Product Demand Shifts and Wage Inequality

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Abstract

The UK and the US have experienced both rising skill premia and rising employment of skilled workers since the 1980s. These trends are typically interpreted as concurrent shifts of relative skill supplies and demands, and the demand shifts are attributed to skill biased technological change or changes in international trade patterns. If more skilled workers demand more skill intensive goods, then an exogenous increase in relative skill supplies will also induce a shift in relative demand. This channel reduces the need to rely on technology and trade to explain the patterns in the data. In this paper, I illustrate this mechanism in a simple two-sector general equilibrium model. The empirical part of the paper demonstrates that more educated and richer workers indeed demand more skill intensive goods in the UK. Calibration of the model suggests that this induced demand shift can explain 12% of the total relative demand shift in the UK between 1981 and 1993. The baseline model only explains between industry shifts in skill upgrading and wage inequality, while empirically, most of these changes took place within industries. An extension of the model with different qualities of goods and labor is also able to explain some of the within industry changes.

Keywords: Wage inequality, Demand shifts, Income elasticity.
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1 Introduction

Wage inequality increased substantially in the US and UK during the 1980s. College graduates in the US earned 41 percent more than high school graduates in 1980, by 1995 they earned 62 percent more [Autor, Katz and Krueger, 1998]. In the UK, in 1978, median wages of workers who left school after age 18 were 40 percent higher than those who left school at or before 16. By 1995 this differential had increased to over 60 percent [Machin, 1999]. Overall wage inequality also increased sharply. The 90-10 log wage differential for male workers increased from 0.9 to 1.17 from 1979 to 1994 in the UK and from 1.16 to 1.45 in the US [Autor and Katz, 1999]. At the same time the employment shares of college graduates rose from 19.2% in 1980 to 26.7% in 1996 in the US and from 8% in 1980 to 13% in 1997 in the UK. The pattern of the increase in wage inequality and the skill premium in the US and UK during the 1980s has been well documented[1], yet much disagreement remains about the causes of the changes. All the theories are faced with the challenge of explaining why the demand for skills accelerated and the college premium increased soon after an unprecedented increase in the supply of skills during the 1970s and the 1980s. Several explanations have been proposed to explain the shift of demand against low skilled workers, in particular: skill biased technical change, trade liberalization and deunionization.

In the skill biased technical change literature Katz and Murphy [1992] and Card and Lemieux [2000] claim that a steady growth in the relative demand for skilled workers combined with a slowing supply is at the base of the rise in wage inequality in the 80s and 90s. Other studies argue that there has been an acceleration in the relative demand for skills in the 1980s. The most popular ones are based on skill biased technical change associated with changes in production techniques [Acemoglu, 1998], organizational changes [Acemoglu 1999], the reduction of the relative price of computer services [Krusell et al., 1999] or the non linear diffusion of "technological revolutions" [Aghion and Howitt, 1998].

The trade literature has focused instead on increased competition from developing countries. Increased trade will have an adverse effect on the demand for less skilled workers as long as import-competing industries are low skill intensive and exporting industries are high skill intensive [Wood, 1996]. The trade explanation fails to be supported by the evidence. First, trade with developing countries is only a very small proportion of GDP of most industrialized countries and therefore it's unlikely to have a big effect on wage inequality [Krugman 1995]. Second, the trade explanation implies a rise in the relative prices of skill intensive goods in developed countries, but empirical studies find little evidence of this [Sachs and Shatz, 1994; Krueger, 1997]. Third, the trade explanation is based on the relocation of labor from low skill intensive to high skill intensive sectors. However, the empirical evidence indicates that most of the shift away from the low skilled took place through within industry changes (60% to 80%) rather than through between industry changes [Berman, Bound and Griliches, 1994; Katz and Murphy, 1992].

Some other studies argue that the change in wage setting institutions such as the decline of the unions and of the real value of the minimum wage can be associated with the increase in wage inequality [DiNardo et al., 1996; Lee, 1999]. The main problem with this explanation is that in the US deunionization began much before wage inequality started to rise. In the UK deunionization began later than the rise in wage inequality.

In this paper I investigate another mechanism that can generate wage inequality. If more skilled workers demand more skill intensive goods, then an exogenous increase in relative skill supplies will also induce a shift in relative demand. If preferences are not homothetic, an increase in the relative supply of skilled workers can shift demand for final products in favor of skill intensive goods and contribute to explaining the rise in the relative demand for skills. Sectors whose technology requires a large proportion of skilled workers are increasingly important in the economy. The weight of industries such as financial services, insurance, health, education, pharmaceuticals, computers, and legal services has increased over

[1] See, for the US, Katz and Autor [1999]. For the UK, Machin [1999].

time both in terms of wage bill share and in terms of share of total employment. If workers that enter those sectors tend to consume more of the goods produced by the same sectors, then an increase in their supply may help create additional demand for their own labor services. Part of the outward shift in the relative demand for skills can be explained by the shift in expenditure from low skill intensive goods to high skill intensive goods induced by the increase in the relative supply of skilled workers.

This paper is related to a recent literature that suggests that changes in supply of skills may induce changes in demand of skills. Acemoglu [1998] gives an explanation in terms of directed technical change. In this model R&D activity is monopolistic in nature and technology producers make more profits the more workers use their new technology. A large increase in the supply of college graduates first moves the economy along the relative demand curve, but then it also increases the size of the market for technologies complementary to skills. This induces a change in the direction of technical change and a shift of the relative demand for skills. In another paper, Acemoglu [1999] suggests that when the fraction of skilled workers increases, profit maximizing firms are induced into creating more jobs targeted for this group. When there are few skilled workers and the productivity gap between the skilled and unskilled is limited, firms create one type of job (one single level of capital) and pool across all types of workers. When the supply of skilled workers rises or their relative productivity increases, firms are induced to differentiate the types of jobs they offer. Some firms invest in more capital than others and target skilled workers only. As a result, skilled workers work with a higher level of capital and wage inequality increases. Kiley [1997] shows in an expanding varieties model that an increase in the supply of skills can induce skill biased technical change and wage inequality. In his model like in Acemoglu's [1998] the attractiveness of investing in skill biased technology depends on the supply of the factor that complements that technology.

My paper differs from this literature in that the link between the rise in supply of skills and the rise in demand for skills is due to consumption elasticities. The mechanism at work is the following: an increase in the supply of skilled workers moves the economy down the relative demand curve but then higher elasticities of skill intensive goods raise the demand for skill intensive goods and the relative demand of skilled labor. Two questions are addressed in this paper. First, is it true that richer and more educated workers tend to consume more skill intensive goods? Secondly, how much can such a mechanism contribute to explain the outward shift in the relative demand for skilled labor?

In the theory part of the work I build a simple two-sector general equilibrium model using non-homothetic preferences and I derive the condition that links the exogenous rise in the supply of skilled workers with the rise of wage inequality. The sign and the magnitude of this relationship depends crucially on the income elasticity of skill intensive goods.

In the empirical part of the work I try to establish whether rich consumers consume more skill intensive goods. To do so I proceed in three steps. First I match micro data on consumption from the Family Expenditure Survey to industry data from the Labour Force Survey; 46 consumption goods are matched to 46 industries that produce them at the manufacturing level. Then I estimate income elasticities using the Almost Ideal System proposed by Deaton and Muellbauer [1980]. Finally, to establish whether rich consumers tend to consume more skill intensive goods, I regress income elasticities on the industry skill intensity. The matched industries represent only 25% of the wage bill and 28% of employment in the economy. The contribution of the industries that produce intermediate inputs and of all those industries that don't have a direct match to any consumption good is taken into account using Input Output tables. Input Output tables are also used to correct the skill intensity of those goods that are mostly imported, since imports don't contribute to the domestic relative demand of skills. The results indicate a positive relationship between income elasticities of consumption goods and the skill intensity of the producing industries.

