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Price Dynamics for Agriculture and Nutrition Policy

**A learning event organized by the International Food Policy
Research Institute**

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International Food Policy Research Institute (IFPRI)
Musanze, November 2021

Learning objectives

- This learning event provides **the key principles and tools** needed for price analysis using e-Soko or any other market price data. We will focus on:
 - The policymaking potential of analyzing market price data
 - Key principles to consider when interpreting the data
 - Hands-on technical approaches in Stata to apply e-Soko market price data to policymaking

Learning event schedule

■ Day 1

- Introduction to e-Soko and other market price datasets
- Using market price data for agriculture and nutrition policy
- Economic principles of price dynamics
- Exploring e-Soko data

■ Day 2

- Field visit to Musanze market
- Cleaning and analyzing e-Soko data
- Investigating and interpreting price trends for agriculture and nutrition policy



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Overview of e-Soko and other market price databases in Rwanda

Market Price Data

- Different types of price data
 - Farm gate prices – price that the farmer receives
 - Market price – price sold at the market to consumers
 - Export prices – price of goods when traded abroad

- In what instances would we use market prices as opposed to the other prices?

E-Soko

- Managed by MINAGRI
- 66 markets in all 30 districts
- Approximately 90 commodities – food items, agricultural inputs, cooking inputs, and live animals
- Data collected every day

Other Market Price Databases in Rwanda

Source	Collection frequency	Geographic coverage	Commodities	Notes
World Bank Rwanda-Rural Market Price Data	Monthly (2017-2020); no longer being collected	130 markets across 21 districts	68 commodities (food, household items, agricultural inputs, etc.)	Markets selected based on proximity to roads scheduled for rehabilitation
WFP Food Price Data	Weekly (2000-current)	28 markets across 7 districts (more markets and districts in earlier years)	23 commodities (all foods)	Markets selected based on proximity to refugee camps

Discussion: Using Market Price Data

- Who already uses e-Soko or other market price databases?
What do you use it for?

- What are some new ways that you would like to use e-Soko that would be useful to your work?



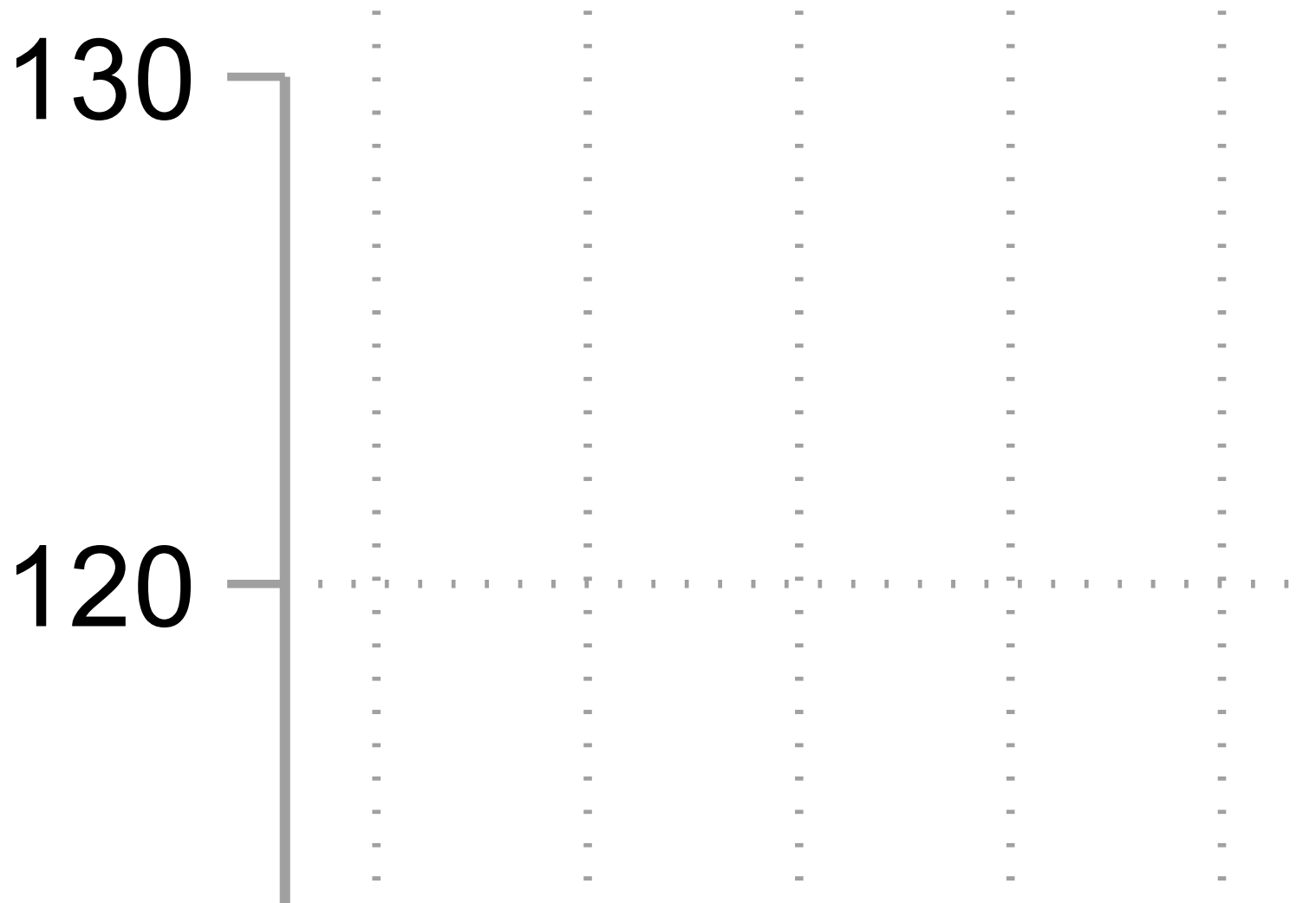
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Using Market Price Data in Agriculture and Nutrition Policy

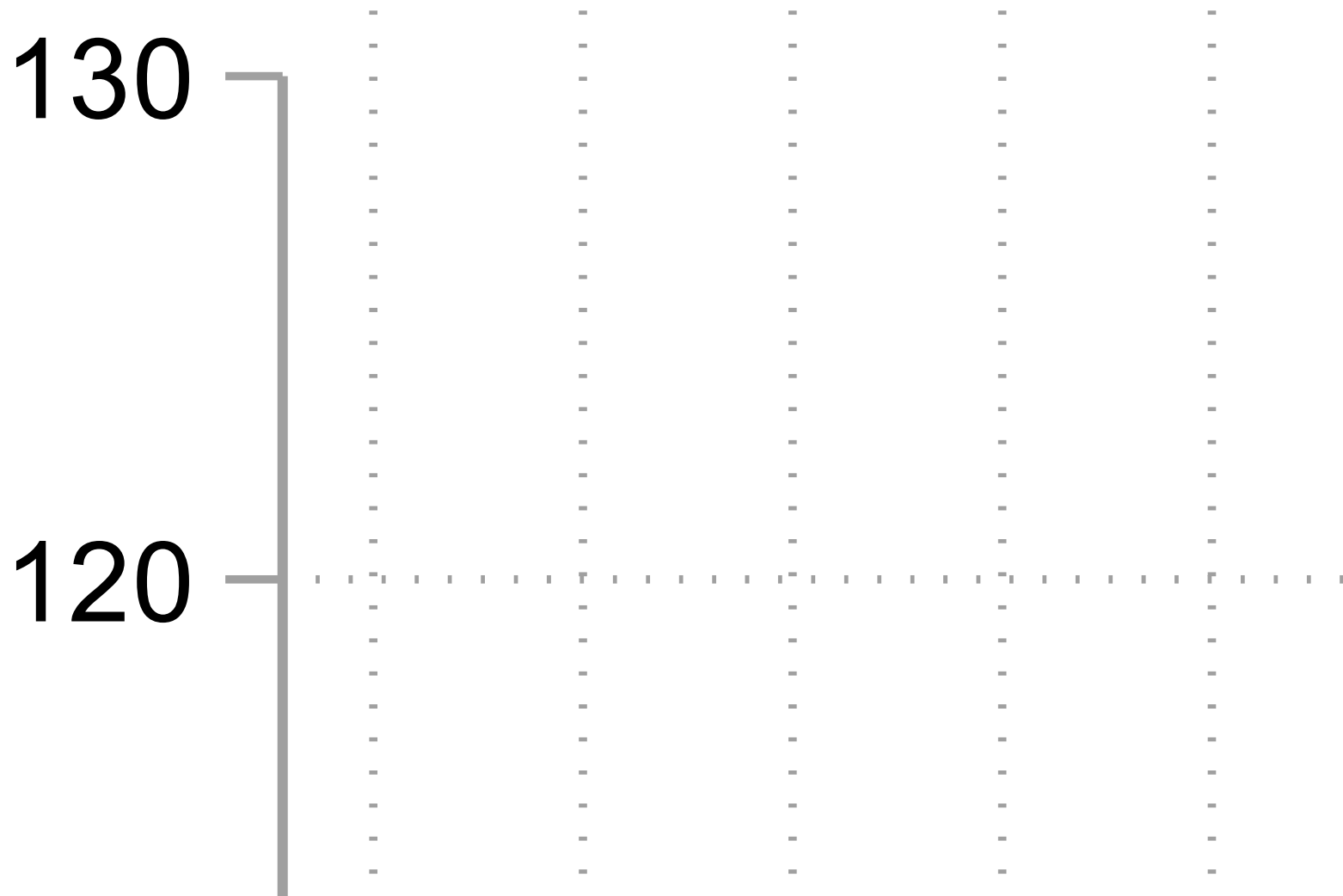
Price Trend Dashboards and Bulletins

- Keep track of prices around the country
- Flag any price shocks
- Compare imports, production, and market prices
- Identify areas of the country that may need assistance

