

Gundlach, Erich

Working Paper — Digitized Version

Demand bias as an explanation for structural change

Kiel Working Paper, No. 594

Provided in Cooperation with:

Kiel Institute for the World Economy – Leibniz Center for Research on Global Economic Challenges

Suggested Citation: Gundlach, Erich (1993) : Demand bias as an explanation for structural change, Kiel Working Paper, No. 594, Kiel Institute of World Economics (IfW), Kiel

This Version is available at:

<https://hdl.handle.net/10419/647>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

Kieler Arbeitspapiere

Kiel Working Papers

Kiel Working Paper No. 594

**Demand Bias as an Explanation for
Structural Change**

by

Erich Gundlach

September 1993



Institut für Weltwirtschaft an der Universität Kiel
The Kiel Institute of World Economics

ISSN 0342 - 0787

Kiel Institute of World Economics
D-24100 Kiel
Department IV

Kiel Working Paper No. 594

**Demand Bias as an Explanation for
Structural Change**

by

Erich Gundlach

September 1993

505 166

The authors themselves, not the Kiel Institute of World Economics, are responsible for the contents and distribution of Kiel Working Papers.

Since the series involves manuscripts in a preliminary form, interested readers are requested to direct criticisms and suggestions directly to the authors and to clear any quotations with them.

Demand Bias as an Explanation for Structural Change

by

Erich Gundlach

Abstract

An income elastic demand for services is usually regarded as one of the major explanations for the observed pattern of structural change in the world economy. Recent empirical findings cast some doubt on this demand-bias hypothesis. This paper presents a simple model of structural change that allows an assessment of the implications of alternative demand elasticities. The analysis focusses on restrictions for the set of consistent parameter values derived from demand theory. The results show that lagging productivity growth in the service sector and a homothetic or income inelastic demand for services do not suffice to explain the stylized facts.

Author's address: The Kiel Institute of World Economics
P.O. Box 4309
D-24100 Kiel (Germany)
Phone: (431) 8814-284
Facsimile: (431) 8814-500

I. Introduction

Conventional wisdom has it that the aggregate demand for services is income elastic: With rising incomes, expenditures for services are expected to increase more than proportionally. This demand-bias hypothesis, together with the hypothesis of lagging productivity growth in the service sector, was suggested by Kuznets (1966) and others¹ as an explanation for the long-run rise of the employment share of the service sector that is a common feature of all industrialized countries. E.g., in the United States, about two thirds of the workforce were employed in the service sector² in the early 1990s, up from roughly one third at the turn of the century.

Other stylized facts of structural change that go hand in hand with a long-run rise of income, are an increase in the relative price of services, and more or less invariant real output shares of services. Hence more advanced economies can be expected to employ a larger fraction of the workforce in the service sector, and to pay higher relative prices for services; in real terms, the contribution of services to GDP will remain much the same in advanced and less advanced economies, however. In the literature, these empirical regularities³ are sometimes referred to as "Petty's Law" (Clark, 1951) or the "cost disease of stagnant services" (Baumol, 1991).

Intuitively, income elastic demand for services (demand bias) and lagging productivity growth in the service sector (productivity bias) may give a reasonable explanation for the stylized facts of structural change. Yet up to now there have been only very few attempts to check the consistency of the demand-bias and the productivity-bias hypotheses within a theoretical model economy. Baumol (1966) suggested a two-goods-one-factor model, with a focus on the supply side. Models with two factors and two goods known from international trade theory and adopted for the present context, usually either abandon the demand bias⁴ (Wolff, 1985) or the productivity bias (Siebert, 1977) to guarantee a model solution.⁵ Hence the Baumol-model, extended by an explicit demand specification as suggested by Inman (1985b), still represents a useful framework to assess the plausibility and the interaction of the demand-bias and productivity-bias hypotheses as explanations for the stylized facts of structural change.

¹ For an overview, see Inman (1985a).

² "Services" defined as: wholesale and retail trade; finance, insurance real estate; other services; public administration. The figures are taken from Fuchs (1981) and U.S. Department of Commerce (1992).

³ For international comparisons, see, e.g., Clark (1951, 1979), Kuznets (1966), Kravis et al. (1982), Heinger (1983), van Gemert (1987), Gundlach (1993).

⁴ For an exception, see Bergstrand (1991).

⁵ For models with two factors and two goods which focus on the demand side but do not provide a solution for sectoral employment shares, see Cheatham et al. (1974) and Skolka (1977). For a similar model with increasing returns to scale, see Locay (1990).

