and wet season rice (0.65 to 0.67)

1043. Somewhat larger effects on production, trade, and income arise from the next simulation, which examines a reduction in postharvest losses from 14 percent to 10 percent; see Table 193 to Table 196. In this simulation, production rises by around 4.5 percent for both dry and wet season rice; see Table 194. Consumption of dry season rice falls by 0.7 percent, while wet season rice consumption increases by around the same amount; see Table 194. The larger rise in production implies greater demand for fertilizer, which increases by around 1.4 percent. Trade effects are naturally large in this simulation, with exports of wet season rice increasing by over 130 percent; see Table 195. Income effects are about 50 percent larger than the previous simulation, with total income rising by over 1.2 percent and agricultural income rising by over 2.5 percent; see Table 196.

Table 193 Improvements in Postharvest Technology for Rice - Change in Prices

Commodity	Producer Price			Consumer Price		
	Base	New	% Change	Base	New	% Change
Dry Season Rice	653.85	653.85	0.00	850.00	850.00	0.00
Wet Season Rice	769.23	769.23	0.00	1000.00	1000.00	0.00
Maize	384.62	387.06	0.64	500.00	503.18	0.64
Vegetables	1153.85	1185.47	2.74	1500.00	1541.11	2.74
Livestock	5846.15	5950.06	1.78	7600.00	7735.07	1.78
Other Food	615.38	625.12	1.58	800.00	812.65	1.58
Fertilizer	615.38	615.38	0.00	800.00	800.00	0.00
Fish	3461.54	3461.54	0.00	4500.00	4500.00	0.00

Riel per kg
Other Food: Soybean, Cassava and Sweetpotato
Simulation: Reductions in post harvest losses for rice from 14 percent down to 10 percent

Table 194 Improvements in Postharvest Technology for Rice - Change in Volumes

Commodity	Production			Consumption		
	Base	New	% Change	Base	New	% Change
Dry Season Rice	444.19	464.62	4.60	215.40	213.99	-0.66
Wet Season Rice	1829.88	1911.19	4.44	1726.50	1739.37	0.75
Maize	163.05	163.14	0.05	154.90	154.99	0.06
Vegetables	152.47	153.06	0.39	144.84	145.43	0.41
Livestock	134.10	134.81	0.53	134.10	134.81	0.53
Other Food	177.44	177.86	0.24	168.60	168.99	0.23
Fertilizer	0.00	0.00	0.00	37.00	37.52	1.40
Fish	360.00	360.00	0.00	310.00	313.73	1.21

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: Reductions in post harvest losses for rice from 14 percent down to 10 percent

Table 195 Improvements in Postharvest Technology for Rice - Change in Net Imports

Commodity	Net Imports		
	Base	New	% Change
Dry Season Rice	-215.40	-237.31	10.17
Wet Season Rice	-50.00	-116.92	133.85
Maize	0.00	0.00	0.00
Vegetables	0.00	0.00	0.00
Livestock	0.00	0.00	0.00
Other Food	0.00	0.00	0.00
Fertilizer	37.00	37.52	1.40
Fish	-50.00	-46.27	-7.46

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: Reductions in post harvest losses for rice from 14 percent down to 10 percent

Table 196 Improvements in Postharvest Technology for Rice - Changes in Income

Income	Total Income		
	Base	New	% Change
Total Income	12112.10	12259.01	1.21
Urban Non-Poor	1983.41	1994.55	0.56
Urban Poor	2338.79	2351.93	0.56
Rural Non-Poor	2415.55	2468.57	2.19
Rural Poor	5374.34	5443.97	1.30
Agricultural Income	4046.39	4148.01	2.51
Rural Non-Poor	2023.19	2074.00	2.51
Rural Poor	2023.193	2074.003	2.51

Billion Riel
Simulation: Reductions in post harvest losses for rice from 14 percent down to 10 percent

K.2.4.1.3 Improvements in Quality

1044. The next simulation looked at the effects of an increase in quality in rice products in Cambodia. The simulation involved an increase in the urban consumer price of rice by 20 percent to reflect the higher quality of the commodity. Table 197 to Table 200 show the results for improving the quality of dry season rice while Table 201 to Table 204 show the results for wet season rice.

1045. As in previous simulations, there are no changes in the prices of rice since they are a tradable commodity; see Table 197 and Table 201.

1046. There are no changes in production volumes of dry season rice but a large change in consumption of dry season rice (5.54 percent increase); see Table 198. The reason for this is the cross-price elasticities which make dry season rice consumption more attractive than the higher quality wet season rice.

1047. Exports of rice fall by a commensurate level to increased domestic consumption of dry season rice; see Table 199. While total incomes increase by 0.14 percent, agricultural incomes increase by 0.62 percent; see Table 200.

1048. For wet season rice, there is around a 1.3 percent increase in production, which is matched with a 6.8 percent increase in consumption and a commensurate fall in wet season exports and a switch to importing rice. This is due to the fact that a 20 percent increase in the price of wet season rice is above the world price for rice, leading to an influx of imports; see Table 202 and Table 203.

1049. Total incomes fall when the quality of wet season rice is increased, as the increase in consumer prices cause consumers to switch to cheaper imported rice. Total income falls by 7 percent, while agricultural income falls by almost 3 percent; see Table 204.

Table 197 Improvements in Quality for Dry Season Rice - Change in Prices

	Producer Price			Consumer Price		
Commodity	Base	New	% Change	Base	New	% Change
Dry Season Rice	653.85	653.85	0.00	850.00	850.00	0.00
Wet Season Rice	769.23	769.23	0.00	1000.00	1000.00	0.00
Maize	384.62	384.56	-0.01	500.00	499.93	-0.01
Vegetables	1153.85	1155.59	0.15	1500.00	1502.27	0.15
Livestock	5846.15	5987.68	2.42	7600.00	7783.99	2.42
Other Food	615.38	617.05	0.27	800.00	802.16	0.27
Fertilizer	615.38	615.38	0.00	800.00	800.00	0.00
Fish	3461.54	3461.54	0.00	4500.00	4500.00	0.00

Riel per kg
Other Food: Soybean, Cassava and Sweetpotato
Simulation: Increase in consumer price for dry season rice by 20 percent

Table 198 Improvements in Quality for Dry Season Rice - Change in Volumes

	Production			Consumption		
Commodity	Base	New	% Change	Base	New	% Change
Dry Season Rice	444.19	444.17	0.00	215.40	227.34	5.54
Wet Season Rice	1829.88	1829.65	-0.01	1726.50	1725.25	-0.07
Maize	163.05	163.04	-0.01	154.90	154.89	-0.01
Vegetables	152.47	152.50	0.02	144.84	144.88	0.03
Livestock	134.10	135.07	0.72	134.10	135.07	0.72
Other Food	177.44	177.51	0.04	168.60	168.64	0.02
Fertilizer	0.00	0.00	0.00	37.00	37.06	0.17
Fish	360.00	360.00	0.00	310.00	313.28	1.06

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: Increase in consumer price for dry season rice by 20 percent

Table 199 Improvements in Quality for Dry Season Rice - Change in Net Imports

	Net Imports		
Commodity	Base	New	% Change
Dry Season Rice	-215.40	-203.51	-5.52
Wet Season Rice	-50.00	-49.51	-0.99
Maize	0.00	0.00	0.00
Vegetables	0.00	0.00	0.00
Livestock	0.00	0.00	0.00
Other Food	0.00	0.00	0.00
Fertilizer	37.00	37.06	0.17
Fish	-50.00	-46.72	-6.56

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: Increase in consumer price for dry season rice by 20 percent

Table 200 Improvements in Quality for Dry Season Rice - Changes in Income

Income	Total Income		
	Base	New	% Change
Total Income	12112.10	12128.52	0.14
Urban Non-Poor	1983.41	1981.26	-0.11
Urban Poor	2338.79	2336.25	-0.11
Rural Non-Poor	2415.55	2427.72	0.50
Rural Poor	5374.34	5383.29	0.17
Agricultural Income	4046.39	4071.57	0.62
Rural Non-Poor	2023.19	2035.78	0.62
Rural Poor	2023.193	2035.783	0.62

Billion Riel
Simulation: Increase in consumer price for dry season rice by 20 percent

Table 201 Improvements in Quality for Wet Season Rice - Change in Prices

Commodity	Producer Price			Consumer Price		
	Base	New	% Change	Base	New	% Change
Dry Season Rice	653.85	653.85	0.00	850.00	850.00	0.00
Wet Season Rice	769.23	769.23	0.00	1000.00	1000.00	0.00
Maize	384.62	365.04	-5.09	500.00	474.55	-5.09
Vegetables	1153.85	963.36	-16.51	1500.00	1252.36	-16.51
Livestock	5846.15	5290.50	-9.50	7600.00	6877.65	-9.50
Other Food	615.38	569.40	-7.47	800.00	740.22	-7.47
Fertilizer	615.38	615.38	0.00	800.00	800.00	0.00
Fish	3461.54	3461.54	0.00	4500.00	4500.00	0.00

Riel per kg
Other Food: Soybean, Cassava and Sweetpotato
Simulation: Increase in consumer price for wet season rice by 20 percent

Table 202 Improvements in Quality for Wet Season Rice - Change in Volumes

Commodity	Production			Consumption		
	Base	New	% Change	Base	New	% Change
Dry Season Rice	444.19	445.57	0.31	215.40	218.72	1.54
Wet Season Rice	1829.88	1854.17	1.33	1726.50	1844.00	6.81
Maize	163.05	162.20	-0.52	154.90	154.05	-0.55
Vegetables	152.47	148.59	-2.54	144.84	140.97	-2.67
Livestock	134.10	130.14	-2.95	134.10	130.14	-2.95
Other Food	177.44	175.38	-1.16	168.60	166.51	-1.24
Fertilizer	0.00	0.00	0.00	37.00	34.01	-8.08
Fish	360.00	360.00	0.00	310.00	290.15	-6.40

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: Increase in consumer price for wet season rice by 20 percent

Table 203 Improvements in Quality for Wet Season Rice- Change in Net Imports

Commodity	Net Imports		
	Base	New	% Change
Dry Season Rice	-215.40	-213.52	-0.87
Wet Season Rice	-50.00	44.73	-189.45
Maize	0.00	0.00	0.00
Vegetables	0.00	0.00	0.00
Livestock	0.00	0.00	0.00
Other Food	0.00	0.00	0.00
Fertilizer	37.00	34.01	-8.08
Fish	-50.00	-69.85	39.70

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: Increase in consumer price for wet season rice by 20 percent

Table 204 Improvements in Quality for Wet Season Rice - Changes in Income

Income	Total Income		
	Base	New	% Change
Total Income	12112.10	11255.74	-7.07
Urban Non-Poor	1983.41	1802.11	-9.14
Urban Poor	2338.79	2125.00	-9.14
Rural Non-Poor	2415.55	2320.15	-3.95
Rural Poor	5374.34	5008.48	-6.81
Agricultural Income	4046.39	3927.32	-2.94
Rural Non-Poor	2023.19	1963.66	-2.94
Rural Poor	2023.193	1963.66	-2.94

Billion Riel
Simulation: Increase in consumer price for wet season rice by 20 percent

K.2.4.2 Simulation Results for Maize

K.2.4.2.1 Improvements in Productivity

1050. Increases in the productivity of maize were simulated through a 20 percent increase in the yield of maize; see Table 205 to Table 208.

1051. In the model maize is not an exported commodity and all surplus production is consumed within Cambodia. Anecdotal evidence suggests that 80 percent of maize is consumed domestically and the rest exported to Vietnam, with minor amounts going into Thailand. As a consequence of not being an exportable commodity in the model, increases in production of maize result in reductions in prices. An increase in yields of 20 percent result in declines in producer prices of around 17 percent, and declines in consumer prices by the same amount. There are flow on effects to other commodities, with prices for vegetables and livestock also falling; see Table 205.

1052. As Table 206 shows, a 20 percent increase in yields results in an almost 17 percent increase in production and almost 17.8 percent increase in consumption. The increase in production is outweighed by the fall in prices, so consumers absorb the extra surplus maize.

1053. The extra maize produced substitutes out rice consumption, with an increase in exports of wet season rice; see Table 207

1054. Income falls under this scenario, with total household income falling by 1.25 percent while agricultural income falls by 0.63 percent; see Table 208.

1055. In order to investigate the effect of allowing exports of maize, the simulation is run again with maize being an exportable commodity. The results are shown in Table 209 to Table 212.

1056. In this scenario, there is no change in prices and while production increases by 20 percent, domestic consumption only increases by 0.09 percent; the surplus maize production being completely exported. Overall, incomes increase by 0.18 percent, while agricultural incomes increase by 0.39 percent.

1057. The simulation shows that the export of agricultural commodities is vital for Cambodia to allow it to vent surplus which would otherwise depress domestic prices and cause incomes to fall.

