Does height affect labor supply? Implications of product variety and caloric needs*

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Abstract

The positive correlation between hourly wages and height, which results in higher labor supply of tall individuals, is well-documented in the literature. Accepting the utilitarian perspective and assuming that height does not affect utility implies that linking income taxes to height is welfare improving. This paper argues that height might not only affect an individual's income but also utility derived from consumption. We introduce two channels through which height might affect utility. Higher caloric needs of tall individuals should result in higher consumption expenditures for food. Size specific products should result in lower product variety and a higher price level for sizes where aggregate demand is low, typically sizes for individuals in the tails of the height distribution. Introducing these two channels into a household's maximization problem we derive a labor supply equation that allows for an empirical test for the relevance of these two channels. We use the German Socio-Economic Panel Study to estimate this labor supply equation. Caloric needs do not have a significant effect on labor supply. Product choice, on the other hand, does increase labor supply significantly. This implies that purely focusing on income might not be optimal under the utilitarian framework for tax analysis.

JEL classification: D11; D12; H21; J22

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1 Introduction

The positive correlation between an individual's height and his or her labor income is well-documented for labor markets around the world, for developed as well as developing economies. In a survey on the role of stature in social sciences Steckel (2009) reports a total of ten papers dealing with the effect of height on wages. While there are several explanations for this positive correlation, the majority opinion seems to be that height is in some way indicative of an individual's productivity.

Height can be suggestive of physical strength (Thomas and Strauss, 1997; Strauss and Thomas, 1998) and health (Haddad and Bouis, 1991; Steckel, 1995, 2008). Therefore, a positive height premium seems to be intuitive for developing economies where labor is physically demanding.[1] However, this positive effect of height on wages has also been documented for developed economies (Schultz, 2002; Persico et al., 2004; Case and Paxson, 2008; Rashad, 2008). With the majority of white collar jobs in such economies this raises the question of what the productivity advantage might be.

There are mainly two competing theories. Persico et al. (2004) argue that being tall as an adolescent facilitates the acquisition of social skills and this way promotes the formation of human capital resulting in higher wages. Case and Paxson (2008) challenge this view. They ascribe the positive height premium to a positive correlation between height and cognitive skills. Schick and Steckel (2010) support this view by showing that tall children on average exhibit higher cognitive skills.

While this paper is agnostic with respect to the driver of this correlation, both explanations have in common that tall individuals are assumed to be in some way blessed with higher productivity they bear no responsibility for.[2] As Mankiw and Weinzierl (2010) point out, the utilitarian perspective and optimal taxation theory, e.g. Mirrlees (1971), imply that such windfall gains should be taxed. Consequently, they argue that accepting the utilitarian view one should advocate linking taxes to height.[3] This conclusion implicitly assumes that height does not affect any other determinant of well-being. The authors note this and explicitly assume that "preferences are not a function of height" (Mankiw and Weinzierl, 2010, p. 157). However, to the best of our knowledge, there is no paper that explicitly tests for the validity of this assumption.

[1] Dinda et al. (2006) find a positive height effect for wages of coal miners in India. Schultz (2002) shows that hourly wages in Ghana and Brazil positively depend on height.

[2] The fact that good nutrition as a child increases height reinforces this effect as healthy nutrition typically is more expensive and this way correlated with parents' income.

[3] The authors explicitly do not share the utilitarian view.

This paper aims at addressing this gap in the literature and thereby contributes to the literature on the effect of stature on economic outcomes with implications for the literature on optimal taxation. The contribution is twofold. First, we introduce two channels through which height might affect individual utility into an otherwise standard household maximization problem. Second, we test for the empirical relevance of these two channels.

The two height-related channels are differing caloric needs and product variety. Caloric needs typically are increasing in height, c.p. resulting in higher consumption expenditures for food of tall individuals. As expenditures to stay alive might be thought of as sunk costs this c.p. reduces expenditures for pleasurable consumption. In the presence of size specific products such as clothing, product variety is lower for sizes where aggregate demand is low. As individuals typically value product choice, this results in a higher price level and lower marginal utility for individuals facing lower product choice. Demand for size specific products depends on two quantities: The number of potential customers and average consumption expenditures of individuals with similar physical features. As we document in Section 2.1 and Section 4, individuals' average consumption expenditures vary less than the number of individuals with similar size such that aggregate demand for size specific products is mainly driven by the number of potential customers. Therefore, aggregate demand and product variety is relatively high in the mode and less so in the tails of the height distribution.

In the empirical application we use the German Socio-Economic Panel Study (SOEP) to estimate a labor supply equation for prime aged males. Our findings suggest that differences in product variety affect individual labor supply significantly. An increase in aggregate consumption expenditures of individuals with similar height substantially increases labor supply. For caloric needs we do not find a significant effect.

2 Intuition

This section discusses the two height-related effects – differing product variety and differing caloric needs – that might affect individuals' utility.

2.1 Product variety

The assumption that utility is increasing in product variety is central to economics. Love-of-variety models, the most prominent one being Dixit-Stiglitz-preferences (Dixit and Stiglitz, 1977), have found their way into many different fields. Such preferences are one building block of New Keynesian models and central to the New Keynesian Phillips Curve and our understanding of inflation dynamics. They are an important ingredient in New Economic Geography models[4] and central to international trade theory as increasing product variety is one channel through which countries benefit from globalization.

The effect of increasing product variety on national welfare due to increasing international trade has gained considerable attention in the trade literature, e.g. Broda and Weinstein (2006). However, product variety might also differ across individuals. There are mainly two reasons why product variety might be different. First, product variety for individuals living in rural areas might be substantially lower than in urban centers, which contributes to differences in house prices.[5] Second, product variety might be different if products come in different sizes and utility from consumption depends on an individual's characteristics.

An illustrative example for products that come in different sizes is clothing. It is easy to see that utility from wearing a shirt strongly depends on an individual's characteristics, her height. Assume there is a shirt with a certain size. An individual with the proper size will be able to derive utility from wearing this shirt. If the shirt only merely fits, utility from consuming this shirt will be somewhat lower. If the shirt does not fit at all, an individual will not be able to derive any utility from wearing it.

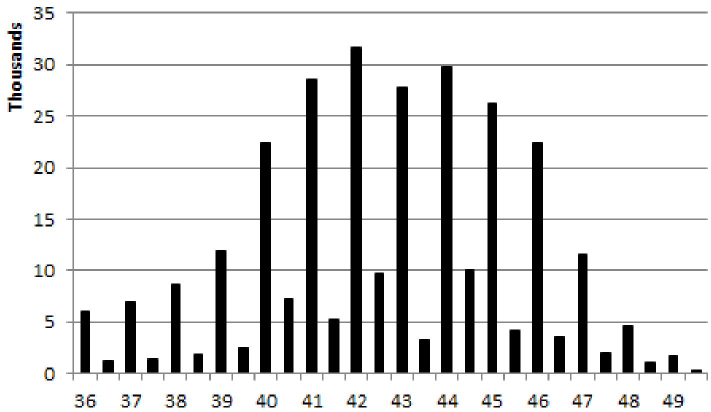
However, product variety is by no means uniformly-distributed, it strongly depends on product size. To put it differently, product choice for individuals at the mode of the height distribution is substantially higher than in the tails. Figure 1 shows this at the example of shoes by plotting the number of men's shoes for different sizes as available on Amazon Germany.

This example clearly shows that product variety is substantially higher for sizes where the number of potential customers is high. This is intuitive as the attractiveness of a market

[4]As Krugman points out in Fujita and Krugman (2004, p. 142) "Dixit-Stiglitz, icebergs, evolution and the computer" is the slogan that summarizes the key ingredients in New Economic Geography.

[5]Product variety this way is important in understanding urban agglomeration and dispersion (Tabuchi, 1998). In a case study, Kim et al. (2005) show that easy access to products, measured by travel time to the closest shop, has a statistically significant positive effect on house prices in Oxfordshire, UK.

Figure 1: Number of different shoes for men by size



Note: Sizes between natural numbers represent half-sizes, which are substantially less frequent.
Source: Amazon.de (Jan. 19, 2014), own illustration.

increases with aggregate purchasing power. The more or less symmetric distribution indicates that product variety is mainly driven by the number of potential customers. Higher average consumption expenditures of tall individuals, which might result from higher wages of tall individuals, do not seem to be the main driver of differences in product variety.

If there are fixed costs in the production process a larger number of potential customers will translate into a larger number of different goods.[6] However, this also has implications for the price level. Not only is product variety lower for individuals in the tails of the height distribution, additionally to that, the price level for the consumption basket of size specific goods is typically higher.