Price Dynamics during COVID-19 in Rwanda



Price Dynamics during COVID-19 in Rwanda



Price Dynamics during COVID-19 in Rwanda

—○— Eastern

—△—

130

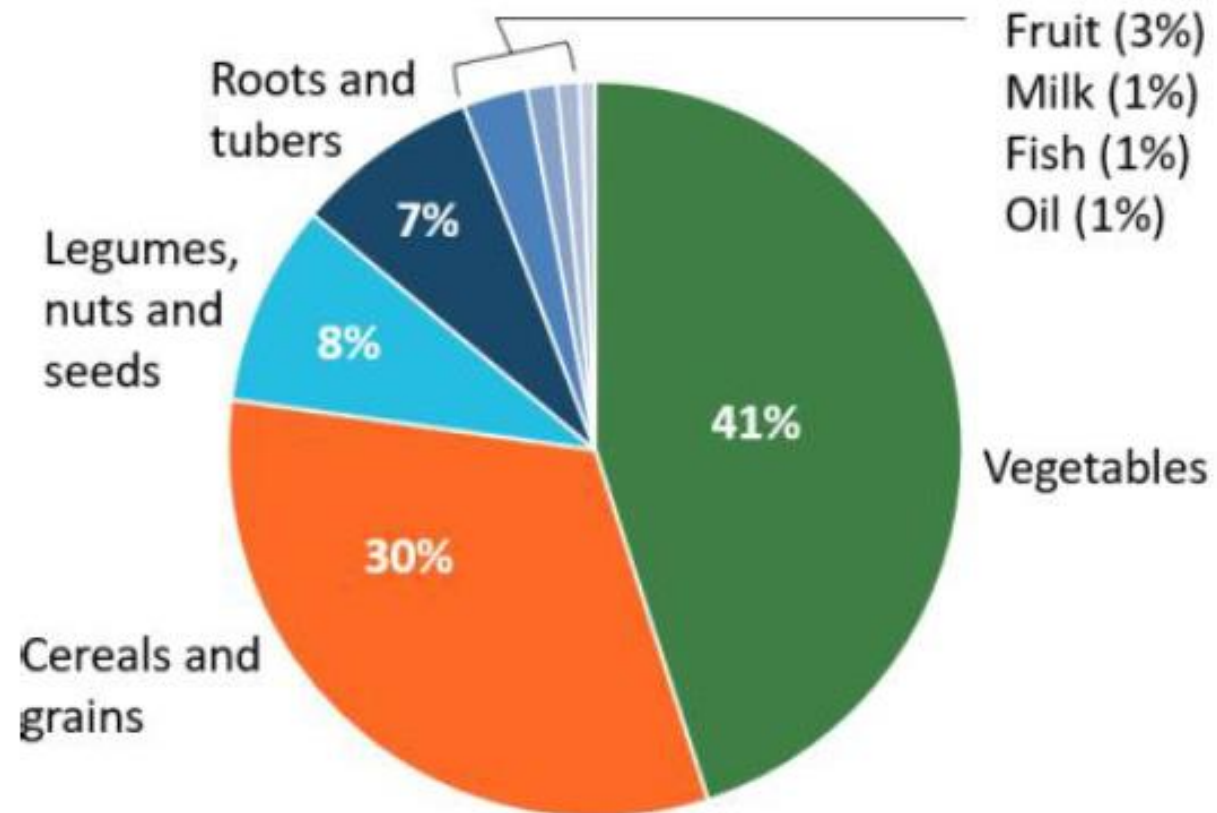


Cost of a Healthy Diet

- World Food Programme, 2019
- Research question: What's the minimum amount per day needed for an individual to consume a “healthy diet”?
- Data inputs:
 - Market price data
 - Consumption survey (EICV) to determine food preferences, estimate expenditures, and assess household compositions/demographics

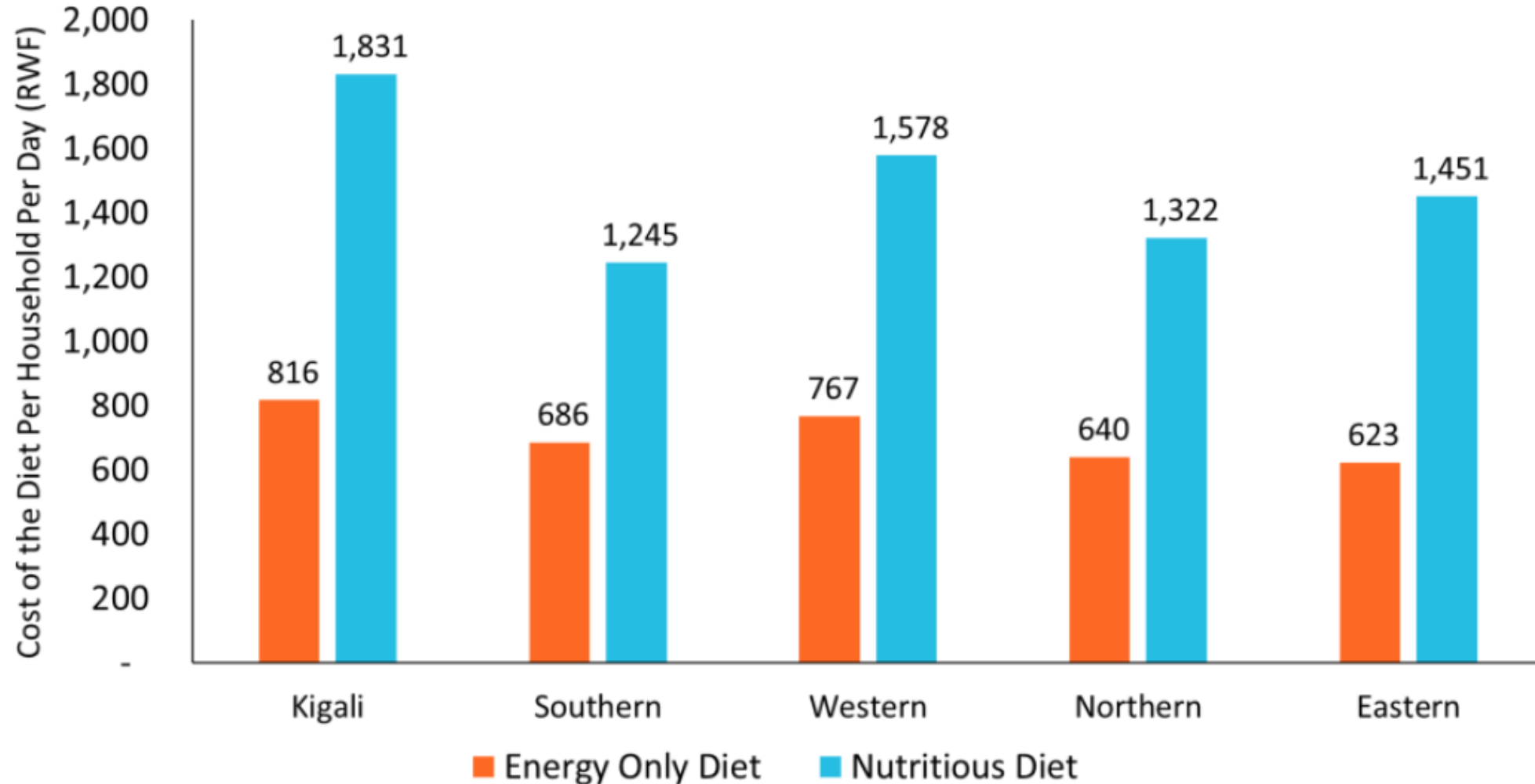
Cost of a Healthy Diet

Figure 10: Percentage quantities of different food constituting the modelled nutritious diet for the household (WFP, 2018).



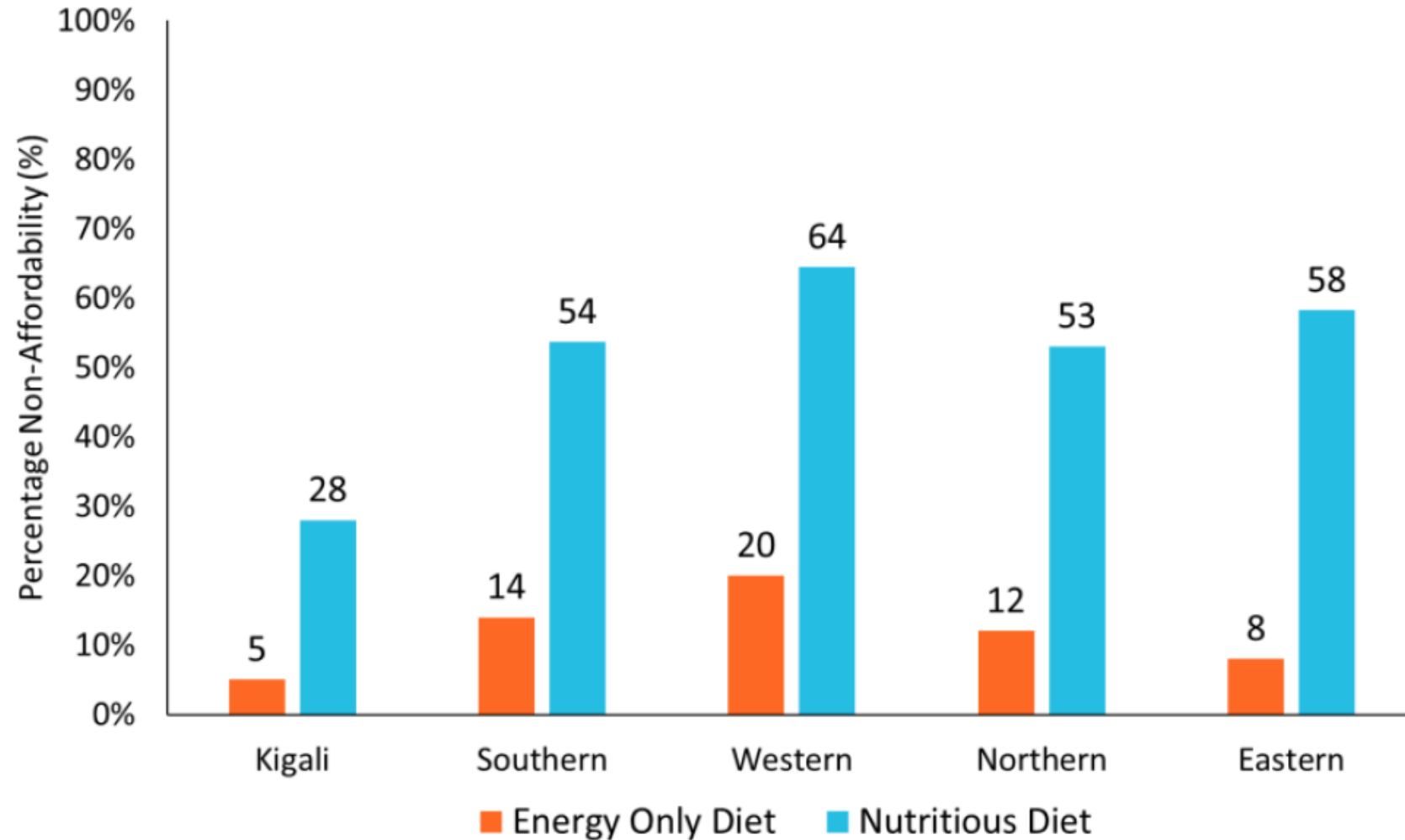
Cost of a Healthy Diet

Figure 11: Cost of the energy-only and nutritious diets for the household, in RWF per day.



