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Supplementary Appendices for

What Time Use Surveys Can (And Cannot) Tell Us About Labour Supply

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Appendix A gives a simple formula of computing standard error of the impute estimator using the correlation coefficients in the DTUS. In Appendix B, we report the results of additional simulations, empirical analyses and robustness checks. In Appendix C, we provide the proofs of the theorems in Section 3.2 of our main paper, Chou and Shi (2019).

A Simple Standard Error Formula Using the Correlation Coefficients in the DTUS

In Section 3.2.2 of the main paper, we claim that one approach[3] to compute the standard errors of $\hat{\beta}_{wk}$, $\hat{\beta}_{im}$ and $\hat{\beta}_{pool}$ using the ATUS data is to first estimate $E(U_i^2 Z_i Z_i')$, $E(Z_i V_{it} V_{i\tau} Z_i')$ and $E(Z_i \alpha_t' Z_i Z_i' \alpha_\tau Z_i')$ $(1 \leq t < \tau \leq 7)$ with the help of other data sources (for example, the DTUS) and then plug those estimates into the formulas provided in Theorem 2. This section elaborates this approach in details.

In the main paper we recommend using the impute estimator $\hat{\beta}_{im}$, because it is more robust than $\hat{\beta}_{day}$ and more efficient than $\hat{\beta}_{pool}$. For these reasons, we will focus on the standard error of the impute estimator $\hat{\beta}_{im}$. For this purpose, we only need to compute Ω_{wk}^* and Ω_{im-wk}^*, which in turn only requires $E(U_i^2 Z_i Z_i')$ and $E(Z_i V_{it} V_{i\tau} Z_i')$. Even though Theorem 2 applies to the case of heteroskedasticity, here we assume homoskedasticity only for the simplicity of

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[3]Recall that this approach does not require Assumption 3 to be satisfied.

notation. Under the homoskedasticity assumption, we have

$$\Omega^*_{wk} = \mathrm{E}(U_i^2)A^{-1} \qquad \text{and} \qquad \Omega^*_{im-wk} = \Big[\sum_{t=1}^{7}(r_t - 1)\,\mathrm{E}(V_{it}^2) - 2\sum_{1\le t<\tau\le 7}\mathrm{E}(V_{it}V_{i\tau})\Big]A^{-1}.$$

Now that A can be estimated using A_n as before, we only need to estimate $\mathrm{E}(U_i^2)$ and $\mathrm{E}(V_{it}V_{i\tau})$. We start with the latter. Recall that V_{it} is the residual in the "H first stage" for day t and by construction $\mathrm{E}(V_{it}) = 0$ ($t = 1, \ldots, 7$). As a result,

$$\widehat{\mathrm{E}}(V_{it}V_{i\tau}) = \widehat{\mathrm{Cov}}(V_{it}, V_{i\tau}) = \underbrace{\hat{\rho}(V_{it}, V_{i\tau})}_{\text{from DTUS}} \cdot \underbrace{\hat{\sigma}(V_{it}) \cdot \hat{\sigma}(V_{i\tau})}_{\text{from ATUS}}, \tag{A.1}$$

where $\hat{\rho}$ represents the sample correlation coefficient and $\hat{\sigma}$ represents the sample standard deviation. The marginal standard deviations $\sigma(\hat{V}_{it})$ and $\sigma(\hat{V}_{i\tau})$ can be computed using the respective daily subsamples in the ATUS, and the correlation coefficient $\hat{\rho}(V_{it}, V_{i\tau})$ should be computed using the "H first stage" residuals from the DTUS.

Next we consider $\mathrm{E}(U_i^2)$. By the definition of U_i and the "H first stage", we have

$$U_i \equiv H_i^w - X_i'\beta = \sum_{t=1}^{7} H_{it} - X_i'\beta = \sum_{t=1}^{7}(Z_i'\alpha_t + V_{it}) - X_i'\beta = \sum_{t=1}^{7} V_{it} + Z_i'\sum_{t=1}^{7}\alpha_t - X_i'\beta.$$

Therefore, we have

$$\mathrm{E}(U_i^2) = \mathrm{Var}(U_i) = \mathrm{Var}(\sum_{t=1}^{7} V_{it}) + \mathrm{Var}(Z_i'\sum_{t=1}^{7}\alpha_t - X_i'\beta) + 2\sum_{t=1}^{7}\mathrm{Cov}(V_{it}, Z_i'\sum_{t=1}^{7}\alpha_t - X_i'\beta).$$

The last two terms in this expression can be estimated using the ATUS data since we have consistent estimators of β (e.g. $\hat{\beta}_{im}$) and α_t (e.g. $\hat{\alpha}_t$ obtained from "H first stage" for $t = 1, \ldots, 7$). Plug in $\hat{\beta}_{im}$ and $\hat{\alpha}_t$ ($t = 1, \ldots, 7$), we see that $\widehat{\mathrm{Var}}(Z_i'\sum_{t=1}^{7}\hat{\alpha}_t - X_i'\hat{\beta}_{im}) = \widehat{\mathrm{Var}}(\hat{H}_i^w - X_i'\hat{\beta}_{im})$ can be easily computed using the entire sample and that $\widehat{\mathrm{Cov}}(V_{it}, Z_i'\sum_{t=1}^{7}\hat{\alpha}_t - X_i'\hat{\beta}_{im}) = \widehat{\mathrm{Cov}}(V_{it}, \hat{H}_i^w - X_i'\hat{\beta}_{im})$ can be easily computed using the diary day subsamples. On the other hand, the first term equals to

$$\mathrm{Var}(\sum_{t=1}^{7} V_{it}) = \sum_{t=1}^{7} \mathrm{E}(V_{it}^2) + 2 \sum_{1 \leq t < \tau \leq 7} \mathrm{E}(V_{it} V_{i\tau}),$$

where $\mathrm{E}(V_{it}^2)$ can be easily computed using the "H first stage" residuals from the diary day subsamples and the estimates of $\mathrm{E}(V_{it}V_{i\tau})$ are given in eq. (A.1).

Finally, we report the correlation coefficients $\hat{\rho}(V_{it}, V_{i\tau})$ among the "H first stage" residuals from the DTUS in Panel (b) of Table B.1. These correlation coefficients are used in eq. (A.1) to compute the standard errors of the impute estimator $\hat{\beta}_{im}$ in the empirical analysis of the main paper. The IVs used to obtain the "H first stage" residuals in the DTUS are number of kids aged under 18 in the household, a dummy of completing secondary education, a dummy of obtaining higher than secondary education, age, age-squared, a dummy of working in private sector, an urban area dummy, year dummies and a gender dummy.

Table B.1 also shows correlation coefficients $\hat{\rho}(H_{it}, H_{i\tau})$ in Panel (a). There is an obvious dichotomy between weekdays and weekends. For the raw daily hours worked in the DTUS, the correlation coefficients among Monday to Friday are large, that between Saturday and Sunday is also sizable, but those between a weekday and a weekend are nearly zero. This dichotomy persists even after controlling many observed characteristics, as shown in Panel (b) of Table B.1. This suggests that the unobserved characteristics account for most of the correlation among daily hours worked.

B Additional Simulations, Empirical Results and Robustness Checks

In this appendix, we show additional simulation results, additional empirical results and various robustness checks that complement our main paper, Chou and Shi (2019).

B.1 Density Plots Based Only on Weekdays in the DTUS

In Figure 1 of the main paper, the ATUS-type daily hours exhibit bimodal distributions since most people work very little hours on weekends, if at all.[4] Figure B.1 shows the results of a similar experiment which takes the common five-day work schedule into account. We only keep those individuals whose diary days are the workdays, and then multiple their ATUS-type daily hours by 5. As is shown in Figure B.1, even though the DTUS weekly hours and the scaled ATUS-type daily hours have similar mode, their distributions differ notably, especially toward the left end. This again highlights the impossibility results in Section 3.1 of the main paper.

B.2 Simulations Based Only on Weekdays in the DTUS

Table B.2 reports the results of simulation experiments that are very similar to those in Table 1. For Table B.2, we only use the daily hours worked in the DTUS for the weekdays. The regressors X_i and the IVs Z_i are generated from the $n \times 5$ matrix with elements H_{it}^{DTUS} $(t = 2, \ldots, 6)$, denoted by $H^{DTUS,5}$, using the same design described in Section Section 4.1. To generate fictitious ATUS-type samples, we randomly choose only one day from Monday to Friday for each individual using equal sampling weights.

Just like in Table 1, the week estimator $\hat{\beta}_{wk}$ is our infeasible benchmark, which has virtually no biases and the smallest variances. The efficiency gain of the impute estimator $\hat{\beta}_{im}$ relative to the pool estimator $\hat{\beta}_{pool}$ and the day estimator $\hat{\beta}_{day}$ becomes less pronounced. This is likely due to the fact that the first principal component of H^{DTUS} captures the dichotomy between weekdays and weekends, and once that is removed, the daily variation of hours worked drops dramatically.[5] Besides, the ATUS assigns equal sampling weights to the weekdays. As we explained in Remark 6 in Chou and Shi (2019), if $H_{i2} =$

[4]According to the U.S. Bureau of Labour Statistics, in 2017, 89% of full-time workers worked on an average weekday, compared with 32.6% on an average weekend day.

[5]Indeed, the first principal component of $H^{DTUS,5}$ assigns the weights $\beta_1 = 0.4389$, $\beta_2 = 0.4560$, $\beta_3 = 0.4580$, $\beta_4 = 0.4531$ and $\beta_5 = 0.4294$ to its columns, which correspond to Monday to Friday, respectively; i.e. each weekday contributes roughly equally to the first principal component.

$\cdots = H_{i6}$ and $r_2 = \cdots = r_6$, then $\Omega_{pool-im} = 0$ and there will be no difference in the asymptotic efficiency between $\hat{\beta}_{im}$ and $\hat{\beta}_{pool}$. Our additional simulation results here verify our theoretical prediction in the main paper.

