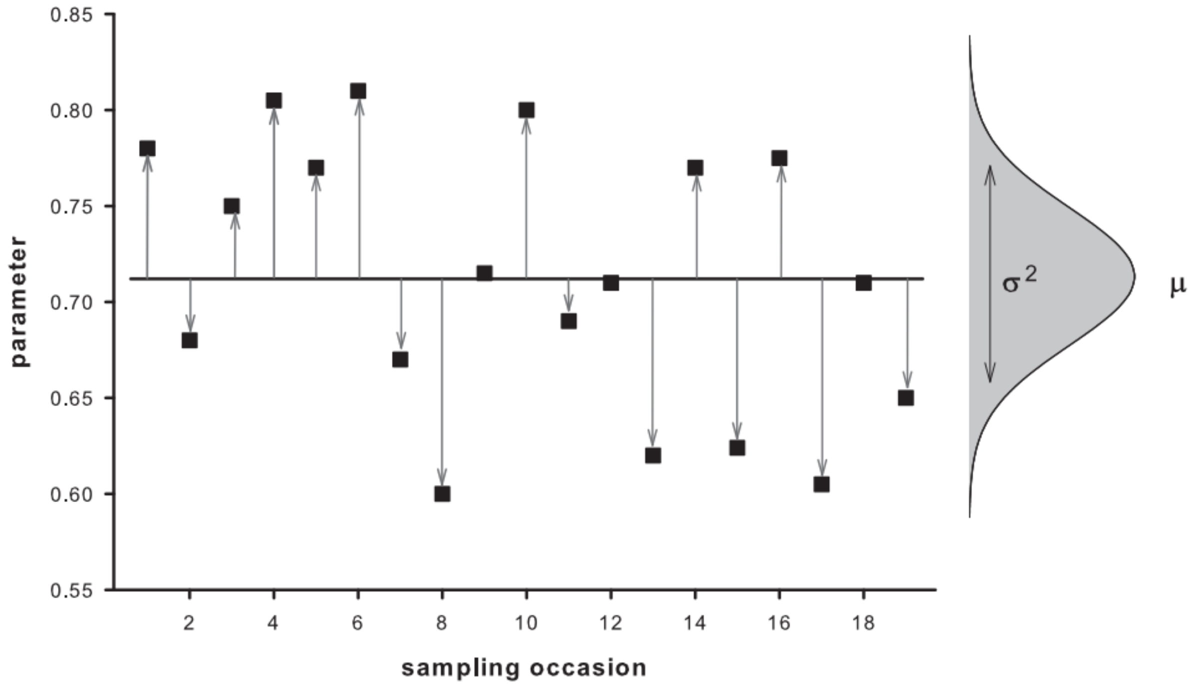
Section 4: Cross-seasonal models & Lincoln estimates

Model

$$\boldsymbol{marr} \sim \text{multinomial}(\boldsymbol{rel}, p)$$
$$\text{logit}(\boldsymbol{S}) = \mu_S + \varepsilon_{S,t}$$
$$\text{logit}(\boldsymbol{f}) = \mu_f + \varepsilon_{f,t}$$

Priors

$$\varepsilon_{S,t} \sim \text{Normal}(0, \sigma_S^2)$$
$$\varepsilon_{f,t} \sim \text{Normal}(0, \sigma_f^2)$$
$$\sigma_S \sim \text{Gamma}(1,1)$$
$$\sigma_f \sim \text{Gamma}(1,1)$$