This positive relationship demonstrates that skilled workers tend to consume more skill intensive goods but cannot give us an idea of how much an increase in the relative supply of skilled workers can increase the relative demand of skilled workers through consumption elasticities. To estimate how much of the relative demand shift can be attributed to this mechanism, I calibrate the theoretical model using

UK data from 1981 to 1993. In section 4 I give an estimate of the relationship between wage inequality and the relative supply of skills implied by the model which suggests that an income effect that favors skill intensive goods can explain about 12 % of the total shift in relative labor demand.

The basic model explains labor demand shifts between sectors and considers wage inequality between different education groups. However the empirical evidence indicates that 50% to 70% of the rise in wage inequality took place within groups with the same education [Juhn, Murphy and Pierce, 1993]. Moreover most of the shifts in relative labor demand occurred within detailed industries rather than between different industries [Berman, Bound and Griliches, 1994; Katz and Murphy, 1992]. In section 5 the model is extended to explain the rise of wage inequality within education group and labor demand shifts within industries. The extension considers production of goods of different qualities within industries and workers of different skills within the same education group. Unfortunately the empirical exercise cannot investigate this extension of the model due to lack of data regarding consumption of goods of different qualities within industries. However the theory can be tested indirectly by establishing whether income elasticities have risen over time.

The plan of the paper is as follows. Section 2 presents the basic model. Section 3 analyses the empirical evidence. Section 4 calibrates the model and gives an estimate of the contribution of income elasticities in explaining the shift in relative labor demand. Section 5 extends the model to explain wage inequality within education group and labor demand shifts within industry. Section 6 concludes.

2 The Model

The formal model builds on 2×2 production-consumption models used in early trade and public finance theory. The economy consists of H skilled workers and L unskilled workers. Labor supply is considered to be exogenous and inelastic. There are two types of goods: Y_h, the high skill intensive goods and Y_l, the low skill intensive goods. The high skill intensive goods are produced using mainly skilled workers, the low skill intensive goods using unskilled workers. Production functions are assumed to be CES. Labor markets are competitive. Demands for goods have a generic form that allows for non-homotheticity, and they are different for educated and non educated workers.

The aim of this model is to explain how the increase in the supply of skilled workers (college graduates) is consistent with the rise in the demand of skilled workers. The mechanism that shifts demand in response to an increase in supply acts through income elasticities. This model links the relative supply of skills to the skill premium through income elasticities of consumption.

The basic structure of the economy is:

Production:

$$Y_h = F_1(L_1, H_1) \tag{1}$$
$$Y_l = F_2(L_2, H_2) \tag{2}$$

Demand:

$$Y_h = Hy_h^h(\frac{p_h}{p_l}, w_h) + Ly_h^l(\frac{p_h}{p_l}, w_l) \tag{3}$$
$$Y_l = Hy_l^h(\frac{p_h}{p_l}, w_h) + Ly_l^l(\frac{p_h}{p_l}, w_l) \tag{4}$$

Factor supplies:

$$L = L_1 + L_2 \tag{5}$$
$$H = H_1 + H_2 \tag{6}$$

Factor returns:

$$\begin{aligned} w_h &= p_h F_{1H}(L_1, H_1) = p_l F_{2H}(L_2, H_2) \quad (7) \\ w_l &= p_h F_{1L}(L_1, H_1) = p_l F_{2L}(L_2, H_2) \quad (8) \end{aligned}$$

Normalize the unskilled wage $w_l = 1$. The system is completely described by the following five equations:

$$\begin{aligned} p_h F_1(H_1, L_1) &= L_1 + w_h H_1 \quad (9) \\ p_l F_2(H - H_1, L - L_1) &= L - L_1 + w_h(H - H_1) \quad (10) \\ d\log(\frac{H_1}{L_1}) &= -\sigma_1 d\log w_h \quad (11) \\ d\log(\frac{H - H_1}{L - L_1}) &= -\sigma_2 d\log w_h \quad (12) \\ H y_h^h(\frac{p_h}{p_l}, w_h) + L y_h^l(\frac{p_h}{p_l}, 1) &= F_1(H_1, L_1) \quad (13) \end{aligned}$$

The first two equations 9, 10 restate the constant return assumption. Equations 11 and 12 are definitions of substitution elasticities in a CES technology. The last equation 13 is the goods market equilibrium condition. By Walras' law, equilibrium in the market for factors and for good 1 implies that the market for good 2 clears.

Differentiating and taking log derivatives:

$$\begin{aligned} d\log p_h &= a_1 d\log w_h \\ d\log p_l &= a_2 d\log w_h \\ d\log H_1 - d\log L_1 &= -\sigma_1 d\log w_h \\ (1+\lambda_H) d\log H - \lambda_H d\log H_1 + \frac{H}{L}(1+\lambda_L) d\log H + \lambda_L d\log L_1 &= -\sigma_2 d\log w_h \end{aligned}$$

$$\begin{aligned} R_1[\varepsilon_{hp}^h d\log(\frac{p_h}{p_l}) + \varepsilon_{hm}^h d\log w_h + d\log H] + \\ + (1 - R_1)[d\log L + \varepsilon_{hp}^l d\log(\frac{p_h}{p_l})] = a_1 d\log H_1 + (1 - a_1) d\log L_1 \end{aligned}$$

The parameter $a_1 = \frac{w_h H_1}{p_h y_h}$ denotes the share of skilled labor in the skill intensive sector h, a_2 is the share of skilled labor in the low skill intensive sector l. $\lambda_H = \frac{H_1}{H - H_1}$ and $\lambda_L = \frac{L_1}{L - L_1}$ are the ratios of skilled and unskilled labor used in sector h and l. $R_1 = \frac{H y_h^h(.)}{H y_h^h(.) + L y_h^l(.)}$ is the share of the skilled in total expenditure for the skill intensive good. ε_{hp}^i is the price elasticity of demand for the skill intensive good h. Demand $i = h, l$ is different for the skilled and the unskilled. ε_{hm}^h is the income elasticity of the skill intensive goods for demand of the skilled.

The system needs to be solved for dw_h as a function of dH. Suppose that $dH = -dL$, i.e. the total supply of labor, is fixed. The result is:

$$\frac{d\log w_h}{d\log H} = \frac{(\lambda_L - \lambda_H)[R_1 - (1 - R_1)\frac{H}{L}] + [1 + \lambda_H + \frac{H}{L}(1 + \lambda_L)]}{(\lambda_H - \lambda_L)T - (\lambda_L \sigma_1 + \sigma_2)} \quad (14)$$

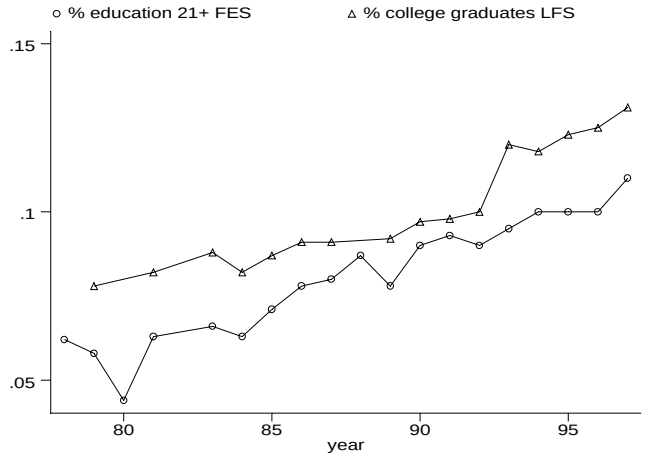

Figure 1: Percentage of heads of household with 16 or more years of education (FES). Percentage of respondents with college degree (LFS). The jump in the LFS series in 1993 is due to a change in the definition. The irregularities in the FES series are due to the small sample size.

