

Agricultural Marketing Efficiency and Price Spread with agriME

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Package version 0.1.0

1 Purpose

The **agriME** package provides a consistent accounting workflow for agricultural price-spread and marketing-efficiency studies. It can calculate indicators directly from channel totals or reconstruct them from producer, wholesaler, retailer, processor, and other intermediary stages. The package also checks whether the recorded prices, costs, and margins reconcile.

All compared values must refer to the same commodity quality, product form, place, period, and quantity. A difference caused by grading, processing, storage duration, or quantity loss is not automatically an inefficiency.

2 Core equations

Let P_f be the net producer price, P_c the consumer price, MC total marketing cost, and MM total net intermediary margin. The package reports:

Indicator	Equation	Interpretation
Price spread	$P_c - P_f$	Monetary gap between consumer and producer
Producer's share	$100P_f/P_c$	Percentage of consumer expenditure reaching the producer
Acharya efficiency	$P_f/(MC + MM)$	Producer return relative to channel cost and net margin
Shepherd ratio	P_c/MC	Consumer value per unit of marketing cost
Conventional efficiency	$(P_c - P_f)/MC$	Marketing value added per unit of marketing cost

When $P_c = P_f + MC + MM$, Acharya efficiency is also $P_c/(MC + MM) - 1$. The package retains any failure of this identity as an **accounting_gap** rather than silently reallocating it.

3 Direct calculation from channel totals

```
> library(agriME)
> marketing_metrics(
+   producer_price = 1900,
+   consumer_price = 3150,
+   marketing_cost = 510,
+   marketing_margin = 740,
```

```

+   channel = "Producer-Wholesaler-Retailer"
+ )

      channel producer_price consumer_price marketing_cost
1 Producer-Wholesaler-Retailer      1900      3150      510
  marketing_margin accounting_gap price_spread price_spread_percent
1           740           0      1250      39.68254
  producer_share_percent tgmm_percent value_added acharya_efficiency
1           60.31746      39.68254      1250      1.52
  shepherd_efficiency conventional_efficiency
1           6.176471      2.45098

```

4 Audited stage-level accounts

The example data contain four illustrative tomato channels. They are synthetic and should not be cited as market evidence.

```

> data(tomato_channels)
> fit <- analyse_channels(tomato_channels)
> summary(fit)[, c(
+   "channel", "producer_price", "consumer_price", "price_spread",
+   "producer_share_percent", "acharya_efficiency"
+ )]

      channel producer_price consumer_price price_spread
1           Direct      2420      2600      180
2           Long channel      1730      3250      1520
3           Producer-Retailer      2130      3000      870
4 Producer-Wholesaler-Retailer      1900      3150      1250
  producer_share_percent acharya_efficiency
1           93.07692      13.444444
2           53.23077      1.138158
3           71.00000      2.448276
4           60.31746      1.520000

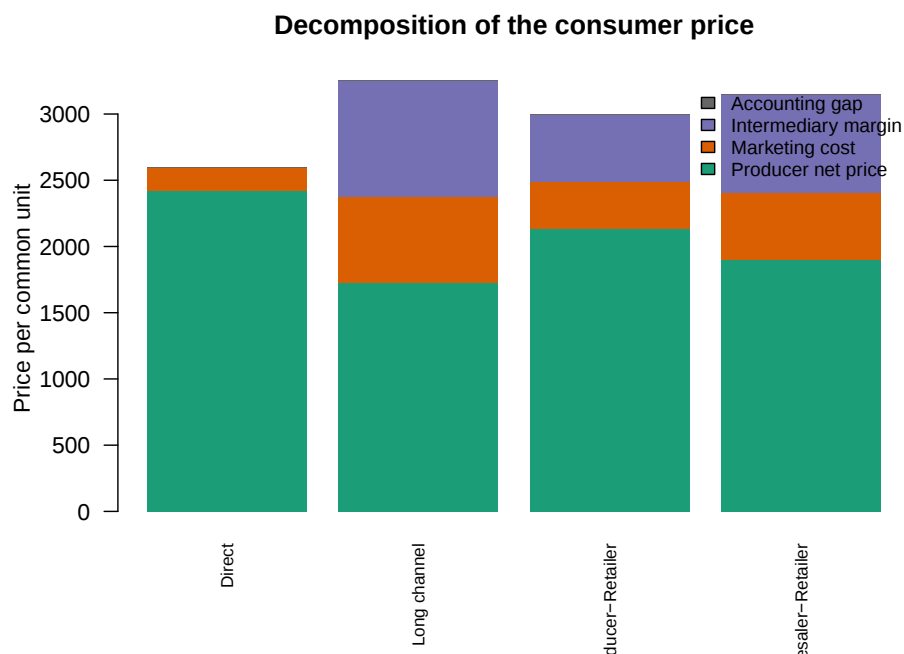
```