Cost of a Healthy Diet

Figure 12: Percentage of non-affordability of the energy-only and the nutritious diets by region.



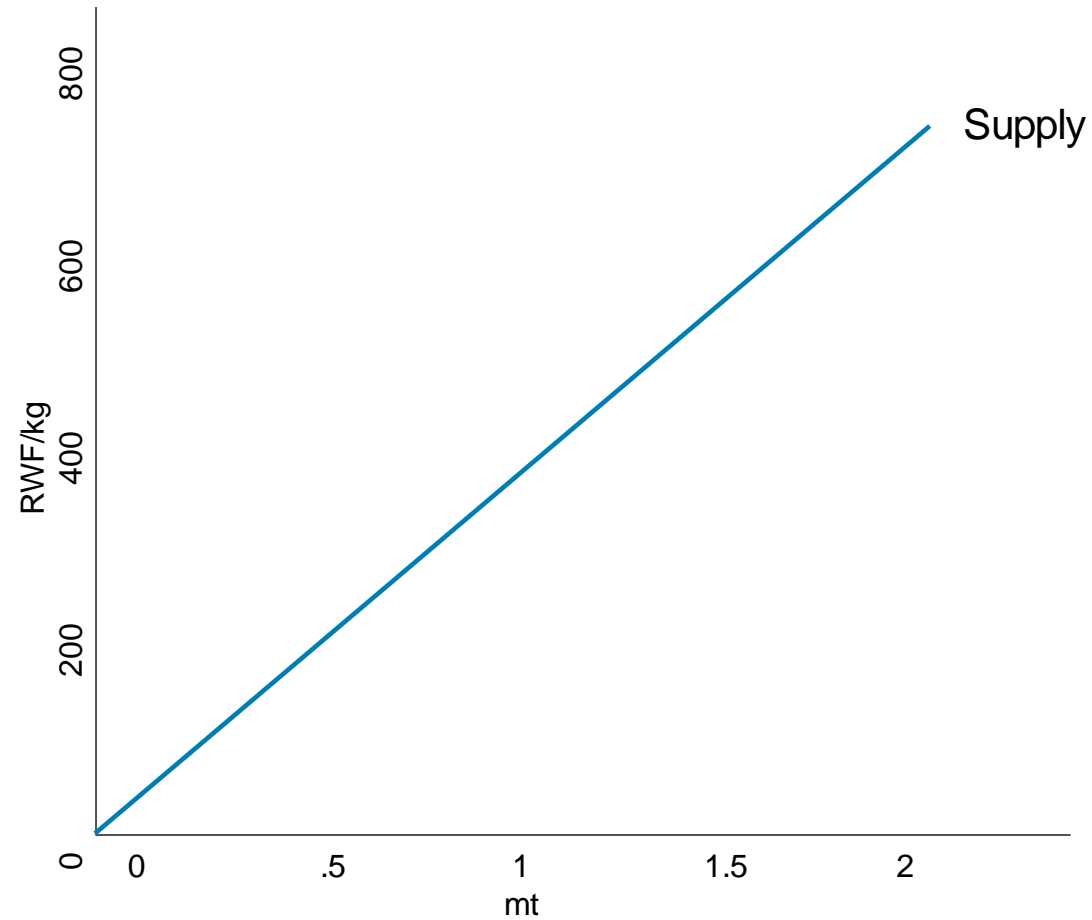


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Economic principles of price dynamics

