Preliminary—Comments Welcome

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TAKING TIME USE SERIOUSLY: INCOME, WAGES AND PRICE DISCRIMINATION

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ABSTRACT

The American Time Use Survey 2003-15, the French *Enquête Emploi du Temps*, 2009-10, and the German *Zeitverwendungserhebung*, 2012-13, have sufficient observations to allow examining the theory of household production in much more detail than ever before. We identify income effects on time use by non-workers, showing that relatively time-intensive commodities—sleep and TV-watching—are inferior. For workers we identify income and substitution effects separately, with both in the same direction on these commodities as the income effects among non-workers. We rationalize the results within a generalization of the theory, allowing both substitution between time and goods in household production and substitution among commodities in utility functions. We then use the substantial evidence of price discrimination in product markets against minorities in the U.S. and immigrants in France to motivate estimating how household production differs between members of these groups and the majority. We find the predicted results that they engage in more time-intensive activities, sleep and TV-watching, than otherwise identical majority-group members.

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I. Introduction—Economic Variables in Time Use

While the literature on time use is immense, the overwhelming majority of contributions simply tabulate time spent in various activities and make comparisons across demographic groups. A few attempts have been made to take Becker's (1965) "commodity production" model seriously as a guide to empirical work, in the sense of deriving and testing the implications of an explicitly specified model; but these efforts have always been limited by the paucity of available time-use data allowing identification of income and price effects (Kooreman and Kapteyn, 1987; Biddle and Hamermesh, 1990). With the recent accumulation in several countries of very large collections of time diaries, this problem can now be vitiated. We generalize the original Becker model by relaxing its rigid assumptions about the technology of household production and rationalize estimates using these new data in light of the implications of the expanded model

Literatures measuring the extent of discrimination along such dimensions as race, ethnicity and gender are immense; and there are burgeoning literatures measuring the amount of discrimination by sexual orientation, disability status, appearance and other characteristics.[1] With the exception of the fairly large literature on racial differences in consumption/saving behavior, a consideration of how discrimination affects the behavior of the agents who are discriminated against is rare.[2] Even the few studies that examine these effects concentrate only on how agents' behavior in market(s) where they are discriminated against is altered by the discrimination that they face. Missing completely is any research on how discrimination in one market affects the behavior of the disadvantaged agents in a different market or area of activity—how discrimination spills over across markets. Within the context of the theory of household production we examine one spillover, namely how racial/ethnic differences in the allocation of time are affected by racially discriminatory behavior in product markets.

[1]On race, see, e.g., Charles and Guryan (2008); on ethnicity, see Leal and Trejo (2011); on gender, see Blau and Kahn (2016). On sexual orientation, Valfort (2017); on disability, Beegle and Stock (2003); on appearance, Hamermesh (2011).

[2]Among the few studies that make this at least part of their analyses is Parsons *et al.* (2011),

We begin by discussing the three countries' sets of time diaries used in this study, those for the U.S., France and Germany. Using these data we present broad-based evidence of a negative relationship between income and two quantitatively important use of time: sleep and television watching, both of which are "time-intensive" commodities. One obvious explanation for this relationship was provided by Becker (1965): rising worker productivity would increase the opportunity cost of time, thus raising the relative prices of time- to goods-intensive commodities, inducing substitution away from the former and towards the latter. However, in most models using this framework all time uses except market work are "normal", so that there is an income effect that works against this substitution effect, even for time-intensive commodities. Also, the explanation does not account for existence of the pattern among non-workers, for whom income differences cannot result from wage differences.

In Section III we use samples of workers to estimate separately the income and substitution effects on time spent sleeping and television watching, along with effects on two activities that are likely to be goods-intensive—eating away from home, and attending museums, sporting events and concerts. In Section IV we offer an explanation of the results found in Sections II and III based on a model that allows substitution between goods and time in the production of commodities and between commodities in agents' utilities. The model identifies a broad range of circumstances under which non-workers will respond to higher incomes, and workers to higher wages, by substituting more goods-intensive commodities for more time-intensive commodities in consumption and using more goods-intensive technologies of household production, in keeping with the empirical results presented in Sections II and III. The model also suggests a hypothesis regarding racial/ethnic differences in time use, and Section V tests this hypothesis using the American and French data.

II. Data Sets and Estimates of Income Effects

With the creation of the ongoing American Time Use Survey (ATUS) in 2003, we now have over 170,000 one-day diaries of people's short-term recollections of how they spend their time.[3] With a sampling

[3]See Hamermesh *et al*. (2005) for a discussion of the characteristics of this data set.

frame based on previous respondents to the Current Population Survey, the ATUS also provides information on a wide array of demographic characteristics and on family incomes. With minorities accounting for around 25 percent of the U.S. population, this sample is also sufficiently large to allow the examination of racial/ethnic differences in time use. For that purpose we divide the sample into the following three mutually exclusive groups: African-Americans, white Hispanics, and white non-Hispanics.[4]

In 2009-10 France fielded its fourth roughly decennial national time-diary study, *Enquête Emploi du Temps 2009-2010* (INSÉÉ, 2014). This survey collected nearly 28,000 diaries containing large amounts of demographic and other information on persons ages 10 or over throughout France, located in roughly 12,000 households. Unlike the ATUS each person in the *Enquête* was asked to complete two one-day diaries, filling each out for 10-minute intervals from Midnight through 11:59PM on the previous day.[5] There is no information on race/ethnicity in this data set; but respondents are categorized by immigrant status, and nearly 8 percent were immigrants. We analogize this demographic characteristic to race/ethnicity in the U.S. and examine how it affects time use in France.

In its third roughly decennial time-diary study the German Statistical Office fielded the *Zeitverwendungserhebung* over five quarters in 2012 and 2013. The survey asked respondents to complete diaries on three separate days, with slightly heavier sampling of weekends than weekdays. As with the French survey respondents were asked to provide their activities in fixed intervals of time, and nearly 25,000 time diaries were collected (Statistiches Bundesamt, 2015). We present detailed descriptions of the construction of the aggregates of time use in this and the other two data sets in the Data Appendix.[6]

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[4]African-American is defined as anyone who reports being of a single race, African-American, or who lists two races, with African-American being one of them. White Hispanic is anyone who is not African-American and who lists his/her ethnicity as Hispanic. White non-Hispanic is any else who lists his/her sole racial affiliation as white.

[5]This contrasts with the ATUS, in which respondents were asked to note the exact time that they began each new activity and to describe its nature so that it could be coded into one of the over 400 categories describing time use.

[6]This data set totals individual activities into seconds/day, so we divide each total by 60. It and the ATUS present daily totals of time spent in each individual activity. The *Enquête* presents the activity undertaken in each ten-minute interval of the day, which we then aggregate across the diary day..