The basic motivation for a reconsideration of this approach is twofold. First, it can be shown that some restrictions derived from demand theory effectively constrain the set of parameter values which is capable of reproducing the stylized facts of structural change in a hypothetical two-goods-one-factor economy. This aspect has not been discussed in the literature so far. Second, the consensus figure for the income elasticity of demand for services seems to be about 1.05 (Inman, 1985b) but empirical evidence in favor of such an estimate has been challenged by recent studies: In an international cross-section analysis, Summers (1985) finds an income elasticity which is not different from 1; Hammes et al. (1989) find an income *inelastic* demand for services in a time series analysis for Canada, France, and the US; Gundlach (1993) finds no conclusive evidence in favor of an income elastic services demand for Germany.

This paper looks at the consequences of an income inelastic or homothetic services demand for an explanation of structural change, i.e. whether these preferences give rise to a theoretically consistent set of parameter values which is compatible with a reproduction of the stylized facts. Section II outlines a two-goods-one-factor model of structural change. Section III presents the model's predictions with regard to relative prices, output shares, and employment shares as a function of supply and demand parameters. Section IV uses alternative parameter estimates from the empirical literature to check the model's ability to reproduce the stylized facts. The concluding section summarizes the main arguments in a diagrammatic way.

II. A Simple Model of Structural Change

Consider a model that attempts to explain shifts in the sectoral allocation of output and labor within a closed system, call it the world economy. Within this world economy, aggregate supply (Q^S) equals aggregate demand (Q^D) at time t :

$$(1) \quad Q_t^S = Q_t^D.$$

Assume that the model economy consists of the two sectors manufactures (m) and services (s), each of them completely specialized either in the production of manufactures (Q_m) or services (Q_s). The only input factor, labor (L), and technology are given; the growth rate of labor productivity (r) in the manufacturing sector is higher than in the service sector ($r_m > r_s$). Hence the two production functions read

$$(2) \quad Q_{m_t}^S = a L_{m_t} e^{r_m t}$$

$$(3) \quad Q_{s_t}^S = b L_{s_t} e^{r_s t}$$

where a and b are constants.

The two demand functions are given by

$$(4) \quad Q_{m_t}^D = c p_{m_t}^{\varepsilon_{mm}} p_{s_t}^{\varepsilon_{ms}} y_t^{\eta_m} L_t$$

$$(5) \quad Q_{s_t}^D = c p_{s_t}^{\varepsilon_{ss}} p_{m_t}^{\varepsilon_{sm}} y_t^{\eta_s} L_t$$

with p_i : prices
 y : income per worker
 ε_{ij} : price elasticities
 η_i : income elasticities
 c, d : constants

where the demand-bias hypothesis postulates that

$$\eta_s > 1, \text{ i.e. } \eta_s > \eta_m.$$

With full employment and perfect competition, income per worker equals the value of the marginal product of labor and is the same in both sectors due to the intersectoral mobility of labor:

$$(6) \quad y_{m_t} \equiv \frac{\partial Q_{m_t}^S}{\partial L_{m_t}} p_{m_t} = a p_{m_t} e^{r_{m_t} t}$$

For simplicity, set $p_m \equiv 1$ and get

$$(7) \quad y_t = a e^{r_{m_t} t}$$

as the wage equation and

$$(8) \quad \frac{dy_t/dt}{y_t} = r_m$$

as the percentage rate of change of income per worker over time. Finally, the budget constraint of the model economy is given by

$$(9) \quad y_t L_t = p_{m_t} Q_{m_t}^D + p_{s_t} Q_{s_t}^D$$

This set-up differs from previous approaches in two ways. First, I delete the restriction that output shares do not change with rising incomes, and second, I use a more flexible demand specification which allows to account for cross-price effects. Therefore, this model is less restrictive with respect to the output structure and at the same time makes possible to constrain the set of consistent parameter values by having recourse to the general restrictions of demand theory.