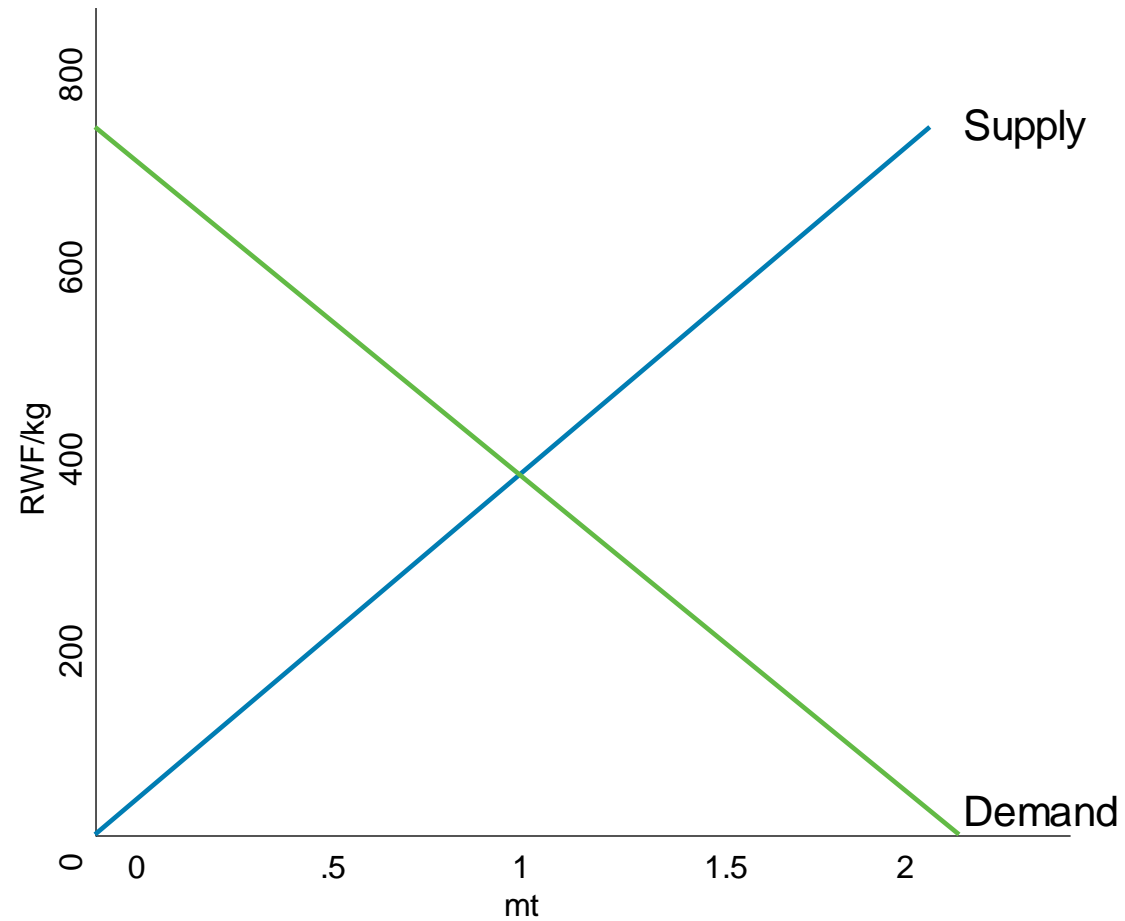
Supply and demand

Hypothetical supply and demand curves for carrots



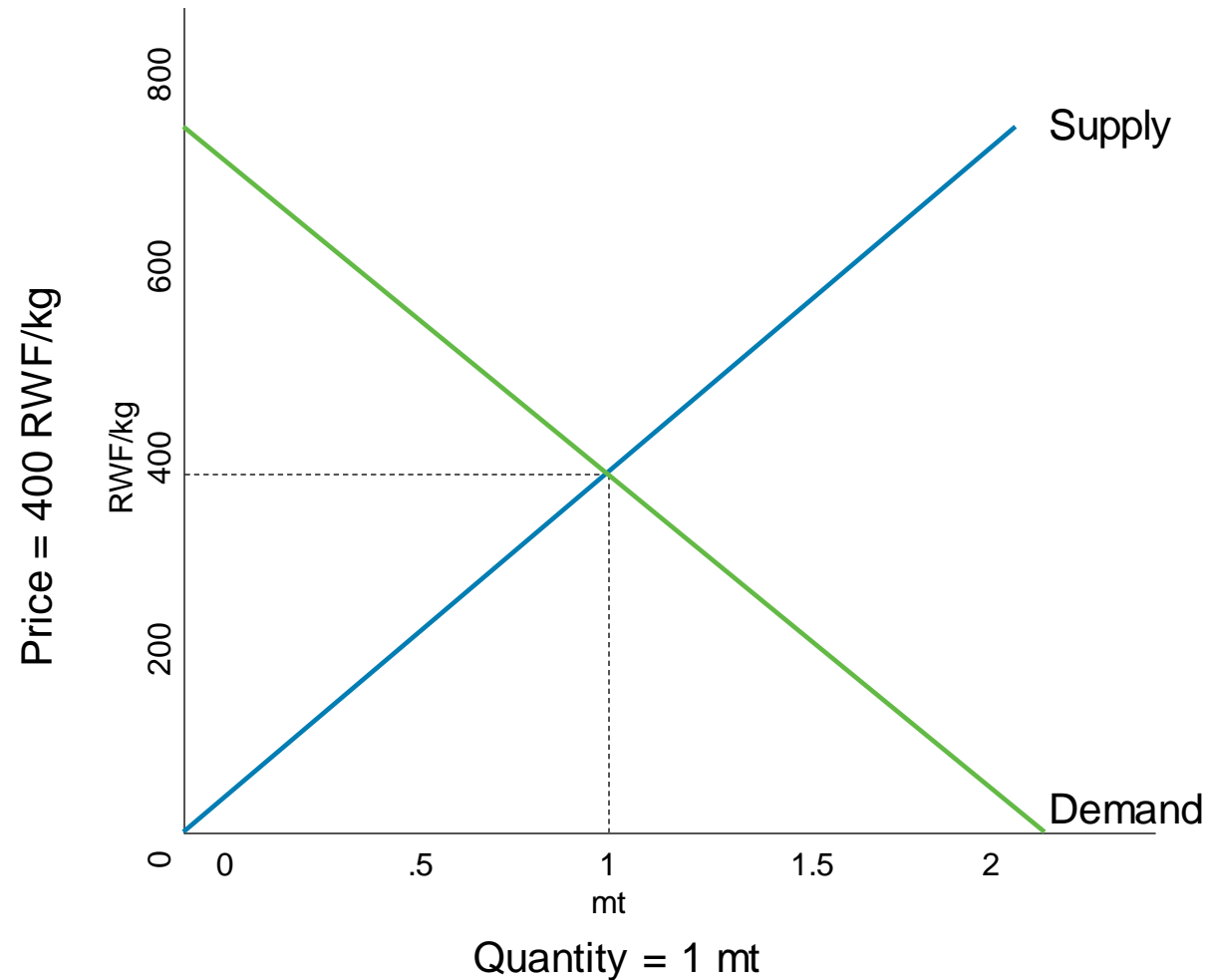
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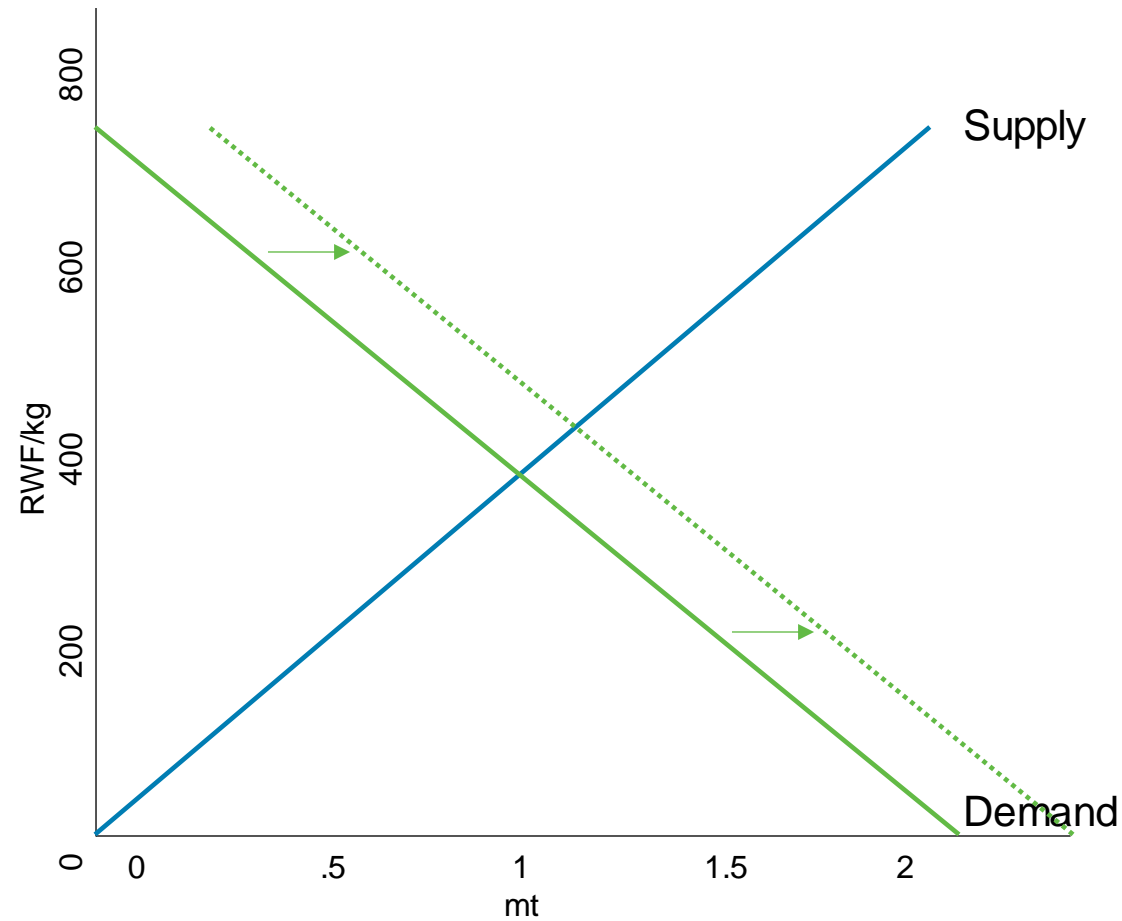
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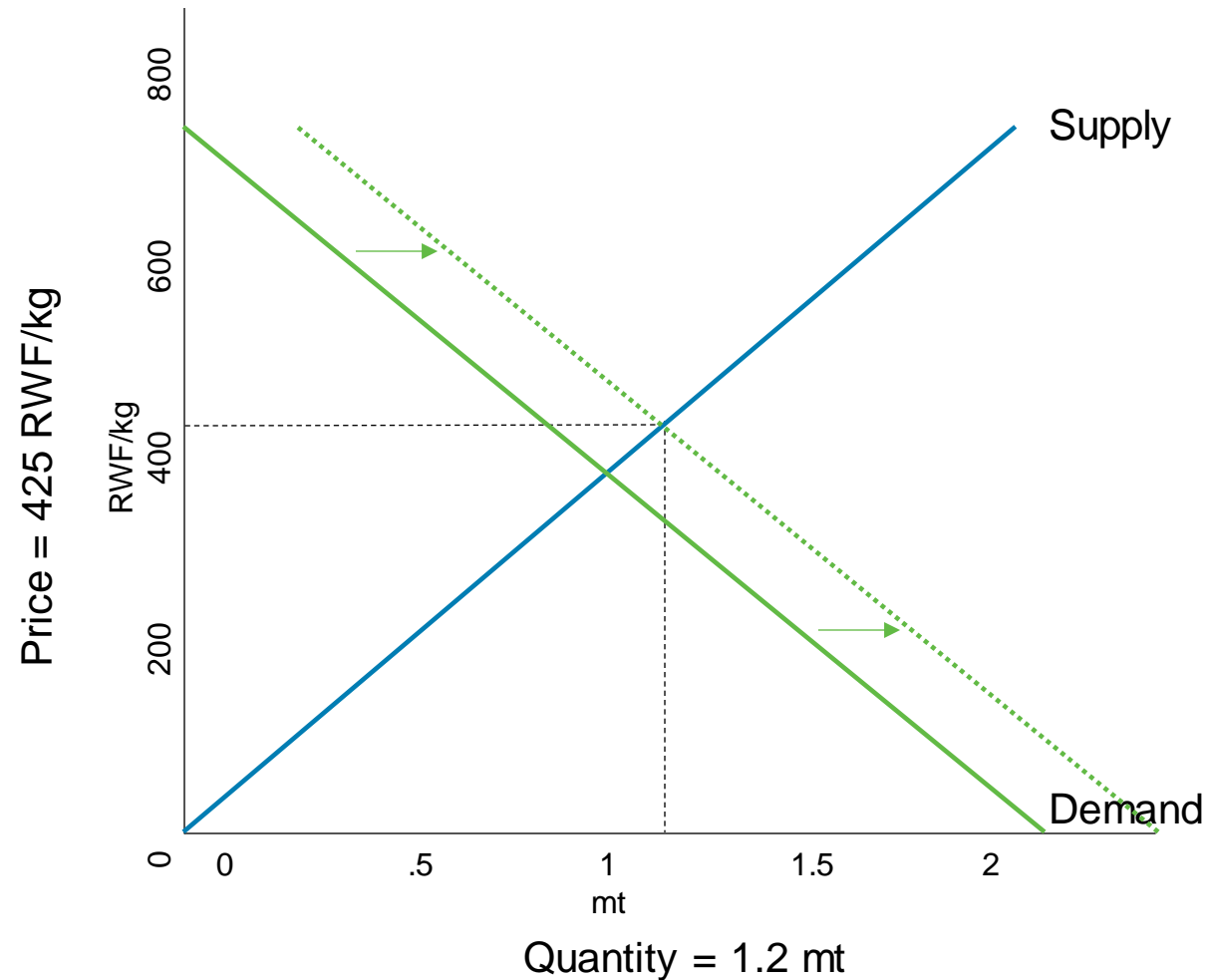
Supply and demand – demand increase

