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ABSTRACT

The Effect of Product Demand on Inequality: Evidence from the US and the UK*

This paper examines the relationship between product demand and the pattern of rising skill premia and rising employment of skilled workers in the US and the UK since the 1980s. If more skilled workers demand more skill-intensive goods, then an increase in relative skill supply will also induce a shift in relative skill demand. This channel reduces the need to rely on technology and trade to explain the patterns in the data. This paper shows that in the US more educated and richer workers demand more low skill-intensive services (such as cleaning and personal services) but also more skill-intensive services (such as education and professional services). The parametrization of a simple model suggests that this induced demand shift can explain around 7% of the total relative demand shift in the US between 1984 and 2002. Similar results are provided for the UK.

JEL Classification: J21, J31

Keywords: wage inequality, product demand, income elasticity

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1 Introduction

Although the pattern of the increase in wage inequality and the college premium in the US (Lemieux, 2006; Autor et al., 2008; Heathcote et al., 2010) and the UK (Gosling et al., 2000; Machin and VanReenen, 2008; Blundell and Etheridge, 2010) during the 1980s and the 1990s has been well documented, there is still some disagreement about the causes of the changes. Several reasons have been proposed to explain the shift in demand against low skilled workers, in particular skill-biased technical change, trade liberalization and changes in wage setting institutions. None of these explanations seems to be exhaustive.[1]

In this paper, I investigate an additional mechanism that may contribute to explaining the evolution of the part of wage inequality which is related to the college premium. I explore the correlation between consumption habits of educated and rich workers and the demand for skills. The mechanism is an "education elasticity of demand" in which individuals with relatively higher education have consumption preferences that favor goods and services whose production is relatively skill-intensive. Thus an increase in the relative supply of skilled workers can shift demand for final products in favor of skill-intensive goods and contribute to the rise in the relative demand for skills (i.e. the college premium). As a complementary mechanism, income elasticities of demand may also favor skill-intensive products so that rising income of workers will reinforce the education demand effect. Income effects and differences in utility functions across educational groups are potentially distinct mechanisms but education and permanent income are obviously very correlated and may contribute jointly to the demand shifts; in the course of the paper I will shed light on the relative importance of education and income elasticities measured at various points of the income distribution.

In the empirical section I investigate (i) if there is an association between the "skill-content" of different goods and their relative demand by people with different incomes or education and (ii) to what extent exogenous changes in the composition of skills (e.g. skill-biased technological change) feed back into additional demand for skills through an increase in demand for high-skill-intensive goods. To translate the consumption patterns into changes in the skill composition of employment and into skilled-unskilled relative wages, I combine micro-data on consumption of 39 non-durable consumption goods and services from the US Consumer Expenditure Survey (CEX) to data on industry skill composition from the Current Population Survey (CPS). I then estimate education and income elasticities of each consumption item and regress them on the skill intensity of the industries which manufacture the final consumption good or provide the final consumption service.

[1] The rise in inequality is concentrated in the '80s and '90s in both countries and slowed down afterwards. Gordon and Dew-Becker (2008) and Acemoglu (2002) review some of the reasons why none of the three main explanations is entirely convincing from the empirical point of view.

The results indicate large education and income elasticities for high-skill-intensive services like education, health and professional services but also for very low-skill-intensive services like food preparation, cleaning, repair services. This U-shaped relationship remains significant when Input-Output tables are used to account for the skill intensity of intermediate inputs and import penetration and is robust to various sample cuts and estimation methods. Finally I show some evidence for the UK based on Family Expenditure Survey (FES) consumption data matched to Labor Force Survey (LFS) data. In the UK the relationship between elasticities and skill intensity (corrected for the skill intensity of intermediate inputs) appears to be linear and positive rather than U-shaped (Leonardi, 2003).

To establish the quantitative importance of income and education effects in accounting for the rise in inequality, I parametrize a simple model with non-homothetic preferences using the estimates for the relevant elasticities and labor aggregates of the US and UK economy. The results indicate that education and income elasticities in favor of high-skill-intensive goods can explain about 7% of the total shift in relative labor demand in the US and a similar proportion of the total shift in the UK.

The plan of the paper is as follows. I conclude the introduction with a review of the related literature in order to delineate the relative contribution of this paper. In Section 2 I present the basic model. The empirical strategy is described in Section 3 while the results and the robustness checks are in Section 4. In Section 5 I quantify the contribution of education and income elasticities in explaining the shift in relative labor demand. In Section 6 I report the results for the UK. The interpretation of the results and the conclusion is found in Section 7.

1.1 Related Literature

There is an old debate on the possibility that the supply of skilled labor can trigger an increase in the equilibrium demand for skilled labor. Kiley (1997) and Acemoglu (1998 and 1999) focus on the market size for technologies and the structure of the organization of labor, in this paper I investigate an income effect of commodity demand.

Focussing on the product demand side and on income elasticities, this paper is related to the literature on structural change. The idea that income growth may explain the evolution from agriculture to services dates back to Colin Clark (1957) who found that income elasticity of demand for services is greater than unitary, implying that preferences are non-homothetic. Recently Buera and Kaboski (2010) have developed a macro model of demand shifts due to non-homothetic preferences. Differently from my paper they focus exclusively on income effects and skill-intensive services, they ignore different tastes across education groups and do not estimate demand elasticities of various goods and services from individual consumption data.

Two recent papers which explicitly link skill supply and skill demand through consumption demand are Manning (2004) and Mazzolari and Ragusa (2007). Using city-level variation they show that the growth of skills and wages at the top of the distribution is related to an increase in demand for low-skill-intensive services such as personal services which in turn increases the demand for low skilled labor. Both papers rely on the hypothesis that rising returns to skills spur high-skilled workers to substitute market for home-based production of household services. Although in this paper I do not rely on the substitution effect in labor supply, my findings are consistent with Manning (2004) and Mazzolari and Ragusa (2007). While the substitution effect is a plausible explanation only for the growth of low-skill-intensive untradable services like cleaning and baby sitting, I show that the consumption channel also works for high-skill-intensive goods and services thus reinforcing the demand shift in favor of skilled workers.

An alternative explanation of structural change is based on the supply side i.e. on different rates of sectorial TFP growth.[2] Autor and Dorn (2009) combine the idea of Baumol (1967) of slow productivity growth in the service sector with the "polarization hypothesis": contrary to the decline of middle-skill occupations, employment and wages in the low-skilled personal service sector grow over time because personal services imply non-routine tasks which cannot be easily substituted by new technologies (Autor, Levy and Murnane, 2003).[3] Their mechanism is based on the observation that if demand for the outputs of service occupations does not admit close substitutes in consumption, the substitution of information technology for routine tasks used in goods production may, in the long run, lead to rising wages and employment in service occupations.

Although with a different mechanism -based on demand for products rather than technology - my results show that rising skills and income may also produce polarization with higher growth of employment and wages in low-skill intensive services but also in high-skill intensive services. The supply- and demand-based explanations of polarization need not to be exclusive and Goos et al. (2010) compare the two using cross-country cross-industry data.

2 The Model

This model is meant as a guidance for the empirical part and provides a framework to quantify the importance of the income and education elasticities of product demand in explaining the evolution of education wage premia. It is a

[2] Examples of papers in this vein are Reshef (2010), Kongsamut, Rebelo and Xie (2001), Ngai and Pissarides (2007). A review of the vast literature on structural change focussed on issues of income distribution can be found in the book by Bertola, Foellmi and Zweimueller (2006).

[3] Acemoglu (1999) and Autor, Katz and Kearney (2006 and 2008) for the US and Goos and Manning (2007) for the UK present evidence of employment polarization during the last two decades. The polarization literature has looked also at other countries such as West Germany, see Spitz-Oener (2006) and Dustmann, Ludsteck and Schönberg (2009). Acemoglu and Autor (2010) provide a model to analyze the effects of technology on wage polarization.

$2x2$ model with two sectors and workers-consumers of two education types; consumers' preferences are non-homothetic and may vary across education group.

The economy consists of H skilled workers and L unskilled workers, skilled workers are workers with a college degree, unskilled workers are workers without a college degree. Labor markets are competitive and both labor inputs move across sectors to equate their marginal value. Labor supply is assumed to be exogenous and inelastic, factor supplies in the two production sectors are given by: $L = L_1 + L_2$ and $H = H_1 + H_2$. Sector 1 is the high-skill-intensive sector, sector 2 is the low-skill-intensive sector. Production functions are assumed to be CES with elasticity of substitution $\sigma_1 = \sigma_2 = \sigma$. $Y_1 = F_1(H_1, L_1)$ denotes the high-skill-intensive commodity (i.e. the aggregate of all high-skill-intensive items) and $Y_2 = F_2(H_2, L_2)$ the low-skill-intensive commodity (i.e. the aggregate of all low-skill-intensive items). Since the focus is on the role of product demand, in this model there is no technical progress.[4]

Demands for the two commodities have a generic form that allows for non-homotheticity, and are different for skilled and unskilled workers:

$$Y_1 = Hy_1^h(\frac{p_1}{p_2}, w_h) + Ly_1^l(\frac{p_1}{p_2}, w_l) \quad (1)$$
$$Y_2 = Hy_2^h(\frac{p_1}{p_2}, w_h) + Ly_2^l(\frac{p_1}{p_2}, w_l) \quad (2)$$

where, $\frac{p_1}{p_2} = p$ is the relative price of skill-intensive commodity and w_h (w_l) is the wage of skilled (unskilled) workers. Equation 1 denotes the total demand for the high-skill-intensive commodity Y_1. The first term of the right hand side (RHS) of equation 1 represents demand by the H skilled workers, the second term represents demand by the L unskilled workers. In this model there is a role for education elasticities because the *per-capita* demand functions for both high-skill-intensive commodity $y_1^i(.)$ and the low-skill-intensive commodity $y_2^i(.)$ are assumed to depend from education $i = h, l$. Skilled and unskilled workers are allowed to have different price and income elasticities. Equation 2 has the same interpretation for the low-skill-intensive commodity Y_2.

Let us normalize $p_2 = 1$. The system is solved for $d \log w_h$ as a function of $d \log H$, assuming that $dH = -dL$ i.e. the initial increase in skilled workers leaves total labor supply unchanged.[5] Because of the assumption of constant labor supply, $\frac{d \log w_h}{d \log H}$ denotes the percentage change in the college premium over the percentage change in the skill ratio. The derivations are given in the

[4] For the effect of technical progress on the wage structure in multi-sector economies, see among others Haskel and Slaughter (2002) or Weiss (2008).

[5] The assumption that $dH = -dL$ implies both a constant labor supply and that one hour of work by an educated worker is weighted with the same efficiency units as one hour of work for a non educated worker. The model can be adjusted to imply an increase in labor supply and a higher efficiency of educated workers without substantial changes in the results.

Appendix. The result is:

$$\frac{d\log w_h}{d\log H} = \frac{(1-a_2)\{(\lambda_H - \lambda_L)[R_1 - (1-R_1)\frac{H}{L}] - [1 + \lambda_H + \frac{H}{L}(1+\lambda_L)]\}}{(\lambda_L + 1)\sigma + (\lambda_H - \lambda_L)(1-a_1)\sigma - (\lambda_H - \lambda_L)T} \tag{3}$$

where $T = \{R_1[(a_1 - a_2)\varepsilon^h_{1p} + (1-a_2)\varepsilon^h_{1m}] + (1-R_1)[(a_1-a_2)\varepsilon^l_{1p} - a_2\varepsilon^l_{1m}]\}$.

Equation 3 establishes the condition that links wage inequality (the skill premium) $\frac{w_h}{w_l}$ to a rise in the skill ratio $\frac{H}{L}$ and depends from the following parameters: (i) The parameters $a_1 = \frac{w_h H_1}{p_1 F_1(.)}$ and $a_2 = \frac{w_l H_2}{p_2 F_2(.)}$ denote the wage bill share of skilled labor in the high-skill-intensive sector 1 and in the low-skill-intensive sector 2; (ii) $\lambda_H = \frac{H_1}{H_2}$ and $\lambda_L = \frac{L_1}{L_2}$ are respectively the ratio of skilled labor employed in sector 1 and 2 and the ratio of unskilled labor employed in sector 1 and 2. We know that $a_1 - a_2 > 0$ and $\lambda_H - \lambda_L > 0$, given that sector Y_1 is high-skill-intensive; (iii) $R_1 = \frac{Hy^h_1(.)}{Hy^h_1(.)+Ly^l_1(.)}$ is the share of total expenditure on the high-skill-intensive commodity 1 by skilled workers; (iv) ε^i_{1p} and ε^i_{1m} are respectively the price and the income elasticities of demand for the high-skill-intensive commodity. The index $i = h, l$ indicates that both elasticities may be different for skilled and unskilled workers[6]; (v) σ is the elasticity of substitution between skilled and unskilled workers in production.

Two notes on the model. First notice that differently from the Katz and Murphy (1992) key equation $\log\frac{w_h}{w_l} = \alpha + \beta t + \gamma \log\frac{H}{L}$, in this model the relationship between $\frac{w_h}{w_l}$ and $\frac{H}{L}$ depends on substitution elasticities in the production function and on price and income elasticities of demand i.e. the γ of the Katz and Murphy equation is a mix of technological substitution and the effect that relative quantities have on relative wages through product demand shifts. Secondly, price elasticities (which are typically negative) tend to decrease wage inequality because they increase the denominator of equation 3. However in this paper I consider education and income as the driving forces of consumption preferences and I view prices as endogenous to income, therefore price elasticities will not be estimated in the benchmark specification in the empirical part.[7] At the end of the paper I will parametrize equation 3 on the basis of the relevant elasticities and labor market aggregates. Only at that stage, to quantify the effects of income and education on inequality, I will also provide an estimate for price elasticities.

2.1 Education and Income Elasticities in the Model

The hypothesis of the model is that college educated workers have different utility functions and may prefer particular types of goods and services such as the education of their own children, health services, professional goods and

[6] Due to normalization with respect to $p_2 = 1$, ε^i_{1m} (ε^i_{1p}) indicates the income (price) elasticity for the skill-intensive commodity 1 relative to the income (price) elasticity for the low-skill-intensive commodity 2 for education group i.

