An RBC model with asset price, irreversibility, and endogenous labor supply

A represntative firm solves the following problem:

$$J(k;S) = \max_{k',n} Ak^{\alpha}n^{1-\alpha} - w(S)n - k' + (1-\delta)k + \mathbb{E}M(S,S')J(k';S')$$
$$\text{s.t. } k' - (1-\delta)k \geq \phi I_{ss}$$

where I_{ss} is the steady-state investment level.

The household-side problem is as follows:

$$V(a;S) = \max_{c,N,a'} \ log(c) - \frac{\eta}{1+\frac{1}{\chi}} N^{1+\frac{1}{\chi}} + \beta\mathbb{E}V(a';S')$$
$$\text{s.t.} \quad c + \int M(S,S')a'(S')d\Gamma_{S'} = a + w(S)N$$

The stochastic discount factor $M(S,S')$ and wage $w(S)$ are determined at the competitive market:

$$[M]: \quad a(S) = J(k(S);S)$$
$$[w]: \quad N(S) = n(S)$$