Leisure Luxuries and the Labor Supply of Young Men*

Mark Aguiar Mark Bils Kerwin Charles Erik Hurst

February 7, 2017

Preliminary and Incomplete:
Do Not Cite or Quote Without Authors' Permission

Abstract

We explore the declining market hours of younger men, ages 21-30, over the last fifteen years. Young men experienced a larger decline in work hours than older men or women. At the same time, time-use data show that young men shifted towards allocating much more of their leisure time to video gaming and other recreational computer activities. We propose a methodology to answer whether improved leisure technology played a role in reducing young men's labor supply. The starting point is a leisure demand system that parallels that often estimated for consumption expenditures. We show that total leisure demand is much more affected by innovations to leisure luxuries, that is, activities that display a high response to one's total leisure time. We estimate that gaming/recreational computer use is distinctly a leisure luxury for young men. Moreover, we calculate that innovations to gaming/recreational computer use can justify on the order of half the increase in leisure for young men over the past fifteen years, and perhaps a third of their decline in market hours.

*We thank Shirley Yarin and Hyun Yeol Kim for outstanding research assistance. We also thank John Kennan and Kevin Murphy as well as seminar participants at Chicago, Columbia, Wharton and the Federal Reserve Bank of Atlanta for helpful comments.

1 Introduction

Between 2000 and 2015, market hours worked fell by 12 percent for younger men ages 21-30, compared to a decline of just over 8 percent for men ages 31-55. These declines started prior to the Great Recession, accelerated sharply during the recession, and have rebounded only modestly since.[1] We use a variety of data sources and measures to document that the declines in hours was particularly pronounced for younger men, especially those with less than four years of college. These trends are robust to including schooling as a form of employment. Not only have hours fallen, but there is a large and growing segment of this population that has remained detached from the labor market: we document that 22 percent of less-educated younger men report working *zero* weeks during the prior year in 2015. The comparable number in 2000 was only 9 percent.

In this paper, we explore the decline in market work of younger men. An obvious candidate is a decline in the demand for their labor, and a corresponding reduction in real wages. However, we document that the real wages of younger men closely track those of their older counterparts, suggesting that labor demand does not readily explain the decline in hours for younger men relative to older prime-age men.

We go a different direction. We ask how much innovations to leisure technology, specifically to recreational computer and gaming activities, has reduced the labor supply of younger men. Our focus is propelled by the sharp changes we see in time use for young men. Comparing data from the American Time Use Survey (ATUS) for recent years, 2012-2015, to eight years prior, 2004-2007, we see that: (a) the drop in market hours for young men has been mirrored by a roughly equivalent increase in leisure hours and (b) the increase in time spent in gaming and computer leisure for younger men, 1.9 hours per week, corresponds to three quarters of their increase in leisure of 2.5 hours per week. Other groups, i.e., older prime age men and women, allocate much less time to computer and gaming and displayed much less of an upward trend in these activities. We document that non-employed young men average 10 hours a week in recreational computer time, sixty percent of that spent playing video games. This exceeds the time spent on home production or socializing with friends. Younger men show a dramatic shift in leisure choices over the past 10 years, with video and computer games now comprising a much larger share. In particular, young men increased their recreational computer use and video gaming by 47% between 2004 and 2015.

An elemental question is whether increased gaming contributed to the rise in younger men's leisure and the corresponding decline in their market hours, or simply reflected their response to working fewer hours due, say, to reduced labor demand. To identify these

[1] Data, described fully below, are from the March CPS and excludes full time students.

channels we introduce a leisure demand system that parallels that typically considered for consumption expenditures. In particular, we estimate how alternative leisure activities vary with the aggregate amount of leisure time, generating “leisure Engel curves.” We find that gaming and recreational computer use is distinctively a “leisure luxury” for younger men, but not for other demographic groups. In particular, a one precent increase in leisure is associated with a more than 2 percent increase in time spent playing video games. Watching TV has an elasticity slightly above one, making it a modest luxury, while all other leisure activities have elasticities less than or equal to one. This implies that any marginal increase in leisure for younger men will be disproportionately devoted to computers and gaming.