[7] Other papers focus on price effects on wage inequality: Moretti (2009) looks at changes in housing prices on purchasing power of households. Cortes (2008) finds that low-skilled immigration benefits the high-skilled native population by decreasing prices of nontraded-goods, Frattini (2010) finds the same on UK data.

services, books and newspapers. The effect of education elasticities may contribute to increase the relative wage of the skilled in equation 3 through the term $R_1 = \frac{Hy_1^h(.)}{Hy_1^h(.)+Ly_1^l(.)}$. In this model an increase in $\frac{H}{L}$ implies a shift from the demand of the high-skill-intensive commodity by unskilled workers, $y_1^l(.)$, to the demand of the high-skill-intensive commodity by skilled workers $y_1^h(.)$. This mechanism tends to increase wage inequality if skilled (i.e. educated) workers demand more of the high-skill-intensive commodity than unskilled workers, i.e. $y_1^h(.) > y_1^l(.)$.[8]

The traditional income effect is potentially distinct from the "education effect" and works within education groups. Income and education effects will be estimated separately but in equation 3 they contribute jointly to the shift in product demand. Income elasticities (which are typically positive) contribute to explain the rise of the relative wage of skilled workers reducing the denominator of equation 3. If richer workers (after controlling for education) tend to consume more of the high-skill-intensive commodity (i.e. $\varepsilon_{1m}^l = \varepsilon_{1m}^h > 0$ for both skilled and unskilled workers), then an increase in the general level of income (both w_l and w_h) will also shift out the relative demand of the skill-intensive commodity and increase the college premium.[9]

3 The Empirical Strategy

3.1 The Match between Consumption Data and Industry Data

To assess whether more educated and richer consumers consume relatively more skill-intensive goods and services, I match the information on individual consumption items from the Consumer Expenditure Survey (CEX) to the skill intensity of the manufacturing industry calculated from the Current Population Survey (CPS). The data on consumption are drawn from the CEX provided at NBER (see Data Appendix for details). I use data on all non-durable items whose consumption has been consistently recorded from 1994 to 1997. Durable goods such as housing expenditure and purchase of motor vehicles are excluded. I select this time period to have a sample in the middle of the rise in wage inequality which is concentrated in the '80s and in the '90s and slowed down after year 2000. I run robustness checks on other periods in Table 6.

[8] To see this more clearly notice that, if educated and non-educated workers had the same demand for the high-skill-intensive commodity (i.e. $y_1^h(.) = y_1^l(.)$), then $R_1 = \frac{H}{H+L}$ and the term $(\lambda_H - \lambda_L)[R_1 - (1-R_1)\frac{H}{L}]$ would disappear and the numerator of equation 3 would then be unambiguously negative. The term R_1 increases the numerator of 3 if $R_1 > (1-R_1)\frac{H}{L}$ i.e. if $y_1^h(.) > y_1^l(.)$.

[9] An increase in income dispersion raises the income of some workers but reduces that of others. Hence, the net effect on product demand is ambiguous. In this model an exogenous increase in inequality, w_h relative to w_l, due for example to skill-biased technical change will raise demand for the skill-intensive commodity and increase wage inequality further if skilled and unskilled workers have different income elasticities and skilled workers tend to increase their demand of the skill-intensive commodity more than unskilled workers (i.e. $\varepsilon_{1m}^h > \varepsilon_{1m}^l$). The effect of inequality on consumption of low-skill-intensive services is the focus of Mazzolari and Ragusa (2007).

The descriptive statistics of the US sample are in Table 1. The final sample includes 23,247 households and their expenditure on 39 consumption items which are matched to the respective manufacturing industry in the CPS in Table 2. The 39 items represent 98% of total non-durable household expenditure and 85% of total expenditure inclusive of durables.

Figure 1 shows the change in the employment share (top panel) and wage bill share (bottom panel) of 39 two-digit industries in the US between 1984 and 2002 ranked by their skill intensity in 1980 (the proportion of workers with some college education in total industry employment). The picture shows a clear positive correlation between employment and wage changes towards skill-intensive industries which is suggestive of a role for demand shifts. This relationship does not have a causal interpretation, but instead needs to be interpreted as an equilibrium relationship. To assess the role of consumption demand I regress income and education elasticities on industry skill intensity and interpret a positive coefficient as evidence of the contribution of income and education growth to the shift of demand towards high-skill-intensive goods and services.

3.2 Econometric Specification

Sixteen of the 39 consumption items considered in the US sample are infrequently purchased and 50% or more households record zero expenditure on them (see the items with mean expenditure share less than 0.010 in Table 1). Due to the large number of zero expenditure on many items, the benchmark education and income elasticities are estimated using a Tobit model, other models are tried in the robustness check section. The Engel curve specification has the form (time subscripts omitted):

$$\omega_{ij} = b_j X_i + \gamma_j' ed_i + \sum_{p=1}^{10} \delta_{jp} d_p (\log x_i) + \varepsilon_{ij} \qquad \text{for } j = 1,..,J \qquad (4)$$

with $J = 39$. $\omega_{ij} = \frac{p_j y_{ij}}{x_i}$ is the expenditure share of item j by household i, $\log x_i$ is the log of real total expenditure of household i, and d_p are 10 dummies, one for each decile of log expenditure. The purpose of estimating income elasticities at various deciles is to investigate income effects at different deciles. X_i contains the age and sex of the head of household, the number of earners, the number of adults and the number of children under 18 in the household.[10] ed_i is an education dummy which is equal to one if the head of household has some college education (13 or more years of completed education).[11]

Since the equations are semi-logaritmic the education elasticity is equal to:

[10] In this specification prices are endogenous and price elasticities are not estimated. A set of estimates of education and income elastiticities obtained adding log prices to equation 4 is available and does not change qualitatively the overall results.

[11] The results which consider college graduates with a completed degree rather than with some college are similar and available upon request. The "education-elasticity" is estimated through a dummy variable for some college education, rather than a continuous variable (e.g. years of schooling) because differences in taste are unlikely to vary by each year of education and the dummy is easier to relate to the 2-skill GE model.

$\widehat{\eta}_j^{ed} = \frac{\widehat{\gamma}_j * \overline{ed}}{\overline{\omega}_j}$ where $\overline{\omega}_j$ is the average budget share of item j and $\overline{ed}$ is the percentage of heads of household who have some college education: $\overline{ed}$= 0.52 in the US sample (CEX 1994-1997). The budget elasticity (in the text and tables is often called income elasticity) is equal to: $\widehat{\eta}_{jp}^{budget} = \frac{\widehat{\delta}_{jp}}{\overline{\omega}_j}$. I calculate income elasticities at the median of log total expenditure $p = 5$, at the 90th income percentile $p = 10$ (the decile where inequality increased the most over the last twenty years both in the US and the UK) and at the 10th percentile $p = 1$.[12] The standard errors of education and income elasticities are calculated using the Delta method.

3.2.1 Education and Income Elasticities

Table 3 shows the education and the budget (income) elasticities for each one of the 39 items in the US CEX 1994-1997. For ease of interpretation, the items are ranked in ascending order according to the skill intensity of their manufacturing industries (as defined below) which is shown in the last column of Table 3. The elasticities calculated at the 90th and 10th percentile are not shown in the Table for space reasons but are plotted in Figure 4. Although the vast majority of elasticities are estimated with precision, the standard errors indicate that the income and education elasticities of some of the items are not estimated with precision probably reflecting their infrequent purchase (for example hospitals). There is also an issue of multicollinearity between education and income which may reduce significance of the estimates, in the robusteness Section we show results obtained introducing separately education and income in equation 4.

Poor families tend to spend relatively more (i.e. low income elasticity) on food consumed at home and home electricity, gas, water and telephone; rich families allocate a relatively larger proportion of their total expenditure in personal goods, recreation services and education at all levels.[13] Education elasticities of low-skill-intensive goods and services such as clothing and domestic services are higher than zero; much higher than zero are also the education elasticities of high-skill-intensive goods and services such as recreation services, airline fares and education services of all levels.

3.3 The Industry Skill Intensity

Table 4 ranks the US industries from the least skill intensive to the most skill intensive. The industry skill intensity is calculated from CPS data 1979-1980 as the share of workers who obtained some college education (13 or more years).[14]

[12] The results of semielasticities and of income elasticities calculated at the mean are not qualitatively different and are available upon request.

[13] The data should capture that educated parents spend more on education for their children. The data should not capture, though, that a kid in college who lives on her own (hence a head of household with some college education in the CEX data) reports to the survey that she spent a certain amount on tuition fees. The likely truth is that those are her parents' expenditures but unfortunately we do not know whether her parents hold a college degree in CEX data. To correct for these cases I run robustness checks excluding young heads of households until age 30 or excluding expenditure on education altogether.

[14] Skill intensity is calculated in 1980 to prevent endogeneity with elasticities estimated in 1994-1997. Results obtained using industry skill intensity in 1994-1997 are not very different

Low-skill-intensive industries (with less than 25% of workers with some education) are food production and eating places, apparel production, repairs, personal services, house supplies and house services. High-skill-intensive industries with more than 50% of workers with some college education are business and professional services, education and social services and financial services and insurance.

3.3.1 Input-Output Tables

The skill intensity of the manufacturing industry is arguably not the best measure of the skill content of the consumption goods. In fact, the 39 industries which have a direct match to a consumption item represent only about 25% of the total wage bill and 28% of total employment in the US economy. Intermediate goods may be important because the industries which produce inputs may have a different skill intensity than those that produce the final output.

To account for the skill intensity of the input-producing industries, I use the US industry-by-industry Input-Output tables in year 1995 (see data Appendix for the details) which provide information on the input contribution of 123 industries.[15] The coarser classification of industries in I-O tables than in the CPS implies that an equal value of skill intensity - when it is adjusted for intermediate goods and services - is attributed to different industries, for example in the case of the last four industries in the second column of Table 4 (education of different levels and social services belong to the same industry in the Input-Output tables).

In the second column of Table 4, I calculate the skill intensity of each of the 39 original industries as the weighted average of the skill intensity of their inputs. In formulas, the skill intensity of final product j, z_j^{INPUT}, is calculated as $z_j^{INPUT} = \sum_i \frac{I_{ij}}{\Sigma_i I_{ij}} z_i$. The weights $\frac{I_{ij}}{\Sigma_i I_{ij}}$ indicate industry's i input contribution to produce one unit of product in industry j and are provided by the Input-Output table. z_i is the skill intensity of intermediate industry i.

An eye-ball comparison of the first and second column of Table 4 shows that taking into account intermediate inputs increases the skill intensity of the low-skill-intensive items and reduces the skill intensity of the high-skill-intensive items. Low-skill-intensive intermediate inputs, like the retail sector, are expected to reduce the skill intensity of all final products. For the low-skill-intensive final items the effect of the retail sector is offset by the contribution of other intermediate inputs which are relatively more skill intensive. Figure 2 shows this phenomenon: very low-skill-intensive items (e.g. apparel) become more skill intensive when skill intensity is adjusted for intermediate goods while very high-skill-intensive goods and services (e.g. education) go through the opposite process.

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and available upon request.

[15] The industries are classified according to an Input-Output industry code and are matched to the original 3-digit industry code of the CPS in Table 1 in the Appendix.

A further concern regards import penetration in the different industries: it may be the case that consumption goods with very high income elasticities are mainly produced abroad and therefore contribute nothing to the increase in the domestic demand for skilled labor.[16] To take into account import penetration, I multiply intermediate-inputs-adjusted skill intensity z_j^{INPUT} by the import penetration of the final industry. The import penetration of industry j, NX_j, is calculated as $NX_j = (1 - I_j)/Y_j$. In this expression I_j and Y_j are respectively imports of goods and services and total final demand of industry j. I_j and Y_j are obtained from the Input-Output tables. The resulting measure of skill intensity, $z_j^{IMPORT} = z_j^{INPUT} * NX_j$, reduces the skill intensity of the importing sectors.[17]

4 Results

4.1 The Relationship between Elasticities and Skill Intensity

Figure 3 and 4 plot respectively education and income elasticities and income elasticities estimated at the 90th and 10th percentile of the log total expenditure against skill intensity. Both figures show that elasticities tend to be higher for low-skill-intensive and high-skill-intensive consumption items, they suggest a sort of "polarization of consumption" towards consumption items at the two extremes of the skill intensity distribution. To allow for the possibility that more educated and richer consumers consume both more low-skill-intensive and high-skill-intensive items, I estimate the quadratic relationship:

$$\widehat{\eta}_{jt} = \alpha + \beta_1 z_j + \beta_2 z_j^2 + d_t + \varepsilon_j \tag{5}$$

where $\widehat{\eta}_{jt}$ is in turn the education and the income elasticity (estimated at the median, at the 90th and the 10th percentile) for commodity j in year t. z_j is skill intensity of industry j measured in 1980 (or the adjusted measures of skill intensity as defined above) and d_t are year dummies. Standard errors are clustered at the industry level. All regressions are weighted by the mean share of the consumption item in total expenditure, a measure of the importance of the item in the household budget. Regressions weighted by the inverse of the estimated variance of $\widehat{\eta}_j$, a measure of estimates' precision, are presented in the robustness table. The two weights by and large coincide because the most infrequently consumed items are also those whose elasticities are more imprecisely estimated.

The estimated coefficients $\widehat{\beta}$ are shown in Table 5. Each panel of Table 5

[16] Most of the industries have a very low share of imports in proportion to total output, the industries with the highest import penetration are clothing and drugs production.

[17] This measure of skill intensity makes the strong hypothesis that the skill content of imports is the same as the skill content of domestically manufactured goods. An interesting political economy application of heterogenous preferences by skill level is provided in Baker (2005). With survey data from 41 nations he shows that heavy consumers of exportables (generally low-skilled workers) are found to be more protectionist than heavy consumers of imports and import-competing goods (generally skilled workers).

shows the estimated coefficients obtained using a different measure of skill intensity. In panel A, income and education elasticities are regressed on the skill intensity z_j of the manufacturing industry in 1980. The significant coefficients in the first (second) column of Table 5 indicate that, keeping income (education) constant, college-educated (richer) workers tend to consume both more high-skill-intensive goods and services and more low-skill-intensive goods and services. The results on the income elasticities calculated at the 90th and 10th percentile and Figure 4 show that there are minor differences in the estimates across the log expenditure distribution in the US.

In panel B skill intensity z_j^{INPUT} is corrected for the contribution of intermediate inputs and is the most adapt measure to establish whether richer and more educated consumers tend to consume more skill intensive goods and services. For this reason I consider Panel B as the benchmark result and in the following section I run robustness checks with respect to Panel B.[18] In panel C, skill intensity $z_j^{IMPORT} = z_j^{INPUT} * NX_j$ takes into account both the contribution of intermediate inputs and import penetration. To measure the effect of education and income elasticities in increasing the domestic demand for skilled labor we should weigh the skill intensity of the manufacturing industry for the industry import intensity since imported goods are not going to increase domestic labor demand.

The significant coefficients on the linear and quadratic terms in both panel B and C of Table 5 confirm the result that the increase in education and in income have plausibly shifted product demand towards both very high-skill-intensive and low-skill-intensive goods and services i.e. the "polarization of consumption" phenomenon of Figures 3 and 4 is robust to substantially different measures of skill intensity.

4.2 Robustness Exercise

In this section I take on various issues about the robustness of the estimates of elasticities $\widehat{\eta}_j$ (the dependent variable of regression 5) which concern the sample used for estimation, the estimation method, the presence of outliers.

Panel A of Table 6 for the US provides some robustness exercises with respect to the weighting of regression 5 and to the sample used to estimate the elasticities. In the robustness tables I show only the results regarding education and income elasticities calculated at the median and neglect the elasticities calculated at the 90th and 10th percentiles because the benchmark results show no substantial difference in estimates across the income distribution. The three robustness tests of Panel A columns (i) to (iii) refer to: (i) the weighting of regression 5 with the inverse variance of the estimated elasticities rather than with the mean share of the consumption items in household budget; (ii) the year in which the elasticities are calculated; (iii) the age composition of the sample.

[18] The robustness checks with respect to panel A i.e. using the raw measure of skill intensity are available upon request, they do not differ substantially from the those in Table 6.