B.3 Coefficient Estimates in the DTUS Weekly Labour Supply Regression

In Table 2 of the main paper, we report the weekly labour supply elasticity estimates using the DTUS. Table B.3 reports the coefficient estimates in the weekly labour supply regression equation shown in eq. (3.4), and the elasticity estimates reported in Table 2 are evaluated at the sample mean hours.

B.4 Coefficient Estimates in the ATUS Weekly Labour Supply Regression

In Table 3 of the main paper, we report the weekly labour supply elasticity estimates using the ATUS. Table B.6 reports the coefficient estimates in the weekly labour supply regression equation shown in eq. (5.1), and the elasticity estimates reported in Table 3 are evaluated at respective sample means based on these coefficients and the sample mean hours.

B.5 Representativeness of the ATUS Sample

The ATUS is designed to be a random subsample of those who recently complete their participation in the CPS. We compare the ATUS sample against the CPS sample. Sample means and sample standard deviations of the key variables used in the empirical studies are reported in Table B.4. The ATUS sample (first column) is the one used in the empirical studies in our main paper. The CPS sample (middle column) is the entire CPS 2003-2017 sample after the same sample selection criterion (hourly paid workers aged between of 25 and 54, whose wage rate is positive, and spouse earnings (if married) and total usual weekly hours worked at all jobs reported in the CPS are observed The entire CPS sample (last column) includes the respondents whose hourly wage or spouse weekly earnings is missing. None of the key variable summary statistics differ significantly among the three samples.

The elasticity estimates in Table 3 of the main paper are based on the sample in the first column of Table B.4. Using the sample of second column of Table B.4, we estimate the labour supply elasticities similar to the main paper. We report such estimates in Table B.5. Comparing them with the CPS results in Table 3 in the main paper, we find no notable differences.

Therefore, it is safe to conclude that the ATUS sample is a representative subsample of the CPS, which implies that the differences between the ATUS and the CPS elasticity estimates are more likely due to the nonclassical measurement errors in the CPS than due to the composition of the ATUS sample.

Moreover, the ATUS sample does not exhibit strong seasonal fluctuations over a year, whether as a whole or within each occupation. In Table B.7, we categorize the ATUS sample into different occupations and months. First, the entire ATUS sample is very balanced over a year, with people surveyed in all months having roughly equal proportions. Second, within each occupation, the ATUS also surveys approximately same numbers of people in every month. Third, among the nine occupation categories, not a single occupation bears overwhelming weights. So the empirical results in the main paper are not likely to be driven by anomaly in a single occupation or a single month.

B.6 Robustness Checks of the Empirical Results in Section 5

In Section 5 of the main paper, we estimate labour supply elasticities using the ATUS daily hours and compare the estimates with those obtained using the CPS recalled weekly hours. The ATUS estimates reported in Table 3 of the main paper uses the "work" hours on all jobs (activity code: 050100) for all the occupations in the ATUS.

In this section, we conduct four robustness checks. The first robustness check, reported in Table B.8, restricts to the three occupations with the most observations; they are computer and mathematical science, healthcare support, and office and administrative support occupations. The second robustness check, reported in Table B.9, uses "work" and "work-related" hours (activity codes: 050100 and 050200) for all the occupations in the ATUS.[6] The third robustness check, reported in Table B.10, estimates the elasticities using the OLS, without correcting the potential measurement issues in own hourly wage and spouse weekly earnings (using their respective decile as IVs). Comparing Tables B.8 to B.10 here with Table 3 of the main paper, we see that none of the estimates change much, neither qualitatively nor quantitatively.

The fourth robustness check, reported in Table B.11, uses survey year-month group indicators as IVs.[7] Angrist (1991) proposes the use of group classification variable that is independent from the error term as IV. He also proves that the resulting 2SLS estimator is a generalization of the Wald estimator in the treatment effect literature that is frequently used in binary treatment and binary IV cases. The identification power of such 2SLS estimators comes from the variation in group means, and it requires that the individual deviation from group means to be uncorrelated with the IVs. Since we have no reason to believe that the error term in the weekly labour supply equation 3.4 is systematically correlated with survey year or survey month, the survey year-month dummies satisfy the exclusion restriction. On the other hand, the correlation between survey year (or survey month) and log wage (or spouse earnings) is probably weak, which may lead to inflated standard errors and sizable finite sample bias. Compare Table B.11 with Table 3 in the main paper, the standard errors of the elasticity estimates (Panel B) rise remarkably. Among those elasticity estimates which remain significant - CPS own wage for all groups, CPS spouse earning and older kids for married women, CPS and ATUS younger kids for married women - neither sign nor magnitude changes much. This shows that our labour supply elasticity estimates are not very sensitive to the choice of IVs.

[6] Examples of work-related activities here include attending social events, attending sporting events, and eating or drinking with bosses, co-workers or clients, etc.

[7] Our sample contains respondents in 15 years (2003-2017), which together with 12 months result in 180 group indicators.

C Proofs of the Theorems in Section 3.2

Proof of Theorem 1. First, we show the consistency of $\hat{\beta}_{wk}$:

$$\hat{\beta}_{wk} - \beta = A_n^{-1} X' P_z U = A_n^{-1} B_n C_n^{-1} (Z'U/n) \xrightarrow{p.} A^{-1} B C^{-1} \operatorname{E}(Z_i U_i) = 0.$$

In fact, this is a standard result for instrumental variable estimators.

Second, we show the consistency of $\hat{\beta}_{im}$. Consider the difference $(\hat{\beta}_{im} - \hat{\beta}_{wk})$ using their definitions:

$$\begin{aligned}
\hat{\beta}_{im} - \hat{\beta}_{wk} &= (X'P_zX)^{-1} X'P_z \left[\sum_{t=1}^{7} Z(Z'D_tZ)^{-1} Z'D_tH_t - H^w \right] \\
&= (X'P_zX)^{-1} X'P_z \left[\sum_{t=1}^{7} Z(Z'D_tZ)^{-1} Z'D_tH_t - P_z \sum_{t=1}^{7} H_t \right] \\
&= \sum_{t=1}^{7} (X'P_zX)^{-1} X'P_z Z[(Z'D_tZ)^{-1} Z'D_tH_t - (Z'Z)^{-1} Z'H_t] \\
&= \sum_{t=1}^{7} (X'P_zX)^{-1} X'Z[(Z'D_tZ)^{-1} Z'D_tH_t - (Z'Z)^{-1} Z'H_t].
\end{aligned}$$

Using the linear projection eq. (3.10), we have

$$\hat{\beta}_{im} - \hat{\beta}_{wk} = \sum_{t=1}^{7} A_n^{-1} B_n \left[\left(\frac{1}{n_t} Z'D_tZ \right)^{-1} \frac{1}{n_t} Z'D_tV_t - \left(\frac{1}{n} Z'Z \right)^{-1} \frac{1}{n} Z'V_t \right]. \tag{C.1}$$

Define

$$C_{n_t} = Z'D_tZ/n_t.$$

Following from the law of large numbers, A, B and C are the probability limit of A_n, B_n, and C_n (also C_{n_t}) as $n \to \infty$, respectively. By the definition of A_n, B_n, C_n and C_{n_t}, we have

$$\hat{\beta}_{im} - \hat{\beta}_{wk} = \sum_{t=1}^{7} A_n^{-1} B_n \left[C_{n_t}^{-1} \frac{1}{n_t} Z'D_tV_t - C_n^{-1} \frac{1}{n} Z'V_t \right]$$

$$
\begin{aligned}
&\xrightarrow{p.} \sum_{t=1}^{7} A^{-1}BC^{-1}[\mathrm{E}(Z_i d_{it} V_{it}) - \mathrm{E}(Z_i V_{it})] \\
&= \sum_{t=1}^{7} A^{-1}BC^{-1}[\mathrm{E}(Z_i V_{it})\,\mathrm{E}(d_{it}) - \mathrm{E}(Z_i V_{it})] \\
&= 0,
\end{aligned}
$$

because $\mathrm{E}(Z_i V_{it}) = 0$. Since $\hat{\beta}_{wk} \xrightarrow{p.} \beta$ and $\hat{\beta}_{im} - \hat{\beta}_{wk} \xrightarrow{p.} 0$, we conclude that $\hat{\beta}_{im} \xrightarrow{p.} \beta$.

Third, we show the consistency of $\hat{\beta}_{pool}$. By the definition of A_n, B_n, C_n and C_{n_t}, we have

$$
\begin{aligned}
\hat{\beta}_{pool} - \hat{\beta}_{wk} &= \sum_{t=1}^{7} A_n^{-1} B_n C_n^{-1} \frac{Z'(r_{nt} D_t - I) H_t}{n} \\
&\xrightarrow{p.} A^{-1}BC^{-1} \sum_{t=1}^{7} \frac{Z'(r_t D_t - I) H_t}{n} \\
&\xrightarrow{p.} A^{-1}BC^{-1} \sum_{t=1}^{7} \mathrm{E}((r_t d_{it} - 1) Z_i H_{it}) \\
&= A^{-1}BC^{-1} \sum_{t=1}^{7} \mathrm{E}(r_t d_{it} - 1)\,\mathrm{E}(Z_i H_{it}) \\
&= 0,
\end{aligned}
$$

where the second line holds because $r_{nt} \xrightarrow{p.} r_t$, and the last equality holds since $\mathrm{E}(r_t d_{it} - 1) = 0$. Combined with the result that $\hat{\beta}_{wk} \xrightarrow{p.} \beta$, this implies that $\hat{\beta}_{pool} \xrightarrow{p.} \beta$.