Where $T = \{R_1[\varepsilon^h_{hp}(a_1 - a_2) + \varepsilon^h_{hm}] + (1 - R_1)\varepsilon^l_{hp}(a_1 - a_2) - (1 - a_1)\sigma_1\}$. We know that $\lambda_H - \lambda_L > 0$ as sector 1 is skill intensive and $a_1 - a_2 > 0$ for the same reason.

Equation 14 establishes the condition that links wage inequality $\frac{w_h}{w_l}$ to a rise in the skill ratio $\frac{H}{L}$ in this model that takes account of the shift in the demand for products due to income effects. The sign of the numerator is going to depend crucially from the value of $R_1 = \frac{Hy^h_h(.)}{Hy^h_h(.)+Ly^l_h(.)}$, the share of the expenditure by skilled workers in total expenditure for the skill intensive good. The denominator is going to be a negative number and the magnitude of it depends from ε^h_{hm} , the income elasticity of the skill intensive goods for demand of the skilled.

An increase in the supply of college graduates has two effects. The standard substitution effect moves the economy along a downward sloping demand curve and decreases the skill premium. The effect through income elasticities may raise the demand of skill intensive goods and therefore the relative demand of skilled labor. An implication of the model is the increase over time of the demand of consumption items with large income elasticities and therefore of the industries that produce them. This is consistent with evidence presented in the following section.

This model can offer an explanation of the increase in the relative labor demand for skills in its between industry component, but it doesn't explain labor demand shifts within industry nor does it explain the rise of wage inequality within education group. In section 5 I extend the model to explain within group wage inequality and within industry labor demand shifts and I provide a test of the theory.

3 The Empirical Evidence

Figure 1 shows the education composition of the British population from 1978 to 1997 using the UK Family Expenditure Survey (FES) and the UK Labour Force Survey (LFS). The percentage of people with a university degree rose from 8% in 1978 to 13% in 1997.

An increase in the supply of college graduates can generate an increase in the demand of skills if skilled workers prefer consuming skill intensive goods. The hypothesis that income elasticities for high skill intensive goods are higher than for low skill intensive goods is crucial in deriving the main result of the paper. In this section I relate income elasticities of consumption goods to the skill intensity of

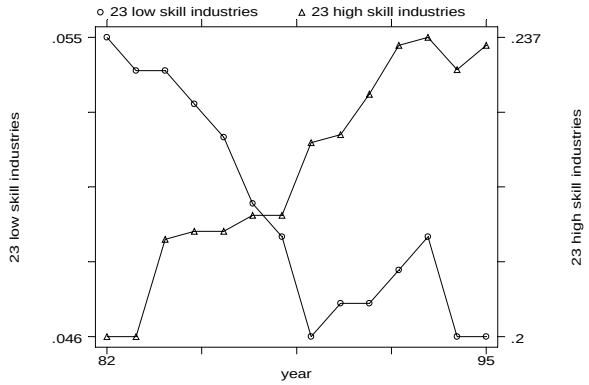

Figure 2: Wage bill share of the 23 most skill intensive and 23 least skill intensive industries 1982-1995. Source: NES data

the producing industry using English data. I match two datasets: the UK Family Expenditure Survey (FES) that contains data on consumption, and the UK Labour Force Survey (LFS) that contains data on industries and their skill intensity. I then estimate income elasticities for each consumption item and regress the estimates on the skill intensity of the producing industry.

3.1 The Match Industry-Consumption Item

To get the data about consumption I use the Family Expenditure Survey from 1986 to 1997. The survey contains information on a detailed set of goods recorded in a two week diary and on household composition. I use data on all the goods whose consumption has been consistently recorded from 1986 to 1997. I consider consumption of 46 goods as shown in table 1 in the appendix. All expenditures are recorded in pounds at current prices and refer to weekly expenditure. All the items except for insurance and education are part of the two week diary and are aimed at measuring recurrent weekly expenditures. Insurance refer to the last premium paid and education to the amount spent in the previous year on fees and maintenance. The amount reported for insurance and education is reported in weekly equivalents i.e. the total amount reported in the questionnaire is divided by 52[2].

I then match all 46 consumption goods to the manufacturing industry that produce them and rank the industries according to their skill intensity. Skill intensity is defined from the LFS calculating the percentage of workers with a university degree that work in each industry. In table 1 in the appendix I rank the industries from the least skill intensive to the most skill intensive. The 46 industries that have a direct match to a consumption item represent 25% of the total wage bill share and 28% of total employment. The industries that have a higher percentage of graduate workers are: education, medical practices, legal services, banking, insurance, printing and publishing, soap and toilet products, data processing equipment. The least skill intensive industries are hairdressing, men's outerwear, fish processing, cleaning services, footwear, laundry, bread, meat production, takeaway, road passenger transport.

Figure 2 shows the increasing weight in the economy of the 23 most skill intensive industries compared to the 23 least skill intensive. The proportion in the total wage bill of the 23 most skilled industries

[2]The recorded expenditure for not very popular items contain many zeros. Weekly expenditure on education fees and maintenance for year 1997 is on average 4.63 pounds, the last premium paid on life and health insurance is 3.08 pounds on average. Conditional on a positive amount the average expenditure on education and on insurance premiums are respectively 20 pounds and 7.6 pounds.

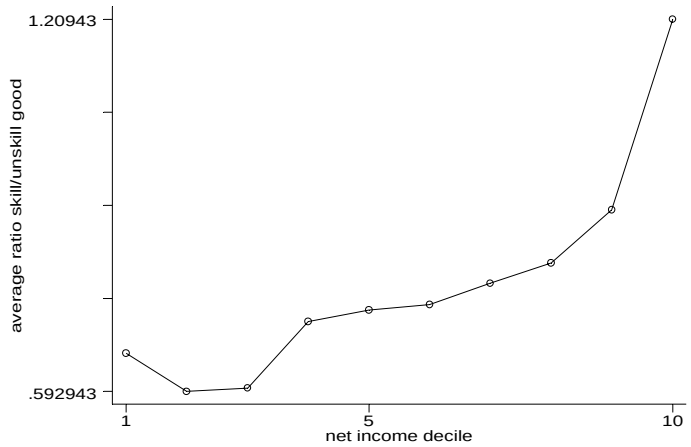

Figure 3: Ratio of expenditure on the 10 most skill intensive goods and the 10 least skill intensive goods, by income decile.

combined rose from 20% in 1982 to 23.7% in 1995. The proportion in the wage bill of the 20 least skill intensive declined from 5.5% to 4.6%.

3.2 The Income Elasticities

Table 2 in the appendix shows the means of the FES data and the expenditure shares of all consumption items for families in the bottom quintile of the earnings distribution and families in the top quintile and for families with the head of household with a university degree and without.

It's already clear from very simple averages that rich families allocate a greater amount of their total expenditure on skill intensive goods such as education, bank services and insurance. Figure 3 plots the average ratio of expenditure on the 10 most skill intensive goods over the 10 least skill intensive against the net income decile. Families in all income deciles except the top decile spend on average more on non skill intensive goods which include bread, fish and meat and bus fares, but the ratio increases with income and goes from 0.6 for the lower deciles to 1.2 for the 10th decile.