Our focus is on the economic measures in these surveys, wages and incomes, so we need to be clear how these are measured. In the ATUS, as in the CPS, household income is currently listed in 16 brackets. We assign mid-points to the closed intervals and assign 1.5 times the top-coded amount to the highest, open interval. We compute the hourly wage rate (available only for those currently employed) as usual weekly earnings divided by usual weekly hours and exclude workers with computed hourly wages below $5 or above $150. The French income data are presented as continuous measures, with no top-coding, and can thus be used as presented. We compute the hourly wage as monthly earnings divided by 4.33 times weekly hours, using the same disqualifiers (in euros) as with the U.S. data. The German data set presents household incomes and monthly earnings in only five brackets, creating a very high positive correlation between them across individuals. For that reason, and because its sample of immigrants is small, we only include the German data in the examination of income effects among non-workers. In each data set, when we examine workers' behavior we include the hourly wage measure and define non-labor income as the household's income less the earnings of the individual worker.

A frequent division of time use is into four categories: Paid work, home production, personal time and leisure. Sleep predominates in personal care, and television-watching is the predominant leisure activity. Each of these is relatively time-intensive (Gronau and Hamermesh, 2007), so that their probable responses to income and price differences may make them non-aggregable with other personal and leisure activities. Thus in each of the three data sets we divide personal care into sleep and other personal care, and leisure into TV-watching and other leisure activities.

Table 1 lists statistics describing the six categories of time use for each of two samples in each of the three data sets: All diaries for which the respondent reported no usual hours of work, no work on the diary day and no usual earnings; and all diaries for which the respondent reported usually working and working on the day of the diary. The statistics and estimates throughout are calculated using the sampling weights. The means in Table 1 accord with what is generally known about time use and its differences across countries. On workdays work time and sleep time are about equal in all three countries. Workers sleep less on workdays than non-workers and watch much less television. In all categories Americans watch

more television than the Europeans, especially among non-workers. Averaging across all households in the samples, household incomes track the national averages quite closely.

For each of the three samples of non-workers we estimate equations describing the responses of each of the five non-work aggregates of time use to changes in household income. Large vectors of demographic controls are included in each equation. While they necessarily differ across the three samples because of differences in the available information, in all cases they include indicators of gender and marital (coupled) status and their interaction, a quadratic in age, indicators of the numbers and ages of young children, and vectors of indicators of educational attainment, geography (region or state) and the year, month and day of the week for which the diary was kept.

Table 2 presents estimates of the impact of a $10,000 (€10,000) increase in annual income, far less than one standard deviation in each case, on the minutes of time spent in each activity on a representative day. These are pure income effects, since the samples are restricted to respondents who report no usual work hours, do not work on the diary day and have no earnings. Because of the adding-up requirement, for each country the five estimated income effects sum to zero.

While there are some variations across countries, there are remarkable similarities too: 1) Sleep and television-watching are uniformly relatively inferior; and in each data set TV-watching is the most relatively inferior commodity. The impacts of income on sleep are very close in the three data sets; 2) Other leisure activities are uniformly relatively superior and constitute the most relatively superior aggregate in each sample; 3) The estimated impact of increased income on the other two aggregates, home production and other personal activities, is not uniformly positive or negative.

If we re-estimate these equations excluding anything that might possible be considered endogenous, leaving only the respondent's age and the year, month and day of the diary, in the U.S. all the estimated income effects become larger in absolute value; most are also larger in the French data, but in the German data the changes are mixed. Another alternative is to estimate this model separately for married individuals, including their spouse's age and education (the same coding as for the respondent's demographic characteristics). This re-specification hardly changes the estimates.

We simulate income effects on the two uniformly relatively inferior activities, sleep and TV-watching, by calculating changes in time spent in response to increases in family incomes from one standard deviation below the mean to one standard deviation above. In the U.S. this increase would reduce the non-worker's sleep time by 20 minutes per night (4 percent), and his/her TV-watching time by 28 minutes (12 percent). In France it would reduce non-workers' sleeping by 12 minutes (2 percent) and TV-watching by 28 minutes (17 percent). In Germany the analogous decreases are 12 minutes (2 percent) of sleeping and 20 minutes (12 percent) of TV-watching. While both commodities are relatively inferior, physical limitations make it difficult to switch away from sleeping when incomes rise, although some switching is apparently possible. No such limitations exist to choosing to watch less television when more goods can be purchased; and people do substitute strongly against this activity in response to pure increases in incomes.

III. Examining Wage and Income Effects on Time Use among Workers

To estimate income and substitution effects for workers, we re-specify the equations estimated in Table 2 by adding the hourly wage rate and replacing household income by household income minus the worker's earnings.[7] Because of the long history of focus in the labor-supply literature on women's labor supply, we estimate the models of time use separately by gender. Other than that, the control variables are the same as those included in the equations underlying Table 2. The sample consists of all those days reported by workers who indicate they engaged in some market work in the week preceding the diary day and in some work on the diary day.

The upper panel of Table 3 shows estimates of the impacts of increases in other household income (in $10,000 units) and the worker's hourly earnings (in $10 units, slightly less than one standard deviation) on time spent in the two time-intensive activities, sleep and TV-watching, in the ATUS.[8] Both activities

[7]We treat all other income the same rather than separating out partners' earnings from unearned income. Because the ATUS only collects one diary per household, we cannot examine cross-wage effects on time use within partnered couples, so that a further disaggregation of household incomes would not be fruitful.

[8]Estimates of the effects of these variables on time spent in the other four major uses of time are presented in the Appendix for the U.S. and France. For purposes of comparison to other studies, the implied elasticities of labor supply (at the intensive margin) are +0.02 for men, +0.06 for women.

respond negatively to increases in the price of the worker's time, with the cuts in time being larger for male workers. One interpretation of the result on TV-watching, consistent with men's lower labor-supply elasticity, is that, with men watching much more television than women, they are more willing to substitute away from television toward other activities as their time price increases. In these specifications the pure income effects are essentially zero, except for the small negative income effect on TV-watching among female workers.[9]

A large literature has demonstrated the inelasticity of men's labor supply and the decreasing elasticity of women's in the U.S. as well (Heim, 2007). While paid work time is obviously endogenous, treating it as fixed in estimating these equations is not a large departure given its relative wage inelasticity. The bottom panel of Table 3 thus estimates the demand equations for sleep and TV-watching holding work time constant. Except for women's sleep time the estimated effects of increases in hourly earnings change little from the upper panel. All the income effects, however, become negative, with three of them becoming statistically significant; but their magnitudes are still quite small, especially compared to the wage effects.