Fourth, we show the consistency of $\hat{\beta}_{day}$. The weekly labour supply equation in eq. (3.4) can be re-written as the sum of seven daily labour supply equations in eq. (3.7), with

$$
\beta = \sum_{t=1}^{7} \beta_t \qquad \text{and} \qquad U_i = \sum_{t=1}^{7} U_{it}.
$$

We then can re-write the day estimator as

$$\begin{aligned}
\hat{\beta}_{day} &= \sum_{t=1}^{7}(X'P_{zt}X)^{-1}X'P_{zt}H_t \\
&= \sum_{t=1}^{7}(X'P_{zt}X)^{-1}X'P_{zt}(X\beta_t + U_t) \\
&= \sum_{t=1}^{7}\beta_t + \sum_{t=1}^{7}(X'P_{zt}X)^{-1}X'P_{zt}U_t \\
&= \beta + \sum_{t=1}^{7}(X'P_{zt}X)^{-1}X'P_{zt}U_t.
\end{aligned}$$

Simply by the law of large numbers, continuous mapping theorem, and the definition of P_{zt}, we have

$$\begin{aligned}
\hat{\beta}_{day} - \beta &= \sum_{t=1}^{7}(X'P_{zt}X)^{-1}X'P_{zt}U_t \\
&= \sum_{t=1}^{7}\left(\frac{X'P_{zt}X}{n_t}\right)^{-1}\frac{X'D_tZ}{n_t}\left(\frac{Z'D_tZ}{n_t}\right)^{-1}\frac{Z'D_tU_t}{n_t} \\
&\xrightarrow{p.} \sum_{t=1}^{7}A^{-1}BC^{-1}\,\mathrm{E}(Z_iU_{it}) \\
&= A^{-1}BC^{-1}\,\mathrm{E}\Big(Z_i\sum_{t=1}^{7}U_{it}\Big) \\
&= A^{-1}BC^{-1}\,\mathrm{E}(Z_iU_i) \\
&= 0.
\end{aligned}$$

This completes the proof. $\square$

Proof of Theorem 2. (i) We have

$$\sqrt{n}(\hat{\beta}_{wk} - \beta) = A^{-1}\frac{1}{\sqrt{n}}X'P_zU + o_p(1),$$

which is asymptotically normal with mean zero and variance

$$\mathit{\Omega}_{wk}^{*} = A^{-1}BC^{-1}\,\mathrm{E}(U_i^2 Z_i Z_i')C^{-1}B'A^{-1},$$

This completes the proof of (i). Again, this is a standard result for instrumental variable estimators.

To show (ii), we consider the decomposition

$$\sqrt{n}(\hat{\beta}_{im} - \beta) = \sqrt{n}(\hat{\beta}_{im} - \hat{\beta}_{wk}) + \sqrt{n}(\hat{\beta}_{wk} - \beta).$$

Since the asymptotic variance of $\sqrt{n}(\hat{\beta}_{wk} - \beta)$ is given by (i), the key to finding the asymptotic distribution of $\sqrt{n}(\hat{\beta}_{im} - \beta)$ is therefore to compute the asymptotic variance of $\sqrt{n}(\hat{\beta}_{im} - \hat{\beta}_{wk})$ and $\sqrt{n}(\hat{\beta}_{wk} - \beta)$, as well as their asymptotic covariance. Recall that eq. (C.1) implies

$$\begin{aligned}\sqrt{n}(\hat{\beta}_{im} - \hat{\beta}_{wk}) &= \sum_{t=1}^{7} A_n^{-1} B_n \sqrt{n}\left[\left(\frac{1}{n_t}Z'D_tZ\right)^{-1}\frac{n}{n_t}\frac{1}{n}Z'D_tV_t - \left(\frac{1}{n}Z'Z\right)^{-1}\frac{1}{n}Z'V_t\right]\\ &= \sum_{t=1}^{7} A_n^{-1} B_n \left[C_{n_t}^{-1} r_{nt}\frac{1}{\sqrt{n}}Z'D_tV_t - C_n^{-1}\frac{1}{\sqrt{n}}Z'V_t\right].\end{aligned}$$

Because $n^{-1/2}Z'D_tV_t = O_p(1)$ and $n^{-1/2}Z'V_t = O_p(1)$, we have

$$\sqrt{n}(\hat{\beta}_{im} - \hat{\beta}_{wk}) = A^{-1}BC^{-1}\sum_{t=1}^{7}\frac{1}{\sqrt{n}}Z'(r_tD_t - I_n)V_t + o_p(1). \tag{C.2}$$

The focus is then the asymptotic distribution of

$$\sum_{t=1}^{7}\frac{1}{\sqrt{n}}Z'(r_tD_t - I_n)V_t = \sum_{t=1}^{7}\frac{1}{\sqrt{n}}\sum_{i=1}^{n}(r_td_{it} - 1)Z_iV_{it}.$$

Because $d_{it} \perp\!\!\!\perp (Z, H_t)$ and $\mathrm{E}(r_td_{it} - 1) = 0$, we have that $\mathrm{E}[(r_td_{it} - 1)Z_iV_{it}] = 0$. Moreover, we have

$$\mathrm{E}[(r_td_{it} - 1)Z_iV_{it}V_{i\tau}Z_i'(r_\tau d_{i\tau} - 1)] = \mathrm{E}[(r_td_{it} - 1)(r_\tau d_{i\tau} - 1)]\,\mathrm{E}\big(Z_iV_{it}V_{i\tau}Z_i'\big).$$

It can be shown that

$$\mathrm{E}[(r_t d_{it} - 1)(r_\tau d_{i\tau} - 1)] = \begin{cases} r_t - 1, & t = \tau, \\ -1, & t \neq \tau. \end{cases} \tag{C.3}$$

We hence have

$$\mathrm{Var}((r_t d_{it} - 1) Z_i V_{it}) = (r_t - 1)\,\mathrm{E}(Z_i V_{it} V_{it} Z_i'),$$

and for $t \neq \tau$,

$$\mathrm{Cov}((r_t d_{it} - 1) Z_i V_{it}, (r_\tau d_{i\tau} - 1) Z_i V_{i\tau}) = -\,\mathrm{E}(Z_i V_{it} V_{i\tau} Z_i').$$

From eq. (C.2), we conclude that $\sqrt{n}(\hat{\beta}_{im} - \hat{\beta}_{wk})$ is asymptotically normal with mean zero and variance

$$\Omega^*_{im-wk} \equiv A^{-1} B C^{-1} \Big[\sum_{t=1}^{7} (r_t - 1)\,\mathrm{E}(Z_i V_{it} V_{it} Z_i') - 2 \sum_{1 \le t < \tau \le 7} \mathrm{E}(Z_i V_{it} V_{i\tau} Z_i') \Big] C^{-1} B' A^{-1};$$

We then proceed to compute the covariance between $\sqrt{n}(\hat{\beta}_{im} - \hat{\beta}_{wk})$ and $\sqrt{n}(\hat{\beta}_{wk} - \beta)$. Note that we have shown $\mathrm{E}\Big[\sqrt{n}(\hat{\beta}_{im} - \hat{\beta}_{wk})\Big] = o_p(1)$ and $\mathrm{E}\Big[\sqrt{n}(\hat{\beta}_{wk} - \beta)\Big] = o_p(1)$. In addition, we have

$$\begin{aligned}
&\mathrm{E}\Big[\sqrt{n}(\hat{\beta}_{im} - \hat{\beta}_{wk})\sqrt{n}(\hat{\beta}_{wk} - \beta)\Big] \\
&= A^{-1} B C^{-1}\,\mathrm{E}\left[\sum_{t=1}^{7} n^{-1} Z' (r_t D_t - I_n) V_t U' P_z X \right] A^{-1} + o_p(1) \\
&= A^{-1} B C^{-1} \sum_{t=1}^{7} \mathrm{E}\big[n^{-1} Z' (r_t D_t - I_n) V_t U' P_z X \big] A^{-1} + o_p(1) \\
&= A^{-1} B C^{-1} \sum_{t=1}^{7} \mathrm{E}\big[n^{-1} Z'\,\mathrm{E}[(r_t D_t - I_n) V_t U' P_z X \mid Z] \big] A^{-1} + o_p(1) \\
&= A^{-1} B C^{-1} \sum_{t=1}^{7} \mathrm{E}\big[n^{-1} Z'\,\mathrm{E}(r_t D_t - I_n)\,\mathrm{E}(V_t U' P_z X \mid Z) \big] A^{-1} + o_p(1),
\end{aligned}$$

where the last equality holds because the diary day is completely random, i.e. d_{it} (and hence D_t) is independent from everything else. This, combined with

$$\mathrm{E}(r_t D_t - I_n) = 0$$

implies

$$\mathrm{E}\Big[\sqrt{n}(\hat{\beta}_{im} - \hat{\beta}_{wk})\sqrt{n}(\hat{\beta}_{wk} - \beta)\Big] = o_p(1).$$

As a result,

$$\mathrm{Cov}\left(\sqrt{n}(\hat{\beta}_{im} - \hat{\beta}_{wk}), \sqrt{n}(\hat{\beta}_{wk} - \beta)\right) = o_p(1).$$

We conclude that the asymptotic variance of the impute estimator equals

$$\varOmega^*_{im} = \varOmega^*_{wk} + \varOmega^*_{im-wk},$$

This completes the proof of (ii).