III. The Stylized Facts of Structural Change in the Model Economy⁶

The model's predictions for the stylized facts of structural change can be derived as follows. With perfect competition, prices equal marginal cost in equilibrium. In a one-factor model, marginal cost (mc) is defined by the ratio of income per worker to physical marginal product

$$(10) \quad mc_m \equiv \frac{y}{\partial Q_m / \partial L_m} = p_m$$

$$(11) \quad mc_s \equiv \frac{y}{\partial Q_s / \partial L_s} = p_s$$

Differentiating the production functions (2) and (3) with respect to labor, and solving for prices gives the solution for *relative prices* as

$$(12) \quad p_m / p_s = \frac{y a e^{r_m t}}{y b e^{r_s t}} \\ = \frac{a}{b} e^{(r_m - r_s)t}$$

and the percentage rate of change of relative prices over time is given by

$$(13) \quad \frac{d(p_s / p_m) / dt}{p_s / p_m} = r_m - r_s$$

Given that the productivity-bias hypothesis holds ($r_m > r_s$), equation (13) confirms that the relative price of services will increase over time which is compatible with the stylized empirical evidence.

The simple model outlined above does not consider intermediate products and no investment goods. Therefore, the structure of production equals the structure of consumption:

$$(14) \quad \frac{Q_s^S}{Q_m^S} = \frac{Q_s^D}{Q_m^D} = \frac{Q_s}{Q_m}$$

Using the demand equations (4) and (5), the wage equation (7), and the equation for relative prices (12), it can be shown that (for $p_m \equiv 1$) the solution for the *output structure* is determined by

$$(15) \quad \frac{Q_s}{Q_m} = \frac{d}{c} p_s^{(\epsilon_m - \epsilon_m)} y^{(\eta_s - \eta_m)} \\ = f e^{[(r_m - r_s)(\epsilon_m - \epsilon_m) + r_m(\eta_s - \eta_m)]}$$

⁶ In the following sections, time subscripts are deleted for convenience.

$$\text{with } f = \frac{d}{c} \left(\frac{a}{b} \right)^{(\epsilon_{ss} - \epsilon_{ms})} a^{(\eta_s - \eta_m)}$$

and the percentage rate of change of the quantity structure over time is given by

$$(16) \quad \frac{d(Q_s/Q_m)/dt}{Q_s/Q_m} = (r_m - r_s)(\epsilon_{ss} - \epsilon_{ms}) + r_m(\eta_s - \eta_m) .$$

To get a result for the employment structure of the model economy, the production functions (2) and (3) can be solved for L . Again using the wage equation (7), the equation for relative prices (12), and the demand equations (4) and (5), it can be shown that (for $p=1$) the employment structure is determined by

$$(17) \quad \frac{L_s}{L_m} = \frac{a}{b} \frac{d}{c} \left[\frac{a}{b} e^{(r_m - r_s)t} \right]^{(\epsilon_{ss} - \epsilon_{ms})} \left[a e^{r_m t} \right]^{(\eta_s - \eta_m)} e^{(r_m - r_s)t} \\ = g e^{[(r_m - r_s)(1 + \epsilon_{ss} - \epsilon_{ms}) + r_m(\eta_s - \eta_m)]t}$$

$$\text{with } g = \frac{a}{b} \frac{d}{c} \left(\frac{a}{b} \right)^{(\epsilon_{ss} - \epsilon_{ms})} a^{(\eta_s - \eta_m)}$$

and the percentage rate of change of the employment structure over time is given by

$$(18) \quad \frac{d(L_s/L_m)/dt}{L_s/L_m} = (r_m - r_s)(1 + \epsilon_{ss} - \epsilon_{ms}) + r_m(\eta_s - \eta_m) .$$

In contrast to the result for relative prices, the model does not give a definite confirmation of the stylized facts for the output and employment structure: Given that demand bias ($\eta_s > \eta_m$) and productivity bias ($r_m > r_s$) hold, equations (16) and (18) allow for rising, constant, or declining shares, depending on the actual outcome of the price elasticities.

If the quantity structure is assumed to remain constant, however, the employment structure must change in favor of the service sector. To see why this is so, note that equation (18) is the sum of equation (16) plus $(r_m - r_s)$. I.e., if equation (16) equals zero, equation (18) predicts a change of the employment share of the service sector equal to $(r_m - r_s)$ which is assumed to be positive according to the productivity-bias hypothesis. Without assuming a constant output structure, the question that arises is whether the sign and the size of the term $(\epsilon_{ss} - \epsilon_{ms})$ in both equations (16) and (18) is compatible with demand bias, productivity bias, and stylized facts. For given $(\eta_s - \eta_m) > 0$ and $(r_m - r_s) > 0$, the quantity structure (equation (16)) cannot remain constant if $(\epsilon_{ss} - \epsilon_{ms}) > 0$; the employment structure (equation (18)) may change in favor of the manufacturing sector or remain constant, if $(\epsilon_{ss} - \epsilon_{ms}) < -1$. Having recourse to demand theory helps to clarify this issue.