We present estimates of the same equations for France in Table 4, again for all those who report some paid work during the week and who work on the diary day. With sub-samples only one-fourth the sizes of the American sub-samples, we cannot expect the same significance of the parameter estimates. Nonetheless, whether we hold paid work time constant or not, we do find substantial negative income effects among workers, especially on time spent watching television. None of the wage effects is statistically significant, but the largest are positive. The estimated wage effects contrast with those for the U.S., which tended to be significant. A general conclusion from these tables is that pure income effects on workers' time spent sleeping and TV-watching are generally negative, and that the wage effects on these two activities are mixed.

As with the results for non-workers in Table 2, here too we re-estimate the models first with only age and the year, month and day indicators, and with the two monetary measures included. The changes are

[9]Some indirect evidence on these effects is provided by Aguiar *et al*. (2013), who use the implied cuts in wages and incomes during the Great Recession to examine time spent in sleep and TV-watching.

similar to those when we re-specified the models estimated in Table 2: The absolute values of the effects, of both wages and incomes, generally become larger. Also similar to Table 2, when we include the spouse's demographic characteristics the essential results change only slightly.

We know that health is correlated with income, so that income or earnings may proxy for poor health. The ATUS has a measure of self-rated health for six of the years in our sample, and the *Enquête* has a similar measure (with both on a 5 to 1 scale, from excellent (very good) to poor (very bad)). Adding these indicators to the estimated equations does reduce the absolute values of the effects in the U.S. equations in Table 2, and in the results in Table 3, but never by more than 25 percent. In the French data in Table 2, and in the results in Table 4, there are almost no changes.

If the impacts on what we believe are the relatively time-intensive activities, sleep and TV-watching, are generally negative, estimating similar equations describing variations in activities that we might believe are relatively goods-intensive should give the opposite results. To examine this possibility we define the two activities, time spent eating away from home, and time spent attending sporting events, museums, concerts, etc. (the latter only for the U.S., as the French data have very few observations with positive amounts of time spent in such activities). Because neither of these activities is undertaken by more than half the samples' respondents, we estimate both a probit describing the incidence of the activity on the diary day(s) and a conditional regression describing its intensity among those who spend any time on it.[10]

Table 5 presents the estimates of the income effects in these equations, specified to include the same controls as in Table 2. Both activities in the U.S. and eating away from home in France are on net superior—the effects of additional household income on non-workers' time use leads them to shift toward these uses of time that we think might be relatively goods-intensive. But their superiority works entirely through the effect of income on the incidence of the activity: Except for eating away in the U.S., the effects on intensity are tiny, negative and statistically insignificant.

[10]These estimates and those presented in Table 2 should make it abundantly clear that sleep and other non-work activities are non-aggregable. Treating sleep as part of leisure, as in, e.g., Aguiar and Hurst (2007), is simply incorrect.

IV. Income and Substitution Effects in Household Production

A. Background

In this section we explore the extent to which the empirical regularities we have demonstrated for the time-intensive commodities of sleep and TV-watching are consistent with the Becker (1965) model. A primary consideration is the nature of the income and substitution effects on various types of time use in such a model. From Becker (1965) to Gronau's (1986) survey, one finds occasional analyses of the impact on various time uses of changes in wages and in non-labor income, but the discussions are characterized by a lack of shared definitions and usually take place in the context of models that assume fixed proportions for combining goods and time. Becker (1965) showed that with fixed coefficient production functions the effect of an increase in non-labor income on all the time uses would generally be positive, while a compensated wage increase "would lead to a shift away from earnings-intensive commodities and towards goods-intensive ones" where earnings intensity was measured by the share of the total cost of a commodity represented by foregone earnings.[11]

There are a number of other relevant results in the literature, but none applies to non-workers—those for whom the marginal utility of time, equalized across all commodities, is less than the wage rate times the marginal utility of income.[12] Gronau (1986) asserts that for non-workers, or when work time is exogenous, "time scarcity depends upon the individual's income and his non-labor time. The higher his income and the smaller his non-labor time, the greater the time scarcity and the shadow price of time. An increase in the shadow price of time should raise the relative price of time intensive commodities (i.e.,

[11]Becker's conclusion about the effect of non-labor income on time uses did not apply in the case of an unusual utility function, that is, "if relatively time-intensive commodities . . . were sufficiently inferior", where the "time intensity" of an activity was equal to its earning intensity divided by the wage.

[12]Baumol (1973) was concerned with what he called the "Linder theorem" . . . "that a rise in real wages ("productivity") will lead to a reallocation of time to the disadvantage of cultural and other time-consuming pursuits" (Linder 1970). He rephrased the proposition more precisely: "the substitution effect of a rise in real wages will decrease consumption of some good or service if the time needed to consume one dollar's worth of the item is greater than the average time used to consume a dollar's worth of all other commodities", and proved it using a two-commodity model with fixed proportion production functions for the commodities. Atkinson and Stern (1979) showed that Baumol's result regarding the substitution effect did not generalize to a three- commodity case if the cross elasticities between commodities in the utility function satisfied certain conditions.

commodities where t_i/x_i is high) and result in a substitution of goods for time", with t_i/x_i being the marginal input requirements of time and goods for commodity i.[13]

B. Model

As in Becker (1965) ours is a one-period model in which individuals maximize utility defined over m commodities $Z_1 \ldots Z_m$. Each commodity is produced by combining time and goods according to a production function $Z_i = f_i(X_i, T_i)$, where X_i is the expenditure on goods (and/or the service flow from durable goods) used in the production of Z_i, and T_i is time spent in producing Z_i. For simplicity we assume that the relative prices of goods are fixed at one and are same for all consumers, although we relax this assumption in Sub-Section F below. We rule out joint production. Individuals can also devote time to market work, receiving a wage w per unit of time. Market work does not directly affect utility or contribute to the production of any of the commodities.

In order to concentrate on the relationship between patterns of time allocation and the characteristics of the commodity production functions, we specify a very simple utility function:

$$U = \sum (Z_i/\gamma)^{\gamma}, \ \gamma < 1.$$

We assume that each commodity is produced according to a commodity-specific CES production function $Z_i = [\delta_i X_i^{\rho(i)} + (1-\delta_i)T_i^{\rho(i)}]^{1/\rho(i)}$, where $\sigma_i = 1/(1-\rho_i)$ is the elasticity of substitution between time and goods in the production of commodity i. This set-up embodies three intuitively appealing properties: 1) Diminishing marginal productivity and utility of money expenditure on each commodity; 2) Diminishing marginal productivity and utility of time spent in each commodity; and 3) Decreasing returns to scale in utility for each commodity.