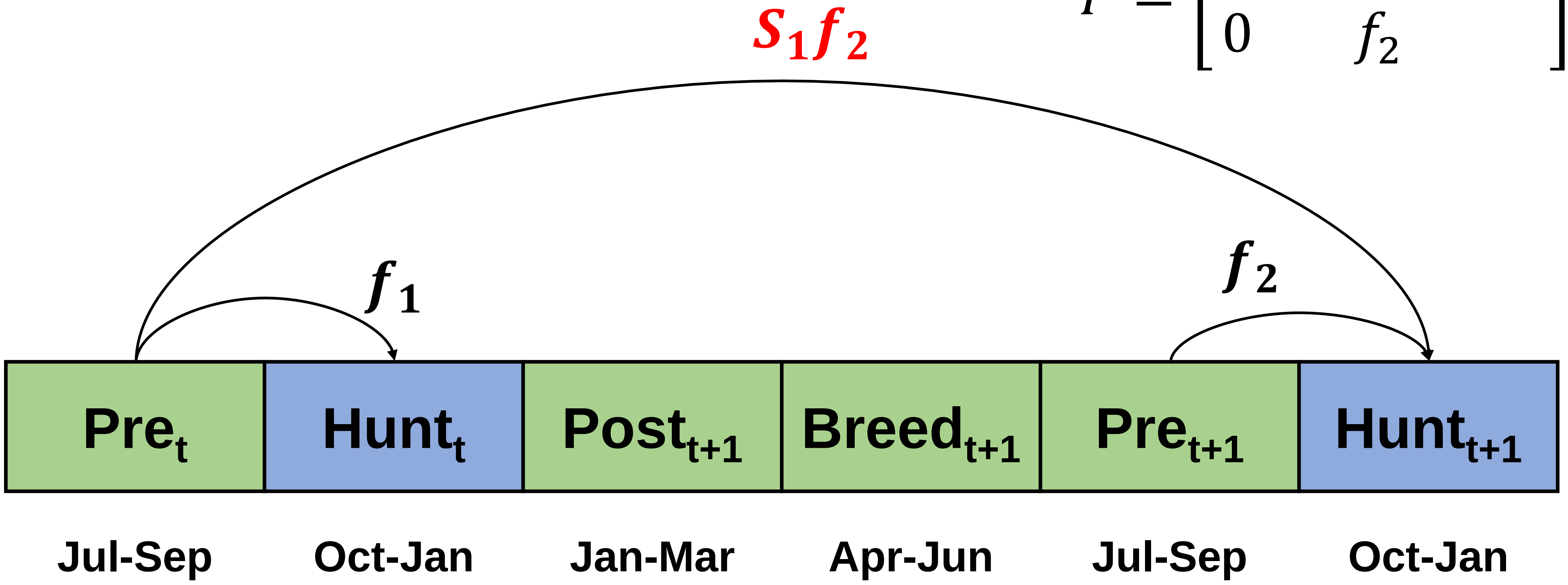
Cross-seasonal models

Models based on pre-season banding

$$P = \begin{bmatrix} f_1 & S_1 f_2 & S_1 S_2 f_3 & S_1 S_2 S_3 f_4 & S_1 S_2 S_3 S_4 f_5 & 1 - \sum P_{1,1:5} \\ 0 & f_2 & S_2 f_3 & S_2 S_3 f_4 & S_2 S_3 S_4 f_5 & 1 - \sum P_{2,1:5} \\ 0 & 0 & f_3 & S_3 f_4 & S_3 S_4 f_5 & 1 - \sum P_{3,1:5} \\ 0 & 0 & 0 & f_4 & S_4 f_5 & 1 - \sum P_{4,1:5} \\ 0 & 0 & 0 & 0 & f_5 & 1 - \sum P_{5,1:5} \end{bmatrix}$$