Hypothetical supply and demand curves for carrots



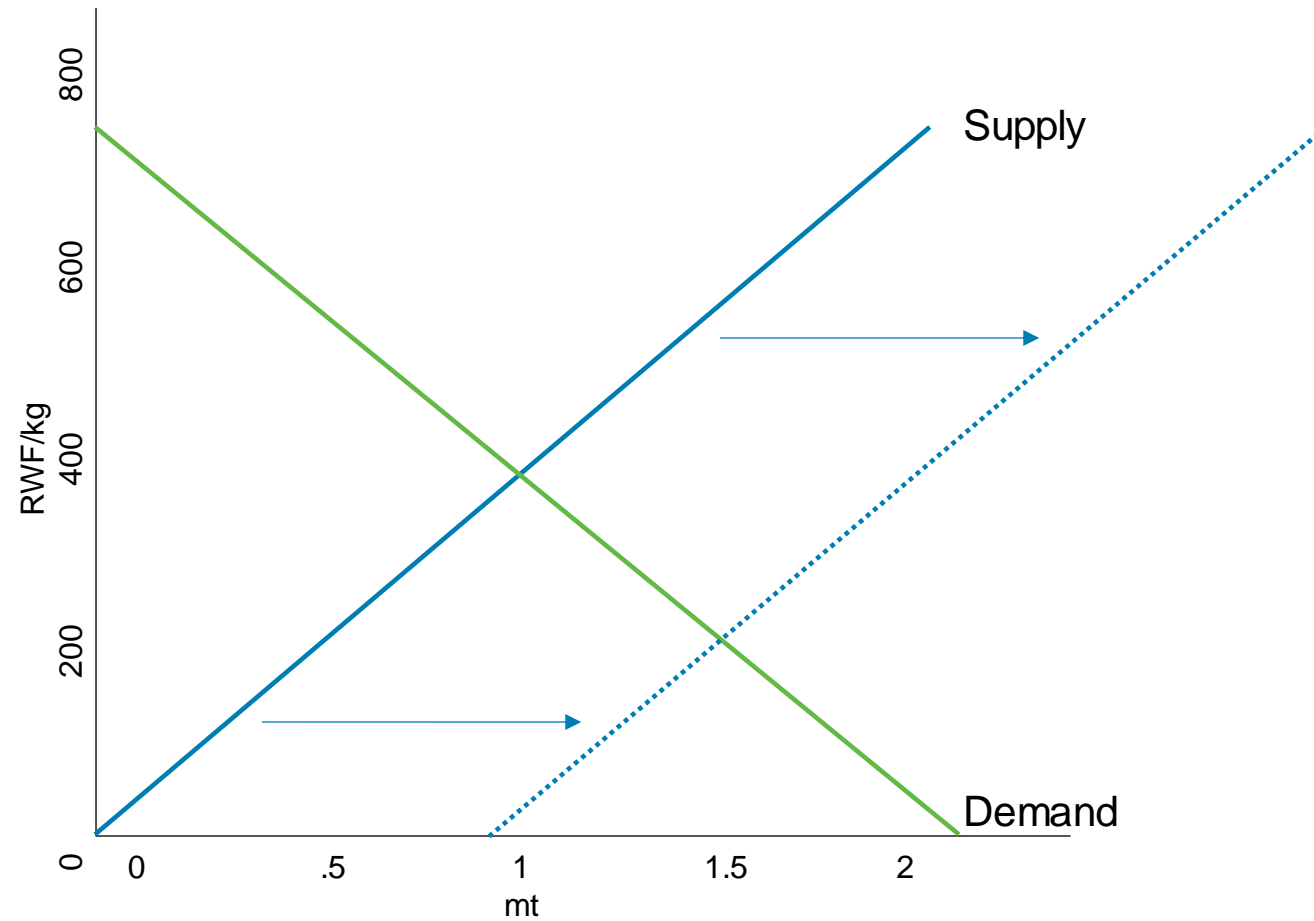
Supply and demand – demand increase

Hypothetical supply and demand curves for carrots



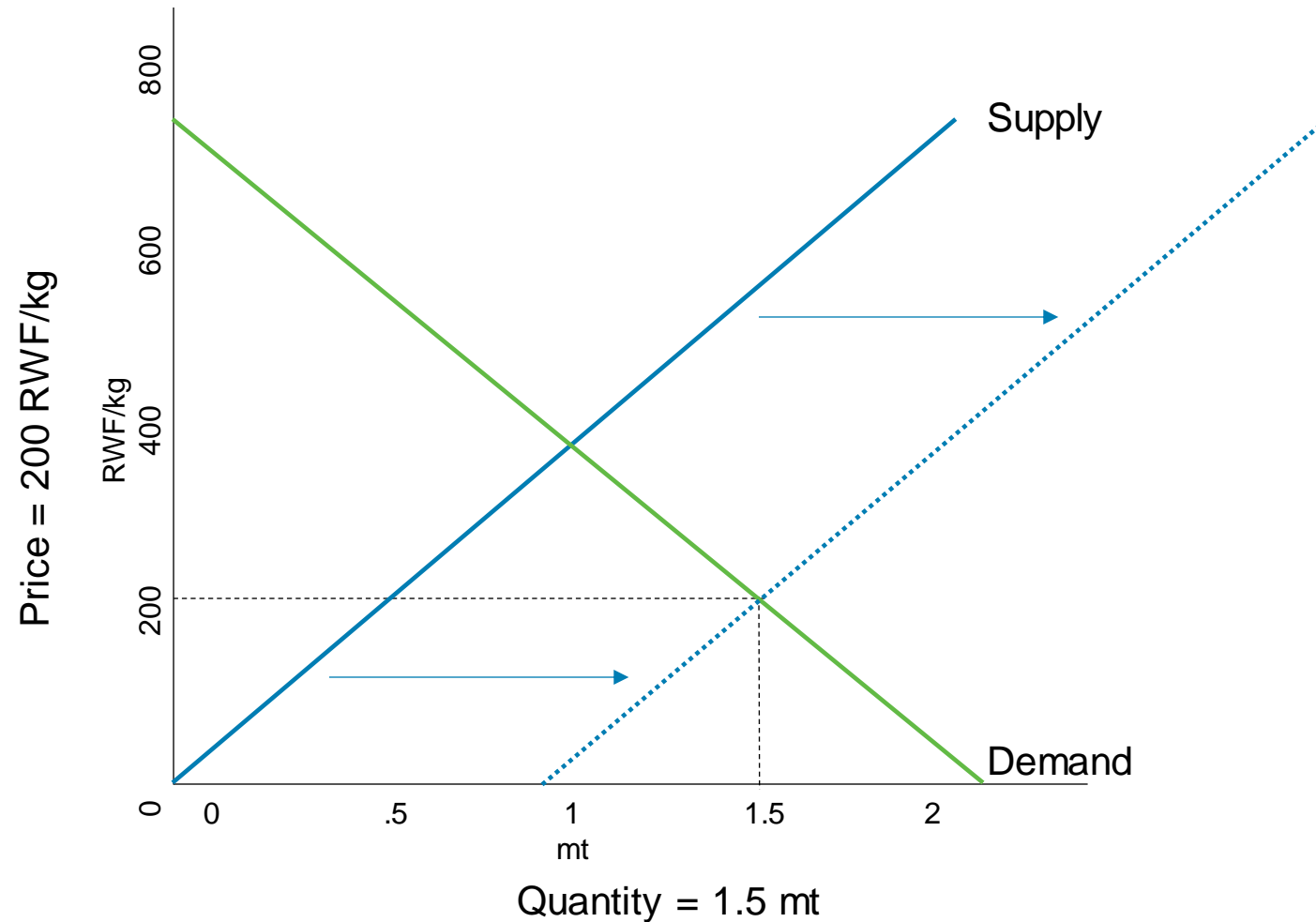
Supply and demand – supply increase

Hypothetical supply and demand curves for carrots



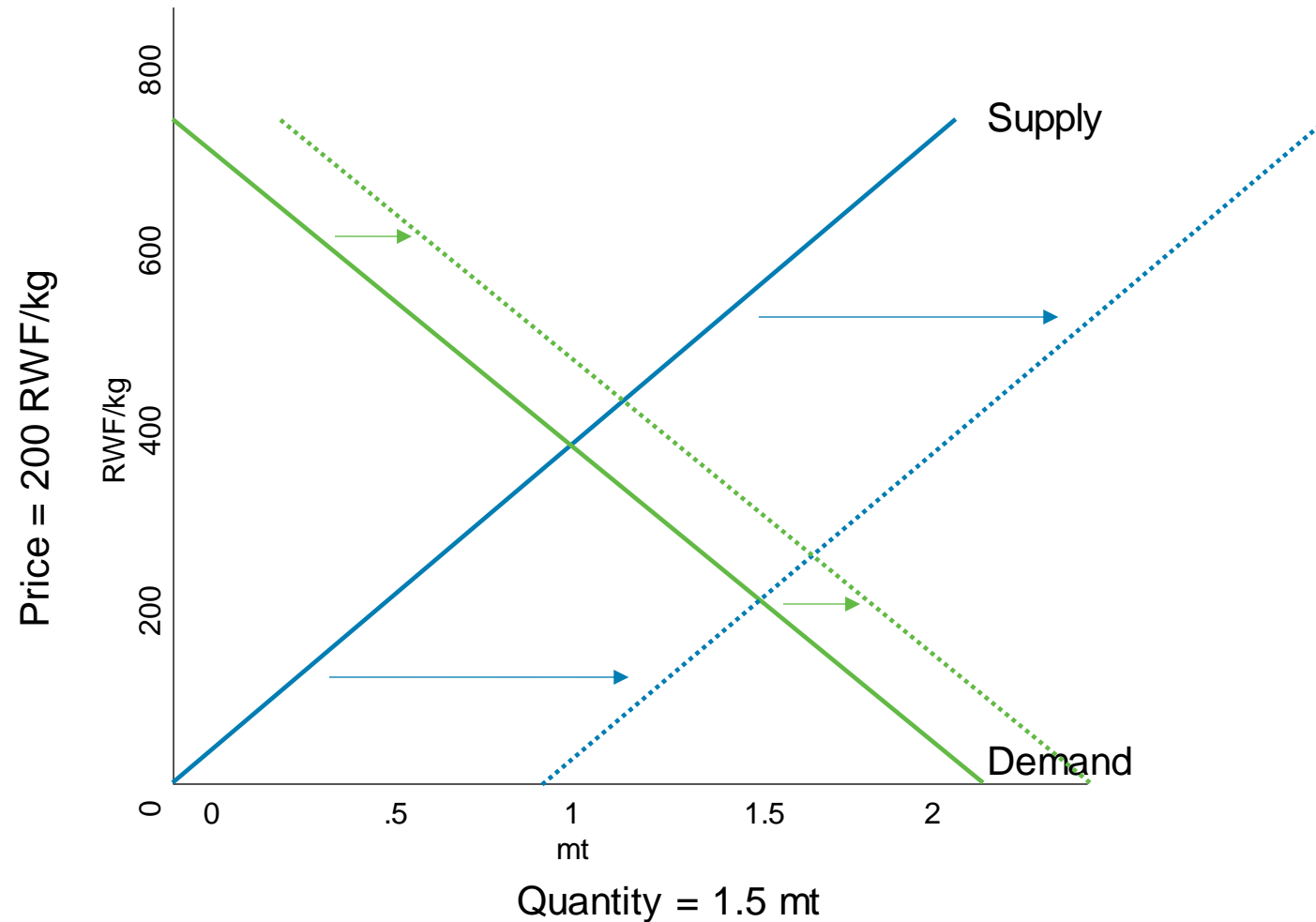