3.2.1 Almost Ideal Demand System

The estimation method for income elaticities is the Almost Ideal Demand System as proposed by Deaton and Muellbauer [1980]. The expenditure decision is modelled following the two stage budgeting approach [Blundell et al., 1993]. At each period t each household h makes a decision on how much to consume conditional on various household characteristics and conditional on the consumption level of a second group of other demands. This latter group contains housing and durables such as cars that we don't consider in our estimation. Let's suppose that the two groups are weakly separable in utility and therefore prices of housing and durables don't affect consumption of the goods we are going to consider. Let's also suppose that preferences are weakly separable over time and therefore incomes and prices outside the period have no effect on the current period consumption decision.

Let y_t be expenditure allocated by a household to these goods in period t. Given y_t the household decides how much to spend on individual goods according to the following share equation (Deaton, 1980, time subscripts omitted).

$$\omega_i = \alpha + \beta_i \log(y/P) + \sum_{j=1}^{n} \zeta_{ij} p_j + \theta_i X + \varepsilon_i \tag{15}$$

Where $\omega_i = \frac{p_i x_i}{y}$ is the expenditure share of item i. $\log y$ is log total expenditure. $P = \sum_j w_j \log p_j$ is the Stone price index where w_j is the monthly average share of good j in the data set. p_j are the items' price series[3]. X contains age and sex of the head of household, regional dummies, the total number of components and the number of children in the household and a trend in time. The budget elasticity will be equal to:

$$\eta_i = \frac{\beta_i}{\overline{\omega}_i} + 1$$

where $\overline{\omega}_i$ is the average budget share of item i.

The estimation of the system is carried out using a two-step procedure. In the first stage each equation is estimated instrumenting total expenditure. The need to consider total expenditure as an endogenous variable comes from the occurrence of zero expenditures in the diary records. Many of the commodity groups considered, especially alcohol and tobacco are purchased infrequently. As the zero expenditure affect both the dependent variable and the total real expenditure variable $\log(y/P)$,ordinary least square OLS will be biased. Instrumental variable estimation, permitting all terms in $\log(y/P)$ to be endogenous, removes this measurement error problem. Total net income and the real interest rate are used as instruments. The real interest rate is included as it may bear on intertemporal substitution and therefore affect total expenditure in year t. In the first stage homogeneity restrictions are also imposed in that they are single equation restrictions.

Given the first-step estimates, the symmetry cross equation restrictions are imposed by means of a minimum distance estimator. Denoting ϕ the vector of unrestricted parameters and ϕ^* the restricted parameters, the symmetry restrictions can be expressed as:

$$\phi = R\phi^*$$

To impose the symmetry restrictions the Minimum Distance estimator chooses ϕ^* to minimize:

$$m = (\widehat{\phi} - R\phi^*)' \Sigma_{\phi}^{-1} (\widehat{\phi} - R\phi^*)$$

Where $\widehat{\phi}$ are the first step estimates and Σ_{ϕ}^{-1} an estimate of the variance-covariance matrix.

Table 3 in the appendix reports the unconstrained estimates of the income elasticity of the individual share equations. Each row shows the results of a particular share equation. The table shows the coefficients on real log income with the standard error in parenthesis, and the corresponding budget elasticity. The symmetry constrained estimates are statistically rejected.

The results indicate that skill intensive products have in general a higher income elasticity than low skill intensive products. In particular expenditure on skill intensive services such as education, legal, medical and financial services all have a budget elasticity much bigger than one. Expenditures on skill intensive products like drugs, soap and cosmetics, and books have an elasticity lower than one. All low skill intensive products have an income elasticity lower or just over one except for cleaning services which seems to be a luxury good.

[3]The category "other personal expenditures" aggregates goods whose price series are not available. For this group I use the general Consumption Price Index.

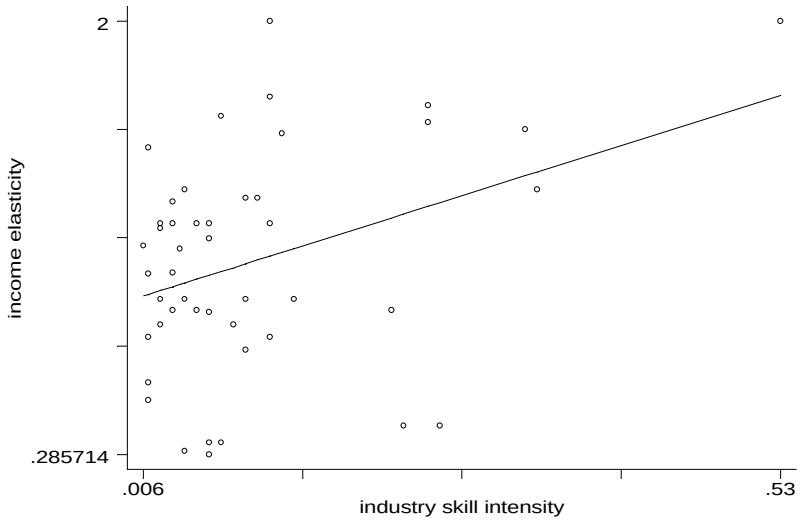

Figure 4: OLS regression of income elasticities on industry skill intensity.

Finally I run a regression of the estimated income elasticities on the corresponding industry's skill intensity. This regression gives us an idea on whether rich consumers tend to consume more skill intensive goods. I estimate:

$$\eta_i = \alpha + \gamma z_i + \varepsilon_i \tag{16}$$

Where η_i is the estimate of income elasticity for good i and z_i is skill intensity of industry i. Skill intensity is defined as the percentage of workers with degree that work in industry i, as reported in table 1 in the appendix. Standard errors are corrected for heteroschedasticity. The estimation gives a coefficient γ =1.51(0.52) and $R^2 = 0.13$. A positive relationship between income elasticities and skill intensity indicates that rich consumers indeed consume more of skill intensive goods. Figure 4 plots the estimated elasticities against skill intensity.

3.2.2 Input Output Tables

As I match consumption items directly to the industries that produce them at the manufacturing level, I am neglecting the retail sector and all other sectors that don't have a direct match to a consumption item. Furthermore I don't consider intermediate goods or the import penetration in the different sectors. Intermediate goods may be important because the industries that produce the inputs may have a different skill intensity than those that produce the final output. The import penetration in the different industries is relevant because consumption goods with very high income elasticities may be mainly produced abroad and therefore contribute little to the increase in the domestic demand of skills.

To take into account the skill intensity of the industries that produce inputs and of the sectors that don't have a match to a consumption item, I use the OECD domestic transaction input ouput tables for the UK in year 1990. In table 4 at the end I match the LFS industry classification to the OECD industry classification.

To take into account the contribution of intermediate inputs I calculate skill intensity of an industry as the weighted average of its inputs' skill intensity using the Input Output table as weights. To take

into account value added of the retail sector and of all other industries that don't have a direct match to a consumption item, I consider the industry skill intensity only for the part of output that is sold directly to final demand. For the part that is first sold to other industries before going into final demand, I consider the final industry skill intensity. In formulas industry's i skill intensity z_i^B is calculated as:

$$z_i^B = \frac{FD_i}{\Sigma_j I_{ij} + FD_i} z_i^A + \sum_j \frac{I_{ij}}{\Sigma_j I_{ij}} \frac{FD_j}{\Sigma_j I_{ij} + FD_j} z_j^A \tag{17}$$

To take into account intermediate inputs, skill intensity of the industry j that produces the final product z_j^A is calculated as the weighted average of the skill intensity of the i industries that produce intermediate inputs: $z_j^A = \sum_i \frac{I_{ij}}{\Sigma_i I_{ij}} z_i$. In this expression $\frac{I_{ij}}{\Sigma_i I_{ij}}$ is industry i input contribution into production of one unit of product j. z_i is skill intensity of industry i.Of course $z_j^A = z_i^A$ for $i = j$ and a unit of produced output can become input in another industry.

