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Abstract

The renewal of interest in macroeconomic theories of search frictions in the goods market requires a deeper understanding of the cyclical properties of the intensive margins in this market. We review the theoretical mechanisms that promote either procyclical or countercyclical movements in time spent searching for consumer goods and services, and then use the American Time Use Survey to measure shopping time through the Great Recession. Average time spent searching declined in the aggregate over the period 2008-2010 compared to 2005-2007, and the decline was largest for the unemployed who went from spending more to less time searching for goods than the employed. Cross-state regressions point towards a procyclicality of consumer search in the goods market. At the individual level, time allocated to different shopping activities is increasing in individual and household income. Overall, this body of evidence supports procyclical consumer search effort in the goods market and a conclusion that price comparisons cannot be a driver of business cycles.

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1 Introduction

The early search and matching literature considered the market for goods and services as the prototypical setting in which buyers and sellers are engaged in a costly and time consuming process to find and establish trading relationships (Diamond, 1982). Firms exert effort and resources advertising their products and maintaining their customer relationships. Consumers spend time selecting and waiting to obtain goods and services, adding and removing items from their consumption basket.[1] Departures from market clearing assumptions introduce a range of possible price determination mechanisms that have important implications for equilibrium allocations in the long run and over the business cycle.

A recent body of research modeling a search frictional goods market with a particular focus on business cycle dynamics agrees on the cyclicality of prices, but not on the cyclicality of effort by consumers searching in the goods market in the aggregate. In Petrosky-Nadeau and Wasmer (2011), Bai et al. (2011), and Gourio and Rudanko (2013), endogenous consumer search effort is procyclical. It increases with income. In Kaplan and Menzio (2013), consumer search effort is exogenous and fixed over time but, by fixing the effort of the unemployed above that of the employed, as the former are assumed to search harder to find better prices, aggregate time shopping appears to be countercyclical. In this paper we first clarify the various interactions between income, shopping time, and working time, and review the theoretical ingredients needed to support the alternative patterns of covariations with the cycle. We then use the detailed daily time use diaries of the American Time Use Survey (ATUS) conducted by the Bureau of Labor Statistics (BLS) to measure the cyclicality of consumer search in the goods market.

From a theoretical perspective, under standard assumptions on utility and cost functions of shopping effort, shopping time depends positively on the surplus from consumption. The consumption surplus itself depends on income. Consumers therefore spend more time and effort to consume following a rise in income. Prices, when they are bargained, respond positively to income and attenuate the procyclicality result. When quantities can adjust, they respond positively to income and thus further raise the consumption surplus. This leads to more procyclicality under price bargaining, but the cyclicality of shopping time disappears under competitive pricing. There

[1]On the procyclicality of advertising and customer relationship building expenditures, along with their implications for product market frictions, see Hall (2012) and Gourio and Rudanko (2013). For a flow approach to a typical household's consumption basket, see Broda and Weinstein (2010) for empirical evidence and Petrosky-Nadeau and Wasmer (2011), Bai et al. (2011), and Michaillat and Saez (2014) for a modeling approach. den Haan (2013) consider the role of product market imperfections for the business cycle of inventories.

are also forces going in the opposite direction. In the face of price dispersion and a reservation search strategy for consumers, an increase in income is associated with a higher reservation price less search effort for goods. Similarly, when working time can be chosen freely, shopping effort and working time covary negatively. Hence, a rise in the hourly wage - due for instance to a productivity innovation generating the business cycle - raises hours if the substitution effect dominates the income effect. This leads to less shopping time.

We then investigate the relations in the data. We obtain three main results. First, we find that aggregate search by consumers in the goods market declined with the onset of the Great Recession. This is true for all labor market statuses, employed, unemployed, and nonparticipants. However, we find that the time allocation to finding and acquiring goods and services declined most for the unemployed. Prior to December 2007 the unemployed, and non-participants, spent more time searching in the goods market than the employed. With the onset of the Great Recession the unemployed drastically reduced their time searching for goods and services, spending less time on this activity than the employed by 2012.

Second, there is a positive relation between cross-state variations in GDP per capita and our different measures of search effort in the goods markets. States with the largest declines in GDP per capita tended to have the largest declines in time spent shopping for goods and services. In Michigan, for instance, there was 21% decline in time spent in this shopping category and a 10% decline in GDP per capita. Oklahoma, with a very different experience over the period in question, experienced a 2% increase in GDP per capita and a 20% increase in shopping time.

Third, we find that search effort in the goods market is increasing in individual income and household income. This result is robust to controlling for state of residence and various demographic characteristics such as age, gender, education, and marital status. The one exception is time spent shopping for groceries, gas, and food, which is unrelated to either income variable. Overall, we don't find much evidence in favor of a negative correlation between income and shopping time.

The time use category most tightly associated with the activity of comparison shopping in the ATUS reveals very little time allocated to this activity. Individuals spend on average 4 seconds per day (25 minutes per year) comparing prices and products. Moreover, nonparticipants and the employed spent more time than the unemployed in this activity. This may indicate that most of the effort made by consumers in the goods market is unrelated to uncovering better prices, although it also suggests that it is difficult to properly measure this activity using the ATUS. Overall, this body of evidence supports a conclusion that price comparisons cannot be a driver of business cycles.

We also confirm a negative correlation between working hours and shopping time found in Aguiar et al. (2013). The opposite finding would have been surprising. The time budget constraint is less tight in a recession. Households have more time to allocate to various non-work activities. However, this does not imply that forces pushing towards a countercyclicality of shopping time dominate over the business cycles, for the reasons indicated above. Our conclusion is that models where the consumption surplus and search effort in the goods market are procyclical are more relevant for discussing business cycles.

Section 2 reviews the various mechanisms at play between income, shopping time, prices, and working time and classifies them into procyclical forces and countercyclical forces. Section 3 describes the ATUS and the time use categories we employ in this study. Section 4 describes aggregate trends in shopping time over the sample period 2003-2012 and according to labor force status. Section 5 then measures the business cycle and income elasticity of time spent searching for goods and services, and discusses some robustness issues. Section 6 discusses the individual regression of shopping time and income. Section 7 concludes.

2 Cyclical forces: surplus from consumption, price bargaining, and price dispersion

Consumers may exert more or less effort in locating products in the goods market. This effort is driven mostly by two different incentives. First, it may be used to match faster with a good and thereby enjoy the associated consumption surplus more quickly. Alternatively, it may be used to locate the best price in the presence of price dispersion across sellers. The two motives may be at play simultaneously. Further, an individual consumer's probability of finding a product in the goods market will depend, in general, on individual effort relative to the effort by other consumers, as well as the amount of consumers and sellers out there in the market.

The purpose of this section is to identify the mechanisms that lead to either procyclical or countercyclical effort over the business cycle. To start with some specific notation, let e_c denote the level of individual consumer search effort, in contrast to the aggregate search effort by other consumers in the goods market that we denote $\bar{e}_c$. At the individual level, the probability of finding a particular good is given by $(e_c/\bar{e}_c)\lambda$, where λ is an aggregate contact rate with a product in the goods market. This rate depends on the aggregate amount of consumers and sellers in the market. If the aggregate amounts of consumers and sellers in the goods market are denoted by, respectively, C and S, the matching literature typically postulates an increasing aggregate matching function $M(\bar{e}_c C, S)$ that governs the number of matches per unit of time. As such, the aggregate rate of matching for consumers is given by $\lambda = M(\bar{e}_c C, S)/C$.[2]

Assume that the consumer preferences are summarized by an increasing and concave utility function $v(x, y)$ associating two goods: a search good denoted by x, and all other goods acquired on frictionless markets, y.

Once in a match with a seller, a consumer spends px out of disposable income ω to consume the search good. The remaining income is spent on the consumption of other goods. We use the following compact notation: $v(\mathbf{1}) = v(x, \omega - px)$ denotes the utility from consuming the search good, and $v(\mathbf{0}) = v(0, \omega)$ denotes the utility from consuming the only the other goods. $\Delta v \equiv v(\mathbf{1}) - v(\mathbf{0})$ denotes their difference.[3] Hence, the value of the consumer's surplus is given as:

$$\Omega_c = v(x, \omega - px) - v(0, \omega) = v(\mathbf{1}) - v(\mathbf{0}) = \Delta v \tag{2}$$

The properties of Δv and its derivatives with respect to y and x will be very important for what follows. In particular, we will assume marginal decreasing utility in both goods ($v_{yy} < 0$ and $v_{xx} < 0$). Under separability between the two types of goods, this leads in particular to

$$\Delta v_y \equiv (v_y(\mathbf{1}) - v_y(\mathbf{0})) > 0 \tag{3}$$

A marginal unit of consumption of good 0 has a greater value when the agent diverts part of its income to also consume the search good. The same is true under nonseparability when the degree of substituability between the two goods is not strong enough. Appendix A.2 derives this more general case.