The results indicate that the quadratic relationship between education and income elasticities and skill intensity is robust to: (i) weighting the regression by a measure of precision of the estimated elasticity rather than with a measure of importance of the consumption item in the average household budget; (ii) changes in the years of estimation to 1999-2002; (iii) the relationship holds when the elasticities are estimated on the group of heads aged 18-60 (due to the large number of elderly heads this group is 75% of the total US sample) and therefore does not depend on patterns of consumption varying by age.

Panel B of Table 6 provides in columns (iv) to (vi) three robustness exercises with respect to the estimation method of the elasticities in equation 4. In column (iv) log total expenditure is instrumented using log total household net income; in column (v) we use OLS models instead of Tobit; in column (vi) we use semiparametric models. Semiparametric models have been used extensively to study the effect of household demographic composition on Engel curves (for example the presence and number of children in Blundell et al., 1998). I adopt the semiparametric specification to study how household expenditures vary with the education level of the head of household controlling for a nonparametric function of log total expenditure $g(\log x)$. In equation 4 the term $\sum_{p=1}^{10} \delta_{jp} d_p(\log x_i)$ is substituted by the generic function $g(\log x)$. The parameters of interest are the γ_j education dummies and the first derivative $\widehat{g}'_j(.)$ for each share equation j where $\widehat{g}(.)$ is a kernel smoother. When calculated at the mean of log total expenditure, $\widehat{g}'_j(.)$ indicates the mean (rather than the median estimated in the Tobit models) income elasticity of each share equation j.[19]

The results indicate that the quadratic relationship between education and income elasticities and skill intensity is robust to: (iv) the endogeneity of total expenditure with respect to the expenditure shares of the single consumption goods which is typically addressed instrumenting total expenditure with total household income; (v) the results do not depend on the Tobit specification of the model and on the number of zero expenditures for many consumption items. In fact OLS models give broadly the same results even if the R-square is lower because of the presence of more outliers among the estimated elasticities. Regarding semiparametric estimation in point (vi), the quadratic relationship does not hold neither for education elasticities nor for income elasticities at the mean but holds at the 90th percentile (not shown). The semiparametric method is the only case where income effect is driven by consumers at the top of the income distribution rather than by all consumers at all points of the distribution.

Finally inspection of Figures 3 and 4 suggests that the quadratic relationship between elasticities and skill intensity may be dependant from the presence of

[19] The income elasticity for each share equation j is calculated using the perturbation method i.e. the derivative of the Engel curve is calculated in the neighborhood $h = 0.15$ of the average of log total expenditure: $\widehat{g}'_j(x) = \frac{1}{2h}(\widehat{g}(x+h) - \widehat{g}(x-h))$ where $x = \overline{\log x}$. The standard error of this estimate is given by the formula $s_{\widehat{g}'_j}(x) = \sqrt{\frac{(1/2\pi^{0.5})1/n\sum(\omega_{ij} - \widehat{g}_j(\log x_i))^2}{\lambda \widehat{p}(x)n}}$ where $\widehat{p}(x) = \frac{1}{\lambda n}\sum_{i=1}^{n} K\frac{(x_i - x)}{\lambda}$ is the density estimated at the mean of log total expenditure $x = (\overline{\log x})$ (Yatchew, 2003).

the expenditure on education which is the most skill-intensive item. The NBER dataset reports three expenditures on education: elementary, high education and other education; they are all very skill intensive and have a high elasticity with respect to income. Panel C of Table 6 shows that: when I exclude the three expenditures on education in column (vii), the significance of the quadratic relationship between education elasticities and skill intensity is still there but it is not significant anymore; the quadratic relationship between income elasticities and skill intensity is still significant even if the R-square is lower. A further issue is that the contemporaneous estimation of education and income elasticities may present collinearity problems which reduce the significance of the estimates. To this extent in column (viii) and (ix) I reestimate education and income elasticities inserting them separately one at a time in equation 4. The standard errors of the estimates are lower and the quadratic relationship is significant (column(viii)) even when I exclude the three education expenditures (column (ix)).

Overall the results in Table 5 and 6 suggest that the quadratic relationship between elasticities and skill intensity is robust to many changes in the sample, the estimation method, the presence of outliers and the definition of skill intensity.

5 Quantification of the Demand Shift

The coefficients of Tables 5 and 6 are not informative as to the extent to which an increase in education or income raises or decreases the demand for skilled labor. To answer this question, in this section I parametrize the two-sector model of section 2 using the relevant elasticities and the labor market aggregates of the US economy. I quantify the increase in the relative demand of skilled labor in response to an increase in the relative supply of skills making use of the relationship between the skill premium and the skill ratio implied by the model in equation 3.

To match the two-sector nature of the model, the 39 items and the corresponding industries are divided into 20 low-skill-intensive items and 19 high-skill-intensive items: All consumption items matched to industries with a skill intensity lower than 0.36 (the skill intensity of the median industry "Electricity") in the last column of Table 3 are considered low-skill-intensive. Once we have divided the low-skill-intensive and the high-skill-intensive industries (and the respective consumption items) to match the two-sector model, we can estimate the parameters of equation 3. The parameters λ_H, λ_L, a_1, a_2 and $\frac{H}{L}$ are estimated using CPS 1994-1997 data. The elasticities ε_{1p}^h, ε_{1p}^l, ε_{1m}^h, ε_{1m}^l, R_1 are estimated using CEX 1994-1997 data. The elasticity of substitution between educated and non-educated workers, $\sigma = 1.4$, is taken from Katz and Murphy (1992).

Table 7 lists the parameters values used to parametrize equation 3. The details of the calculation of labor market aggregates and of the estimation of the parameters can be found in the Parameter Appendix. For ease of exposition the Table contains parameters values also for the UK which are commented later.

Plugging the parameter values of Table 7 in equation 3, the final result is $\frac{d \log w_h}{d \log H} = -0.67$. The interpretation of this number makes sense with respect to the counterfactual of what would have happened without the education and income effect in favor of high-skill-intensive consumption items. The same model solved with identical demand functions for skilled and unskilled workers (i.e. $y_1^h(.) = y_1^l(.) = y_1(.)$) gives the following counterfactual result (which is a two-sector version of the basic framework by Katz and Murphy, 1992):[20]

$$\frac{d \log w_h}{d \log H} = \frac{-(1-a_2)[1+\lambda_H + \frac{H}{L}(1+\lambda_L)]}{(\lambda_L+1)\sigma + (\lambda_H - \lambda_L)(1-a_1)\sigma - (\lambda_H - \lambda_L)\varepsilon_{1p}(a_1 - a_2)} \tag{6}$$

Parametrization of equation 6 gives the result $\frac{d \log w_h}{d \log H} = -0.73$.

The comparison between equation 3 and equation 6 shows that education and income effects contribute to reduce the extent of the fall of $\frac{w_h}{w_l}$ in response to an increase in $\frac{H}{L}$.[21] To understand the magnitude of this contribution we need to compare the actual numbers of the college premium in the US economy with the counterfactual prediction of the model with homothetic demand functions (equation 6) and calculate how much of the difference can be explained by equation 3 which includes education and income effects. The result of this exercise is summarized in Table 8.

The actual skill ratio in the US economy $\frac{H}{L}$ increased by 81% between 1984 and 2002 and the college premium $\frac{w_h}{w_l}$ increased by 11% (CEX data). Taking $\frac{H}{L}$ as the exogenous variable, equation 3 which incorporates the education and income effect in favor of skill-intensive consumption items implies that $\frac{w_h}{w_l}$ should have fallen by 54% (-0.67*0.81=-0.54) as a result of an increase in $\frac{H}{L}$ of 81%. Equation 6 with identical preferences across educated and non-educated workers implies a fall of $\frac{w_h}{w_l}$ by 59% (-0.73*0.81=-0.59).

If we take equation 6 with identical demand functions across educated and non-educated workers as the counterfactual, the total shift in relative labor demand which is left unexplained is 70% (the actual 11% plus the counterfactual 59% implied by equation 6). These calculations imply that the education effect in favor of skill-intensive consumption items can account only for around 7% of

[20] Notice that without education and income effects, $\frac{d \log w_h}{d \log H}$ is unambiguously negative. The only additional parameter which we need to parametrize equation 6 is ε_{1p} i.e. the price elasticity of high-skill-intensive consumption items estimated on the sample of all workers (educated and non-educated). ε_{1p} is estimated at ε_{1p} =-0.53(0.21) for the US and -0.59(0.11) for the UK.

[21] The total effect is of 0.06 points (0.67-0.73). The total effect can be also decomposed in different parts. The direct effect of education elasticities can be quantified in $(1-a_2)(\lambda_H - \lambda_L)[R_1 - (1-R_1)\frac{H}{L}] = 0.50$ in the numerator of 3. The effect through different price and income elasticities across educated and non-educated workers can be quantified in the difference between $T = \{R_1[\varepsilon_{1p}^h(a_1-a_2) + \varepsilon_{1m}^h(1-a_2)] + (1-R_1)[\varepsilon_{1p}^l(a_1 - a_2) - a_2\varepsilon_{1m}^l]\}$ and $\varepsilon_{1p}(a_1 - a_2)$. The difference in income elasticities is calculated at $R_1(1-a_2)\varepsilon_{1m}^h - (1-R_1)a_2\varepsilon_{1m}^l$ =0.27. The difference in price elasticities is calculated at $R_1(a_1-a_2)\varepsilon_{1p}^h + (1-R_1)(a_1-a_2)\varepsilon_{1p}^l - (a_1-a_2)\varepsilon_{1p} = -0.10$.

the total shift in the relative demand of labor. Namely the effect of different preferences across educated and non-educated workers reduces by 5% the fall of the relative wage (54% instead of 59%) and 5% points constitute about 7% of the 70% total shift in the relative labor demand.

6 Results for the UK

In this section I summarize the results obtained for the UK and comment on the differences with the US putting all the background information in the Appendix Tables.[22] There is a large difference between the US and the UK data in the percentage of heads of household with some college education: $\overline{ed}$= 0.52 in the US sample (CEX 1994-1997) and $\overline{ed}$= 0.12 in the UK sample (FES 1994-1997). As a result of this difference the skill intensity of UK industries is on average much lower and the education sector is a clear outlier because its skill intensity (54% of workers left full time education after their 19th year of age) is much higher than that of all other sectors.

The results on UK data are presented in Table 9. The U-shaped relationship between elasticities and skill-intensity - the "polarization of consumption" result - is significant in the UK for education and income elasticities calculated at the 10th, 50th and 90th percentile. However this quadratic relationship is driven by the presence of expenditure on education which is a clear outlier in UK data (more than in US data). Differently from the US, the quadratic relationship does not hold when skill intensity is adjusted for intermediate inputs and imports, the coefficients become insignificant and the R square is very low (not shown).

The observation of Figure 5 which plots income and education elasticities (estimated on the pooled sample rather than year-by-year for clarity reasons) against skill intensity adjusted for intermediate inputs suggests that the relationship is linear rather than quadratic. In panel B and C of Table 9 I present the results of fitting a linear line and I find that the linear coefficient is positive significant for income elasticities but it is insignificant for education elasticities. In the UK tables I report LAD regressions results of equation 5 rather than OLS because, when the elasticities are estimated by year rather than on the pooled sample, there are some outliers in the estimates due to the many items which are infrequently purchased. The tables report the R-square of the corresponding OLS regressions. In panel B and C of Table 9 I also find that the income elasticities of skill intensive items is higher for richer consumers as indicated

[22] The UK sample is drawn from FES data 1994:1-1997:12 and includes 26,213 households and their expenditure on 39 non-durable consumption items (see the Data Appendix and descriptive statistics in Appendix Table 2). Consumption data are matched to LFS industry data in Table 3 in the Appendix. Table 4 in the Appendix shows that industry skill intensity is on average much lower in the UK than in the US however the ranking is similar with the footwear and clothing industry and personal services (hairdressing, domestic help etc.) at the bottom and education services at the top of the distribution. The elasticities of the 39 goods (estimated over the pooled sample of years) are ranked in ascending order according to the skill intensity of their manufacturing industries in Table 5 in the Appendix. Some of the results are similar to the US even if the disaggregation of the consumption variables is different: income elasticities are large for the low-skill-intensive domestic services and personal services and for skill-intensive services such as education and medical services.

by the steeper slope of the regression at the 90th percentile than at the 10th percentile. In comparison to the US the demand bias towards skill-intensive goods and services is driven by income rather than education and in the UK (more than in the US), the income effects are stronger among consumers at the top percentiles of the income distribution.

Similarly to the US case, in Table 10 I run robustness checks with respect to z_j^{INPUT} i.e. the skill intensity adjusted for intermediate inputs. Columns (i) to (iii) of Panel A of Table 10 indicate that the positive and significant linear coefficient between income elasticities and skill intensity is robust to: (i) weighting the regression by the inverse of the variance of the estimated elasticity rather than with the mean share of the consumption item; (ii) changing the year of estimation of elasticities to 1987-1990; (iii) the relationship holds when elasticities are estimated on the group of heads aged 18-60 and therefore does not depend on patterns of consumption varying by age. Actually in the sample of working age heads 18-60 and in the sample of years 1987-1990 also the education elasticities are positively significantly related to skill intensity. Panel B shows that changing the method of estimation has no qualitative impact on the benchmark results: the coefficient is positive significant for income elasticities and insignificant for education elasticities. This is true when the elasticities are estimated instrumenting log total expenditure with log total net income (column (iv) which actually shows a much steeper slope of the linear relationship); but it is also true in column (v) using OLS models instead of Tobit and in column (vi) using semiparametric models.

Finally we want to try if the results obtained for z_j^{INPUT} - and shown in Figure 5 - are sensitive to the presence of expenditure on education. Panel C of Table 10 shows (vii) that the results excluding expenditure on education (which is only one item in UK data and accounts on average - including families with no children - for less than 1% of total expenditure, see Table 2 in Appendix) are virtually equal to the benchmark. To verify whether the insignificance of the results regarding education elasticities depend on multicollinearity in the estimation of both education and income in equation 4, results in column (vii) show that results do not change if education and income are estimated in separate equations including expenditure on education - in column (viii) - and excluding expenditure on education in column (ix).

6.1 Quantification of Demand Effect for the UK

Table 8 summarizes the quantification exercise. The UK numbers on the labor market aggregates are taken from the LFS 1994-1997, the elasticities are estimated on FES data (see Table 7 in the Appendix). For the quantification exercise all goods and services in Appendix Table 5 up to "Personal articles" included are considered low-skill-intensive, from there onwards they are considered high-skill-intensive. Notice that skill intensity is much lower on average in the UK and the threshold that separates low-skill-intensive from high-skill-intensive consumption items is 0.092 (9.2% of workers in industry "Personal articles" in the UK have some college education in 1994-1997). The skill ratio is much lower in the UK than in the US: $\frac{H}{L} = 0.28$ in the LFS sample 1994-1997. Not only the skill ratio is much lower in the UK but also the distribution of college-educated workers is much more concentrated in the skill-intensive industries (sector 1) in the UK rather than in the US: hence the higher value of $\lambda_H = \frac{H_1}{H_2} = 6.73$ and the lower value of $\alpha_2 = \frac{w_h H_2}{p_2 y_2} = 0.08$ in the UK with respect to the US. While income and price elasticities (ε^h_{1m}, $\varepsilon^l_{1m}, \varepsilon^h_{1p}, \varepsilon^l_{1p}$) are fairly similar across the US and UK, the value of $R_1 = 0.16$ is much lower in the UK. This is not surprising because the numerator of R_1 is the total expenditure on the 19 high-skill-intensive items by college-educated workers and the share of college-educated workers is much lower in the UK than in the US.