With the estimated leisure demand system in hand, we can use the shifts over time in how leisure is allocated across various alternative activities to quantify the change in the marginal return to additional leisure. Specifically, we decompose the large increase in recreational computer use between 2004 and 2015 into a movement along the leisure Engel curve due to additional leisure time, and the shift of the expansion path due to technological improvement in computer and video games relative to other leisure goods. From this decomposition, we infer how much the marginal return to leisure increases over time due to improvements in computers and video gaming technology.

We then use our framework to calculate how improved computer and video game technology reduces young men’s labor supply at a given wage. This impact depends on how a decline in labor supply affects consumption. We consider two scenarios. If individuals are “hand-to-mouth,” so consumption equals labor earnings, we calculate that improvements in video game technology shifted leisure at a fixed wage an amount roughly equal to one third of the increase in reported leisure for young men, and nearly a fourth of their observed decline in market hours. Alternatively, if consumption is held constant, which in our framework is the same as holding the marginal value of a dollar constant, then the effects are considerably larger. Under constant consumption, we calculate that better computer and gaming options induced a constant-wage change in leisure over two-thirds the size of the observed increase in leisure for young men, and a decline in market hours nearly one half the observed decline. Our methodology allows us to estimate shifts in the labor curve. How this shift is allocated between market hours and wages depends on the elasticity of labor demand.

The assumption that consumption is held constant turns out to be consistent with several pieces of data. More generally, a natural question is how these young men support themselves given the large decline in labor earnings. We document that 70 percent of non-employed less educated young men lived with a parent or close relative in 2015, compared to 49 percent in 2000. The importance of cohabitation with a parent has been emphasized in the business-cycle context by Kaplan (2012) and Dyrda et al. (2012). We document that it is also relevant for the longer-run decline in employment of younger men. While government transfers are not large for young men, family transfers are substantial. To get a sense of the value of such intra-family transfers, we measure the consumption of younger men using the Panel Study of Income Dynamics. Specifically, we compare expenditures for households that contain young men to expenditures for all households, scaled appropriately for household size. By this measure, we see little, if any, decline in the relative consumption of younger men since 2000.

Our narrative emphasizes the impact on labor supply of expanded leisure opportunities and family transfers. An alternative is that young men face diminished market opportunities, perhaps because their market hours are rationed by longer-run rigidities that disproportionately affect younger men. One avenue to gauge how young men perceive their fortunes is to use survey data on happiness. In this spirit, we complement the patterns in hours, wages, and consumption with data on life satisfaction from the General Social Survey. We find that LEYM increased their self-reported happiness during the 2000s, despite stagnant wages, declining employment rates and increased propensity to live with parents/relatives. These patterns stand in stark contrast to answers from older workers during the 2000s, for whom satisfaction fell sharply, tracking their declines in employment. We take these results as suggesting a role for improved leisure options for young men.

Our focus on time allocation owes a natural debt to the seminal papers of Mincer (1962) and Becker (1965), which emphasize that labor supply is influenced by how time is allocated outside of market work. We introduce the concept that some non-market activities are leisure luxuries, which display little diminishing returns and thus make labor supply more elastic to wage changes and more sensitive to improvements in leisure technology. Because recreational computer use and video gaming is such a leisure luxury for younger men, improvement in its technology can readily rationalize some portion of the decline in labor supply since the early 2000s. By contrast, for older men, for whom computer and gaming activity is not a leisure luxury, such innovations rationalize much less of a response.