Consumers incur a cost to search effort in the goods market described by the increasing and convex function $\sigma(e_c)$, with elasticity $\eta_c > 1$. Given this environment, the generic optimality

[2] Appendix A.1 explores a more general specification of individual consumption match probability where individual and aggregate efforts are complementary, allowing for different consumption effort externalities.

[3] We also denote by a subscript x or y the first-order derivative of any function of x and y. For instance, the full differentiation of the consumption surplus with respect to a change in income ω and price p is given by:

$$\begin{aligned} d\Delta v &= (v_y(x, \omega - px) - v_y(0, \omega))\, d\omega - x v_y(x, \omega - px) dp = (v_y(\mathbf{1}) - v_y(\mathbf{0}))\, d\omega - x v_y(\mathbf{1}) dp \\ &= \Delta v_y d\omega - x v_y(\mathbf{1}) dp \end{aligned} \tag{1}$$

condition for consumer search effort states that effort is increasing in the expected surplus from finding a good in the product market:

$$\sigma'(e_c) = \frac{\lambda}{\bar{e}_c}\Omega_c \tag{4}$$

On the other side of the market, a seller has a cost of providing the search good $\kappa(x)$, with $\kappa_x, \kappa_{xx} > 0$. The seller's surplus to the match is

$$\Omega_f = px - \kappa(x) \tag{5}$$

2.1 Surplus sharing with a fixed supply of the search good x

Assume for the moment that the supply of the search good is fixed at some level. We explore two alternative pricing rules.

Price setting - simple sharing rule:

The simplest price setting mechanism is a price that equalizes the surplus to the consumer and the firm, i.e., such that $\Omega_c = \Omega_f$. This results in a simple price rule:

$$xp = \Delta v + \kappa(x) \tag{6}$$

A positive, procyclical, shock to income $d\omega$, keeping the cost κ constant, leads to:

$$x\frac{dp}{d\omega} = \frac{\Delta v_y}{1 + v_y(\mathbf{1})} > 0 \tag{7}$$

The assumption that utility is increasing, concave and separable in x and y, implies that the price varies positively with income.[4]

The cyclicality of the consumer and firm match surpluses follows easily from their definitions in equations (2) and (5). We have under the inequality (3):

$$\begin{aligned}\frac{d\Omega_f}{d\omega} &= x\frac{dp}{d\omega} > 0 \\ \frac{d\Omega_c}{d\omega} &= \Delta v_y - xv_y(\mathbf{1})\frac{dp}{d\omega} = \frac{\Delta v_y}{1 + v_y(\mathbf{1})} > 0\end{aligned}$$

[4]See Appendix A.2 for a more general case where the inequality holds under imperfect substitutability between y and x. See also Petrosky-Nadeau and Wasmer (2014) for an application of this property to fiscal shocks in a frictional goods market.

Hence, a positive income shock raises the consumer's surplus and, from the optimal search effort condition (4), individual search effort in the goods market. Moreover, the same shock will raise the number of sellers, thus raising λ. Therefore, consumer search effort is procyclical.

Price setting - Nash bargaining:

The results are similar under a formal Nash-sharing rule with the exception that the marginal utility of the composite good y now affects the bargained price. Assuming equal bargaining weights, the price is set to maximize the Nash-product $[\Delta v]^{1/2}[px - \kappa(x)]^{1/2}$, and must satisfy a sharing rule similar to equation (6) but with the marginal utility of goods y appearing in the denominator of the consumption surplus Δv:

$$xp = \Delta v / v_y(\mathbf{1}) + \kappa(x) \tag{8}$$

A positive, procyclical, shock to income ω, $d\omega$, keeping the marginal cost κ constant, leads to (see Appendix for the derivation):

$$x\frac{dp}{d\omega} = \frac{\Delta v_y v_y(\mathbf{1}) - v_{yy}(\mathbf{1})\Delta v}{2v_y^2(\mathbf{1}) - v_{yy}(\mathbf{1})\Delta v}$$

with the same conclusion as we found previously by the fact that $v_{yy} < 0$. The effect of an income shock on the price and surplus remains positive. It is still the case that consumer search effort is procyclical.

2.2 Endogenous supply of the search good x

Now assume that, at the time of the match, sellers can react to the demand of matched consumers by varying instantaneously their production of x at cost $\kappa(x)$. Different pricing and bargaining assumptions may be introduced here.

Nash-bargaining on price p and quantity x

Assume that the seller and the consumer can bargain over two dimensions: p and x. The Nash problem is:

$$p, x = \text{argmax}\,[v(x, \omega - px) - v(0, \omega)]^{1/2}\,[px - \kappa(x)]^{1/2}$$

The maximization of the Nash-product with respect to the price leads to a pricing rule identical to equation (8). The maximization of the Nash-product with respect to the quantity produced leads to

$$\frac{\Delta v}{v_x(\mathbf{1}) - p v_y(\mathbf{1})} + \frac{xp - \kappa(x)}{p - \kappa_x} = 0 \tag{9}$$

Combining (8) and (9) leads to the equality between the marginal production cost and the marginal utility of the good divided by its marginal utility cost:

$$\kappa_x(x) = \frac{v_x(\mathbf{1})}{v_y(\mathbf{1})} \tag{10}$$

Again, the key for the elasticity of consumer search effort to an income shock is the response of the surplus $\Omega_c = \Delta v$. This can be decomposed by differentiating equation (2) into income, quantity, and price effects:

$$\frac{d\Omega_c}{d\omega} = \frac{d\Delta v}{d\omega} = \underbrace{\Delta v_y}_{\text{Change in income:}>0} - \underbrace{x v_y(\mathbf{1}) \frac{dp}{d\omega}}_{\text{Change in price}} + \underbrace{[v_x(\mathbf{1}) - p v_y(\mathbf{1})] \frac{dx}{d\omega}}_{\text{Change in quantity}} \tag{11}$$

The direction of search effort with endogenous price and quantity is ambiguous. The income effect raises the surplus but, if the price increases with income, this will reduce the surplus. Moreover, the quantity effect may increase or decrease the surplus depending on the sign of the bracketed term, which is positive if the marginal utility from consumption 1 (being able to consume the search good) exceeds its opportunity cost pv_y. One may presume that the production of the search good in a match is increasing in income ω and decreasing in the price p, while the price increases with income. In that case, under small marginal utility of the composite good y (small v_y) and large marginal utility from the search good (large v_x), the positive effect would dominate.

More specific cases

Some additional results can be obtained in specific cases. First, if utility is linear in y , then both x and p become independent of income ω. Therefore the consumer's surplus and search effort in the goods market become independent of the business cycle.[5]

Second, a similar result holds under the alternative assumption of an exhaustion of profit margins. This would be the case if the market price is such that $p = \kappa(x)$. The firm's surplus vanishes to zero. If in addition workers and firms bargain on the quantity, the consumption surplus will also vanish. Hence, search effort will not react to the cycle due to the surplus. Consumers may

[5]This is shown in Appendix A.4. However, this result does not hold in the general case derived in Appendix A.4.

however respond to further entry of firms. An increase in S raises the contact rate λ, implying once again that search effort will be procyclical.

Third, if one assumes that the quantity x is chosen so as to share the surplus equally, while the price is equal to the marginal cost of production with a markup to account for ex post monopoly power, again a large utility from the search good and small utility from the composite leads to a positive effect of income on the surplus and search effort.[6]

2.3 Price posting with homogeneous consumers and a given distribution of prices

Assume that the search good has different prices in different locations. Consumer search effort is now also motivated by finding better prices. Let $G(p)$ be the c.d.f. of prices. The program of a searching, unmatched consumer with income ω and search effort cost $\sigma(e_c)$ can be represented by the Bellman equation $D_U(e_c)$, while $D_M(p)$ describes the asset value of being matched at price p:

$$rD_U(e_c) = v(0,\omega) - \sigma(e_c) + \frac{e_c}{\bar{e}_c}\lambda \int^{p_R} \left(D_M(p) - D_U(e_c)\right) dG(p) \tag{12}$$

$$rD_M(p) = v(x, \omega - px) + \tau \left[D_U(e_c) - D_M(p)\right] \tag{13}$$

where p_R is the reservation price above which the consumer keeps searching, τ is an exogenous destruction of the consumption match and r is a constant discount rate.

