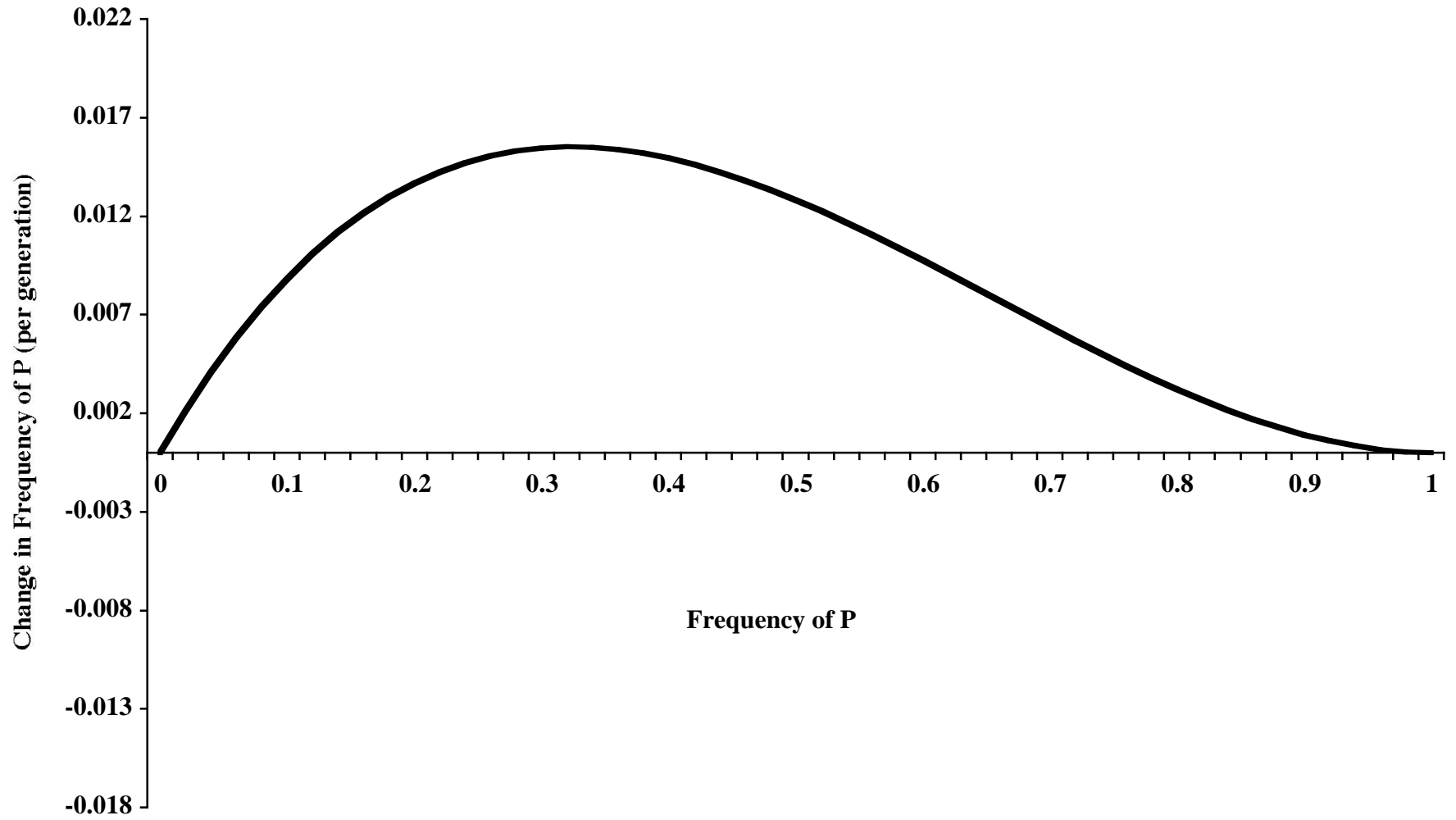