Our work complements that of Greenwood and Vandenbroucke (2008), Vandenbroucke (2009), and Kopecky (2011), who use a quantitative Beckerian model to show that a relative decline in the price of leisure goods is important in explaining secular trends in employment over the last century. We augment this approach by considering a leisure demand system and exploring how the allocation of time across differing leisure activities may also be relevant for understanding labor supply. We show that it is key for the impact on labor supply whether innovations affect leisure luxuries or leisure necessities. Our distinction across leisure activities parallels the reasoning that the inter-temporal elasticity of consumption hinges on the shares of goods with little versus a lot of curvature in consumption, as emphasized by Browning and Crossley (2000).

There is, of course, a large literature on the decline in U.S. employment rates during the Great Recession. A separate literature has focused on what forces might explain longer-term employment declines during the 2000s.[2] Collectively, these papers provide evidence – often by exploiting cross-region variation – that declining labor demand has been the predominant factor for depressed wages and employment rates during the 2000s, with the effects concentrated among prime-age less-educated workers. Our work complements this extensive literature by providing a labor-supply force for the sustained decline in hours worked driven by changes in leisure technology. Additionally, because younger men are predicted to respond more the these new leisure technologies, our work helps explain why their hours declined more relative to hours for older men and women.

The paper is organized as follows: Section 2 documents declines in employment and hours for younger men and other demographic groups; Section 3 documents patterns for real wages, cohabitation, consumption, and self-reported well being; Section 4 documents the changing nature of time use during the 2000s with an emphasis on the dramatic increases of computer and video game time for young men. Section 5 presents our leisure demand system methodology our estimates of leisure Engel curves. Section 6 uses our model and estimated Engel curves to compute shifts in leisure and labor supply curves for different demographic groups during the 2000s; and Section 7 concludes.

2 Employment and Hours Trends

In this section, we document a series of facts about the labor market changes for young men relative to other demographic groups during the 2000s. Our primary dataset for measuring trends in employment, hours, and wages is the March Current Population Survey (CPS).[3] We restrict the sample to include civilian individuals between the ages of 21 and 55 (inclusive). We further restrict the sample to exclude individuals under the age of 25 who report being a full time student.[4] This restriction mitigates the possibility that the decline in market work hours we document for young men is being driven by increased college attendance for this group. When showing labor market trends, we focus on two age groups: those aged

[2]For example, Autor et al. (2003), Moffit (2012), Autor and Dorn (2013),Autor et al. (2013), Hall (2014), Charles et al. (forthcoming), Charles et al. (2016), and Acemoglu et al. (2016). For a discussion of longer term trends in male labor force participation, see Council of Economic Advisors' 2016 Economic Report of the President.

[3]We include a detailed Data Appendix that accompanies the paper. In the Data Appendix, we provide a much greater discussion of all data sets used in the paper including relevent yearly sample sizes for all of our analyzes.

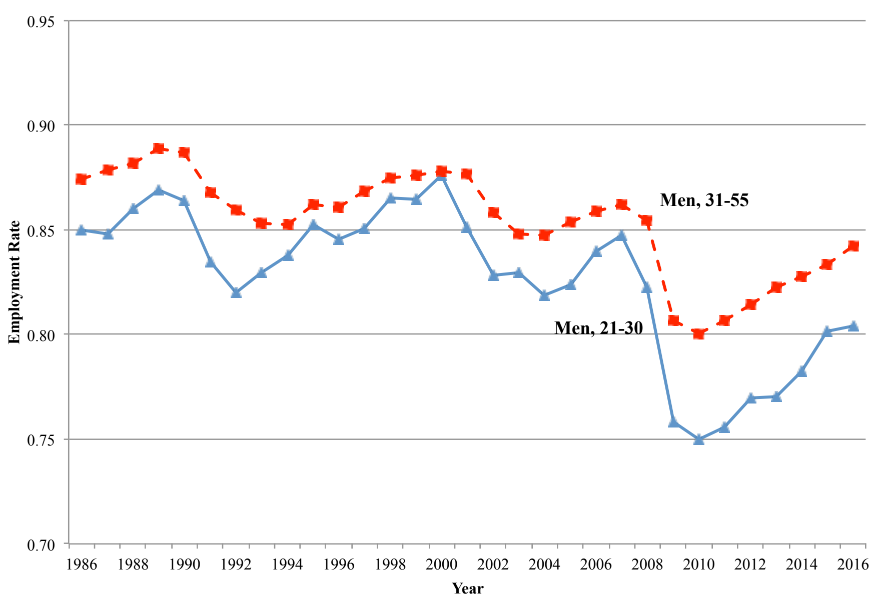
[4]Between 1986 and 2012, the CPS only asked school/college attendence for individuals who were under 25. Starting in 2013, the CPS asked school/college attendence for all individuals regardless of age. Prior to 1986, the CPD did not consistently ask schooling attendence.

