§ 6 Demand and International Trade

Bibliography:

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Rose, K. / Sauernheimer, K. (2006): Theorie der Außenwirtschaft. 14. Aufl., München, pp 471 - 492 [or 13th ed. 1999, pp 463 - 484].

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6.1 Introduction

We have seen in § 5 that the difference between national autarky price relations determine the pattern of trade. As a concrete example, we considered the case where the domestic autarky price of good 2 was relatively high compared to the price ratio in Foreign; with a common price ratio $(p_2/ p_1)^W$ between the national autarky ratios, the domestic country would import good 2 (and export good 1):

$$\text{(5.8)} \qquad \left(\frac{p_2}{p_1}\right)^a > \left(\frac{p_2}{p_1}\right)^W > \left(\frac{p_2}{p_1}\right)^{fa} \quad \begin{array}{l} \nearrow \; EX_1 \\ \searrow \; IM_2 \end{array}$$

In the introductory exhibit 5.0 of § 5, we indicated that demand differences between both countries may be the cause of the differing price ratio. Thus, the reason for the relative high price of good 2 in Home may be a comparatively high domestic demand for that good. Put in more general terms: a relatively high demand for a good creates a tendency towards a comparative price disadvantage in international trade.

In order to work out the implications of demand differences as clearly as possible, we assume that the two countries are equal in all other respects. Most of all, we assume identical supply sides, represented by an identical transformation curve.

In contrast to the supply side, the demand side differs between countries. This is due to different preferences. We express preferences by national welfare functions:

- they explain collective welfare as a function of aggregate consumption of the goods available

- in spite of their macroeconomic nature, a national welfare function is assumed to exhibit the same properties as a utility function in traditional microeconomic models.

We will now start the analysis in 6.2 with the simplest possible demand structure: a constant ratio of consumption quantities of the two goods under consideration.

6.2 International Trade with Fixed Consumption Structures

(1) Modelling a fixed demand structure

Demand of a country is determined by a so-called activity-analysis social welfare function:

$$(6.1)\quad U = \min\left\{ \frac{C_1}{u_1}, \frac{C_2}{u_2} \right\} , \quad 0 < u_1 , u_2 = \text{const.}$$

According to (6.1), a certain welfare level (U) can be efficiently realized by just one specific combination of consumption goods (C_1, C_2). The reason is that the goods are complements in consumption. Moreover, for different welfare levels this combination remains constant.

The background for this particular welfare function is the assumption that a given welfare level requires a minimum consumption quantity of each good. The minimum (i. e. efficient) consumption quantities per unit of welfare (u_1, u_2) are assumed to be constant:

$$(6.2a)\quad C_1 \geq u_1 \cdot U ,$$

$$(6.3a)\quad C_2 \geq u_2 \cdot U .$$

Rational consumers will avoid waste. Thus, we may assume the equality signs to hold:

$$(6.2)\quad C_1 = u_1 \cdot U , \quad 0 < u_1 = \text{const.} ,$$

$$(6.3)\quad C_2 = u_2 \cdot U , \quad 0 < u_2 = \text{const.}$$

Division of the equations (6.2) and (6.3) leads to the equation of the “welfare ray” (6.4). It shows that the efficient combination of C_1 and C_2 is independent from the levels of welfare and consumption:

(6.4) $C_1 = \left(\frac{u_1}{u_2}\right) \cdot C_2$.

In the following exhibit, the indifference curves shrink to one point. As an example, take point A: it shows the only efficient combination of consumption quantities leading to a welfare level U = 1.