The value of searching in the goods market, D_U, is maximized by varying the level of effort. The reservation price p_R satisfies an indifference condition $rD_M(p_R) = rD_U$. In a symmetric equilibrium where $e_c = \bar{e}_c$, optimal search effort and reservation price are given by the conditions:

$$\eta_c \sigma_c(e_c^*) = \lambda \int^{p_R} (D_M(p) - D_U(e_c^*))dG(p) \tag{14}$$

$$\sigma(e_c^*) + v(x, \omega - p_R x_1) - v(0,\omega) = \lambda \int^{p_R} (D_M(p) - D_U(e_c^*))dG(p) \tag{15}$$

which combined yield a relation between search effort, income, and the reservation price:

$$(\eta_c - 1)\sigma_c(e_c^*) \quad = \quad v(x_1, \omega - p_R x) - v(0,\omega) \tag{16}$$

For a given level of the reservation price, the right-hand side is procyclical under concavity of the utility function with respect to income. This is the procyclical channel of income on search effort

[6] See Appendix A.4 for details.

outlined in earlier sections. The key countervailing force is the movement in the reservation price. If p_R varies procyclically, then the second term has a countercyclical component. That is, an increase in the reservation price leads to a decline in the expected payoff to search in the goods market, and reduces the incentive to exert effort in searching. Variations in the reservation price must therefore be studied jointly with variations in effort. Differentiating equation (16), we have:

$$(\eta_c - 1)\sigma'{}_c(e_c^*)\mathrm{d}e_c^* = [v_y(x, \omega - p_R x) - v_y(0, \omega)]\,\mathrm{d}\omega - x v_y(x, \omega - p_R x)\mathrm{d}p_R \tag{17}$$

It can be shown that $dp_r/d\omega > 0$. A reservation price increasing in income limits the positive response of consumer search effort to an income shock.

The link between the distribution of prices and search effort in the goods market is ambiguous. The mechanisms are similar to the relation between wage dispersion and job search. In the labor market, more dispersed wages lead workers, ceteris paribus, to be more picky about wage offers. This raises their reservation wage and reduces the so-called hazard rate (the exit rate from unemployment to employment). To compensate, workers may reduce their search effort if the lower hazard rate discourages them, or raise it if the surplus value of getting better jobs dominates. Transposed to search for products, price dispersion may reduce the reservation price p_R with an ambiguous effect on shopping effort.

2.4 Correlation between income, shopping time, and working time

So far, we have assumed that working time was indivisible and the supply of shopping time was elastic, only limited by the cost of supplying effort. We now relax this assumption and generate a setup that allows us to discuss the findings of Aguiar et al. (2013) and how they differ from ours.

Let h and e_c be the two relevant time inputs, working time and shopping effort, respectively. We remain close to the previous analysis, ignoring other nonworking time, and consider an environment similar to Section 2.1 to determine a consumer's optimal choices. We assume that e_c and h enter additively in the cost of effort function, and that the choice of hours is made before the consumer is actually matched with a good. The consumer knows the matching probability in the goods market $m(e_c) = e_c\lambda/\bar{e_c}$ and the separation probability in the labor market (denoted by s) so that (s)he expects to be matched $\alpha(e_c) = m/(m+s)$ of the time.[7] The first-order conditions for e_c and h,

[7]The special case where agents choose hours worked while they search for goods corresponds to the case $\alpha(e_c) = 0$. The special case where agents choose hours worked while they consume corresponds instead to $\alpha(e_c) = 1$.

respectively, are given by:

$$\sigma'(e_c + h) = \frac{\lambda}{\bar{e}_c}\Omega_c(h) \tag{18}$$

$$\sigma'(e_c + h) = \alpha(e_c)\frac{dv}{dh}(x, h\omega - p(h)x) + (1 - \alpha(e_c))\frac{dv}{dh}(0, h\omega) \tag{19}$$

where $\Omega_c(h) = v(x, h\omega - px) - v(0, h\omega)$. Inspection of equation (18) shows that an increase in h increases the cost of an extra unit of shopping time. However, it also affects the right-hand side. In particular, it raises Ω_c by $\omega\,[v_y(x, h\omega - px) - v_y(0, h\omega)]$ which, under the same separability and concavity assumptions as in the benchmark case of Section 2.1, is positive. Hence, we expect an increase in hours worked to decrease shopping time and, reciprocally, a drop in hours worked to raise shopping effort. The response of search effort in the goods market to an income shock, however, is ambiguous and explored empirically in the rest of the paper.

3 Searching for goods and services in the ATUS

We use data from the 2003-2012 waves of the ATUS, conducted by the BLS drawing on individuals from the exiting sample of the Current Population Survey (CPS). The types of activities recorded in the ATUS are described in detail in Hammermesh et al. (2005), and have been used to document changes in overall time use during the Great Recession (Aguiar et al. 2013), with a particular emphasis on how individuals reallocate decreased hours of market work to other activities.

We focus on time spent in the process of selecting and acquiring goods and services. Our measure of time spent shopping for market goods and services is divided into three broad categories. Each category is mutually exclusive and sum to total time spent shopping:[8]

1 - **Consumer goods and services** is divided into three subcategories. The first is time spent shopping other than for groceries, gas, and food. The second is time spent researching purchases. The third corresponds to waiting associated with purchasing services.

2 - **Groceries, Gas, and Food (GGF)** includes all time spent shopping for groceries, gas, and food. We present results for all three subcategories.

3 - **Travel time** includes all travel associated with the purchasing of goods and services.

[8] Appendix B.1 provides the ATUS time use codes that compose each category.

We focus on the population ages of 24 and 55. We exclude the population aged 16 to 24 because labor force status, such as unemployment and participation, line up very closely with the CPS based rates published by the BLS for all age groups except this younger group.[9] We remove those aged 55 and over because labor farce participation rates for these individuals decline dramatically, whereas our main results emphasize differences across labor force status. We also exclude respondents with a positive amount of unclassified time. In total with have 66,958 individuals in our sample for the baseline results.[10] We use the sample weights provided by the ATUS to aggregate responses to either year or state-year averages.

4 Aggregate trends in shopping time

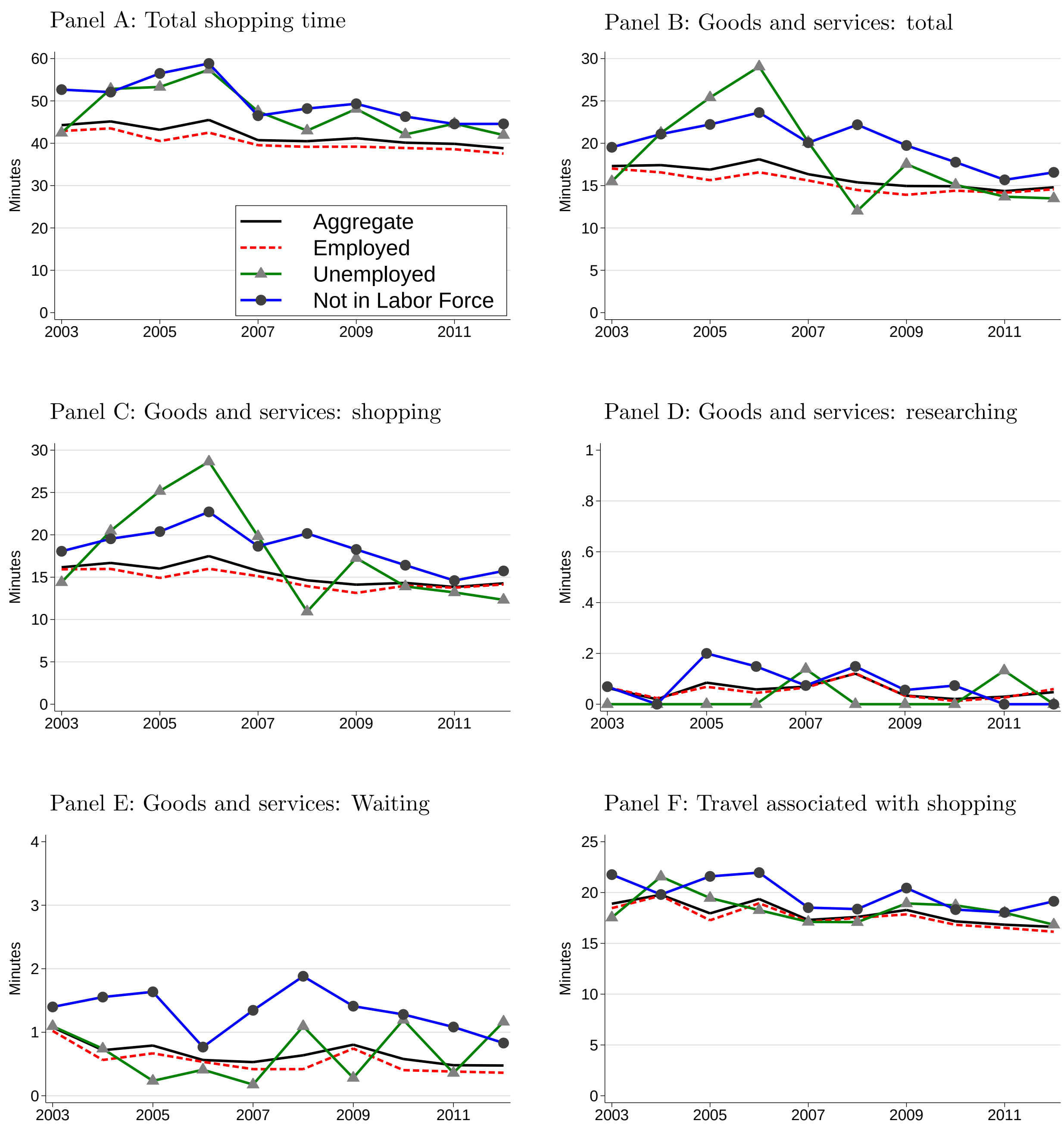
Figure 1 plots the annual data for our main components of shopping time, in the aggregate – averaging across all individuals in the sample (solid black line) – and by labor force status. Time spent by the employed is plotted by the red dashed line, time spent by the unemployed by the triangle green line, and time spent by nonparticipants by the blue circled line. Table 1 provides the average values for the sample period, 2003 to 2012. The table also reports averages by gender and marital status, as well as for the population over age 55.

