Sequence 2 : The farm model

Unit 2.1 : Enriching the base model

Lesson 12 : Constraints per period

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ModelEco

# Introduction

Labour availabilities

available labour-force
available days
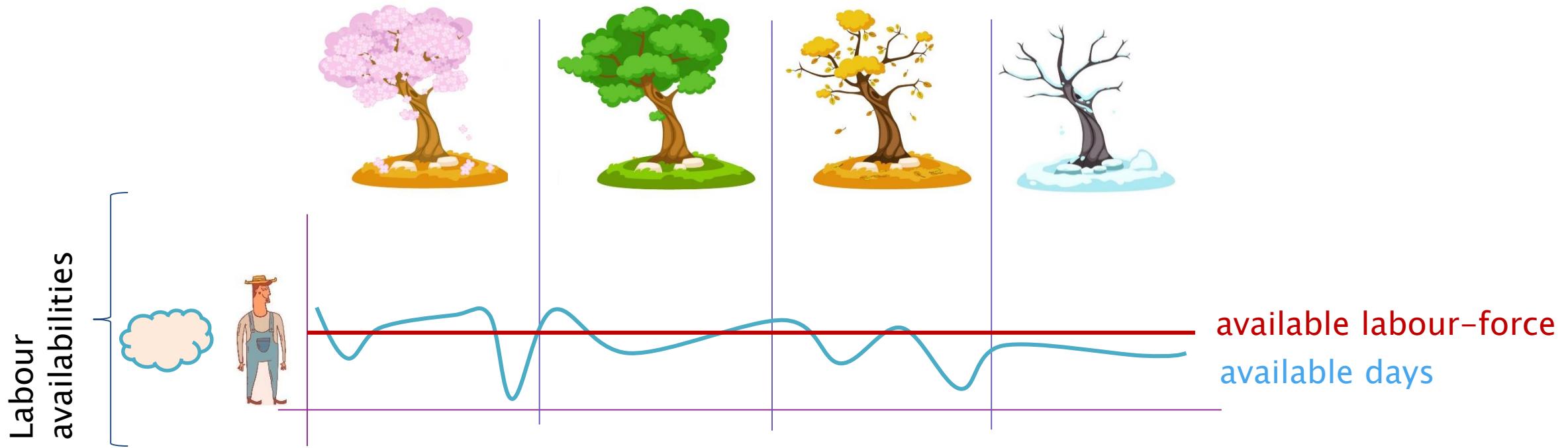
Available labour-force :
– On the farm
– Different types of labour :
  • Skilled or not
  • Male or female
  • …

Available days :
- Days on which climatic conditions make it possible to work the fields
- Difficult to obtain via surveys
- Calculate using weather data, soil types, …