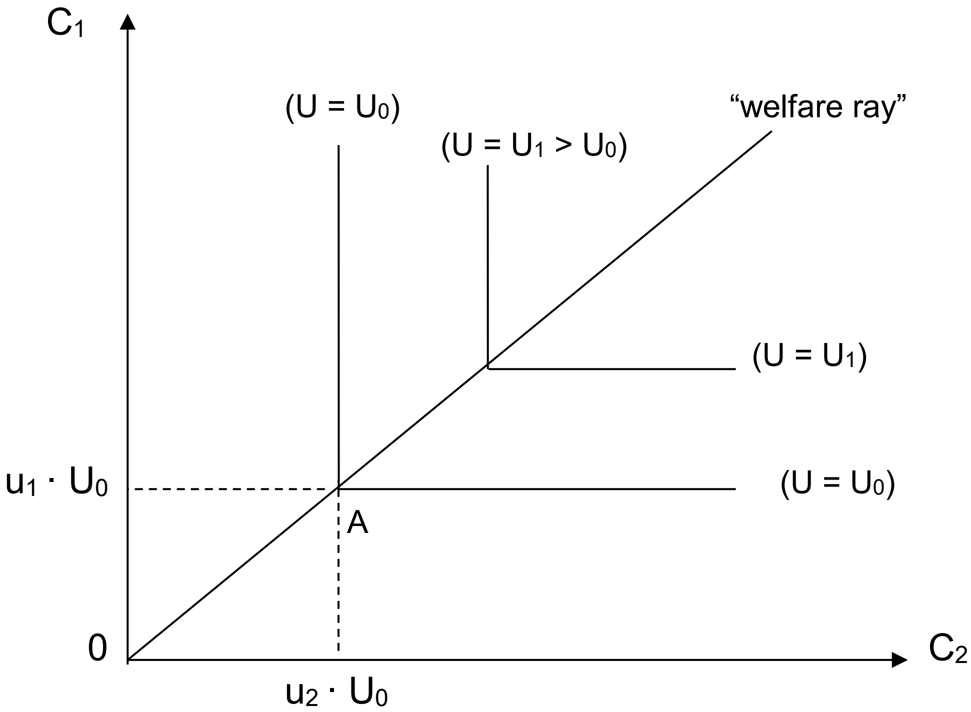

Exhibit 6.2 (1): Domestic Demand

The welfare ray is congruent with the national income consumption line.

(2) Autarky equilibrium

In the following exhibit, we assume the same production possibility curve for Home and Foreign. Foreign has a higher demand preference for good 1 than Home. This is illustrated by a steeper Foreign welfare ray:

$$(6.5) \qquad \tan ß = \frac{C_1^f}{C_2^f} > \frac{C_1}{C_2} = \tan \alpha \quad .$$