Once z_i^A has been calculated, formula 17 takes into account the contribution to value added of the retail sector and of all those sectors that don't have a direct match to a consumption good. Once one unit of product i is produced it can either be sold directly to private consumers, FD_i, or it can be sold to industry j, I_{ij}, through which it will reach private consumption later. The first term of formula 17 indicates that industry's i skill intensity z_i^A is relevant only for the part of product i that is sold directly to final demand, $\frac{FD_i}{\Sigma_j I_{ij} + FD_i}$. The second term of formula 17 says that for the part of product i that is first sold to industry j before reaching final demand, $\frac{I_{ij}}{\Sigma_j I_{ij}}$, the relevant skill intensity is industry j skill intensity, z_j^A. Industry j skill intensity has to be weighted by the part of product j that is directly sold to final demand $\frac{FD_j}{\Sigma_j I_{ij} + FD_j} z_j^A$.

Regression 16 calculated using skill intensities corrected for the contribution of intermediate inputs and the retail sector, z_j^B, gives a result of γ =2.05(1.11) and $R^2 = 0.10$. The relationship between between income elasticities and skill intensity is stronger than before. The retail sector, being very low skilled, is expected to reduce the skill intensity of all goods. The effect of the retail sector on the skill intensity of all products is more than offset by the contribution of industries that produce intermediate inputs, which are relatively more skill intensive.

To the extent we want to answer the question whether skilled workers consume more skill intensive goods, we are interested in the relationship between income elasticities for domestic products and skill intensity of domestic production. In this case skill intensity doesn't need to be weighted by the import penetration of the corresponding industry, and the relevant results are those of the second column of table 6, where skill intensity is corrected for the contribution of intermediate inputs and the retail sector.

If instead we want to have an idea of how much an increase in income may increase the demand for skilled labor through income elasticities, we should weight the regression for imports since imported goods are not going to increase domestic demand of labor. Skill intensity z_i^B is then multiplied by the import penetration of the final industry. The import penetration of industry i, NX_i , is calculated as $NX_i = 1 + (E_i - I_i)/Y_i$. Where E_i I_i and Y_i are exports, imports and total production of industry i. The regression 16 in this case gives γ =2.44(1.11) and $R^2 = 0.11$. The higher value of the regression coefficient reflects the fact that the UK exports skill intensive goods and imports low skill intensive goods.

Table 6 compares the results of regression 16 in three cases. In the first column skill intensity z_i is simply the skill intensity of the producing industry, in the second column skill intensity is corrected for the contribution of intermediate goods and the retail sector, z_i^B, in the third column skill intensity is corrected for intermediate goods, the retail sector and import penetration, $z_i^B * NX_i$. The relationship between income elasticities and skill intensity, the coefficient γ, is always positive and significative. A positive value of γ indicates that rich consumers tend to consume more skill intensive goods. However this coefficient doesn't say how much an increase in income raises the demand for skilled labor.

To answer that question I attempt to quantify the explanatory power of the model with respect to the implied rise in the demand of skilled labor and wage inequality. In the next section I calibrate the model using the data of the UK economy.

Dependent variable: Income elasticity	Regression 1 Skill intensity=z_i	Regression 2 Skill intensity=z^B_i	Regression 3 Skill intensity=z^B_i*NX_i
constant	0.90(0.06)	0.93(0.07)	0.91(0.07)
skill intensity	1.51(0.52)	2.05(1.11)	2.44(1.1)
Rsquare	0.13	0.1	0.11
Sample size	46	46	46

Table 6: Results from regression of income elasticity on skill intensity. First column: skill intensity of manufacturing industry. Second column: skill intensity corrected for intermediate inputs and the retail sector. Third column: skill intensity corrected for intermediate inputs, retail sector and import penetration.

4 Model's Calibration

This section describes a calibrated version of the model, choosing parameters in line with the UK economy. In this section I attempt to quantify the explanatory power of the model with respect to the implied increase in the demand of skilled labor and wage inequality in response to an increase in the relative supply of skills. In the first part of this section I estimate the relationship between the skill premium and the skill ratio implied by the model of section 2. In the second part I estimate the implied labor demand shifts in each sector given the observed changes in total relative supply of skills and the change in the skill premium.

The calibration of the model is conducted using data on the 46 industries that match the consumption items as in table 1 in the appendix. The 46 industries are divided in 23 low skill intensive sectors and 23 high skill intensive sectors to match the characteristics of the model of section 2. The 46 industries represent 25% of total employment and 28% of the total wage bill. An estimate of the following equation will give an idea of the importance of income elasticities in explaining the rise of wage inequality.

$$\frac{d\log w_h}{d\log H} = \frac{(\lambda_L - \lambda_H)[R_1 - (1-R_1)\frac{H}{L}] + [1 + \lambda_H + \frac{H}{L}(1+\lambda_L)]}{(\lambda_H - \lambda_L)T - (\lambda_L\sigma_1 + \sigma_2)} \tag{18}$$

Where $T = \{R_1[\varepsilon^h_{hp}(a_1 - a_2) + \varepsilon^h_{hm}] + (1-R_1)\varepsilon^l_{hp}(a_1 - a_2) - (1-a_1)\sigma_1\}$. Using LFS data from 1981 to 1993 I obtain a measure of skill intensity ratio of the 23 most skill intensive and the 23 least skill intensive industries $\lambda_H = \frac{H_1}{H_2} = 23.1$ and $\lambda_L = \frac{L_1}{L_2} = 1.98$. The skill ratio in the economy is $\frac{H}{L} = 0.11$. The share of the skilled in total expenditure for the skill intensive good $R_1 = \frac{Hy^h_h(.)}{Hy^h_h(.)+Ly^l_h(.)} = 0.2$. An estimate of the income elasticity $\varepsilon^h_{hm} = \frac{\beta}{\overline{\omega}} + 1$ is obtained from a fixed effect regression considering only the 23 most skill intensive goods and only educated workers. I get a value of $\beta = 0.0009$. The average mean share among the 23 skilled goods in total expenditure for the educated workers is $\overline{\omega} = 0.0032$. This implies an income elasticity ε^h_{hm} =1.28. The price elasticities are estimated at ε^h_{hp} =-0.9 and ε^l_{hp} =-0.6. The value of the wage bill share of skilled work in the skill intensive sector $\alpha_1 = \frac{w_h H_1}{p_h y_h} = 0.48$ while $\alpha_2 = \frac{w_h H_2}{p_l y_l} = 0.1$. The final result is $\frac{d\log w_h}{d\log H} = -1.2$.

In the UK economy from 1981 to 1993 $\frac{H}{L}$ increased by 52% and $\frac{w_h}{w_l}$ increased by 14%. An increase in $\frac{H}{L}$ has two effects: it first moves the skill premium $\frac{w_h}{w_l}$ down labor demand but at the same time may

generate an income effect that increases the demand of skill intensive goods and shifts out the relative demand for skilled labor. The model of section two solved with homothetic preferences that neglect the income effect in favor of skill intensive goods implies a fall in $\frac{w_h}{w_l}$ of 73%. Taking into account demand effect through income elasticities, the same model implies that $\frac{w_h}{w_l}$ should fall by 62% as a result of an increase in $\frac{H}{L}$ of 52%. These calculations imply that income elasticities can explain 12% of the total shift of 87% in the relative demand of labor.