2.2 Caloric Needs

In the medical literature it is well documented that stature has a non-negligible effect on an individual's metabolism. One early contribution is the seminal paper by Harris and Benedict (1918). They estimate caloric needs by measuring energy expenditures of individuals in good health as a function of age, body weight and body surface. For weight and body surface, which clearly depend on height, they find positive effects.

Following this seminal work, there is comprehensive literature further investigating the

[6] In Section 3.1 we formally show that the number of potential customers affects product variety in an otherwise standard household maximization problem.

determinants for human energy expenditures using different methods and examining different population groups. One consistent finding seems to be that height is an important determinant for energy expenditures. By compiling 22 studies Schulz and Schoeller (1994) find that height has a significant and positive effect on an individual's energy expenditures. They also show that there are other important factors such as weight or age. However, unexplained variation is substantial, indicating the presence of further determinants. One example of such an additional factor might be physical activity, which should affect energy expenditures to a great extent.

If energy expenditures are increasing in height, tall individuals c.p. have higher caloric needs, require higher food intake and this way should exhibit higher expenditures for food. However, it is not clear that these expenditures, which are more or less expenditures to stay alive, are more beneficial to tall individuals than to shorter ones since the outcome – survival – is the same. The assumption in this paper is that utility from food intake to stay alive is similar for all individuals and is independent of height. This way, such expenditures represent sunk costs, which c.p. reduce tall individuals' income that is available for pleasurable consumption.

3 The model

Let us now introduce the two channels through which height might affect individual utility into a standard household maximization problem. As we focus on the individuals' labor supply decision, which is static, we drop time indices for simplicity.

3.1 Product variety

Consumers differ with respect to height. Depending on height, individuals can be clustered into different groups. There are infinitely many non-overlapping clusters k, each cluster spanning over an identical amount of units of height $\overline{a} = \overline{k} - \underline{k}$ with $\overline{k}$ and $\underline{k}$ the upper and lower boundaries of cluster k. Consumption goods are height specific. Each good comes in a certain size and only consumers whose height matches a product's size are able to derive utility from consuming this product.

Each individual i in cluster k bundles the different consumption goods $c_{i,j,k}$ to the individual basket of consumption goods $C_{i,k}$ she consumes. j identifies the individual product. All consumers bundle individual products according to the same CES function:

$$C_{i,k} = \left[\int_{j \in \Omega_k} c_{i,j,k}^{\frac{\theta-1}{\theta}} dj \right]^{\frac{\theta}{\theta-1}} . \tag{1}$$

Ω_k represents the variety of available products in cluster k, θ is the elasticity of substitution between different products. It is well known that this setup results in the (cluster specific) price level P_k and the individuals' demand $c_{i,j,k}$ for the individual consumption good j of size k, which can be written as

$$P_k = \left[\int_{j \in \Omega_k} {p_{j,k}}^{1-\theta} dj \right]^{\frac{1}{1-\theta}} \tag{2}$$

and

$$c_{i,j,k} = \left(\frac{p_{j,k}}{P_k} \right)^{-\theta} C_{i,k} . \tag{3}$$

Individual good prices are given by $p_{j,k}$. Aggregation over all individuals in a height cluster results in the aggregate demand function for an individual size specific good

$$\int c_{i,j,k} \, di = \left[F(\overline{k}) - F(\underline{k}) \right] c_{j,k} = \left[F(\overline{k}) - F(\underline{k}) \right] \left(\frac{p_{j,k}}{P_k} \right)^{-\theta} C_k . \tag{4}$$

$c_{j,k}$ represents the individuals' average real consumption expenditures for the individual product j in cluster k and C_k represents the individuals' average real consumption expenditures for the product basket in cluster k. $\left[F(\overline{k}) - F(\underline{k}) \right]$ indicates the number of individuals in the respective height cluster.

Production takes place in homogenous firms. Each firm produces the quantity $\left[F(\overline{k}) - F(\underline{k}) \right] c_{j,k}$ of product j that is only valuable to individuals in cluster k. Following Melitz (2003), there are fixed costs in the production process. Each firm faces the production function $\left[F(\overline{k}) - F(\underline{k}) \right] c_{j,k} = A(l_{j,k} - f)$ with f representing fixed costs, $l_{j,k}$ represents labor input standardized by productivity and A is the production technology. The production technology and fixed costs are identical for all firms in the economy. There is free market entry and exit. We can express total labor input of firm j producing for consumers in cluster k as $l_{j,k} = \frac{\left[F(\overline{k}) - F(\underline{k}) \right] c_{j,k}}{A} + f$. Individual firm's profits $d_{j,k}$ are thus given by

$$d_{j,k} = \left[F(\overline{k}) - F(\underline{k}) \right] p_{j,k} c_{j,k} - wP \left(\left[F(\overline{k}) - F(\underline{k}) \right] \frac{c_{j,k}}{A} + f \right) \tag{5}$$

with w the real wage for one unit of labor $l_{j,k}$ standardized by productivity[7] and P is the aggregate price level in the economy. Cost minimization by firms implies that real marginal costs are given by $\varphi = \frac{w}{A}$. Using this as well as Equation (4) we can rewrite (5):

$$d_{j,k} = \left[F(\overline{k}) - F(\underline{k})\right] \left(\frac{p_{j,k}}{P_k}\right)^{1-\theta} C_k - \varphi \frac{P}{P_k} \left[\left[F(\overline{k}) - F(\underline{k})\right] \left(\frac{p_{j,k}}{P_k}\right)^{-\theta} C_k + Af\right] . \quad (6)$$

Profit maximization by individual firms gives an expression for the individual firm's price mark-up over marginal costs φ

$$\frac{p_{j,k}}{P} = \frac{\theta}{\theta - 1} \varphi . \quad (7)$$

It is easy to see that price setting for an individual product $p_{j,k}$ is independent of the population size in the height cluster k. Furthermore, free market entry and exit implies that firms' profits are bound to be zero $d_{j,k} = 0$ in equilibrium. Otherwise, e.g. in the presence of positive profits new firms would have an incentive to enter the market which would drive down profits of incumbent firms till the no profit condition is satisfied.

Given the homogenous production function in the economy this implies that aggregate demand for the individual product $c_{j,k}$ is independent of product size and this way also independent of the number of potential consumers.

$$\left[F(\overline{k}) - F(\underline{k})\right] c_{j,k} = Af(\theta - 1) \quad (8)$$

To link product variety to individuals' consumption and the price level in cluster k we make use of Equations (7) and (3), which show that the individual products' price markup is similar for all products ($p_{j,k} = p_k = p$) and that demand for the individual product within a cluster is identical for all products ($c_{j,k} = c_k$). Therefore, we can rewrite the individual consumers' consumption expenditures in cluster k as a function of the number of firms that produce for the respective height cluster.

[7] In Section 3.3 we allow for wages to vary with height taking into account the the well-documented height premium for tall individuals. Therefore, w represents the economy wide compensation for labor that produces one arbitrarily standardized unit of output.

$$P_k C_{i,k} = \int_{j \in \Omega_k} p_{j,k} c_{i,j,k} dj = \int_0^{n_k} p_k c_{i,j,k} dj = n_k p_k c_{i,k} \tag{9}$$

n_k is the number of different products in cluster k, the measure for product variety. Rearranging yields an expression for product variety $n_k = \frac{P_k C_{i,k}}{p_k c_{i,k}}$. The symmetry of individual products and prices within a cluster allows us to rewrite Equations (1) and (2).

$$C_{i,k} = n_k^{\frac{\theta}{\theta-1}} c_{i,k} \tag{10}$$

$$P_k = n_k^{\frac{1}{1-\theta}} p_k \tag{11}$$

With $\theta > 1$ it is easy to see that the value of an individual's consumption basket $C_{i,k}$ increases with the number of available products n_k. On the other hand, the price level is a decreasing function of product variety.

However, measuring product variety for individuals seems impossible. That is why we combine Equations (11) and (9), to get an expression for the price level in cluster k as a function of aggregate consumption expenditures in the respective height cluster $\left[F(\overline{k}) - F(\underline{k})\right] P_k C_k$.

$$P_k = \left(\frac{A f \theta \varphi P}{\left[F(\overline{k}) - F(\underline{k})\right] P_k C_k} \right)^{\frac{1}{\theta-1}} \frac{\theta}{\theta - 1} \varphi P \tag{12}$$

3.2 Caloric Needs

To implement daily caloric needs in our analysis we have to employ a shortcut. As we discuss in Section 4, we are not able to observe actual consumption expenditures for different product categories such as food. We only observe individual consumption expenditures as a whole. Let us therefore briefly discuss the implications of differing caloric needs resulting in height-specific sunk costs on individuals' utility.