Rational behavior of consumers requires that every demand system must satisfy the general restrictions

$$(19) \quad \sum_i w_i \eta_i = 1 \quad (\text{adding up})$$

$$(20) \quad \sum_j \epsilon_{ij}^* = 0 \quad (\text{homogeneity})$$

$$(21) \quad \epsilon_{ij}^* w_i = \epsilon_{ji}^* w_j \quad (\text{symmetry})$$

$$(22) \quad \epsilon_{ii}^* < 0 \quad (\text{negativity})$$

with w_i = expenditure shares

ϵ_{ij}^* = compensated price elasticities.

With two goods, only two of the six demand parameters can be chosen independently, if these general restrictions hold.⁷ For $\eta_s > \eta_m$, equations (19)-(22) imply that in the case of two goods $(\epsilon_{ss} - \epsilon_{ms})$ is negative but not necessarily larger than -1. This result follows from the definition of uncompensated price elasticities

$$(23) \quad \epsilon_{ij} = \epsilon_{ij}^* - \eta_i w_j$$

which can be used together with the homogeneity condition (20) and the symmetry condition (21) to get

$$(24) \quad \epsilon_{ss} - \epsilon_{ms} = \epsilon_{ms}^* \left(-1 - \frac{w_m}{w_s} \right) - w_s (\eta_s - \eta_m) .$$

In the case of two goods, compensated cross price elasticities cannot be negative due to the negativity condition (22) and the homogeneity condition (20). Therefore, the first term of equation (24) is negative, because expenditure shares are always positive; for $\eta_s > \eta_m$, the second term is negative, too. Hence $(\epsilon_{ss} - \epsilon_{ms})$ is negative, if the general restrictions of demand theory hold, but not necessarily larger than -1. This result shows that productivity bias and demand bias alone do not suffice to reproduce the stylized facts of structural change. The price elasticities have also to be taken into account, i.e. $0 > (\epsilon_{ss} - \epsilon_{ms}) > -1$ must hold.⁸ Theory only predicts the negative sign of $(\epsilon_{ss} - \epsilon_{ms})$, not its size which is a purely empirical question.

⁷ For n goods, the number of parameter values that can be chosen independently is given by $(n-1)(1/2n+1)$; see, e.g., Deaton, Muellbauer (1980).

⁸ This restriction has been largely ignored in the literature. For a hint, see Bradford (1969) who points out that the Baumol-model (1966) implicitly requires the assumption of a (own-) price inelastic demand for services to generate a rising employment share of the service sector.

IV. The Implications of Alternative Demand Elasticities

Recent empirical research casts some doubt on the hypothesis that the aggregate demand for services is income elastic. By contrast, the hypothesis of lagging productivity growth in the service sector is unchallenged up to now, and the consensus figure for the uncompensated own-price elasticity of the demand for services is about -0.6 (Inman, 1985b).⁹ The following computations demonstrate the impact of alternative income elasticities of the demand for services on the model's prediction for the stylized facts of structural change, given that the productivity-bias hypothesis holds and the demand for services is price inelastic. All computations assume that the expenditure share of services (w_s) is 40 per cent; hence the expenditure share of manufactures (w_m) is 60 per cent.

(a) Income Elastic Demand for Services

This case represents the traditional demand-bias hypothesis. Assume that

$$(25) \quad \eta_s = 1.05 \text{ and}$$

$$(26) \quad \epsilon_{ss} = -0.6.$$

From the adding-up condition (19), it follows that

$$(27) \quad \eta_m = (1 - \eta_s w_s) / w_m \\ = 0.97$$

and using the homogeneity condition (20), it follows from equation (23) that

$$(28) \quad \epsilon_{sm}^* = \epsilon_{sm} + \eta_s w_m \\ = 0.18.$$

I.e., the assumed parameter values for η_s and ϵ_{ss} are consistent with the restriction of demand theory because they imply a positive compensated cross-price elasticity. For the predictions of the model with regard to output and employment structures (see equations (16) and (18)), $(\epsilon_{ss} - \epsilon_{ms})$ has to be calculated. The symmetry condition (21) gives

$$(29) \quad \epsilon_{ms}^* = \epsilon_{sm}^* w_s / w_m \\ = 0.12$$

which can be converted by equation (23) into

⁹ For supporting evidence with regard to the price elasticity based on international cross-section studies, see, e.g., Luch et al. (1977) and Summers (1985). In the latter, the published elasticity of -0.06 obviously is a printing error.