The assumption of no joint production leads to the standard budget constraint:

$$I + w(T^* - \sum T_i) = \sum X_i,$$

[13]A final relevant result is due to Deardorff and Stafford (1976), who show that with a homothetic utility function defined over two commodities and linearly homogenous commodity production functions, the wage elasticity of labor supply will be an increasing function of a weighted average of the elasticities of substitution of the production functions and the utility function. If this weighted average is greater than one, the wage elasticity of labor supply will be positive. Versions of this result have appeared in more recent papers proposing explanations of aggregate trends in time use, including Kopecky (2011) and Aguiar and Hurst (2007).

with I being non-labor income, T^* total time available, and $(T^* - \sum T_i)$ time devoted to market work. The first-order conditions for the individual's problem take the form:

$$\gamma\delta_i\rho_i X_i^{\rho(i)-1}[\delta_i X_i^{\rho(i)} + (1-\delta_i)T_i^{\rho(i)}]^{((\gamma-\rho(i))/\gamma)} = \lambda \text{ for all i;} \quad (1a)$$

$$\gamma(1-\delta_i)\rho_i T_i^{\rho(i)-1}[\delta_i X_i^{\rho(i)} + (1-\delta_i)T_i^{\rho(i)}]^{((\gamma-\rho(i))/\gamma)} \geq \lambda w \text{ for all i,} \quad (1b)$$

where λ is the Lagrangian multiplier on the goods budget constraint. Note that we assume that (1a) always holds with equality, but that it is possible for the marginal utility of time to be less than the marginal utility of the wage rate, so that the individual chooses not to engage in market work. In that case, the problem takes a different form, with maximization subject to two separate constraints: $(T^* - \sum T_i) = 0$ and $I = \sum X_i$. The first-order conditions become:

$$\gamma\delta_i\rho_i X_i^{\rho(i)-1}[\delta_i X_i^{\rho(i)} + (1-\delta_i)T_i^{\rho(i)}]^{((\gamma-\rho(i))/\gamma)} =$$

$$\gamma\delta_k\rho_k X_k^{\rho(k)-1}[\delta_k X_k^{\rho(k)} + (1-\delta_k)T_k^{\rho(k)}]^{((\gamma-\rho(k))/\gamma)} \text{ for all i and k;} \quad (2a)$$

$$\gamma(1-\delta_i)\rho_i T_i^{\rho(i)-1}[\delta_i X_i^{\rho(i)} + (1-\delta_i)T_i^{\rho(i)}]^{((\gamma-\rho(i))/\gamma)} =$$

$$\gamma(1-\delta_k)\rho_k T_k^{\rho(k)-1}[\delta_k X_k^{\rho(k)} + (1-\delta_k)T_k^{\rho(k)}]^{((\gamma-\rho(k))/\gamma)} \text{ for all i and k.} \quad (2b)$$

C. *Wage and Income Effects on the Time Allocation of Workers*

Conditions (1a) and (1b) place restrictions on the expenditure per unit of time of each commodity:

$$(\delta_i/(1-\delta_i))(X_i/T_i)^{\rho(i)-1} = (1/w) \quad (3)$$

Equating the left-hand side of (1b) for commodity i to its counterpart for an arbitrarily chosen commodity k, then using (3) to substitute for X_i and X_k in that expression, provides an equation in T_i and T_k:

$$(1-\delta_i)T_i^{(\gamma-1)}[\delta_i\,(\delta_i/(1-\delta_i))^{\rho(i)/(1-\rho(i))} w^{\rho(i)/(\rho(i)-1)} + (1-\delta_i)]^{(\gamma-\rho(i))/\rho(i)} =$$

$$(1-\delta_k)T_k^{(\gamma-1)}[\delta_k\,(\delta_k/(1-\delta_k))^{\rho(k)/(1-\rho(k))} w^{\rho(k)/(\rho(k)-1)} + (1-\delta_k)]^{(\gamma-\rho(k))/\rho(k)} \quad (4)$$

Logarithmically differentiating (4) we obtain an expression that shows the relationship between the wage and income elasticities of the time inputs into any pair of commodities i and k:

$$dlnT_i = dlnT_k + Q^k{}_i * dlnw,$$

$$Q^k{}_i = [a_i(\sigma_u - \sigma_i) - a_k(\sigma_u - \sigma_k)] = [(a_i - a_k)\sigma_u - a_i\sigma_i + a_k\sigma_k] , \quad (5)$$

where $a_i = X_i/(X_i + wT_i)$ is the share of money expenditures on commodity i in the total (opportunity) cost of commodity i, and σ_u is the elasticity of substitution between commodities in the utility function. An

immediate implication of (5) is that all uses of time have the same elasticity with respect to non-labor income (i.e., $(dlnT_i/dlnI) = (dlnT_k/dlnI)$. Whether the wage elasticity of one commodity is more or less positive than that of another (and whether it is greater or less than zero), depends on the sign of the Q term, the determinants of which we discuss below.

To obtain an expression for the wage elasticity of time spent on a single commodity, logarithmically differentiate the budget constraint, after using (3) to substitute out the X_i terms, then use (5) to replace the $dlnT_i$ terms. This leads to

$$dlnT_k/dlnI = \theta_I/(1+ (1-\theta_I)T_w); \tag{6a}$$

$$dlnT_k/dlnw = \{(1-\theta_I) - \sum[s_i + (1-\theta_I)r_i]Q^k_i - \sum s_i\sigma_i\}/(1+ (1-\theta_I)T_w), \tag{6b}$$

where θ_I is the share of non-labor income in total money income, s_i is the share of expenditure on commodity i in total expenditures, and $r_i = (T_i/T_w)$ is the ratio of time spent on commodity i to time in market work.

Equation (6a) shows the elasticity of time in a commodity with respect to non-labor income, which is positive and, as noted above, the same for all time uses. Equation (6b) is the wage elasticity. The first term in its numerator is due to the income effect. The final term is a weighted average of the elasticities of substitution for the various commodities and exerts the same negative influence on the wage elasticity for all time uses. The middle term is different for each commodity, as it involves Q^k_i which may be positive or negative.