Table 205 Increase in Agricultural Productivity of Maize - Change in Prices

Commodity	Producer Price			Consumer Price		
	Base	New	% Change	Base	New	% Change
Dry Season Rice	653.85	653.85	0.00	850.00	850.00	0.00
Wet Season Rice	769.23	769.23	0.00	1000.00	1000.00	0.00
Maize	384.62	317.97	-17.33	500.00	413.36	-17.33
Vegetables	1153.85	924.84	-19.85	1500.00	1202.29	-19.85
Livestock	5846.15	5744.79	-1.73	7600.00	7468.23	-1.73
Other Food	615.38	614.89	-0.08	800.00	799.35	-0.08
Fertilizer	615.38	615.38	0.00	800.00	800.00	0.00
Fish	3461.54	3461.54	0.00	4500.00	4500.00	0.00

Riel per kg
Other Food: Soybean, Cassava and Sweetpotato
Simulation: 20 percent increase in maize yields

Table 206 Increase in Agricultural Productivity of Maize - Change in Volumes

Commodity	Production			Consumption		
	Base	New	% Change	Base	New	% Change
Dry Season Rice	444.19	446.03	0.41	215.40	231.84	7.63
Wet Season Rice	1829.88	1867.95	2.08	1726.50	1703.43	-1.34
Maize	163.05	190.58	16.88	154.90	182.43	17.77
Vegetables	152.47	147.78	-3.08	144.84	140.15	-3.24
Livestock	134.10	133.40	-0.52	134.10	133.40	-0.52
Other Food	177.44	177.42	-0.01	168.60	168.55	-0.03
Fertilizer	0.00	0.00	0.00	37.00	33.26	-10.12
Fish	360.00	360.00	0.00	310.00	309.11	-0.29

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: 20 percent increase in maize yields

Table 207 Increase in Agricultural Productivity of Maize - Change in Net Imports

Commodity	Net Imports		
	Base	New	% Change
Dry Season Rice	-215.40	-200.86	-6.75
Wet Season Rice	-50.00	-109.62	119.24
Maize	0.00	0.00	0.00
Vegetables	0.00	0.00	0.00
Livestock	0.00	0.00	0.00
Other Food	0.00	0.00	0.00
Fertilizer	37.00	33.26	-10.12
Fish	-50.00	-50.89	1.78

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: 20 percent increase in maize yields

Table 208 Increase in Agricultural Productivity of Maize - Changes in Income

Income	Total Income		
	Base	New	% Change
Total Income	12112.10	11960.40	-1.25
Urban Non-Poor	1983.41	1952.40	-1.56
Urban Poor	2338.79	2302.22	-1.56
Rural Non-Poor	2415.55	2396.62	-0.78
Rural Poor	5374.34	5309.15	-1.21
Agricultural Income	4046.39	4020.79	-0.63
Rural Non-Poor	2023.19	2010.40	-0.63
Rural Poor	2023.193	2010.397	-0.63

Billion Riel
Simulation: 20 percent increase in maize yields

Table 209 Increase in Agricultural Productivity of Maize with Exports - Change in Prices

Commodity	Producer Price			Consumer Price		
	Base	New	% Change	Base	New	% Change
Dry Season Rice	653.85	653.85	0.00	850.00	850.00	0.00
Wet Season Rice	769.23	769.23	0.00	1000.00	1000.00	0.00
Maize	384.62	384.62	0.00	500.00	500.00	0.00
Vegetables	1153.85	1157.37	0.31	1500.00	1504.58	0.31
Livestock	5846.15	5861.75	0.27	7600.00	7620.28	0.27
Other Food	615.38	617.00	0.26	800.00	802.10	0.26
Fertilizer	615.38	615.38	0.00	800.00	800.00	0.00
Fish	3461.54	3461.54	0.00	4500.00	4500.00	0.00

Riel per kg
Other Food: Soybean, Cassava and Sweetpotato
Simulation: 20 percent increase in maize yields

Table 210 Increase in Agricultural Productivity of Maize with Exports - Change in Volumes

Commodity	Production			Consumption		
	Base	New	% Change	Base	New	% Change
Dry Season Rice	444.19	444.17	-0.01	215.40	215.26	-0.07
Wet Season Rice	1829.88	1829.50	-0.02	1726.50	1728.40	0.11
Maize	163.05	195.65	19.99	154.90	155.05	0.09
Vegetables	152.47	152.54	0.04	144.84	144.91	0.05
Livestock	134.10	134.21	0.08	134.10	134.21	0.08
Other Food	177.44	177.51	0.04	168.60	168.64	0.02
Fertilizer	0.00	0.00	0.00	37.00	37.09	0.24
Fish	360.00	360.00	0.00	310.00	310.58	0.19

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: 20 percent increase in maize yields

Table 211 Increase in Agricultural Productivity of Maize with Exports - Change in Net Imports

Commodity	Net Imports		
	Base	New	% Change
Dry Season Rice	-215.40	-215.58	0.08
Wet Season Rice	-50.00	-46.20	-7.59
Maize	0.00	-32.46	0.00
Vegetables	0.00	0.00	0.00
Livestock	0.00	0.00	0.00
Other Food	0.00	0.00	0.00
Fertilizer	37.00	37.09	0.24
Fish	-50.00	-49.42	-1.15

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: 20 percent increase in maize yields

Table 212 Increase in Agricultural Productivity of Maize with Exports - Changes in Income

Income	Total Income		
	Base	New	% Change
Total Income	12112.10	12134.29	0.18
Urban Non-Poor	1983.41	1984.97	0.08
Urban Poor	2338.79	2340.63	0.08
Rural Non-Poor	2415.55	2423.79	0.34
Rural Poor	5374.34	5384.90	0.20
Agricultural Income	4046.39	4062.24	0.39
Rural Non-Poor	2023.19	2031.12	0.39
Rural Poor	2023.193	2031.119	0.39

Billion Riel
Simulation: 20 percent increase in maize yields

K.2.4.2.2 Improvements in Technology

1058. Improvements in postharvest technology for maize were simulated through a reduction in postharvest losses from 10 percent down to 7 percent. Reductions in postharvest losses imply an extra amount of maize available for sale. As with the previous simulation of improvements in agricultural productivity, this means that prices have to fall in order to balance supply and demand conditions as surplus maize is unable to be exported.

1059. The results are shown in Table 213 to Table 216. Prices for maize fall by almost 3.4 percent as production increases by almost 3 percent. Total household income falls by a small amount, 0.26 percent, while agricultural income falls by 0.15 percent. As will the previous simulations, exports play a key role in determining returns to maize production given the limited size of the Cambodian market.

Table 213 Improvements in Postharvest Technology for Maize - Change in Prices

Commodity	Producer Price			Consumer Price		
	Base	New	% Change	Base	New	% Change
Dry Season Rice	653.85	653.85	0.00	850.00	850.00	0.00
Wet Season Rice	769.23	769.23	0.00	1000.00	1000.00	0.00
Maize	384.62	371.57	-3.39	500.00	483.04	-3.39
Vegetables	1153.85	1107.82	-3.99	1500.00	1440.17	-3.99
Livestock	5846.15	5824.91	-0.36	7600.00	7572.39	-0.36
Other Food	615.38	615.13	-0.04	800.00	799.67	-0.04
Fertilizer	615.38	615.38	0.00	800.00	800.00	0.00
Fish	3461.54	3461.54	0.00	4500.00	4500.00	0.00

Riel per kg
Other Food: Soybean, Cassava and Sweetpotato
Simulation: Reductions in post harvest losses for maize from 10 percent down to 7 percent

Table 214 Improvements in Postharvest Technology for Maize - Change in Volumes

Commodity	Production			Consumption		
	Base	New	% Change	Base	New	% Change
Dry Season Rice	444.19	444.53	0.08	215.40	218.31	1.35
Wet Season Rice	1829.88	1836.79	0.38	1726.50	1721.98	-0.26
Maize	163.05	167.69	2.84	154.90	159.54	2.99
Vegetables	152.47	151.60	-0.57	144.84	143.97	-0.60
Livestock	134.10	133.96	-0.11	134.10	133.96	-0.11
Other Food	177.44	177.43	-0.01	168.60	168.56	-0.03
Fertilizer	0.00	0.00	0.00	37.00	36.31	-1.87
Fish	360.00	360.00	0.00	310.00	309.74	-0.08

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: Reductions in post harvest losses for maize from 10 percent down to 7 percent

Table 215 Improvements in Postharvest Technology for Maize - Change in Net Imports

Commodity	Net Imports		
	Base	New	% Change
Dry Season Rice	-215.40	-212.89	-1.17
Wet Season Rice	-50.00	-59.91	19.82
Maize	0.00	0.00	0.00
Vegetables	0.00	0.00	0.00
Livestock	0.00	0.00	0.00
Other Food	0.00	0.00	0.00
Fertilizer	37.00	36.31	-1.87
Fish	-50.00	-50.26	0.53

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: Reductions in post harvest losses for maize from 10 percent down to 7 percent

Table 216 Improvements in Postharvest Technology for Maize - Changes in Income

Income	Total Income		
	Base	New	% Change
Total Income	12112.10	12080.52	-0.26
Urban Non-Poor	1983.41	1977.13	-0.32
Urban Poor	2338.79	2331.39	-0.32
Rural Non-Poor	2415.55	2411.29	-0.18
Rural Poor	5374.34	5360.72	-0.25
Agricultural Income	4046.39	4040.36	-0.15
Rural Non-Poor	2023.19	2020.18	-0.15
Rural Poor	2023.193	2020.178	-0.15

Billion Riel
Simulation: Reductions in post harvest losses for maize from 10 percent down to 7 percent

K.2.4.2.3 Improvements in Quality

1060. The next simulation looked at the effects of an increase in quality in maize products in Cambodia. The simulation involved an increase in the urban consumer price of maize by 20 percent to reflect the higher quality of the commodity. Table 217 to Table 220 show the results for improving the quality of maize.

1061. Increasing the price of maize results in the equilibrium price increasing by 16.6 percent, while production increases by 2.4 percent and consumption increases by 2.5 percent.

1062. Income falls under this scenario, due to export restrictions preventing the extra surplus of maize being exported. Total household income falls by 0.23 percent while agricultural income falls by 0.17 percent.

Table 217 Improvements in Quality for Maize - Change in Prices

	Producer Price			Consumer Price		
Commodity	Base	New	% Change	Base	New	% Change
Dry Season Rice	653.85	653.85	0.00	850.00	850.00	0.00
Wet Season Rice	769.23	769.23	0.00	1000.00	1000.00	0.00
Maize	384.62	448.42	16.59	500.00	582.95	16.59
Vegetables	1153.85	1117.52	-3.15	1500.00	1452.78	-3.15
Livestock	5846.15	5827.28	-0.32	7600.00	7575.47	-0.32
Other Food	615.38	615.09	-0.05	800.00	799.61	-0.05
Fertilizer	615.38	615.38	0.00	800.00	800.00	0.00
Fish	3461.54	3461.54	0.00	4500.00	4500.00	0.00

Riel per kg
Other Food: Soybean, Cassava and Sweetpotato
Simulation: Increase in consumer price for maize by 20 percent

Table 218 Improvements in Quality for Maize - Change in Volumes

	Production			Consumption		
Commodity	Base	New	% Change	Base	New	% Change
Dry Season Rice	444.19	443.65	-0.12	215.40	217.84	1.13
Wet Season Rice	1829.88	1818.81	-0.61	1726.50	1722.59	-0.23
Maize	163.05	166.91	2.36	154.90	158.75	2.49
Vegetables	152.47	151.51	-0.63	144.84	143.89	-0.66
Livestock	134.10	133.97	-0.10	134.10	133.97	-0.10
Other Food	177.44	177.43	-0.01	168.60	168.55	-0.03
Fertilizer	0.00	0.00	0.00	37.00	37.13	0.34
Fish	360.00	360.00	0.00	310.00	309.74	-0.08

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: Increase in consumer price for maize by 20 percent

Table 219 Improvements in Quality for Maize - Change in Net Imports

	Net Imports		
Commodity	Base	New	% Change
Dry Season Rice	-215.40	-212.49	-1.35
Wet Season Rice	-50.00	-41.32	-17.35
Maize	0.00	0.00	0.00
Vegetables	0.00	0.00	0.00
Livestock	0.00	0.00	0.00
Other Food	0.00	0.00	0.00
Fertilizer	37.00	37.13	0.34
Fish	-50.00	-50.26	0.52

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: Increase in consumer price for maize by 20 percent

Table 220 Improvements in Quality for Maize - Changes in Income

Income	Total Income		
	Base	New	% Change
Total Income	12112.10	12084.29	-0.23
Urban Non-Poor	1983.41	1978.24	-0.26
Urban Poor	2338.79	2332.69	-0.26
Rural Non-Poor	2415.55	2411.15	-0.18
Rural Poor	5374.34	5362.22	-0.23
Agricultural Income	4046.39	4039.62	-0.17
Rural Non-Poor	2023.19	2019.81	-0.17
Rural Poor	2023.193	2019.809	-0.17

Billion Riel
Simulation: Increase in consumer price for maize by 20 percent

K.2.4.3 Simulation Results for Vegetables

K.2.4.3.1 Improvements in Productivity

1063. Increases in the productivity of vegetables were simulated through a 20 percent increase in the yield of vegetables; see Table 221 to Table 224.

1064. In the model vegetables are not an exported commodity and all surplus production is consumed within Cambodia. As a consequence of not being an exportable commodity in the model, increases in production of vegetable result in reductions in prices. An increase in yields of 20 percent result in declines in producer prices of around 21.77 percent, and declines in consumer prices by the same amount. There are flow on effects to other commodities, with prices for other foods and livestock also falling; see Table 221.

1065. The key implication is that restrictions on the flow of vegetables (e.g. exporting) will depress prices as the domestic market currently satisfies its vegetable demand through consumption of locally produced vegetables as well as imports from Thailand and Vietnam.