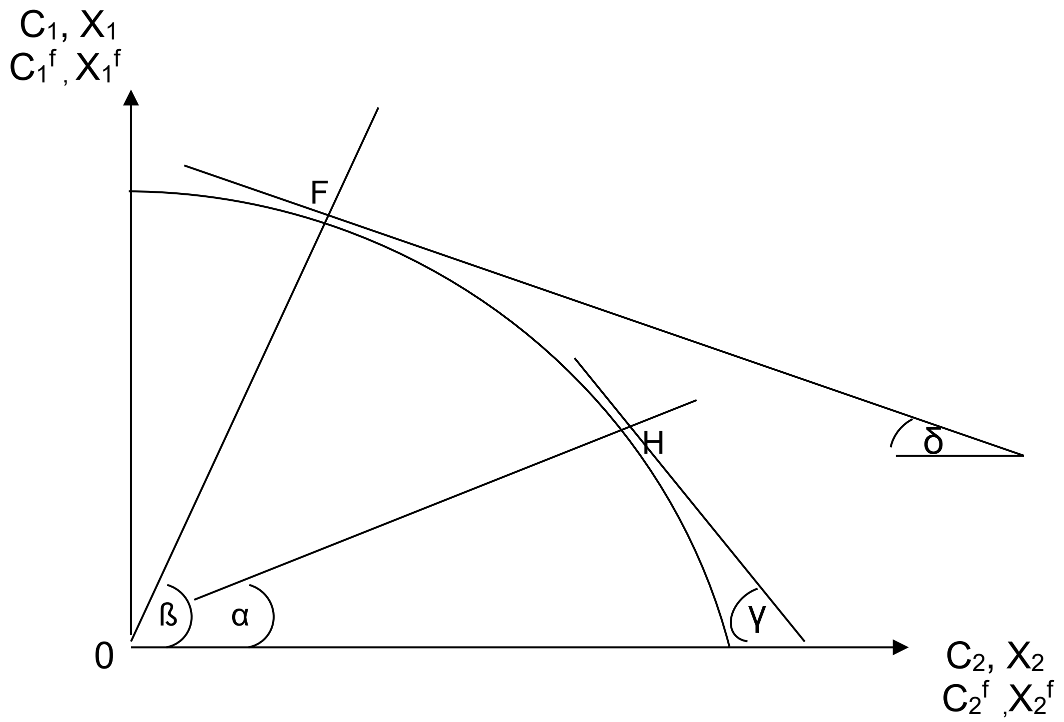

Exhibit 6.2 (2): Autarky Equilibrium in Home and in Foreign

Given identical supply sides, the relatively high demand for good 1 leads to a higher relative price of good 1 in Foreign. This implies a lower relative price of good 2 for Foreign:

$$(6.6) \qquad \tan \delta = \left(\frac{p_2}{p_1}\right)^{fa} < \left(\frac{p_2}{p_1}\right)^{a} = \tan \gamma \quad .$$

The high relative price of good 1 creates an incentive for the companies in Foreign to produce a high quantity of good 1 (point F). In contrast to this, Home produces comparatively much of good 2 (point H). As a consequence, the marginal rate of transformation of good 2 into good 1 is higher in Home:

$$(6.7) \qquad \left(\frac{dX_1}{dX_2}\right)^{MRT\,fa} < \left(\frac{dX_1}{dX_2}\right)^{MRT\,a}$$

As explained in § 5, this rate shows the higher opportunity costs of good 2 in production. The graph illustrates that it equals the corres-ponding national price ratio:

$$(6.8) \quad \left(\frac{p_2}{p_1}\right)^{fa} = \left(\frac{dX_1}{dX_2}\right)^{MRT\,fa} < \left(\frac{dX_1}{dX_2}\right)^{MRT\,a} = \left(\frac{p_2}{p_1}\right)^{a}$$

(3) International Trade

When trade is opened, foreign consumers realize the relatively cheap price of good 1 in Home. They will start to buy that good in Home. In home, this increasing demand will drive the relative price of good 1 up. This creates an incentive for domestic producers to increase production of good 1 and to sell the additional production to foreigners. All in all, we thus have an export of good 1 by Home and an import of it by Foreign. The opposite holds for good 2.

As indicated, the relative price of good 1 in Home increases. This is not only due to the demand by foreigners. It is also a result of a decline of demand for good 2: domestic consumers realize that good 2 is relatively cheaper abroad and therefore shift their demand from domestic producers to foreign ones.

These adjustment processes lead to an equalization of the price ratio across borders. The exhibit illustrates that the common price ratio $(p_2/p_1)^W$ lies between the autarky ratios:

(6.9) $$\left(\frac{p_2}{p_1}\right)^{fa} < \left(\frac{p_2}{p_1}\right)^{W} < \left(\frac{p_2}{p_1}\right)^{a}$$