To show (iii), we follow similar steps as for (ii). We decompose

$$\sqrt{n}(\hat{\beta}_{pool} - \beta) = \sqrt{n}(\hat{\beta}_{pool} - \hat{\beta}_{im}) + \sqrt{n}(\hat{\beta}_{im} - \beta),$$

where we only need to find the asymptotic variance of $\sqrt{n}(\hat{\beta}_{pool} - \hat{\beta}_{im})$ and the asymptotic covariance between the two terms. First, we have

$$\begin{aligned}
\sqrt{n}(\hat{\beta}_{pool} - \hat{\beta}_{im}) &= \sqrt{n}(X'P_zX)^{-1}X'Z\sum_{t=1}^{7}\big[(Z'Z)^{-1}r_{nt}Z'D_tH_t - (Z'D_tZ)^{-1}Z'D_tH_t\big] \\
&= A_n^{-1}B_n\sum_{t=1}^{7}\big(C_n^{-1} - C_{n_t}^{-1}\big)\frac{1}{\sqrt{n}}r_{nt}Z'D_tH_t.
\end{aligned}$$

In light of the linear projection eq. (3.10) of H_t, we have

$$\begin{aligned}
\sqrt{n}(\hat{\beta}_{pool} - \hat{\beta}_{im}) &= A_n^{-1}B_n\sum_{t=1}^{7}\big(C_n^{-1} - C_{n_t}^{-1}\big)\frac{1}{\sqrt{n}}r_{nt}Z'D_t\big(Z\alpha_t + V_t\big) \\
&= A_n^{-1}B_n\sum_{t=1}^{7}\big(C_n^{-1} - C_{n_t}^{-1}\big)\frac{1}{\sqrt{n}}r_{nt}Z'D_tZ\alpha_t + o_p(1)
\end{aligned}$$

$$= A_n^{-1} B_n \sum_{t=1}^{7} \left(C_n^{-1} \frac{1}{\sqrt{n}} Z' r_{nt} D_t Z \alpha_t - \sqrt{n} \alpha_t \right) + o_p(1)$$

$$= A_n^{-1} B_n \sum_{t=1}^{7} \left(C_n^{-1} \frac{1}{\sqrt{n}} Z' r_{nt} D_t Z \alpha_t - \sqrt{n} C_n^{-1} \frac{Z'Z}{n} \alpha_t \right) + o_p(1)$$

$$= A_n^{-1} B_n C_n^{-1} \sum_{t=1}^{7} \left(\frac{1}{\sqrt{n}} Z' r_{nt} D_t Z \alpha_t - \frac{1}{\sqrt{n}} Z' Z \alpha_t \right) + o_p(1)$$

$$= A^{-1} B C^{-1} \sum_{t=1}^{7} \frac{1}{\sqrt{n}} Z' (r_t D_t - I_n) Z \alpha_t + o_p(1),$$

where the second equality holds since $C_n^{-1} - C_{n_t}^{-1} = o_p(1)$, $n^{-1/2} r_{nt} Z' D_t V_t = O_p(1)$, and $C_{n_t}^{-1} Z' D_t Z / n_t = I_n$, and the last equality holds by the definition of C_n and C_{n_t}. It follows straightforward that $\sqrt{n}(\hat{\beta}_{pool} - \hat{\beta}_{im})$ is asymptotically normal with some asymptotic variance $\Omega^*_{pool-im}$. To calculate $\Omega^*_{pool-im}$, let

$$\delta_{it} = (r_t d_{it} - 1) Z_i \alpha_t' Z_i,$$

and rewrite

$$\sqrt{n}(\hat{\beta}_{pool} - \hat{\beta}_{im}) = A^{-1} B C^{-1} \sum_{t=1}^{7} \frac{1}{\sqrt{n}} \sum_{i=1}^{n} \delta_{it} + o_p(1).$$

Using eq. (C.3), we can show that

$$\mathrm{Var}(\delta_{it}) = (r_t - 1) \, \mathrm{E}(Z_i \alpha_t' Z_i Z_i' \alpha_t Z_i'),$$

and

$$\mathrm{Cov}(\delta_{it}, \delta_{i\tau}) = - \, \mathrm{E}(Z_i \alpha_t' Z_i Z_i' \alpha_\tau' Z_i').$$

As a result,

$$\Omega^*_{pool-im} = A^{-1} B C^{-1} \Big[\sum_{t=1}^{7} (r_t - 1) \, \mathrm{E}(Z_i \alpha_t' Z_i Z_i' \alpha_t Z_i') - 2 \sum_{1 \le t < \tau \le 7} \mathrm{E}(Z_i \alpha_t' Z_i Z_i' \alpha_\tau' Z_i') \Big] C^{-1} B' A^{-1}. \tag{C.4}$$

Second, we consider the asymptotic covariance between $\sqrt{n}(\hat{\beta}_{pool} - \hat{\beta}_{im})$

and $\sqrt{n}(\hat{\beta}_{im} - \beta)$. By the definition of $V_{i\tau}$ in the linear projection eq. (3.10), Z_i and $V_{i\tau}$ ($\tau = 1, \ldots, 7$) are orthogonal with each other. This implies that for any $1 \leq t \leq \tau \leq 7$,

$$\mathrm{Cov}((r_t d_{it} - 1) Z_i \alpha_t' Z_i, (r_\tau d_{i\tau} - 1) Z_i V_{i\tau}) = 0.$$

This further implies that $\sqrt{n}(\hat{\beta}_{pool} - \hat{\beta}_{im})$ and $\sqrt{n}(\hat{\beta}_{im} - \hat{\beta}_{wk})$ are asymptotically uncorrelated. Furthermore, using the same argument as in the proof of (ii), one can show that $\sqrt{n}(\hat{\beta}_{pool} - \hat{\beta}_{im})$ and $\sqrt{n}(\hat{\beta}_{wk} - \beta)$ are asymptotically uncorrelated. Together they imply that $\sqrt{n}(\hat{\beta}_{pool} - \hat{\beta}_{im})$ and $\sqrt{n}(\hat{\beta}_{im} - \beta)$ are asymptotically uncorrelated.

To summarize, we have shown that the asymptotic variance of $\sqrt{n}(\hat{\beta}_{pool} - \beta)$ equals to

$$\Omega^*_{pool} = \Omega^*_{pool-im} + \Omega^*_{im}.$$

Note that since Ω^*_{pool} is positive definite, it implies that $\hat{\beta}_{im}$ is asymptotically more efficient than $\hat{\beta}_{pool}$. This completes the proof of (iii).

Part (iv) follows from writing $\mathrm{Var}(\sqrt{n}(\hat{\beta}_{im} - \hat{\beta}_{wk}))$ as the following sum,

$$\mathrm{Var}(\sqrt{n}(\hat{\beta}_{im} - \beta)) + \mathrm{Var}(\sqrt{n}(\hat{\beta}_{wk} - \beta)) - 2\,\mathrm{Cov}(\sqrt{n}(\hat{\beta}_{im} - \beta), \sqrt{n}(\hat{\beta}_{wk} - \beta)).$$

Because we have shown $\mathrm{E}(\sqrt{n}(\hat{\beta}_{im} - \hat{\beta}_{wk})\sqrt{n}(\hat{\beta}_{wk} - \beta)) = o_p(1)$, we have that

$$\mathrm{E}(\sqrt{n}(\hat{\beta}_{im} - \beta)\sqrt{n}(\hat{\beta}_{wk} - \beta)) = \mathrm{Var}(\sqrt{n}(\hat{\beta}_{wk} - \beta)) + o_p(1).$$

We hence conclude that $\mathrm{Var}(\sqrt{n}(\hat{\beta}_{im} - \hat{\beta}_{wk})) = \mathrm{Var}(\sqrt{n}(\hat{\beta}_{im} - \beta)) - \mathrm{Var}(\sqrt{n}(\hat{\beta}_{wk} - \beta))$. The rest of part (iv) follows immediately. □

Proof of Theorem 3. We first prove (i). Plugging eq. (3.7), the daily labour supply equation into eq. (3.9), the expression of the impute estimator, and using the notation of A_n, B_n, C_n and C_{n_t}, we can write

$$\sqrt{n}(\hat{\beta}_{im} - \beta) = \sqrt{n}(T_{im,1} - \beta) + \sqrt{n} T_{im,2},$$

where

$$
\begin{aligned}
T_{im,1} &= \sum_{t=1}^{7} (X'P_zX)^{-1}X'P_zZ(Z'D_tZ)^{-1}Z'D_tX\beta_t \\
&= \sum_{t=1}^{7} (X'P_zX)^{-1}X'Z(Z'D_tZ)^{-1}Z'D_tX\beta_t \\
&= A_n^{-1}B_n \sum_{t=1}^{7} C_{n_t}^{-1}Z'D_tX\beta_t/n_t, \\
T_{im,2} &= \sum_{t=1}^{7} (X'P_zX)^{-1}X'P_zZ(Z'D_tZ)^{-1}Z'D_tU_t \\
&= \sum_{t=1}^{7} (X'P_zX)^{-1}X'Z(Z'D_tZ)^{-1}Z'D_tU_t, \\
&= A_n^{-1}B_n \sum_{t=1}^{7} C_{n_t}^{-1}Z'D_tU_t/n_t.
\end{aligned}
$$

We then proceed in three steps: (a) find the asymptotic distribution of $\sqrt{n}(T_{im,1} - \beta)$; (b) find the asymptotic distribution of $\sqrt{n}T_{im,2}$; and (c) find the asymptotic covariance between the two.