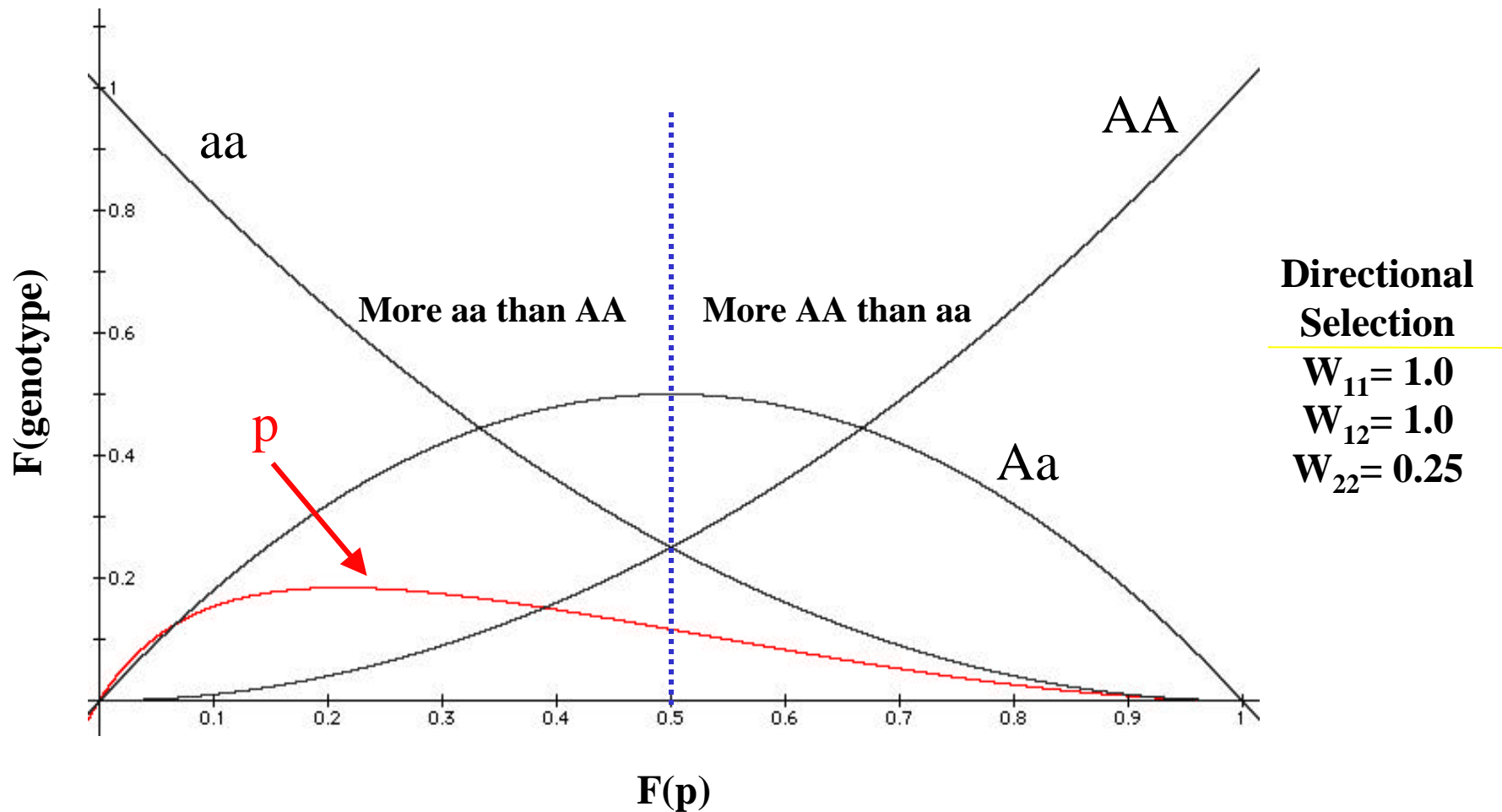