Supply and demand – supply increase

Hypothetical supply and demand curves for carrots



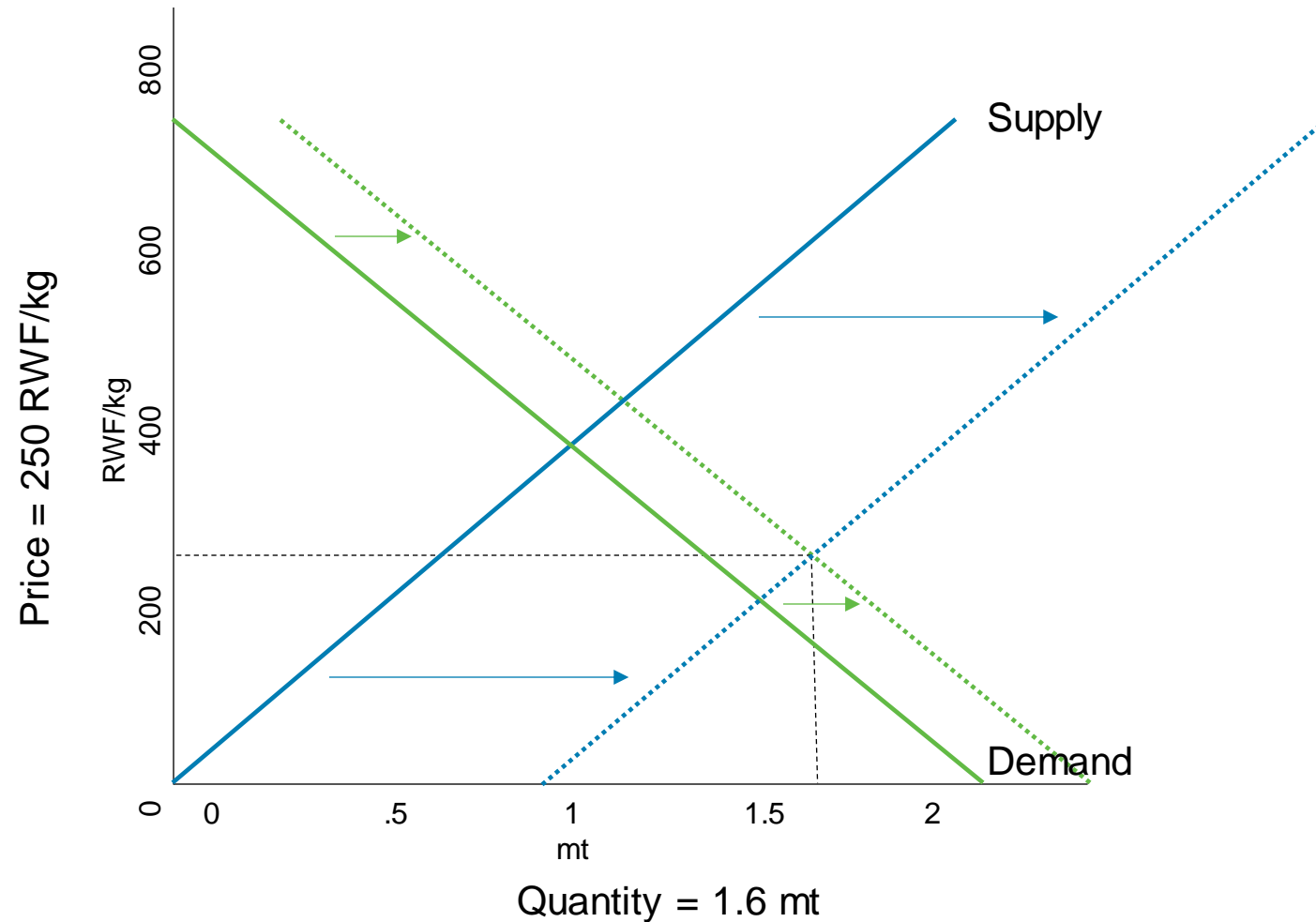
Supply and demand – supply and demand increases

Hypothetical supply and demand curves for carrots



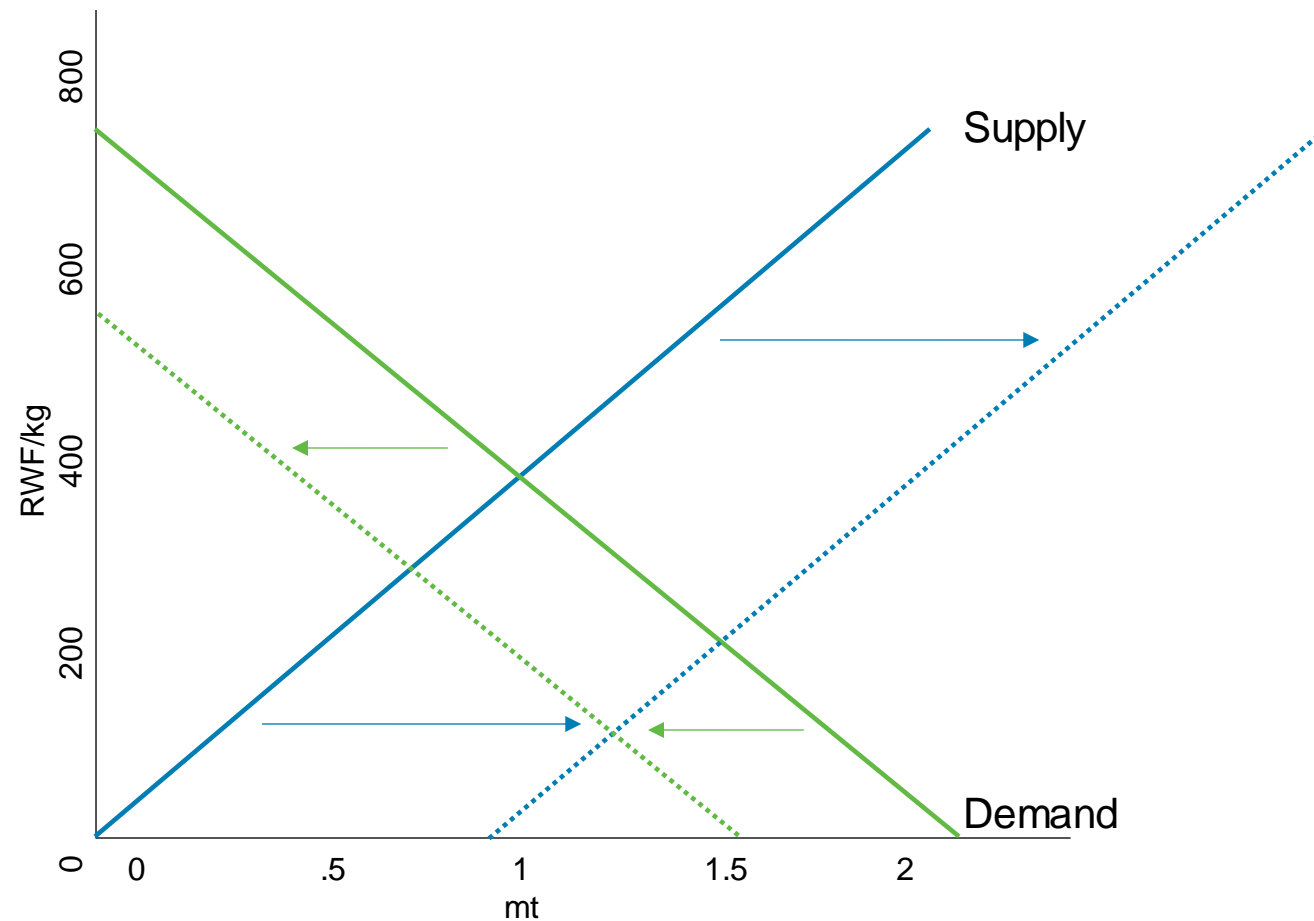
Supply and demand – supply and demand increases