Given its role in determining responses, the Q^k_i term bears closer examination. Despite our choice of a simple utility function, further assumptions about utility are required to determine the signs of the wage elasticities given the presence of terms involving σ_u. These terms, however, reflect meaningful economic considerations. The economic phenomenon of "substituting money for time" encompasses two distinct actions: Substituting in production (increasing expenditure per unit of time), and substituting against less goods-intensive commodities. The σ_i terms represent the possibilities for doing the former, and the σ_u the possibility of doing the latter. In a fixed-coefficient production model, $\sigma_i = 0$ for all commodities, and all substitution between time and money takes place via substitution between commodities. Q^k_i in (5) and (6b) becomes $(a_i - a_k)\sigma_u$, and the third term in the numerator of (6b) equals zero. Time use in commodities that

are goods-intensive in the sense of having relatively high values of a_k will have more positive (less negative) wage elasticities. Equation (6b) thus embodies as a special case the Becker result that a compensated wage increase will lead to a substitution of goods-intensive for time-intensive commodities, a tendency that will be stronger the higher the value of σ_u.[14]

Suppose, however, that σ_u is less than all the σ_i's (substitution between commodities is difficult relative to substitution within commodities). Assuming also for simplicity that all σ_i's are equal to σ, Q^k_i becomes $(a_i - a_k)(\sigma_u - \sigma)$. Since $(\sigma_u - \sigma)$ is negative, a relatively low value of a_k (low goods-intensity) will lead to a preponderance of negative Q^k_i values in (6b) and a less negative/more positive wage elasticity for T_k. A smaller value of σ_u implies less substitution towards the more goods-intensive commodities in response to a rise in the relative price of time-intensive commodities caused by a wage increase. And the opportunity to substitute money for time within commodities, measured by σ, pushes time use towards the time-intensive commodities: Since $(1- a_k)$ is proportional to the elasticity of Z_k with respect to T_k, a unit of time taken away from a goods-intensive commodity has a lower utility cost, favoring a greater substitution of money for time in goods-intensive commodities.

A related result concerns the relative wage elasticities of time use when the values of σ_i differ across commodities. If we assume that all the a_i are equal, then $Q^k_i = a_i(\sigma_k - \sigma_i)$. Wage elasticities are less positive/more negative for time use in commodities with higher elasticities of substitution, as a higher elasticity of substitution leads to a more negative response to the increase in the price of the time input to the commodity.

The distinction between substitution in the production of the Z's and substitution in the consumption of commodities depends on how the commodities are defined. In empirical work, however, the commodity definitions adopted by researchers are often arbitrarily determined by the nature of the available data. As time use and expenditure data grow in quantity and quality, it will increasingly be

[14]The value of a_k is proportional to the elasticity of output of Z_k with respect to X_k, so that one could also describe the phenomenon as substituting toward activities in which the marginal productivity of expenditure is higher.

possible and worthwhile to maintain the distinction between substitution within and substitution across commodities, and to think in terms of the relative values of σ_u and the σ_i and their differing impacts on time allocation.[15]

D. Income Effects on the Time Allocation of Non-Workers

The optimal allocations of time and expenditure to commodities by non-workers, and by those who cannot vary their hours of work, are described by equations (2a) and (2b). For the former group, changes in the market wage are not relevant to the time-allocation decision, provided that these changes are not sufficiently large to induce entry into the labor force. For the latter group the elasticity of time spent on a commodity with respect to a change in the wage is proportional to the elasticity with respect to a change in non-labor income. Unlike the case for workers analyzed above, it is not possible for the income effect on time use to be positive for all commodities. Unless the income elasticities of all time uses are zero, there must be both positive and negative elasticities.

Deriving the income elasticity of time use with respect to income from (2a) and (2b) leads to a complicated expression from which little insight can be gleaned. In the two-commodity version of the model, however, the sign of the income elasticity of time use in commodity 1 is the sign of $[a_1(\sigma_u - \sigma_1) - a_2(\sigma_u - \sigma_2)]$.[16] This expression is similar to Q^k_i in the expression describing the time elasticities for workers, indicating that the effect of a pure income change on the time allocation of non-workers resembles the substitution effect of a wage change for workers. The reason for the resemblance is that a change in income for non-workers causes a change in the relative opportunity costs of the activities, as is readily apparent in a version of the model with fixed-coefficient production.[17] The same argument applies, *mutatis mutandis*,

[15]For example, in an analysis of changes over time in how Americans have fed themselves, we could define an activity "eating", and discuss changing possibilities for substituting money for time within that activity by eating less at home and more at more or less fast service restaurants.

[16]The derivation is available from the second author.

[17]Letting b_i represent the required goods input for a unit of Zi, and t_i the required time input, the (utility) cost to the non-worker of a unit of Z_i relative to a unit of Z_k is $(\lambda b_i + \mu t_i)/(\lambda b_k + \mu t_k)$. An increase in income lowers λ, which lowers the relative cost of Z_i if $b_i/t_i > b_k/t_k$, that is, if Z_i is more goods intensive than Z_k.In contrast, the relative prices of the activities for workers $(b_i + wt_i)/(b_k + wt_k)$ are determined in the market and are thus unaffected by changes in non-labor income.

when the production functions are CES. If the elasticity of substitution between commodities is greater than the elasticity of substitution within commodities, a higher goods-intensity contributes to a more positive income elasticity. If both commodities are equally goods-intensive, rising incomes will lead to a fall in time devoted to the commodity with a higher elasticity of substitution in production.[18]

E. Explaining the Results on Sleep and TV Watching

The preceding analysis suggests explanations of the results for sleep and TV-watching reported in Tables 2-4. Consider a three-commodity version of the model, with sleep, TV-watching and a composite commodity. The first two are very time-intensive (low values of a_i relative to the composite commodity), which leads to a more negative income effect for non-workers, and a more negative wage effect for workers. A high elasticity of substitution between commodities amplifies this effect, and one would suspect a high elasticity of substitution between TV-watching and the aggregate commodity and a moderate one between sleep and the aggregate commodity. Working against this would be low elasticities of substitution in the production of both sleep and TV-watching, as it seems reasonable to assume that, compared to the average activity, increasing goods expenditure per unit of time on either of them adds relatively little to utility. However, the consistently negative and significant income effects for non-workers in Table 2, and the predominance of negative wage effects for American workers in Table 3, suggest that the high time-intensity of TV-watching and sleep and the high elasticity of substitution between commodities are the dominant factors.

An additional assumption is required to rationalize the coefficients on non-labor income in Tables 3 and 4, as they are predominantly negative and occasionally significant, and no configuration of parameters in our model leads to negative income effects for workers. If we assume, however, that an appreciable number of the workers are temporarily or permanently constrained in their choice of work hours, then negative income effects on workers become possible. The responses of workers who are hours-constrained,

[18]Simulations of the three-commodity version of the model confirm the indications of the two-commodity version. In particular, with two very time-intensive commodities, one commodity evenly balanced between time and goods, and σ_i values that are small relative to σ_u and nearly equal to each other, rising incomes lead to substitution away from the two time-intensive commodities and toward the goods-intensive commodity.

at least in the short-run, to increases in both wages and non-labor income will be the same as the responses predicted by the model for non-workers to increases in income: If substitution between activities is easy, higher wages and higher incomes will cause hours-constrained workers to decrease the time spent in time-intensive activities like TV-watching and sleep.