If expenditures for food to satisfy caloric needs are sunk cost, utility should be decreasing in height as a smaller share of consumption expenditures is available for pleasurable consumption. Marginal utility, on the other hand, should be an increasing function of height. Holding consumption expenditures constant, tall individuals spend a lower fraction of consumption expenditures on pleasurable consumption and a larger one to satisfy caloric needs. Assuming a concave utility function for pleasurable consumption, marginal utility of consumption is higher for tall individuals for similar levels of total consumption expenditures.

To replicate these two features of utility extraction we assume the following functional form:

$$U(C_{i,k}, H_{i,k}) = \frac{1}{1-\sigma} {C_{i,k}}^{1-\sigma} {H_{i,k}}^{\varphi} - \left(g\left(H_{i,k}\right)\right)^{\varphi} \tag{13}$$

$H_{i,k}$ is the measure for caloric needs, $g\left(H_{i,k}\right)$ is function of caloric needs, representing the height specific utility loss due to sunk costs.

Employing assumptions with regard to the parameter φ allows us to replicate the properties of caloric needs representing sunk costs. Our baseline assumption is $\varphi = 0$. In this case, Equation (13) collapses to a standard utility function, implying that caloric needs are irrelevant. If $\varphi \neq 0$, differing caloric needs do have implications for utility and marginal utility of individuals.[8]

The standard assumptions of utility increasing in consumption ($\frac{\partial U}{\partial C} > 0$) and marginal utility decreasing in consumption ($\frac{\partial U^2}{\partial^2 C} < 0$) are unaffected by introducing caloric needs into the utility function. However, we now have $\frac{\partial U}{\partial H} < 0$ if $\frac{1}{1-\sigma} C^{1-\sigma} H^{\varphi - 1} < \frac{\partial g}{\partial H}^{\varphi - 1}$. This represents the feature of tall individuals facing higher sunk costs and therefore exhibiting a lower utility level. The feature of increasing marginal utility in height ($\frac{\partial U^2}{\partial C \partial H} > 0$) is replicated, if $\varphi > 0$.

3.3 Labor supply and height

To test whether height is an important ingredient in the utility function we now derive a labor supply equation for an individual in a height cluster k. Utility is separable in consumption $C_{i,k}$ and labor $L_{i,k}$. Utility from consumption is derived according to Equation (13). Working time reduces utility. The utility function for individuals in cluster k takes the form

[8] As we test for the effect of height in a labor supply equation, we can only test for the effect of caloric needs on marginal utility, which is represented by the parameter φ. We do not test for any direct effects of caloric needs on the utility level, which is represented by $\left(g\left(H_{i,k}\right)\right)^{\varphi}$.

$$U(C_{i,k}, L_{i,k}, H_{i,k}) = \frac{1}{1-\sigma} {C_{i,k}}^{1-\sigma} {H_{i,k}}^{\varphi} - \left(g\left(H_{i,k}\right)\right)^{\varphi} - \frac{\chi}{1+\eta} {L_{i,k}}^{1+\eta} \, . \tag{14}$$

η is the inverse of the Frisch elasticity. Consumption expenditures are constrained by resources. We assume a very general budget constraint of the form

$$P_k C_{i,k} = (1-\tau_{i,k}) w_{i,k} P L_{i,k} + P T_{i,k} \, . \tag{15}$$

$w_{i,k}$ are hourly earnings, $\tau_{i,k}$ is the individual tax rate. $T_{i,k}$ represents real (government) transfers as well as real net capital income. Labor supply in such a setup is described by the following equation:

$$\chi {L_{i,k}}^{\eta} = {P_k}^{-1} (1-\tau_{i,k}) w_{i,k} P {C_{i,k}}^{-\sigma} {H_{i,k}}^{\varphi} \tag{16}$$

It is easy to see that Equation (16) collapses to a standard labor supply equation under the assumptions that consumption goods are not size specific (the price deflator for consumption goods is the same for all individuals, $P_k = P$) and that caloric needs do not affect marginal utility ($\varphi = 0$).

$$\chi {L_{i,k}}^{\eta} = (1-\tau_{i,k}) w_{i,k} {C_{i,k}}^{-\sigma} \tag{17}$$

However, to allow for a test of the two proposed channels of height we proceed by substituting the cluster specific price level P_k (Equation 12) into Equation (16), which yields

$$\chi L_{i,k}^{1+\eta} = (1-\tau_{i,k}) w_{i,k} P L_{i,k} \; (P_k C_{i,k})^{-\sigma} \; {H_{i,k}}^{\varphi} \left(\frac{A f \theta \varphi P}{\left[F(\overline{k}) - F(\underline{k})\right] P_k C_k} \right)^{\frac{\sigma-1}{\theta-1}} \; \left(\frac{\theta}{\theta-1} \varphi P \right)^{(\sigma-1)} \, . \tag{18}$$

Rearranging, employing a logarithmic transformation and redefining results in an equation for hours worked ($l_{i,k} = \log(L_{i,k})$) as a function of nominal after tax labor income ($wl_{i,k} = \log((1-\tau_{i,k}) w_{i,k} P L_{i,k})$), an individual's consumption expenditures ($pc_{i,k} = \log(P_k C_{i,k})$), a proxy for the individual's caloric needs ($h_{i,k} = \log(H_{i,k})$), and aggregate consumption expenditures of individuals with similar size $\left(pc_k = \log\left(\left[F(\overline{k}) - F(\underline{k})\right] P_k C_k\right)\right)$. Clusterinvariant terms such as the general price level, the production technology, marginal and fixed costs in the production process and the constant $\log(\chi)$ are collected in b. The log-linearized labor supply equation reads

$$l_{i,k} = \frac{1}{1+\eta} wl_{i,k} - \frac{\sigma}{1+\eta} pc_{i,k} + \frac{\varphi}{1+\eta} h_{i,k} + \frac{1-\sigma}{(1+\eta)(\theta-1)} pc_k + \beta b \,. \tag{19}$$

An individual's labor supply increases in labor income and is negatively related to the individual's consumption expenditures, which is consistent with a labor supply equation resulting from a standard representative household's maximization problem. The two variables representing the channels of height are a proxy for an individual's caloric needs $h_{i,k}$, representing the channel of higher costs to stay alive, and aggregate consumption expenditures of similar individuals pc_k, representing the effect of product variety. For caloric needs we expect a positive effect on labor supply as being tall c.p. lowers expenditures for pleasurable consumption which increases marginal utility from consumption expenditures due to the concave utility function. Higher aggregate consumption expenditures of individuals with similar height result in increased attractiveness for firms to produce for this audience, resulting in higher product variety and a lower price level. This way, marginal utility from consumption is higher for individuals at the mode of the height distribution which increases labor supply as disutility from working is unaffected by height.

4 Data

To test for the empirical relevance of height on marginal utility through the two proposed channels we estimate the labor supply Equation (19) using individual survey data. We use the German Socio Economic Panel Study (SOEP) to test for such effects in Germany. Similar to Schultz (2002) we restrict our sample to prime age males.[9] The SOEP is an longitudinal annual data study on biographies and living conditions of German households and individuals (Wagner et al., 2008). The data-set covers the years 1984 to 2012.[10] However, as questionnaires evolve and the set of questions has changed over time we have

[9]Prime age is defined as the years from 25 to 55. We concentrate on males as it has been shown that female labor supply differs substantially from labor supply of males (Killingsworth and Heckman, 1986) and depends on factors we do not account for in the model.

[10]We use the SOEP v29. The data-set has been generated using SOEPINFO-WWW available at http://www.diw-berlin.de/soep

to reduce the sample period to the years 1992 to 2011.[11] Equation (19) consists of five variables we require data for: actual hours worked, after tax labor income, individual nominal consumption expenditures, a measure for caloric needs, and aggregate consumption expenditures of individuals with similar height.

For the number of hours worked $l_{i,k}$, our left had side variable, we use the statement on actual weekly hours worked by the individual.[12] For after tax labor income $wl_{i,k}$ we use the statement on the individuals' current net labor income.[13]

As there is no statement on individual consumption expenditures in the SOEP we have to derive consumption expenditures as the difference between income and savings (Freyland, 2005; Drechsel-Grau and Schmid, 2014), which are available on the household level. As measure for household income we use adjusted monthly household net income[14] and subtract monthly savings[15], which are available starting in 1992. Dissaving of households is not observed in the data as the variable indicating savings is defined to be positive. However, households reporting that they have not been saving might as well have been dissaving. To take this into account we construct two samples to check for the robustness of our results. Our first sample consists of all households for which we have information on the amount of monthly savings, including all households without monthly savings. Our second sample excludes households that report not to be saving and only consists of households that declare to have positive monthly savings.[16]

We are also not able to directly observe consumption expenditures for food. We therefore have to take a shortcut and directly link our measure of individual caloric needs to labor supply. Our first measure is height. In the SOEP reported height is available biannually starting in 2002.[17] As we are analyzing prime age males it is reasonable to assume that height does not change over time for these individuals. Therefore, we do not use reported height in the respective year, but instead construct our measure for height as the average

[11] The restriction to the first year being 1992 is due to the variable indicating household savings, which is available since 1992, only. The restriction to the last year being 2011 is due to household income not yet available for the year 2012.