1066. Total household income falls by 0.94 percent while agricultural income falls by 0.22 percent; see Table 224.

Table 221 Increase in Agricultural Productivity of Vegetables - Change in Prices

Commodity	Producer Price			Consumer Price		
	Base	New	% Change	Base	New	% Change
Dry Season Rice	653.85	653.85	0.00	850.00	850.00	0.00
Wet Season Rice	769.23	769.23	0.00	1000.00	1000.00	0.00
Maize	384.62	381.72	-0.75	500.00	496.24	-0.75
Vegetables	1153.85	902.67	-21.77	1500.00	1173.46	-21.77
Livestock	5846.15	5774.71	-1.22	7600.00	7507.13	-1.22
Other Food	615.38	609.04	-1.03	800.00	791.75	-1.03
Fertilizer	615.38	615.38	0.00	800.00	800.00	0.00
Fish	3461.54	3461.54	0.00	4500.00	4500.00	0.00

Riel per kg
Other Food: Soybean, Cassava and Sweetpotato
Simulation: 20 percent increase in vegetable yields

Table 222 Increase in Agricultural Productivity of Vegetables - Change in Volumes

Commodity	Production			Consumption		
	Base	New	% Change	Base	New	% Change
Dry Season Rice	444.19	445.36	0.26	215.40	216.41	0.47
Wet Season Rice	1829.88	1853.56	1.29	1726.50	1717.79	-0.51
Maize	163.05	163.29	0.14	154.90	155.14	0.15
Vegetables	152.47	176.38	15.68	144.84	168.76	16.51
Livestock	134.10	133.61	-0.37	134.10	133.61	-0.37
Other Food	177.44	177.16	-0.15	168.60	168.29	-0.18
Fertilizer	0.00	0.00	0.00	37.00	33.51	-9.43
Fish	360.00	360.00	0.00	310.00	307.47	-0.82

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: 20 percent increase in vegetable yields

Table 223 Increase in Agricultural Productivity of Vegetables - Change in Net Imports

Commodity	Net Imports		
	Base	New	% Change
Dry Season Rice	-215.40	-215.63	0.11
Wet Season Rice	-50.00	-80.88	61.76
Maize	0.00	0.00	0.00
Vegetables	0.00	0.00	0.00
Livestock	0.00	0.00	0.00
Other Food	0.00	0.00	0.00
Fertilizer	37.00	33.51	-9.43
Fish	-50.00	-52.53	5.06

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: 20 percent increase in vegetable yields

Table 224 Increase in Agricultural Productivity of Vegetables - Changes in Income

Income	Total Income		
	Base	New	% Change
Total Income	12112.10	11998.34	-0.94
Urban Non-Poor	1983.41	1957.66	-1.30
Urban Poor	2338.79	2308.42	-1.30
Rural Non-Poor	2415.55	2405.95	-0.40
Rural Poor	5374.34	5326.32	-0.89
Agricultural Income	4046.39	4037.36	-0.22
Rural Non-Poor	2023.19	2018.68	-0.22
Rural Poor	2023.193	2018.682	-0.22

Billion Riel
Simulation: 20 percent increase in vegetable yields

K.2.4.3.2 Improvements in Technology

1067. Improvements in postharvest technology are simulated through a reduction in postharvest losses from 10 percent down to 7 percent. Reductions in postharvest losses imply an extra amount of vegetables available for sale. As with the previous simulation of improvements in agricultural productivity, this means that prices have to fall in order to balance supply and demand conditions as surplus vegetables are unable to be exported.

1068. The results are shown in Table 225 to Table 228. Prices for vegetables fall by almost 4.4 percent, while volumes produced increase by 2.65 percent. Total household income falls by 0.19 percent and agricultural income falls by 0.05 percent.

Table 225 Improvements in Postharvest Technology for Vegetables - Change in Prices

	Producer Price			Consumer Price		
Commodity	Base	New	% Change	Base	New	% Change
Dry Season Rice	653.85	653.85	0.00	850.00	850.00	0.00
Wet Season Rice	769.23	769.23	0.00	1000.00	1000.00	0.00
Maize	384.62	384.04	-0.15	500.00	499.25	-0.15
Vegetables	1153.85	1103.26	-4.38	1500.00	1434.24	-4.38
Livestock	5846.15	5831.25	-0.25	7600.00	7580.63	-0.25
Other Food	615.38	614.16	-0.20	800.00	798.40	-0.20
Fertilizer	615.38	615.38	0.00	800.00	800.00	0.00
Fish	3461.54	3461.54	0.00	4500.00	4500.00	0.00

Riel per kg
Other Food: Soybean, Cassava and Sweetpotato
Simulation: Reductions in post harvest losses for vegetables from 10 percent down to 7 percent

Table 226 Improvements in Postharvest Technology for Vegetables - Change in Volumes

	Production			Consumption		
Commodity	Base	New	% Change	Base	New	% Change
Dry Season Rice	444.19	444.41	0.05	215.40	215.60	0.10
Wet Season Rice	1829.88	1834.20	0.24	1726.50	1724.70	-0.10
Maize	163.05	163.09	0.03	154.90	154.94	0.03
Vegetables	152.47	156.50	2.65	144.84	148.88	2.79
Livestock	134.10	134.00	-0.08	134.10	134.00	-0.07
Other Food	177.44	177.39	-0.03	168.60	168.51	-0.05
Fertilizer	0.00	0.00	0.00	37.00	36.36	-1.73
Fish	360.00	360.00	0.00	310.00	309.47	-0.17

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: Reductions in post harvest losses for vegetables from 10 percent down to 7 percent

Table 227 Improvements in Postharvest Technology for Vegetables - Change in Net Imports

	Net Imports		
Commodity	Base	New	% Change
Dry Season Rice	-215.40	-215.48	0.04
Wet Season Rice	-50.00	-54.60	9.20
Maize	0.00	0.00	0.00
Vegetables	0.00	0.00	0.00
Livestock	0.00	0.00	0.00
Other Food	0.00	0.00	0.00
Fertilizer	37.00	36.36	-1.73
Fish	-50.00	-50.53	1.06

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: Reductions in post harvest losses for vegetables from 10 percent down to 7 percent

Table 228 Improvements in Postharvest Technology for Vegetables - Changes in Income

	Total Income		
Income	Base	New	% Change
Total Income	12112.10	12088.68	-0.19
Urban Non-Poor	1983.41	1978.19	-0.26
Urban Poor	2338.79	2332.64	-0.26
Rural Non-Poor	2415.55	2413.42	-0.09
Rural Poor	5374.34	5364.43	-0.18
Agricultural Income	4046.39	4044.19	-0.05
Rural Non-Poor	2023.19	2022.10	-0.05
Rural Poor	2023.193	2022.097	-0.05

Billion Riel
Simulation: Reductions in post harvest losses for vegetables from 10 percent down to 7 percent

K.2.4.3.3 Improvements in Quality

1069. The next simulation looked at the effects of an increase in quality in vegetable products in Cambodia. The simulation involved an increase in the urban consumer price of vegetables by 20 percent to reflect the higher quality of the commodity. Table 229 to Table 232 show the results for improving the quality of vegetables.

1070. Increasing the price of vegetables results in the equilibrium price increasing by 16.6 percent, while production increases by 2.3 percent and consumption increases by 2.5 percent.

1071. Income increases under this scenario. Total household income increases by 0.15 percent while agricultural income increases by 0.58 percent.

Table 229 Improvements in Quality for Vegetables - Change in Prices

	Producer Price			Consumer Price		
Commodity	Base	New	% Change	Base	New	% Change
Dry Season Rice	653.85	653.85	0.00	850.00	850.00	0.00
Wet Season Rice	769.23	769.23	0.00	1000.00	1000.00	0.00
Maize	384.62	385.47	0.22	500.00	501.11	0.22
Vegetables	1153.85	1345.74	16.63	1500.00	1749.47	16.63
Livestock	5846.15	5860.29	0.24	7600.00	7618.37	0.24
Other Food	615.38	616.75	0.22	800.00	801.77	0.22
Fertilizer	615.38	615.38	0.00	800.00	800.00	0.00
Fish	3461.54	3461.54	0.00	4500.00	4500.00	0.00

Riel per kg
Other Food: Soybean, Cassava and Sweetpotato
Simulation: Increase in consumer price for vegetables by 20 percent

Table 230 Improvements in Quality for Vegetables - Change in Volumes

	Production			Consumption		
Commodity	Base	New	% Change	Base	New	% Change
Dry Season Rice	444.19	443.49	-0.16	215.40	215.06	-0.16
Wet Season Rice	1829.88	1815.57	-0.78	1726.50	1728.41	0.11
Maize	163.05	162.85	-0.12	154.90	154.70	-0.13
Vegetables	152.47	156.02	2.33	144.84	148.40	2.46
Livestock	134.10	134.20	0.07	134.10	134.20	0.08
Other Food	177.44	177.50	0.03	168.60	168.63	0.02
Fertilizer	0.00	0.00	0.00	37.00	39.39	6.46
Fish	360.00	360.00	0.00	310.00	310.49	0.16

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: Increase in consumer price for vegetables by 20 percent

Table 231 Improvements in Quality for Vegetables - Change in Net Imports

Commodity	Net Imports		
	Base	New	% Change
Dry Season Rice	-215.40	-215.10	-0.14
Wet Season Rice	-50.00	-32.27	-35.46
Maize	0.00	0.00	0.00
Vegetables	0.00	0.00	0.00
Livestock	0.00	0.00	0.00
Other Food	0.00	0.00	0.00
Fertilizer	37.00	39.39	6.46
Fish	-50.00	-49.51	-0.98

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: Increase in consumer price for vegetables by 20 percent

Table 232 Improvements in Quality for Vegetables - Changes in Income

Income	Total Income		
	Base	New	% Change
Total Income	12112.10	12130.22	0.15
Urban Non-Poor	1983.41	1982.09	-0.07
Urban Poor	2338.79	2337.23	-0.07
Rural Non-Poor	2415.55	2427.04	0.48
Rural Poor	5374.34	5383.86	0.18
Agricultural Income	4046.39	4069.88	0.58
Rural Non-Poor	2023.19	2034.94	0.58
Rural Poor	2023.193	2034.943	0.58

Billion Riel
Simulation: Increase in consumer price for vegetables by 20 percent

K.2.4.4 Simulation Results for Soybeans, Cassava and Sweet Potato

K.2.4.4.1 Improvements in Productivity

1072. Increases in the productivity of Soybeans, Cassava and Sweetpotato were simulated through a 20 percent increase in the yield of Other Food Crops; see Table 233 to Table 236.

1073. In the model Other Food Crops is not an exported commodity group and all surplus production is consumed within Cambodia. Anecdotal evidence suggests that 70 percent of soybean is exported to Vietnam and the rest consumed domestically, with minor amounts going into Thailand. As a consequence of not being an exportable commodity group in the model, increases in production of Other Food Crops result in reductions in prices. An increase in yields of 20 percent result in declines in producer prices of around 16 percent, and declines in consumer prices by the same amount. There are flow on effects to other commodities, with prices for maize, vegetables and livestock also falling slightly; see Table 233.

1074. Production of Other Food Crops increases by almost 17 percent and with falling prices consumption also increases by 17.7 percent. Total household income falls by 0.43 percent, while agricultural income falls by just 0.07 percent.

Table 233 Increase in Agricultural Productivity of Other Food Crops - Change in Prices

Commodity	Producer Price			Consumer Price		
	Base	New	% Change	Base	New	% Change
Dry Season Rice	653.85	653.85	0.00	850.00	850.00	0.00
Wet Season Rice	769.23	769.23	0.00	1000.00	1000.00	0.00
Maize	384.62	384.24	-0.10	500.00	499.51	-0.10
Vegetables	1153.85	1147.20	-0.58	1500.00	1491.36	-0.58
Livestock	5846.15	5811.61	-0.59	7600.00	7555.09	-0.59
Other Food	615.38	514.69	-16.36	800.00	669.10	-16.36
Fertilizer	615.38	615.38	0.00	800.00	800.00	0.00
Fish	3461.54	3461.54	0.00	4500.00	4500.00	0.00

Riel per kg
Other Food: Soybean, Cassava and Sweetpotato
Simulation: 20 percent increase in Other Food Crop yields

Table 234 Increase in Agricultural Productivity of Other Food Crops - Change in Volumes

Commodity	Production			Consumption		
	Base	New	% Change	Base	New	% Change
Dry Season Rice	444.19	445.02	0.19	215.40	214.47	-0.43
Wet Season Rice	1829.88	1837.05	0.39	1726.50	1717.99	-0.49
Maize	163.05	163.33	0.17	154.90	155.18	0.18
Vegetables	152.47	152.61	0.09	144.84	144.99	0.10
Livestock	134.10	133.86	-0.18	134.10	133.86	-0.18
Other Food	177.44	207.29	16.83	168.60	198.42	17.69
Fertilizer	0.00	0.00	0.00	37.00	36.29	-1.92
Fish	360.00	360.00	0.00	310.00	311.46	0.47

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: 20 percent increase in Other Food Crop yields

Table 235 Increase in Agricultural Productivity of Other Food Crops - Change in Net Imports

Commodity	Net Imports		
	Base	New	% Change
Dry Season Rice	-215.40	-217.22	0.84
Wet Season Rice	-50.00	-64.17	28.33
Maize	0.00	0.00	0.00
Vegetables	0.00	0.00	0.00
Livestock	0.00	0.00	0.00
Other Food	0.00	0.00	0.00
Fertilizer	37.00	36.29	-1.92
Fish	-50.00	-48.54	-2.92

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: 20 percent increase in Other Food Crop yields

Table 236 Increase in Agricultural Productivity of Other Food Crops - Changes in Income

Income	Total Income		
	Base	New	% Change
Total Income	12112.10	12059.50	-0.43
Urban Non-Poor	1983.41	1971.13	-0.62
Urban Poor	2338.79	2324.32	-0.62
Rural Non-Poor	2415.55	2411.79	-0.16
Rural Poor	5374.34	5352.26	-0.41
Agricultural Income	4046.39	4043.71	-0.07
Rural Non-Poor	2023.19	2021.86	-0.07
Rural Poor	2023.193	2021.856	-0.07

Billion Riel
Simulation: 20 percent increase in Other Food Crop yields

K.2.4.4.2 Improvements in Technology

1075. Improvements in postharvest technology are simulated through a reduction in postharvest losses from 10 percent down to 7 percent. Reductions in postharvest losses imply an extra amount of soybeans, cassava and sweetpotato available for sale. As with the previous simulation of improvements in agricultural productivity, this means that prices have to fall in order to balance supply and demand conditions as surpluses are unable to be exported.