The result of the parametrization equation 3 using the UK parameter values of Table 7 is $\frac{d\log w_h}{d\log H}$ = -0.78 while the parametrization of the counterfactual equation 6 gives the result $\frac{d\log w_h}{d\log H}$ =-0.85. Similarly to the US, in the UK the skill ratio $\frac{H}{L}$ increased by 88% between 1982 and 2000 and the college premium $\frac{w_h}{w_l}$ increased by 14%. Equation 3 implies that $\frac{w_h}{w_l}$ should have fallen by 68% (-0.78*0.88=-0.68) as a result of an increase in $\frac{H}{L}$ of 88%. Equation 6 with identical preferences across educated and non-educated workers (which we take as counterfactual of what would have happened if there had not been an effect of income and education elasticities) implies a fall of $\frac{w_h}{w_l}$ by 74% (-0.85*0.88=-0.74). Therefore the total unexplained shift in relative labor demand in the UK is 88% (the actual 14% plus the counterfactual 74% implied by equation 6). These calculations imply that the education and income effect in favor of skill-intensive goods can account only for around 7% of the total shift in the relative demand of labor: a reduction of 6% in the fall of the relative wage (68% instead of 74%) corresponds to about 7% of the 88% total shift in the relative labor demand.

7 Conclusions

The evidence presented in this paper shows that more educated and richer consumers consume more skill-intensive services such as education and professional services but also more of the very low-skill-intensive goods and services such as cleaning services and baby sitting (see Mazzolari and Ragusa, 2007) . The U-shaped relationship between education and income elasticities and skill-intensity of consumption goods and services is prevalent in the US while in the UK the relationship appears to be linear and positive. Both the US and UK results are robust to various sample cuts and estimation methods and to measures of skill intensity calculated using Input-Output tables to take into account the contribution of intermediate inputs to the skill content of final goods.

The parametrization of a simple two-sector model suggests that overall the income and education effects in favor of skill-intensive services can explain around 7% of the total increase in the college premium in the US from 1984 to 2002. Approximately the same quantitative result is obtained for the UK in the same period. Notwithstanding the differences between the US and UK in the share of college-educated workers in the economy and their distribution across high-skill and low-skill intensive sectors (see the large differences in the parameters in Table 8), the overall results in terms of explanatory power are similar across the UK and US which is an indication of the robustness of this simple model to parameter changes. The effect is not large but of potential interest because of the stable structure of income and education elasticities over time which suggests a constant bias towards high-skill-intensive services.

The mechanism based on education and income elasticities can give an additional contribution (besides the traditional explanations based on technology or trade) to the accounting of the increase in the college premium but it is certainly not able to fully explain this phenomenon. Inspection of equation 3 reveals that only implausibly high values of the education (R_1) and income elasticities (ε^h_{1m}) would be able to explain the full extent of the increase in $\frac{w_h}{w_l}$ in this simple static model. In this respect a further line of research would endogenize college choice in the model and in the estimation of the elasticities. In this vein Buera and Kaboski (2010) calibrate a dynamic general equilibrium model based on income elasticities and obtain very large effects of income.

In conclusion the evidence presented here complements the recent literature which explains the distribution of employment across sectors and the evolution of wage inequality relying either on demand-based explanations (Manning, 2004 and Mazzolari and Ragusa, 2007) or on supply-based explanations (i.e. computerization of routine tasks like in Autor and Dorn, 2009). In this paper I point to a robust and relatively unresearched empirical fact and quantify its relevance using a simple model, however further research is certainly needed to distinguish the contribution of the various explanations.

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Data Appendix

US CEX: The data used in this paper are drawn from the Consumer Expenditure Survey provided by Ed Harris and John Sabelhaus at NBER (www.nber.org/data/ces_cbo.html). The mapping of the single items into the 39 aggregate items is detailed in (www.nber.org/ces_cbo/Cexfam.pdf). The item "food at work" is not considered because it refers to payments in form of food vouchers. The sample size of the original NBER data 1994 -1997 is 23,301 households. I drop 54 records reporting implausible consumption expenditures shares of more than 100% on a single item. The only changes from the NBER dataset are the following: (i) Non-durable total expenditure is obtained subtracting from NBER-provided total expenditure housing costs and durables such as autos. (ii) Household disposable income includes the sum of wages, salaries, business and farm income earned by each member plus household financial income (including interest, dividends and rents) plus private transfers (including private pensions, alimony and child support) plus public transfers (including social security, unemployment compensation, welfare and food stamps) minus total taxes paid (including federal, state, local and social security contribution). Total expenditure and income are deflated using the CPI-U for that period.

The family records data contain consumer unit information on expenditures, income, wealth, and basic household demographics. The data of the third and fourth quarter of 1995 are not available due to a change in the sampling frame. The member record data are used only to extract the age, sex and education level of the head of household. As explained on the NBER web page the four quarterly records of each household have been merged into an annual record. For example, the 1997:1 files contain the annual expenditures for households that began the survey 1997:1 and combines expenditures reported from 1997:1 - 1997:4. For this reason the sample size is different form the dataset by Heathcote et al. (2010) who use quarterly expenditure data. The aggregation introduces some sample attrition bias therefore I use weights (TOTWJ) in estimation. The use of weights does not change the results in any substantial way.

US CPS: industry skill intensity in 1980 is calculated using the 1979 and 1980 CPS-MORG files on 399,912 employed individuals with a valid three-digit industry record (IND70). Sample weights are not used.

US other data: Price data for each consumption good are obtainable on the BLS web page. The Input-Output tables used to account for intermediate inputs and import penetration are the industry-by-industry domestic use matrices at basic prices for the US in 1995.

UK FES: The measure of consumption includes non-durable goods and services and excludes durable and semi-durable goods. The main omissions are housing costs, furniture, furnishings and electrical appliances, motor vehicles and garden and audiovisual equipment (see Blundell and Etheridge, 2010) plus some other very minor expenditures such as TV licence and car tax which do not have any obvious industry match. Household gross income is the sum of labour earnings and asset earnings across individuals. Net disposable income consists of gross income plus public transfers (social security benefits, state pension, luncheon vouchers, education grants and student top-ups) minus labour and payroll taxes. Qualifications are not given in the FES, so I define "some college education" those heads who left school after age 19.

The 1994:1-1997:12 baseline sample consists of 26,618 households. To each household I allocate a head (usually the male in a household consisting two or more individuals). The final sample is formed as follows: we drop 264 households whose head left full-time education before 6 years of age; 20 households who allocate more than 90% of non-durable expenditure on any of the 39 items; 121 households who have negative total expenditure. The final sample is of 26,213 households. I do not use sample weights in estimation.

UK LFS: industry skill intensity is calculated using the 1981-83-84 files on 240,833 employed individuals with a valid four-digit industry record. Sample weights are not used. I use the highest qualification attained "first degree or higher" as measure of proportion of college-educated by industry.

UK other data: The price series for each consumption item are provided by the Office of National Statistics. When the consumption items are aggregated at a higher level, the corresponding price series are constructed as a weighted average of their basic components.

Input-Output tables are 1997 Office of National Statistics official tables. Differently from the US, the 1997 UK Input-Output table is classified according to the same 1992 Standard Industry Classification code used to match the consumption items to their manufacturing industries in the LFS. Therefore there is no need to match different industry classifications to calculate adjusted skill intensities in the second and third column of Appendix Table 4 for the UK. The only discrepancies between the coding used to calculate skill intensity in the first column of the Table, and the coding of the Input-Output table used to calculate skill intensity in the second and third column of the same Table, are the following: SIC 1992 codes 93.02 "hairdressing" and 93.05 "domestic help" are joint in 93 "other service activities". SIC codes 15.91+15.92 "alcoholic drinks distilling", 15.93 "wine production" and 15.96+15.97 "beer production" are joint in 15.91 to 15.97 "alcoholic beverages". SIC codes 22.1+22.2 "printing and publishing" and 22.3 "reproduction of recorded media" are joint in 22 "printing and publishing and reproduction of recorded media".

Model Appendix

The general equilibrium is completely described by the following five equations where the price of the low-skill-intensive commodity has been normalized to unity, $p_2 = 1$:

$$p_1 F_1(H_1, L_1) = w_l L_1 + w_h H_1 \tag{7}$$

$$F_2(H - H_1, L - L_1) = w_l(L - L_1) + w_h(H - H_1) \tag{8}$$

$$d\log\left(\frac{H_1}{L_1}\right) = -\sigma d\log\left(\frac{w_h}{w_l}\right) \tag{9}$$

$$d\log\left(\frac{H - H_1}{L - L_1}\right) = -\sigma d\log\left(\frac{w_h}{w_l}\right) \tag{10}$$

$$H y_1^h(p_1, w_h) + L y_1^l(p_1, w_l) = F_1(H_1, L_1) \tag{11}$$

The first two equations, 7 and 8, restate the constant returns assumption. Equations 9 and 10 are definitions of substitution elasticities in a CES technology.

The last equation 11 is the market equilibrium condition for commodity Y_1. According to Walras' law, equilibrium in the factors' market and in the market of commodity Y_1 implies that the market of commodity Y_2 clears.

Taking the total differential and logs of equations 7-11:

$$d\log p_1 = a_1 d\log w_h + (1-a_1)d\log w_l \tag{12a}$$
$$(1-a_2)d\log w_l = -a_2 d\log w_h \tag{12b}$$
$$d\log H_1 - d\log L_1 = -\sigma(d\log w_h - d\log w_l) \tag{12c}$$
$$(1+\lambda_H)d\log H - \lambda_H d\log H_1 - (1+\lambda_L)d\log L + \lambda_L d\log L_1 = -\sigma(d\log w_h - d\log w_l) \tag{12d}$$

$$R_1[\varepsilon^h_{1p} d\log(p_1) + \varepsilon^h_{1m} d\log w_h + d\log H] +$$
$$+(1-R_1)[d\log L + \varepsilon^l_{1p} d\log(p_1) + \varepsilon^l_{1m} d\log w_l] = a_1 d\log H_1 + (1-a_1)d\log L_1 \tag{13}$$

Assuming total labor supply is fixed $dH = -dL$, substituting equations 12a to 12d in 13 we obtain:

$$\frac{d\log w_h}{d\log H} = \frac{(1-a_2)\{(\lambda_H - \lambda_L)[R_1 - (1-R_1)\frac{H}{L}] - [1+\lambda_H + \frac{H}{L}(1+\lambda_L)]\}}{(\lambda_L\sigma_1 + \sigma_2) + (\lambda_H - \lambda_L)(1-a_1)\sigma_1 - (\lambda_H - \lambda_L)T} \tag{14}$$

where $T = \{R_1[\varepsilon^h_{1p}(a_1 - a_2) + \varepsilon^h_{1m}(1-a_2)] + (1-R_1)[\varepsilon^l_{1p}(a_1-a_2) - a_2\varepsilon^l_{1m}]\}$.

In this model the relationship between $\frac{w_h}{w_l}$ and $\frac{H}{L}$ depends on substitution elasticities in the production function and on price and income elasticities of demand for high-skill-intensive goods which in turn reflect elasticities of substitution of high-skill-intensive and low-skill-intensive goods in consumption. Obviously factors should not be perfect substitutes in production ($\sigma_i \neq \infty$) nor goods should be perfect substitutes in consumption ($\varepsilon^i_{1p} \neq \infty$).

Parameters Appendix

Parameters from the CPS sample 1994-1997: the ratio of the number of workers with some college education who work in the 19 high-skill-intensive industries over those who work in the 20 low-skill-intensive industries is calculated at $\lambda_H = \frac{H_1}{H_2} = 2.21$. The ratio of the number of workers without a college education who work in the 19 high-skill-intensive industries over those who work in the 20 low-skill-intensive industries is calculated at $\lambda_L = \frac{L_1}{L_2} = 0.6$. The wage bill share of workers with some college education in the 19 high-skill-intensive industries is $\alpha_1 = \frac{w_h H_1}{p_1 y_1^h} = 0.65$; in the 20 low-skill-intensive industries it is $\alpha_2 = \frac{w_h H_2}{p_2 y_2^h} = 0.37$.[23] The skill ratio $\frac{H}{L} = 0.57$ in the CPS sample 1994-1997.

Parameters from the CEX sample 1994-1997: Due to the normalization in the model with respect to the low skill sector, the elasticities ε^i_{1m} and ε^i_{1p} (where i is the education group) are expressed in relative terms and they refer to consumption of high-skill-intensive items relative to low-skill-intensive items, therefore the estimation takes into account a system of equations and the constraints imposed by the theory. The two-equation system will have an equation for high-skill-intensive items and one "auxiliary" equation for low-skill-intensive items with the purpose of imposing constraints on the first equation. A system will be estimated for each education group $i = h, l$.

$$\omega_{1ij} = \gamma X_i + \beta_1 \log(\frac{x}{P})_i + \gamma_1 \log(\frac{x}{P})^2_i + \theta_1 \log p_1 + \phi_1 \log p_2 + \zeta_{1j} + \varepsilon_{1ij}$$
$$\omega_{2ij} = \gamma X_i + \beta_2 \log(\frac{x}{P})_i + \gamma_2 \log(\frac{x}{P})^2_i + \theta_2 \log p_1 + \phi_2 \log p_2 + \zeta_{2j} + \varepsilon_{2ij}$$

where $\omega_{1,2ij} = \frac{p_i y_{ij}}{x}$ is the expenditure share of item j by household i and the subscripts 1 and 2 indicate that the first equation pools the 19 high-skill-intensive items produced in sector 1 and the second equation pools the 20 low-

[23] a_1 and a_2 are calculated assuming constant returns to scale i.e. $p_1 y_1 = w_l L_1 + w_h H_1$ and $p_2 y_2 = w_l L_2 + w_h H_2$. The value of production in the high-skill and in the low-skill intensive sector is calculated summing the wages of all workers in that sector.

skill-intensive items produced in sector 2. $\zeta_{1,2j}$ indicates fixed effects for each item j. $\log(\frac{x}{P})$ is log total expenditure and $\log P = \sum_j w_j \log p_j$ is the Stone price index where w_j is the annual average share of commodity j in the data. X_i contains age and sex of the head and the number of children in the household. $\log p_1 = \sum_{j=1}^{19} w_j \log p_j$ is an aggregate price index constructed using the individual commodity price series $\log p_j$ of the 19 high-skill-intensive items (or of the 20 low-skill-intensive items) and their annual shares in total expenditure w_j as weights. The standard errors are clustered at the household level.

The system is estimated imposing the homogeneity constraint (the effect of a 1% increase in income will produce between the two equations a total increase in expenditure of 1% therefore the sum of the income elasticities must be equal to one) i.e. $\varepsilon_{1m} = \frac{(\widehat{\beta}_1 + 2\widehat{\gamma}_1 \overline{\log(\frac{x}{P})})}{\overline{\omega}} + 1 = 1 - \varepsilon_{2m} = 1 - \left(\frac{(\widehat{\beta}_2 + 2\widehat{\gamma}_2 \overline{\log(\frac{x}{P})})}{\overline{\omega}} + 1 \right)$ and and the symmetry constraints (the effect of an increase in $\log p_1$ or $\log p_2$ must be symmetric across the two equations) i.e. $\theta_1 = -\theta_2$ and $\phi_1 = -\phi_2$.