[12] The variable is named *$tatzeit* with $ in the variable name identifying the wave.

[13] The variable is named *labnet$$*, here $$ identifies the wave.

[14] The variable name is *ahinc$$*. $$ indicates the wave.

[15] The name for this variable does changes over time. In 1992, the first year this question is asked, the variable name is *ih5002*.

[16] In the SOEP there is a variable indicating whether or not a household is saving. Similar to the savings amount the variable name has changed over time. In the first year this respective question has been asked, 1992, the variable name is *ih5001*.

[17] The variable we use is m11122$$. $$ indicates the year of observation.

of all reported values for each individual.[18] To check for robustness, we also employ a second measure. This one is based on the estimations in Mifflin et al. (1990). They derive an equation for an individual's resting energy expenditures (REE), which can be converted to total energy expenditures (TEE), e.g. by multiplying REE by the factor 1.7 for healthy men that are moderately active. However, this requires some additional information on body weight, which is not available to us.[19] We therefore compute REE assuming a body weight of healthy adults. We assume a body mass index (BMI) of 23. Such an "optimal" weight for each individual is computed according to: $w_{opt} = BMI\left(\frac{height}{100}\right)^2$. Given the information on an individual's age[20] this allows us to compute REE according to the equation in Mifflin et al. (1990, Eq. 3):

$$REE = 9.99\, w_{opt} + 6.25\, height - 4.92\, age + 5\ . \tag{20}$$

The last right hand side variable in Equation (19) for which we require information is aggregate consumption expenditures of individuals with similar height. However, from the empirical distribution of individual consumption expenditures with respect to height it is a priori not clear what the "right" cluster size should be, such that all individuals in the same cluster consume a similar basket of goods. We therefore use three different cluster sizes. Clusters span over 1cm, 2cm, and 4cm of height. In all cases, we begin by computing the average height of all prime age males in the respective year and build the first cluster surrounding this annual average. We then build the adjoining clusters. Aggregate consumption expenditures in the respective year are given by the sum of consumption expenditures of prime age males in the same height cluster that live in households with similar size. This leaves us with three different measures for aggregate consumption expenditures of individuals with similar size.[21]

The constituents of aggregate consumption expenditures of individuals in the different

[18] This seems to be a common procedure and has e.g. been applied by Schultz (2002), for the SOEP it has been applied by Hübler (2012).

[19] Body weight is available for some years in the SOEP. However, as weight is not fixed over time we cannot use a procedure similar to the one applied for height. Additionally to that, using weight might raise some concerns with regards to endogeneity as body weight might be a choice variable for adults.

[20] Age is coded *11101$$* with $$ indicating the wave.

[21] While small cluster sizes are more accurate with respect to individuals in a given cluster indeed consuming similar goods, larger cluster sizes loose precision in this respect. However, they are less prone to peculiarities of the empirical distribution of height. We choose 1cm as the minimum cluster size as individuals typically report natural number when asked about their height. This results in answers being clustered around natural numbers. Cluster sizes of less than one centimeter would result in some clusters not entailing any natural number, which would result in a drop of observations with respect to neighboring clusters and this way yield an implausible distribution function.

height clusters, average consumption expenditures and labor income of similar individuals, are reported in Table 1.[22] While variation in average consumption expenditures is non negligible, variation in the number of individuals in the different height clusters is substantially larger in relative terms. This seems to be in line with our presumption and the interpretation of Figure 1 that the number of individuals is the main driver of aggregate consumption expenditures in the different height clusters and therefore of product variety as well.

Additionally to the information that is required to estimate Equation (19) we use information on the individuals' gender[23] as we want to restrict our analysis to males. We also restrict the analysis to individuals' that are employed.[24] As subdued labor supply of unemployed individuals is not due to a choice based on utility maximization but rather due to underemployment because they are not able to find an appropriate job, we exclude individuals that are registered as unemployed from the analysis. Finally, we use information on household size.[25] As we explore individual labor supply, we restrict our analysis to single person household. As a robustness check, we also construct a sample for households consisting of two individuals.[26]

In Table 1 we report the summary statistics for the relevant variables in the four samples. Individuals report to be working approximately 44 hours per week in all samples. Height also does not seem to vary substantially across the four samples. Individuals report to be roughly 1.8m tall and aggregate consumption expenditures of saving and non-saving households seem to be quite similar. However, there are some differences with respect to age. One person households are slightly younger, but this does not translate into substantial differences in TEE. This seems plausible as Equation (20) shows that age is not the dominant variable driving REE and this way TEE. With respect to after tax labor income, this seems to be slightly higher for individuals in two person households and substantially higher in households that are saving.[27] For individual consumption expenditures the op-

[22]Average consumption expenditures and labor income are used as additional instruments for a robustness check. In contrast to aggregate consumption expenditures of individuals in the different height clusters these variables only refer to individuals that are not registered as unemployed.

[23]The variable indicating the individuals' gender is *sex*

[24]The name for the variable indicating the employment status has changed over time. In the year 1992 it was named *ip09*.

[25]The respective variable in the SOEP is named *$hhgr*, $ identifying the year.

[26]We argue that there is a correlation of height in two person households. Tall males, on average, live with a partner that also is also taller than the respective population average, such that the effect of height might still be observed. We abstain from including households consisting of more than two individuals, as the presence of a third person, typically a child, affects the labor supply in a variety of ways we do not think we are be able to control for.

[27]In this table we compare the different samples we use in our estimation. Therefore, we compare

posite is true. Here, the difference between saving and non-saving households is relatively small, while variation across household size is substantial. However, consumption expenditures refer to the household, not the individual level. We therefore should expect higher consumption expenditures for two person households, but expenditures in two person households are substantially lower than the sum of two single person households.

5 Estimation Results

In a first step, we present the results allowing for both channels of height to have a simultaneous effect on labor supply (Section 5.1). As height is the underlying factor for both channels we proceed by estimating the effect of height allowing for only one channel at a time. This way, we want to verify that our results are not driven by a correlation between the two variables resulting in spurious significance. In Section 5.2 we present the estimation results allowing for an effect of caloric needs, only. In Section 5.3 we only allow for an effect of product variety. Section 5.4 presents additional robustness checks.

As the left hand side variable, working hours, also directly affects individuals' labor income and the decisions on working hours and individual consumption expenditures are, at least in theory, simultaneous decisions, there are concerns with regard to endogeneity.[28] To rule out correlation between regressors and residuals we apply an instrumental variable approach. We use the one period lagged values for the two instrumented variables, individual consumption expenditures $pc_{i,k}$ and net labor income $wl_{i,k}$, as instruments, which is a common procedure in the literature (Yogo, 2004). Given rational expectations, each period households decide on the current level as well as the expected path of economic variables. Future shocks are unforeseeable and therefore, current period shocks uncorrelated with lagged values of economic variables. This has been pointed out by Hall (1988) for consumption and is similarly applicable to labor income if the notice period of employment contracts is less than one year, which typically is the case. To test for the validity of the instruments we conduct robustness checks by including additional instruments and test for overidentification (Hansen, 1982). We can estimate the individual

saving households with saving and non-saving households. This way, slightly higher labor income for saving households implies substantially lower labor income for non-saving households.

[28]Aggregate consumption expenditures should not be subject to endogeneity as an individual's contribution to aggregate consumption expenditures in the respective height cluster should be negligible. However, due to the construction of the aggregated variables this might be a concern, especially for the smallest cluster size of 1cm. To take this into account we also conducted estimations – not presented in the paper – in which we instrument aggregate consumption expenditures with its one period lagged value to take this into account. The results are robust to this change in the estimation.

households' labor supply equation in the time period from 1993 to 2011. Standard errors are clustered on the individual level.

We focus on one person households as additional individuals in the household, for which we do not have information on the physical status, might distort the analysis. Households are required to consist of only one individual in period t and period $t-1$ as one period lagged values have been used in the first stage regression. In Section 5.4 we modify this assumption and also conduct estimations for two person households. Height between two individuals living in the same household is likely to be correlated such that height effects might still be detectable for two person households. We include time fixed effects to take into account potential time variation of variables such as the aggregate price level, collected in b.

5.1 Joint Analysis

Let us first discuss the estimation results of our baseline sample, all one person households, allowing for both channels of height simultaneously (Table 2). As all variables have been transformed using the natural logarithm we can interpret coefficients as elasticities. Columns (1)-(3) show the results with height as proxy for caloric needs, in Columns (4)-(6) we report the results for the estimations with total energy expenditures based on Mifflin et al. (1990, Eq. 3) and a BMI of 23. All results are reported for the cluster sizes 1cm, 2cm, and 4cm.