$$\begin{aligned}
 (30) \quad \varepsilon_{ms} &= \varepsilon_{ms}^* - \eta_m w_s \\
 &= -0.27 .
 \end{aligned}$$

As a result, $0 > (\varepsilon_{ss} - \varepsilon_{ms}) > -1$, which allows for a reproduction of the stylized facts for the output structure and employment structure if the positive and the negative term in equation (16) add up to zero.

(b) Homothetic Demand for Services

With a homothetic demand for services ($\eta_s = 1$, see Summers (1985)), the demand for manufactures is homothetic as well ($\eta_m = 1$) if the adding up condition (19) holds. With $\varepsilon_{ss} = -0.6$ as before, it follows from the homogeneity condition (20) that

$$(31) \quad \varepsilon_{sm} = -0.4 .$$

Similar to the previous case, it can be shown that the compensated cross-price effect is positive and $(\varepsilon_{ss} - \varepsilon_{ms}) < 0$. This parameter constellation is theoretically consistent but does not reproduce the stylized fact for the output structure (equation (16)): For homothetic demand, $(\eta_s - \eta_m) = 0$, i.e. the output structure is predicted to change in favor of the manufacturing sector because in this case, the first term of equation (16) is negative.

Alternatively, a homothetic demand for services as suggested by Summers (1985) may be interpreted in terms of a Cobb-Douglas utility function. Such a specification, however, introduces the additional restriction that the uncompensated own-price elasticity equals -1 as well. As a consequence, the employment structure is predicted to remain unchanged because then both terms on the right-hand-side of equation (18) equal zero. By contrast, the output structure (equation (16)) is predicted to change in favor of the manufacturing sector. Hence Cobb-Douglas preferences are incompatible with the stylized facts, because they imply just the opposite of the actually observed pattern of structural change.

(c) Income Inelastic Demand for Services

Consider an income elasticity of the demand for services

$$(32) \quad \eta_s = 0.65$$

which is an average taken from Hammes et al. (1989), and

$$(33) \quad \varepsilon_{ss} = -0.3$$

which is the only statistically significant price elasticity of the demand for services estimated by Hammers et al. (1989). The corresponding compensated price elasticity can be computed as

$$(34) \quad \epsilon_{ss}^* = -0.4$$

and, using the homogeneity condition (20), the compensated cross-price elasticity equals

$$(35) \quad \epsilon_{sm}^* = 0.4$$

which is compatible with the general restrictions. These parameter values are not compatible, however, with a constant output structure. The symmetry condition (21) gives

$$(36) \quad \begin{aligned} \epsilon_{ms}^* &= \epsilon_{sm}^* w_s / w_m \\ &= 0.03 \end{aligned}$$

and the uncompensated cross-price elasticity is given by

$$(37) \quad \begin{aligned} \epsilon_{ms} &= \epsilon_{ms}^* - \eta_m w_s \\ &= -0.46 \end{aligned}$$

where η_m follows from the adding up condition (19) as

$$(38) \quad \eta_m = 1.23.$$

Hence in this set up, the term $(\epsilon_{ss} - \epsilon_{ms})$ is *positive*. As a consequence, the equation for the employment structure (18) gives an indefinite prediction because the first term is positive and the second term is negative; the equation for the quantity structure (16) predicts a change in favor of the manufacturing sector, in contrast to the observed stylized fact. The latter result can be derived as follows.

Insert the right-hand-side of equation (24) into equation (16) and rearrange terms to arrive at

$$(39) \quad \frac{d(Q_2/Q_1)/dt}{Q_2/Q_1} = (r_m - r_s) \epsilon_{ms}^* \left(-1 - \frac{w_m}{w_s} \right) \\ - r_m w_s (\eta_s - \eta_m) \\ + r_s w_s (\eta_s - \eta_m) \\ + r_m (\eta_s - \eta_m)$$

The underlying assumptions imply that

$$\begin{aligned}
 r_m, r_s &> 0 \\
 r_m - r_s &> 0 \\
 \varepsilon_{ms}^* &> 0 \\
 w_i &> 0 \\
 \eta_s - \eta_m &< 0
 \end{aligned}$$

Therefore, the second term in equation (39) is positive, all other terms are negative. Since the second term is smaller than the fourth

$$(40) \quad r_m w_s (\eta_s - \eta_m) < r_m (\eta_s - \eta_m)$$

the right-hand-side of equation (39) is negative, indicating a rise of the output share of the manufacturing sector.