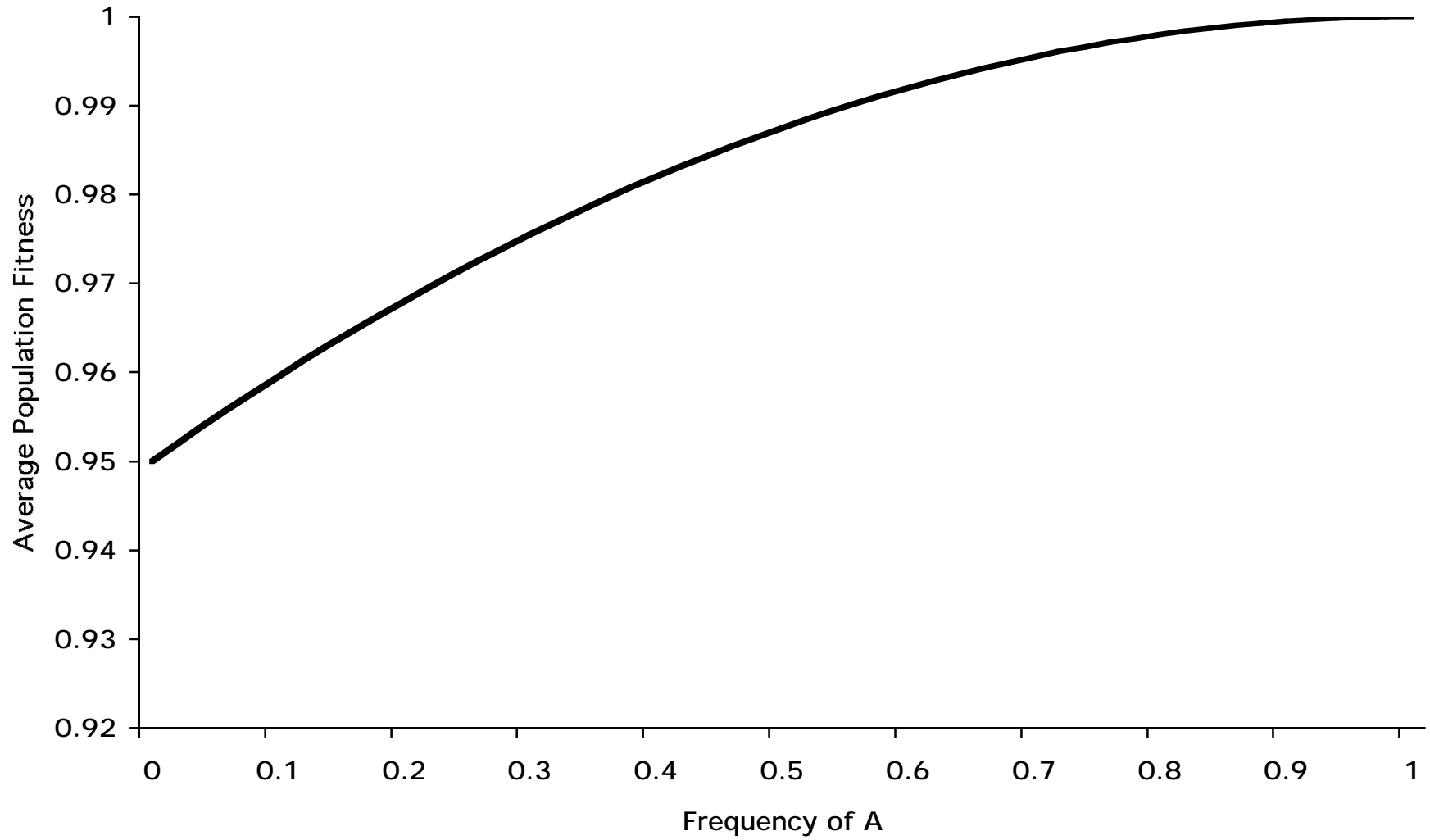
Directional Selection Model



Rate of Change in Δp is Proportional to Genotype Frequency and Selection Differential



Population Fitness with Directional Selection



IV) Models of Selection – continued

A) Directional Selection with Co-Dominant Alleles

| | Genotype | <u>AA</u> | <u>Aa</u> | <u>aa</u> |
|----|----------|-----------|-----------|-----------|
| | Fitness | 1 | 1 – 1/2s | 1 – s |
| OR | Fitness | 1 | 1 – hs | 1 – s |

$$\Delta p = \frac{spq}{2(1 - qs)}$$

Δp is larger than in the dominant case for the same values of p, q, and s

B) Rate of Change of Allele Frequencies

i. Dominant deleterious – initially very fast but slows because once rare only hets available

1. goes to fixation of non-deleterious allele
2. few cases of this (Hodgkin's disease)

ii. Recessive deleterious – rate of change is slower

1. never goes to fixation because hidden in heterozygotes.

