1. Since there is only one type of marriage, let μ be the number of marriages. Let M and F be the numbers of men and women respectively. The CS marriage matching function is:

$$\frac{\mu}{\sqrt{(M-\mu)(F-\mu)}} = \pi$$

$$\begin{aligned}
\mu &= \pi\sqrt{(M-\mu)(F-\mu)} \\
\frac{\partial \mu}{\partial F} &= \pi \frac{M-\mu}{2\sqrt{(M-\mu)\,(F-\mu)} + \pi(F-\mu) + \pi(M-\mu)} > 0 \\
\frac{\partial \mu}{\partial \pi} &= 2\frac{(M-\mu)(F-\mu)}{2\sqrt{(M-\mu)\,(F-\mu)} + \pi(F-\mu) + \pi(M-\mu)} > 0
\end{aligned}$$

2. Now the quasi demand curve for men becomes:

$$\ln \mu = \ln(M-\mu) + \alpha - b\tau$$

The quasi supply curve of women is:

$$\ln \mu = \ln(F-\mu) + \gamma + \tau$$

Solving out τ in the above two equations to get:

$$\ln \mu = \ln(M-\mu) + \alpha - b(\ln \mu - \ln(F-\mu) - \gamma)$$

$$(1+b)\ln \mu - \ln(M-\mu) - b\ln(F-\mu) = \pi' \tag{1}$$

where $\pi' = \alpha + b\gamma$.

Even if we observe μ, M and F, there are still two unknowns in (1), b and π'. So all we can identify is the locus of b and π' which satisfy (1).

(ii) From (1):

$$\frac{\partial \pi'}{\partial b} = \ln \frac{\mu}{F-\mu}$$

Given $\ln \frac{\mu}{F-\mu}$, $\frac{\partial \pi'}{\partial b}$ is constant. So letting b range from $1-z$ to $1+z$, you will be able to find the range of π' which are consistent with that. Since $\frac{\partial \pi'}{\partial b}$ is constant, for each b, there will be a unique π'.

(iii) b measures the marginal cost of resources for men relative to its marginal value to women. Its hard to think about whether b should be 1 or not because we dont know what else to compare it to. Put another way, if b increase, then we know that there will be less marriages. But perhaps π', the gains to marriage is low. This shows the limit of what we can say even in a simple model of marriage.