The results of the system estimation are in Table 6 and 7 respectively for the US and UK in the Appendix. The first two columns of the Tables show the results obtained on the sample of workers with some college education, columns three and four refer to the sample of non-college educated workers. Column 1 and 3 of Appendix Table 6 refer to the "auxiliary" equation of low-skill-intensive items and their coefficients are not used directly in calculating the elasticities. We use instead the coefficients in the second and fourth columns of the table which refer to the equations of high-skill-intensive items. I explain only the US parameters but the UK parameters are obtained in the same way. The income elasticities calculated at the average household characteristics are equal to $\varepsilon^h_{1m} = \frac{(\widehat{\beta}_1 + 2\widehat{\gamma}_1 \overline{\log(\frac{x}{P})})}{\overline{\omega}} + 1$ where $\overline{\log(\frac{x}{P})}$ is the average log real expenditure and $\overline{\omega}$ is the average expenditure share. To calculate income elasticity of skilled workers ε^h_{1m}, I use $\overline{\omega}, \widehat{\beta}_1, \widehat{\gamma}_1$ and $\overline{\log(\frac{x}{P})}$ of the sample of workers with some college education (column 4 of Appendix Table 6). To calculate the income elasticity of unskilled workers ε^l_{1m}, I use $\overline{\omega}, \widehat{\beta}_1, \widehat{\gamma}_1$ and $\overline{\log(\frac{x}{P})}$ of the sample of non-college-educated workers (column 2 of Table Appendix 6). On the basis of the coefficient estimates shown in Appendix Table 6, the income elasticities are estimated at $\varepsilon^h_{1m} = 0.89(0.30)$ and $\varepsilon^l_{1m} = 0.83(0.38)$.

The uncompensated price elasticity is given by: $\varepsilon^h_{1p} = \frac{\widehat{\theta}_1}{\overline{\omega}} - (\widehat{\beta}_1 + 2\widehat{\gamma}_1 \overline{\log(\frac{x}{P})}) - 1$. To calculate the price elasticity of skilled workers, ε^h_{1p}, I use $\widehat{\theta}_1, \overline{\omega}$ of the sample of college-educated workers (column 4 of Appendix Table 6). To calculate the price elasticity of unskilled workers, ε^l_{1p}, I use $\widehat{\theta}_1, \overline{\omega}$ of the sample of non-college-educated workers (column 2 of Appendix Table 6). ε^h_{1p} and ε^l_{1p} are estimated at ε^h_{1p} =-0.22(0.09) and ε^l_{1p} =-2.33(0.46). Finally, the share of expenditure on the 19 most skill-intensive goods by workers with some college education R_1, is calculated summing up total expenditure on the 19 high-skill-intensive items across college-educated workers and taking the ratio over total expenditure on the 19 high-skill-intensive items across all workers, $R_1 = \frac{Hy^h_1(.)}{Hy^h_1(.) + Ly^l_1(.)} = 0.66$.

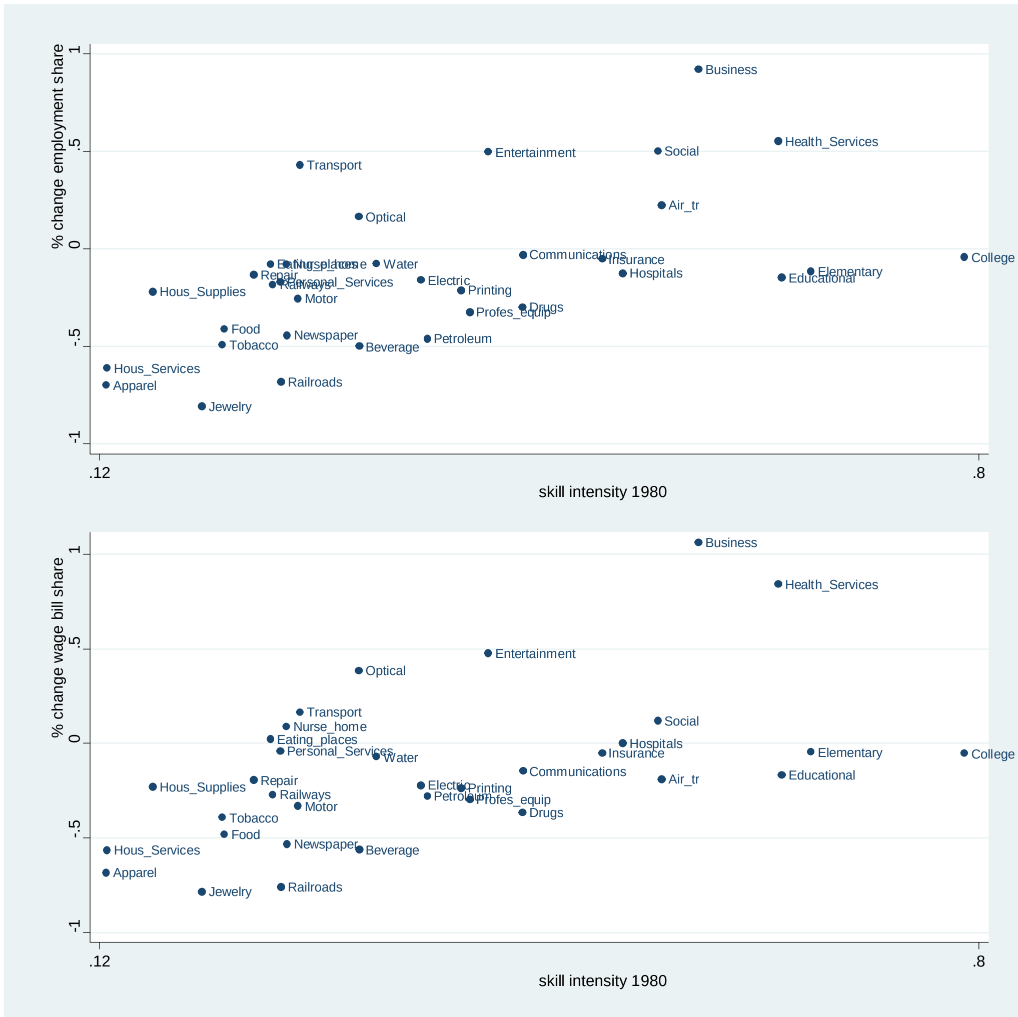

Figure 1: Percentage change in employment share between 1984 and 2002 (top panel) and in the wage bill share between 1984 and 2002 (bottom panel) by industry skill intensity in 1980. Source: CPS and CEX data

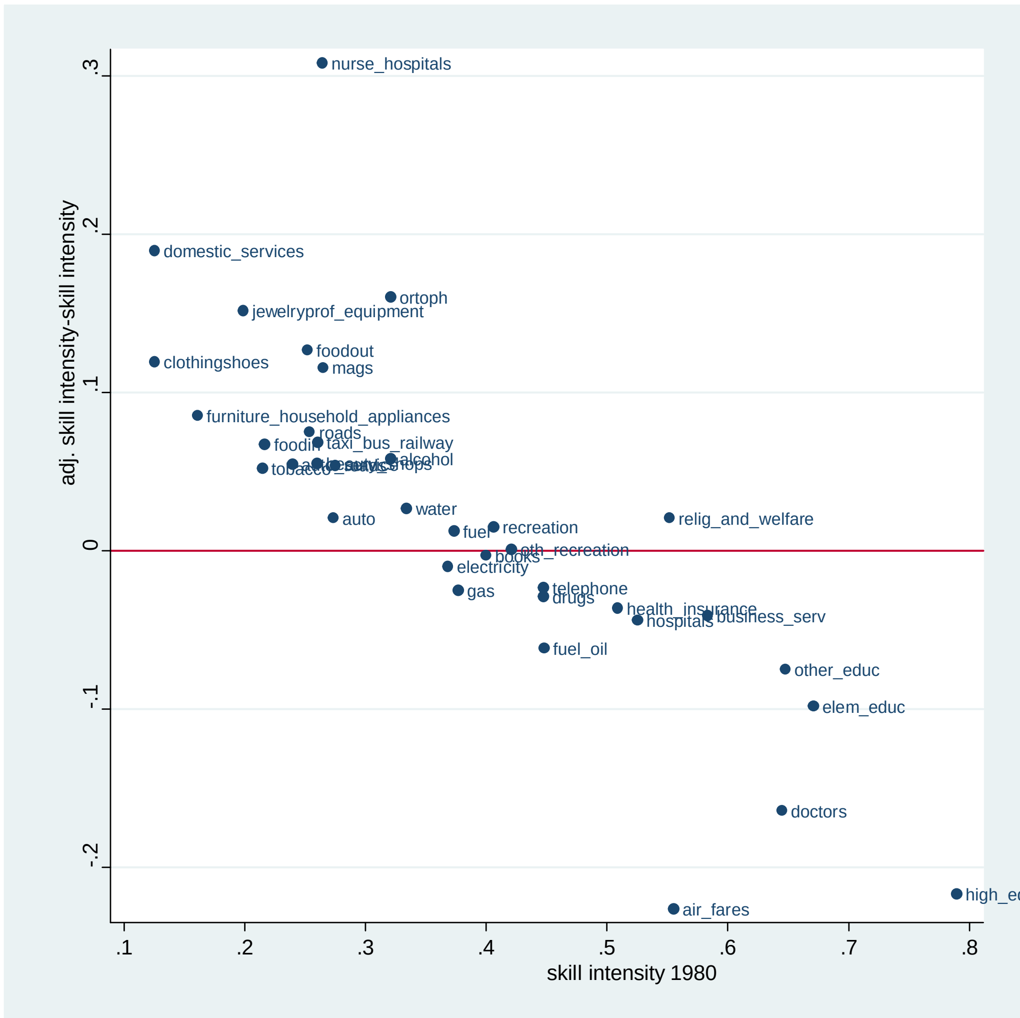

Figure 2: Adjusting skill intensity by intermediate inputs reduces the distance in skill intensity across consumption items. On the y-axis, the difference between adjusted skill intensity and skill intensity. Source: US CPS data and 1995 Input-Output tables.

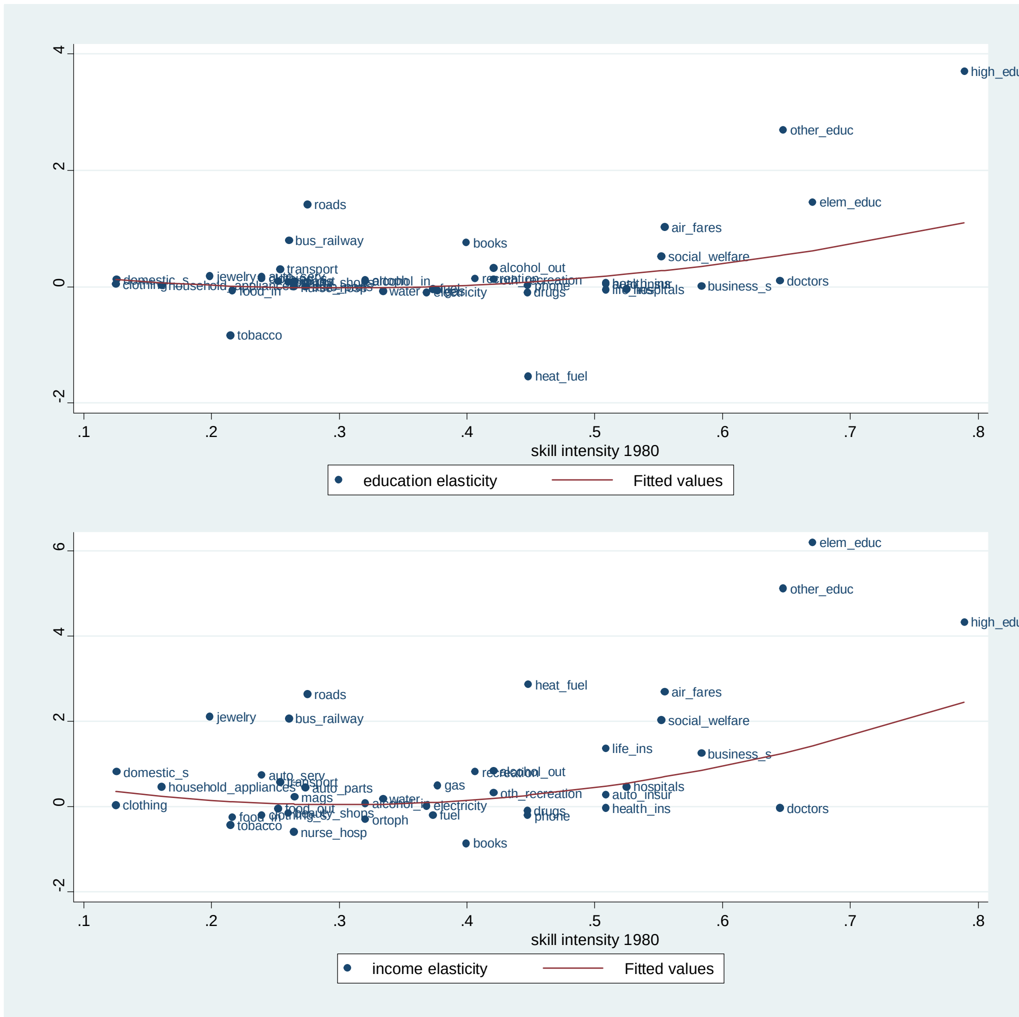

Figure 3: Weighted OLS regression of education and income elasticities on industry skill intensity. Fitted values assume a quadratic relationship. Source: US CPS and CEX data.