V) Maintenance of Polymorphisms Under Selection

A) Stabilizing Selection – The most fit type is the heterozygote

i. AKA: Balancing Selection or Overdominance

| Genotype | <u>AA</u> | <u>Aa</u> | <u>aa</u> |
|----------|-----------|-----------|-----------|
| Fitness | 1 + s | 1 | 1 + t |
| | W_{11} | W_{12} | W_{22} |

s and t are negative numbers

$$W_{12} > W_{11}, W_{22}$$

**AA Homozygote dies with a probability of s
 aa Homozygote dies with a probability of t**

ii. Probability of “death” of A allele

A allele unites with another A allele with a probability of p (i.e., the frequency) and dies with a probability of s therefore:

loss of A allele = ps

a allele unites with another a allele with a probability of q (i.e., the frequency) and dies with a probability of t therefore:

loss of a allele = qt

When these balance each other there is an EQUILIBRIUM (\hat{p} – i.e., the loss of the A allele is balanced by the loss of the a allele)

$$ps = qt$$

$$\hat{p} = \frac{t}{s + t}$$

B) Disruptive Selection – Heterozygote is least fit (AKA Underdominance)

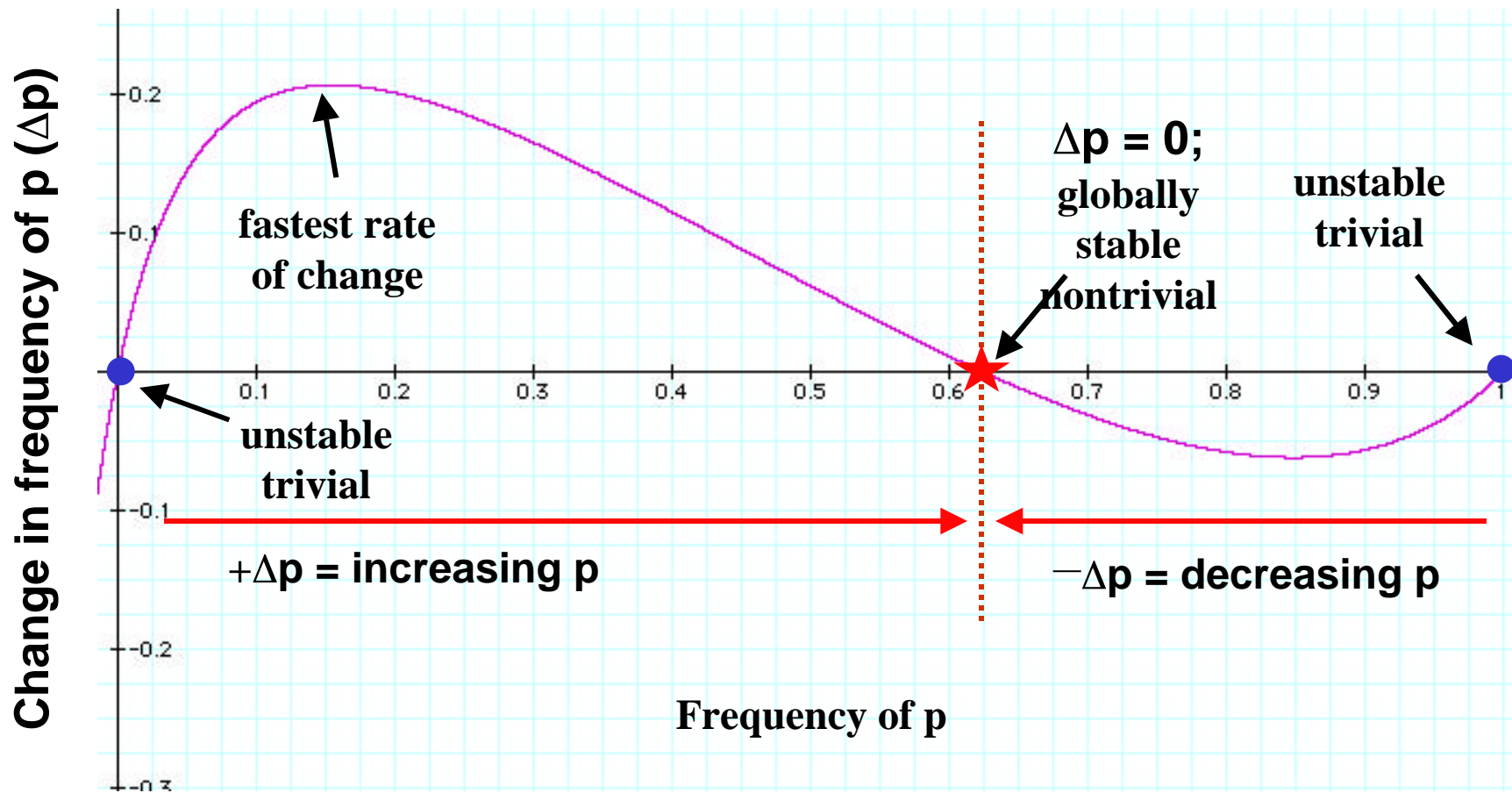
| Genotype | <u>AA</u> | <u>Aa</u> | <u>aa</u> |
|-----------------|----------------------------|----------------------------|----------------------------|
| Fitness | 1 + s | 1 | 1 + t |
| | W_{11} | W_{12} | W_{22} |