4.1 Shift Share Analysis

In this subsection I try to assess how much of the shift in relative labor demand favoring college educated workers can be explained in terms of the model of section 2. A standard decomposition of the percentage change in the proportion of college graduates in aggregate employment between year τ and year t ($\Delta H_t = H_t - H_\tau$) is given by:

$$\frac{\Delta H_t}{H_t} = \sum_k \gamma_k \left(\frac{\Delta E_{kt}}{E_{kt}} \right) + \sum_k E_k \left(\frac{\Delta \gamma_{kt}}{\gamma_{kt}} \right)$$

where k indexes industry, E_{kt} is employment in industry k in year t as a share of total employment, $E_k = (E_{kt} + E_{k\tau})/2$ is the average employment of industry k. $\gamma_k = (H_{kt} + H_{k\tau})/2$ is the average share of educated workers in industry k. The first term reflects the change in the aggregate proportion of educated workers attributable to changes in employment shares between industries that utilize different proportions of college graduates. The second term reflects within industry skill upgrading.

The model of section 2 has precise implications about the increase in the demand of educated workers in each sector. Given the observed changes in wage inequality and in the skill ratio, the increase in the demand of skilled labor in each sector is related to the value of income and price elasticities.

Consider a continuum of sectors i. Each one of them has constant return to scale, CES technology with elasticity of substitution σ_i and a market clearing condition. The three conditions are formalized in the following equations:

$$\begin{aligned} p_i F_i(h_i, l_i) &= l_i + w_h h_i \\ d\log(\frac{h_i}{l_i}) &= -\sigma_i d\log w_h \\ H y_i^h(\frac{p_h}{p_l}, w_h) + L y_i^l(\frac{p_h}{p_l}, 1) &= F_i(h_i, l_i) \end{aligned}$$

The implied shift in the demand of skilled labor in each sector is:

$$\begin{aligned} d\log h_i &= d\log w_h[R_i(a_i\epsilon^h_{ip_i} + \epsilon^h_{im}) + (1-R_i)a_i\epsilon^l_{ip_i} - (1-a_i)\sigma_i] + \\ &\quad + d\log H[R_i - (1-R_i)\frac{H}{L}] - [R_i\epsilon^h_{ip_i} + (1-R_i)\epsilon^l_{ip_i}]d\log p \end{aligned} \tag{19}$$

Where $\alpha_i = \frac{w_h h_i}{p_i y_i}$ is the wage bill share of educated workers in the industry's total wage bill. σ_i is the elasticity of substitution and it's set to the common value $\sigma = 1.41$ as suggested in Katz and Murphy [1992]. Using LFS data from 1981 to 1993 I estimate equation 19 for each sector and then sum the implied shifts in the demand of skilled workers across sectors. I obtain the total labor demand shift implied by the model. In UK data from 1981 to 1993 $\frac{\Delta H_t}{H_t} = 0.52$ of which the between industry share is $\sum_k \gamma_k \left(\frac{\Delta E_{kt}}{E_{kt}} \right) = 0.175$. From estimation of equation 19 I obtain the labor demand shift implied by the model of section 2 $\sum_i d\log h_i = 0.137$.

The conclusion is that the model of section 2 which takes into account the effects on relative labor demand of the differential pattern of price and income elasticities across sectors can account for part of the shift in the relative demand of skilled labor.

5 Within Group Wage Inequality

Juhn, Murphy and Pierce [1993] attribute from one half to two thirds of the total increase in wage inequality in the US to wage differentials within education groups. Katz and Murphy [1992] show that between industry shifts in the composition of employment are not enough to account for the total shift in the relative demand for skills in the US. Most of the shift in relative labor demand occurs within detailed industries. Machin and VanReenen [1998] show that within industry shifts are predominant across a sample of OECD countries.

In this section the model of section 2 is extended to account for within education group wage inequality and within industry labor demand shifts. To explain within education wage inequality and within industry relative labor demand shifts is necessary to introduce goods of different qualities within sectors and workers of different skills within education group. I introduce goods of high and low quality within the high skill intensive and the low skill intensive sectors and high skilled and low skilled workers within the educated and the non educated workers.

Assume that within each of the two sectors only skilled workers can produce high quality goods. In the skill intensive sector work only educated workers and the skilled among them produce goods of high quality, the unskilled produce goods of low quality. The same applies in the low skill intensive sector where only uneducated workers work. Assume furthermore that as consumers become richer not only they want to consume more high skill intensive goods but also they want to consume more high quality goods within each of the two sectors: preferences are non homothetic in goods and non homothetic in quality. This delivers the result that an income effect increases the demand of high quality goods in both sectors and therefore the wage of skilled workers that produce those goods in both sectors. This model generates an increase in residual wage inequality because the skills of those that produce high or low quality goods cannot be observed but only their education.

In formal terms the model can be specified as follows. There are four types of workers differentiated by education and unobserved skills. There are four sectors in the economy and each of them produces using only one type of worker. The production functions in the skill intensive sector where all the H educated workers work are of the type:

$$y_{hj} = (A_{hj}H_j)^{\rho} \text{ where } j = s, u$$

H_s skilled educated workers produce high quality goods in the skill intensive sector of the economy. H_u unskilled educated workers produce low quality goods. By the same token the production functions in the low skill intensive sector are of the type:

$$y_{lj} = (A_{lj}L_j)^{\rho} \text{ where } j = s, u$$

I assume that the fraction of skilled workers in each education group is constant with $\phi_h = \frac{H_s}{H_u} > \phi_l = \frac{L_s}{L_u}$. The proportion of skilled workers among the educated is bigger than among the uneducated. In this model within group wage inequality is given by:

$$\frac{w_{hs}}{w_{hu}} = \frac{p_{hs}}{p_{hu}} \left(\frac{A_{hs}}{A_{hu}} \right)^{\rho} \phi_h^{\rho-1}$$

and

$$\frac{w_{ls}}{w_{lu}} = \frac{p_{ls}}{p_{lu}} \left(\frac{A_{ls}}{A_{lu}} \right)^{\rho} \phi_l^{\rho-1}$$

When the supply of educated workers H increases, residual wage inequality $\frac{w_{hs}}{w_{hu}}$ goes up if $\frac{\delta \log p_{hs}}{\delta \log H} > \frac{\delta \log p_{hu}}{\delta \log H}$.

The equilibrium in the model is given by four zero profit conditions and three market clearing conditions of the type:

$$\phi_h H_u y_i^j(\frac{p_{ij}}{p}, w_{hs}) + H_u y_i^j(\frac{p_{ij}}{p}, w_{hu}) + \phi_l L_u y_i^j(\frac{p_{ij}}{p}, w_{ls}) + L_u y_i^j(\frac{p_{ij}}{p}, w_{lu}) = y_{ij}$$

where $y_i^j(\frac{p_{ij}}{p}, w_.)$ for $i = h, l$ and $j = s, u$ is the demand for each of the four types of goods by each of the four types of workers. Total demand is equal to production y_{ij}. The last market clearing condition is satisfied by Walras' law.