The direct channel has only a producer stage. In that case the producer's sale price is the consumer price, while producer-borne marketing cost explains the difference between gross and net producer price.

```

> plot(fit, type = "decomposition", las = 2, cex.names = 0.75)

```



5 Consumer-price decomposition and ranking

```
> consumer_rupee(fit)
```

	channel	component	value	percent
1	Direct	producer_net_price	2420	93.076923
2	Direct	marketing_cost	180	6.923077
3	Direct	intermediary_margin	0	0.000000
4	Direct	accounting_gap	0	0.000000
5	Long channel	producer_net_price	1730	53.230769
6	Long channel	marketing_cost	650	20.000000
7	Long channel	intermediary_margin	870	26.769231
8	Long channel	accounting_gap	0	0.000000
9	Producer-Retailer	producer_net_price	2130	71.000000
10	Producer-Retailer	marketing_cost	360	12.000000
11	Producer-Retailer	intermediary_margin	510	17.000000
12	Producer-Retailer	accounting_gap	0	0.000000
13	Producer-Wholesaler-Retailer	producer_net_price	1900	60.317460
14	Producer-Wholesaler-Retailer	marketing_cost	510	16.190476
15	Producer-Wholesaler-Retailer	intermediary_margin	740	23.492063
16	Producer-Wholesaler-Retailer	accounting_gap	0	0.000000

```
> rank_channels(fit)
```

Composite ranking of agricultural marketing channels

rank	channel	composite_score
1	Direct	1.000
2	Producer-Retailer	0.333
3	Producer-Wholesaler-Retailer	0.129
4	Long channel	0.000

Weights: acharya_efficiency=0.333, producer_share_percent=0.333, price_spread_percent=0.333

The default ranking gives equal weights to Acharya efficiency, producer share, and the inverse of price-spread percentage. Analysts should report alternative weighting schemes because rankings necessarily reflect the chosen criteria.

6 Bootstrap uncertainty

Repeated price observations allow sampling uncertainty to be shown instead of reporting each efficiency ratio as if it were known without error.