Hypothetical supply and demand curves for carrots



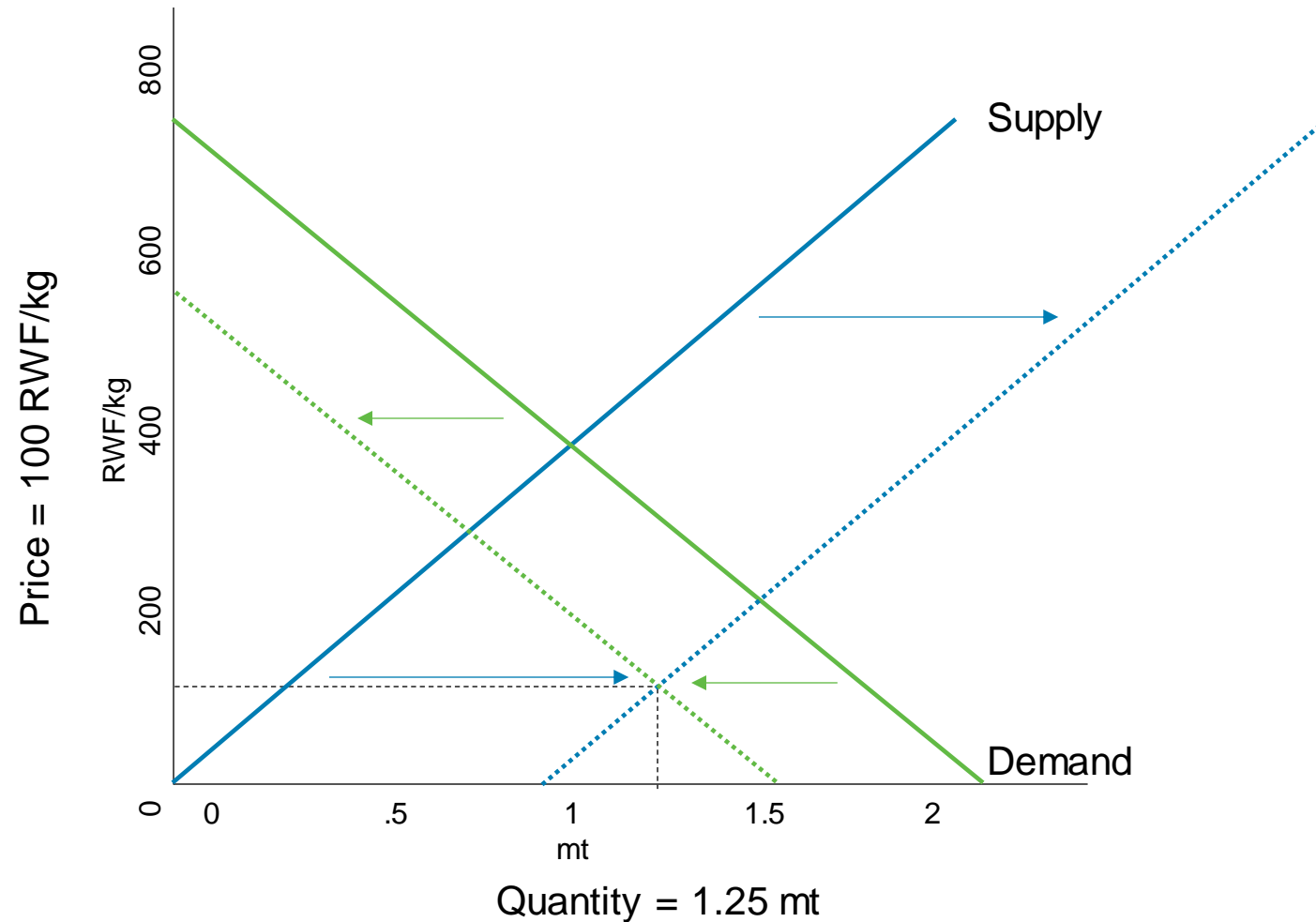
Supply and demand – supply increase and demand decrease

Hypothetical supply and demand curves for carrots



Supply and demand – supply increase and demand decrease

Hypothetical supply and demand curves for carrots



Inflation/deflation

- **Inflation** – a general increase in prices and fall in the purchasing value of money
- **Deflation** – a general reduction in prices across the economy
- How do we measure/keep track of inflation and deflation?

Inflation/deflation

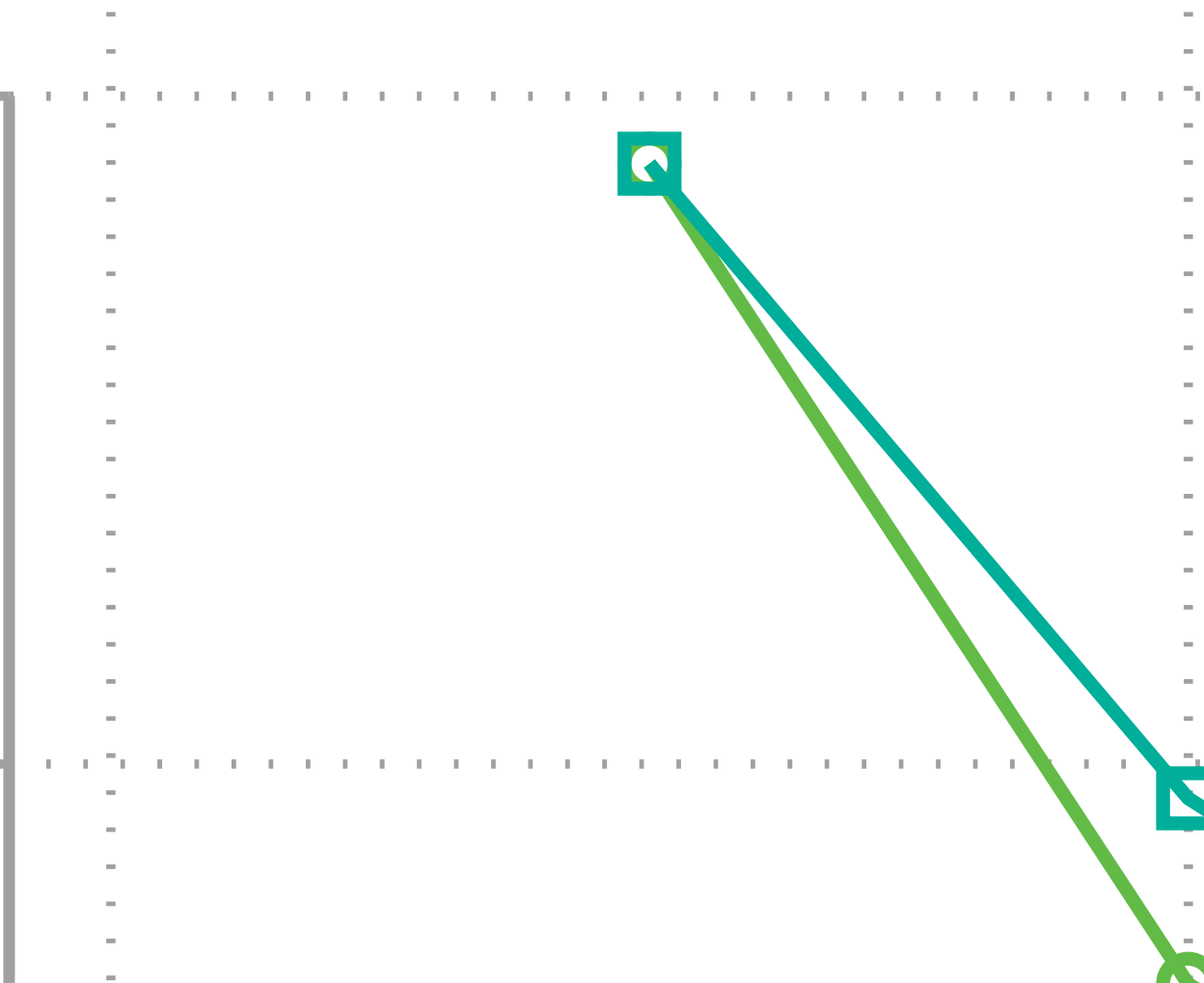
- **Nominal price** – the current monetary value of the commodity
- **Real price** – the value of the commodity adjusted for inflation
- When looking at price trends over time, we want to account for inflation so that we are comparing apples to apples instead of apples to oranges

Inflation/deflation

Nominal an

4300

4200



CPI – Consumer Price Index

- Consumer Price Index (CPI) – the average change over time in the prices paid by consumers for a market basket of consumer goods and services.
 - Usually disaggregated by urban and rural
 - In Rwanda, the household basket includes 1,622 commodities

CPI – Consumer Price Index, Rwanda

GENERAL INDEX (CPI)

Food and non-alcoholic beverages

✓ *Bread and cereals*

✓ *Meat*

✓ *Milk, cheese and eggs*

✓ *Vegetables*

✓ *Non-alcoholic beverages*

Alcoholic beverages and tobacco

Clothing and footwear

Housing, water, electricity, gas and other fuels

Furnishing, household equipment and routine household maintenance

Health

Transport

Communication

Recreation and culture

Education

Restaurants and hotels

Miscellaneous goods and services

Using the CPI to calculate *real* prices

- Base is February 2014 (when CPI=100 for everything)
- But we can choose our own base using the CPI data:

$$\text{Nominal price} * \frac{\text{price period CPI}}{\text{base period CPI}}$$



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Exploring e-Soko in Stata

E-Soko – Exploring the data

- Whenever we are working with a new dataset, we always have to think about:
 - The e-Soko data is at the market-commodity-day level
 - This is A LOT of detail!
- What “level” is the data at?
 - The e-Soko data is at the market-commodity-day level
 - This is A LOT of detail!
- What “level” do we want the data at?
 - Province-commodity-month is probably good

prov	district	market	commodity_eng	year	month	day
Kigali City	GASABO	Mulindi	Maize-flour	2021	1	1
Kigali City	GASABO	Mulindi	Maize-flour	2021	1	2
Kigali City	GASABO	Mulindi	Maize-flour	2021	1	4
Kigali City	GASABO	Mulindi	Maize-flour	2021	1	5
Kigali City	GASABO	Mulindi	Maize-flour	2021	1	6
Kigali City	GASABO	Mulindi	Maize-flour	2021	1	7
Kigali City	GASABO	Mulindi	Maize-flour	2021	1	8
Kigali City	GASABO	Mulindi	Maize-flour	2021	1	9
Kigali City	GASABO	Mulindi	Maize-flour	2021	1	11
Kigali City	GASABO	Mulindi	Maize-flour	2021	1	12
Kigali City	GASABO	Mulindi	Maize-flour	2021	1	12
Kigali City	GASABO	Mulindi	Maize-flour	2021	1	12
Kigali City	GASABO	Mulindi	Maize-flour	2021	1	13
Kigali City	GASABO	Mulindi	Maize-flour	2021	1	13
Kigali City	GASABO	Mulindi	Maize-flour	2021	1	13

E-Soko – Exploring the data

- Whenever we are working with a new dataset, we always have to think about:
- How was the data collected and processed?
 - Was the data collected consistently? For example, fish was only added to e-Soko in 2020, so if we do any food groupings over time, we need to consider this.
 - Was the data cleaned? E-Soko data is uploaded directly to the website, so there may be outliers.