Aggregate time spent shopping for goods and services, plotted in Panel A of Figure 1, averaged 42 minutes per day over the sample period. Two main observation arise from this first look at the data. First, individuals not in the labor force spend the most time shopping for goods and services, an average of 50 minutes a day. Second, individuals not in the labor force and unemployed display a similar pattern of total time spent shopping for goods and services, with a pronounced decline in time spent starting in 2007.

[9] We have attempted to identify the reasons for this discrepancy with the BLS in private communications but have so far been unsuccessful.

[10] Appendix B provides more details for these deletions. The results for the whole age sample change very little. The results are available upon request.

Figure 1: Shopping time: ages 25 to 54 by labor force status



The solid black line represents the aggregate for the age category 25 to 54 years. Time spent by the employed is plotted by the red dashed line, time spent by the unemployed by the triangle green line, and time spent by nonparticipants by the blue circled line. The ATUS definition for time spent in Panels A though F are detailed Appendix B.1.

Table 1: Shopping time by labor force status and by age - minutes per day

	Ages: 25 to 54										Age:
		Labor force status			Men			Women			
Categories	Agg.	Emp.	Unem.	NLF	All	Married	Single	All	Married	Single	55+
Total Shopping Time	42.0	40.2	47.3	50.1	34.2	34.6	33.6	49.8	52.5	45.2	44.9
Consumer Goods and Servies	16.1	15.3	18.3	20.0	12.3	12.6	11.9	19.8	20.8	18.1	17.4
-Consumer Goods	15.3	14.7	17.6	18.4	11.8	12.1	11.4	18.9	20.0	17.0	15.7
-Researching G&S	0.07	0.05	0.03	0.20	0.06	0.07	0.04	0.09	0.07	0.13	0.07
-Waiting for services	0.67	0.55	0.68	1.32	0.51	0.51	0.51	0.82	0.72	1.00	1.55
Groceries, Gas, and Food	7.91	7.31	10.7	10.3	5.82	5.82	5.82	10.0	10.8	8.67	8.48
-Groceries	6.25	5.56	9.36	9.06	4.22	4.24	4.18	8.31	9.10	6.89	7.32
-Gas	0.41	0.43	0.35	0.30	0.42	0.44	0.39	0.39	0.37	0.42	0.38
-Food	1.25	1.32	0.94	0.95	1.18	1.13	1.24	1.33	1.31	1.36	0.78
Travel time	18.0	17.6	18.4	19.8	16.0	16.1	15.9	20.0	20.9	18.4	19.0

Notes: ATUS, sample restricted to respondents with no unclassified time. "Agg.," "Emp.," "Unem.," and "NLF" correspond to "Aggregate," "Employed," "Unemployed," and "Not in Labor Force." For the baseline sample of individuals aged 25 to 54, there were 10,434 respondents per year, on average. Marital status refers to the presence of a spouse and does not include unmarried partners.

The second panel of Figure 1 plots time spent shopping for goods and services other than groceries, gas, and food, and excluding the time spent traveling associated with shopping activities. This is the core measure of search effort by consumers in the goods market. The average time spent in a day over the period 2003-2012 is 16 minutes, with nonparticipants spending the most time, 20 minutes a day. Interestingly, the unemployed start out resembling nonparticipants early in the sample time period, even spending more time shopping for goods and services by a significant margin in 2006. In the second half of the sample, after the onset of the Great Recession, the unemployedt are very similar to the employed in time spent shopping for goods and services. By 2012, the unemployed spend less time shopping for goods and services than the employed.

Average time spent in researching goods and services is small, averaging 0.07 minute a day. However, we note that nonparticipants spent the most time, 0.20 minute, and that the employed spent on average more time than the unemployed researching goods and services (see Table 1). Finally, time spent waiting associated with the acquiring of goods and services averages 0.67 minute a day. The employed and unemployed spent about the same amount of time waiting, while individuals not in the labor force wait twice as long, or 1.3 minutes.

Individuals spend on average 8 minutes a day purchasing groceries, gas, and food, the bulk of which is spent purchasing groceries (6 minutes), and an average of 18 minutes a day in travel associated with purchasing goods and services.

The last columns of Table 1 report the time spent shopping for goods and services for men and women, each according to marital status, as well as for individuals age 55 and older. Women spend 15 more minutes a day shopping for goods and services relative to men. The largest difference is in the shopping for goods and services category. Conditioning on marital status reveals little difference in the pattern of time spent searching for and acquiring goods and services across married and single men. Married women spend 7 more minutes a day in total shopping time than single women. Time spent shopping for groceries show the most important differences across married and single women, along with travel time associated with shopping for goods and services. The last column reports that individuals over age 55 spend, on average, 3 more minutes a days shopping than individuals aged 25 to 54.

5 Shopping time and the business cycle

The ATUS does not cover an entire business cycle at the moment. This renders the discussion of trends and cycle in time use data delicate. We address this question in the first subsection by comparing average time spent shopping for goods and services by individuals in the three years leading up to and three years following the start of the Great Recession. Next, we estimate the elasticity of time spent on different goods market search categories over the business cycle in the manner of Aguiar et al (2013). That is, we exploit cross-state variations in time spent and a measure of state business cycles. We then look at the relationship between individual and household income and our measure of shopping time, as well as changes in hours of market work. In each section we emphasize differences across labor market statuses.

5.1 The cycle and goods market search

A first step in examining the cyclicality of search time in the goods market, presented in Table 2, is to compare the average time spent on our different subcategories over two time periods. This also has the advantage, as argued by Aguiar et al. (2013), of smoothing some year-to-year noise in the ATUS.[11] The periods we compared are the expansion years of 2005-2007 prior to the onset of the Great Recession in December 2007, to the following three years, 2008-2010. The sample in Table 2 Panel A are all individuals in the age category 25 to 54, our baseline. Panel B reports the results for employed individuals, while Panels A and B of Table 3, respectively, report the results for unemployed individuals and persons not in the labor force.

The first two columns of Table 2 present the average time spent in each category for the two periods. The third column presents the unconditional difference in time spent over the two periods. The last column presents the difference in time spent conditioning on age, education, race, gender, marital status, and the presence of children.

Overall time spent shopping saw a statistically significant decline of 2.5 minutes per day in 2008-2010 compared with 2005-2007. A closer examination reveals that the decline is concentrated in the consumer goods and services category. None of the increases in time spent shopping is statistically

[11] It does not appear appropriate to remove a time trend from the data when the sample does not cover an entire business cycle. Such a transformation will introduce a bias in the direction of the differences that reflects the fraction of the cycle actually covered by the said sample, and on the state of the cycle at the start of the sample. The next section will use cross-state changes in GDP and time use in order to further investigate the cyclicality of shopping time.

Table 2: Shopping time by period - minutes per day

Panel A: Full sample

Categories	Average 2005-2007 (1)	Average 2008-2010 (2)	Difference 2008-2010 vs 2005-2007 Unconditional (3)	Difference 2008-2010 vs 2005-2007 Conditional (4)
Total Shopping Time	43.1	40.7	-2.49 **	-2.44 **
Consumer Goods and Servies	17.1	15.1	-1.97 ***	-1.92 ***
-Consumer goods	16.4	14.4	-2.06 ***	-2.01 ***
-Researching G&S	0.07	0.11	0.04	0.04
-Waiting for services	0.63	0.67	0.05	0.04
Groceries, Gas, and Food	7.83	7.84	0.01	0.03
- Groceries	6.17	6.13	-0.04	-0.01
- Gas	0.38	0.46	0.08 ***	0.08 ***
- Food	1.28	1.25	-0.03	-0.04
Travel time	18.2	17.7	-0.53	-0.55

Panel B: Employed individuals

Categories	Average 2005-2007 (1)	Average 2008-2010 (2)	Difference 2008-2010 vs 2005-2007 Unconditional (3)	Difference 2008-2010 vs 2005-2007 Conditional (4)
Total Shopping Time	40.9	39.1	-1.78 *	-1.87 *
Consumer Goods and Servies	15.9	14.3	-1.68 ***	-1.68 ***
-Consumer goods	15.3	13.7	-1.66 ***	-1.65 ***
-Researching G&S	0.06	0.06	-0.004	-0.002
-Waiting for services	0.56	0.52	-0.02	-0.02
Groceries, Gas, and Food	7.14	7.42	0.28	0.27
- Groceries	5.42	5.6	0.18	0.18
- Gas	0.39	0.48	0.09 **	0.09 ***
- Food	1.32	1.34	0.02	0.005
Travel time	17.8	17.4	-0.38	-0.46

Notes: ATUS using individual demographic and time use information. Sample restricted to respondents of age 25 to 54 (Panel A), and employed (Panel B), and have no amount of unclassified time use. Columns 1 and 2 report average minutes per day spent on various shopping activities during 2005-2007 and 2008-2010. Column 3 reports the unconditional difference and Column 4 reports the conditional difference in a regression controlling for age, education, race, gender, marriage status, and the presence of children. The asterisks *, ** ,and *** denote statistical significance at 10%, 5%, and 1% levels, respectively.