With regard to the standard variables in a labor supply equation the results seem to be in line with the respective literature. Higher labor income c.p. increases an individual's labor supply as this makes working relatively more attractive. Higher consumption expenditures seem to reduce labor supply as marginal utility of consumption is decreasing and leisure becomes a relatively more attractive good. To further show that our estimation results are in line with the literature we compute the parameters from the households' maximization problem. The estimate for the parameter η is virtually identical in all estimations, η varies between 1.42 and 1.43, implying a Frisch elasticity of labor supply of about 0.7. In a review of the literature Reichling and Whalen report: "Estimates of the Frisch elasticity for the intensive margin among men range from zero to 0.8." (Reichling and Whalen, 2012, p. 4). In a meta-analysis Chetty et al. (2011) find a somewhat lower point estimate for the intensive margin of about 0.54, only. With respect to the constant relative risk aversion, we find σ to be about 0.42, which implies that individuals are risk averse. Again, this seems to be in line with microeconomic evidence. In a laboratory experiment Holt and

Laury (2002) find that "there is a lot of risk aversion, centered around the $0.3 - 0.5$ range"(Holt and Laury, 2002, p. 1649).

With regard to the main interest of the paper, the effect of height, we find mixed results. The channel of higher caloric needs does not seem to play any role. We find a negative coefficient for both measures of caloric needs, which is at odds with the proposed positive effect of caloric needs on marginal utility. A negative prefix implies that caloric needs do not have a positive, but a negative effect on marginal utility. However, the coefficient is insignificant in all cases. Accordingly, the parameter φ is insignificant as well.[29] However, we want to stress that we employ some simplifying assumptions as individuals' consumption expenditures for food are not directly observable. Additionally to that, height is only one factor driving caloric needs. Physical activity, which is another important determinant, does not seem to be available in any such dataset, impeding a definite judgment.

Differing product variety, on the other hand, does seem to have a significant effect on labor supply. The coefficient for aggregate consumption expenditures of individuals in the same height cluster is significant at the 5% level in all cases and has the expected positive sign. A 1% increase in aggregate consumption expenditures of individuals with similar height increases individual labor supply by roughly 0.03%. The choice of the measure for caloric needs does not seem to affect the results, which is expected as this variable does not seem to explain any variation in labor supply. For the elasticity of substitution between different products, we find a parameter θ of about 9.4 – varying between 9.1 and 9.8 – implying a price markup of about 12%. This seems to be in line with standard assumptions of price markups of about 10% (Di Pace and Hertweck, 2012). Christiano et al. (2005) find a price markup of about 11% in a model with flexible prices for the US economy. Broda and Weinstein (2006) estimate the elasticity of substitution for different sectors. Their findings suggest slightly higher elasticities of substitution of about 13 for internationally traded goods on the ten-digit (HTS) sector level in the US in the more recent period 1991 to 2001.

[29] As the formula by Mifflin et al. (1990) makes use of estimated parameters this requires an adjustment as estimated parameters are an additional source of uncertainty (Murphy and Topel, 1985). However, the procedure in case of clustered standard errors is not straightforward (Klonner and Oldiges, 2014). As the effect of an individual's caloric needs is insignificant and the results are virtually identical to the estimation using height as proxy, which does not require the Murphy Topel-adjustment, we refrain from employing such an adjustment.

5.2 Caloric Needs

Extending the standard labor supply Equation (17) to only allow for an effect of caloric needs as presented in Section 3.2 results in the equation

$$l_{i,k} = \frac{1}{1+\eta} wl_{i,k} - \frac{\sigma}{1+\eta} pc_{i,k} + \frac{\varphi}{1+\eta} h_{i,k} + \beta b \ . \tag{21}$$

Variables are defined as presented in Section 3.3. The estimation results are reported in Table 3. As life cycle theory predicts an effect of age on labor supply we introduce age and age squared as additional controls in columns (2) and (5). In columns (3) and (6) we also control for the interview month as consumption expenditures and labor income might be subject to seasonal fluctuations.

Columns (1) to (3) show the results with height as proxy for caloric needs, in columns (4) to (6) we use TEE as given by the Mifflin et al. (1990) formula. The results are similar to the previous findings. In all cases, the coefficient for caloric needs is negative implying a negative effect of height on marginal utility, which is in contrast to the proposed positive effect. However, coefficients are insignificant. The coefficients for labor income and consumption expenditures as well as the underlying parameters η and σ are in line with our expectations and very similar to the ones reported in Table 2. They are highly significant, at the 1% level in all cases.

5.3 Product Variety

Allowing for differing product variety only results in the equation

$$l_{i,k} = \frac{1}{1+\eta} wl_{i,k} - \frac{\sigma}{1+\eta} pc_{i,k} + \frac{1-\sigma}{(1+\eta)(\theta-1)} pc_k + \beta b \ . \tag{22}$$

Variable definitions are again consistent with Section 3.3. The results of estimating Equation (22) are reported in Table 4. In contrast to caloric needs, product variety has a significant effect on labor supply. An increase in aggregate consumption expenditures of individuals in the same height cluster of 1% increases individual labor supply by roughly 0.03%. The effect is statistically significant at the 5% level for the cluster sizes of 1cm and 2cm, at the 10% level for the broader cluster size of 4cm. The effects of labor income and consumption seem to be very similar to the ones in Section 5.1.

5.4 Robustness Analysis

To check for the robustness of our results we proceed by running robustness checks using different samples as explained in Section 4. Let us start by excluding households that report not to be saving. Up till now, we have assumed net saving of 0 for these households. As they might as well be dissaving this would result in consumption expenditures being too low, which might distort the analysis. We report the estimation results excluding non-saving households in Table 5. The structure is similar to the one of Table 2. Again, we do not find a significant effect of caloric needs. With respect to product variety, the coefficient for aggregate consumption expenditures of individuals in the same height cluster is significant at the 5% level for the narrow cluster definition of 1cm, at the 10% level for the cluster sizes of 2cm and 4cm. We mainly ascribe the lower significance to the reduced sample size resulting in higher standard errors. Comparing the point estimates of the coefficients to the ones for the sample including all households (Table 2) shows that the point estimates are very similar.

To further test for the robustness of our results we now estimate Equation (19) for households consisting of two individuals (Table 6). In this case, the inverse of the Frisch elasticity η increases to about 3.6, which might reflect inter household substitution of working hours. σ slightly decreases implying a somewhat lower risk aversion. With regard to variables affected by height, caloric needs do not affect labor supply as coefficients are insignificant. Differences in product variety, on the other hand, still seem important. Coefficients are significant on the 5% level for the cluster size of 1cm, on the 10% level for cluster sizes of 2cm and 4cm. The coefficients are substantially lower than the ones for single person households. An increase in the respective cluster's aggregate consumption expenditures by 1% increases individual labor supply by 0.013%. Equivalently, the coefficient of substitution between different goods θ is slightly higher, implying a lower preference for individual products. The estimates range from 12.1 to 12.9.

Estimating Equation (19) for two person households, this time only using households that report that they have been saving (Table 7), yields similar results. There is no significant effect of caloric needs. The effect of product variety is significant, even though on the 10% level, only.

Finally, we check for the robustness by varying the set of instruments. To test for the validity of the instruments we include additional instrumental variables to allow for a test for overidentification. These are average consumption expenditures and labor income of similar individuals. As similar individuals we define individuals that live in households with similar size, belong to the same height cluster and are not registered as unemployed. The results are essentially unaffected by including these additional instruments (Table 8). Caloric needs do not affect an individual's labor supply. Higher aggregate consumption expenditures of similar individuals, which represent the effect of differing product variety, do increase an individual's labor supply significantly. Additionally to that, the assumption of exogeneity of the instruments seems justified. Only for estimations in columns (1) and (4), the ones using all one person households and a cluster size of 1cm, the hypothesis of exogeneity of the instruments has to be rejected at the 5% level.

6 Concluding remarks

This paper derives a labor supply equation that allows for two channels through which height might affect individual labor supply, which are in excess of the well-known wage premium for tall individuals. First, caloric needs are increasing in height resulting in higher consumption expenditures for food, which might be thought of as sunk costs. Second, the presence of size specific products results in lower product variety, lower utility extraction and a higher price level for individuals in the tails of the height distribution.