21-30 (young) and those aged 31-55 (older). Also, we focus on two education groups: those with less than a bachelor's degree (less educated) and those with a bachelor's degree or more (more educated).[5]

2.1 Employment and Hours Worked: Younger Men versus Older Men

Figure 1 documents trends in employment rates for younger men (YM) and older men (OM) between 1986 and 2015 using data from the March CPS. The employment rate of OM has been steadily declining over the last thirty years. Specifically, the employment rate for OM was 89 percent, 88 percent, 86 percent and 84 percent in 1990, 2000, 2007, and 2016, respectively. The employment rate of young men is more cyclical. However, the trend during the 2000s was much sharper. The employment rate for YM was 86 percent, 88 percent, 85 percent and 80 percent in 1990, 2000, 2007, and 2016, respectively. Between 2000 and 2016, the employment rate for YM fell by 8 percentage points while the comparable decline for OM was only 4 percentage points.

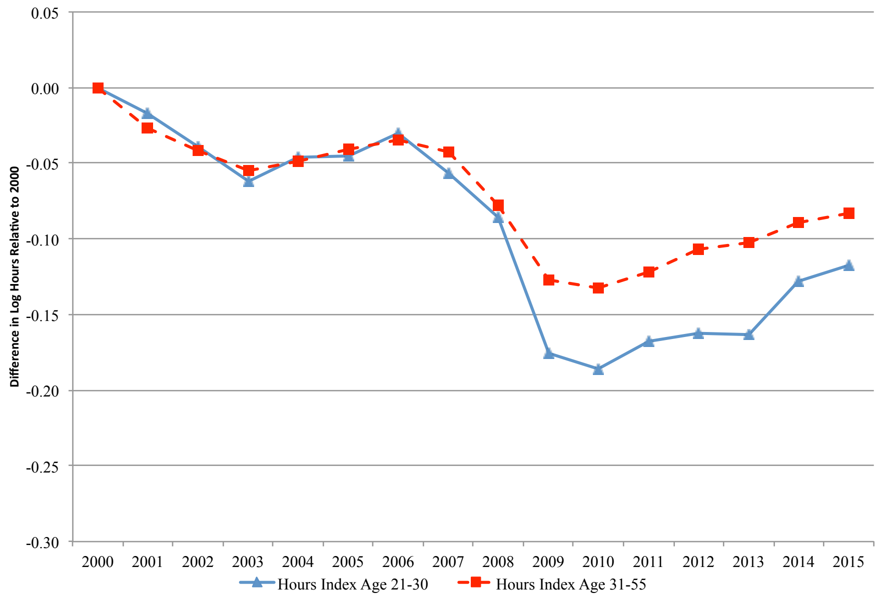
Figure 1: Employment Rates for Younger and Older Men



Note: Figure shows the employment rate of men between the ages of 31-55 (squares) and the employment rate of men between the ages of 21 and 30 (triangles). Data from the March supplement of the Current Population Survey. Individuals under the age of 25 reporting attending school full time are dropped from the sample. See text for additional details.

[5]Throughout the paper, we weight all data using the relevant survey's sampling weights.