Table 3: Shopping time by period - minutes per day

Panel A: Unemployed individuals

Categories	Average 2005-2007 (1)	Average 2008-2010 (2)	Difference 2008-2010 vs 2005-2007 Unconditional (3)	Conditional (4)
Total Shopping Time	52.7	44.4	-8.34	-9.01 *
Consumer Goods and Servies	24.9	14.9	-9.98 ***	-10.3 ***
-Consumer goods	24.5	14	-10.5 ***	-10.9 ***
-Researching G&S	0.05	0	-0.05	-0.05
-Waiting for services	0.27	0.86	0.58	0.64
Groceries, Gas, and Food	9.59	11.3	1.67	1.6
- Groceries	8.1	10	1.94	1.88
- Gas	0.27	0.49	0.21	0.22
- Food	1.22	0.73	-0.49 *	-0.5 *
Travel time	18.3	18.2	-0.03	-0.28

Panel B: Individuals not in the labor force

Categories	Average 2005-2007 (1)	Average 2008-2010 (2)	Difference 2008-2010 vs 2005-2007 Unconditional (3)	Conditional (4)
Total Shopping Time	54	48.3	-5.67 *	-5.09 *
Consumer Goods and Servies	22	20.3	-1.7	-1.45
-Consumer goods	20.6	18.3	-2.32	-1.89
-Researching G&S	0.14	0.5	0.36	0.28
-Waiting for services	1.25	1.52	0.27	0.17
Groceries, Gas, and Food	11.3	8.99	-2.3 ***	-2.23 **
- Groceries	9.96	7.75	-2.21 **	-2.15 **
- Gas	0.33	0.35	0.03	0.03
- Food	1.01	0.89	-0.11	-0.11
Travel time	20.7	19	-1.67	-1.41

Notes: ATUS using individual demographic and time use information. Sample restricted to respondents of age 25 to 54 who are unemployed (Panel A) or not in the labor force (Panel B), and have no of unclassified time use. Columns 1 and 2 report average minutes per day spent on various shopping activities during 2005-2007 and 2008-2010. Column 3 reports the unconditional difference and Column 4 reports the conditional difference in a regression controlling for age, education, race, gender, marriage status, and the presence of children. The asterisks *, **, and *** denote statistical significance at 10%, 5%, and 1% levels, respectively.

significant, with the exception of time spent purchasing gas. Presumably individuals are willing to commute greater distances to work at scarce jobs. Moreover, the conditional difference in time spent is almost identical to the unconditional difference.

We find that the largest decline in time spent shopping for goods and services is by the unemployed. Time spent shopping for consumer goods and services declines by 10 minutes for the unemployed, compared with 1.7 minutes for the employed. Both declines are highly statistically significant. This decline is slightly larger for the unemployed after controlling for other individual characteristics. The corresponding time use categories for nonparticipants also declines, but the difference is not statistically significant.

This finding relates to the composition of individuals across labor market statuses and aggregate search effort in the goods market. Prior to the onset of the Great Recession, the unemployed spent more time searching for goods and services than the employed: 24.5 minutes against 15.3 by the employed. As such, the rapid increase in unemployment in 2008 and 2009 could have led to an increase in aggregate search effort in the goods market. The ATUS data show that this was not the case. Shopping time of the unemployed declined to an average of 14 minutes in the 2008-2010 period, below the average of 13.7 for the employed. Since shopping time declined for every labor force status, aggregate search time declined (Panel A of Table 2). Again, the search effort of the unemployed declined most during the recession. By the end of the sample, the unemployed spent less time than the employed searching in the goods market.

Average time spent shopping for groceries, gas, and food, just as travel time associated with shopping, saw essentially no change across time periods. This is true across labor force statuses, with one exception. There is a 2.3 minute decline in time spent shopping for groceries by individuals not in the labor force.

5.2 Cross-state variations in shopping time

We define the state-level aggregates of time use of category j as follows:

$$\tau_{st}^{j} = \sum_{i=1}^{N_{st}} \left(\frac{\omega_{ist}}{\sum_{i=1}^{N_{st}} \omega_{ist}} \right) \tau_{ist}^{j}, \tag{20}$$

where τ_{ist}^{j} represents minutes per day by individual i from state s during period t spent on time use category j. N_{st} is the total number of individuals in our sample from state s during period

t and ω_{ist} is the ATUS sampling weight.[12] We then construct state-level differences in shopping between the 2005-2007 period and 2008-2010 period, along with corresponding changes in state real GDP per capita. Figure 2 plots the log change in state GDP per capita against the log change in different categories of shopping time in the corresponding state. Panel A corresponds to total shopping time, panel B corresponds to time spent shopping for goods and services, panel C for groceries, gas and food, and panel D corresponds to the travel time associated with shopping. Each panel also plots a cross-state regression line using state population as regression weights.

The pattern in panel A of Figure 2 is clear. States with the strongest decline in GDP per capita experienced the most significant decline in total shopping time. Likewise, states that saw an increase in GDP per capita also saw an increase in total shopping. In Michigan for instance, there was a 21% decline in time spent and a 10% decline in GDP per capita. Oklahoma, with a very different experience over the period in question, experienced a 2% increase in GDP per capita and an 20% increase in shopping time. The regression line has a positive slope with coefficient 1.09, implying that, on average, a 1% decline in state GDP per capita coincided with a 1.1% decline in total time spent shopping.

Time spent shopping for goods and services, in Panel B, shows a similar pattern of decline with the contraction of state GDP. The regression line has a slope of 1.60, implying a stronger positive relation than in the case of total shopping time.

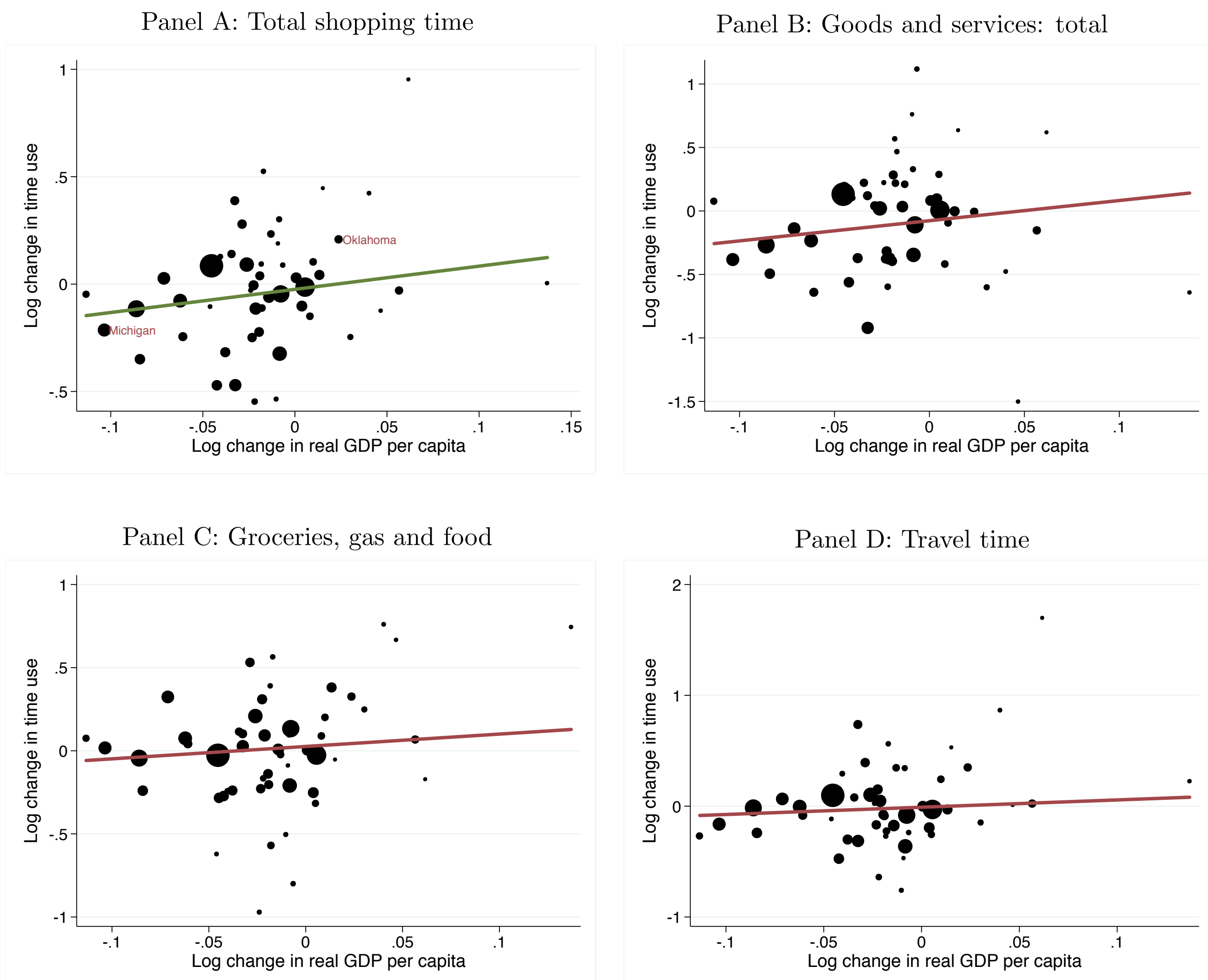
The state-level changes in time spent shopping for groceries, gas, and food or travel time associated with shopping have a weaker positive relation to changes in state GDP per capita, but neither is significant. Most states, especially the most populous, saw virtually no change in the time spent shopping for groceries, gas, and food (see Panel C).

