This paper presents the estimation of a discrete freight transport chain choice model for Europe, which was developed for the European Union as part of the Transtools 3 project. The model describes nine different multi- and single mode chain alternatives of which three can be either container or non-containerised, and it segments freight into dry bulk, liquid bulk, containers and general cargo. The model was estimated on the basis of disaggregate data at the shipment level (Swedish CFS and French ECHO data). Several transport costs specifications and nesting structures were tested and elasticities compared with reference literature. It was found that freight models are characterised by heterogeneity, non-linearity in transport costs and hence Value of Time and non-constant rates of substitution. Not taking these elements into account will have consequences for the evaluation of transport policies using the freight transport model.