Using the linear projection eq. (3.12) and letting $\epsilon = (\epsilon_1, \ldots, \epsilon_n)'$, we can re-write

$$
\begin{aligned}
T_{im,1} &= A_n^{-1}B_n \sum_{t=1}^{7} C_{n_t}^{-1}Z'D_tZ\lambda\beta_t/n_t + A_n^{-1}B_n \sum_{t=1}^{7} C_{n_t}^{-1}Z'D_t\epsilon\beta_t/n_t \\
&= A_n^{-1}B_n\lambda \sum_{t=1}^{7} \beta_t + A_n^{-1}B_n \sum_{t=1}^{7} C_{n_t}^{-1}Z'D_t\epsilon\beta_t/n_t
\end{aligned}
$$

Also re-write β using this linear projection and the notation of A_n, B_n and C_n, we get

$$
\beta = \sum_{t=1}^{7} \beta_t = \sum_{t=1}^{7} (X'P_zX)^{-1}X'Z(Z'Z)^{-1}Z'X\beta_t
$$

$$
\begin{aligned}
&= \sum_{t=1}^{7} (X'P_zX)^{-1}X'Z(Z'Z)^{-1}Z'Z\lambda\beta_t + \sum_{t=1}^{7}(X'P_zX)^{-1}X'Z(Z'Z)^{-1}Z'\epsilon\beta_t \\
&= A_n^{-1}B_n\lambda\sum_{t=1}^{7}\beta_t + A_n^{-1}B_n\sum_{t=1}^{7}C_n^{-1}\frac{1}{n}Z'\epsilon\beta_t.
\end{aligned}
$$

It then follows that

$$
\sqrt{n}(T_{im,1}-\beta) = A_n^{-1}B_n\sum_{t=1}^{7}\left[C_{n_t}^{-1}r_{nt}\frac{1}{\sqrt{n}}Z'D_t\epsilon\beta_t - C_n^{-1}\frac{1}{\sqrt{n}}Z'\epsilon\beta_t\right].
$$

Because both $n^{-1/2}Z'D_t\epsilon$ and $n^{-1/2}Z'\epsilon$ are $O_p(1)$, we have

$$
\begin{aligned}
\sqrt{n}(T_{im,1}-\beta) &= A^{-1}BC^{-1}\sum_{t=1}^{7}\left[\frac{1}{\sqrt{n}}Z'(r_tD_t - I_n)\epsilon\right]\beta_t + o_p(1) \\
&= A^{-1}BC^{-1}\sum_{t=1}^{7}\left[\frac{1}{\sqrt{n}}\sum_{i=1}^{n}(r_td_{it}-1)Z_i\epsilon_i'\right]\beta_t + o_p(1).
\end{aligned}
$$

Let

$$
\eta_{it} = (r_td_{it}-1)Z_i\epsilon_i'\beta_t,
$$

so that we can write

$$
\sqrt{n}(T_{im,1}-\beta) = A^{-1}BC^{-1}\sum_{t=1}^{7}\frac{1}{\sqrt{n}}\sum_{i=1}^{n}\eta_{it} + o_p(1).
$$

Using eq. (C.3), we can show that

$$
\mathrm{Var}(\eta_{it}) = (r_t - 1)\,\mathrm{E}(Z_i\beta_t'\epsilon_i\epsilon_i'\beta_tZ_i'),
$$

and

$$
\mathrm{Cov}(\eta_{it},\eta_{i\tau}) = -\,\mathrm{E}(Z_i\beta_t\epsilon_i'\epsilon_i\beta_\tau Z_i').
$$

As a result, $\sqrt{n}(T_{im,1}-\beta)$ is asymptotically normal, and its asymptotic variance is

$$\mathit{\Omega}_{im,1} = A^{-1}BC^{-1}\Big[\sum_{t=1}^{7}(r_t-1)\,\mathrm{E}(Z_i\beta_t'\epsilon_i\epsilon_i'\beta_t Z_i') - 2\sum_{1\le t<\tau\le 7}\mathrm{E}(Z_i\beta_t\epsilon_i'\epsilon_i\beta_\tau Z_i')\Big]C^{-1}B'A^{-1}.$$

Second, we consider the asymptotic distribution of $\sqrt{n}T_{im,2}$. Let

$$\xi_{it} = r_t d_{it} Z_i U_{it}.$$

Using the notation of A_n, B_n, C_n and C_{n_t}, and because $n^{-1/2}Z'D_tU_t = O_p(1)$, we can write

$$\sqrt{n}T_{im,2} = A^{-1}BC^{-1}\sum_{t=1}^{7}\frac{1}{\sqrt{n}}\sum_{i=1}^{n}\xi_{it} + o_p(1).$$

Note that we have

$$\mathrm{E}(\xi_{it}) = \mathrm{E}(r_t d_{it})\,\mathrm{E}(Z_i U_{it}) = 0, \qquad \mathrm{Var}(\xi_{it}) = r_t\,\mathrm{E}\big(U_{it}^2 Z_i Z_i'\big), \qquad \text{and} \qquad \mathrm{Cov}(\xi_{it}, \xi_{i\tau}) = 0,$$

since $d_{it}d_{i\tau} = 0$ for any $t \ne \tau$. Hence $\sqrt{n}T_{im,2}$ is asymptotically normal and its asymptotic variance is

$$\mathit{\Omega}_{im,2} = A^{-1}BC^{-1}\Big[\sum_{t=1}^{7} r_t\,\mathrm{E}\big(U_{it}^2 Z_i Z_i'\big)\Big]C^{-1}B'A^{-1}.$$

Finally we consider the covariance between $\sqrt{n}(T_{im,1}-\beta)$ and $\sqrt{n}T_{im,2}$. We note that

$$\mathrm{E}(\eta_{it}\xi_{i\tau}') = \begin{cases} (r_t-1)\,\mathrm{E}(U_{it}Z_i\beta_t'\epsilon_i Z_i'), & t=\tau, \\ -\,\mathrm{E}(U_{i\tau}Z_i\beta_t'\epsilon_i Z_i'), & t\ne\tau. \end{cases}$$

Note that $\mathrm{E}(U_{it}Z_i\beta_t'\epsilon_i Z_i') \ne 0$ when X_i is endogenous, so the covariance between $\sqrt{n}(T_{im,1}-\beta)$ and $\sqrt{n}T_{im,2}$ is

$$\mathit{\Omega}_{im,3} = A^{-1}BC^{-1}\Big[\sum_{t=1}^{7}(r_t-1)\,\mathrm{E}(U_{it}Z_i\beta_t'\epsilon_i Z_i') - 2\sum_{1\le t<\tau\le 7}\mathrm{E}(U_{i\tau}Z_i\beta_t'\epsilon_i Z_i')\Big]C^{-1}B'A^{-1}.$$

We conclude that the asymptotic variance under the condition $\mathrm{E}(Z_i U_{it}) = 0$ for all t is

$$\Omega_{im} = \Omega_{im,1} + \Omega_{im,2} + 2\Omega_{im,3}.$$

This completes the proof of (i).

The proof of (ii) is exactly the same as that of (iii) of Theorem 2, and hence is omitted here.

Finally we prove (iii). For every $t = 1, \ldots, 7$, it follows from a standard result for instrumental variable estimators that

$$\sqrt{n_t}(\hat{\beta}_t - \beta_t) \xrightarrow{d.} N(0, A^{-1}BC^{-1}E(U_{it}^2 Z_i Z_i')C^{-1}B'A^{-1}),$$

which implies that

$$\sqrt{n}(\hat{\beta}_t - \beta_t) \xrightarrow{d.} N(0, r_t A^{-1}BC^{-1}E(U_{it}^2 Z_i Z_i')C^{-1}B'A^{-1}).$$

Moreover, note that $\hat{\beta}_t$ only uses the data on those individuals whose diary day is t. Since the individuals are drawn independently, $\hat{\beta}_t$ is independent of $\hat{\beta}_\tau$ for any $t \neq \tau$. This implies that the asymptotic variance of the day estimator $\hat{\beta}_{day}$ is

$$\Omega_{day} = A^{-1}BC^{-1}\left[\sum_{t=1}^{7} r_t\,\mathrm{E}(U_{it}^2 Z_i Z_i')\right]C^{-1}B'A^{-1}.$$

□

Lemma 1. *Under Assumptions 1 to 5, the daily instrumental variable estimators are consistent. That is,* $\hat{\beta}_t \xrightarrow{p.} \beta_t$ *for* $t = 1, \ldots, 7$.

Proof. It is a standard result for instrumental variable estimators, so the proof is omitted. □

Proof of Theorem 4. Lemma 1 gives $\hat{\beta}_t \xrightarrow{p.} \beta_t$, and the rest of the result follows simply by law of large numbers and the continuous mapping theorem. □

References

Angrist, Joshua D., "Grouped-Data Estimation and Testing in Simple Labour-Supply Models," *Journal of Econometrics*, 1991, *47* (2-3), 243-266.

Chou, Cheng and Ruoyao Shi, "What Time Use Surveys Can (And Cannot) Tell Us About Labour Supply," *unpublished manuscript*, 2019.

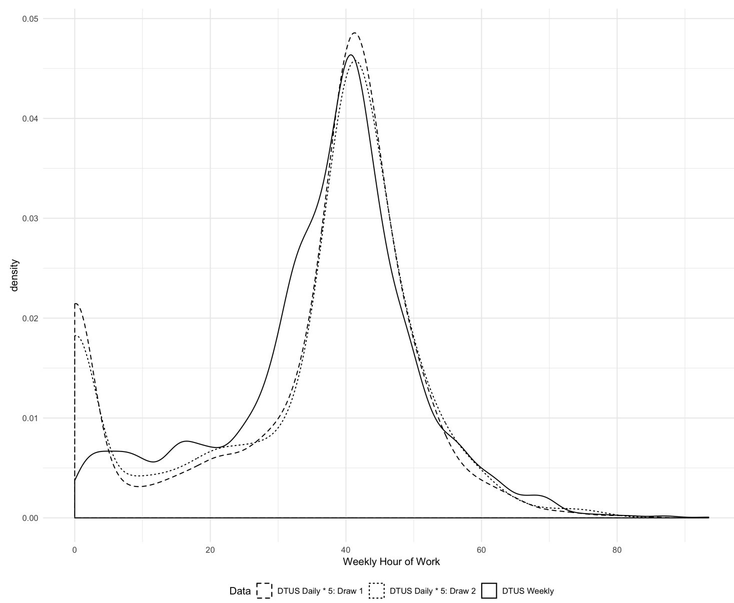

Figure B.1: DTUS Weekly Hours vs. Randomly Drawn Weekday Daily Hours ×5

Table B.1: Correlation Coefficients in the DTUS

(a) Among the Daily Hours Worked in the DTUS

$\hat{\rho}(H_{it}, H_{i\tau})$	Sun	Mon	Tue	Wed	Thu	Fri	Sat
Sun	1.00						
Mon	0.04	1.00					
Tue	0.01	0.61	1.00				
Wed	0.00	0.51	0.59	1.00			
Thu	-0.01	0.48	0.54	0.59	1.00		
Fri	0.04	0.41	0.46	0.48	0.56	1.00	
Sat	0.26	0.03	0.06	0.07	0.07	0.19	1.00

(b) Among the "H First Stage" Residuals in the DTUS[1]

$\hat{\rho}(V_{it}, V_{i\tau})$	Sun	Mon	Tue	Wed	Thu	Fri	Sat
Sun	1.00						
Mon	0.02	1.00					
Tue	-0.00	0.52	1.00				
Wed	-0.02	0.38	0.48	1.00			
Thu	-0.03	0.36	0.43	0.48	1.00		
Fri	0.03	0.29	0.35	0.35	0.47	1.00	
Sat	0.26	0.01	0.05	0.04	0.05	0.17	1.00

[1] The "H first stage" is the linear projection of H_{it}, the daily hours worked on the IV Z_i. For the DTUS, the IVs are number of kids aged under 18 in the household, a dummy of completing secondary education, a dummy of obtaining higher than secondary education (with less than secondary being base group), age, age-squared, a dummy of working in private sector (with public sector as base group), an urban area dummy (with rural being base group), year dummies and a gender dummy.