F. Product Market Discrimination and Majority/Minority Differences in Time Use

Assume that a group is discriminated against in the product market, so that while the price faced by members of the majority group for goods inputs is p, the price facing minorities is p(1 + d) with d being the discriminatory price premium. The impact of this discrimination on the time-allocation decisions of workers is seen by noting that the left hand side of (3) becomes p/w for members of the majority group, and p[1 + d]/w for minorities. Logarithmically differentiating the minorities' version of (4) at d=0 leads to $dlnT_i /dln(1+d)= dlnT_k/ dln(1+d) - Q^k_i$, so that price discrimination in a product market affects time allocation the same way as a lower wage.

The case for non-workers is similar. If minorities face a product-market discrimination coefficient d, the budget constraint becomes $I/[p(1 + d)] - \sum X_i = 0$, and d affects time allocation only thorough its impact on real income I/[p(1 + d)]. Increasing discrimination in a product market acts on time allocation in the same way as a decrease in I, raising the relative price of goods-intensive activities. (This makes it more obvious why the income effect on non-workers' time allocations in a Becker model looks like a substitution effect). Under the circumstances posited above to explain the results in Tables 2-4 (substitution between commodities relatively easier than substitution within commodities) price discrimination will lead minorities to spend more time in time-intensive activities than otherwise similar members of the majority group. This will be the case for both workers and non-workers.

V. Evidence on Racial/Ethnic Discrimination in Goods Markets, and Its Spillovers

A.. Discrimination in Product Markets

A number of studies have attempted to measure the extent to which minorities pay more than majority citizens for equal-quality goods and services. Many of these are audit studies (with Ayres and Siegelman, 1995, apparently the first in this literature), in which racially different but otherwise identical individuals seek price quotes on some well-defined product or service. Munnell *et al.* (1996) examined discrimination in the treatment of applications for mortgage loans, showing higher denial rates to otherwise identical minority applicants.[19] More recent work in this vein is exemplified by Zussman (2013). Another still smaller vein of the literature is exemplified by field studies such as List (2004).

Some of the more recent literature (e.g., Antecol and Cobb-Clark, 2008; Brewster, 2012) has used respondents' subjective views of their treatment in various retail contexts to analyze differences in outcomes by race. Myers (2004) used data from the American Housing Survey to examine racial differences in purchase and rental prices of housing with narrow geographic clusters; Bayer *et al*. (2012) looked at the same question using detailed data on housing sales. Related to this, Edelman *et al.* (2017) demonstrate that minority applicants for rentals with AirBnB are less likely than majority applicants to have their bids accepted, other things equal. All of these studies suggest the existence of price discrimination against minority purchasers. It is nearly impossible to use this literature to answer the question: How much more does the average minority purchaser pay for a typical market basket of goods and services than does a majority purchaser? The literature is, however, sufficiently conclusive enough to allow us to assume that d > 0 in the United States.

This line of research has spread to other countries, with most of the recent research also relying on audit studies and focusing on housing markets. Thus Acolin *et al.* (2016) examined how a variety of immigrant groups were treated when they responded to advertisements for rental housing in France.

[19]These and the other existing studies at the time are summarized by Yinger (1998).

Drydakis (2011) did a similar study in Greece, focusing on the treatment of Albanian immigrants. The results are similar to those for racial minorities in the U.S.

This literature implies that the goods prices faced by minorities will, as discussed in Section IV.F, exceed those facing majority consumers. All else equal, including incomes and wages, discrimination in goods markets will raise the relative prices of commodities that are relatively goods-intensive. Thus we expect to observe minorities spending less time producing/consuming goods-intensive commodities and more in time-intensive commodities than members of the majority. With sleep and TV-watching being particularly time-intensive commodities, we should expect minorities to be more heavily engaged in these.

B. Evidence on the Impacts of Product-Market Discrimination on Time Use

In both the American and French samples we examine majority-minority differences in sleep and TV-watching, the two clearly relatively inferior activities, with minorities designated as explained in Section II. While we have identified TV-watching as relatively even more inferior than sleeping, there is a language problem in testing the model of spillovers of consumer discrimination to TV-watching: Majority-minority differences in time spent watching television are likely to be confounded by language issues in the case of white Hispanics in the U.S. and immigrants in France. Thus the only American groups whose television-watching we consider are white Non-Hispanics and African-Americans.

The upper panel of Table 6 lists the estimates of the impacts of race or ethnicity on time spent sleeping in the U.S., and in TV-watching for African-Americans. Each equation includes all the controls that underlay the estimates presented in Tables 2 and 3. The sample includes both workers and non-workers; because of that the only monetary measure that we include is the household's total income.[20] African-American women and men sleep more than otherwise identical white non-Hispanics; they also watch more television.[21] As with the pure income effects, the differences are larger for TV-watching than for sleep,

[20]Separate estimates for samples of non-workers and workers in each country, using the same control variables as in Tables 2-4, yield essentially similar results: Greater sleep time among otherwise identical minorities, whether or not they are workers.

[21]One might be concerned that annual incomes understate the difference in annual spending ability between whites and African-Americans because the latter may expect fewer and smaller inheritances. Perhaps so, although most

suggesting that the discriminatory price effects on consumer goods are working along the same margin of choice in these time-intensive activities as the results in Tables 2 and 3 implied about the effects of decreases in household incomes. White Hispanics also sleep more than otherwise identical white non-Hispanics, a difference that on average about the same as among African-Americans.

The bottom panel of Table 6 presents the estimates of the same equations as in Tables 2 and 4, but with workers and non-workers pooled, and including household income as the only economic variable. These results for France are weaker than those in the U.S.; with sub-sample sizes that are only one-sixth as large their relative weakness is not surprising. The impact on the sleep time of immigrants in France compared to that of similar natives, however, is about the same as the difference between African-American and white non-Hispanic males. That between female immigrants and natives in France is positive, but much smaller than in the U.S. Overall the French results corroborate the more secure findings in Table 6 for the U.S.[22]

VI. Conclusion

We have documented a significant negative relationship between household income and time spent in two time-intensive activities, sleep and television-watching, which together with market work are two of the three activities that account for the majority of time spent in Western economies. The relationship exists among non-workers in time-dairy data from the United States, France, and Germany, and among workers in the former two countries. Among workers, it results mainly from a negative wage effect, although there is also evidence for a smaller negative effect of non-labor income in the French sample. For both the U.S. and France we demonstrated a significant minority/majority difference in time use: Minorities engage in more time-intensive activities than otherwise similar members of the majority group.

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inheritances are fairly small (Hurd and Smith, 2001). More important, with the average African-American in our sample expecting to live four fewer years than the average white, if anything annual incomes overstate the difference in annual spending ability, so that our results understate the racial difference in sleep time arising from discrimination in incentives to purchase goods.

[22]Except for the estimate for black males in describing sleep, the parameter estimates change only slightly when the respondent's time spent working on the diary day is added to the specification.