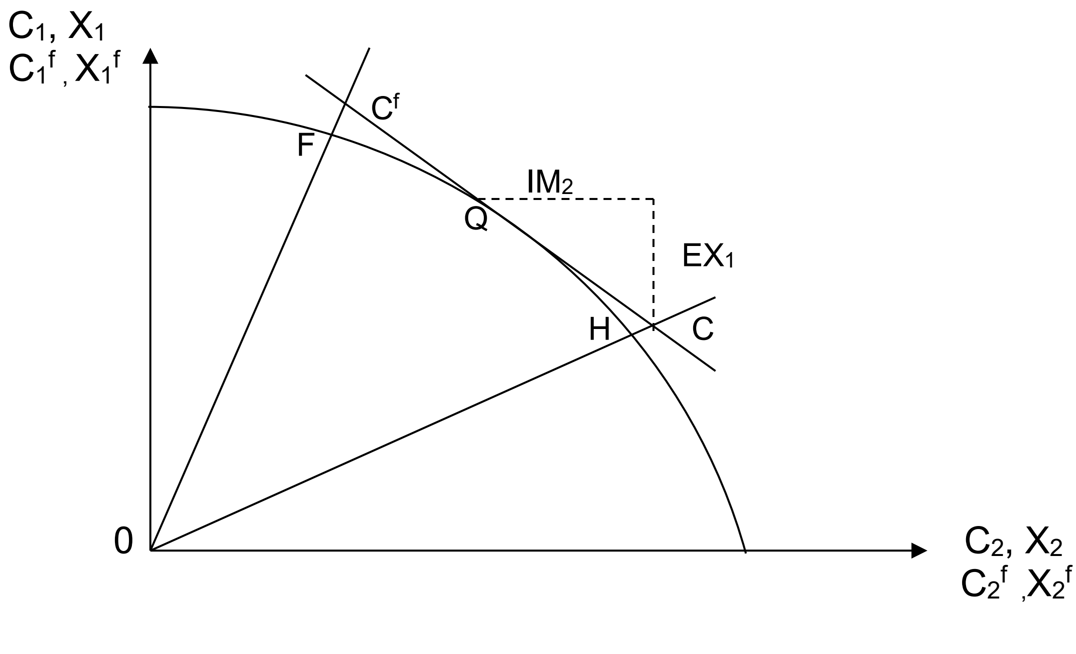

Exhibit 6.2 (3): International Equilibrium

Given the same supply side characteristics, the “law of one price” leads to identical production quantities in both countries (point Q). The consumption of Home is shown in point C:

- demand of good 2 exceeds production; the excess demand is imported:

$$(6.10) \quad IM_2 = C_2 - X_2 [(p_2/p_1)^W]$$

- as for good 1, production exceeds consumption; the excess supply is exported:

$$(6.11) \quad EX_1 = X_1 [(p_2/p_1)^W] - C_1$$

Export and import of Home are indicated by dashed lines in the above exhibit. Together with the price line, they constitute the so-called trade triangle of home. International equilibrium requires that the corresponding triangle of Foreign must have exactly the same size; for reason of clarity, it is not drawn in the graph.

6.3 Generalization of the Demand Side

(1) Budget Restriction: Objective Demand Possibilities

Domestic households spend their entire real income Y^n/p_1 – that is income expressed in units of good 1 – on the consumption of the two goods (Y^n designates nominal income):

(6.15) $$\frac{Y^n}{p_1} = C_1 + \frac{p_2}{p_1} \cdot C_2 \quad .$$

If we solve (6.15) for C_1 and rearrange, the resulting equation (5.60a) describes the budget constraint faced by each household in the economy:

(6.15a) $$C_1 = \frac{Y^n}{p_1} - \frac{p_2}{p_1} \cdot C_2 \quad .$$

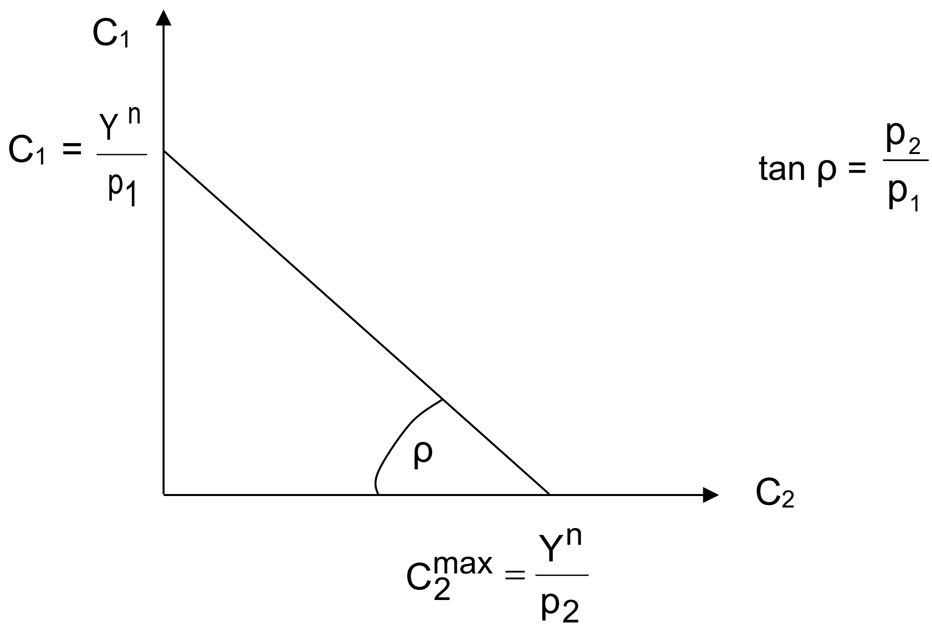

Exhibit 6.3 (1): National Budget Line

The slope of the budget constraint is equal to the first derivative of (6.15a):

$$(6.16) \qquad \left(\frac{dC_1}{dC_2}\right)^{Bil} = -\frac{p_2}{p_1} = -\tan\rho \quad .$$

(2) Welfare function and indifference curves: subjective demand wishes

In contrast to section 6.2, we now assume that the goods are substitutes in consumption. Thus, a given level of welfare can be achieved by alternative combinations of goods 1 and 2. For Home, the welfare function is:

$$(6.17) \qquad U = U(C_1, C_2) \ .$$

Each good provides nonnegative marginal utility. The welfare function can be illustrated in the C_1-C_2-diagram with the help of indifference curves, the slopes of which are negative and convex. As you further know, well-behaved indifference curves cannot cross each other. The slope of an indifference curve is:

$$(6.18) \qquad \left(\frac{dC_1}{dC_2}\right)^{Ind} = -\frac{\frac{\partial U}{\partial C_2}(C_1, C_2)}{\frac{\partial U}{\partial C_1}(C_1, C_2)} = -\tan\Omega .$$

Its absolute value is the marginal rate of substitution (MRS) in consumption:

$$(6.19) \qquad \left(\frac{dC_1}{dC_2}\right)^{MRS} = \left|\frac{dC_1}{dC_2}\right| \quad .$$

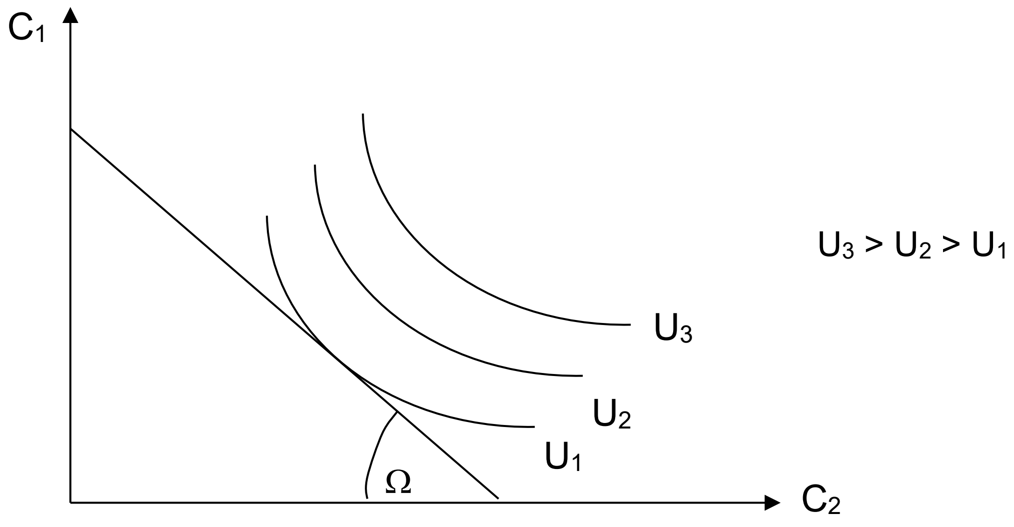

Exhibit 6.3 (2): Community Indifference Curves

We assume that welfare functions are homothetic. (Homogeneous utility functions and their monotonous transformations form the group of homothetic utility functions.) This means that the ratio of the marginal utility of the two goods and, hence, the slope of the indifference curves does not depend on the absolute amounts consumed, but on the quotient of the consumption amounts – the consumption structure – expressed by the term (C_1/C_2):

