burdensome. While virtually all likelihood functions can be maximized *in principle,* doing so for real applied examples with several thousand observations can be prohibitively expensive.

4. Separability

In the conventional demand analysis discussed so far, a number of important assumptions have not been justified. First, demand within each period is analysed conditional on total expenditure and prices for that period alone, with no mention of the broader determinants of behavior, wealth, income, other prices and so on. Second, considerations of labor supply were completely ignored. Third, no attention was given to questions of consumption and saving or to the problems arising for goods which are sufficiently durable to last for more than one period. **Fourth,** the practical analysis has used, not the elementary goods of the theory, but rather aggregates such as food, clothing, etc., each with some associated price index. Separability of one sort or another is behind each of these assumptions and this section gives the basic results required for applied analysis. No attempt is made to give proofs, for more detailed discussion the reader may consult Blackorby, Primont and Russell (1978), Beaton and Muellbauer (1980a Chapter 5) or the original creator of much of the material given here, Gorman (1959) (1968) as well as many unpublished notes.

4.1. Weak separability

Weak separability is the central concept for much of the analysis. Let q^A be some subvector of the commodity vector q so that $q=(q^A,q^A)$ without loss of generality. qA is then said to be (weakly) *separable* if the direct utility function takes the form

$$u = v(v_4(q^4),q'^T), \tag{113}$$

$u_A(q^A)$ is the subutility (or felicity) function associated with q^A. This equation is equivalent to the existence of a preference ordering over qA alone; choices over the q^4 bundles are consistent independent of the vector re. More symmetrically, preferences as a whole are said to be separable if q can be partitioned into

(4,A, q_N+) such that

$$u\ v(v_A(q^A),v,(q^B),...,u_N(q^N)). \tag{114}$$

Since v is increasing in the subutility levels, it is immediately obvious that