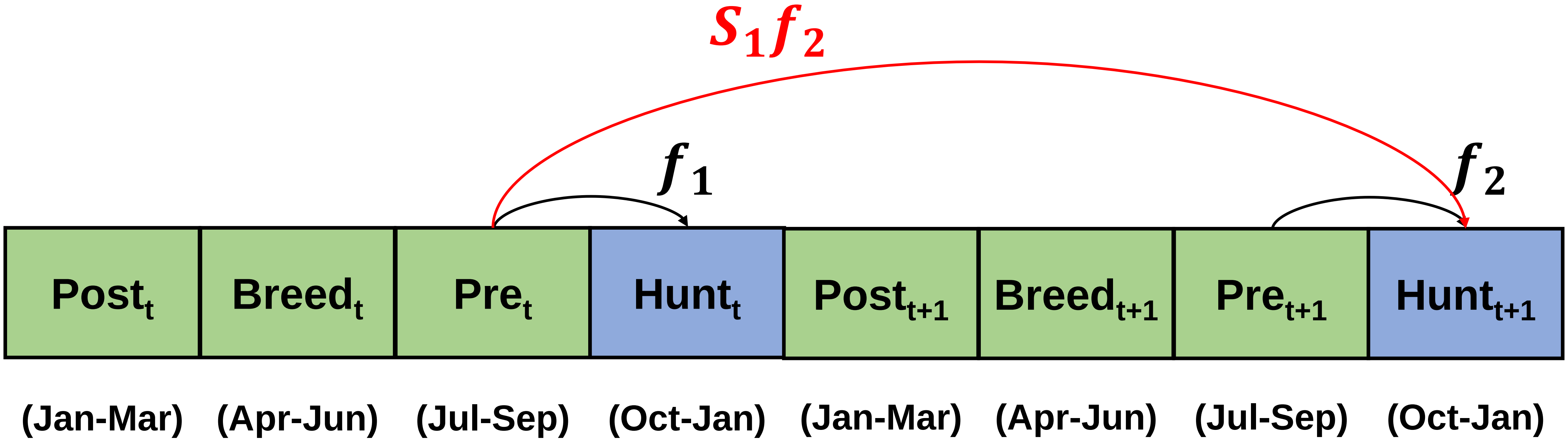
Models based on pre-season banding

$$P = \begin{bmatrix} f_1 & \boldsymbol{S_1 f_2} \\ 0 & f_2 \end{bmatrix}$$



Models based on <u>pre-</u> and post-season banding

$$P_{pre-} = \begin{bmatrix} f_1 & \color{red}{\boldsymbol{s_1 f_2}} \\ 0 & f_2 \end{bmatrix}$$



Models based on pre- and post-season banding

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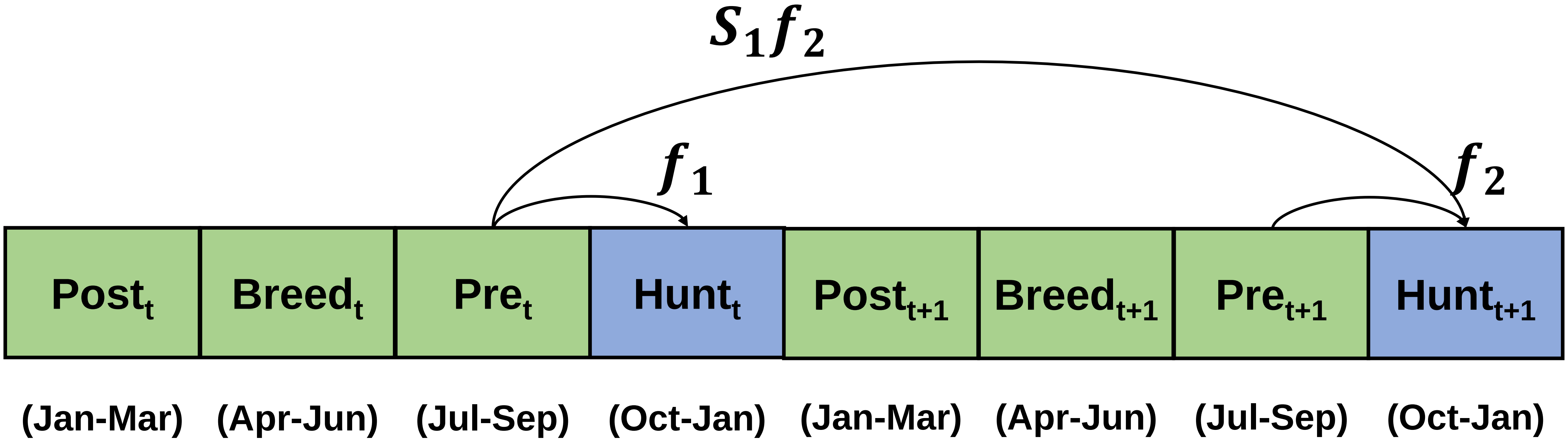

$$P_{post-} = \begin{bmatrix} \varphi_1 f_1 & \varphi_1 S_1 f_2 \\ 0 & \varphi_2 f_2 \end{bmatrix}$$