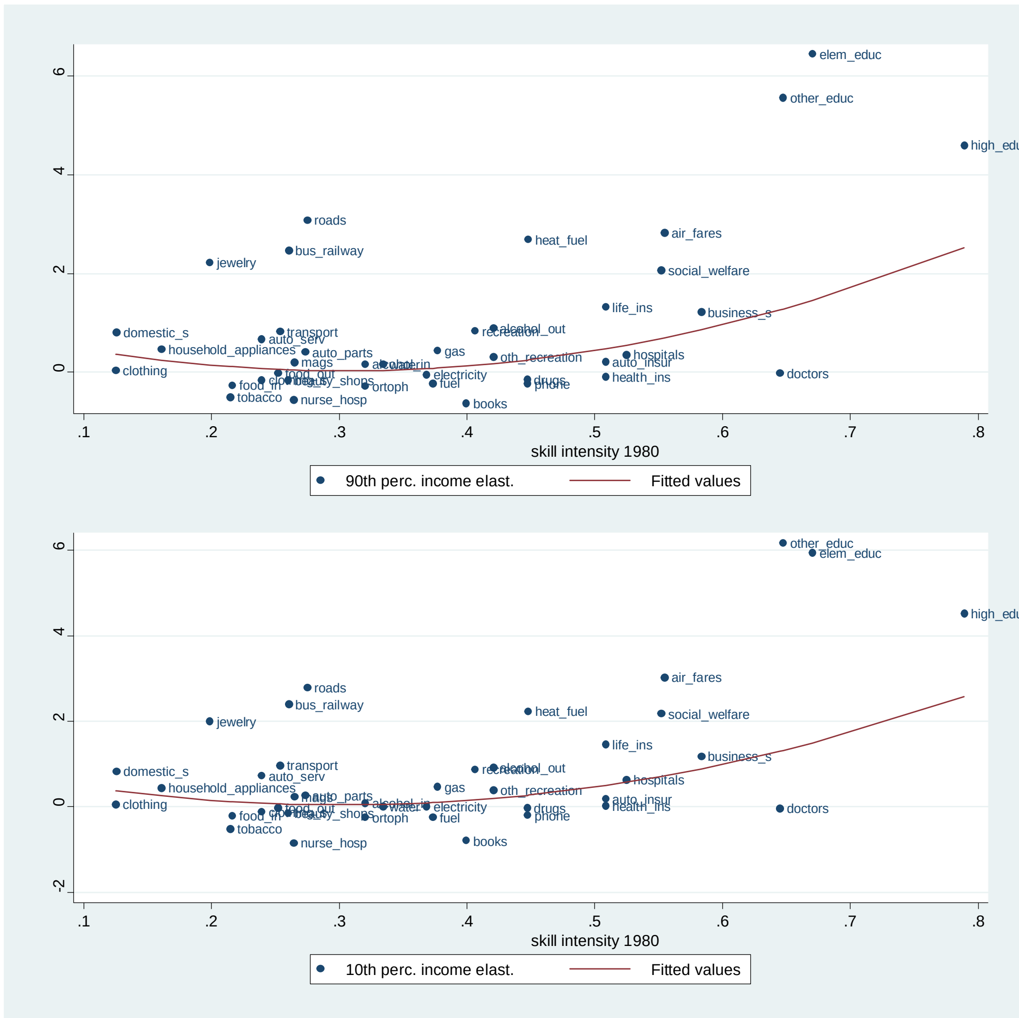

Figure 4: Weighted OLS regression of income elasticities at the 90th and at the 10th income percentile on industry skill intensity. Fitted values assume a quadratic relationship. Source: US CPS and CEX data.

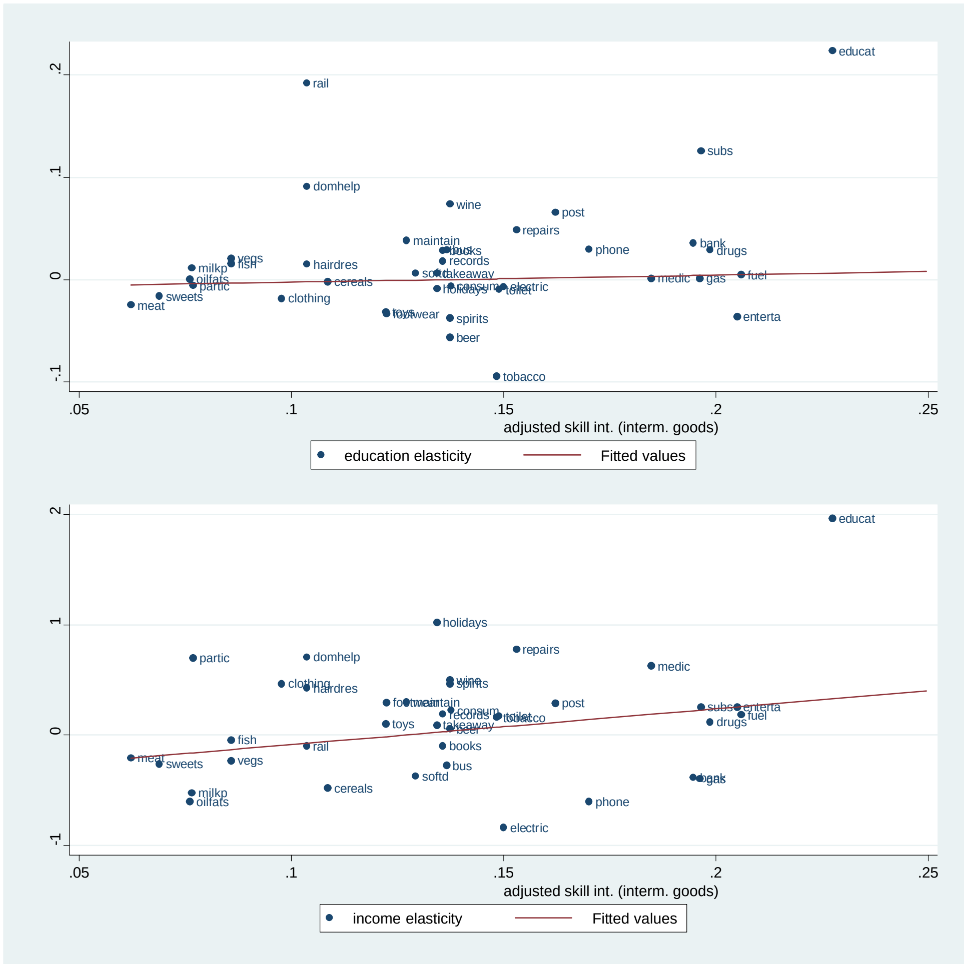

Figure 5: UK data. Weighted OLS regression of education and income elasticities on industry skill intensity adjusted for intermediate inputs. Fitted values assume a linear relationship. Source: UK LFS and FES data.

Table 1: Descriptive Statistics

Expenditure Shares	N	mean	sdt dev	min	max
Food Off-Premise	23247	0.147	0.091	0	0.994
Food On-Premise	23247	0.044	0.046	0	0.799
Tobacco Products	23247	0.012	0.026	0	0.969
Alcohol Off-Premise	23247	0.006	0.014	0	0.397
Alcohol On-Premise	23247	0.005	0.015	0	0.405
Clothing and Shoes	23247	0.039	0.042	0	0.727
Clothing Services	23247	0.006	0.010	0	0.255
Jewelry and Watches	23247	0.004	0.016	0	0.576
Barbershops, Beauty Parlors, Health Clubs	23247	0.010	0.013	0	0.655
Nondurable Household Supplies and Equipment	23247	0.026	0.046	0	0.812
Electricity	23247	0.034	0.029	0	0.435
Gas	23247	0.011	0.018	0	0.247
Water and Other Sanitary Services	23247	0.009	0.012	0	0.282
Fuel Oil and Coal	23247	0.003	0.012	0	0.251
Telephone and Telegraph	23247	0.032	0.029	0	0.524
Domestic Service, Other Household Operation	23247	0.016	0.028	0	0.517
Drug Preparations	23247	0.009	0.028	-0.119	0.986
Ophthalmic Products and Orthopedic Appliances	23247	0.003	0.011	-0.121	0.442
Physicians, Dentists, Other Medical Professionals	23247	0.014	0.035	-0.369	0.963
Hospitals	23247	0.003	0.024	-0.508	0.932
Health Insurance	23247	0.033	0.051	0	0.927
Business Services	23247	0.012	0.036	0	0.790
Expense of Handling Life Insurance	23247	0.011	0.023	0	0.528
Tires, Tubes, Accessories and Other Parts	23247	0.005	0.012	0	0.424
Repair, Greasing, Washing, Parking, Storage, Rental	23247	0.024	0.041	0	0.577
Gasoline and Oil	23247	0.040	0.034	0	0.569
Bridge, Tunnel, Ferry and Road Tolls	23247	0.000	0.001	0	0.036
Auto Insurance	23247	0.025	0.030	0	0.744
Mass Transit Systems	23247	0.003	0.011	0	0.397
Taxicab, Railway, Bus and Other Travel Expenses	23247	0.002	0.010	0	0.419
Airline Fares	23247	0.007	0.020	0	0.673
Books and Maps	23247	0.006	0.023	0	0.765
Magazines, Newspapers, Other Nondurable Toys, etc.	23247	0.010	0.014	0	0.348
Recreation and Sports Equipment	23247	0.020	0.042	0	0.774
Other Recreation Services	23247	0.031	0.030	0	0.753
Higher Education	23247	0.011	0.055	0	0.949
Nursery, Elementary, and Secondary Education	23247	0.006	0.025	0	0.621
Other Education Services	23247	0.002	0.012	0	0.650
Religious and Welfare Activities	23247	0.013	0.038	0	0.627
Some college education of head (dummy)	23247	0.522	0.500	0	1
Age of head	23247	45.608	17.903	15	94
Sex of head	23247	1.408	0.492	1	2
Number of children	23247	0.842	1.166	0	10
Number of earners	23247	1.330	0.937	0	12
Family size	23247	2.500	1.511	1	28
Log total househ. expenditure (price=2000)	23247	9.519	1.032	4.695	12.525
Log total househ. net income (price=2000)	15980	10.296	1.270	0.112	13.147

Notes: US CEX data 1994-1997.

Table 2: The Consumption Item-Industry Match

CEX consumption item	CPS Industry name	Sic 70	Sic 80
Food Off-Premise	Food and kindred products	268-298	100-122
Food On-Premise	Eating and drinking places	669	641
Tobacco Products	Tobacco manufactures	299	130
Alcohol Off-Premise	Beverage industries	289	120
Alcohol On-Premise	Eating and drinking places	669	641
Clothing and Shoes	Apparel and finished textile prod.	319-327	151-152
Clothing Services	Repair Services	749-759	751-760
Jewelry and Watches	Watches, clocks, clockwork devices	249	381
Barbershops, Beauty Parlors etc.	Personal Serv., Except Private Housh.	777-798	762-791
Nondurable Household Supplies	Soaps and cosmetics	358	182
Electricity	Electric light and power	467	460
Gas	Gas and steam supply systems	469	461
Water and Other Sanitary Services	Water supply	477	470
Fuel Oil and Coal	Petroleum products	558	200-201
Telephone and Telegraph	Communications	447-449	440-442
Domestic Service, Other Househ. Op.	Private Household Services	769	761
Drug Preparations	Drugs and medicines	357	541
Ophthalmic Products	Optical and health services supplies	247	372
Physicians, Dentists, Medical Profess.	Health Services , Except Hospitals	828-837, 839-848	812-830, 832-840
Hospitals	Hospitals	838	831
Health Insurance	Insurance and Real Estate	717-718	711-712
Business Services	Business Services	727-748	721-750
Expense of Handling Life Insurance	Insurance and Real Estate	717-718	711-712
Tires, Tubes, Accessories and Parts	Motor vehicles, motor vehicle equip.	219	351
Repair, Greasing, Parking etc.	Repair Services	749-759	751-760
Gasoline and Oil	Petroleum products	558	200-201
Bridge, Tunnel, Ferry, and Road Tolls	Street railways and bus lines	408	401
Auto Insurance	Insurance and Real Estate	717-718	711-712
Mass Transit Systems	Street railways and bus lines	408	401
Taxicab, Railway, Bus, and Travel Exp.	Railroads and railway express serv.	407	400
Airline Fares	Air transportation	427	421
Books and Maps	Printing, publishing	339	171
Magazines, Newspapers, Toys, etc.	Newspaper publishing and printing	338	172
Recreation and Sports Equipment	Professional and photo equipment	239-257	371-382
Other Recreation Services	Entertainment and Recreation Serv.	807-809	800-810
Higher education	College and university	858	850
Nursery, Elementary, and Sec. Education	Elementary and sec. schools	857	842
Other Education Services	Other educational Services	867	860
Religious and Welfare Activities	Social Services	877-879	861-871

Notes: US CPS and CEX data.

Table 3: Estimates of Education and Income Elasticities.

CEX consumption item	education elasticity	std. error	income elasticity	std. error	skill intensity
Clothing and Shoes	0.043	0.007	0.033	0.060	0.125
Domestic Service, Other Household Operation	0.119	0.019	0.807	0.123	0.126
Nondurable Household Supplies and Equipment	0.020	0.015	0.461	0.106	0.161
Jewelry and Watches	0.179	0.073	2.104	0.499	0.199
Tobacco Products	-0.836	0.041	-0.434	0.272	0.215
Food Off-Premise	-0.068	0.004	-0.253	0.036	0.217
Clothing Services	0.139	0.017	-0.210	0.136	0.239
Repair, Greasing, Washing, Parking, Storage, Rental	0.174	0.015	0.727	0.101	0.239
Food On-Premise	0.093	0.008	-0.045	0.070	0.252
Mass Transit Systems	0.304	0.089	0.582	0.536	0.254
Barbershops, Beauty Parlors, Health Clubs	0.075	0.011	-0.159	0.131	0.260
Taxicab, Railway, Bus and Other Travel Expenses	0.795	0.110	2.064	0.804	0.260
Magazines, Newspapers, Other Nondurable Toys etc.	0.094	0.011	0.215	0.086	0.265
Tires, Tubes, Accessories and Other Parts	-0.002	0.034	0.446	0.230	0.273
Bridge, Tunnel, Ferry and Road Tolls	1.418	0.169	2.638	0.941	0.275
Ophthalmic Products and Orthopedic Appliances	0.110	0.032	-0.307	0.329	0.321
Alcohol Off-Premise	0.091	0.034	0.073	0.280	0.321
Water and Other Sanitary Services	-0.073	0.018	0.178	0.143	0.334
Electricity	-0.094	0.007	0.018	0.061	0.368
Gasoline and Oil	-0.034	0.006	-0.205	0.055	0.373
Gas	-0.064	0.025	0.502	0.161	0.377
Books and Maps	0.755	0.033	-0.865	0.329	0.400
Recreation and Sports Equipment	0.140	0.022	0.813	0.215	0.406
Alcohol On-Premise	0.325	0.036	0.829	0.234	0.421
Other Recreation Services	0.119	0.008	0.311	0.059	0.421
Drug Preparations	-0.092	0.026	-0.106	0.188	0.447
Telephone and Telegraph	0.023	0.007	-0.210	0.111	0.447
Fuel Oil and Coal	-1.538	0.148	2.858	1.052	0.448
Expense of Handling Life Insurance	-0.046	0.033	1.363	0.313	0.509
Auto Insurance	0.046	0.012	0.273	0.094	0.509
Health Insurance	0.061	0.018	-0.038	0.139	0.509
Hospitals	-0.044	0.096	0.467	0.473	0.525
Religious and Welfare Activities	0.520	0.056	2.024	0.429	0.552
Airline Fares	1.023	0.068	2.688	0.477	0.555
Business Services	0.013	0.040	1.240	0.280	0.583
Physicians, Dentists and Other Medical Professionals	0.097	0.023	-0.034	0.110	0.645
Other Education Services	2.694	0.332	5.115	1.660	0.648
Nursery Elementary and Secondary Education	1.450	0.257	6.194	1.720	0.671
Higher education	3.701	0.241	4.327	1.351	0.789

Notes: US CEX data 1994-1997. The standard errors are calculated with the Delta method. Skill intensity is calculated from CPS data 1979-80.