Testing for the empirical relevance of these two channels, we find that caloric needs do not have a significant effect on individuals' labor supply and therefore on marginal utility of individuals. If there is an effect, marginal utility seems to be decreasing in height. There are several possible explanations for this. First, we use total energy expenditures and height as proxies for expenditures for food, because information on such expenditures is not available to us. These proxies might be inappropriate. Second, the effect might be superposed by other effects of height, which also affect utility. Marginal utility of tall individuals could be lower if similar products yield less utility for tall individuals. The discussion about the knee defender has brought this topic to public debate (Barro, 2014). Disutility of reduced moving space might be substantially higher for tall individuals when consuming e.g. transportation services. One could extend this line of thought and argue that tall individuals require e.g. a larger bed and that (marginal) utility from living space is therefor smaller for tall individuals. Third, the effect of differing caloric needs might indeed be economically irrelevant.

For product variety, on the other hand, we do find significant effects. For prime age males in single person households, an increase in aggregate consumption expenditures with similar height increases individual labor supply by about 0.03%. For two person households, the effect is somewhat smaller, about 0.013%, possibly due to labor supply not being decided on the individual but on the household level.

Physical features do affect individual labor supply and therefore (marginal) utility of individuals in excess of the well-documented higher wages for tall individuals. The widespread negative attitude towards linking income taxes to height might reflect the intuition that the link between height and utility is substantially more complex than typically assumed. A tax code, simply linking income taxes to height wantonly neglects these additional channels, putting the proposed advantageousness of such a tax code into question. Therefore, the negative attitude towards this tax code does not necessarily reflect proponents of the utilitarian perspective being picky with regard to policy recommendations.

This also shows that great care is indispensable when choosing appropriate "tag-variables". Such variables need not only be correlated with the opportunity to produce income. It is also necessary to ensure that such variables do not have a direct effect on or are correlated with other variables that might affect individual utility. Otherwise, such effects need to be taken into account.

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Table 1: Summary Statistics, 1992 - 2011

	One Person Households						Two Person Households					
	all HH			saving HH			all HH			saving HH		
	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N
Working hours, weekly	43.19	10.18	6591	43.68	9.18	4370	44.07	9.79	12388	44.04	9.19	9487
Net labor income, monthly	1634.74	914.42	6742	1799.37	998.18	4441	1758.29	974.37	12732	1838.07	995.73	9679
Household consumption expenditures, monthly	1429.92	837.77	7225	1485.56	912.02	4561	2406.30	1260.05	13470	2410.27	1232.06	10018
Height	178.95	6.96	6793	179.12	6.92	4289	178.76	7.04	12440	179.15	7.00	9251
Caloric needs (TEE)	2829.19	195.88	6793	2833.56	193.97	4289	2807.97	207.03	12440	2820.10	206.15	9251
Age	39.68	8.53	7225	39.66	8.49	4561	41.58	9.37	13470	41.27	9.31	10018
Aggregate consumption expenditures (1cm cluster), monthly	2.24e+08	1.59e+08	6793	2.23e+08	1.60e+08	4289	3.85e+08	2.32e+08	12440	3.83e+08	2.31e+08	9251
Aggregate consumption expenditures (2cm cluster), monthly	4.06e+08	2.36e+08	6793	4.03e+08	2.34e+08	4289	7.06e+08	3.83e+08	12440	7.04e+08	3.81e+08	9251
Aggregate consumption expenditures (4cm cluster), monthly	7.97e+08	4.62e+08	6793	7.92e+08	4.58e+08	4289	1.37e+09	7.18e+08	12440	1.37e+09	7.12e+08	9251
Average consumption expenditures (1cm cluster), monthly	1352.11	283.39	6793	1349.02	288.01	4289	2363.50	536.24	12440	2362.32	538.13	9251
Average consumption expenditures (2cm cluster), monthly	1348.47	248.60	6793	1348.39	256.56	4289	2360.70	493.66	12440	2360.84	492.66	9251
Average consumption expenditures (4cm cluster), monthly	1345.33	207.93	6793	1342.89	209.61	4289	2358.30	471.41	12440	2357.30	469.03	9251
Observations in 1cm cluster	27.75	19.41	6793	27.63	19.59	4289	42.65	23.34	12440	42.42	23.16	9251
Observations in 2cm cluster	50.83	29.47	6793	50.40	29.34	4289	79.32	39.30	12440	78.91	38.93	9251
Observations in 4cm cluster	100.51	58.40	6793	99.72	58.27	4289	154.91	74.82	12440	153.99	73.80	9251
Net labor income (similar individuals, 1cm cluster), monthly	1625.82	321.22	6786	1796.24	405.24	4284						
Net labor income (similar individuals, 2cm cluster), monthly	1622.88	274.63	6791	1797.18	337.31	4286						
Net labor income (similar individuals, 4cm cluster), monthly	1622.68	213.58	6793	1793.42	261.08	4289						
Aggregate consumption expenditures (similar individuals, 1cm cluster), monthly	1445.70	322.59	6793	1505.68	427.09	4289						
Aggregate consumption expenditures (similar individuals, 2cm cluster), monthly	1443.72	281.66	6793	1505.92	363.10	4289						
Aggregate consumption expenditures (similar individuals, 4cm cluster), monthly	1444.20	238.65	6793	1504.00	321.90	4289						

Table 2: One Person Households, all Households

	Hours worked					
	(1)	(2)	(3)	(4)	(5)	(6)
Height	-0.3160	-0.3165	-0.3270			
	(0.2531)	(0.2533)	(0.2536)			
Caloric needs				-0.2044	-0.2047	-0.2117
				(0.1630)	(0.1632)	(0.1635)
$\text{Consumption}_{\text{k}}$	0.0293^{**}			0.0294^{**}		
(1cm cluster)	(0.0119)			(0.0119)		
$\text{Consumption}_{\text{k}}$		0.0274^{**}			0.0275^{**}	
(2cm cluster)		(0.0136)			(0.0136)	
$\text{Consumption}_{\text{k}}$			0.0285^{**}			0.0286^{**}
(4cm cluster)			(0.0143)			(0.0143)
Labor income	0.4139^{***}	0.4121^{***}	0.4117^{***}	0.4140^{***}	0.4122^{***}	0.4117^{***}
	(0.0681)	(0.0683)	(0.0684)	(0.0681)	(0.0683)	(0.0683)
$\text{Consumption}_{\text{i,k}}$	-0.1768^{***}	-0.1720^{***}	-0.1719^{***}	-0.1769^{***}	-0.1720^{***}	-0.1720^{***}
	(0.0619)	(0.0618)	(0.0619)	(0.0619)	(0.0618)	(0.0619)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Age, age^2	Yes	Yes	Yes	Yes	Yes	Yes
Interview month FE	Yes	Yes	Yes	Yes	Yes	Yes
η	1.4160^{***}	1.4263^{***}	1.4292^{***}	1.4157^{***}	1.4260^{***}	1.4289^{***}
	(0.3977)	(0.4019)	(0.4034)	(0.3975)	(0.4018)	(0.4032)
σ	0.4272^{***}	0.4173^{***}	0.4176^{***}	0.4273^{***}	0.4174^{***}	0.4177^{***}
	(0.0917)	(0.0927)	(0.0929)	(0.0917)	(0.0937)	(0.0929)
θ	9.0837^{**}	9.7599^{**}	9.4118^{**}	9.0683^{**}	9.7376^{**}	9.3896^{**}
	(3.6052)	(4.6288)	(4.5028)	(3.5952)	(4.6112)	(4.4843)
φ	-0.7634	-0.7679	-0.7944	-0.4937	-0.4966	-0.5142
	(0.6076)	(0.6114)	(0.6135)	(0.3917)	(0.3943)	(0.3959)
Observations	5869	5869	5869	5869	5869	5869
R^2	0.207	0.207	0.208	0.207	0.207	0.208
F-stat (excl. iv)	73.86	73.03	72.76	73.87	73.03	72.76
Individuals	1410	1410	1410	1410	1410	1410

One period lagged values as instruments for labor income and $\text{consumption}_{\text{i,k}}$. Standard errors clustered on the individual level in parentheses. All variables except the controls 'age', 'age^2', 'Interview month FE', and 'Time FE' in logs. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 3: One Person Households, all Households