These results can be rationalized by our generalized model of time allocation, which allows substitution between time and goods in the production of commodities and substitution between commodities in a representative individual's utility function. The analysis demonstrates that the effect of a change in income on non-workers' time use will generally resemble the substitution effect of a wage change on workers' time allocations. It produces the observed negative relation between income and time spent in time-intensive activities, provided that the elasticity of substitution between commodities is sufficiently large relative to the average elasticity of substitution between goods and time in the production of each commodity. This combination of circumstances also leads to the observed minority/majority differences in time use if, as other evidence shows, minorities experience discrimination in goods markets. This extension of the theory and its demonstrated use in explaining the novel findings suggest that it might usefully be applied to policy propositions that affect how people spend time.

These theoretical and empirical results have at least two implications for future research. First, the results on minority/majority differences in time use are examples of how discrimination in a particular market can affect behavior outside the market where discrimination is practiced. There are undoubtedly many other examples of this kind of spillover that could be investigated. Second, the rising quantity and quality of time diary data available from several nations should lead to a wide array of interesting empirical results. Our generalized model of time allocation can be used both to help make sense of the patterns observed in such data and to suggest what patterns of time use to look for.

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Table 1. Descriptive Statistics, Time Use in the U.S., 2003-15; France, 2009-10; Germany, 2012-13

	Work	Home Production	Sleep	Other Personal	TV-watching	Other Leisure
ATUS:						
Non-workers	-----	249	557	48	236	350
(N = 51,997)		(0.90)	(0.62)	(0.35)	(0.89)	(0.97)
Family Income:	$49,383					
(annual)	(210)					
Workers	500	115	476	50	108	191
(N = 24,681)	(1.12)	(0.76)	(0.74)	(0.25)	(0.67)	(0.90)
Family Income:	$61,434	Earnings	$15.12			
(annual)	(301)	(hourly)	(0.06)			
Enquête:						
Non-workers	------	257	532	210	167	274
(N = 5,854)		(2.26)	(1.50)	(1.39)	(1.73)	(2.26)
Family Income:	€28,005					
(annual)	(259)					
Workers	499	119	458	170	86	109
(N = 4,287)	(2.58)	(1.72)	(1.45)	(1.19)	(1.24)	(1.70)
Family Income:	€39,972	Earnings	€11.71			
(annual)	(369)	(hourly)	(0.15)			
Zeitverwendungserhebung:						
Non-workers	------	265	526	183	164	302
(N = 1,993)		(3.51)	(2.00)	(1.68)	(2.65)	(3.85)
Family Income:	€28,683					
(annual)	(397)					
Workers	476	127	455	130	94	158
(N = 8,173)	(2.06)	(1.31)	(1.06)	(0.62)	(0.92)	(1.51)
Family Income:	€41,892					
(annual)	(223)					

*Standard errors of means in parentheses.

Table 2. Income Effects on Time Use (Minutes/Day in Response to +10,000 ($ or €) Annual Income): Non-workers U.S., 2003-15; France, 2009-10; Germany, 2012-13*

	Home Production	Sleep	Other Personal	TV-watching	Other Leisure
ATUS:**					
(N = 51,997)	2.19	-2.05	-0.03	-2.95	2.84
	(0.18)	(0.14)	(0.08)	(0.20)	(0.22)
Adj. R^2	0.260	0.078	0.018	0.121	0.078
Enquête:**					
(N = 5,439)	-0.63	-3.00	3.19	-7.07	7.52
	(1.74)	(1.22)	(1.53)	(1.49)	(2.03)
Adj. R^2	0.324	0.122	0.068	0.101	0.208
Zeitverwendungserhebung:***					
(N = 1,993)	0.82	-3.35	-4.10	-5.68	12.31
	(2.18)	(1.49)	(1.19)	(1.81)	(2.70)
Adj. R^2	0.221	0.068	0.053	0.080	0.102

*Standard errors in parentheses below the parameter estimates. Those in the French and German equations are clustered on the individuals.

**The equations also include a quadratic in age; indicators and numbers of children in several age groups; gender, marital status and their interaction; a vector of indicators of educational attainment; and vectors of indicators of state of residence, metropolitan status, year, month and diary day.

***The equations also include a quadratic in age; a vector of indicators of educational attainment; indicators and numbers of children in several age groups; gender, coupled status and their interaction; and vectors of indicators of the month, diary day and region.

****The equations also include a quadratic in age; indicators of number of children under age 10; gender, marital status and their interaction; and, vectors of indicators of quarter, diary day, educational attainment and East Germany.

Table 3. Parameter Estimates, Sleep and TV-watching (Minutes/Day in Response to +$10 Hourly Earnings, +$10,000 Other Annual Income): Married Workers, ATUS 2003-15*

	Sleep		TV-watching	
	Male	**Female**	**Male**	**Female**
Ind. Var.:				
Annual Other Income	-0.18	0.02	0.049	-0.70
	(0.41)	(0.27)	(0.049)	(0.28)
Hourly Earnings	-4.31	0.18	-7.60	-4.16
	(1.45)	(1.37)	(1.73)	(1.43)
Adj. R^2	0.109	0.111	0.101	0.065
Ind. Var.:				
Annual Other Income	-0.79	-0.62	-0.08	-1.16
	(0.37)	(0.25)	(0.46)	(0.27)
Hourly Earnings	-3.57	2.25	-6.89	-2.56
	(1.32)	(1.27)	(1.63)	(1.38)
Work Time	-0.21	-0.18	-0.20	-0.14
	(0.01)	(0.01)	(0.01)	(0.01)
Adj. R^2	0.267	0.231	0.204	0.132
N =	8,339	10,859	8,339	10,859

*All equations also include a quadratic in age; indicators and numbers of children in several age groups; a vector of indicators of educational attainment; and vectors of indicators of state of residence, metropolitan status, year, month and diary day.

Table 4. Parameter Estimates, Sleep and TV-watching (Minutes/Day in Response to +€10 Hourly Earnings, +€10,000 Other Annual Income: Partnered Workers, *Enquête Emploi du Temps*, 2009-10*

	Sleep (minutes/day)		TV-watching (minutes/day)	
	Male	**Female**	**Male**	**Female**
Ind. Var.:				
Annual Other Income	-0.07	-0.08	-0.38	-0.32
	(0.202)	(0.17)	(0.15)	(0.10)
Hourly Earnings	2.08	1.32	-3.44	7.65
	(3.00)	(5.60)	(2.35)	(5.87)
Adj. R^2	0.111	0.156	0.090	0.098
Ind. Var.:				
Annual Other) Income	-0.091	-0.09	-0.39	-0.397
	(0.195)	(0.11)	(0.15)	(0.114)
Hourly Earnings	3.16	-1.08	-2.83	6.39
	(2.47)	(4.49)	(0.252)	(5.21)
Work Time	-0.17	-0.14	-0.10	-0.08
	(0.02)	(0.01)	(0.01)	(0.01)
Adj. R^2	0.216	0.250	0.131	0.137
N =	2,775	2,635	2,775	2,635

*Standard errors below the parameter estimates, clustered on individuals. The regressions also include a quadratic in age; a vector of indicators of educational attainment; indicators and numbers of children in several age groups and vectors of indicators of the month, diary day and region.

