In calculation of economic aggregates it is often necessary to compute the value of such aggregates for some relevant subgroups of statistical units as well as for the entire population of interest. A method of aggregation is said to be consistent in aggregation if it gives the same result regardless of whether the method is applied directly to the whole data or in two (or more) steps. The latter route consists of first partitioning the data into subgroups and applying the aggregation method in these, and then in the second step aggregating these subaggregates into a total aggregate using the same method.

This intuitively appealing and practically important property has lacked a general definition until now. In this thesis such a definition is given and it is shown that any aggregation method with this property corresponds to repeated application of an Abelian semigroup operation and vice versa. The range of aggregation problems the result covers is quite broad, as semigroup operations may be defined for example on sets of real numbers, vectors of real numbers, sets, functions such as stochastic processes etc.

The semigroup interpretation makes it possible to formulate many classical aggregation problems using algebraic concepts such as isomorphisms between semigroups, subsemigroups and homomorphisms. The strength of the algebraic approach is demonstrated by applying algebraic techniques to index number theory. One of the main results is that under general conditions an index number formula that is consistent in aggregation has a simple quasilinear representation, that is, the semigroup that defines the index number formula is isomorphic to an addition semigroup. This representation allows the use of functional equations techniques to prove many results concerning the possible functional form of formulas that satisfy interesting axiomatic criteria, such as reversibility and proportionality tests.

Finally, the relation of these results, which are in the axiomatic or test-theoretic tradition of index number theory, to utility-maximizing behaviour, is explored. First a critical review of the economic approach is presented, and a large class of new, asymmetric superlative index number formulas emerges as a by-product. It is then shown, that the quasilinear indices and their subindices quadratically approximate meaningful economic indices and sub-indices under standard regularity assumptions.