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Introduction

Labour availabilities

available labour–force

available days

Labour needs

Labour needs crop A

Labour needs crop B

Labour needs crop C
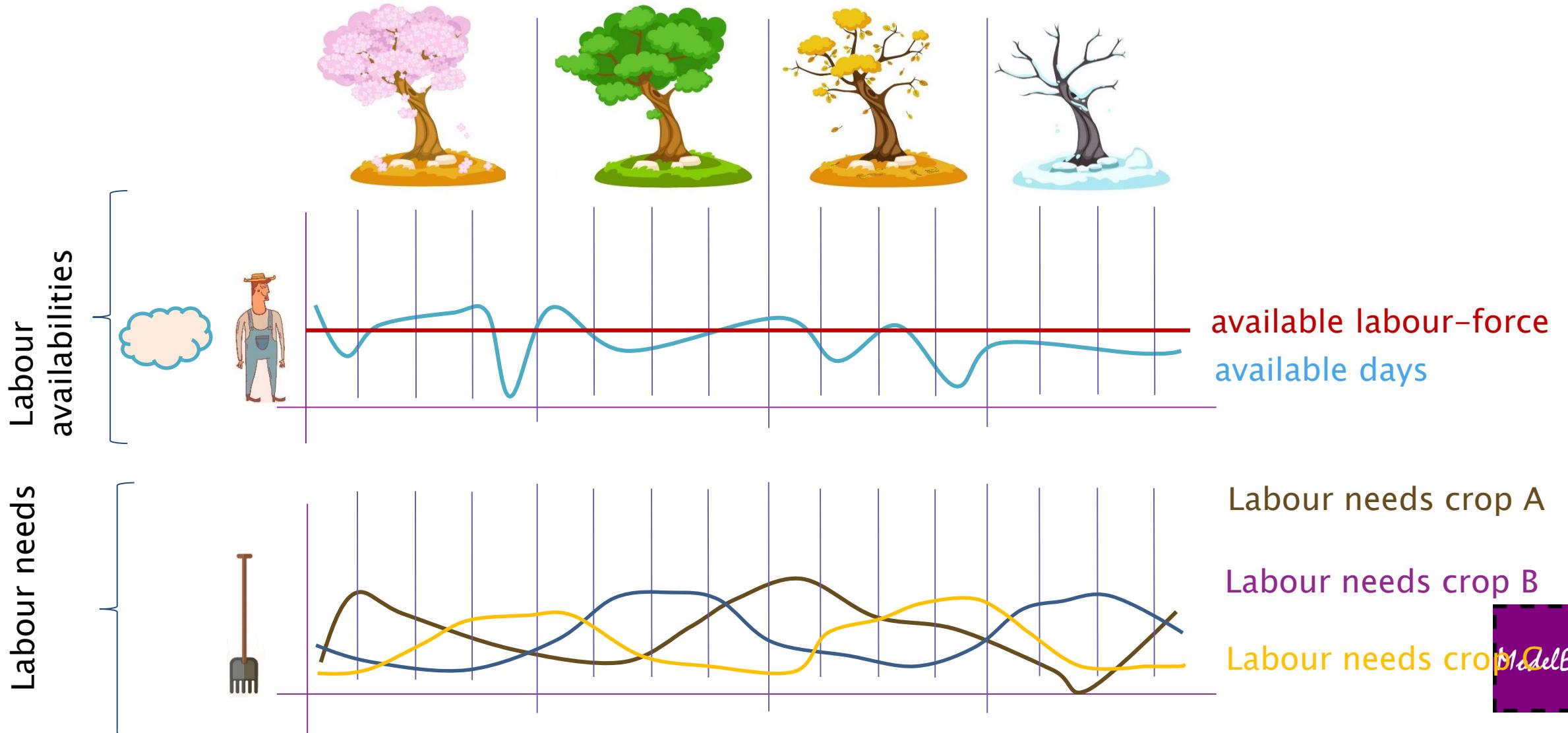
Model with periods

Maximize $Z = 425X_{1E} + 450X_{1I} + 800X_{2E} + 1000X_{2I}$
With $\qquad X_{1E} + X_{1I} + X_{2E} + X_{2I} \leq 50$

$15X_{1E} + 25X_{1I} + 45X_{2E} + 50X_{2I} \leq 2000$

$X_{1E}, X_{1I}, X_{2E}, X_{2I} \geq 0$

Maximize $Z = 425X_{1E} + 450X_{1I} + 800X_{2E} + 1000X_{2I}$
With $\qquad X_{1E} + X_{1I} + X_{2E} + X_{2I} \leq 50$

(summer) $\quad 10X_{1E} + 15X_{1I} + 10X_{2E} + 10X_{2I} \leq 1000$
(winter) $\quad 5X_{1E} + 10X_{1I} + 35X_{2E} + 40X_{2I} \leq 1000$

$X_{1E}, X_{1I}, X_{2E}, X_{2I} \geq 0$

X_{1E} extensive wheat area (ha)
X_{1I} intensive wheat area (ha)
X_{2E} extensive maize area (ha)
X_{2I} intensive maize area (ha)