$$(6.20)\qquad \left(\frac{dC_1}{dC_2}\right)^{Ind} = -\frac{\dfrac{\partial U}{\partial C_2}}{\dfrac{\partial U}{\partial C_1}} = f\underset{-}{\left(\frac{C_1}{C_2}\right)} \quad .$$

The larger the quotient C_1/C_2 is, the smaller the ratio of marginal utilities and the steeper the slope of the indifference curves. Since any ray originating at the origin of the axes is defined by a constant quotient C_1/C_2, (6.20) implies that on a ray from the origin the slope of the indifference curves is constant.

(3) Optimal plan of consumption

By maximizing (6.17) subject to the (6.15), we find the necessary condition for welfare-maximizing consumption levels (C_1^d, C_2^d). Taking (6.20) into account, this can be written as:

$$(6.21) \quad \frac{\frac{\partial U}{\partial C_2}}{\frac{\partial U}{\partial C_1}}\left(\frac{C_1^d}{C_2^d}\right) = \frac{p_2}{p_1} \quad .$$

Thus, in the point of utility-maximization an indifference curve is tangent to the budget constraint, since (6.21) can also be written as:

$$(6.22) \quad \left(\frac{dC_1}{dC_2}\right)^{Ind} = \left(\frac{dC_1}{dC_2}\right)^{Bud}$$

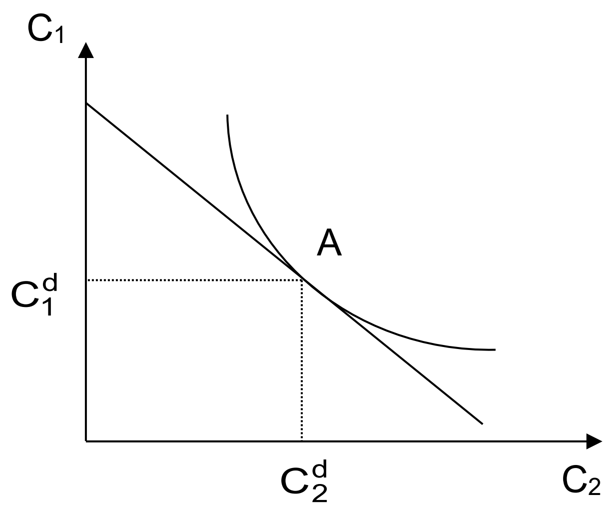

Exhibit 6.3 (3): Optimum Consumption

The amounts demanded of both goods can be derived using (6.21) and (6.15). They are a function of real income Y^n/p_1 and the price ratio p_2/p_1:

$$(6.23) \qquad C_1^d = C_1^d\left(\frac{p_2}{p_1}, \frac{Y^n}{p_1}\right) \quad ,$$

$$(6.24) \qquad C_2^d = C_2^d\left(\frac{p_2}{p_1}, \frac{Y^n}{p_1}\right) \quad .$$

(4) Price-consumption curve

Say we successively lower the price ratio p_2/p_1. Specifically, suppose the ratio sinks solely because the price p_2 decreases. Graphically, this means that the budget restraint rotates in the intercept point with the vertical axis counter-clockwise to the right.

