total costs is no longer reversed.

### 6.3 Resilience to Targeted Attacks: Impact of Network Structure

One of the important streams in the network science literature is the question of relative resilience of different network topologies to failures, random or targeted. A central result, replicated in a number of contexts, is that network topology is a vital factor in determining resilience [Albert et al., 2000, Newman, 2010]. Of particular interest to us is the observation that scale-free networks such as PA exhibit poor tolerance to targeted attacks as compared to ER [Albert et al., 2000], which is precisely the context that we consider.

In Figure 5 (top) we show the defender’s utility for three different network topologies, PA, ER, and Fedwire as a function of cost \( c \). Remarkably, there is essentially no difference between PA and ER (and not much between these and Fedwire) until \( c \) is quite high, at which point they begin to diverge. This seems to contradict essentially all the previous findings in that network topology seems to play little role in resilience in our case! A superficial difference here is that we consider a cascading failure model, while most of the previous work on the subject focused on diminished connectivity due to attacks. We contend that the most important distinction, however, is that previous work studying resilience did not account for a simple observation that most important targets are also most heavily defended; indeed, there was no notion of endogenous defense at all. In scale-free graphs, there are well connected nodes whose failure has global consequences. These are the nodes which are most important, and are heavily defended in optimal decisions prescribed by our framework. Once the defense decision becomes endogenous, differences in network topology disappear. Naturally, once \( c \) is high enough, defense of important targets weakens, and eventually we recover the standard result: for high \( c \), PA is considerably more vulnerable than ER.

To investigate the impact of network topology on resilience further, we consider the generalized PA model in which we systematically vary the homogeneity of the degree distribution by way of the parameter \( \mu \). The results are shown in Figure 5 (bottom). In this graph, we do observe clear variation in resilience as a function of network topology, but the operational factor in this variation is homogeneity in the distribution of expected utilities, rather than degrees: increasing homogeneity of the utility distribution lowers network resilience. This seems precisely the opposite...