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Triple-entry table – GAMS

	LN(C, T, S)	S	
C	T	WINTER	SUMMER
WHEAT	EXT	10	5
	INT	15	10
MAIZE	EXT	10	35
	INT	10	40

Third domain in column

First and second domain in row

```
TABLE
LN(C, T, S)  labour-force needs per crop
                   WINTER           SUMMER
   WHEAT.EXT    10                  5
   WHEAT.INT    15                  10
   MAIZE.E      10                  35
   MAIZE.INT    10                  40
;
```

ModelEco
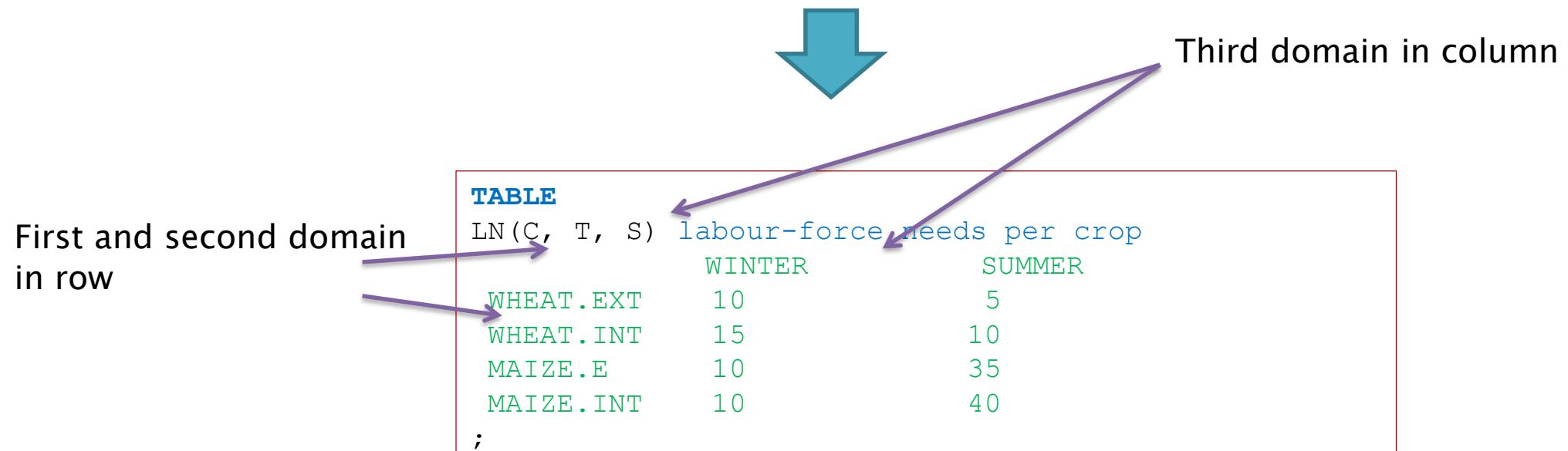
Unidimensional equation

$$10X_{1E} + 15X_{1I} + 10X_{2E} + 10X_{2I} \leq 1000 \ (summer)$$
$$5X_{1E} + 10X_{1I} + 35X_{2E} + 40X_{2I} \leq 1000 \ (winter)$$

⟶ (Indices)   C={1,2} T={E,I} and S={summer, winter}

⟶ (Data) $LN_{C,T,S}$ Labour-force needs per crop, technology and period

```
EQUATIONS
LABOUR1
LABOUR2 ;

LABOUR1.. sum[ (C,T), LN(C,T,'summer')*X(C,T)] =l= 1000;
LABOUR2.. sum[ (C,T), LN(C,T,'winter')*X(C,T)] =l= 1000;
```

OU

```
EQUATIONS
LABOUR(S);

LABOUR(S).. sum[ (C,T), LN(C,T,S)*X(C,T)] =l= 1000;
```

$$\sum\nolimits_{C,T} LN_{C,T,summer}*X_{C,T} \leq 1000$$
$$\sum\nolimits_{C,T} LN_{C,T,winter}*X_{C,T} \leq 1000$$

Condensed writing

Writing in GAMS

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