1076. The results are shown in Table 237 to Table 240. Prices for Other Food Crops fall by just over 3 percent, while volumes produced increase by 2.84 percent. Total household income falls by 0.09 percent and agricultural income falls by 0.02 percent.

Table 237 Improvements in Postharvest Technology for Other Food Crops - Change in Prices

	Producer Price			Consumer Price		
Commodity	Base	New	% Change	Base	New	% Change
Dry Season Rice	653.85	653.85	0.00	850.00	850.00	0.00
Wet Season Rice	769.23	769.23	0.00	1000.00	1000.00	0.00
Maize	384.62	384.53	-0.02	500.00	499.88	-0.02
Vegetables	1153.85	1152.38	-0.13	1500.00	1498.09	-0.13
Livestock	5846.15	5839.18	-0.12	7600.00	7590.93	-0.12
Other Food	615.38	595.90	-3.17	800.00	774.67	-3.17
Fertilizer	615.38	615.38	0.00	800.00	800.00	0.00
Fish	3461.54	3461.54	0.00	4500.00	4500.00	0.00

Riel per kg
Other Food: Soybean, Cassava and Sweetpotato
Simulation: Reductions in post harvest losses for Other Food Crops from 10 percent down to 7 percent

Table 238 Improvements in Postharvest Technology for Other Food Crops - Change in Volumes

	Production			Consumption		
Commodity	Base	New	% Change	Base	New	% Change
Dry Season Rice	444.19	444.34	0.03	215.40	215.24	-0.07
Wet Season Rice	1829.88	1831.19	0.07	1726.50	1724.89	-0.09
Maize	163.05	163.10	0.03	154.90	154.95	0.03
Vegetables	152.47	152.49	0.02	144.84	144.87	0.02
Livestock	134.10	134.05	-0.03	134.10	134.05	-0.03
Other Food	177.44	182.47	2.84	168.60	173.60	2.97
Fertilizer	0.00	0.00	0.00	37.00	36.89	-0.29
Fish	360.00	360.00	0.00	310.00	310.24	0.08

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: Reductions in post harvest losses for Other Food Crops from 10 percent down to 7 percent

Table 239 Improvements in Postharvest Technology for Other Food Crops - Change in Net Imports

Commodity	Net Imports		
	Base	New	% Change
Dry Season Rice	-215.40	-215.77	0.17
Wet Season Rice	-50.00	-51.41	2.82
Maize	0.00	0.00	0.00
Vegetables	0.00	0.00	0.00
Livestock	0.00	0.00	0.00
Other Food	0.00	0.00	0.00
Fertilizer	37.00	36.89	-0.29
Fish	-50.00	-49.76	-0.47

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: Reductions in post harvest losses for Other Food Crops from 10 percent down to 7 percent

Table 240 Improvements in Postharvest Technology for Other Food Crops - Changes in Income

Income	Total Income		
	Base	New	% Change
Total Income	12112.10	12101.64	-0.09
Urban Non-Poor	1983.41	1981.00	-0.12
Urban Poor	2338.79	2335.95	-0.12
Rural Non-Poor	2415.55	2414.75	-0.03
Rural Poor	5374.34	5369.94	-0.08
Agricultural Income	4046.39	4045.74	-0.02
Rural Non-Poor	2023.19	2022.87	-0.02
Rural Poor	2023.193	2022.868	-0.02

Billion Riel
Simulation: Reductions in post harvest losses for Other Food Crops from 10 percent down to 7 percent

K.2.4.4.3 Improvements in Quality

1077. The next simulation looked at the effects of an increase in quality in Other Food Crop products in Cambodia. The simulation involved an increase in the urban consumer price of Other Food Crops by 20 percent to reflect the higher quality of the commodity. Table 241 to Table 244 show the results for improving the quality of Other Food Crops.

1078. Increasing the price of Other Food Crops results in the equilibrium price increasing by 17.21 percent, while production increases by 2.4 percent and consumption increases by 2.5 percent.

1079. Income increases under this scenario. Total household income increases by 0.15 percent while agricultural income increases by 0.5 percent.

Table 241 Improvements in Quality for Other Food Crops - Change in Prices

Commodity	Producer Price			Consumer Price		
	Base	New	% Change	Base	New	% Change
Dry Season Rice	653.85	653.85	0.00	850.00	850.00	0.00
Wet Season Rice	769.23	769.23	0.00	1000.00	1000.00	0.00
Maize	384.62	385.80	0.31	500.00	501.54	0.31
Vegetables	1153.85	1164.37	0.91	1500.00	1513.68	0.91
Livestock	5846.15	5862.91	0.29	7600.00	7621.79	0.29
Other Food	615.38	721.27	17.21	800.00	937.65	17.21
Fertilizer	615.38	615.38	0.00	800.00	800.00	0.00
Fish	3461.54	3461.54	0.00	4500.00	4500.00	0.00

Riel per kg
Other Food: Soybean, Cassava and Sweetpotato
Simulation: Increase in consumer price for Other Food Crops by 20 percent

Table 242 Improvements in Quality for Other Food Crops - Change in Volumes

Commodity	Production			Consumption		
	Base	New	% Change	Base	New	% Change
Dry Season Rice	444.19	443.43	-0.17	215.40	214.81	-0.27
Wet Season Rice	1829.88	1822.97	-0.38	1726.50	1728.07	0.09
Maize	163.05	162.86	-0.12	154.90	154.70	-0.13
Vegetables	152.47	152.43	-0.02	144.84	144.81	-0.02
Livestock	134.10	134.22	0.09	134.10	134.22	0.09
Other Food	177.44	181.71	2.41	168.60	172.84	2.52
Fertilizer	0.00	0.00	0.00	37.00	37.77	2.09
Fish	360.00	360.00	0.00	310.00	310.98	0.32

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: Increase in consumer price for Other Food Crops by 20 percent

Table 243 Improvements in Quality for Other Food Crops - Change in Net Imports

Commodity	Net Imports		
	Base	New	% Change
Dry Season Rice	-215.40	-215.29	-0.05
Wet Season Rice	-50.00	-40.01	-19.99
Maize	0.00	0.00	0.00
Vegetables	0.00	0.00	0.00
Livestock	0.00	0.00	0.00
Other Food	0.00	0.00	0.00
Fertilizer	37.00	37.77	2.09
Fish	-50.00	-49.02	-1.97

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: Increase in consumer price for Other Food Crops by 20 percent

Table 244 Improvements in Quality for Other Food Crops - Changes in Income

Income	Total Income		
	Base	New	% Change
Total Income	12112.10	12135.56	0.19
Urban Non-Poor	1983.41	1984.25	0.04
Urban Poor	2338.79	2339.78	0.04
Rural Non-Poor	2415.55	2425.75	0.42
Rural Poor	5374.34	5385.79	0.21
Agricultural Income	4046.39	4066.45	0.50
Rural Non-Poor	2023.193	2033.228	0.50
Rural Poor	2023.193	2033.226	0.50

Billion Riel
Simulation: Increase in consumer price for Other Food Crops by 20 percent

K.2.4.5 Simulation Results for Fish Products

K.2.4.5.1 Improvements in Technology

1080. Improvements in postharvest technology are simulated through a reduction in postharvest losses from 10 percent down to 7 percent. Reductions in postharvest losses imply an extra amount of fish available for sale.

1081. The results are shown in Table 245 to Table 248. Prices for Fish do not change since Fish is an exportable product. Volumes of fish traded do not change, neither does income.

Table 245 Improvements in Postharvest Technology for Fish - Change in Prices

	Producer Price			Consumer Price		
Commodity	Base	New	% Change	Base	New	% Change
Dry Season Rice	653.85	653.85	0.00	850.00	850.00	0.00
Wet Season Rice	769.23	769.23	0.00	1000.00	1000.00	0.00
Maize	384.62	384.61	0.00	500.00	499.99	0.00
Vegetables	1153.85	1153.77	-0.01	1500.00	1499.90	-0.01
Livestock	5846.15	5846.06	0.00	7600.00	7599.88	0.00
Other Food	615.38	615.50	0.02	800.00	800.15	0.02
Fertilizer	615.38	615.38	0.00	800.00	800.00	0.00
Fish	3461.54	3461.54	0.00	4500.00	4500.00	0.00

Riel per kg
Other Food: Soybean, Cassava and Sweetpotato
Simulation: Reductions in post harvest losses for Fish from 10 percent down to 7 percent

Table 246 Improvements in Postharvest Technology for Fish - Change in Volumes

	Production			Consumption		
Commodity	Base	New	% Change	Base	New	% Change
Dry Season Rice	444.19	444.19	0.00	215.40	215.40	0.00
Wet Season Rice	1829.88	1829.88	0.00	1726.50	1726.50	0.00
Maize	163.05	163.05	0.00	154.90	154.90	0.00
Vegetables	152.47	152.47	0.00	144.84	144.85	0.00
Livestock	134.10	134.10	0.00	134.10	134.10	0.00
Other Food	177.44	177.44	0.00	168.60	168.57	-0.02
Fertilizer	0.00	0.00	0.00	37.00	37.03	0.09
Fish	360.00	360.00	0.00	310.00	310.00	0.00

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: Reductions in post harvest losses for Fish from 10 percent down to 7 percent

Table 247 Improvements in Postharvest Technology for Fish - Change in Net Imports

	Net Imports		
Commodity	Base	New	% Change
Dry Season Rice	-215.40	-215.46	0.03
Wet Season Rice	-50.00	-48.48	-3.04
Maize	0.00	0.00	0.00
Vegetables	0.00	0.00	0.00
Livestock	0.00	0.00	0.00
Other Food	0.00	0.00	0.00
Fertilizer	37.00	37.03	0.09
Fish	-50.00	-50.00	0.01

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: Reductions in post harvest losses for Fish from 10 percent down to 7 percent

Table 248 Improvements in Postharvest Technology for Fish - Changes in Income

Income	Total Income		
	Base	New	% Change
Total Income	12112.10	12112.16	0.00
Urban Non-Poor	1983.41	1983.43	0.00
Urban Poor	2338.79	2338.81	0.00
Rural Non-Poor	2415.55	2415.55	0.00
Rural Poor	5374.34	5374.37	0.00
Agricultural Income	4046.39	4046.38	0.00
Rural Non-Poor	2023.19	2023.19	0.00
Rural Poor	2023.193	2023.19	0.00

Billion Riel
Simulation: Reductions in post harvest losses for Fish from 10 percent down to 7 percent

K.2.4.5.2 Improvements in Quality

1082. The next simulation looked at the effects of an increase in quality in fish products in Cambodia. The simulation involved an increase in the urban consumer price of Fish by 20 percent to reflect the higher quality of the commodity. Table 249 to Table 252 show the results for improving the quality of Fish.

1083. Production of fish does not change, but consumption of fish increases by 7.84 percent. This is commensurate with the reduction in fish exports of the same quantities. Due to the cross-substitution effects with other commodities, Total household income falls by 5.54 percent while agricultural income falls by 2.25 percent.

Table 249 Improvements in Quality for Fish - Change in Prices

Commodity	Producer Price			Consumer Price		
	Base	New	% Change	Base	New	% Change
Dry Season Rice	653.85	653.85	0.00	850.00	850.00	0.00
Wet Season Rice	769.23	769.23	0.00	1000.00	1000.00	0.00
Maize	384.62	372.23	-3.22	500.00	483.90	-3.22
Vegetables	1153.85	1020.94	-11.52	1500.00	1327.23	-11.52
Livestock	5846.15	5418.65	-7.31	7600.00	7044.25	-7.31
Other Food	615.38	580.72	-5.63	800.00	754.93	-5.63
Fertilizer	615.38	615.38	0.00	800.00	800.00	0.00
Fish	3461.54	3461.54	0.00	4500.00	4500.00	0.00

Riel per kg
Other Food: Soybean, Cassava and Sweetpotato
Simulation: Increase in consumer price for Fish by 20 percent

Table 250 Improvements in Quality for Fish - Change in Volumes

Commodity	Production			Consumption		
	Base	New	% Change	Base	New	% Change
Dry Season Rice	444.19	445.14	0.21	215.40	220.51	2.37
Wet Season Rice	1829.88	1846.27	0.90	1726.50	1687.92	-2.23
Maize	163.05	162.55	-0.31	154.90	154.40	-0.33
Vegetables	152.47	149.83	-1.73	144.84	142.21	-1.82
Livestock	134.10	131.08	-2.25	134.10	131.08	-2.25
Other Food	177.44	175.90	-0.87	168.60	167.03	-0.93
Fertilizer	0.00	0.00	0.00	37.00	34.95	-5.53
Fish	360.00	360.00	0.00	310.00	334.30	7.84

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: Increase in consumer price for Fish by 20 percent

Table 251 Improvements in Quality for Fish - Change in Net Imports

Commodity	Net Imports		
	Base	New	% Change
Dry Season Rice	-215.40	-211.30	-1.90
Wet Season Rice	-50.00	-103.45	106.89
Maize	0.00	0.00	0.00
Vegetables	0.00	0.00	0.00
Livestock	0.00	0.00	0.00
Other Food	0.00	0.00	0.00
Fertilizer	37.00	34.95	-5.53
Fish	-50.00	-25.70	-48.59

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: Increase in consumer price for Fish by 20 percent

Table 252 Improvements in Quality for Fish - Changes in Income

Income	Total Income		
	Base	New	% Change
Total Income	12112.10	11440.53	-5.54
Urban Non-Poor	1983.41	1840.65	-7.20
Urban Poor	2338.79	2170.45	-7.20
Rural Non-Poor	2415.55	2341.81	-3.05
Rural Poor	5374.34	5087.63	-5.33
Agricultural Income	4046.39	3955.39	-2.25
Rural Non-Poor	2023.19	1977.69	-2.25
Rural Poor	2023.193	1977.693	-2.25

Billion Riel
Simulation: Increase in consumer price for Fish by 20 percent

K.2.4.6 Improvements in Infrastructure

1084. The last two simulations looked at improvements in infrastructure through the reduction of marketing margins. Two types of simulations were conducted. In the first simulation, the margin between farm and urban areas was reduced by 20 percent. In the second simulation, the margin between farm areas and the port was reduced by 20 percent. Such simulations thus posit the effects of improvements in road infrastructure or a decline in unofficial costs, for example. The results are summarized in Table 253 to Table 256 for the first simulation and Table 257 to Table 260 for the second simulation.