6 Individual regressions

This section examines the relationships between two measures of income, household and individual, and search activity in the goods market in the ATUS. In the first case we use reported household income brackets. In the second case we use reported weekly earnings in the CPS files. Both

[12] Unlike the CPS, which is designed to produce reliable estimates at both the state and national level, the ATUS only has a national reliability requirement. Less populous states constitute a smaller proportion of the ATUS sample and will not produce estimates as reliable as for the more populous states. We use the average state population between 2003 and 2012 as weights in the regressions to account for this concern regarding the state-level estimates.

Figure 2: Cross-State variations in shopping time: 2008-2010 vs. 2005-2007



approaches uncover a positive relation between income and search effort in the goods market. The results are strongest for shopping for goods and services and time spent traveling associated with shopping. We find no evidence in the time use data that individuals with lower incomes search far and wide.

6.1 Household income

We consider the relation between household income and consumer search in the goods market using six income categories: (1) \$0 to \$24,999; (2) \$25,000 to \$49,999; (3) \$50,000 to \$74,999; (4) \$75,000 to \$99,999; (5) \$100,000 to \$149,999, and; (6) \$150,000 and over, and running the following regression:[13]

$$\tau_{ist}^{j} = \alpha^{j} + \beta^{j} F_{ist} + D_t + S_i + \delta X_{ist} + \epsilon_{ist}, \tag{21}$$

where F_{ist} is a vector of family income categorical variables, D_t is a time dummy, S_i is a state dummy, and X_{ist} is a vector of demographic and educational variables.

Table 4 reports the estimated coefficients on income categories 2 to 6. Each coefficient represents the increment in shopping time for an increment in the household income categories relative to the first household income category \$0-\$24,999. For instance, total shopping time for households with an income between \$100,000 and \$150,000 (category 5) is 5 to 7 minutes greater than average shopping time by an individual in a household with income in the \$0 to \$24,999 bracket (category 1). After controlling for various individual characteristics (column I), this is robust to including both time and state (columns II and III), as well as labor force status dummy variables (column IV).

The three broad subcategories show that both time spent shopping for consumer goods and services, as well as the associated travel time, are increasing in household income, and the differences are highly statistically significant. For instance, households in the \$50,000 to \$75,000 income bracket (category 3) spend an extra 1.3 minutes shopping for goods and services and an extra 1.8 minutes waiting. Households in the \$100,000 to \$150,000 income bracket (category 5) spend an extra 3.9 minutes shopping for goods and services and an extra 2.6 minutes waiting. There appears not to be any statistically significant relationship between time spent shopping for groceries, gas, and food and household income.

[13]The ATUS provides two family income variables – hufaminc for 2002-2009 and hefaminc for 2010-2012 – with the distinction that the second variable has been edited to leave no empty responses.

Table 4: Individual level regression of shopping time on household income

Category	HH. Income	I	II	III	IV
Total Shopping Time	2	1.53	1.52	1.41	3.00 ***
	3	1.34	1.42	1.37	3.30 ***
	4	4.01 ***	3.97 ***	3.62 ***	5.73 ***
	5	4.36 ***	4.99 ***	4.45 ***	6.59 ***
	6	4.86 ***	5.69 ***	4.90 ***	6.90 ***
Consumer Goods and Servies	2	0.86	0.84	0.82	1.52 ***
	3	0.41	0.43	0.47	1.32 **
	4	1.85 ***	1.79 ***	1.76 **	2.69 ***
	5	2.75 ***	3.06 ***	2.93 ***	3.86 ***
	6	1.44	1.86 **	1.65 *	2.52 ***
Groceries, Gas and Food	2	-0.02	0.00	-0.04	0.45 *
	3	-0.43	-0.41	-0.45	0.14
	4	-0.34	-0.31	-0.45	0.20
	5	-0.35	-0.30	-0.51	0.15
	6	-0.32	-0.26	-0.54	0.09
Travel time	2	0.69	0.68	0.63	1.03 **
	3	1.36 ***	1.40 ***	1.35 ***	1.84 ***
	4	2.51 ***	2.49 ***	2.31 ***	2.84 ***
	5	1.96 ***	2.23 ***	2.03 ***	2.58 ***
	6	3.73 ***	4.09 ***	3.79 ***	4.29 ***
Demo. controls		Yes	Yes	Yes	Yes
Time dummy		No	Yes	Yes	Yes
State dummy		No	No	Yes	Yes
LFS dummy		No	No	No	Yes

There are six income categories: (1) \$0 to \$24,999; (2) \$25,000 to \$49,999; (3) "\$50,000 to \$74,999; (4) \$75,000 to \$99,999; (5) \$100,000 to \$149,999, and; (6) \$150,000 and over. The table reports the estimated coefficients on income categories 2 to 6. The demographic controls are for age, education, gender, marital status, race, and the presence of children. "LFS" stands for the inclusion of a labor force status indicator. We restrict our sample to respondents aged 25-54 and with zero unclassified time for 66,958 observations in total. The asterisks *, **, and *** denote statistical significance at 10%, 5%, and 1% levels, respectively.

Table 5: Individual level regression of shopping time on personal income

Category	I	II	III
Total Shopping Time	0.75	1.34	0.64
	(0.55)	(0.28)	(0.61)
Consumer Goods and Servies	0.40	0.69	0.41
	(0.60)	(0.37)	(0.60)
Groceries, Gas, and Food	-1.00	-0.99	-1.23
	(0.00)	(0.00)	(0.00)
Travel time	1.35	1.65	1.46
	(0.03)	(0.01)	(0.02)
Demo. controls	Yes	Yes	Yes
Time dummy	No	Yes	Yes
State dummy	No	No	Yes

The regression sample is restricted to respondents who are between the ages 25 and 54, have no unclassified time use and have positive personal income (employed). The table reports the estimate of β^j and its standard errors in parentheses. Personal income is in thousands of dollars. Estimates of β^j are multiplied by 100.

6.2 Individual income

Reported weekly income for employed respondents averages \$37,856 per year. We use this information to estimate the following relation between income and search effort in the data:

$$\tau^j_{ist} = \alpha^j + \beta^j I_{ist} + D_t + S_i + \delta X_{ist} + \epsilon_{ist}, \tag{22}$$

where j is the time use category, I_{ist} is annual personal income (in thousands of dollars) for individual i in state s, D_t is a time dummy, S_i a dummy for the individual's state, and X_{ist} is a vector of demographic and educational variables (age, gender, race, education, marital status, and presence of children). The coefficient of interest, β^j is reported in Table 5, with standard errors in parentheses, for total shopping time and the three broad subcategories: consumer goods and services; groceries, gas, and food; and travel time.

The first row of Table 5 reveals that total shopping time is increasing in individual income but that none of the coefficients are statistically significant. The second row indicates that time spent shopping for consumer goods and services is increasing in individual income, yet none of the specifications yield a statistically significant coefficient. Time shopping for groceries, gas, and food, however, declines with income, and the coefficient is highly significant in each of the specifications.

Table 6: Individual level regression of shopping time on market work time

Category	I	II	III
Total Shopping Time	-8.17	-8.17	-8.18
	(0.00)	(0.00)	(0.00)
Consumer Goods and Servies	-3.85	-3.85	-3.86
	(0.00)	(0.00)	(0.00)
Groceries, Gas, and Food	-1.24	-1.24	-1.24
	(0.00)	(0.00)	(0.00)
Travel time	-3.08	-3.08	-3.08
	(0.00)	(0.00)	(0.00)
Demo. Control	Yes	Yes	Yes
Time Dummy	No	Yes	Yes
State Dummy	No	No	Yes

The table reports the estimate of β and its p-value in parentheses. Market work is in terms of minutes per day. Estimates of β are multiplied by 100 for readability. An estimate of 1 means that the time use is expected to be 0.01 minutes per day if market work is 1 minute higher.