s and t are positive numbers

$$W_{12} < W_{11}, W_{22}$$

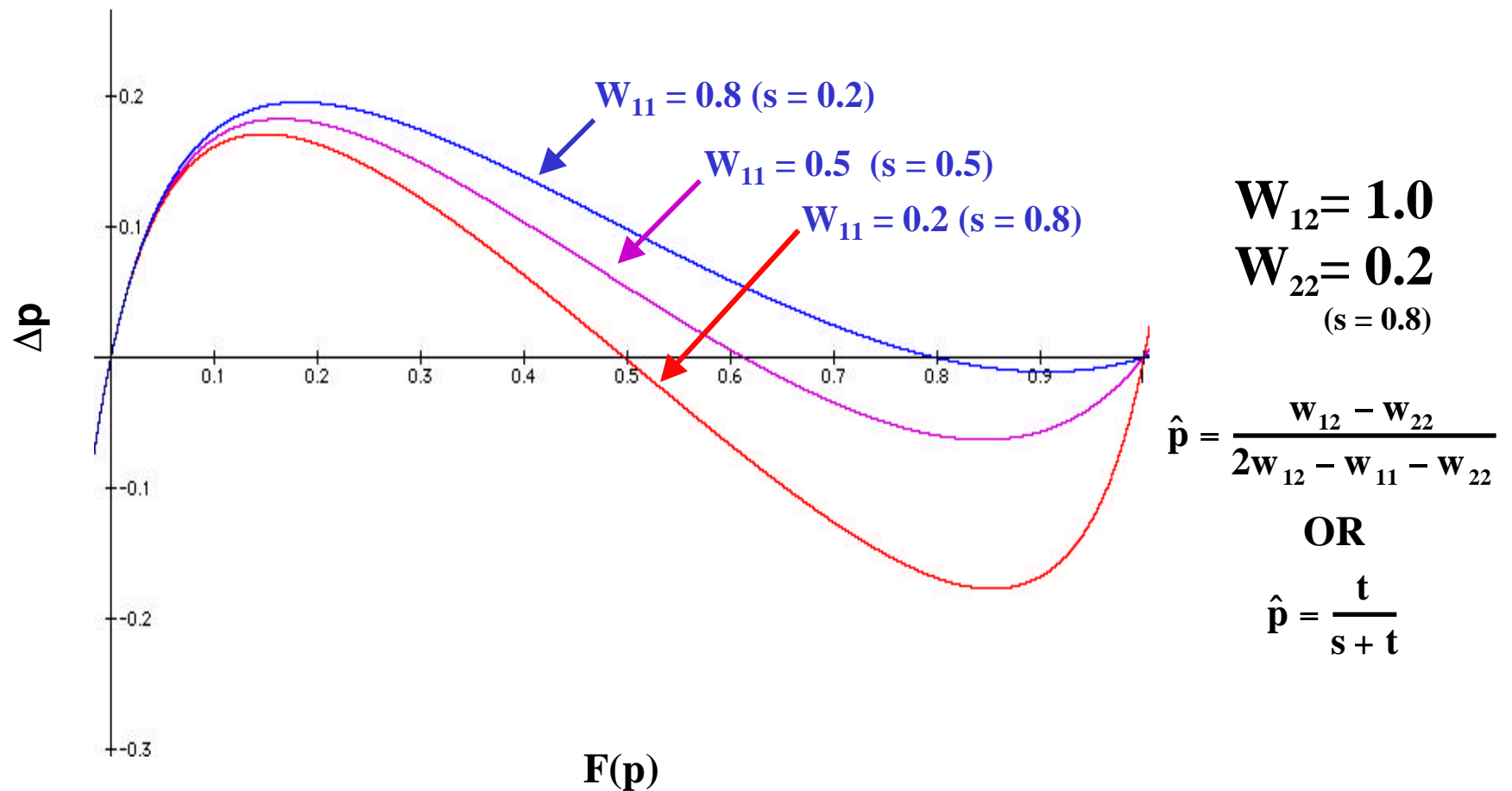
$$\hat{p} = \frac{t}{s + t}$$

Equilibrium Points

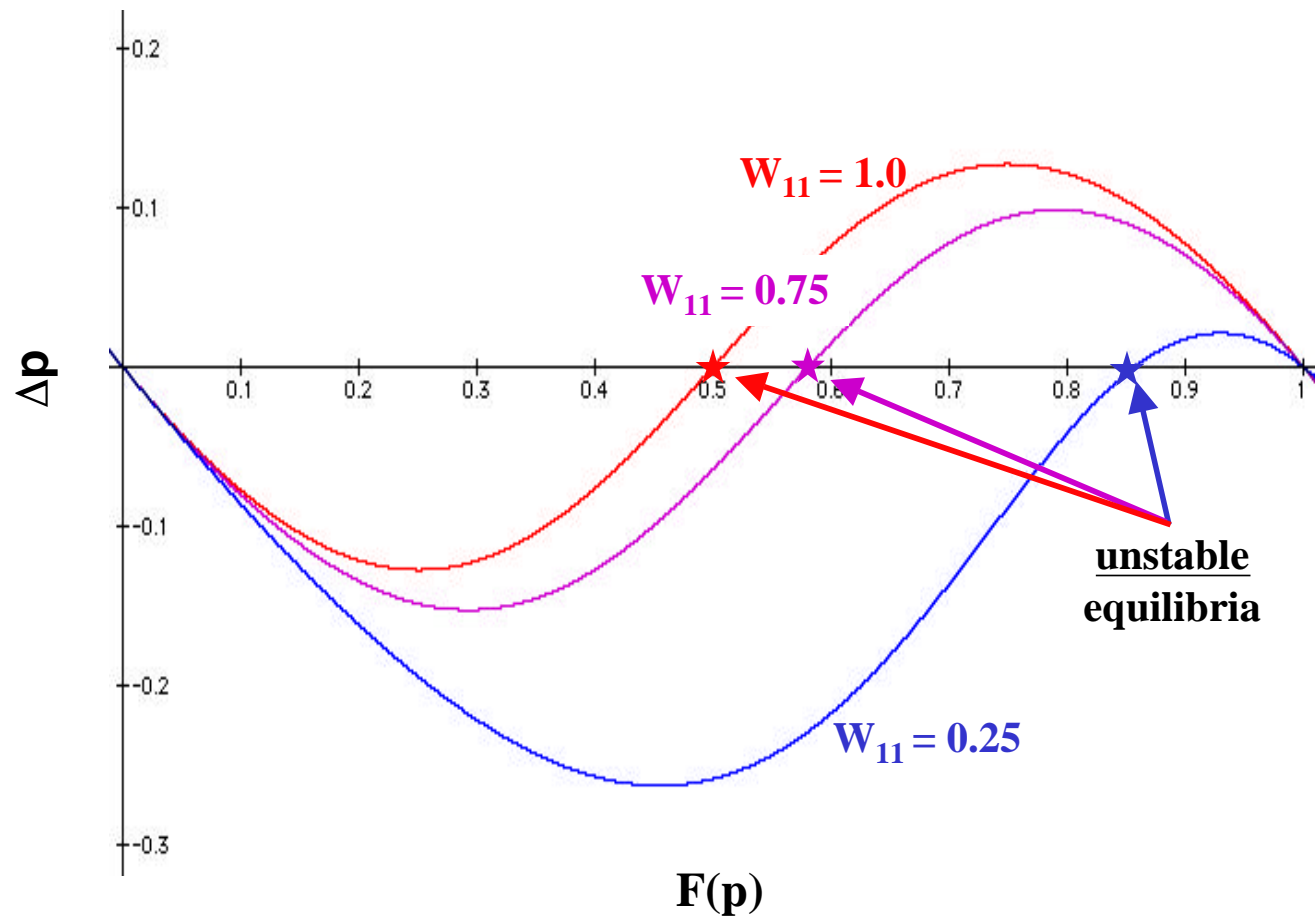


Overdominance Selection

Aa Best



Underdominance Selection



$$W_{12} = 0.1$$

$$W_{22} = 1.0$$

$$\hat{p} = \frac{w_{12} - w_{22}}{2w_{12} - w_{11} - w_{22}}$$