	Hours worked					
	(1)	(2)	(3)	(4)	(5)	(6)
Height	-0.2776	-0.3125	-0.3132			
	(0.2519)	(0.2584)	(0.2579)			
Caloric needs				-0.0848	-0.2009	-0.2013
				(0.1333)	(0.1663)	(0.1660)
Labor income	0.4144***	0.4163***	0.4168***	0.4123***	0.4163***	0.4168***
	(0.0702)	(0.0688)	(0.0685)	(0.0702)	(0.0688)	(0.0685)
$\text{Consumption}_{\text{i,k}}$	-0.1761***	-0.1750***	-0.1738***	-0.1759***	-0.1751***	-0.1738***
	(0.0625)	(0.0623)	(0.0624)	(0.0628)	(0.0623)	(0.0624)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Age, age^2	No	Yes	Yes	No	Yes	Yes
Interview month FE	No	No	Yes	No	No	Yes
η	1.4129***	1.4022***	1.3995***	1.4256***	1.4020***	1.3993***
	(0.4088)	(0.3973)	(0.3947)	(0.4129)	(0.3972)	(0.3946)
σ	0.4249***	0.4204***	0.4169***	0.4268***	0.4205***	0.4170***
	(0.0900)	(0.0921)	(0.0930)	(0.0909)	(0.0921)	(0.0930)
φ	-0.6698	-0.7507	-0.7515	-0.2057	-0.4826	-0.4829
	(0.6035)	(0.6179)	(0.6161)	(0.3194)	(0.3979)	(0.3967)
Observations	5869	5869	5869	5869	5869	5869
R^2	0.198	0.201	0.202	0.197	0.201	0.202
F-stat (excl. iv)	72.97	73.14	72.74	72.97	73.14	72.75
Individuals	1410	1410	1410	1410	1410	1410

One period lagged values as instruments for labor income and $\text{consumption}_{\text{i,k}}$. Standard errors clustered on the individual level in parentheses. All variables except the controls 'age', 'age^2', 'Interview month FE', and 'Time FE' in logs. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 4: One Person Households, all Households

	Hours worked								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Consumption_{k}	0.0299**	0.0292**	0.0293**						
(1cm cluster)	(0.0120)	(0.0119)	(0.0120)						
Consumption_{k}				0.0283**	0.0272**	0.0273**			
(2cm cluster)				(0.0139)	(0.0137)	(0.0138)			
Consumption_{k}							0.0288**	0.0281*	0.0281*
(4cm cluster)							(0.0145)	(0.0144)	(0.0144)
Labor income	0.4097***	0.4099***	0.4102***	0.4080***	0.4081***	0.4084***	0.4076***	0.4076***	0.4079***
	(0.0698)	(0.0683)	(0.0680)	(0.0699)	(0.0685)	(0.0682)	(0.0700)	(0.0686)	(0.0683)
$\text{Consumption}_{i,k}$	-0.1787***	-0.1777***	-0.1763***	-0.1737***	-0.1729***	-0.1715***	-0.1735***	-0.1726***	-0.1714***
	(0.0624)	(0.0623)	(0.0624)	(0.0623)	(0.0622)	(0.0623)	(0.0624)	(0.0623)	(0.0624)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age, age^2	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Interview month FE	No	No	Yes	No	No	Yes	No	No	Yes
η	1.4406***	1.4394***	1.4380***	1.4511***	1.4504***	1.4484***	1.4536***	1.4534***	1.4518***
	(0.4157)	(0.4065)	(0.4043)	(0.4201)	(0.4111)	(0.4089)	(0.4216)	(0.4128)	(0.4107)
σ	0.4362***	0.4335***	0.4299***	0.4258***	0.4236***	0.4199***	0.4257***	0.4235***	0.4203***
	(0.0897)	(0.0920)	(0.0930)	(0.0908)	(0.0930)	(0.0940)	(0.0912)	(0.0933)	(0.0943)
θ	8.7379**	8.9511**	8.9874**	9.2877**	9.6468**	9.6731**	9.1188**	9.3728**	9.4134**
	(3.4509)	(3.5959)	(3.6323)	(4.3694)	(4.6777)	(4.6964)	(4.4074)	(4.6058)	(4.6522)
Observations	5869	5869	5869	5869	5869	5869	5869	5869	5869
R^2	0.202	0.205	0.206	0.203	0.206	0.206	0.204	0.206	0.207
F-stat (excl. iv)	73.07	73.38	73.03	72.25	72.51	72.15	72.00	72.24	71.88
Individuals	1410	1410	1410	1410	1410	1410	1410	1410	1410

One period lagged values as instruments for labor income and $\text{consumption}_{i,k}$. Standard errors clustered on the individual level in parentheses. All variables except the controls 'age', 'age^2', 'Interview month FE', and 'Time FE' in logs. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 5: One Person Households, saving Households

	Hours worked					
	(1)	(2)	(3)	(4)	(5)	(6)
Height	-0.0428	-0.0459	-0.0653			
	(0.2771)	(0.2776)	(0.2811)			
Caloric needs				-0.0316	-0.0338	-0.0464
				(0.1784)	(0.1789)	(0.1811)
$\text{Consumption}_{\text{k}}$ (1cm cluster)	0.0267^{**}			0.0267^{**}		
	(0.0133)			(0.0133)		
$\text{Consumption}_{\text{k}}$ (2cm cluster)		0.0291^{*}			0.0292^{*}	
		(0.0162)			(0.0162)	
$\text{Consumption}_{\text{k}}$ (4cm cluster)			0.0323^{*}			0.0323^{*}
			(0.0172)			(0.0172)
Labor income	0.2927^{***}	0.2902^{***}	0.2901^{***}	0.2929^{***}	0.2904^{***}	0.2902^{***}
	(0.0492)	(0.0487)	(0.0490)	(0.0492)	(0.0487)	(0.0490)
$\text{Consumption}_{\text{i,k}}$	-0.0937^{**}	-0.0886^{**}	-0.0889^{**}	-0.0937^{**}	-0.0887^{**}	-0.0890^{**}
	(0.0408)	(0.0398)	(0.0400)	(0.0408)	(0.0398)	(0.0400)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Age, age^2	Yes	Yes	Yes	Yes	Yes	Yes
Interview month FE	Yes	Yes	Yes	Yes	Yes	Yes
η	2.4161^{***}	2.4456^{***}	2.4473^{***}	2.4146^{***}	2.4440^{***}	2.4456^{***}
	(0.5744)	(0.5785)	(0.5827)	(0.5736)	(0.5777)	(0.5818)
σ	0.3201^{***}	0.3054^{***}	0.3066^{***}	0.3201^{***}	0.3055^{***}	0.3066^{***}
	(0.1027)	(0.1019)	(0.1023)	(0.1027)	(0.1018)	(0.1022)
θ	8.4610^{**}	7.9171^{*}	7.2245^{**}	8.4612^{**}	7.9165^{*}	7.2214^{**}
	(4.1588)	(4.1494)	(3.6342)	(4.1631)	(4.1533)	(3.6340)
φ	-0.1463	-0.1583	-0.2250	-0.1080	-0.1164	-0.1599
	(0.9460)	(0.9564)	(0.9686)	(0.6088)	(0.6159)	(0.6237)
Observations	3980	3980	3980	3980	3980	3980
R^2	0.174	0.176	0.178	0.174	0.176	0.178
F-stat (excl. iv)	47.31	46.97	46.82	47.30	46.96	46.81
Individuals	1090	1090	1090	1090	1090	1090

One period lagged values as instruments for labor income and $\text{consumption}_{\text{i,k}}$. Standard errors clustered on the individual level in parentheses. All variables except the controls 'age', 'age^2', 'Interview month FE', and 'Time FE' in logs. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 6: Two Person Households, all Households

	Hours worked					
	(1)	(2)	(3)	(4)	(5)	(6)
Height	-0.0534	-0.0519	-0.0534			
	(0.1340)	(0.1340)	(0.1338)			
Caloric needs				-0.0340	-0.0330	-0.0341
				(0.0851)	(0.0852)	(0.0850)
$\text{Consumption}_{\text{k}}$	0.0132^{**}			0.0132^{**}		
(1cm cluster)	(0.0066)			(0.0066)		
$\text{Consumption}_{\text{k}}$		0.0125^{*}			0.0125^{*}	
(2cm cluster)		(0.0068)			(0.0068)	
$\text{Consumption}_{\text{k}}$			0.0130^{*}			0.0130^{*}
(4cm cluster)			(0.0073)			(0.0073)
Labor income	0.2160^{***}	0.2164^{***}	0.2159^{***}	0.2160^{***}	0.2164^{***}	0.2159^{***}
	(0.0281)	(0.0281)	(0.0281)	(0.0281)	(0.0281)	(0.0281)
$\text{Consumption}_{\text{i,k}}$	-0.0685^{**}	-0.0681^{**}	-0.0679^{**}	-0.0685^{**}	-0.0681^{**}	-0.0679^{**}
	(0.0304)	(0.0306)	(0.0305)	(0.0304)	(0.0306)	(0.0305)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Age, age^2	Yes	Yes	Yes	Yes	Yes	Yes
Interview month FE	Yes	Yes	Yes	Yes	Yes	Yes
η	3.6303^{***}	3.6217^{***}	3.6318^{***}	3.6304^{***}	3.6218^{***}	3.6318^{***}
	(0.6033)	(0.6002)	(0.6024)	(0.6033)	(0.6002)	(0.6024)
σ	0.3171^{***}	0.3149^{***}	0.3146^{***}	0.3171^{***}	0.3149^{***}	0.3146^{***}
	(0.1153)	(0.1160)	(0.1162)	(0.1153)	(0.1160)	(0.1162)
θ	12.1552^{**}	12.8671^{*}	12.3741^{*}	12.1368^{**}	12.8433^{*}	12.3505^{*}
	(6.0042)	(6.7359)	(6.6445)	(5.9856)	(6.7113)	(6.6158)
φ	-0.2471	-0.2398	-0.2475	-0.1573	-0.1527	-0.1582
	(0.6192)	(0.6182)	(0.6185)	(0.3935)	(0.3929)	(0.3929)
Observations	10834	10834	10834	10834	10834	10834
R^2	0.092	0.092	0.092	0.092	0.092	0.092
F-stat (excl. iv)	65.58	65.45	65.15	65.53	65.41	65.11
Individuals	2828	2828	2828	2828	2828	2828