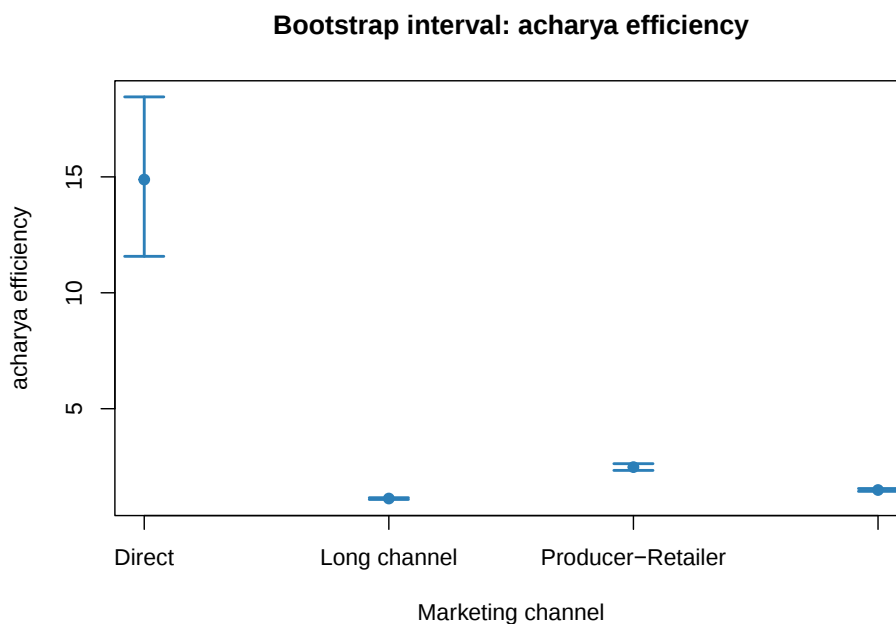
```
> data(market_observations)
> boot <- bootstrap_marketing_metrics(
+   market_observations,
+   marketing_margin = "marketing_margin",
+   channel = "channel",
+   weight = "volume_qtl",
+   R = 199,
+   seed = 2026
+ )
> subset(boot$summary, metric == "acharya_efficiency")
```

	channel	metric	estimate	std_error
4	Direct	acharya_efficiency	14.883198	1.74840856
10	Long channel	acharya_efficiency	1.126198	0.01878453
16	Producer-Retailer	acharya_efficiency	2.480720	0.06880795
22	Producer-Wholesaler-Retailer	acharya_efficiency	1.493469	0.02871597

```

  conf_low conf_high conf   R   n
4  11.571348 18.449269 0.95 199 18
10 1.085670 1.161762 0.95 199 18
16 2.339302 2.628567 0.95 199 18
22 1.436637 1.557217 0.95 199 18

> plot(boot, metric = "acharya_efficiency")
```



Percentile intervals describe empirical resampling variability within the observed channel records. They do not correct a non-random survey design, measurement error, omitted quality differences, or selection into channels.

7 Sensitivity and efficiency targets

```
> sens <- marketing_sensitivity(
+   producer_price = 1900,
+   consumer_price = 3150,
+   marketing_cost = 510,
+   marketing_margin = 740,
+   producer_change = c(-0.05, 0, 0.05),
+   cost_change = c(-0.10, 0, 0.10)
+ )
> head(sens[, c(
+   "producer_change", "cost_change", "price_spread",
+   "producer_share_percent", "acharya_efficiency"
+ )])
```

Agricultural marketing sensitivity analysis
Scenarios: 6

```
> efficiency_target(
+   target = 2,
+   method = "acharya",
+   solve_for = "marketing_cost",
+   producer_price = 1900,
+   marketing_margin = 740
+ )
```

	method	shepherd_variant	target	solve_for	required_value
1	acharya		<NA>	2 marketing_cost	210

8 Physical loss

If 100 kg are purchased but only 92 kg are sold, the acquisition cost per sold kilogram is higher than the quoted purchase price. The loss-adjusted function makes that conversion explicit.

```
> loss_adjusted_margin(
+   purchase_price = 20,
+   sale_price = 28,
+   quantity_purchased = 100,
+   quantity_sold = 92,
+   marketing_cost = 180,
+   cost_basis = "lot"
+ )
```

	purchase_price	sale_price	quantity_purchased	quantity_sold	loss_quantity
1	20	28	100	92	8
	loss_percent	purchase_value	sales_value	marketing_cost_total	
1	8	2000	2576	180	
	effective_purchase_cost_per_sold_unit	gross_margin_total	net_margin_total		

1	21.73913	576	396
net_margin_per_sold_unit			
1	4.304348		

9 Responsible interpretation

These ratios are descriptive measures of channel accounts. A channel with a higher ratio is not automatically more competitive, equitable, resilient, or socially desirable. Interpretation should incorporate services added, risk bearing, market power, seasonal storage, product losses, credit, quality, and transaction volume. Causal statements require a separate research design.