Models based on pre- and post-season banding

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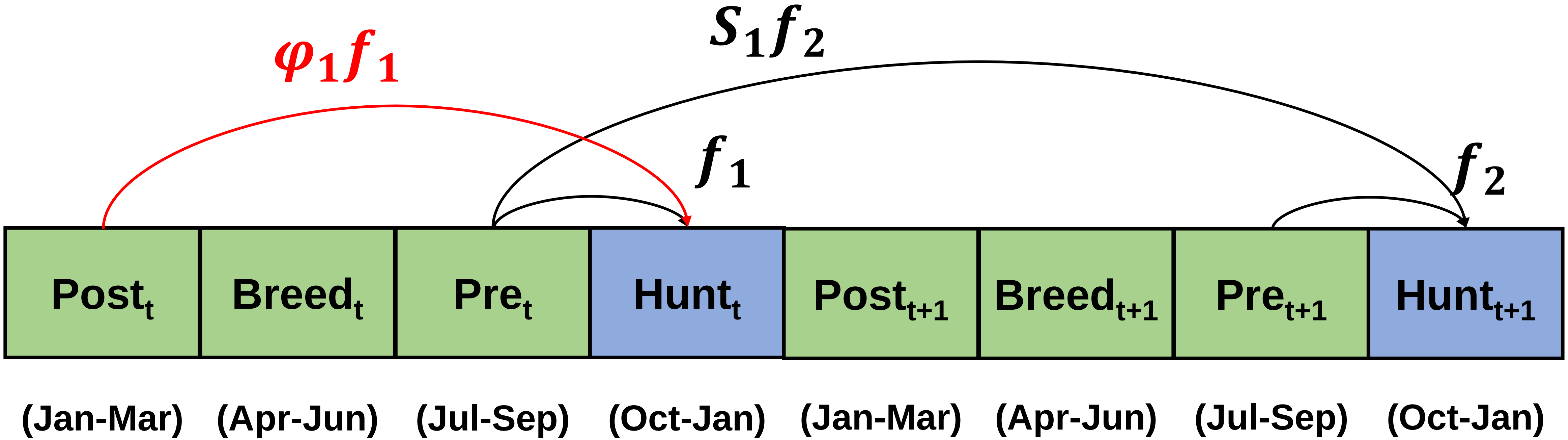

$$P_{post-} = \begin{bmatrix} \boldsymbol{\varphi_1 f_1} & \varphi_1 S_1 f_2 \\ 0 & \varphi_2 f_2 \end{bmatrix}$$

Models based on <u>pre-</u> and <u>post-</u>season banding

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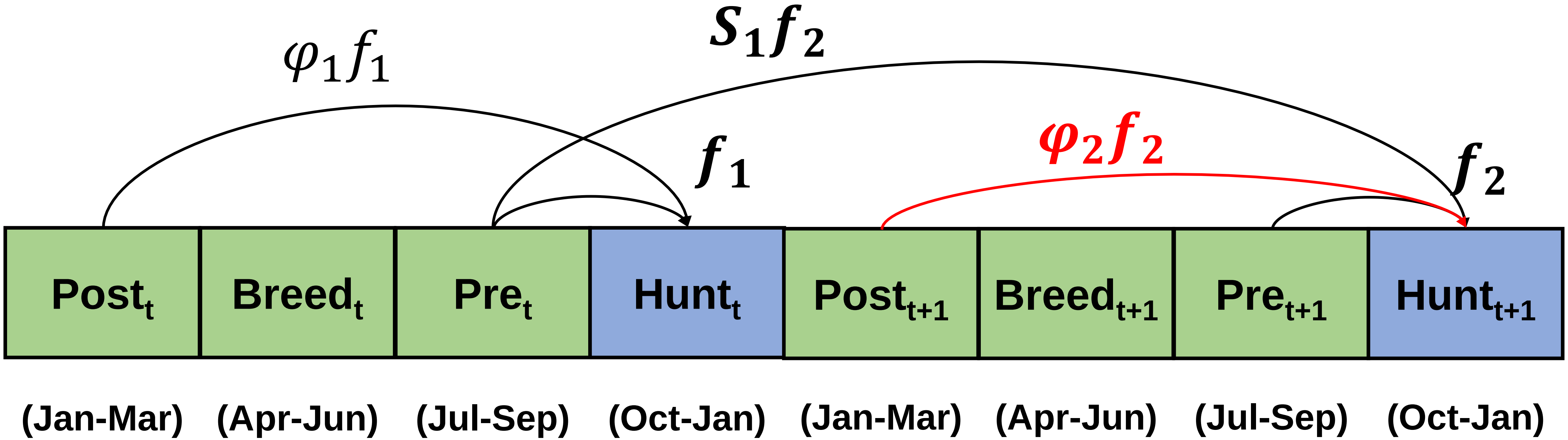