E-Soko – Exploring the data

- Whenever we are working with a new dataset, we always have to think about:
 - Outliers
 - Continuous data (e.g. prices) can be messy and contain *outliers*
 - An outlier is an observation that is very different from all other observations
 - Can happen due to:
 - Input error (e.g. data collector typed that a kilo of carrots costs 5,000 RWF instead of 500)
 - Confusion/misunderstanding (e.g. enumerator thought it was per carrot instead of per kilo)

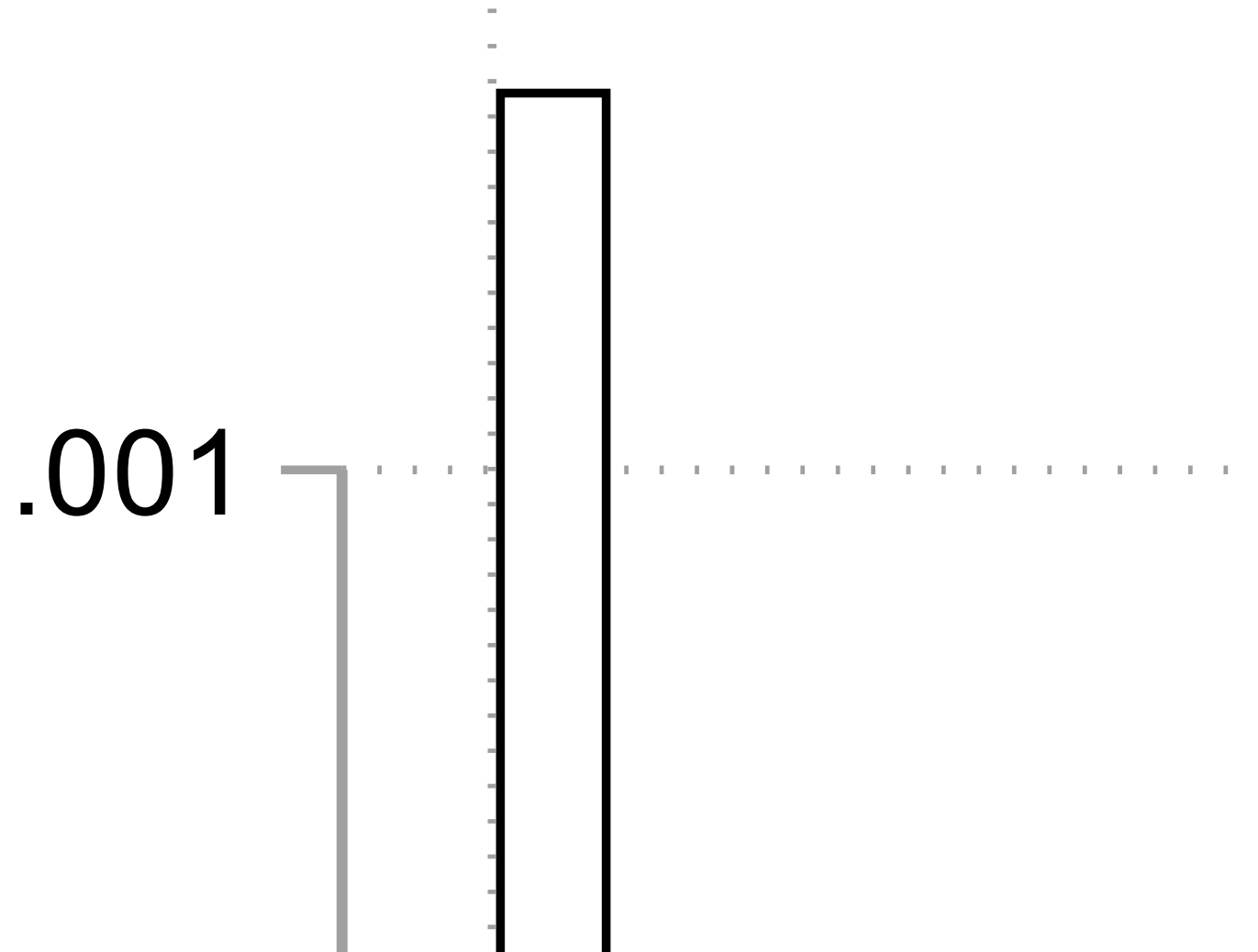
E-Soko – Exploring the data

```
. sum averageprice if commodity_eng=="Carrot", detail
```

		Average Price			
Percentiles		Smallest			
1%	140	30			
5%	200	50			
10%	250	50	Obs	21,573	
25%	300	50	Sum of wgt.	21,573	
50%	400		Mean	406.811	
		Largest	Std. dev.	385.0419	
75%	500	2000			
90%	600	4500	Variance	148257.3	
95%	600	38000	Skewness	86.35522	
99%	700	38000	Kurtosis	8425.532	

E-Soko – Exploring the data

A



E-Soko – Exploring the data

- Cleaning outliers is important because they can skew the data. Cleaning requires you to:
 - Identify outliers – 2 common approaches are:
 - 1% and/or 99% percentile (depending on the skew)
 - 3 standard deviations away from the mean
 - Decide how to clean them – 3 common approaches are:
 - Change the values to the median
 - Change the values to missing
 - Drop the observations

Practice

- Form groups of 2-3 people
- Think of a hypothesis or question that you have about price trends in the last year
- Put together a presentation that includes:
 - Your hypothesis
 - The policy implications of your question
 - At least 2-3 figures and/or tables with your analysis
 - Key implications/recommendations of your findings
- Remember to think about:
 - What commodity you are interested in, what time period you want to use for comparison, what geographic area you are interested in
 - Don't forget to clean outliers and adjust for inflation

Example Presentation - Hypothesis

- We predict that the price of milk spiked at the end of 2021 during the milk shortage

Example Presentation – Potential policy implications

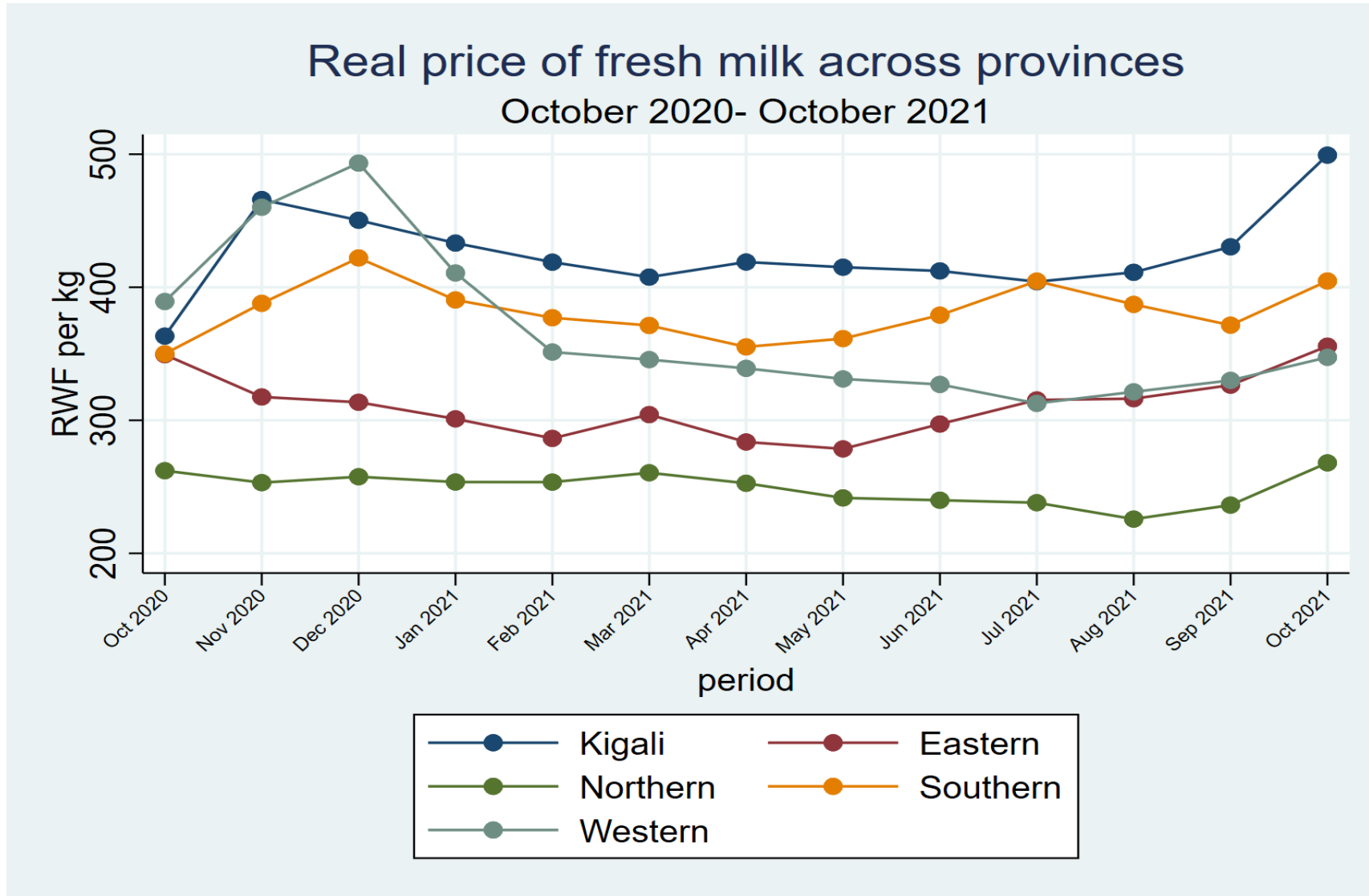
- The cost of the government program one cup of milk per child will drastically increase with an increase in the price of milk
- Farmers might try to invest in dairy cows since the price of milk is very favorable to suppliers

Example Presentation – Figure/table 1

Table 1: Trend of fresh milk real price (RWF/liter) across provinces in October 2020 to October 2021

Provinces	Oct-20	Jan-21	Apr-21	Jul-21	Oct-21
Eastern	349	301	284	315	356
Kigali City	363	433	419	404	499
Northern	262	254	253	238	268
Southern	350	390	355	405	405
Western	389	411	339	313	347

Example Presentation – Figure/table 2



Example Presentation – Key findings/ recommendations

- There was a high increase in fresh milk prices from September to October 2021 across all provinces
- In Oct. 2021, the average real price of milk was highest in Kigali city (499 RWF/liter) and lowest in Northern Province (268 RWF/liter)
- Next steps:
 - Think about the balance between supply and demand
 - Assess milk value chains and market dynamics
 - Consider policies to promote dairy farmers bargaining power (e.g: provide them with supporting infrastructure: transport, storage, packaging facilities)