1085. In the first simulation, there are price effects for rice, since the gap between producer and consumer prices are reduced. While the producer price does not change (since it is linked to the world price), the reduction in marketing margins means that consumer prices fall by almost 4 percent for rice; see Table 253. Since producer prices do not fall, production of rice is virtually unaffected; see Table 254. However, rice consumption, particularly dry season rice consumption, rises. Dry season rice consumption increases by over 2 percent, while the increase in wet season rice consumption is less than half of this increase; see Table 254. The increase in domestic consumption implies that exported surplus of rice declines. In this scenario, exports of dry season rice fall by 2 percent, while wet season rice exports fall by nearly 30 percent; see Table 255. Agricultural income in this scenario falls slightly, mainly as a result of lower prices for vegetables and livestock domestically; see Table 256. Total income falls by 2.8 percent.

1086. In the final simulation, the margins between farmgate and ports are reduced by 20 percent. This could simulate the effect of lowering unofficial costs for example or reducing the transaction costs in exporting. In this simulation, producer prices for rice increase by nearly 6 percent, reflecting the price increase passed along to farmers from the reduction

in transaction costs; see Table 257. Production rises in response, with dry season rice increasing by over 0.5 percent and wet season rice increasing by 0.08 percent; see Table 258. Consumption of rice falls in this case, since consumers pay a higher price for rice. Rice consumption falls by 4.9 percent for dry season rice and increases slightly under 1 percent for wet season rice. Fertilizer demand increases significantly, due to greater demand from increased rice production, rising by over 16 percent. Lower consumption and higher production leads to higher levels of exports of dry season rice (6 percent), with wet season rice exports falling to 33,000 tonnes; see Table 259. Income effects in this simulation are significant, with agricultural income rising by almost 9 percent and total household income rising by 8 percent; see Table 260.

Table 253 Improvements in Marketing Infrastructure - Change in Prices

	Producer Price			Consumer Price		
Commodity	Base	New	% Change	Base	New	% Change
Dry Season Rice	653.85	653.85	0.00	850.00	817.31	-3.85
Wet Season Rice	769.23	769.23	0.00	1000.00	961.54	-3.85
Maize	384.62	390.47	1.52	500.00	488.09	-2.38
Vegetables	1153.85	1110.56	-3.75	1500.00	1388.21	-7.45
Livestock	5846.15	5814.08	-0.55	7600.00	7267.60	-4.37
Other Food	615.38	618.64	0.53	800.00	773.30	-3.34
Fertilizer	615.38	640.00	4.00	800.00	800.00	0.00
Fish	3461.54	3461.54	0.00	4500.00	4326.92	-3.85

Riel per kg
Other Food: Soybean, Cassava and Sweetpotato
Simulation: Reductions in internal marketing margins for all commodities by 20 percent

Table 254 Improvements in Marketing Infrastructure - Change in Volumes

	Production			Consumption		
Commodity	Base	New	% Change	Base	New	% Change
Dry Season Rice	444.19	444.27	0.02	215.40	220.02	2.15
Wet Season Rice	1829.88	1831.80	0.11	1726.50	1741.79	0.89
Maize	163.05	163.48	0.26	154.90	155.33	0.28
Vegetables	152.47	151.57	-0.59	144.84	143.94	-0.62
Livestock	134.10	133.88	-0.16	134.10	133.88	-0.16
Other Food	177.44	177.58	0.08	168.60	168.71	0.06
Fertilizer	0.00	0.00	0.00	37.00	36.54	-1.23
Fish	360.00	360.00	0.00	310.00	311.45	0.47

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: Reductions in internal marketing margins for all commodities by 20 percent

Table 255 Improvements in Marketing Infrastructure - Change in Net Imports

	Net Imports		
Commodity	Base	New	% Change
Dry Season Rice	-215.40	-210.92	-2.08
Wet Season Rice	-50.00	-35.12	-29.77
Maize	0.00	0.00	0.00
Vegetables	0.00	0.00	0.00
Livestock	0.00	0.00	0.00
Other Food	0.00	0.00	0.00
Fertilizer	37.00	36.54	-1.23
Fish	-50.00	-48.55	-2.90

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: Reductions in internal marketing margins for all commodities by 20 percent

Table 256 Improvements in Marketing Infrastructure - Changes in Income

Income	Total Income		
	Base	New	% Change
Total Income	12112.10	11773.06	-2.80
Urban Non-Poor	1983.41	1902.37	-4.09
Urban Poor	2338.79	2243.23	-4.09
Rural Non-Poor	2415.55	2394.78	-0.86
Rural Poor	5374.34	5232.68	-2.64
Agricultural Income	4046.39	4036.90	-0.23
Rural Non-Poor	2023.193	2018.452	-0.23
Rural Poor	2023.193	2018.452	-0.23

Billion Riel
Simulation: Reductions in internal marketing margins for all commodities by 20 percent

Table 257 Improvements in Export Marketing Infrastructure - Change in Prices

Commodity	Producer Price			Consumer Price		
	Base	New	% Change	Base	New	% Change
Dry Season Rice	653.85	692.31	5.88	850.00	900.00	5.88
Wet Season Rice	769.23	814.48	5.88	1000.00	1058.82	5.88
Maize	384.62	404.33	5.13	500.00	525.63	5.13
Vegetables	1153.85	1389.23	20.40	1500.00	1806.00	20.40
Livestock	5846.15	6475.44	10.76	7600.00	8418.08	10.76
Other Food	615.38	672.08	9.21	800.00	873.71	9.21
Fertilizer	615.38	581.20	-5.56	800.00	755.56	-5.56
Fish	3461.54	3665.16	5.88	4500.00	4764.71	5.88

Riel per kg
Other Food: Soybean, Cassava and Sweetpotato
Simulation: Reductions in export marketing margins for all commodities by 20 percent

Table 258 Improvements in Export Marketing Infrastructure - Change in Volumes

Commodity	Production			Consumption		
	Base	New	% Change	Base	New	% Change
Dry Season Rice	444.19	446.57	0.54	215.40	204.91	-4.87
Wet Season Rice	1829.88	1831.24	0.08	1726.50	1743.32	0.97
Maize	163.05	163.37	0.19	154.90	155.21	0.20
Vegetables	152.47	156.11	2.39	144.84	148.49	2.52
Livestock	134.10	138.28	3.12	134.10	138.28	3.12
Other Food	177.44	180.11	1.51	168.60	171.24	1.56
Fertilizer	0.00	0.00	0.00	37.00	43.07	16.39
Fish	360.00	366.23	1.73	310.00	319.69	3.13

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: Reductions in export marketing margins for all commodities by 20 percent

Table 259 Improvements in Export Marketing Infrastructure - Change in Net Imports

Commodity	Net Imports		
	Base	New	% Change
Dry Season Rice	-215.40	-228.33	6.00
Wet Season Rice	-50.00	-33.02	-33.95
Maize	0.00	0.00	0.00
Vegetables	0.00	0.00	0.00
Livestock	0.00	0.00	0.00
Other Food	0.00	0.00	0.00
Fertilizer	37.00	43.07	16.39
Fish	-50.00	-46.54	-6.92

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: Reductions in export marketing margins for all commodities by 20 percent

Table 260 Improvements in Export Marketing Infrastructure - Changes in Income

Income	Total Income		
	Base	New	% Change
Total Income	12112.10	13094.55	8.11
Urban Non-Poor	1983.41	2135.63	7.67
Urban Poor	2338.79	2518.29	7.67
Rural Non-Poor	2415.55	2627.38	8.77
Rural Poor	5374.34	5813.25	8.17
Agricultural Income	4046.39	4409.82	8.98
Rural Non-Poor	2023.19	2204.91	8.98
Rural Poor	2023.193	2204.908	8.98

Billion Riel
Simulation: Reductions in export marketing margins for all commodities by 20 percent

K.2.4.7 Simulation Results for Rice and Vegetable Value Chain Improvements

K.2.4.8 Improvements in Productivity

1087. These sets of simulations were undertaken to examine the effect of interventions simultaneously in the Rice and Vegetable value chain, rather than individual effects. Due to the multi-market nature of the model, it is not just a matter of simply adding up the individual effects to obtain an overall effect; as the cross-price elasticities will determine the final equilibrium outcome.

1088. The first set of simulations involve a 20 percent increase in the yields of rice and vegetables; see Table 261 to Table 264. While the prices of rice do not change, the price of vegetables falls by over 32 percent because vegetables are not able to be exported in the model so any increases in yields leads to a reduction in prices as surplus production has to be consumed domestically.

1089. Production of dry season rice increases by nearly 20.6 percent, while production of wet season rice increases by nearly 22.7 percent. Vegetable production increases by 20.2 percent. Consumption of dry season rice increases by 1.68 percent, while wet season rice consumption falls by 2.32 percent as more is exported. Consumption of vegetables increases by 21 percent.

1090. Exports of both dry season and wet season rice expand significantly (41 and 907 percent respectively).

1091. Agricultural income increases by 1.72 percent, but total household income falls by 4.4 percent, due to reductions in non-agricultural incomes.

Table 261 Improvements in Agricultural Productivity for Rice and Vegetables - Change in Prices

Commodity	Producer Price			Consumer Price		
	Base	New	% Change	Base	New	% Change
Dry Season Rice	653.85	653.85	0.00	850.00	850.00	0.00
Wet Season Rice	769.23	769.23	0.00	1000.00	1000.00	0.00
Maize	384.62	373.40	-2.92	500.00	485.42	-2.92
Vegetables	1153.85	778.51	-32.53	1500.00	1012.07	-32.53
Livestock	5846.15	4258.86	-27.15	7600.00	5536.52	-27.15
Other Food	615.38	585.96	-4.78	800.00	761.75	-4.78
Fertilizer	615.38	615.38	0.00	800.00	800.00	0.00
Fish	3461.54	3461.54	0.00	4500.00	4500.00	0.00

Riel per kg
Other Food: Soybean, Cassava and Sweetpotato
Simulation: 20 percent increase in yields for dry season rice, wet season rice, and vegetables

Table 262 Improvements in Agricultural Productivity for Rice and Vegetables - Change in Volumes

Commodity	Production			Consumption		
	Base	New	% Change	Base	New	% Change
Dry Season Rice	444.19	535.55	20.57	215.40	219.03	1.68
Wet Season Rice	1829.88	2244.99	22.69	1726.50	1686.39	-2.32
Maize	163.05	163.05	0.00	154.90	154.90	0.00
Vegetables	152.47	183.27	20.20	144.84	175.65	21.27
Livestock	134.10	157.51	17.46	134.10	157.51	17.46
Other Food	177.44	176.14	-0.73	168.60	167.27	-0.79
Fertilizer	0.00	0.00	0.00	37.00	231.10	524.59
Fish	360.00	360.00	0.00	310.00	298.64	-3.67

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: 20 percent increase in yields for dry season rice, wet season rice, and vegetables

Table 263 Improvements in Agricultural Productivity for Rice and Vegetables - Change in Net Imports

Commodity	Net Imports		
	Base	New	% Change
Dry Season Rice	-215.40	-303.20	40.76
Wet Season Rice	-50.00	-503.71	907.42
Maize	0.00	0.00	0.00
Vegetables	0.00	0.00	0.00
Livestock	0.00	0.00	0.00
Other Food	0.00	0.00	0.00
Fertilizer	37.00	231.10	524.59
Fish	-50.00	-61.37	22.73

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: 20 percent increase in yields for dry season rice, wet season rice, and vegetables

Table 264 Improvements in Agricultural Productivity for Rice and Vegetables - Changes in Income

Income	Total Income		
	Base	New	% Change
Total Income	12112.10	11577.43	-4.41
Urban Non-Poor	1983.41	1834.83	-7.49
Urban Poor	2338.79	2163.58	-7.49
Rural Non-Poor	2415.55	2420.95	0.22
Rural Poor	5374.34	5158.08	-4.02
Agricultural Income	4046.39	4115.96	1.72
Rural Non-Poor	2023.19	2057.98	1.72
Rural Poor	2023.193	2057.979	1.72

Billion Riel
Simulation: 20 percent increase in yields for dry season rice, wet season rice, and vegetables

K.2.4.9 Improvements in Technology

1092. In this set of simulations improvements in postharvest technology for rice and vegetables were simulated through a reduction in postharvest losses from 14 percent down to 10 percent for rice and from 10 percent down to 7 percent for vegetables. Reductions in postharvest losses imply an extra amount of commodity available for sale. As with the previous simulation of improvements in agricultural productivity, this means that vegetable prices have to fall in order to balance supply and demand conditions as surplus vegetables are unable to be exported.