V. Income Elasticities and Stylized Facts: Conclusion

Together with the productivity-bias hypothesis, an income elastic demand for services is regarded as a major determinant of the uniform pattern of structural change observed in the world economy. Recent empirical evidence casts some doubt on the validity of the demand-bias hypothesis. The implications of these findings for an explanation of the stylized facts for the output structure and the employment structure have been discussed in detail in the previous section. This discussion can be summarized with the help of simple diagrams which show the impact of alternative income elasticities (representing alternative consumer preferences) on the output structure.

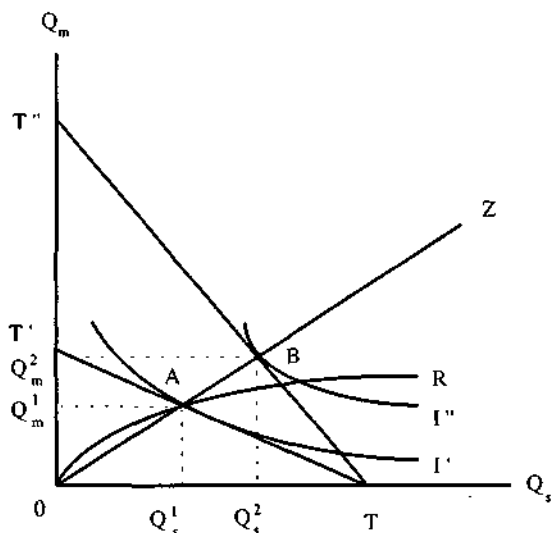
The basic setting of each diagram is the same. The output of the manufacturing sector (Q_m) is given on the vertical axis, the output of the service sector (Q_s) is given on the horizontal axis. The transformation curve (TT') is linear and identical to the price line because there is only one input factor (labor). The indifference curve (I') represents consumer preferences.

The initial equilibrium in A is determined by the indifference curve I' tangential to the transformation curve TT' . Hence in A the marginal rate of substitution equals the marginal rate of transformation equals the price ratio. With relatively faster productivity growth in the manufacturing sector, the relative price of services increases (see equation (13)). I.e., the slope of the transformation curve (price line) increases and this new transformation curve is given by TT'' . The new equilibrium is realized in B, where a higher indifference curve I'' is tangential to TT'' . Alternative consumer preferences give rise to alternative expansion paths OR which must satisfy the condition that the slope at the intersection of the expansion path and the indifference curve is the same for all indifference curves. The impact of alternative consumer preferences on the sectoral output shares is given by a comparison of the ratio

Q_m/Q_D in the equilibrium points A and B. I.e., the quantity structure does not change if both A and B lie on the same ray OZ through the origin.

Figure 1 shows how an income elastic demand for services may influence the output structure. With rising income, the new equilibrium in B may or may not exhibit the same output share of services. Put differently, an income elastic demand for services and lagging productivity growth in the service sector are capable of reproducing a constant output structure, yet there is no mechanism in the system which guarantees such an outcome.

Figure 1 - Income Elastic Demand for Services



Figures 2 and 3 represent cases which are supported by recent empirical studies. The implication of a homothetic demand for services (Figure 2) is that the output structure cannot remain constant. The new equilibrium in B must lie above the OR (OZ) line, i.e. with rising income and homothetic preferences, the manufacturing sector will gain output shares. The same picture emerges for an income inelastic demand for services, with a potentially even larger shift in favor of the manufacturing sector (Figure 3). Such a result is not supported by the empirical evidence for the output structure, however.