Last, we find that travel time associated with shopping is increasing with individual income, and the coefficient is highly statistically significant in each specification. This suggests that individuals with lower income do not travel further and search wider for goods and services.

6.3 Market work and shopping time

In this section we examine the relation of shopping time to time in market work. We apply the same definition of market work in the ATUS as Aguiar et al. (2013) and run the following regression:[14]

$$\tau^j_{ist} = \alpha^j + \beta^j \tau^M_{ist} + D_t + S_i + \delta X_{ist} + \epsilon_{ist}, \tag{23}$$

where τ^M_{ist} is the time spent on market work, D_t and S_i are the time and state dummies, respectively, and X_{ist} is a vector of demographic and educational variables (age, gender, race, education, marital status, and the presence of children). Table 6 reports the resulting estimates β^j.

The results indicate that a 1 minute decline in market hours is associated with a 0.04 minute decline in shopping time. The impact of diminished hours of the employed on shopping time is very small.

[14]The ATUS time use categories used to measure market hours of work are: 05-01, 05-02, 05-99, 18-05.

7 Conclusion

The recent availability of new data sets measuring the inflows and outflows of goods and services in a household's consumption basket (Broda and Weinstein, 2010) and the presence and investment in customer relationships (Gourio and Rudanko, 2013) has lead to a renewal of theories in which search frictions in the goods market play an important role for macroeconomic outcomes. The cyclical properties of the intensive margins in this market, by consumers and firms, have quickly shown themselves to be important to our deeper understanding of dynamics of consumption, employment, and business cycles in general.

A precursor paper by Hall (2012) had shown that advertisement by firms is very procyclical. In this paper we find, on the other side of the market, that consumers spend a varying amount of time for purchasing goods and products. This shopping time declined significantly with the onset of the Great Recession across all types of individuals, and it is positively correlated with individual and household income. In addition, consumption effort dropped more in states where economic activity decreased relatively more following the financial crisis. We also find that a decline in working time raises shopping time. Nonetheless, employed individuals spent less time shopping during the recession.

Overall, we don't find much evidence in favor of a negative correlation between income and shopping time, particularly comparison shopping possibly motivated by locating better prices. As a matter of fact, whereas total time spent purchasing goods and services is about 20 minutes per day, the component of shopping time devoted to comparing prices and products seems to be extremely low in the data. It is about 4 seconds a day on average, given the large number of respondents declaring zero. Moreover, nonparticipants and the employed spent more time than the unemployed in this activity. This may indicate that most of the effort made by consumers in the goods market is unrelated to uncovering better prices.

The data used in this paper are the best available from a macro perspective. More precise information about consumer shopping efforts should be obtained from microeconomic data such as consumer surveys. This is left for future works.

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Appendix

A Theory

A.1 Individual consumption probability: a more general specification

At the individual level, one could assume that the probability of finding a particular good is given by $\lambda e_c / \left(\bar{e}_c^{1-a}\right)$, in which $a \geq 0$. When $a = 0$, the most frequent assumption explored in the text, only the ratio of individual to aggregate effort matters for the individual finding rate. In contrast, assuming a positive value for a allows for a potential positive externality from consumer search effort. In essence, if my neighbors search for a good, they may transmit some information to me thereby increasing the probability of locating a particular good.

A key insight here is that allowing for a positive a does not change the results on cyclicality. Indeed, the aggregate level of effort does not change the cyclicality of individual search effort. In a symmetric equilibrium, we have $d(\ln \bar{e}_c)/d\ln\Omega_c = \eta_c - a$, where η_c is the elasticity of the search cost function with respect to effort, assumed larger than 1. Thus, $d(\ln \bar{e}_c)/d\ln\Omega_c > 0$ under the sufficient condition that $a < 1$ even for positive consumption externality $a > 0$.

A.2 Non-separable utility

One could write the utility function as:

$$v(x, y) = X(x) + Y(y) + bZ(x, y) \tag{A.1}$$

where X and Y are increasing concave functions of their input, and Z is a complementary function with $\partial^2 Z/(\partial y \partial x) > 0$ and $Z(0, y) = Z(x, 0) = 0$. This reflects the interaction between x and y. b is a scalar that may be zero in the case of perfect separability, and positive (negative) depending on the degree of complementarity (substitutability) between the two consumption goods. The important property for the main discussion on consumer search effort is the sign of

$$\Delta v_y = [Y_{yy}(\omega - px) - Y_{yy}(\omega)] + b\frac{\partial^2 Z}{\partial y \partial x}(x, \omega - px)$$

The first term in brackets is positive due to the concavity of utility in goods y. If the second term is assumed to be positive, e.g., if $Z(x, y) = xy$, it is sufficient that the value of b is not too negative, e.g. $Z(x, y) = xy$, it suffices that be is larger than the negative of $Y_{yy}(\omega - px) - Y_{yy}(\omega)$ to preserve a positive sign of Δv_y.

A.3 Appendix to Section 2.1: price bargaining

We have:

$$xp = \frac{\Delta v}{v_y(\mathbf{1})} + \kappa(x)$$

Full differentiation of the price leads to:

$$xdp = \frac{d(\Delta v)v_y(\mathbf{1}) - v_{yy}(\mathbf{1})(d\omega - xdp)\Delta v}{v_y^2(\mathbf{1})}$$

or, using equation (1),

$$v_y^2(\mathbf{1})xdp = \left[\Delta v_y d\omega - xv_y(\mathbf{1})dp\right] v_y(\mathbf{1}) - v_{yy}(\mathbf{1})(d\omega - xdp)\Delta v$$

Rearranging the terms we have:

$$xdp\left[2v_y^2(\mathbf{1}) - v_{yy}(\mathbf{1})\Delta v\right] = \left[\Delta v_y v_y(\mathbf{1}) - v_{yy}(\mathbf{1})\Delta v\right] d\omega$$

A.4 Appendix to Section 2.2: Optimal consumption choice when x is endogenous

Simpler case of y as a numeraire

Start from equations (8) and (9). Under separability and constant marginal utility for the composite (the case of a numeraire) these equations simplify to:

$$xp = \kappa(x) + \Delta v \tag{A.2}$$

$$\frac{v_x(\mathbf{1}) - p}{\Delta v} = \frac{p - \kappa_x}{xp - \kappa(x)} \tag{A.3}$$

where $v(\mathbf{1}) = X(x) + (\omega - px)$ and $\Delta v = X(x) - px$. This implies that Δv is independent of income, and therefore replacing $xp - \kappa(x)$ in the equation (A.2):

$$xp = \frac{xX_x(x) + x\kappa_x}{2} = \frac{X(x) + \kappa(x)}{2}$$

This last equality implies that x is such that the elasticity of the function $g(x) \equiv X(x) + \kappa(x)$ is 1. It follows that both the price and quantity of x are independent of income, and so is the surplus.

General case under separability of x and y

The full system represented by equations (8) and (9) must be differentiated to obtain the variations of p and x in response to a change in ω. Before doing so, one can rewrite the utility function

$v(x,y) = X(x) + Y(y)$ and manipulate the two equations to obtain:

$$xp = \kappa(x) + \frac{\Delta v}{Y_y(\omega - px)} \tag{A.4}$$

$$X_x(x) = \kappa(x) Y_y(\omega - px) \tag{A.5}$$

$$\Delta v = X(x) - Y(\omega - px) + Y(\omega) \tag{A.6}$$

The second equation can be differentiated to obtain:

$$Y_y \kappa_{xx} dx + \kappa_x Y_{yy}(d\omega - d(px)) = X_{xx} dx$$

The functions are evaluated at consumption point $\mathbf{1}$. That is, Y and its derivatives are evaluated at $\omega - px$, and X and κ and their derivatives are evaluated at x. This equation defines a linear relation between dp, dx, and $d\omega$. The first equation can also be differentiated to provide another linear relation between these variations:

$$[d(xp) - \kappa_x dx]\, Y_y + (xp - \kappa(x)) Y_{yy}(d\omega - d(px)) = d\Delta v$$

where $d\Delta v$ can be obtained as $X_x(x)dx + Y_x(\omega - px)d(\omega - px) - Y_y(\omega)d\omega$. In this general case, both x and p vary with income ω.

