In [39]:

```
import matlab.engine
eng = matlab.engine.start_matlab()
para= eng.get_log_para(narout = 1)
para_se = eng.get_log_se(narout = 1)
print(para)
print(para_se)
```

```
[[0.0568237067543],[2.90254313798],[-12.6051326697],[-2.09924064092]]
[[0.00182053598234],[0.0749653577461],[1.9997620191],[0.0494761934928]]
```

Question(a)

Given the matlab code (prop_haz.m) we can know that estimating hazard function follows the following formula:

$$\begin{aligned}\lambda(t) &= Pr(\tau = t|\tau > t-1, v)\\ &= \frac{\gamma p(\gamma t)^{p-1}}{1+(\gamma t)^p}e^{\beta v}\end{aligned}$$

where the covariates v are:

1. Indicator for summer months.
2. Difference between "contract mortgage rate" and "the 3 month lag of the 10 year LIBOR rate".

From the formula, we know γ is the magnitude of the baseline hazard, and p is the shape parameter for the baseline hazard. The last two parameters are coefficients for covariates, which are $\beta 1$ and $\beta 2$. $\beta 1$ measures how borrowers react to coupoon gaps and $\beta 2$ measures the sensitivity to the summer months.

In [43]:

```
para_non= eng.get_log_para_non(narout = 1)
para_se_non = eng.get_log_se_non(narout = 1)
print(para_non)
print(para_se_non)
```

```
[[0.0048375447524],[1.31377206773],[69.752653213],[-0.408218169874]]
[[0.000447252684004],[0.0293563569075],[3.00396507062],[0.045844247549]]
```

Question(d)

The economics ideas are quite similar after considering the time-varying feature of the hazard model.

From the formula, we know γ is the magnitude of the baseline hazard, and p is the shape parameter for the baseline hazard. The last two parameters are coefficients for covariates, which are $\beta 1$ and $\beta 2$.

$\beta 1$ measures how borrowers react to coupoon gaps and $\beta 2$ measures the sensitivity to the summer months.

Now, we use time-varying data to estimate the time-varying hazard model using log-logistic baseline hazard method. Compared to the result in question a, the magnitude of hazard function is 0.0048 which is slightly smaller than the non-varying model. The shape parameter (p) is 1.31 which is much smaller than the shape coefficient in question a.

The β parameters behave quite different from question a, within time-varying model, the reaction to coupon gaps $(\beta 1)$ is strongly positive while in non-time varying model, there is a negative relation. For $\beta 2$, summer indicator used to have a negative impact on hazard rate, however, the effect diminish to zero when we use time-varying model.