Figure 2 - Homothetic Demand for Services

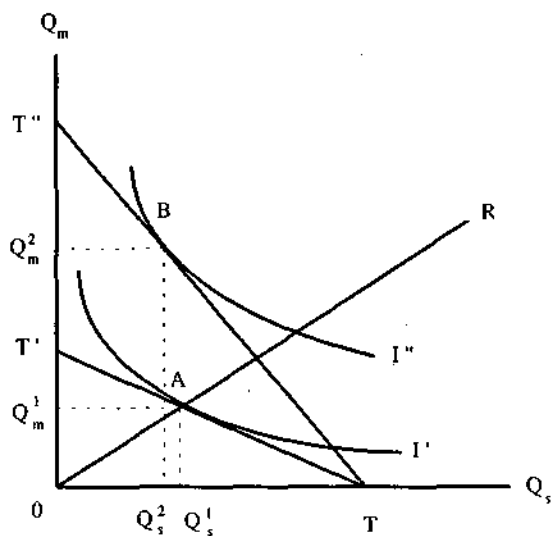
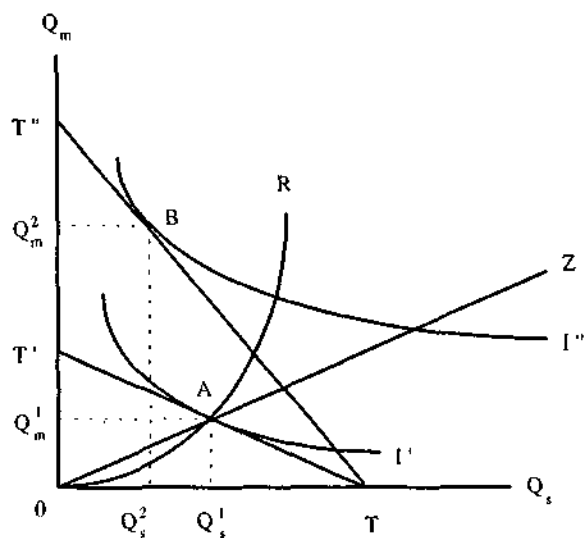


Figure 3 - Income Inelastic Demand for Services



Summing up, the discussion of this model outlined in section II has shown that demand bias and productivity bias provide a potential explanation for the observed stylized facts of structural change with respect to relative prices, employment shares, and output shares. Yet both hypotheses together do not guarantee such an outcome. The subsequent analysis has shown that a successful explanation of the stylized facts depends on the actual size of certain parameter values including price elasticities which have been overlooked in most of the literature so far. Furthermore, for the model economy to be compatible with the stylized facts, the income elasticity of the demand for services is required to be larger than 1, contrary to recent empirical evidence. This evidence is based on different data and estimation methods and, therefore, it is not plausible to argue that it is completely misleading. Hence it obviously is the model of structural change that has to be changed to give a proper account of the stylized facts.

One possible extension of the model could be to include socio-demographic factors such as, e.g., changing age structures of the population due to declining birth rates, declining household sizes, and increasing female labor force participation, which all can be expected to have a positive impact on aggregate demand for services. The link between these factors and the rising share of service sector employment derives from the fact that the increase in female labor force participation is concentrated on the service sector. I.e. more women entering the labor market may not only mean relative employment gains of the service sector, but also a higher aggregate demand for services because of the implied necessary substitution of non-market services produced within the household. This effect could probably counter-balance the counterfactual shift of the output structure in favor of manufactures predicted by the model presented in this paper, without disregarding the empirical evidence on demand elasticities.

The open question is whether socio-demographic factors are exogenous or are themselves influenced by changes in relative prices and income, as suggested by the literature on the economics of population.¹⁰ If so, the model outlined in this paper would have to be extended substantially, but no other exogenous variables than preferences (demand elasticities) and technology (sectorally different rates of productivity growth) would be necessary to drive such a model. Going through the literature on both structural change and the economics of population, it becomes apparent that in the former, socio-demographic factors are considered to be exogenous (see, e.g., Fuchs (1968)) whereas in the latter, rising employment shares of

¹⁰ For a survey, see, e.g., Schultz (1981).

the service sector are assumed to be exogenous (see, e.g., Winegarden (1984), Schultz (1985)). Therefore, a synthesis of these rather diverse strands of the literature may help to explain structural change in the world economy by endogenizing a number of socio-demographic factors.