$$P_{post-} = \begin{bmatrix} \varphi_1 f_1 & \varphi_1 S_1 f_2 \\ 0 & \boldsymbol{\varphi_2 f_2} \end{bmatrix}$$

Models based on <u>pre-</u> and <u>post-</u>season banding

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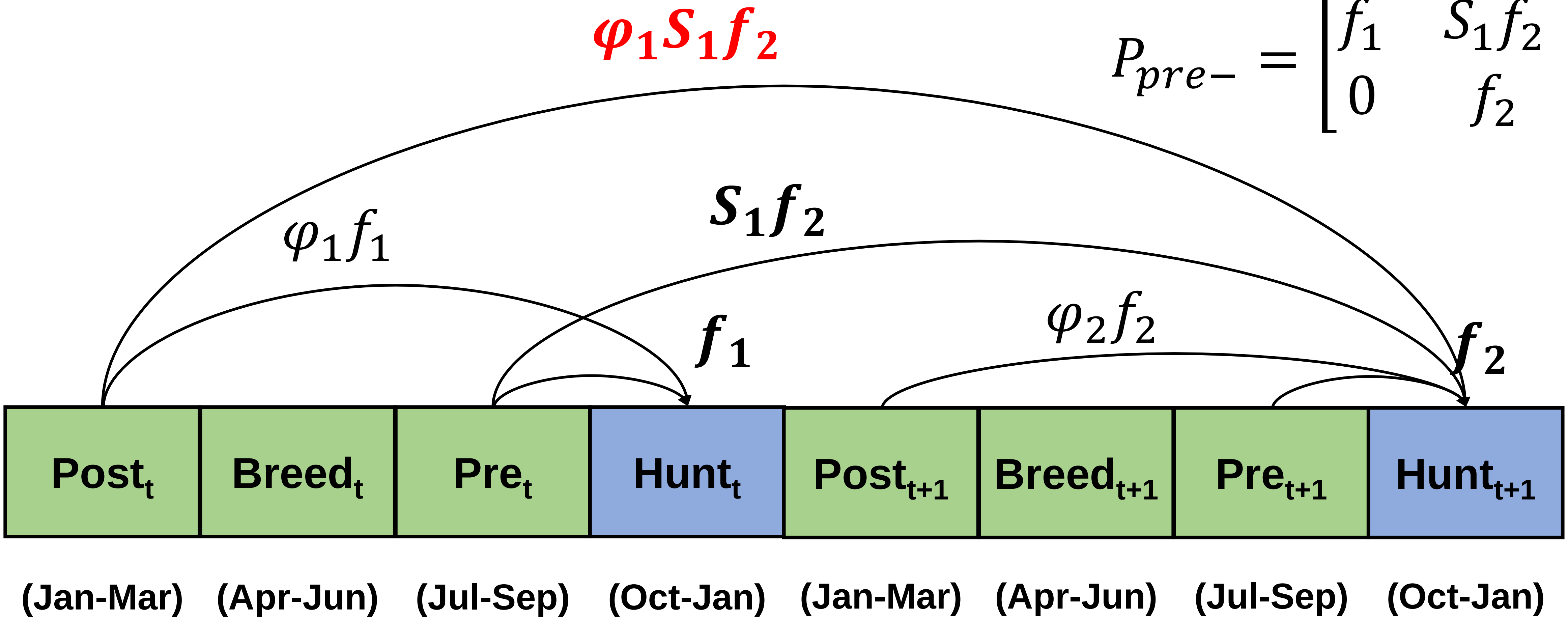
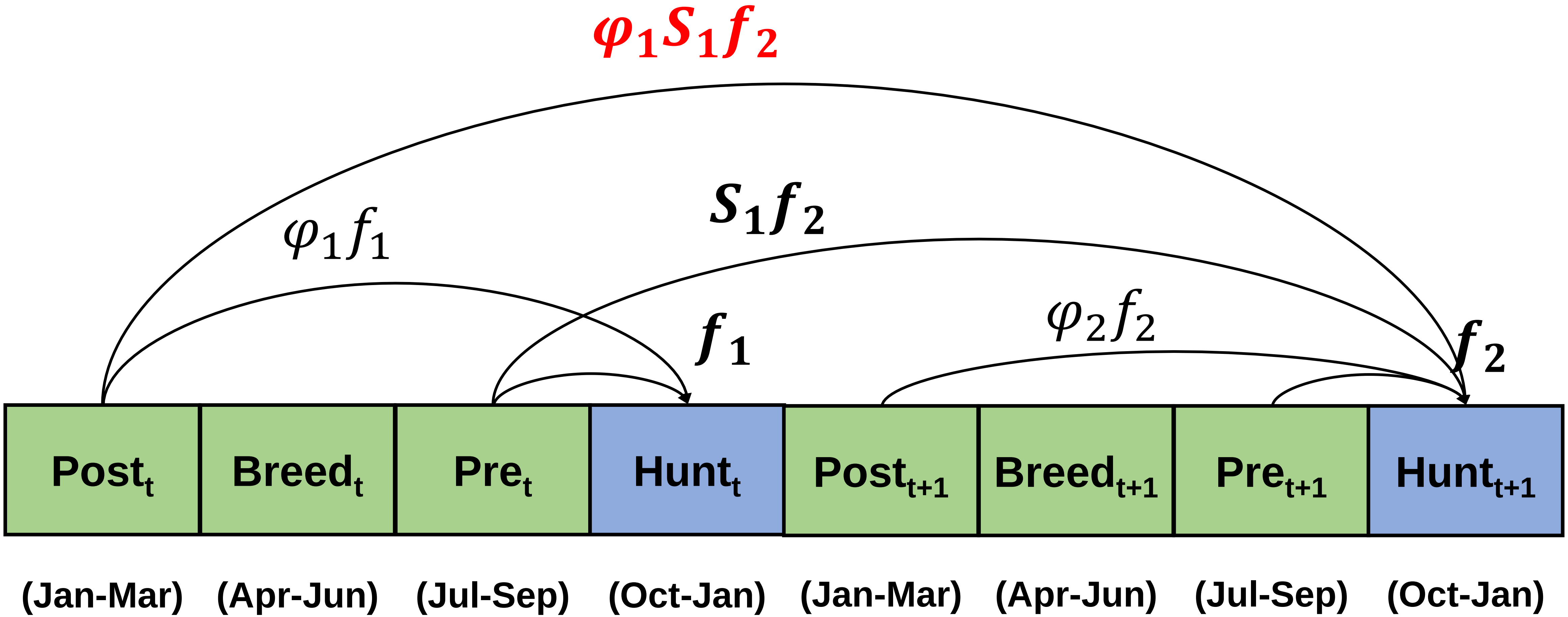


$$P_{post-} = \begin{bmatrix} \varphi_1 f_1 & \boldsymbol{\varphi_1 S_1 f_2} \\ 0 & \varphi_2 f_2 \end{bmatrix}$$

Survival



$$S_1 = \varphi_2 \times \omega_1(1 - \kappa_1)$$

Lincoln estimates

50 is 10% of <u>500</u>

$$f_2 = \frac{100}{1000} = 0.1$$

If **we shoot 50** birds banded in the first year in year two, and **we know we're shooting 10% of the ducks**, then how many were available to be shot?

$$50 = \mathbf{500} * 0.1$$

<u>500</u>

$$\mathbf{500} = 1000 * S_1$$

If there are 1m birds, and we shoot 10% of them…

How many will we shoot?

If there are 1m birds, and we shoot 10% of them…

How many will we shoot?

100k

What if…

We estimate total harvest was 100k

And we estimate we harvested 10% of the birds?

How many birds are there?

What if…

We estimate total harvest was 100k

And we estimate we harvested 10% of the birds?

How many birds are there?
<u>1m</u>

Lincoln estimates

$$N_t = \frac{H_t}{h_t}$$

$$f_t = h_t \times \rho_t$$