One period lagged values as instruments for labor income and $\text{consumption}_{\text{i,k}}$. Standard errors clustered on the individual level in parentheses. All variables except the controls 'age', 'age^2', 'Interview month FE', and 'Time FE' in logs. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 7: Two Person Households, saving Households

	Hours worked					
	(1)	(2)	(3)	(4)	(5)	(6)
Height	0.0490	0.0518	0.0517			
	(0.1466)	(0.1464)	(0.1464)			
Caloric needs				0.0305	0.0321	0.0319
				(0.0929)	(0.0929)	(0.0928)
$\text{Consumption}_{\text{k}}$	0.0134*			0.0134*		
(1cm cluster)	(0.0077)			(0.0077)		
$\text{Consumption}_{\text{k}}$		0.0139*			0.0139*	
(2cm cluster)		(0.0079)			(0.0079)	
$\text{Consumption}_{\text{k}}$			0.0141*			0.0140*
(4cm cluster)			(0.0084)			(0.0084)
Labor income	0.2210***	0.2214***	0.2211***	0.2210***	0.2214***	0.2211***
	(0.0359)	(0.0358)	(0.0358)	(0.0359)	(0.0358)	(0.0358)
$\text{Consumption}_{\text{i,k}}$	-0.0700*	-0.0701*	-0.0699*	-0.0700*	-0.0700*	-0.0699*
	(0.0372)	(0.0374)	(0.0374)	(0.0372)	(0.0374)	(0.0374)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Age, age^2	Yes	Yes	Yes	Yes	Yes	Yes
Interview month FE	Yes	Yes	Yes	Yes	Yes	Yes
η	3.5254***	3.5165***	3.5228***	3.5252***	3.5163***	3.5225***
	(0.7350)	(0.7307)	(0.7323)	(0.7350)	(0.7307)	(0.7323)
σ	0.3166**	0.3164**	0.3163**	0.3166**	0.3163**	0.3162**
	(0.1373)	(0.1381)	(0.1382)	(0.1373)	(0.1381)	(0.1382)
θ	12.2626*	11.8677*	11.7542*	12.2800*	11.8890*	11.7765*
	(6.9258)	(6.4052)	(6.7046)	(6.9432)	(6.4267)	(6.7240)
φ	0.2217	0.2341	0.2337	0.3166	0.1449	0.1444
	(0.6661)	(0.6643)	(0.6655)	(0.1373)	(0.4212)	(0.4215)
Observations	8404	8404	8404	8404	8404	8404
R^2	0.083	0.083	0.083	0.083	0.083	0.083
F-stat (excl. iv)	45.93	45.96	45.77	45.89	45.93	45.74
Individuals	2432	2432	2432	2432	2432	2432

One period lagged values as instruments for labor income and $\text{consumption}_{\text{i,k}}$. Standard errors clustered on the individual level in parentheses. All variables except the controls 'age', 'age^2', 'Interview month FE', and 'Time FE' in logs. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 8: One Person Households, Alternative Set of Instruments

	Hours worked											
	All households						Saving households					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Height	-0.2943	-0.3061	-0.3154				-0.0301	-0.0424	-0.0654			
	(0.2495)	(0.2497)	(0.2502)				(0.2750)	(0.2760)	(0.2798)			
Caloric needs				-0.1903	-0.1980	-0.2042				-0.0235	-0.0316	-0.0465
				(0.1606)	(0.1608)	(0.1612)				(0.1770)	(0.1777)	(0.1801)
Consumption_k (1cm cluster)	0.0275^{**}			0.0276^{**}			0.0255^{*}			0.0255^{*}		
	(0.0117)			(0.0117)			(0.0132)			(0.0133)		
Consumption_k (2cm cluster)		0.0273^{**}			0.0273^{**}			0.0288^{*}			0.0288^{*}	
		(0.0136)			(0.0136)			(0.0161)			(0.0161)	
Consumption_k (4cm cluster)			0.0285^{**}			0.0285^{**}			0.0319^{*}			0.0320^{*}
			(0.0142)			(0.0142)			(0.0170)			(0.0171)
Labor income	0.3674^{***}	0.3891^{***}	0.3864^{***}	0.3675^{***}	0.3891^{***}	0.3865^{***}	0.2683^{***}	0.2809^{***}	0.2841^{***}	0.2684^{***}	0.2811^{***}	0.2843^{***}
	(0.0606)	(0.0651)	(0.0683)	(0.0606)	(0.0651)	(0.0683)	(0.0506)	(0.0530)	(0.0521)	(0.0506)	(0.0530)	(0.0521)
$\text{Consumption}_{i,k}$	-0.1155^{**}	-0.1413^{**}	-0.1389^{**}	-0.1156^{**}	-0.1414^{**}	-0.1390^{**}	-0.0645^{*}	-0.0758^{*}	-0.0771^{*}	-0.0645^{*}	-0.0758^{*}	-0.0772^{*}
	(0.0493)	(0.0567)	(0.0603)	(0.0493)	(0.0567)	(0.0603)	(0.0372)	(0.0419)	(0.0413)	(0.0372)	(0.0419)	(0.0412)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age, age^2	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Interview month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
η	1.7219^{***}	1.5703^{***}	1.5878^{***}	1.7213^{***}	1.5697^{***}	1.5873^{***}	2.7278^{***}	2.5597^{***}	2.5197^{***}	2.7257^{***}	2.5578^{***}	2.5178^{***}
	(0.4489)	(0.4304)	(0.4575)	(0.4485)	(0.4300)	(0.4571)	(0.7038)	(0.6720)	(0.6458)	(0.7023)	(0.6705)	(0.6445)
σ	0.3145^{***}	0.3631^{***}	0.3596^{***}	0.3146^{***}	0.3632^{***}	0.3596^{***}	0.2404^{**}	0.2697^{***}	0.2715^{***}	0.2405^{**}	0.2697^{***}	0.2715^{***}
	(0.0928)	(0.0956)	(0.1022)	(0.0927)	(0.0956)	(0.1022)	(0.1070)	(0.1115)	(0.1083)	(0.1069)	(0.1114)	(0.1082)
θ	10.1461^{**}	10.0886^{**}	9.6944^{**}	10.1287^{**}	10.0671^{**}	9.6728^{**}	9.0059^{*}	8.1166^{*}	7.4792^{**}	9.0078^{*}	8.1175^{*}	7.4773^{**}
	(4.2032)	(4.7476)	(4.5466)	(4.1912)	(4.7299)	(4.5285)	(4.6248)	(4.2556)	(3.7494)	(4.6307)	(4.2602)	(3.7500)
φ	-0.8011	-0.7868	-0.8161	-0.5179	-0.5089	-0.5283	-0.1121	-0.1511	-0.2301	-0.0874	-0.1123	-0.1634
	(0.6852)	(0.6512)	(0.6573)	(0.4415)	(0.4199)	(0.4241)	(1.0251)	(0.9837)	(0.9866)	(0.6594)	(0.6334)	(0.6353)
Observations	5869	5869	5869	5869	5869	5869	3980	3980	3980	3980	3980	3980
R^2	0.223	0.217	0.218	0.223	0.217	0.218	0.180	0.179	0.181	0.180	0.179	0.181
F-stat (excl. iv)	68.88	53.22	49.81	68.89	53.23	49.81	59.06	34.77	35.84	59.04	34.78	35.85
p-value, Hansen J statistic	0.02	0.24	0.18	0.02	0.24	0.18	0.27	0.66	0.08	0.27	0.66	0.08
Individuals	1410	1410	1410	1410	1410	1410	1090	1090	1090	1090	1090	1090

One period lagged values and average labor income and average consumption expenditures of similar individuals as instruments for labor income and $\text{consumption}_{i,k}$. Standard errors clustered on the individual level in parentheses. All variables except the controls 'age', 'age^2', 'Interview month FE', and 'Time FE' in logs. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.