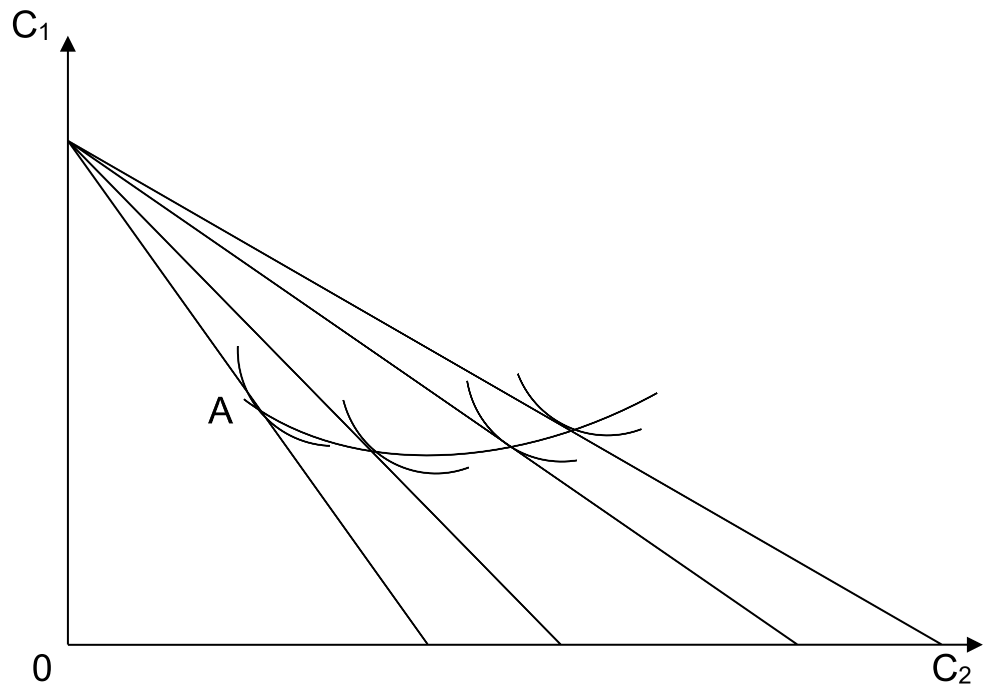

Exhibit 6.3 (4): Price-Consumption Curve

The relative reduction in the price of good 2 has a positive (negative) substitution effect on C_2^d (C_1^d). At the same time, there is a positive income effect on the demanded amounts for both goods. All together, the amount C_2^d increases unequivocally. For C_1^d we are assuming that, at first, the negative substitution effects dominates. Gradually, however, the positive income effect has a growing influence so that ultimately C_1^d increases.

The curve tracing the utility-maximizing points of consumption as the price of one good successively falls is called the price-consumption curve.

(5) Income-consumption curve

Let us now allow real income (Y^n/p_1) to increase successively. The resulting curve tracing the utility-maximizing combinations of the two goods is called the income-consumption curve. As the welfare function is homothetic, the income-consumption curve is linear (just as it was in the case of the activity-analysis welfare function in section 6.1).

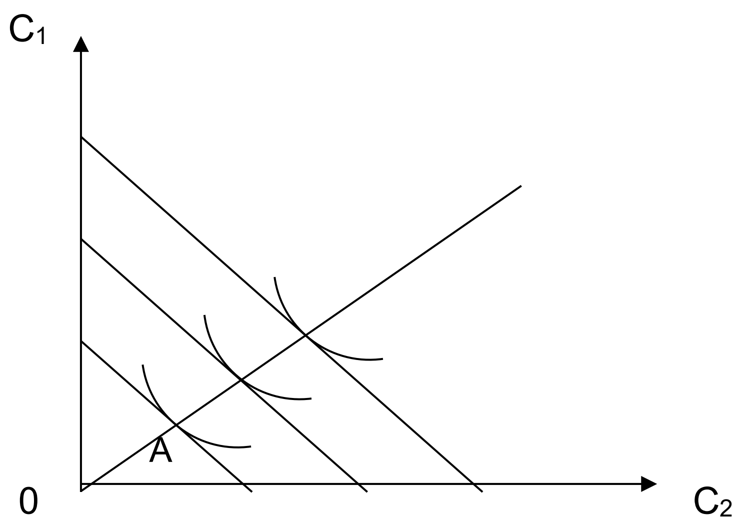

Exhibit 6.2 (5): Income-Consumption Curve