Markup pricing and bargaining over quantity

If one assumes that the quantity x is chosen so as to divide the surplus into equal shares, while the price is equal to the marginal cost of production with a markup to account for ex post monopoly power, a large utility from the search good and small utility from the composite lead to a positive effect of income on the surplus and search effort. Set the price to $p = \kappa_x(1+\epsilon)$, such that the consumer's surplus is $\Delta v = xp - \kappa(x) = x\kappa_x(1+\epsilon) - \kappa(x)$. Then, differentiation of this last equation leads to:

$$\frac{dp}{dx} = \kappa_{xx}(1+\epsilon) = (p/x)\,(\eta_c - 1) > 0$$

where η_c is the elasticity of κ with respect to x. Therefore, using equation (11), and replacing dp/dw with $(dp/dx) \times (dx/d\omega)$, and using the second part of the equality above, one has:

$$\begin{aligned} \frac{d\Omega_c}{d\omega} = \frac{d\Delta v}{d\omega} &= \underbrace{\Delta v_y}_{\text{Change in income:}>0} - \underbrace{v_y(\mathbf{1})p(\eta_c - 1)\frac{dx}{d\omega}}_{\text{Change in price}} + \underbrace{[v_x(\mathbf{1}) - p v_y(\mathbf{1})]\frac{dx}{d\omega}}_{\text{Change in quantity}} \\ &= \Delta v_y + [v_x(\mathbf{1}) - v_y(\mathbf{1}) p \eta_c]\frac{dx}{d\omega} \end{aligned}$$

Again, large utility from the search good and small utility from the composite lead to a positive effect of income on the surplus.

B Data

B.1 Shopping Time in the American Time Use Survey

The ATUS classifies diary activities into 18 major categories, and each category has additional second- and third-tier categories. According to the 2003-2012 multiyear lexicon, each activity has a code in the form of “x-y-z”, where “x” denotes the first-tier, “y” , the second tier, and “z”, the third tier classification. For example, major categories include personal care activities 01, household activities 02, work and work-related activities 05, education 06, etc. The second- and third-tier categories further break down the major categories. For example, under the major category of work and work- related activities, second-tier categories include working 05-01, working-related activities 05-02, other income-generating activities 05-03, job searching and interviewing 05-04, etc. And under the second-tier category of working, the third-tier categories are main job work 05-01-01, other job(s) work 05-01-02, security procedures related to work 05-01-03, etc.

We group the time spent shopping for market goods and services as follows:

Total time shopping for market goods and services:

1. Consumer Goods and Services shopping other than Groceries Gas and Food:
   (a) Shopping for consumer goods: 07-01-04, 07-01-05,07-01-99, 07-99.
   (b) Researching goods and services: 07-02.
   (c) Waiting associated with shopping for goods and services: Professional and Personal Care Services: 08-01-02, 08-02-03, 08-03-02, 08-04-03, 08-05-02, 08-06-02, 08-07-02; Household Services not done by self: 09-01-04, 09-02-02, 09-03-02, 09-04-02, 09-05-02; Arts and entertainment: 12-05-04.
2. Purchasing Groceries, Gas, and Food (GG&F):
   (a) Groceries: 07-01-01.
   (b) Gas: 07-01-02.
   (c) Food: 07-01-03.
3. Travel Time associated with shopping for goods and services: 18-07, 18-08, 18-09, 18-12-04.

B.2 Labor force status in the ATUS

The ATUS sample is a subset of the CPS sample. We verify how the estimates of labor force status – employed, unemployed, and nonparticipant – line up with the population estimates provided by the BLS based on the CPS. The five possible labor force statuses in the ATUS are: (1) employed – at work; (2) employed – absent; (3) unemployed – on layoff; (4) unemployed – looking, and; (5)

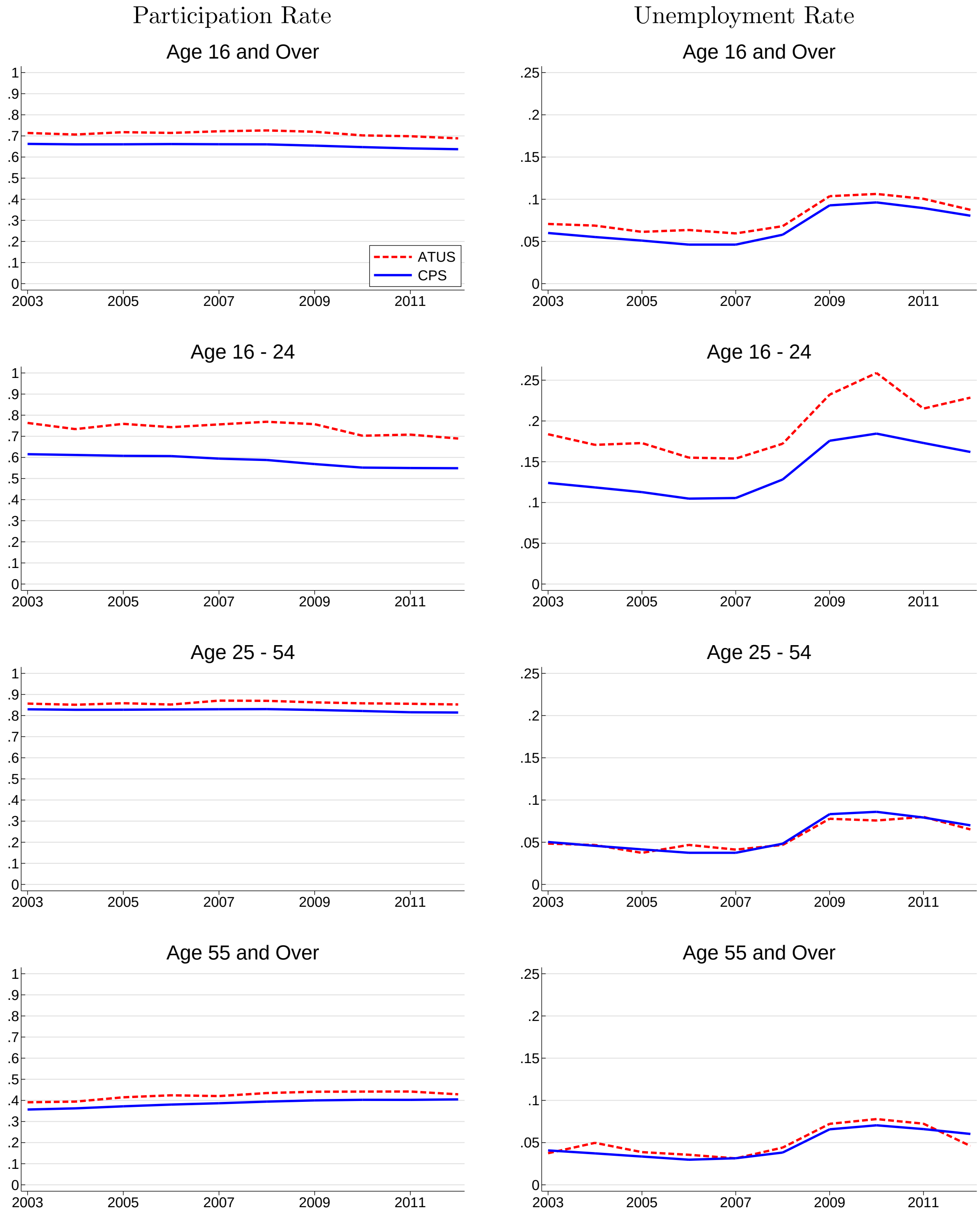
not in the labor force. Let D_i be the dummy variable for labor status, which equals one when the correspondent is in a given labor status and zero otherwise. The formula for calculating the percentage of the population being in one labor status is given by:

$$P = \frac{\sum_i I_i wt_i}{\sum_i wt_i} \tag{A.7}$$

where wt_i is the final weight assigned by ATUS. The formula can also be applied to a subsample of the same interview year and age group.

We compare the implied labor participation rate and unemployment rate from ATUS to those provided by the BLS. The ATUS labor participation rate is defined as the sum of employed and unemployed as percentages of population, and the unemployment rate is defined as the ratio of unemployed to the sum of employed and unemployed. The CPS participation rate is the ratio of the civilian labor force to the civilian non-institutional population, and the unemployment rate is the ratio of the unemployment level to the civilian labor force. Annual participation and unemployment rates from both ATUS and BLS are plotted in Figure B.2. The ATUS participation rate for the age group 16 and over is 5.6% higher than the CPS rate, on average. A closer look and different age groups reveals that the difference is 15.2% for the 16 to 24 age category, 3.3% for ages 25 to 54, and 3.7% for ages 55 and over. The ATUS unemployment rate for ages 16 and over is 1.1% higher than the CPS rate, on average. Again, the difference is largest for the 16 to 24 group, 5.5%, while it negligible for those between 25 and 54, -0.1%, and for those over 25 is 0.4%.

Figure A.1: Participation and unemployment rates in the ATUS and CPS



The solid line and dashed line represent the CPS and ATUS, respectively. The left column of figures compare the participation rates from ATUS and CPS, and the right column of figures compares the unemployment rates from ATUS and CPS. For ATUS, the participation rate is calculated as the sum of employed and unemployed as a percentage of the population, the unemployment rate is the ratio of the unemployed to labor market participants. For CPS, we calculate the participation rate as the ratio of the civilian labor force to the civilian noninstitutional population, and unemployment rate as the unemployment level to the civilian labor force.