Table B.2: Simulations Based Only on Weekdays in the Dutch Time Use Survey (DTUS)

Corr($\tilde{X}_i, U_i$) / Corr($\tilde{X}_i, \tilde{Z}_i$)		Panel A: $n = 250$				Panel B: $n = 500$			
		$\hat{\beta}_{wk}$	$\hat{\beta}_{im}$	$\hat{\beta}_{pool}$	$\hat{\beta}_{day}$	$\hat{\beta}_{wk}$	$\hat{\beta}_{im}$	$\hat{\beta}_{pool}$	$\hat{\beta}_{day}$
0 / 1	MSE	0.002	0.019	0.019	0.019	0.001	0.009	0.009	0.009
	Bias^2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Var	0.002	0.019	0.019	0.019	0.001	0.009	0.009	0.009
0.25 / 0.95	MSE	0.000	0.017	0.017	0.017	0.000	0.008	0.008	0.008
	Bias^2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Var	0.000	0.017	0.017	0.017	0.000	0.008	0.008	0.008
0.5 / 0.80	MSE	0.002	0.019	0.019	0.020	0.001	0.009	0.009	0.009
	Bias^2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Var	0.002	0.019	0.019	0.020	0.001	0.009	0.009	0.009
0.75/ 0.43	MSE	0.047	0.064	0.064	124.978	0.022	0.031	0.031	0.043
	Bias^2	0.000	0.000	0.000	0.008	0.000	0.000	0.000	0.004
	Var	0.047	0.064	0.064	124.970	0.022	0.031	0.031	0.039
Corr($\tilde{X}_i, U_i$) / Corr($\tilde{X}_i, \tilde{Z}_i$)		Panel C: $n = 1000$				Panel D: $n = 2500$			
		$\hat{\beta}_{wk}$	$\hat{\beta}_{im}$	$\hat{\beta}_{pool}$	$\hat{\beta}_{day}$	$\hat{\beta}_{wk}$	$\hat{\beta}_{im}$	$\hat{\beta}_{pool}$	$\hat{\beta}_{day}$
0 / 1	MSE	0.001	0.004	0.005	0.004	0.000	0.002	0.002	0.002
	Bias^2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Var	0.001	0.004	0.005	0.004	0.000	0.002	0.002	0.002
0.25 / 0.95	MSE	0.000	0.004	0.004	0.004	0.000	0.002	0.002	0.002
	Bias^2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Var	0.000	0.004	0.004	0.004	0.000	0.002	0.002	0.002
0.5 / 0.80	MSE	0.001	0.004	0.005	0.005	0.000	0.002	0.002	0.002
	Bias^2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Var	0.001	0.004	0.005	0.005	0.000	0.002	0.002	0.002
0.75/ 0.43	MSE	0.011	0.015	0.015	0.017	0.004	0.006	0.006	0.006
	Bias^2	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000
	Var	0.011	0.015	0.015	0.016	0.004	0.006	0.006	0.006

[1] This table compares finite sample performance of various estimators using the DTUS data. 10,000 random samples of different sizes are drawn from the original DTUS sample of 6,567 individual-year records.
[2] The two numbers in the first column represent: (i) correlation coefficient between regressor $\tilde{X}_i$ and error term U_i (degree of endogeneity); (ii) correlation coefficient between regressor $\tilde{X}_i$ and IV $\tilde{Z}_i$ (strength of IV). Both are adjusted by changing the parameter ρ in the simulation setup.
[3] $\hat{\beta}_{wk}$ is the 2SLS estimator given in equation (3.5), which uses the accurate hours worked from Mondays to Fridays in the DTUS and serves as an infeasible benchmark for the three estimators based on the ATUS. $\hat{\beta}_{wk}$ has virtually no bias and the smallest variance.
[4] For each individual in the DTUS, we randomly draw one from the five weekdays using the (equal) diary day sampling probabilities of the ATUS, thus obtained samples that imitate the ATUS, and we apply $\hat{\beta}_{im}$, $\hat{\beta}_{pool}$ and $\hat{\beta}_{day}$ to them in order to evaluate their performance.
[5] $\hat{\beta}_{im}$ has virtually no bias and the smallest variance among the three, followed closely by $\hat{\beta}_{pool}$.
[6] $\hat{\beta}_{day}$ is numerically equivalent to $\hat{\beta}_{im}$ when $\tilde{X}_i$ is exogenous. When $\tilde{X}_i$ is endogenous, however, $\hat{\beta}_{day}$ could display notable bias and considerable variance, especially when the sample size is smaller (and hence each day subsample is even smaller).

Table B.3: Weekly Labour Supply Regression Coefficient Estimates: the DTUS

	Married Men			Married Women		
	$\hat{\beta}_{re}$	$\hat{\beta}_{wk}$	$\hat{\beta}_{im}$	$\hat{\beta}_{re}$	$\hat{\beta}_{wk}$	$\hat{\beta}_{im}$
n of kids aged < 18	0.42	0.16	0.09	0.01	−4.17	−5.24
	(0.18)	(0.24)	(0.50)	(0.36)	(0.43)	(0.81)
			[0.48]			[0.80]
Educ: completed 2ndry	0.95	−0.48	−3.10	−0.96	2.95	2.44
	(0.50)	(0.66)	(1.30)	(0.94)	(1.11)	(2.06)
			[1.31]			[2.04]
Educ: above 2ndry	1.84	−0.85	−2.33	−0.39	5.63	5.37
	(0.53)	(0.70)	(1.27)	(1.12)	(1.32)	(2.41)
			[1.39]			[2.44]
P value of joint Hausman test	0.00	0.14		0.00	0.50	
n of Obs.	1746	1746	1746	835	835	835
R squared[4]	0.06	0.03	0.07	0.18	0.39	0.26

[1] The other control variables are age, age-squared, a dummy of working in private sector (with public sector as base group), an urban area dummy (with rural being base group), and year dummies.
[2] $\hat{\beta}_{re}$ uses the recalled weekly hours; $\hat{\beta}_{wk}$ uses the true diary weekly hours; $\hat{\beta}_{im}$ uses the fictitious sample where only one day is randomly chosen for each individual using the ATUS diary day sampling weights.
[3] Standard errors are in parentheses. For $\hat{\beta}_{im}$, we report the standard errors using the formulas in Theorem 4 (under Assumption 5, in round parentheses) and the formulas in Supplementary Appendix A (in square parentheses) using the DTUS correlation matrix.
[4] We conduct the joint Hausman tests (i.e. the coefficients associated with the three regressors in the table) regarding whether there are significant differences between $\hat{\beta}_{re}$ and $\hat{\beta}_{im}$, and between $\hat{\beta}_{wk}$ and $\hat{\beta}_{im}$, respectively.
[5] The R squared for impute estimator is the average R squared of the seven linear regression of daily hours worked $H_{it} = X_i'\beta_t + U_{it}$ for $t = 1, \ldots, 7$.

Table B.4: Comparison between the Respondents in the ATUS and the CPS

	ATUS	CPS (in ATUS or not, Table B.5)	Entire CPS
Male	40.5%	48.3%	48.6%
College graduates	21.3%	18.1%	18.5%
Age	39.4	39.3	39.3
s.d.	(8.4)	(8.6)	(8.7)
Hours usually worked per week	36.1	38	38
s.d.	(9.0)	(8.5)	(8.5)
Hourly wage (2017 US dollars)	18.7	18.4	18.4
s.d.	(9.0)	(8.8)	(8.8)
Num. of children aged < 5	0.23	0.21	0.20
s.d.	(0.52)	(0.50)	(0.50)
Num. of children aged 5–18	0.79	0.92	0.90
s.d.	(1.00)	(1.11)	(1.11)
Num. of obs.	19,038	73,429	991,116

[1] "ATUS" column refers to the sample that was used in our empirical studies. "CPS (in ATUS or not, Table B.5)" column refers to the CPS 2003-2017 sample after the same sample selection criterion (hourly paid workers aged between of 25 and 54, whose wage rate is positive, and spouse earnings and total usual weekly hours worked at all jobs reported in the CPS are observed) is applied, whether they participate in the ATUS or not. "Entire CPS" differs from "CPS (in ATUS or not, Table B.5)" only in that "Entire CPS" keeps the respondents whose hourly wage or spouse weekly earnings is missing.

