An RBC model with asset price and convex adjustment cost

A represntative firm solves the following problem:

$$J(k;S) = \max_{k'} Ak^{\alpha} - k' + (1-\delta)k - \frac{\mu}{2}\left(\frac{k' - (1-\delta)}{k}\right)^2 k + \beta \mathbb{E} M(S,S')J(k';S')$$
$$\text{s.t.} \quad S' = \Gamma_S(S) \quad \text{(Aggregate law of motion)}$$

where $S = \{K, A, \mu\}$ is the aggregate state. A and μ follow an exogenous Markov process.

The household-side problem is as follows:

$$V(a;S) = \max_{c,a'} \; log(c) + \beta \mathbb{E} V(a';S')$$
$$\text{s.t.} \quad c + \int q(S,S')a'(S')d\Gamma_{S'} = a$$

The stochastic discount factor $M(S,S')$ is determined at the competitive market:

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