Normalize total labor supply $H + L = 1$. Consider an increase in the supply of educated workers H and the corresponding decrease of the uneducated L. Differentiating and taking log derivatives and combining the equations the condition the gives a rise in wage inequality is:

$$\frac{\delta \log p_{hs}}{\delta \log H_u} > \frac{\delta \log p_{hu}}{\delta \log H_u} \Longleftrightarrow \epsilon_{hm}^s > \epsilon_{hm}^u \text{ and } 2\epsilon_{lm}^s \phi_l L_u > -(1+\phi_h)\epsilon_{lp}^s$$

To generate wage inequality within the educated in the skill intensive sector the model requires that the income elasticity of the high quality goods be bigger than the income elasticity of low quality goods. The second condition requires that the income elasticity of high quality goods in the low skill intensive sector be big enough to counteract the negative effect of the price elasticity. I assume that the second condition is satisfied and focus on the first. The test of this extension of the model to goods of different quality is has to take an indirect route. Consumption surveys don't have information about the quality of the goods purchased. The estimated income elasticities are going to be averages of the income elasticities of high quality and low quality goods:

$$\epsilon_{hm} = \frac{y_h^s \epsilon_{hm}^s + y_h^u \epsilon_{hm}^u}{y_h^s + y_h^u}$$

Demand for high quality and low quality goods within the high skill intensive sector, y_h^s and y_h^u , are unobservable; we have only total demand of a skill intensive good $y_h^s + y_h^u$ and the corresponding income elasticity ϵ_{hm}. The hypothesis that high quality goods have a higher income elasticity than low quality goods can be tested looking at the evolution of elasticities over time. If the hypothesis $\epsilon_{hm}^s > \epsilon_{hm}^u$ is correct, then over time we should observe a higher relative demand of high quality goods y_h^s and a rise in the estimated elasticity ϵ_{hm}.

To test this implication of the model I estimate a fixed effect model where I regress income elasticities calculated in each single year of the sample on a time trend and a dummy for each good:

$$\eta_{it} = \alpha + \beta t + \xi_i + \varepsilon_{it}$$

Where η_{it} is the income elasticity of good i in year t , t is a time trend and ξ_i is a dummy for each good. Each observation is weighted by the inverse of its variance. In table 7 I present the results on the whole sample where the time trend is interacted with skill intensity and separately on the sample of the 23 most skill intensive goods and on the sample of the 23 less skill intensive goods. The results for both the skilled and unskilled sectors show a rising trend in the estimated income elasticities. The results on the whole sample show a stronger rising trend for the more skilled goods.

Dependent variable	Elasticity whole sample	Elasticity high skill intensive goods	Elasticity low skill intensive goods
constant	1.37 (0.005)	1.53 (0.009)	0.79 (0.005)
trend	0.006 (0.001)	0.017 (0.001)	0.004 (0.0007)
trend*skill intensity	0.02 (0.005)		
Rsquare	0.97	0.96	0.94
Sample size	552	276	276

Table 7: Time trend in the estimated income elasticity. Fixed effect estimates. Weighted regression.

6 Conclusions

In this paper I claim that the shift of relative labor demand for skills doesn't need to be attributed exclusively to skill biased technical change or trade. If more skilled workers demand more skill intensive goods, then an exogenous increase in the relative supply of skills can induce a shift in relative labor demand for skills. The shift in relative labor demand can be at least partially explained by an income effect that increases the demand of skill intensive products.

I build a very simple general equilibrium model where I relate wage inequality and the skill ratio when preferences are not homothetic. In the empirical part of the paper I match data on consumption to data on industry skill intensity. I show that richer and more educated people tend to consume a larger proportion of skill intensive goods. I correct skill intensity to take into account the contribution of industries that produce intermediate inputs and industries that don't have a direct match to a consumption good. Direct estimation of the model suggests that the estimated income elasticities of consumption of skill intensive goods can explain 12% of the total increase in relative labor demand for skills in the UK from 1981 to 1993. Finally I extend the model to explain wage inequality within education group and labor demand shifts within industry. I also give an indirect empirical test of this extension of the model which suggests that income elasticities of the consumption goods considered have increased over time.

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Consumption item	Industry name and code	LFS proportion of graduates	Average weekly wage (pounds 1993)
hairdressing	9820 hairdressing	0.006	122.5
men's outerwear	4532 men's outerwear	0.013	119.5
fish	4150 fish processing	0.016	187.5
furniture	4671 wood furniture	0.016	167
cleaning services	9900 cleaning services	0.018	119.2
footwear	4510 footwear	0.018	207.1
laundry	9811 laundry	0.02	163.6
bread and biscuit	4196 bread and biscuit	0.021	229.2
beef+poultry+lamb	4123 meat production	0.025	218.9
take away	6612 take away	0.028	119.6
bus fares	7210 road passenger transport	0.029	180
postage	7901 post services	0.033	282.6
domestic electric appl.	3460 domestic electric appl.	0.035	163
toys	4942 toys	0.038	261.6
soft drinks	4283 soft drinks	0.042	217.7
house furnishing	4555 soft furnishing	0.049	313.7
fruit and vegetables	4147 fruit and vegetables	0.049	266
records	3452 records	0.05	243
rail fares	7100 railways	0.05	335.8
milk products	4130 preparation of milk	0.054	323.7
tobacco	4290 tobacco	0.055	290
other fares	7500 air trasport	0.081	217.7
cereals	4160 grain milling	0.085	250
sweets	4213 ice cream , chocolate	0.09	371.7
wine	4261 wine	0.09	293.1
spirits	4240 spirit distilling	0.093	301
beer	4270 brewing	0.1	320.2
electricity bill	1610 electricity distrib	0.11	342.3
gas bill	1620 gas supply	0.11	302.3
sugar	4200 sugar	0.11	405
nhs payments	9510 hospitals	0.12	242.8
phone	7902 telecommunications	0.12	310
books	4751 printing and publishing	0.12	347.6
insurance premium	8200 insurance	0.13	358.4
soap and toilet products	2581 soap and toilet	0.13	355.7
subscriptions to trade unions	9631 trade unions associations	0.13	257
entertainment	9770 recreational services	0.13	255
bank charges	8140 banking	0.14	356.3
contributions to priv pension	8150 other financial	0.16	372.7
electronic cons goods	3460 electronic cons goods	0.166	377
petrol	1300 mineral oil extraction	0.19	366.5
drugs	2570 pharmaceuticals	0.21	350.9
computers	3301 data processing equipment	0.22	339.4
TV licence	9741 radio &TV	0.24	299
medical fees	9530 medical practices	0.25	163.6
legal fees	8350 legal services	0.32	290
education	9310 education	0.53	301.8

Table 1: The industry-consumption item match. Consumption items from FES 1986-1997. Industry skill intensity is ratio of graduates over total employment from LFS 1986-1997. Average weekly wage in 1993 pounds from NES data.