Table B.5: Weekly Labour Supply Elasticity Estimates: the CPS (in the ATUS or not)

Panel A: Mean and std dev of hours and wage				
	Married Men	Unmarried Men	Married Women	Unmarried Women
CPS Usual Weekly Hours Worked	41.02	39.21	34.90	36.65
s.d.	(7.01)	(7.99)	(9.16)	(8.29)
Hourly Wage (2017 US dollars)	21.22	17.92	17.79	16.23

Panel B: Elasticities (hundredths)[2]				
	Married Men	Unmarried Men	Married Women	Unmarried Women
Wage	7.66	11.15	10.02	12.41
	(0.36)	(0.48)	(0.55)	(0.58)
Spouse weekly earnings	−0.29		−2.52	
	(0.12)		(0.24)	
Num. of kids age < 5	0.34		−6.10	
	(0.21)		(0.42)	
Num. of kids ages 5–18	0.30		−2.18	
	(0.11)		(0.17)	
R squared	0.16	0.18	0.18	0.17
n of obs.	20,307	15,134	21,165	16,823

[1] The sample here contains the CPS 2003-2017 sample after the same sample selection criterion (hourly paid workers aged between of 25 and 54, whose wage rate is positive, and spouse earnings and total usual weekly hours worked at all jobs reported in the CPS are observed) is applied, whether they participate in the ATUS or not.
[2] The elasticities are evaluated at the respective mean hours worked in each data source.
[3] The other control variables are including age, age-squared, the number of children aged below 5, the number of children aged between 5 and 18, two education dummies, eight Census division dummies, a metropolitan area dummy, race dummies, year dummies, occupation dummies and industry dummies.

Table B.6: Weekly Labour Supply Regression Coefficient Estimates: the CPS and the ATUS

Panel A: Mean and std dev of hours and wage				
	Married Men	Unmarried Men	Married Women	Unmarried Women
CPS Usual Weekly Hours Worked	39.625	38.421	32.499	35.524
s.d.	(6.130)	(7.260)	(10.430)	(8.630)
ATUS Hours Worked on Diary Day	4.698	4.741	3.557	4.182
s.d.	(4.550)	(4.440)	(4.000)	(4.210)
ATUS Imputed Weekly Hours Worked	41.270	40.380	31.960	36.180
s.d. (lower bound)[1]	(9.569)	(9.792)	(9.255)	(9.677)
Hourly Wage (2017 US dollars)	21.877	18.649	18.699	16.564

Panel B: Elasticities (hundredths)[2]				
	Married Men	Unmarried Men	Married Women	Unmarried Women
Wage (CPS)	2.136	4.371	5.163	4.165
	(0.353)	(0.406)	(0.410)	(0.380)
Wage (ATUS)	0.607	1.902	3.349	2.945
	(1.347)	(1.316)	(1.040)	(1.172)
	[1.364]	[1.300]	[1.021]	[1.130]
Spouse weekly earnings ($100) (CPS)	−0.000		−0.003	
	(0)		(0)	
Spouse weekly earnings ($100) (ATUS)	−0.002		−0.002	
	(0.001)		(0.001)	
	[0.001]		[0.001]	
Num. of kids age <5 (CPS)	−0.316		−2.788	
	(0.192)		(0.266)	
Num. of kids age <5 (ATUS)	−0.445		−2.868	
	(0.789)		(0.665)	
	[0.791]		[0.676]	
Num. of kids ages 5–18 (CPS)	−0.002		−0.932	
	(0.101)		(0.138)	
Num. of kids ages 5–18 (ATUS)	−0.183		−0.383	
	(0.455)		(0.372)	
	[0.449]		[0.374]	
R squared (CPS)	0.083	0.149	0.219	0.147
R squared (ATUS)[5]	0.155	0.242	0.174	0.169
p value of joint Hausman test	0.240	0.049	0.058	0.271
n of obs.	3889	3816	5602	5731

[1] See footnote 40 in the paper for more details.
[2] The estimates based on the CPS recalled weekly hours are $\hat{\beta}_{re}$; the estimates based on the ATUS diary day hours are $\hat{\beta}_{im}$.
[3] The standard errors of estimating regression coefficients using CPS recalled hours are in parentheses. When use ATUS hours, we report the standard errors using the formulas in Theorem 4 (under Assumption 5, in round parentheses) and the formulas in Supplementary Appendix A (in square parentheses) using the DTUS correlation matrix.
[4] The R squared for impute estimator is the average R squared of the seven linear regression of daily hours worked $H_{it} = X_i'\beta_t + U_{it}$ for $t = 1, \ldots, 7$.
[5] For each sample group, we conduct joint Hausman tests regarding whether there are significant differences between $\hat{\beta}_{re}$ and $\hat{\beta}_{im}$.
[6] The other control variables are including age, age-squared, the number of children aged below 5, the number of children aged between 5 and 18, two education dummies, eight Census division dummies, a metropolitan area dummy, race dummies, year dummies, occupation dummies and industry dummies.

Table B.7: The ATUS Sample Sizes of All Occupations and Percentages by Month

	1	2	3	4	5	6	7	8	9	10	11	12	Total n
Management occupations	10.9	9.2	10.8	7.4	5.8	7.8	9.3	7.3	8.6	8.2	6.5	8.3	1262
Computer and mathematical science occupations	10.0	8.2	9.2	8.5	8.7	8.0	6.7	7.6	8.1	8.8	8.4	7.8	3575
Healthcare support occupations	9.8	8.3	9.6	8.2	8.6	7.4	7.9	8.1	7.7	8.8	8.0	7.6	3777
Sales and related occupations	11.3	9.2	9.2	7.8	7.2	8.0	9.3	7.5	7.2	7.8	7.4	8.2	1443
Office and administrative support occupations	10.9	7.9	8.5	8.5	7.2	8.6	7.3	8.0	8.1	8.3	8.3	8.5	3669
Construction and extraction occupations	10.4	8.1	9.0	9.6	6.9	7.6	8.6	8.9	7.9	8.0	8.0	7.0	1032
Installation, maintenance, and repair occupations	9.8	8.1	9.9	8.5	8.4	7.6	7.2	7.3	8.5	8.3	8.7	7.7	885
Production occupations	9.6	7.8	9.2	8.6	7.9	8.2	7.9	8.3	7.6	9.0	8.9	7.1	2066
Transportation and material moving occupations	11.1	6.9	10.8	8.4	7.2	6.1	8.4	7.8	7.8	9.3	9.0	7.2	1329
Monthly num. of obs.	10.4	8.2	9.4	8.4	7.8	7.8	7.8	7.9	7.9	8.6	8.2	7.8	19038

[1] The numbers are the percentage of sample size in the total sample size per occupation.

Table B.8: Weekly Labour Supply Elasticity Estimates: the CPS and the ATUS
(Computer & Mathematical, Healthcare, Office & Administrative Occupations)

Panel A: Mean and std dev of hours and wage[1]				
	Married Men	Unmarried Men	Married Women	Unmarried Women
CPS Usual Weekly Hours Worked	38.87	37.22	31.97	35.20
s.d.	(7.12)	(8.13)	(10.68)	(8.90)
ATUS Hours Worked on Interview Day	4.64	4.76	3.47	4.18
s.d.	(4.57)	(4.46)	(4.01)	(4.21)
ATUS Imputed Weekly Hours Worked	40.69	37.85	30.72	35.89
s.d. (lower bound)[2]	(10.37)	(10.63)	(9.41)	(9.67)
Hourly Wage (2017 US dollars)	21.91	17.79	19.39	17.01

Panel B: Elasticities (hundredths)[2]				
	Married Men	Unmarried Men	Married Women	Unmarried Women
Wage (CPS)	6.61	13.78	13.65	9.22
	(1.93)	(1.88)	(1.51)	(1.32)
Wage (ATUS)	10.82	8.65	6.71	3.81
	(5.78)	(5.73)	(3.97)	(3.78)
	[5.81]	[5.85]	[3.84]	[3.64]
Spouse weekly earnings (CPS)	−1.67		−10.58	
	(0.97)		(0.94)	
Spouse weekly earnings (ATUS)	−5.01		−7.20	
	(2.70)		(2.57)	
	[2.89]		[2.48]	
Num. of kids age < 5 (CPS)	0.77		−8.95	
	(1.10)		(0.97)	
Num. of kids age < 5 (ATUS)	5.15		−9.67	
	(3.27)		(2.57)	
	[3.22]		[2.56]	
Num. of kids ages 5–18 (CPS)	0.08		−3.26	
	(0.59)		(0.51)	
Num. of kids ages 5–18 (ATUS)	−1.84		−2.77	
	(1.79)		(1.38)	
	[1.90]		[1.42]	
R squared (CPS)	0.13	0.19	0.22	0.12
R squared (ATUS)[5]	0.42	0.40	0.18	0.18
p value of joint Hausman test	0.41	0.37	0.04	0.14
n of obs.	1227	1483	4224	4087

[1] This table only contains the three occupations with the most observations in the ATUS (see Table B.7).
[2] See footnote 40 in the paper for more details.
[3] The estimates based on the CPS recalled weekly hours are $\hat{\beta}_{re}$; the estimates based on the ATUS diary day hours are $\hat{\beta}_{im}$.
[4] The standard errors of estimating elasticities using CPS recalled hours are in parentheses. When use ATUS hours, we report the standard errors using the formulas in Theorem 4 (under Assumption 5, in round parentheses) and the formulas in Supplementary Appendix A (in square parentheses) using the DTUS correlation matrix.
[5] The elasticities are evaluated at the respective mean hours worked in each data source.
[6] The R squared for impute estimator is the average R squared of the seven linear regression of daily hours worked $H_{it} = X_i'\beta_t + U_{it}$ for $t = 1, \ldots, 7$.
[7] For each sample group, we conduct joint Hausman tests regarding whether there are significant differences between $\hat{\beta}_{re}$ and $\hat{\beta}_{im}$.
[8] The other control variables are including age, age-squared, the number of children aged below 5, the number of children aged between 5 and 18, two education dummies, eight Census division dummies, a metropolitan area dummy, race dummies, year dummies, occupation dummies and industry dummies.