Table 4: Industry Skill Intensity

CPS Industry	(1) skill intensity	(2) adj. skill intensity interm. goods	(3) adj. skill intensity import penetration
Food production	0.216	0.283	0.260
Eating places	0.252	0.378	0.378
Tobacco	0.214	0.266	0.238
Beverage	0.320	0.378	0.378
Bars and drinking places	0.252	0.421	0.419
Apparel	0.122	0.244	0.133
Repair	0.239	0.293	0.293
Jewelry and toys	0.198	0.350	0.321
Personal services	0.259	0.315	0.315
House supplies	0.160	0.246	0.206
Electric	0.368	0.358	0.356
Gas	0.376	0.351	0.351
Water	0.334	0.360	0.360
Petroleum	0.447	0.386	0.352
Communications	0.447	0.424	0.420
House services	0.125	0.315	0.315
Drugs	0.447	0.418	0.284
Optical	0.320	0.481	0.481
Health services	0.645	0.481	0.481
Hospitals	0.524	0.481	0.481
Health Insurance	0.508	0.472	0.468
Business serv.	0.583	0.542	0.540
Life Insurance	0.508	0.472	0.468
Motor parts	0.273	0.293	0.293
Auto Repair	0.239	0.293	0.293
Petroleum	0.373	0.386	0.352
Transport	0.274	0.329	0.327
Car Insurance	0.508	0.477	0.468
Railways	0.253	0.328	0.327
Railroads	0.260	0.329	0.327
Air transport	0.554	0.328	0.282
Printing	0.399	0.396	0.386
Newspaper	0.264	0.380	0.365
Profess equip	0.406	0.421	0.419
Entertainment	0.420	0.421	0.419
College	0.789	0.572	0.572
Elementary	0.670	0.572	0.572
Educational	0.647	0.572	0.572
Social services	0.551	0.572	0.572

Notes: Skill intensity in column (1) is calculated from CPS data 1979-80 as the share of workers in the industry with some college education (13 or more years of schooling). Skill intensity in column (2) is calculated using the 1997 industry-by-industry Input-Output table. Skill intensity in column (3) is calculated using the Input-Output tables weighted for import penetration (always from IO tables). See the text for more details.

Table 5: US data - OLS Regression of Estimated Education and Income Elasticities on Various Measures of Skill Intensity

Dependent variable	education elasticity	income elasticity	90th perc. income elast	10th perc. income elast
	Panel A			
skill intensity 1980	-7.306***	-10.75***	-11.59***	-11.05***
	(0.874)	(2.190)	(2.136)	(2.374)
skill intensity 1980 sq	11.10***	17.52***	18.68***	17.95***
	(1.063)	(2.663)	(2.598)	(2.888)
Constant	1.066***	1.498***	1.625***	1.544***
	(0.170)	(0.425)	(0.414)	(0.460)
R-squared	0.541	0.373	0.406	0.345
	Panel B			
adjusted skill int. (interm. goods)	-19.42***	-44.68***	-46.62***	-45.99***
	(3.473)	(7.241)	(7.117)	(7.860)
adjusted skill int. (interm. goods) sq.	26.04***	59.62***	62.09***	61.24***
	(4.096)	(8.540)	(8.394)	(9.270)
Constant	3.503***	8.141***	8.504***	8.408***
	(0.715)	(1.490)	(1.464)	(1.617)
R-squared	0.346	0.381	0.405	0.352
	Panel C			
adjusted skill int. (imported goods)	-8.895***	-19.21***	-20.11***	-19.82***
	(1.839)	(3.903)	(3.854)	(4.216)
adjusted skill int. (imported goods) sq.	14.27***	30.97***	32.28***	31.81***
	(2.391)	(5.073)	(5.009)	(5.480)
Constant	1.289***	2.782***	2.919***	2.886***
	(0.347)	(0.737)	(0.728)	(0.797)
R-squared	0.309	0.323	0.343	0.298

Notes: N=156. OLS regressions weighted by the mean share of the consumption item. All specifications include year dummies. Skill intensity in Panel A is the proportion of workers with college degree qualification or equivalent in total industry employment, in Panel B skill intensity is adjusted using Input-Output tables and in Panel C is adjusted using Input-Output tables and industry import penetration. Clustered standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Robustness Test of US Education and income Elasticities Calculated on Various Samples and with Various Methods

Panel A: Elasticities estimated on various samples

	(i) weighted by variance		(ii) sample aged 18-60		(iii) years 1999-2002	
	edu elast	income elast	edu elast	income elast	edu elast	income elast
adj. skill int.	-7.644***	-27.19***	-18.39***	-49.07***	-20.99***	-52.38***
	(2.686)	(6.841)	(3.107)	(7.157)	(3.928)	(7.654)
adj. skill int. sq.	10.44***	35.99***	24.98***	65.33***	28.18***	69.84***
	(3.289)	(8.312)	(3.664)	(8.441)	(4.597)	(8.958)
Constant	1.384**	5.151***	3.275***	8.939***	3.783***	9.576***
	(0.539)	(1.380)	(0.639)	(1.472)	(0.814)	(1.586)
Obs.	156	156	156	156	156	156
R-squared	0.105	0.155	0.395	0.421	0.343	0.446

Panel B: Different estimation methods of elasticities

	(iv) IV tobit		(v) OLS		(vi) semiparametric	
	edu elast	income elast	edu elast	income elast	edu elast	income elast
adj. skill int.	-21.70***	-34.25***	-1.989**	-8.687***	-1.693	-2.905
	(4.359)	(9.045)	(0.803)	(2.428)	(1.929)	(2.240)
adj. skill int. sq.	28.92***	46.78***	2.945***	11.67***	2.796	4.078
	(5.141)	(10.67)	(0.947)	(2.864)	(2.273)	(2.639)
Constant	3.926***	6.113***	0.316*	1.486***	0.219	0.399
	(0.897)	(1.861)	(0.165)	(0.500)	(0.396)	(0.460)
Obs.	156	156	156	156	156	156
R-squared	0.283	0.224	0.201	0.181	0.217	0.151

Panel C: Outliers

	(vii) exclude expenditure on education		(viii) separate education and income		(ix) separate educ and inc + exclude educ	
	edu elast	income elast	edu elast	income elast	edu elast	income elast
adj. skill int.	-2.157	-21.76***	-31.00***	-49.67***	-6.424**	-22.47***
	(2.207)	(6.012)	(4.644)	(7.662)	(3.129)	(6.134)
adj. skill int. sq.	3.424	29.59***	41.42***	66.24***	9.230**	30.61***
	(2.675)	(7.286)	(5.477)	(9.037)	(3.792)	(7.434)
Constant	0.337	3.952***	5.614***	9.063***	1.098*	4.078***
	(0.444)	(1.208)	(0.955)	(1.576)	(0.629)	(1.232)
Obs.	144	144	156	156	144	144
R-square	0.061	0.185	0.421	0.403	0.110	0.191

Notes: Skill intensity is always adjusted for intermediate inputs. Each column is the result of a OLS regression weighted by the mean share of the consumption item except in (i) where OLS are weighted by the inverse of the dependent variable variance. In (viii) and (ix) income and education elasticities are obtained estimating separate share equations where education or income enter exclusively to avoid multicollinearity. In (vii) and (ix) we drop expenditure on education (elementary, high education and other education expenditure). All specifications include year dummies. Clustered standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table 7: Parameters of the Model

λ_H	λ_L	a_1	a_2	$\frac{H}{L}$	ε^h_{1m}	ε^l_{1m}	ε^h_{1p}	ε^l_{1p}	ε_{1p}	R_1	σ
US CPS					US CEX						
2.21	0.6	0.65	0.37	0.57	0.89	0.83	-0.22	-2.33	-0.53	0.66	1.4
UK LFS					UK FES						
6.73	0.74	0.42	0.08	0.28	0.91	1.08	-0.61	-1.39	-0.59	0.15	1.4

Notes: $\lambda_H = \frac{H_1}{H_2}$, $\lambda_L = \frac{L_1}{L_2}$, $a_1 = \frac{w_h H_1}{p_1 . y^h_1}$, $a_2 = \frac{w_h H_2}{p_2 . y^h_2}$ and $\frac{H}{L}$ are estimated using CPS and LFS 1994 to 1997. ε^h_{1p}, ε^l_{1p}, ε^h_{1m}, ε^l_{1m}, R_1 are estimated using CEX and FES 1994 to 1997. σ is from Katz and Murphy (1992).

Table 8: Quantification of the Income and Education Effects

	(a) model with income and educ effect	(b) model without income and educ effect	(c) difference (a)-(b)	(d) demand shift $\frac{w_h}{w_l}$	(e) contribution income effect (c)/(d)
US CEX					
Implied $\frac{d \log w_h}{d \log H}$	-0.67	-0.73			
Percentage terms	-54%	-59%	5%	70%	7%
UK FES					
Implied $\frac{d \log w_h}{d \log H}$	-0.78	-0.85			
Percentage terms	-68%	-74%	6%	88%	7%

Notes: Implied $\frac{d \log w_h}{d \log H}$ are obtained parametrizing equation 3 in column (a) and equation 6 in column (b). Percentage terms in column (a) and (b) are obtained multiplying the implied $\frac{d \log w_h}{d \log H}$ by the actual increase between 1984-2002 in $\frac{H}{L}$ (in the US=81% and in the UK=88%). Percentage terms in column (d) is obtained summing the implied decrease of $\frac{w_h}{w_l}$ along the relative demand curve of the counterfactual model, i.e. the number in column (b), to the actual increase between 1984-2002 in $\frac{w_h}{w_l}$ (in the US=11% and in the UK=14%).

Table 9: UK data - LAD Regression of Estimated Education and Income Elasticities on Various Measures of Skill Intensity

Dependent variable	education elasticity	income elasticity	90th perc income elast	10th perc income elast
	Panel A			
skill intensity 1980	-1.704***	-23.25***	-24.84***	-18.91**
	(0.310)	(8.641)	(8.657)	(8.990)
skill intensity 1980 sq	8.091***	78.57***	85.20***	56.49**
	(0.783)	(21.84)	(21.88)	(22.73)
Constant	0.0551**	1.806**	1.859**	1.508*
	(0.0276)	(0.771)	(0.772)	(0.802)
R-squared	0.524	0.086	0.100	0.041
	Panel B			
adjusted skill int. (interm. goods)	0.152	3.664***	3.245***	2.490***
	(0.112)	(0.778)	(0.999)	(0.489)
Constant	-0.0192	-0.463***	-0.463***	-0.329***
	(0.0181)	(0.120)	(0.153)	(0.0789)
R-squared	0.055	0.081	0.099	0.010
	Panel C			
adjusted skill int. (imported goods)	0.0188	3.441***	3.638***	2.676***
	(0.0729)	(0.636)	(0.687)	(0.644)
Constant	0.00105	-0.458***	-0.496***	-0.380***
	(0.0129)	(0.109)	(0.118)	(0.110)
R-square	0.034	0.054	0.120	0.111

Notes: N=156. Results are obtained by LAD regressions weighted by the mean share of the consumption item. R-squares refer to the equivalent OLS regression. All specifications include year dummies. Skill intensity in Panel A is the proportion of workers with college degree qualification or equivalent in total industry employment, in Panel B skill intensity is adjusted using Input-Output tables and in Panel C is adjusted using Input-Output tables and industry import penetration. Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table 10: UK data - Robustness Test of Elasticities Calculated on Various Samples and With Various Methods

	Panel A: Elasticities estimated on various samples					
	(i)		(ii)		(iii)	
	weighted by variance		aged 18-60		years 1987-1990	
	edu elast	income elast	edu elast	income elast	edu elast	income elast
adj. skill int.	0.0771	2.887***	0.168***	4.083***	0.214***	3.384***
	(0.0647)	(0.849)	(0.0575)	(1.226)	(0.0305)	(0.803)
Constant	-0.00717	-0.462***	-0.0299***	-0.519***	-0.0306***	-0.440***
	(0.0102)	(0.138)	(0.00946)	(0.187)	(0.00461)	(0.119)
Observations	156	156	156	156	156	156
R-squared	0.032	0.123	0.111	0.213	0.099	0.130

	Panel B: Different estimation methods of elasticities					
	(iv)		(v)		(vi)	
	IV tobit		OLS		semiparametric	
	edu elast	income elast	edu elast	income elast	edu elast	income elast
adj. skill int.	0.358	16.53**	0.116	1.790**	0.136	2.660**
	(0.306)	(8.184)	(0.0903)	(0.862)	(0.160)	(1.250)
Constant	-0.0455	-1.017	-0.0154	-0.318**	-0.0211	-0.408**
	(0.0479)	(1.282)	(0.0150)	(0.140)	(0.0234)	(0.178)
Observations	156	156	156	156	156	156
R-squared	0.009	0.027	0.124	0.034	0.090	0.081

	Panel C: Outliers					
	(vii)		(viii)		(ix)	
	exclude expenditure on education		separate educ and income		separate educ and inc + exclude educ	
	edu elast	income elast	edu elast	income elast	edu elast	income elast
adj. skill int.	0.111	3.388***	0.239	3.720***	0.231	3.585***
	(0.106)	(0.554)	(0.156)	(0.653)	(0.169)	(0.974)
Constant	-0.0146	-0.438***	-0.0283	-0.477***	-0.0334	-0.462***
	(0.0164)	(0.0811)	(0.0255)	(0.100)	(0.0260)	(0.143)
Observations	152	152	156	156	152	152
R-squared	0.143	0.211	0.023	0.125	0.022	0.125

Notes: Skill intensity is always adjusted for intermediate inputs. Each column shows the results obtained by LAD regressions weighted by the mean share of the consumption item except for (i) which is weighted by inverse of the dependent variable variance. In (viii) and (ix) income and education elasticities are obtained estimating separate share equations to avoid multicollinearity. In (vii) and (ix) we drop expenditure on education. R-squares refer to equivalent OLS regression. All specifications include year dummies. Standard errors in parentheses, *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 1: APPENDIX. US data - The CPS Industry and Input-Output Table Match

Sic 80	CPS Industry name	IO code	IO industry code
100-122	Food and kindred products	3110	Food manufacturing
641	Eating and drinking places	7220	Food services and drinking places
130	Tobacco manufactures	3122	Tobacco manufacturing
120	beverage industries	3121	Beverage manufacturing
641	Eating and drinking places	7130	Amusements and recreation
151-152	Apparel and other finished textile prod.	3150	Apparel manufacturing
751-760	Repair Services	812900	Other personal services
381	Watches, clocks, and devices	339910	Jewelry and silverware manuf
762-791	Personal Serv., Except Private Hous	812100	Personal care services
182	Soaps and cosmetics	3256	Soap, toiletry manuf
460	Electric light and power	2211	Power generation and supply
461	Gas and steam supply systems	2212	Natural gas distribution
470	Water supply	2213	Water, sewage and other systems
200-201	Petroleum products	3240	Petroleum and coal products manuf
440-442	Communications	5133	Telecommunications
761	Private Household Services	8120	Personal and laundry services
541	Drugs and medicines	3254	Pharmaceutical and medicine manuf
372	Optical and health services supplies	3391	Medical equip. and supplies manuf
812-830, 832-840	Health Services , Except Hospitals	6210	Ambulatory health care services
831	Hospitals	6220	Hospitals
711-712	Insurance and Real Estate	5240	Insurance and related activities
721-750	Business Services	5411-5419	Prof. and technical serv.
711-712	Insurance and Real Estate	5240	Insurance and related activities
351	Motor vehicles, motor vehicle equip.	336300	Motor vehicle parts manufacturing
751-760	Repair Services	8111	Automotive repair and maintenance
200-201	Petroleum products	2110	Oil and gas extraction
401	Street railways and bus lines	4850	Transit and ground passenger transp.
711-712	Insurance and Real Estate	5240	Insurance carriers and related activities
401	Street railways and bus lines	4850	Transit and ground passenger transp.
400	Railroads and railway express serv.	4820	Rail transportation
421	Air transportation	4810	Air transportation
171	Printing, publishing	5111	Newspaper, book, and directory publishers
172	Newspaper publishing and printing	511120	Periodical publishers
371-382	Professional and photographic equip.	339920	Sporting and athletic goods manufacturing
800-810	Entertainment and Recreation Serv.	71A0+7130	arts entert. and recreation
850	College and university	611A00	Colleges, universities, and junior colleges
842	Elementary and secondary schools	611100	Elementary and secondary schools
860	Educational Services	611B00	Other educational services
861-871	Social Services	813A	Religious, social advocacy organizations