1093. The results are shown in Table 265 to Table 268. Under this scenario, vegetable prices fall by 1.76 percent, while production of vegetables increase by 3.04 percent. Production of rice increases by 4.7 percent. Consumption of dry season rice falls by 0.56 percent, while wet season rice consumption rises by 0.64 percent and vegetable consumption increases by 3.2 percent.

1094. Exports of dry season rice increase by 10 percent, while exports of wet season rice increase by 146 percent.

1095. Under this scenario, total household income increases by 1 percent, while agricultural income increases by 2.46 percent.

Table 265 Improvements in Postharvest Technology for Rice and Vegetables - Change in Prices

	Producer Price			Consumer Price		
Commodity	Base	New	% Change	Base	New	% Change
Dry Season Rice	653.85	653.85	0.00	850.00	850.00	0.00
Wet Season Rice	769.23	769.23	0.00	1000.00	1000.00	0.00
Maize	384.62	386.48	0.48	500.00	502.42	0.48
Vegetables	1153.85	1133.53	-1.76	1500.00	1473.58	-1.76
Livestock	5846.15	5934.86	1.52	7600.00	7715.32	1.52
Other Food	615.38	623.74	1.36	800.00	810.86	1.36
Fertilizer	615.38	615.38	0.00	800.00	800.00	0.00
Fish	3461.54	3461.54	0.00	4500.00	4500.00	0.00

Riel per kg
Other Food: Soybean, Cassava and Sweetpotato
Simulation: reduction in post harvest losses from 14 to 10 percent for rice and from 10 to 7 percent for vegetables

Table 266 Improvements in Postharvest Technology for Rice and Vegetables - Change in Volumes

	Production			Consumption		
Commodity	Base	New	% Change	Base	New	% Change
Dry Season Rice	444.19	464.85	4.65	215.40	214.19	-0.56
Wet Season Rice	1829.88	1915.71	4.69	1726.50	1737.53	0.64
Maize	163.05	163.18	0.08	154.90	155.03	0.08
Vegetables	152.47	157.10	3.04	144.84	149.48	3.20
Livestock	134.10	134.71	0.45	134.10	134.71	0.46
Other Food	177.44	177.80	0.20	168.60	168.93	0.19
Fertilizer	0.00	0.00	0.00	37.00	36.84	-0.44
Fish	360.00	360.00	0.00	310.00	313.20	1.03

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: reduction in post harvest losses from 14 to 10 percent for rice and from 10 to 7 percent for vegetables

Table 267 Improvements in Postharvest Technology for Rice and Vegetables - Change in Net Imports

Commodity	Net Imports		
	Base	New	% Change
Dry Season Rice	-215.40	-237.33	10.18
Wet Season Rice	-50.00	-123.28	146.56
Maize	0.00	0.00	0.00
Vegetables	0.00	0.00	0.00
Livestock	0.00	0.00	0.00
Other Food	0.00	0.00	0.00
Fertilizer	37.00	36.84	-0.44
Fish	-50.00	-46.80	-6.39

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: reduction in post harvest losses from 14 to 10 percent for rice and from 10 to 7 percent for vegetables

Table 268 Improvements in Postharvest Technology for Rice and Vegetables - Changes in Income

Income	Total Income		
	Base	New	% Change
Total Income	12112.10	12234.99	1.01
Urban Non-Poor	1983.41	1989.19	0.29
Urban Poor	2338.79	2345.60	0.29
Rural Non-Poor	2415.55	2466.40	2.10
Rural Poor	5374.34	5433.80	1.11
Agricultural Income	4046.39	4145.79	2.46
Rural Non-Poor	2023.19	2072.89	2.46
Rural Poor	2023.193	2072.893	2.46

Billion Riel
Simulation: reduction in post harvest losses from 14 to 10 percent for rice and from 10 to 7 percent for vegetables

K.2.4.10 Improvements in Quality

1096. The next simulation looked at the effects of an increase in quality in rice and vegetable products in Cambodia. The simulation involved an increase in the urban consumer price of rice and vegetables by 20 percent to reflect the higher quality of the commodity; see Table 269 to Table 272.

1097. As in previous simulations, there are no changes in the prices of rice since they are a tradable commodity while the price of vegetables decreases by 2.8 percent in equilibrium.

1098. Production of dry season rice increases by 0.16 percent while wet season rice increases by 0.55 percent. Production of vegetables decreases by 0.3 percent. On the consumption side, domestic consumption of dry season rice increases by 7 percent, while consumption of wet season rice increases by 6.75 percent. Consumption of vegetables falls by 0.31 percent.

1099. The increase in domestic consumption of rice is mirrored by decreases in the exportable surplus of rice. Exports of dry season rice falls by 6.74 percent while exports of wet season rice falls by 216 percent.

1100. Improvements in quality of rice and vegetables do not add value to households. Total household income falls by nearly 7 percent while agricultural income falls by just over 2 percent.

1101. Higher prices for rice and vegetables substitute consumption out of livestock, fish and other food crops and into (relatively lower priced) rice products but at the expense of reducing exports and hence lowering returns to farmers.

Table 269 Improvements in Quality for Rice and Vegetables - Change in Prices

	Producer Price			Consumer Price		
Commodity	Base	New	% Change	Base	New	% Change
Dry Season Rice	653.85	653.85	0.00	850.00	850.00	0.00
Wet Season Rice	769.23	769.23	0.00	1000.00	1000.00	0.00
Maize	384.62	365.50	-4.97	500.00	475.15	-4.97
Vegetables	1153.85	1121.57	-2.80	1500.00	1458.04	-2.80
Livestock	5846.15	5420.09	-7.29	7600.00	7046.12	-7.29
Other Food	615.38	570.91	-7.23	800.00	742.18	-7.23
Fertilizer	615.38	615.38	0.00	800.00	800.00	0.00
Fish	3461.54	3461.54	0.00	4500.00	4500.00	0.00

Riel per kg
Other Food: Soybean, Cassava and Sweetpotato
Simulation: 20 percent increase in consumer prices for dry season rice, wet season rice, and vegetables

Table 270 Improvements in Quality for Rice and Vegetables - Change in Volumes

	Production			Consumption		
Commodity	Base	New	% Change	Base	New	% Change
Dry Season Rice	444.19	444.88	0.16	215.40	230.66	7.08
Wet Season Rice	1829.88	1839.91	0.55	1726.50	1842.95	6.75
Maize	163.05	161.98	-0.66	154.90	153.83	-0.69
Vegetables	152.47	152.01	-0.30	144.84	144.39	-0.31
Livestock	134.10	131.09	-2.24	134.10	131.09	-2.24
Other Food	177.44	175.45	-1.12	168.60	166.58	-1.20
Fertilizer	0.00	0.00	0.00	37.00	36.16	-2.28
Fish	360.00	360.00	0.00	310.00	293.25	-5.40

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: 20 percent increase in consumer prices for dry season rice, wet season rice, and vegetables

Table 271 Improvements in Quality for Rice and Vegetables - Change in Net Imports

	Net Imports		
Commodity	Base	New	% Change
Dry Season Rice	-215.40	-200.89	-6.74
Wet Season Rice	-50.00	57.94	-215.88
Maize	0.00	0.00	0.00
Vegetables	0.00	0.00	0.00
Livestock	0.00	0.00	0.00
Other Food	0.00	0.00	0.00
Fertilizer	37.00	36.16	-2.28
Fish	-50.00	-66.75	33.49

Thousand Tonnes
Other Food: Soybean, Cassava and Sweetpotato
Simulation: 20 percent increase in consumer prices for dry season rice, wet season rice, and vegetables

Table 272 Improvements in Quality for Rice and Vegetables - Changes in Income

Income	Total Income		
	Base	New	% Change
Total Income	12112.10	11270.36	-6.95
Urban Non-Poor	1983.41	1796.72	-9.41
Urban Poor	2338.79	2118.65	-9.41
Rural Non-Poor	2415.55	2337.35	-3.24
Rural Poor	5374.34	5017.64	-6.64
Agricultural Income	4046.39	3963.84	-2.04
Rural Non-Poor	2023.19	1981.92	-2.04
Rural Poor	2023.193	1981.919	-2.04

Billion Riel
Simulation: 20 percent increase in consumer prices for dry season rice, wet season rice, and vegetables

K.2.5 Quantification of Value Added along the Value Chain

1102. The simulations above provided estimates of the effects of various interventions along the value chain for agricultural commodities in the model. These interventions fell into the following categories:

5. **Improvements in Agricultural Productivity**: This is the introduction of technologies (seeds, irrigation, fertilizer, etc.) which lead to a 20 percent increase in yields.

6. **Changes in Technology**: These include improvements in milling technology for rice which leads to the milling recovery ratios to increase, as well as a reduction in post harvest losses along the value chain.

7. **Improvements in Quality**: This simulates changes in practices which result in higher quality commodities being sold in the market. This is simulated though an increase in consumer prices for the same (unchanged) commodity which should hopefully flow through to increased farm gate prices.

8. **Improvements in Infrastructure**: These include reductions in the marketing margins between the farm gate and urban areas, as well as a reduction in the marketing margins between the farm and border areas. These simulate an improvement in road infrastructure, a reduction in transportation costs (more efficient transportation, less unofficial costs), as well as an improvement in the marketing functions which lower transaction costs.

1103. It is of interest to quantify the effects of these various interventions in order to estimate the likely benefits accruing at each stage of the value chain. These are summarized in graphical format in Figure 4 to Figure 9

1104. Table 10 and Table 11 present estimates of the income effects of each of the interventions on poor and non-poor households[54] in both urban and rural areas. Of importance to note that even though the underlying income elasticities of each household group are different, the net effect on agricultural income from each of the simulations is the same across different groups. The main differences occur in the impact on non-agricultural incomes, and hence total household incomes.

[54] Non-Poor are the top two income deciles and the Poor are the bottom 8 deciles.

1105. In Table 11 the percentage change in income from the base income is presented for each of the simulations, while in Table 10 the value (in US$) of each intervention along the value chain for each commodity is presented.

1106. For several commodities such as maize, vegetables and Other Food Crops (soybean, cassava and sweet potato) the model treats these crops as non-exportable, meaning that domestic demand and supply conditions have to be in equilibrium and so if supply increases then prices must fall to compensate. As a consequence, simulations which involve an increase in production (whether through yield increases or reductions in losses) will invariably result in reduced prices and therefore reduced incomes.

1107. This highlights the important role of exports in the Cambodian economy as the domestic economy is too small to absorb surplus production. In all cases except vegetables Cambodia is a net exporter and hence domestic demand is satisfied before the surplus is exported.

1108. As Table 11 shows, in most cases the net effect on income is minor. Interventions in increasing agricultural productivity only increase agricultural income by at most 1.85 percent, while improvements in post harvest technology improve incomes by 2.5 percent in the case of rice improvements, but for other commodities there are income changes of less than 0.15 percent; see Figure 4 to Figure 8.

1109. The most significant benefits to the agricultural economy come from improvements in export marketing. Agricultural income increases by almost 9 percent from reductions in transaction costs and barriers to exporting.

1110. The improvements in export marketing, combined with the above implications on non-exportable commodities, highlight the crucial role in providing an enabling environment for the export of surplus production.

1111. Interestingly, the improvements in quality of agricultural products do not have a major positive effect on agricultural incomes, and indeed in several cases actually reduce incomes. The main reason for this is that the improvements in quality are proxied by increases in consumer prices. Naturally if price elasticities do not change then any increase in price will be met with reductions in demand. These point to an obvious conclusion; consumers have to be willing to pay for higher quality products and in the case of Cambodia there does not seem to be any evidence of widespread demand for such higher quality (and more expensive) products. As such, an export oriented approach to quality improvements should be undertaken.

1112. As indicated above, Table 10 shows the value added for each of the value chain interventions. While the change in income might be only a few percent, the large size of the Cambodian economy demonstrates the overall effect on farm family incomes.

1113. Most of the value added comes from improvements in export marketing, which affect all commodities equally. Some US$88.5million in value added comes from just improvements in domestic and export marketing infrastructure.

1114. Overall, improvements in the rice value chain accrue just over US$142 million in value added, while maize accrues just under US$79 million, vegetables US$91.6 million other food crops (soybeans, cassava and sweetpotato) US$92.7 million and fish US$65.7 million.

1115. If just two value chains were chosen for support, these would have to be rice and vegetables. The Other Food Crops value chain has a higher value added comparted with vegetables, but the disparate nature of the grouping (soybeans, cassava and sweetpotato) would make it difficult to formulate a consistent intervention strategy. Combined, the value added for the rice and vegetable value chain is around US$110 million[55]; the reduction compared with the individual value chains is due to cross-elasticity effects. Figure 9 graphically shows the income accruing along the combined rice and vegetable value chain for each of the interventions.