Table 5. Income Effects on Time Use (Minutes/Day in Response to +10,000 ($ or €) Other Annual Income): Non-workers U.S., 2003-15; France, 2009-10*

	U.S.**				France***	
	Eating Out		Sports/Arts		Eating Out	
Determinants of:	**Prob.**	**Cond. Mean**	**Prob.**	**Cond. Mean**	**Prob.**	**Cond. Mean**
	0.028	0.462	0.028	-0.556	0.058	-16.71
	(0.002)	(0.091)	(0.002)	(0.423)	(0.017)	(18.78)
Pseudo-R^2 or Adj. R^2	0.037	0.026	0.071	0.026	0.094	0.168
N =	51,997	8,834	51,997	2,408	5,407	1,154

*Standard errors in parentheses below the parameter estimates. Those in the French equations are clustered on the individuals.

**The equations also include a quadratic in age; indicators and numbers of children in several age groups; gender, marital status and their interaction; a vector of indicators of educational attainment; and vectors of indicators of state of residence, metropolitan status, year, month and diary day.

***The equations also include a quadratic in age; a vector of indicators of educational attainment; indicators and numbers of children in several age groups; gender, coupled status and their interaction; and vectors of indicators of the month, diary day and region.

Table 6. Effect of Minority Status on Minutes of Sleep and TV-watching (Minutes/Day): U.S. Minorities/Immigrants, 2003-15; French Immigrants, 2009-10*

	Sleep		TV-watching	
		U.S.		
Ind. Var.:	**Male**	**Female**	**Male**	**Female**
African-American	7.22	14.88	37.56	25.21
	(1.72)	(1.42)	(2.23)	(1.68)
White Hispanic	10.69	11.54	------	------
	(1.67)	(1.48)		
.				
Adj. R^2	0.099	0.091	0.154	0.126
N	64,766	83,229	55,640	72,112
	France			
Immigrant	12.23	4.78		
	(6.17)	(6.53)		
Adj. R^2	0.141	0.110		
N	10,517	12,169		

*Each equation includes the variables listed and all the variables included for each country in the estimates presented in Tables 3 and 4. The French estimates are clustered on the individual respondents.

DATA APPENDIX: Definitions of Time-Use Aggregates

ATUS:
Work—*bls_work* (+ *bls_educ* if *age*<=25)
Home production—*bls-carehh* + *bls_hhact_*+ *bls_purch*
Sleep—*bls_pcare_sleep*
Other personal care—*bls-pcare – sleep*
TV-watching—*bls_leis_tv*
Other leisure—*bls_comm* + *bls_social* + *bls_carenhh* + *bls_leis – bls_leis_tv* (+ *bls_educ* if *age*>25)
Eating out—*bls_food* (not at home or workplace)
Sports and arts—*bls_leis_arts* + *bls_leis_atts*

Enquête Emploi du Temps:
Work— $\Sigma_i[act_i>210$ and $act_i<252$ or $act_i=811] + (\Sigma_i[act_i>260$ and $act_i<300]$ if $age<=25)$, i = 1,…,144
Home production— $\Sigma_i[act_i>299$ and $act_i<435] + \Sigma_i[act_i=813]$, i = 1,…,144
Sleep— $\Sigma_i[act_i=111]$, i = 1,…,144
Other personal care— $\Sigma_i[act_i>111$ and $act_i<200]$, i = 1,…,144
TV-watching— $\Sigma_i[act_i>633$ and $act_i<637]$, i = 1,…,144
Other leisure— $\Sigma_i[act_i>434$ and $act_i<700] + \Sigma_i[act_i=810$ or $=812$ or $=819]$ – *tvwatching* (+ $\Sigma_i[act_i>260$ and $act_i<300]$ if $age>25)$, i = 1,…,144
Eating out—$\Sigma_i[act_i=143$ or $act_i=146]$, i = 1,…,144

***Zeitverwendungserhebung*:**
Work— *hainklweg_2* + (*hainklweg_3* if *age*<=25)
Home production—*hainklweg_4*
Sleep—*ha_11*
Other personal care—*hainklweg_1 – sleep*
TV-watching—*ha_82*
Other leisure— *hainklweg_5+hainklweg_6+hainklweg_7+hainklweg_8* - *tvwatching* + *(hainklweg_3* if *age*>25)

Appendix Table 1. Effects on Work Time, Household Production, Non-Sleep Personal Time, and Non-TV Leisure Time (Minutes/Day in Response to +$10 $ or € Hourly Earnings, +10,000 $ or € Other Annual Income): U.S. 2003-15; France 2009-10*

A. U.S., 2003-15

	Male	**Female**	**Male**	**Female**
Ind. Var.	**Paid Work**		**Home Production**	
Annual Other Income	-2.91	-3.36	1.40	2.33
	(0.83.)	(0.55)	(0.55)	(0.42)
Hourly Earnings	3.59	11.72	7.82	-3.88
	(2.96)	(2.83)	(1.94)	(2.15)
Adj. R^2	0.303	0.260	0.086	0.130
	Non-Sleep Personal		**Non-TV Leisure**	
Annual Other Income	-0.10	0.09	1.30	1.65
	(0.17)	(0.13)	(0.60)	(0.41)
Hourly Earnings	-0.01	-0.46	0.52	-3.39
	(0.60)	(0.68)	(2.14)	(2.11)
Adj. R^2	0.018	0.021	0.116	0.117

B. France, 2009-10

	Male	Female	Male	Female
Ind. Var.:	**Paid Work**		**Home Production**	
Annual Other Income	-0.23	-1.07	-3.39	1.95
	(3.51)	(3.94)	(3.70)	(2.71)
Hourly Earnings	6.36	-16.47	-5.28	-1.00
	(5.46)	(10.48)	(2.69)	(4.66)
Adj. R^2	0.412	0.287	0.143	0.151
	Non-Sleep Personal		**Non-TV Leisure**	
Annual Other Income	-1.15	2.09	1.64	1.88
	(1.29)	(1.27)	(2.45)	(2.76)
Hourly Earnings	-0.10	1.17	-1.52	7.33
	(2.43)	(2.16)	(3.58)	(4.06)
Adj. R^2	0.092	0.107	0.257	0.218

*The equations include the same other regressors as in Tables 3 and 4, and the same numbers of observations.