Table 2: APPENDIX. UK data - Descriptive Statistics

Expenditure shares	N	mean	sd	min	max
Meat	26213	0.061	0.047	0	0.571
Fish	26213	0.011	0.016	0	0.370
Fruit and vegetables	26213	0.046	0.033	0	0.387
Edible oil and fats	26213	0.007	0.008	0	0.143
Milk products	26213	0.035	0.027	0	0.800
Bread and biscuits	26213	0.042	0.031	0	0.351
Sugar and sweets	26213	0.014	0.017	0	0.384
Beer	26213	0.038	0.066	0	0.860
Wine	26213	0.012	0.026	0	0.506
Spirits	26213	0.010	0.029	0	0.535
Soft drinks	26213	0.021	0.018	0	0.252
Tobacco	26213	0.042	0.075	0	0.739
Clothing	26213	0.060	0.085	0	0.727
Personal articles	26213	0.008	0.031	0	0.786
Footwear	26213	0.016	0.039	0	0.449
Books	26213	0.034	0.033	0	0.536
Records	26213	0.008	0.023	0	0.502
Petrol	26213	0.058	0.067	0	0.648
Household consumables	26213	0.028	0.041	0	0.702
Drugs	26213	0.006	0.016	0	0.884
Soap and toiletries	26213	0.020	0.024	0	0.455
Toys	26213	0.008	0.029	0	0.611
Electricity bill	26213	0.054	0.051	-0.224	0.885
Gas bill	26213	0.041	0.048	-0.023	0.601
Motor vehicle maintainance	26213	0.021	0.050	0	0.891
Repairs to personal and househ. goods	26213	0.005	0.028	0	0.726
Holidays	26213	0.024	0.099	0	0.899
Food eaten out	26213	0.071	0.068	0	0.722
Rail fares	26213	0.005	0.026	0	0.526
Bus fares	26213	0.012	0.031	0	0.571
Postage	26213	0.004	0.011	0	0.344
Phone bill	26213	0.037	0.036	0	0.662
Bank charges	26213	0.002	0.010	0	0.639
Education expenditure	26213	0.008	0.044	0	0.797
Health expenditure	26213	0.007	0.032	0	0.822
Subscriptions to organizations	26213	0.004	0.013	0	0.451
Entertainment	26213	0.034	0.048	0	0.696
Hairdressing	26213	0.011	0.025	0	0.399
Domestic help	26213	0.014	0.048	0	0.777
Some college education of head (dummy)	26213	0.123	0.328	0	1
Age of head	26213	50.419	17.639	16	96
Sex of head	26213	0.258	0.437	0	1
Number of children	26213	0.642	1.036	0	10
Number of adults	26213	1.798	0.702	1	7
Log total househ. expenditure (price=1997)	26213	9.543	0.730	5.768	12.846
Log total househ. net income (price=1997)	26178	10.148	0.761	2.983	13.379

Notes: UK FES data 1994-1997.

Table 3: APPENDIX. UK data - The Consumption Item-Industry Match

FES consumption Item	SIC 1992 code	LFS industry name
Food		
Bread and biscuit	15.81+15.82	Bread and biscuit manufacture
Meat	15.1	Meat production
Fish	15.2	Fish processing
Edible oils and fats	15.4	Oils and fats manufacture
Milk products	15.5	Dairy products
Soft drinks	15.98	Soft drinks production
Sugar and sweets	15.83+15.84	Sugar and sweets manufacture
Fruit and vegetables	15.3	Fruit and vegetables
Food eaten out	55	Restaurants and take-away
Alcohol		
Beer	15.96+15.97	Beer production
Wine	15.93	Wine production
Spirits	15.91+15.92	Alcoholic drinks distilling
Tobacco	16	Tobacco products
Home energy		
Electricity bill	40.10	Electricity generation
Gas bill	40.2	Gas production supply
Household goods		
Household consumables	24.1+24.2	Pesticides and detergents manufacture
Household services		
Postage	64.1	Post services
Phone bill	64.2	Telecommunications
Domestic help	93.05	Domestic service activities
Repairs	52.7	Repairs to personal and household goods
Clothing		
Men's and women's clothing	17+18	Textile manufacturing
Footwear	19.3	Footwear
Private transport		
Petrol	23.2	Mineral oil refining
Motor vehicle maintenance	50.2+50.4	Maintenance and repair of vehicles
Fares		
Bus fares	60.2	Road passenger transport
Rail fares	60.1	Transport via railways
Other fares	62.1+62.2	Air transport
Personal goods and services		
Personal articles	19.1+19.2,36.2+36.3	Luggage, jewelry and musical instr.
Soap and toiletries	24.5	Soap and toilet preparations
Drugs	24.4	Pharmaceuticals
Hairdressing	93.02	Hairdressing
Leisure goods		
Records	22.3	Reproduction of recorded media
Books	22.1+22.2	Printing and publishing
Toys	36.5	Toys production
Domestic electronic appliances	32	Electronic equipment manufacture
Leisure and other services		
Holidays in UK	55.1+55.2	Hotels and provision of lodgings
Entertainment	92.1 to 92.7	Recreational activities
Subscriptions to organizations	91.1 to 91.3	Membership organizations
Professional services fees	74.1 to 74.8	Professional services
Bank charges	65.1+65.2	Financial intermediation
Health expenditure	85.1	Human health activities
Education expenditure	80	Education

Notes: UK FES and LFS data.

Table 4: APPENDIX. UK data - Industry Skill Intensity

LFS Industry	(1) skill intensity	(2) adj. skill intensity interm. goods	(3) adj. skill intensity import penetration
Hairdressing	0.010	0.188	0.170
Footwear	0.019	0.123	0.172
Domestic help	0.022	0.188	0.170
Maintenance of motor vehicles	0.023	0.126	0.119
Meat production	0.025	0.062	0.065
Fish processing	0.029	0.084	0.084
Restaurants and take-away	0.031	0.135	0.154
Road passenger transport	0.032	0.142	0.141
Post services	0.035	0.169	0.165
Textile manufacturing	0.043	0.105	0.124
Bread and biscuits manufacturing	0.044	0.107	0.104
Hotels and lodgings	0.047	0.135	0.154
Repairs of personal and household goods	0.053	0.151	0.147
Soft drinks production	0.064	0.117	0.113
Tobacco production	0.071	0.140	0.199
Dairy products	0.072	0.075	0.073
Fruit and vegetables	0.082	0.084	0.084
Sugar and sweets	0.084	0.092	0.097
Luggage, jewelry and musical instruments	0.092	0.091	0.164
Railways	0.092	0.105	0.106
Oils and fats manufacture	0.100	0.075	0.070
Beer production	0.113	0.124	0.173
Toys production	0.119	0.120	0.175
Soap and toiletries	0.133	0.144	0.182
Printing and publishing	0.139	0.134	0.133
Gas supply	0.147	0.196	0.174
Telecommunications	0.156	0.161	0.159
Electricity generation	0.159	0.150	0.144
Wine production	0.166	0.124	0.173
Financial intermediation	0.167	0.189	0.197
Air transport	0.168	0.194	0.232
Human health activities	0.175	0.184	0.177
Alcoholic drinks distilling	0.189	0.124	0.173
Entertainment	0.202	0.202	0.206
Pesticides and detergents	0.206	0.149	0.150
Reproduction of recorded media	0.235	0.134	0.133
Mineral oil refining	0.238	0.207	0.235
Membership organisations	0.267	0.213	0.190
Professional services	0.294	0.228	0.230
Pharmaceuticals	0.301	0.195	0.289
Education	0.538	0.232	0.233

Notes: Skill intensity in column (1) is calculated from LFS data 1979-80 as the share of workers in the industry with a degree-level qualification. Skill intensity in column (2) is calculated using the 1997 industry-by-industry Input-Output table. Skill intensity in column (3) is calculated using the Input-Output tables weighted for import penetration. See the text for more details.

Table 5: APPENDIX. UK Data - Education and Income Elasticities.

	education elasticity	std. error	income elasticity	std. error	skill intensity
Hairdressing	0.050	0.014	1.641	0.371	0.011
Footwear	-0.123	0.019	1.769	0.575	0.019
Domestic help	0.214	0.022	2.219	0.576	0.022
Maintenance	0.091	0.011	1.014	0.338	0.024
Meat	-0.020	0.002	-0.187	0.038	0.026
Fish	0.017	0.004	0.038	0.104	0.030
Food eaten out	0.007	0.002	0.077	0.056	0.031
Bus fares	0.040	0.014	-0.106	0.340	0.032
Postage	0.107	0.011	1.303	0.285	0.036
Men's and women's clothing	-0.021	0.004	0.849	0.125	0.044
Bread and biscuits	0.000	0.001	-0.469	0.032	0.044
Holidays	-0.089	0.059	13.402	1.897	0.048
Repairs	0.393	0.118	11.296	3.550	0.054
Soft drinks	0.006	0.002	-0.307	0.045	0.064
Tobacco	-0.243	0.011	0.304	0.238	0.071
Milk products	0.010	0.001	-0.516	0.035	0.073
Fruit and vegetables	0.019	0.001	-0.207	0.035	0.083
Sugar and sweets	-0.015	0.003	-0.186	0.071	0.085
Personal articles	-0.018	0.029	2.992	0.912	0.092
Rail fares	0.950	0.063	2.782	2.013	0.093
Edible oils and fats	-0.004	0.003	-0.542	0.065	0.100
Beer	-0.061	0.006	0.505	0.157	0.113
Toys	-0.064	0.031	2.141	0.994	0.120
Soap and toiletries	-0.011	0.003	0.317	0.078	0.134
Books	0.028	0.002	-0.081	0.053	0.140
Gas bill	0.001	0.003	-0.439	0.071	0.147
Phone bill	0.026	0.002	-0.579	0.050	0.156
Electricity bill	-0.004	0.002	-0.847	0.042	0.160
Wine	0.128	0.010	1.428	0.286	0.167
Bank charges	0.140	0.046	1.590	1.489	0.167
Health expenditure	0.117	0.060	4.534	1.938	0.176
Spirits	-0.080	0.022	1.735	0.619	0.190
Entertainment	-0.039	0.004	0.472	0.101	0.202
Household consumables	-0.005	0.004	0.368	0.089	0.206
Records	0.040	0.020	0.878	0.629	0.235
Petrol	0.009	0.004	0.427	0.103	0.239
Subscriptions to organizations	0.260	0.021	1.820	0.684	0.267
Drugs	0.032	0.012	1.125	0.307	0.301
Education	1.150	0.107	10.034	3.865	0.538

Notes: UK FES data 1994-1997. The 39 goods and services are ordered according to their skill intensity. The standard errors are calculated with the Delta method. Skill intensity is calculated from LFS data 1979-80.

Table 6: APPENDIX. US data - System Estimates of Income and Price Elasticities of Low-Skill Intensive and High-Skill Intensive Items.

	system (1) non-college educated heads		system (2) college educated heads	
	expenditure share 20 low-skill items	expenditure share 19 high-skill items	expenditure share 20 low-skill items	expenditure share 19 high-skill items
age of head	-0.013	0.005	-0.007	0.002
	(0.001)***	(0.001)***	(0.000)***	(0.001)***
sex of head	-0.039	-0.074	0.012	-0.034
	(0.017)**	(0.016)***	(0.013)	(0.013)***
number children	0.109	-0.028	0.024	0.003
	(0.008)***	(0.007)***	(0.006)***	(0.005)
log total exp.	-0.059	-0.034	-0.041	-0.028
	(0.004)***	(0.004)***	(0.004)***	(0.003)***
log total exp. sq.	0.003	0.002	0.002	0.001
	(0.000)***	(0.000)***	(0.000)***	(0.000)***
log price index	-0.022	0.022	-0.026	0.026
low skill goods	(0.003)***	(0.002)***	(0.002)***	(0.002)***
log price index	-0.019	0.019	-0.015	0.015
high skill goods	(0.005)***	(0.004)***	(0.002)***	(0.003)***
Constant	0.397	0.156	0.311	0.141
	(0.019)***	(0.021)***	(0.019)***	(0.019)***
Observations	201647		211537	
R-squared	0.59	0.23	0.54	0.19

Notes: US CEX data 1994-1997. The 19 high-skill-intensive items are defined according to the first column of Table 4. The price index of high- and low-skill-intensive goods is defined as $\log p_1 = \sum_{j=1}^{20} w_{jt} \log p_{jt}$ where $\log p_{jt}$ are the individual commodity price series of the 19 high- or 20 low-skill-intensive goods and w_{jt} their monthly shares in total expenditure. Fixed effect for each item included. System estimation impose homogeneity and symmetry constraints. See the text for details.

Table 7: APPENDIX. UK data - System Estimates of Income and Price Elasticities of Low-Skill Intensive and High-Skill Intensive Items.

	system (1) non-college educated heads		system (2) college educated heads	
	expenditure share 20 low-skill items	expenditure share 19 high-skill items	expenditure share 20 low-skill items	expenditure share 19 high-skill items
age of head	0.004	-0.004	0.002	-0.002
	(0.000)***	(0.000)***	(0.001)**	(0.001)**
sex of head	0.157	-0.163	0.082	-0.082
	(0.010)***	(0.010)***	(0.032)***	(0.031)***
number children	0.067	-0.066	0.048	-0.048
	(0.004)***	(0.004)***	(0.010)***	(0.010)***
log total exp	0.002	-0.002	0.002	-0.002
	(0.000)***	(0.000)***	(0.000)***	(0.000)***
log total exp. sq.	0.000	-0.000	-0.000	0.000
	(0.000)**	(0.000)	(0.000)	(0.000)
log price index	-0.008	0.008	-0.008	0.008
low-skill goods	(0.001)***	(0.001)***	(0.003)***	(0.002)***
log price index	-0.006	0.006	-0.008	0.008
high skill goods	(0.002)***	(0.001)***	(0.003)***	(0.002)***
Constant	0.023	0.020	0.024	0.017
	(0.000)***	(0.000)***	(0.001)***	(0.001)***
Observations	546017		66171	
R-squared	0.14	0.19	0.13	0.12

Notes: UK FES data 1994-1997. The 19 high-skill-intensive items are defined according to the first column of Appendix Table 4. The price index of high-skill-intensive goods is defined as $\log p_1 = \sum_{j=1}^{19} w_{jt} \log p_{jt}$ where $\log p_{jt}$ are the individual commodity price series of the 19 high- or low-skill-intensive goods and w_{jt} their monthly shares in total expenditure. Fixed effect for each item included. System estimation impose homogeneity and symmetry constraints. See the text for details.