Table 273 Estimated Value Added from Value Chain Interventions

Value Chain	Value Chain Intervention				Total
	Agricultural Productivity	Technology	Quality	Marketing Infrastructure	
Rice	35.04	42.30	-23.47	88.49	142.35
Maize	-6.40	-1.51	-1.69	88.49	78.89
Vegetables	-2.26	-0.55	5.87	88.49	91.56
Other Food Crops	-0.67	-0.16	5.02	88.49	92.67
Fish	n.a.	0.00	-22.75	88.49	65.74
Rice and Vegetables Combined	17.39	24.85	-20.64	88.49	110.09

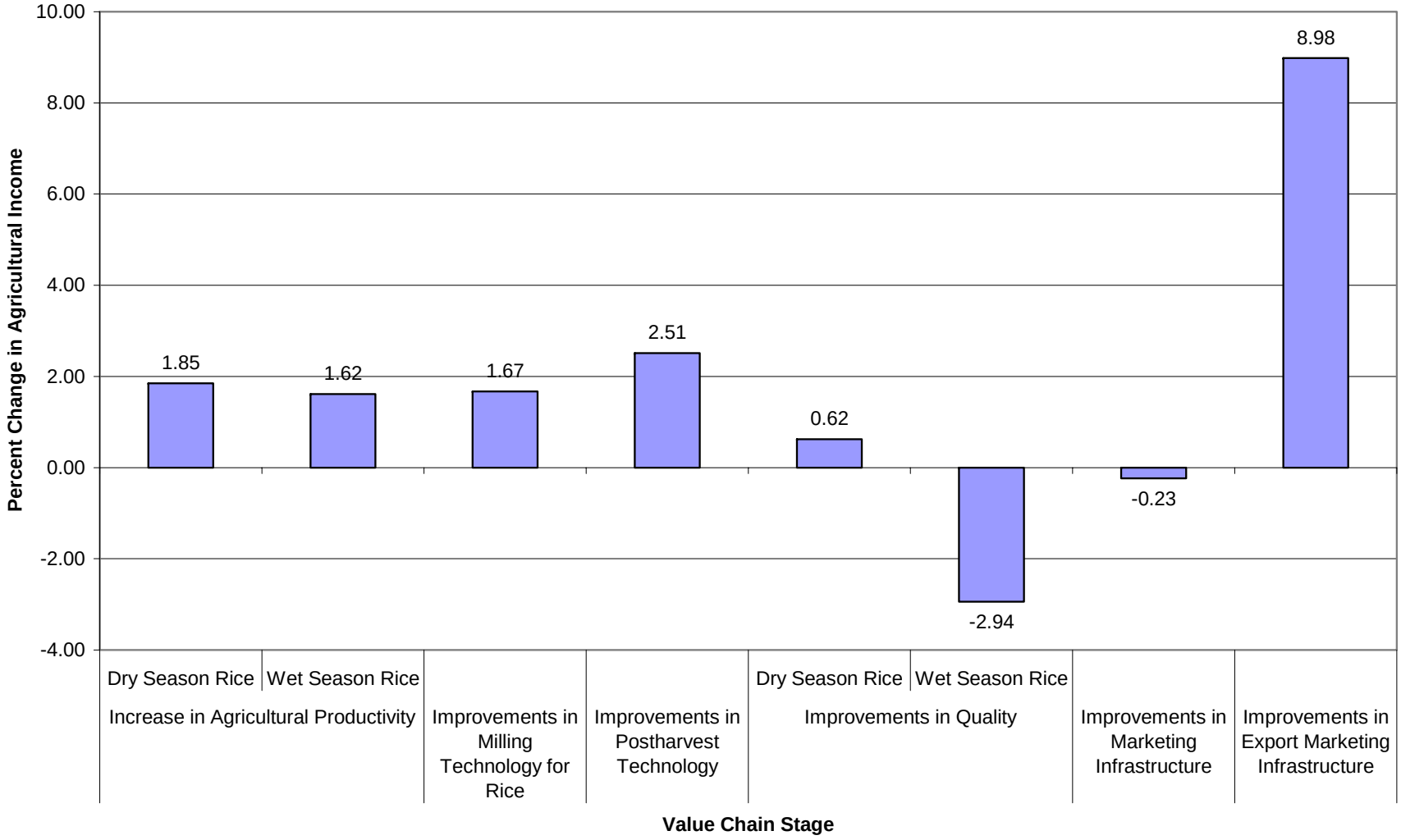
Million US$
Note: Agricultural Productivity Interventions are increases in yields, while technology interventions are reductions in postharvest losses and increases in rice milling recovery ratios. Quality improvements are modeled as increased consumer price in the presence of a higher quality product. Marketing infrastructure improvements are reductions in marketing margins and transaction costs for farm-urban trade as well as farm-export trade.
Note: Negative value added for maize, vegetables and other food crops is because of restrictions on exports in the model. All production increases results in falling prices and consequently incomes.
Note: The scenario with Rice and Vegetables combined has lower value added because of cross-substitution effects within the model.
Note: The Marketing infrastructure intervention has the same value added due to its none-exclusivity in impact; i.e. the intervention is across all sectors.
Source: CAMSEM Simulations

[55] A rough calculation shows that under a US$30 million AusAID program the Benefit-Cost ratio would be 3.67.

Table 274 Effects of Different Program Interventions on Incomes

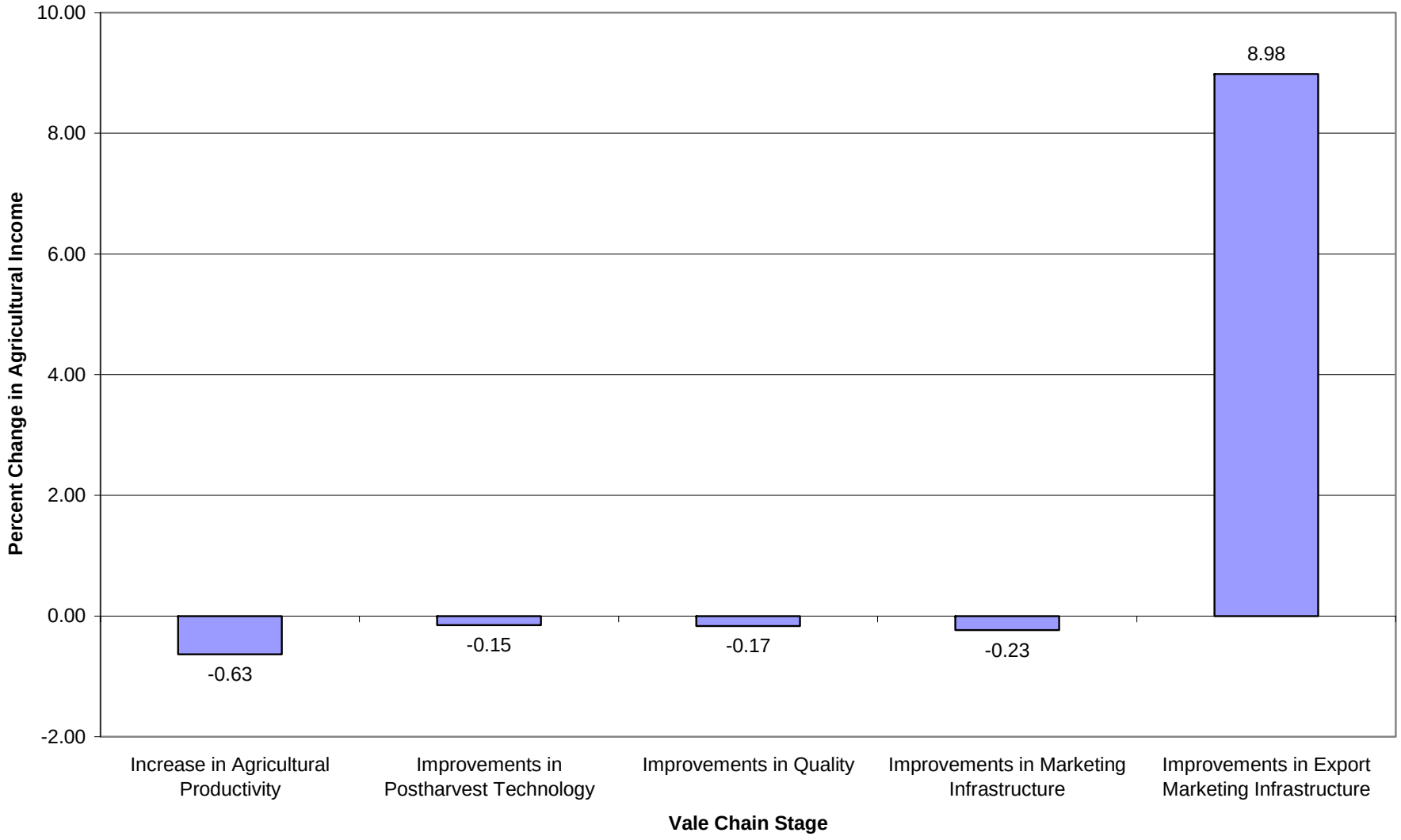
Program Intervention	Commodity	Total Income from Agriculture and Non Agriculture					Agricultural Income		
		Urban		Rural		Total	Rural		Total
		Non-Poor	Poor	Non-Poor	Poor		Non-Poor	Poor	
Increase in Agricultural Productivity	Dry Season Rice	0.41	0.41	1.62	0.95	0.89	1.85	1.85	1.85
	Wet Season Rice	-4.91	-4.91	0.56	-2.45	-2.73	1.62	1.62	1.62
	Maize	-1.56	-1.56	-0.78	-1.21	-1.25	-0.63	-0.63	-0.63
	Vegetables	-1.30	-1.30	-0.40	-0.89	-0.94	-0.22	-0.22	-0.22
	Other Food Crops	-0.62	-0.62	-0.16	-0.41	-0.43	-0.07	-0.07	-0.07
	Rice and Vegetables	-7.49	-7.49	0.22	-4.02	-4.41	1.72	1.72	1.72
Improvements in Milling Technology for Rice		0.37	0.37	1.46	0.86	0.81	1.67	1.67	1.67
Improvements in Postharvest Technology	Rice	0.56	0.56	2.19	1.30	1.21	2.51	2.51	2.51
	Maize	-0.32	-0.32	-0.18	-0.25	-0.26	-0.15	-0.15	-0.15
	Vegetables	-0.26	-0.26	-0.09	-0.18	-0.19	-0.05	-0.05	-0.05
	Other Food Crops	-0.12	-0.12	-0.03	-0.08	-0.09	-0.02	-0.02	-0.02
	Fish	0.00086	0.00086	0.00000	0.00047	0.00052	-0.00015	-0.00015	-0.00017
	Rice and Vegetables	0.29	0.29	2.10	1.11	1.01	2.46	2.46	2.46
Improvements in Quality	Dry Season Rice	-0.11	-0.11	0.50	0.17	0.14	0.62	0.62	0.62
	Wet Season Rice	-9.14	-9.14	-3.95	-6.81	-7.07	-2.94	-2.94	-2.94
	Maize	-0.26	-0.26	-0.18	-0.23	-0.23	-0.17	-0.17	-0.17
	Vegetables	-0.07	-0.07	0.48	0.18	0.15	0.58	0.58	0.58
	Other Food Crops	0.04	0.04	0.42	0.21	0.19	0.50	0.50	0.50
	Fish	-7.20	-7.20	-3.05	-5.33	-5.54	-2.25	-2.25	-2.25
	Rice and Vegetables	-9.41	-9.41	-3.24	-6.64	-6.95	-2.04	-2.04	-2.04
Improvements in Marketing Infrastructure		-4.09	-4.09	-0.86	-2.64	-2.80	-0.23	-0.23	-0.23
Improvements in Export Marketing Infrastructure		7.67	7.67	8.77	8.17	8.11	8.98	8.98	8.98

Percent Change from Base Income Scenario
Other Food: Soybean, Cassava and Sweetpotato
Note: Negative income effects are due mainly to two feature; (i) price elasticities and (ii) exportability of the crop. As production increases, prices fall and this is exacerbated by the lack of export outlets.



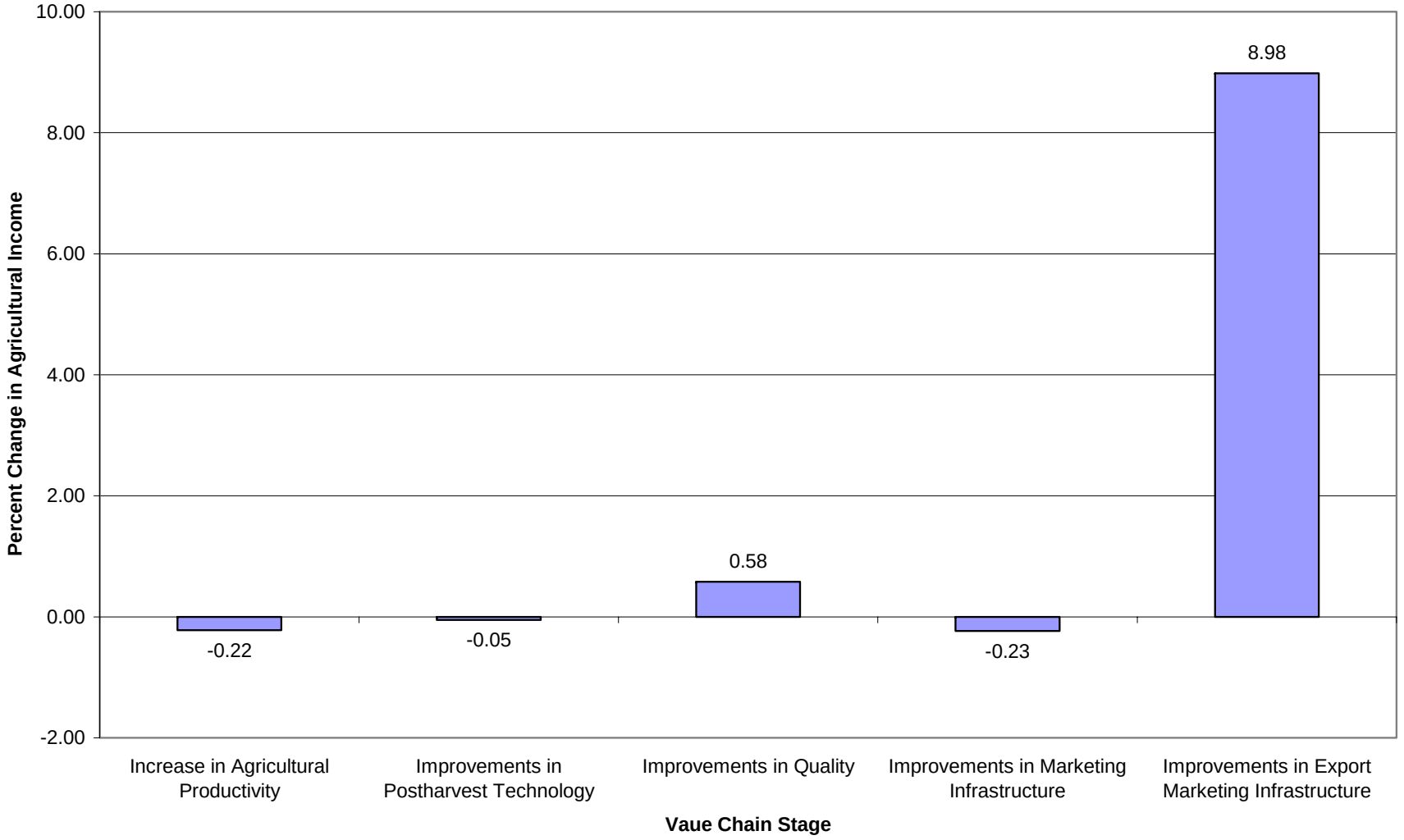
Source: CAMSEM Simulations

Figure 36 Quantification of the Value Added along the Value Chain of Rice from Program Interventions