Table B.9: Weekly Labour Supply Elasticity Estimates: the CPS and the ATUS
(Work-related Hours)

Panel A: Mean and std dev of hours and wage[1]				
	Married Men	Unmarried Men	Married Women	Unmarried Women
CPS Usual Weekly Hours Worked	39.63	38.42	32.50	35.52
s.d.	(6.13)	(7.27)	(10.44)	(8.63)
ATUS Hours Worked on Diary Day	4.70	4.75	3.56	4.19
s.d.	(4.55)	(4.44)	(4.01)	(4.21)
ATUS Imputed Weekly Hours Worked	41.38	40.45	31.99	36.19
s.d. (lower bound)[2]	(9.57)	(9.80)	(9.26)	(9.69)
Hourly Wage (2017 US dollars)	21.88	18.65	18.70	16.56

Panel B: Elasticities (hundredths)[2]				
	Married Men	Unmarried Men	Married Women	Unmarried Women
Wage (CPS)	5.39	11.38	15.89	11.72
	(0.89)	(1.06)	(1.26)	(1.07)
Wage (ATUS)	1.55	4.76	10.44	8.15
	(3.26)	(3.25)	(3.25)	(3.24)
	[3.30]	[3.22]	[3.19]	[3.13]
Spouse weekly earnings (CPS)	−0.19		−9.43	
	(0.41)		(0.77)	
Spouse weekly earnings (ATUS)	−3.47		−5.80	
	(1.60)		(2.08)	
	[1.57]		[2.03]	
Num. of kids age <5 (CPS)	−0.80		−8.58	
	(0.48)		(0.82)	
Num. of kids age <5 (ATUS)	−1.03		−8.95	
	(1.89)		(2.08)	
	[1.92]		[2.11]	
Num. of kids ages 5–18 (CPS)	−0.00		−2.87	
	(0.26)		(0.42)	
Num. of kids ages 5–18 (ATUS)	−0.47		−1.19	
	(1.10)		(1.16)	
	[1.09]		[1.17]	
R squared (CPS)[5]	0.08	0.15	0.22	0.15
R squared (ATUS)	0.16	0.24	0.17	0.17
p value of joint Hausman test	0.25	0.05	0.06	0.27
n of obs.	3889	3816	5602	5731

[1] The ATUS hours worked in this table include all work-related hours.
[2] See footnote 40 in the paper for more details.
[3] The estimates based on the CPS recalled weekly hours are $\hat{\beta}_{re}$; the estimates based on the ATUS diary day hours are $\hat{\beta}_{im}$.
[4] The standard errors of estimating elasticities using CPS recalled hours are in parentheses. When use ATUS hours, we report the standard errors using the formulas in Theorem 4 (under Assumption 5, in round parentheses) and the formulas in Supplementary Appendix A (in square parentheses) using the DTUS correlation matrix.
[5] The elasticities are evaluated at the respective mean hours worked in each data source.
[6] The R squared for impute estimator is the average R squared of the seven linear regression of daily hours worked $H_{it} = X_i'\beta_t + U_{it}$ for $t = 1, \dots, 7$.
[7] For each sample group, we conduct joint Hausman tests regarding whether there are significant differences between $\hat{\beta}_{re}$ and $\hat{\beta}_{im}$.
[8] The other control variables are including age, age-squared, the number of children aged below 5, the number of children aged between 5 and 18, two education dummies, eight Census division dummies, a metropolitan area dummy, race dummies, year dummies, occupation dummies and industry dummies.

Table B.10: Weekly Labour Supply Elasticity Estimates: the CPS and the ATUS (OLS)

Panel A: Mean and std dev of hours and wage				
	Married Men	Unmarried Men	Married Women	Unmarried Women
CPS Usual Weekly Hours Worked	39.63	38.42	32.50	35.52
s.d.	(6.13)	(7.26)	(10.43)	(8.63)
ATUS Hours Worked on Diary Day	4.70	4.74	3.56	4.18
s.d.	(4.55)	(4.44)	(4.00)	(4.21)
ATUS Imputed Weekly Hours Worked	41.39	40.30	31.95	36.18
s.d. (lower bound)[1]	(9.57)	(9.79)	(9.26)	(9.68)
Hourly Wage (2017 US dollars)	21.88	18.65	18.70	16.56

Panel B: Elasticities (hundredths)[2]				
	Married Men	Unmarried Men	Married Women	Unmarried Women
Wage (CPS)	5.24	10.99	15.31	11.47
	(0.89)	(1.06)	(1.25)	(1.07)
Wage (ATUS)	2.18	5.78	11.19	8.56
	(3.15)	(3.14)	(3.20)	(3.16)
	[3.25]	[3.15]	[3.16]	[3.06]
Spouse weekly earnings (CPS)	−0.26		−9.53	
	(0.40)		(0.75)	
Spouse weekly earnings (ATUS)	−2.94		−6.75	
	(1.52)		(2.01)	
	[1.55]		[1.99]	
Num. of kids age <5 (CPS)	−0.80		−8.56	
	(0.49)		(0.82)	
Num. of kids age <5 (ATUS)	−1.07		−8.19	
	(1.91)		(2.08)	
	[1.94]		[2.15]	
Num. of kids ages 5–18 (CPS)	−0.01		−2.87	
	(0.26)		(0.42)	
Num. of kids ages 5–18 (ATUS)	−1.03		−1.26	
	(1.10)		(1.16)	
	[1.10]		[1.19]	
R squared (CPS)	0.08	0.15	0.22	0.15
R squared (ATUS)	0.16	0.24	0.17	0.17
p value of Hausman test	0.35	0.11	0.14	0.36
n of obs.	3889	3816	5602	5731

[1] See footnote 40 in the paper for more details.
[2] The estimates based on the CPS recalled weekly hours are $\hat{\beta}_{re}$; the estimates based on the ATUS diary day hours are $\hat{\beta}_{im}$.
[3] The standard errors of estimating elasticities using CPS recalled hours are in parentheses. When use ATUS hours, we report the standard errors using the formulas in Theorem 4 (under Assumption 5, in round parentheses) and the formulas in Supplementary Appendix A (in square parentheses) using the DTUS correlation matrix.
[4] The elasticities are evaluated at the respective mean hours worked in each data source.
[5] The R squared for impute estimator is the average R squared of the seven linear regression of daily hours worked $H_{it} = X_i'\beta_t + U_{it}$ for $t = 1, \ldots, 7$.
[6] For each sample group, we conduct joint Hausman tests regarding whether there are significant differences between $\hat{\beta}_{re}$ and $\hat{\beta}_{im}$.
[7] The other control variables are including age, age-squared, the number of children aged below 5, the number of children aged between 5 and 18, two education dummies, eight Census division dummies, a metropolitan area dummy, race dummies, year dummies, occupation dummies and industry dummies.

Table B.11: Weekly Labour Supply Elasticity Estimates: the CPS and the ATUS (Year-Month Grouped IV)

Panel A: Mean and std dev of hours and wage				
	Married Men	Unmarried Men	Married Women	Unmarried Women
CPS Usual Weekly Hours Worked	39.63	38.42	32.50	35.52
s.d.	(6.13)	(7.26)	(10.43)	(8.63)
ATUS Hours Worked on Diary Day	4.70	4.74	3.56	4.18
s.d.	(4.55)	(4.44)	(4.00)	(4.21)
ATUS Imputed Weekly Hours Worked	41.56	40.51	31.85	35.79
s.d. (lower bound)[1]	(9.57)	(9.79)	(9.26)	(9.68)
Hourly Pay (2017 US dollars)	21.88	18.65	18.70	16.56

Panel B: Elasticities (hundredths)[2]				
	Married Men	Unmarried Men	Married Women	Unmarried Women
Wage (CPS)	6.04	10.15	21.78	18.81
	(2.68)	(2.93)	(3.97)	(3.51)
Wage (ATUS)	0.00	1.59	−2.10	1.72
	(11.09)	(9.65)	(12.12)	(10.37)
	[13.06]	[11.26]	[13.78]	[12.51]
Spouse weekly earnings (CPS)	−0.18		−11.45	
	(1.27)		(2.59)	
Spouse weekly earnings (ATUS)	0.00		0.49	
	(5.81)		(7.72)	
	[5.89]		[8.73]	
Num. of kids age < 5 (CPS)	−0.91		−8.86	
	(0.49)		(0.82)	
Num. of kids age < 5 (ATUS)	−0.16		−8.52	
	(1.98)		(2.11)	
	[1.98]		[2.19]	
Num. of kids ages 5–18 (CPS)	0.02		−2.77	
	(0.26)		(0.43)	
Num. of kids ages 5–18 (ATUS)	−0.87		−1.87	
	(1.13)		(1.19)	
	[1.15]		[1.25]	
R squared (CPS)	0.08	0.14	0.21	0.13
R squared (ATUS)	0.12	0.20	0.15	0.14
p value of Hausman test	0.59	0.38	0.03	0.08
n of obs.	3889	3816	5602	5731

[1] See footnote 40 in the paper for more details.
[2] The estimates based on the CPS recalled weekly hours are $\hat{\beta}_{re}$; the estimates based on the ATUS diary day hours are $\hat{\beta}_{im}$.
[3] The standard errors of estimating elasticities using CPS recalled hours are in parentheses. When use ATUS hours, we report the standard errors using the formulas in Theorem 4 (under Assumption 5, in round parentheses) and the formulas in Supplementary Appendix A (in square parentheses) using the DTUS correlation matrix.
[4] The elasticities are evaluated at the respective mean hours worked in each data source.
[5] The R squared for impute estimator is the average R squared of the seven linear regression of daily hours worked $H_{it} = X_i'\beta_t + U_{it}$ for $t = 1, \ldots, 7$.
[6] For each sample group, we conduct joint Hausman tests regarding whether there are significant differences between $\hat{\beta}_{re}$ and $\hat{\beta}_{im}$.
[7] The other control variables are including age, age-squared, the number of children aged below 5, the number of children aged between 5 and 18, two education dummies, eight Census division dummies, a metropolitan area dummy, race dummies, year dummies, occupation dummies and industry dummies.