

- How exactly do agents update their beliefs given new information in  $S_{it}$ ?

- How exactly do agents update their beliefs given new information in  $S_{it}$ ?
- The simplest way to handle this is to assume Bayesian updating

- How exactly do agents update their beliefs given new information in  $S_{it}$ ?
- The simplest way to handle this is to assume Bayesian updating
- As the name implies, this comes from Bayes' rule

- How exactly do agents update their beliefs given new information in  $S_{it}$ ?
- The simplest way to handle this is to assume Bayesian updating
- As the name implies, this comes from Bayes' rule
- Given prior beliefs  $\mathbb{E}_t[a_i]$  and  $\mathbb{V}_t[a_i]$ , agents update as follows:

$$\mathbb{E}_{t+1}[a_i] = \mathbb{E}_t[a_i] \frac{\sigma_\varepsilon^2}{\sigma_\varepsilon^2 + \mathbb{V}_t[a_i]} + S_{it} \frac{\mathbb{V}_t[a_i]}{\sigma_\varepsilon^2 + \mathbb{V}_t[a_i]}$$
$$\mathbb{V}_{t+1}[a_i] = \mathbb{V}_t[a_i] \frac{\sigma_\varepsilon^2}{\sigma_\varepsilon^2 + \mathbb{V}_t[a_i]}$$

- How exactly do agents update their beliefs given new information in  $S_{it}$ ?
- The simplest way to handle this is to assume Bayesian updating
- As the name implies, this comes from Bayes' rule
- Given prior beliefs  $\mathbb{E}_t[a_i]$  and  $\mathbb{V}_t[a_i]$ , agents update as follows:

$$\mathbb{E}_{t+1}[a_i] = \mathbb{E}_t[a_i] \frac{\sigma_\varepsilon^2}{\sigma_\varepsilon^2 + \mathbb{V}_t[a_i]} + S_{it} \frac{\mathbb{V}_t[a_i]}{\sigma_\varepsilon^2 + \mathbb{V}_t[a_i]}$$
$$\mathbb{V}_{t+1}[a_i] = \mathbb{V}_t[a_i] \frac{\sigma_\varepsilon^2}{\sigma_\varepsilon^2 + \mathbb{V}_t[a_i]}$$

- $\mathbb{E}_{t+1}[a_i]$  and  $\mathbb{V}_{t+1}[a_i]$  are referred to as the posterior beliefs

## Properties of Bayesian Learning

1.  $\mathbb{V}_{t+1}[a_i] > 0$  for all  $t$

## Properties of Bayesian Learning

1.  $\mathbb{V}_{t+1}[a_i] > 0$  for all  $t$

- One is never completely certain of what he has learned

## Properties of Bayesian Learning

1.  $\mathbb{V}_{t+1}[a_i] > 0$  for all  $t$

- One is never completely certain of what he has learned

2. If  $\sigma_a^2 > 0$  then  $\frac{\partial \mathbb{V}_{t+1}[a_i]}{\partial t} < 0$



## Properties of Bayesian Learning

1.  $\mathbb{V}_{t+1}[a_i] > 0$  for all  $t$

- One is never completely certain of what he has learned

2. If  $\sigma_a^2 > 0$  then  $\frac{\partial \mathbb{V}_{t+1}[a_i]}{\partial t} < 0$

- As additional signals are received, uncertainty of beliefs goes down

## Properties of Bayesian Learning

1.  $\mathbb{V}_{t+1}[a_i] > 0$  for all  $t$

- One is never completely certain of what he has learned

2. If  $\sigma_a^2 > 0$  then  $\frac{\partial \mathbb{V}_{t+1}[a_i]}{\partial t} < 0$

- As additional signals are received, uncertainty of beliefs goes down

3. If  $\sigma_a^2 > 0$  then  $\lim_{t \rightarrow \infty} \mathbb{V}_{t+1}[a_i] = 0$

## Properties of Bayesian Learning

1.  $\mathbb{V}_{t+1}[a_i] > 0$  for all  $t$

- One is never completely certain of what he has learned

2. If  $\sigma_a^2 > 0$  then  $\frac{\partial \mathbb{V}_{t+1}[a_i]}{\partial t} < 0$

- As additional signals are received, uncertainty of beliefs goes down

3. If  $\sigma_a^2 > 0$  then  $\lim_{t \rightarrow \infty} \mathbb{V}_{t+1}[a_i] = 0$

- In the limit, uncertainty of beliefs vanishes

## Properties of Bayesian Learning

1.  $\mathbb{V}_{t+1}[a_i] > 0$  for all  $t$

- One is never completely certain of what he has learned

2. If  $\sigma_a^2 > 0$  then  $\frac{\partial \mathbb{V}_{t+1}[a_i]}{\partial t} < 0$

- As additional signals are received, uncertainty of beliefs goes down

3. If  $\sigma_a^2 > 0$  then  $\lim_{t \rightarrow \infty} \mathbb{V}_{t+1}[a_i] = 0$

- In the limit, uncertainty of beliefs vanishes

4. The **speed of learning** is dictated by the signal-to-noise ratio

## Properties of Bayesian Learning

1.  $\mathbb{V}_{t+1}[a_i] > 0$  for all  $t$

- One is never completely certain of what he has learned

2. If  $\sigma_a^2 > 0$  then  $\frac{\partial \mathbb{V}_{t+1}[a_i]}{\partial t} < 0$

- As additional signals are received, uncertainty of beliefs goes down

3. If  $\sigma_a^2 > 0$  then  $\lim_{t \rightarrow \infty} \mathbb{V}_{t+1}[a_i] = 0$

- In the limit, uncertainty of beliefs vanishes

4. The **speed of learning** is dictated by the signal-to-noise ratio

These properties may not always be desirable, but they are intrinsic to Bayesianism