References

- Baumol, William J., "Macroeconomics of Unbalanced Growth: The Anatomy of Urban Crisis". *The American Economic Review*, Vol. 57, 1967, No. 3, pp. 415-426.
- Baumol, William J., "Toward a Newer Economics: The Future Lies Ahead!" *The Economic Journal*, Vol. 101, 1991, pp. 1-8.
- Bergstrand, Jeffrey H., "Structural Determinants of Real Exchange Rates and National Price Levels: Some Empirical Evidence". *The American Economic Review*, Vol. 81, 1991, No. 1, pp. 325-334.
- Bradford, David F., "Balance on Unbalanced Growth". *Zeitschrift für Nationalökonomie*, Vol. 29, 1969, No. 3/4, pp. 237-266.
- Cheetham, Russel J., Allen C. Kelley, Jeffrey G. Williamson, "Demand, Structural Change, and the Process of Economic Growth". In: Paul A. David, Melvin W. Reder (Eds.), *Nations and Households in Economic Growth. Essays in Honor of Moses Abramovitz*. New York 1974, pp. 239-263.
- Clark, Colin, *The Conditions Economic Progress*. 2nd ed., London 1951.
- Clark, Colin, "Productivity in the Service Industries". In: C.H. Hanumantha Rao, P.C. Joshi (Eds.), *Reflections on Economic Development and Social Change. Essays in Honour of Professor V.K.R.V. Rao*. New Delhi 1979, pp. 141-168.
- Deaton, Angus S., John Muellbauer [1980], "An Almost Ideal Demand System". *The American Economic Review*, Vol. 70, 1980, No. 3, pp. 312-326.
- Fuchs, Victor R., *The Service Economy*. New York 1968.
- Fuchs, Victor R., "Economic Growth and the Rise of Service Employment". In: Herbert Giersch (Ed.), *Towards an Explanation of Economic Growth. Symposium 1980. Tübingen 1981*, pp. 221-242.
- Gemert, Henk G., van, "Structural Change in OECD Countries: A Normal Pattern Analysis". *De Economist*, Vol. 135, 1987, No. 1, pp. 29-51.
- Gundlach, Erich, *Die Dienstleistungsnachfrage als Determinante des wirtschaftlichen Strukturwandels*. Kieler Studien, 252, Tübingen, 1993.
- Hammes, David L., Jean-Jaques Rosa, Herbert G. Grubel, "The National Accounts, Household Service Consumption and Its Monetization". *Kyklos*, Vol. 42, 1989, pp. 3-15.
- Heitger, Bernhard, *Strukturwandel und realer Wechselkurs*. Kieler Studien, 183, Tübingen 1983.
- Inman, Robert P. [1985a], (Ed.), *Managing the Service Economy. Prospects and Problems*. Cambridge, MA, 1985.
- Inman, Robert P. [1985b], "Introduction and Overview". In: Robert P. Inman (Ed.), *Managing the Service Economy. Prospects and Problems*. Cambridge, MA, 1985, pp. 1-24.
- Kravis, Irving B., Alan W. Heston, Robert Summers, *World Product and Income. International Comparisons of Real Gross Product*. Baltimore 1982.
- Kuznets, Simon, *Modern Economic Growth. Rate, Structure, and Spread*. New Haven 1966.

- Lluch, Constantino, Alan A. Powell, Ross A. Williams, *Patterns in Household Demand and Saving*. New York 1977.
- Locay, Luis, "Economic Development and the Division of Production between Households and Markets". *Journal of Political Economy*, Vol. 98, 1990, pp. 965-982.
- Schultz, T. Paul, *Economics of Population*. Reading MA, 1981.
- Schultz, T. Paul, "Changing World Prices, Women's Wages and the Fertility Transition: Sweden, 1860-1910". *Journal of Political Economy*, Vol. 93, 1985, pp. 1126-1154.
- Siebert, Horst, "Sektorstruktur, Preise und Faktorallokation". *Jahrbücher für Nationalökonomie und Statistik*, Vol. 192, 1977, pp. 225-243.
- Skolka, J., "Long-Term Effects of Unbalanced Labour Productivity Growth: On the Way to a Self-Service Society". In: L. Solari, J.-N. du Pasquier (Eds.), *Private and Enlarged Consumption*. Amsterdam 1976, pp. 279-301.
- Summers, Robert, "Services in the International Economy". In: Robert P. Inman (Ed.), *Managing the Service Economy, Prospects and Problems*. Cambridge, MA, 1985, pp. 27-48.
- U.S. Department of Commerce, Economics and Statistics Administration, Bureau of the Census, *Statistical Abstract of the United States 1992*. Washington, D.C., 1992.
- Winegarden, C.R., "Women's Fertility, Market Work and Marital Status: A Test of the New Household Economics with International Data". *Economica*, Vol. 51, 1984, pp. 447-456.
- Wolff, Edward N., *Unbalanced Growth, Capital Accumulation and Productivity Growth*. C.V. Starr Center for Applied Economics, Economic Research Reports, 85-19, May 1985.