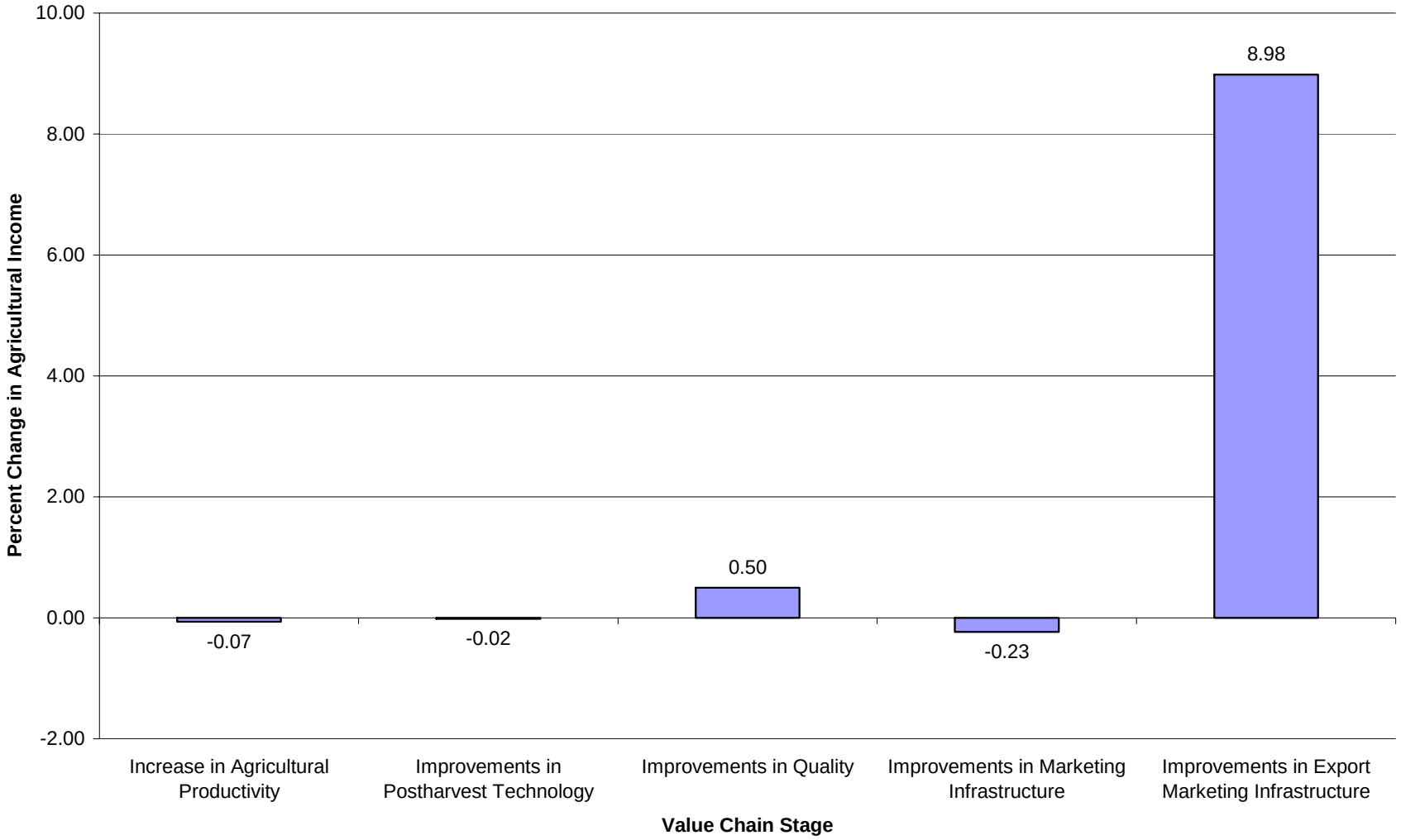
Source: CAMSEM Simulations

Figure 37 Quantification of the Value Added along the Value Chain of Maize from Program Interventions



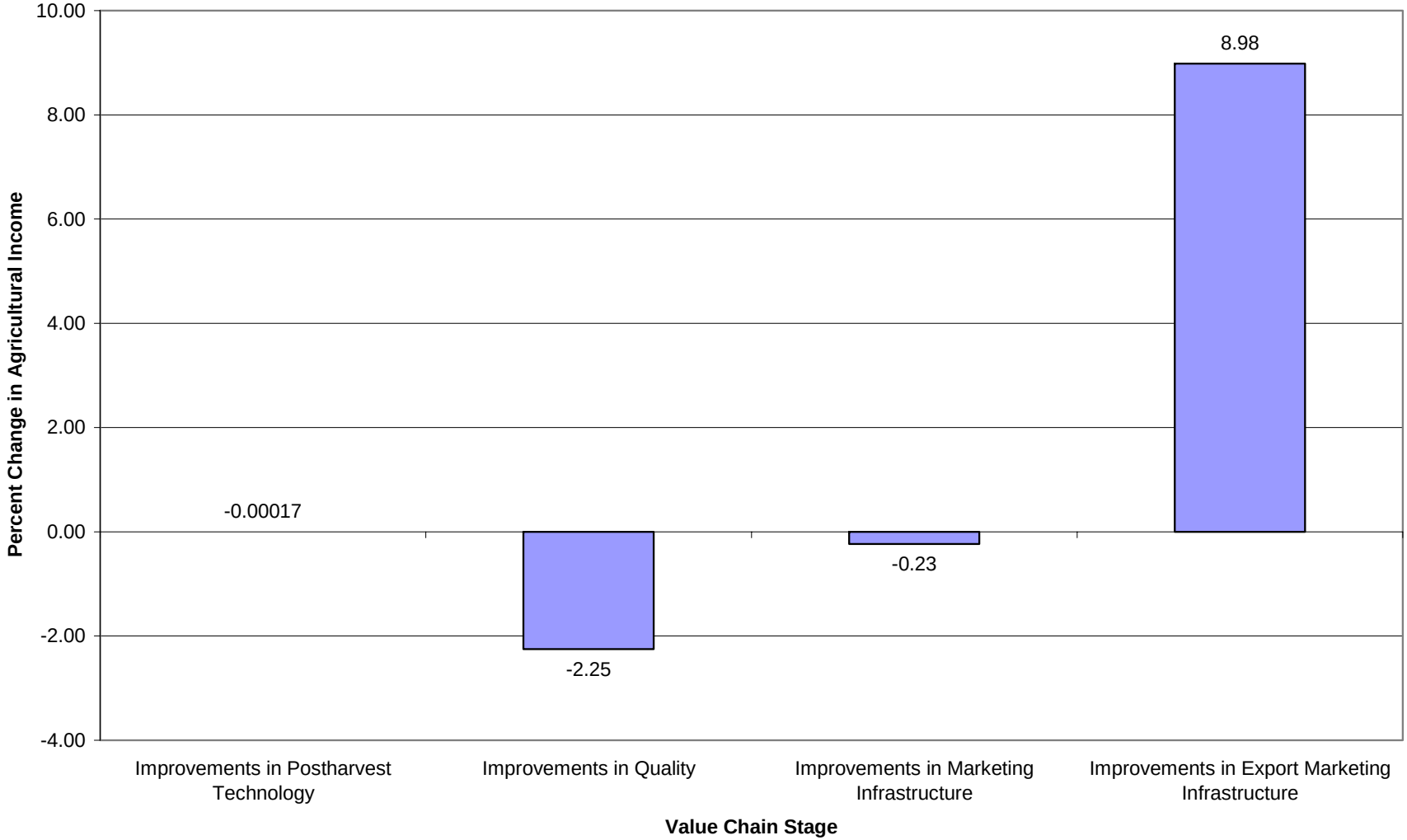
Source: CAMSEM Simulations

Figure 38 Quantification of the Value Added along the Value Chain of Vegetables from Program Interventions



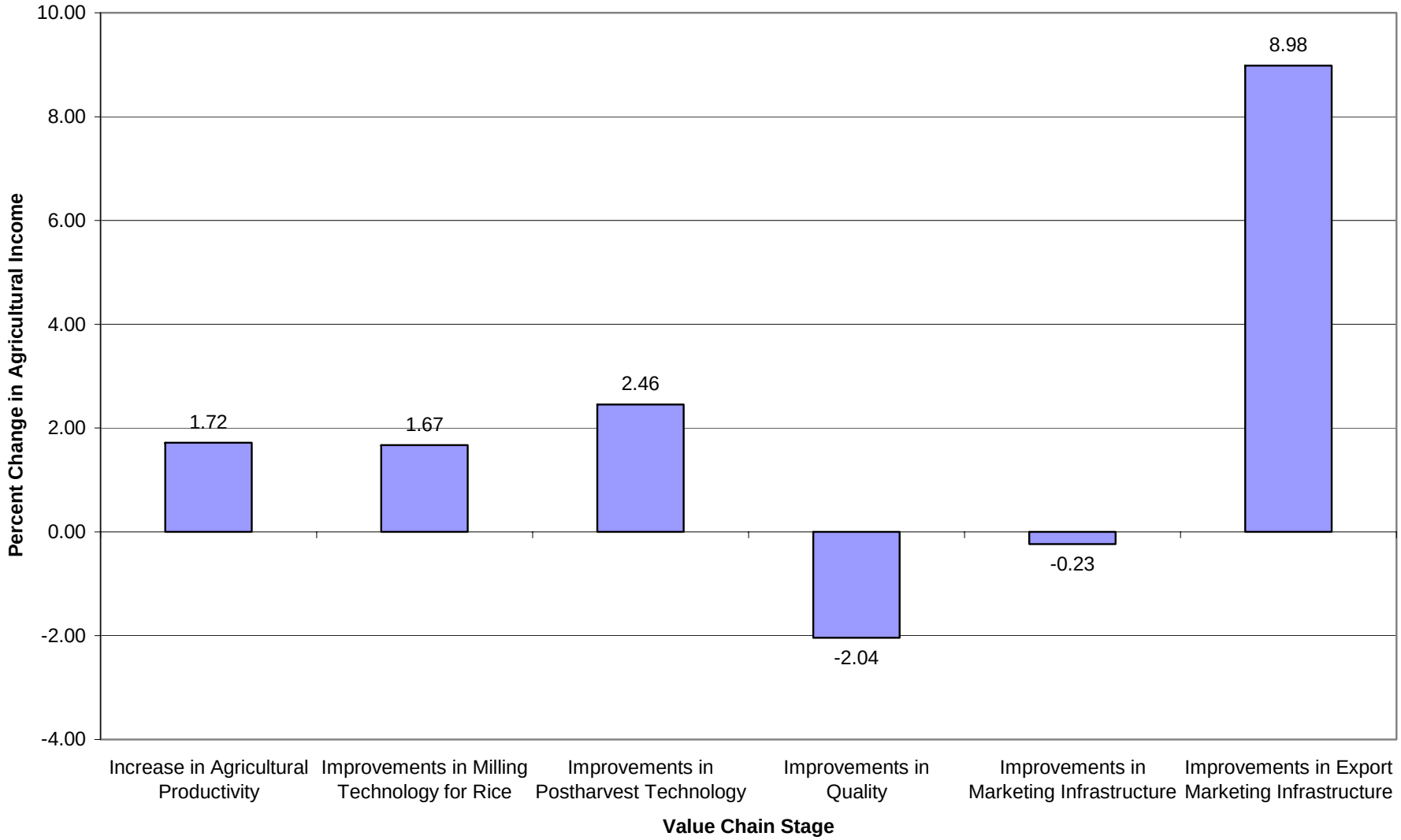
Source: CAMSEM Simulations

Figure 39 Quantification of the Value Added along the Value Chain of Soybeans, Cassava and Sweetpotato from Program Interventions



Source: CAMSEM Simulations

Figure 40 Quantification of the Value Added along the Value Chain of Fish from Program Interventions



Source: CAMSEM Simulations

Figure 41 Quantification of the Value Added along the Value Chain of Rice and Vegetables from Program Interventions