	total	Lowest 20 percent Income distribution	Highest 20 percent income distribution	Education less than college	College education
Number of families	79403	15886	15886	72039	7364
Age of head of household	50.2	54.4	46	51.1	41.8
Average number in family					
persons	2.4	2.3	2.5	2.46	2.56
Children under 18	0.6	0.8	0.3	0.6	0.7
retired	0.4	0.6	0.1	0.4	0.1
workers	1.1	0.3	1.8	1	1.4
Average Pounds per week					
Income before tax	430	147.8	889	387.8	759.2
Income after tax	358.8	142	708.3	328.3	595.7
Average expenditure	270.9	138	490	246.5	460.7
Average shares in total expenditure					
Food	0.208(0.11)	0.28(0.12)	0.14(0.07)	0.22(0.11)	0.14(0.09)
Cater	0.05(0.05)	0.03(0.05)	0.06(0.05)	0.05(0.05)	0.06(0.05)
Alcohol	0.049(0.067)	0.035(0.073)	0.06(0.05)	0.05(0.06)	0.04(0.05)
Tobacco	0.032(0.057)	0.042(0.074)	0.016(0.03)	0.03(0.06)	0.01(0.03)
Fuel	0.08(0.07)	0.13(0.09)	0.05(0.04)	0.09(0.07)	0.05(0.04)
Household goods	0.08(0.09)	0.07(0.09)	0.08(0.1)	0.08(0.09)	0.08(0.1)
Household services	0.06(0.06)	0.06(0.06)	0.06(0.06)	0.06(0.06)	0.07(0.07)
Clothing	0.06(0.08)	0.046(0.082)	0.078(0.081)	0.06(0.08)	0.06(0.08)
Personal goods and serv.	0.05(0.05)	0.04(0.05)	0.05(0.05)	0.04(0.05)	0.05(0.05)
Motor	0.11(0.14)	0.06(0.11)	0.16(0.15)	0.11(0.14)	0.14(0.15)
Fares	0.02(0.05)	0.02(0.04)	0.03(0.06)	0.02(0.06)	0.03(0.07)
Leisure goods	0.05(0.06)	0.04(0.05)	0.06(0.07)	0.05(0.06)	0.06(0.07)
Leisure services	0.05(0.06)	0.05(0.05)	0.06(0.05)	0.05(0.06)	0.07(0.08)
Medical services	0.003(0.019)	0.002(0.019)	0.004(0.019)	0.003(0.01)	0.004(0.02)
Drugs	0.007(0.015)	0.007(0.021)	0.006(0.010)	0.007(0.01)	0.006(0.01)
Books	0.02(0.022)	0.027(0.027)	0.016(0.017)	0.02(0.02)	0.02(0.03)
Education	0.007(0.029)	0.002(0.02)	0.017(0.044)	0.006(0.02)	0.02(0.05)
Bank charges	0.001(0.005)	0.0005(0.004)	0.001(0.004)	0.001(0.005)	0.002(0.006)
Legal fees	0.0007(0.016)	0.0002(0.1)	0.001(0.018)	0.0006(0.01)	0.001(0.01)
Computer	0.001(0.018)	0.0002(0.009)	0.002(0.024)	0.0008(0.01)	0.002(0.02)
Life and other personal insurance	0.015(0.03)	0.012(0.027)	0.024(0.036)	0.01(0.03)	0.02(0.04)
Soap and toilet products	0.012(0.016)	0.013(0.2)	0.011(0.014)	0.01(0.01)	0.01(0.01)
Contributions to private pension	0.01(0.048)	0.002(0.023)	0.022(0.07)	0.01(0.04)	0.02(0.07)

Table 2: The means of the data. FES consumption survey 1986-1997.

Consumption item	Income coefficient	Income elasticity	Education coefficient
hairdressing	0.001	1.11	0.0002
men's outerwear	0.002	1.2	0.002
fish	-0.002	0.75	-0.0006
furniture	0.004	1.2	0.001
cleaning services	0.0004	1.5	0.0006
footwear	0.00001	1	-0.001
laundry	-0.0003	0.57	0.00005
bread and biscuit	-0.005	0.5	-0.003
beef+poultry+lamb	-0.002	0.8	-0.004
take away	0.009	1.1	0.004
bus fares	0.0001	1	0.007
postage	-0.0003	0.9	0.0009
domestic electric appl.	0.001	1.1	-0.0001
toys	0.002	1.2	0.002
soft drinks	-0.001	0.85	-0.001
house furnishing	0.002	1.2	-0.0005
fruit and vegetables	-0.001	0.9	0.001
records	0.0007	1.1	0.0008
rail fares	0.002	1.33	0.008
milk products	-0.007	0.3	-0.004
tobacco	-0.02	0.3	-0.02
other fares	0.003	1.3	0.003
cereals	-0.00005	0.3	-0.00001
sweets	-0.001	0.8	-0.002
wine	0.005	1.6	0.006
spirits	0.002	1.2	-0.001
beer	-0.006	0.8	-0.01
electricity bill	-0.01	0.7	-0.01
gas bill	-0.009	0.7	-0.006
sugar	-0.002	0.3	-0.0009
nhs payments	0.0006	1.3	0.0001
phone	-0.003	0.8	0.001
books	-0.002	0.9	0.002
insurance premium	0.007	1.7	0.004
soap and toilet products	-0.001	0.9	-0.002
bank charges	0.0002	1.2	0.0003
contributions to priv pension	0.01	2	0.009
electronic cons goods	0.001	1.1	-0.0001
petrol	-0.003	0.4	-0.002
drugs	-0.001	0.8	-0.0003
computers	0.0005	1.55	0.0009
subscriptions to trade unions	0.006	1.6	0.006
TV licence	-0.006	0.4	-0.006
medical fees	0.001	1.33	0.001
legal fees	0.0004	1.57	0.0003
entertainment	0.02	1.66	0.02
education	0.007	2	0.01

Table 3: Almost Ideal Demand System. Income and education elasticities. Unrestricted estimates. Log total expenditure instrumented with total net income and the real interest rate.

OECD Input-output table	Industry name and code	Consumption item
Community social and personal services	9820 hairdressing	hairdressing
Textiles	4532 men's outerwear	men's outerwear
Food beverages tobacco	4150 fish processing	fish
Wood products	4671 wood furniture	furniture
Community social and personal services	9230 cleaning services	cleaning services
Textiles	4510 footwear	footwear
Community social and personal services	9811 laundry	laundry
Food beverages tobacco	4196 bread and biscuit	bread and biscuit
Food beverages tobacco	4123 meat production	beef+poultry+lamb
Restaurants and hotels	6612 take away	take away
Transport and storage	7210 road passenger transport	bus fares
Government consumption	7901 post services	postage
Electric apparatus	3460 domestic electric appl.	domestic electric appl.
Rubber and plastic products	4942 toys	toys
Food beverages tobacco	4283 soft drinks	soft drinks
Textiles	4555 soft furnishing	house furnishing
Food beverages tobacco	4147 fruit and vegetables	fruit and vegetables
Rubber and plastic products	3452 records	records
Transport and storage	7100 railways	rail fares
Food beverages tobacco	4130 preparation of milk	milk products
Food beverages tobacco	4290 tobacco	tobacco
Transport and storage	7500 air trasport	other fares
Food beverages tobacco	4160 grain milling	cereals
Food beverages tobacco	4213 ice cream , chocolate	sweets
Food beverages tobacco	4261 wine	wine
Food beverages tobacco	4240 spirit distilling	spirits
Food beverages tobacco	4270 brewing	beer
Electricity gas and water	1610 electricity distrib	electricity bill
Electricity gas and water	1620 gas supply	gas bill
Food beverages tobacco	4200 sugar	sugar
Government consumption	9510 hospitals	nhs payments
Communication	7902 telecommunications	phone
Paper and printing	4751 printing and publishing	books
Finance and insurance	8200 insurance	insurance premium
Industrial chemicals	2581 soap and toilet	soap and toilet products
Finance and insurance	8140 banking	bank charges
Finance and insurance	8150 other financial	contributions to priv pension
Electric apparatus	3460 electronic cons goods	electronic cons goods
Petroleum and coal	1300 mineral oil refining	petrol
Drug and medicines	2570 pharmaceuticals	drugs
Office and computing machinery	3301 data processing equipment	computers
Community social and personal services	9631 trade unions associations	subscriptions to trade unions
Community social and personal services	9741 radio &TV	TV licence
Community social and personal services	9530 medical practices	medical fees
Real estate and business services	8350 legal services	legal fees
Community social and personal services	9770 recreational services	entertainment
Government consumption	9310 education	education

Table 4: Input Output tables. Consumption items from FES 1986-1997. Four digit industry classification from LFS. OECD domestic transactions input-output table 1990.