2.3.2 Community Structure

The *clustering coefficient* of a graph can be defined as follows. Let d be the degree of a vertex v. The maximum number of edges possible between neighbors of v is $\Delta := d(d-1)/2$. The *clustering coefficient of a vertex* v, denoted $cc(v)$ is the ratio of the actual number of edges between neighbors of v to Δ. The clustering coefficient of a graph is the average of $cc(v)$ over all vertices v. In social networks, $cc(v)$ measures the extent to which people that v comes into contact with, also come into contact with each other. In other words, $cc(v)$ measures the extent to which the neighborhood of v forms a community. One of the observations that motivated the work of Watts and Strogatz [109] is that the real world networks they examined had clustering coefficients that were orders of magnitude larger than the clustering coefficient of the comparable Erdös-Renyi graphs. A comparison between cc and cc_{rand} in Figure 2.11 shows that this is the case for the HCW contact networks as well.

Communities need not be restricted to neighborhoods in a network and an additional property of social networks that has attracted a lot of attention is their *community structure* [46, 81]. Informally speaking, a graph is said to have a strong community structure if it can be partitioned into groups of nodes that are densely connected with very few edges between groups. This structural feature can be measured in many different ways, the particular measure we consider, defined by Newman and Girvan [81], is called *modularity*.

Defined loosely, the *modularity* of a given vertex-partition of a graph (i.e., the