Figure 2: Index of Annual Hours Worked for Younger and Older Men



Note: Figure shows the difference in log hours (relative to year 2000) of men between the ages of 31-55 (squares) and for men between the ages of 21 and 30 (triangles). Data from the March supplement of the Current Population Survey. Individuals under the age of 25 reporting attending school full time are dropped from the sample. See text for additional details. Annual hours are calculated by multiplying self-reported weeks worked last year by self-reported usual hours worked per week last year.

Figure 2 documents the change in log average annual hours worked for both YM and OM relative to 2000 using data from the March CPS. We define annual hours worked by multiplying self reported weeks worked during the prior year and self reported usual hours worked per week during the prior year. When reporting annual hours, we refer to "year" as the year to which the data corresponds. This implies annual hours worked in year t come from year $t+1$ survey respondents. Similar to the change in employment rates, annual hours worked fell more for YM between 2000 and 2015 relative to OM. Table 1 reports hours worked for both YM and OM during the 2000s. Between 2000 and 2015, YM reduced their hours worked by 203 hours a year (roughly 12 log points) while OM reduced their hours worked by 163 hours a year (roughly 8 log points). It is worth noting that the primary differences between OM and YM work hours concern the extensive margin of work.

Figure 3 uses CPS data to plot the fraction of YM and OM that worked *zero* weeks during the year. A few things are worth noting from Figure 3. First, between 1985 and 2000, trends in the fraction of individuals who did not work for the entire year were nearly identical between YM and OM. In 1985, roughly 7 percent of both groups did not work for

Table 1: Annual Hours Worked by Men

	Men	
Year	21-30	31-55
2000	1,829	2,050
2007	1,728	1,964
2010	1,519	1,796
2015	1,626	1,887
Change 2000-15	-203	-163
Log Point Change 2000-15	-11.8	-8.2

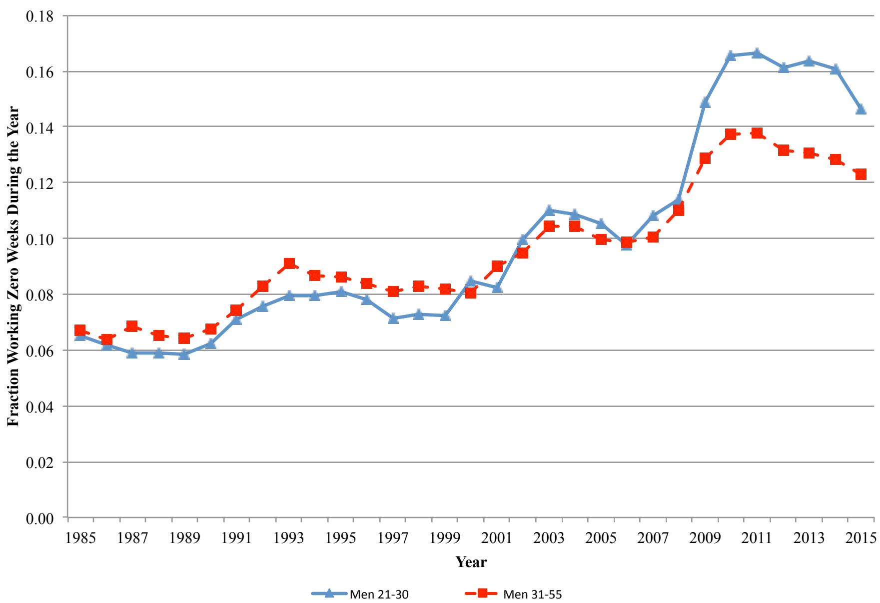
Note: Table shows annual hours worked in 2000, 2007, 2010, and 2015 using data from the March CPS. Annual hours are calculated by multiplying self-reported weeks worked last year by self-reported usual hours worked per week last year. As a result, year t hours refer to the reported hours worked by year $t+1$ respondents. Sample excludes individuals under the age of 25 who report being full time students. See text for additional details.

the entire year. As of 2000, that number was roughly 8 percent for both groups. Second, after 2000 a shift occurred such that young men were more likely to not work for an entire year relative to their older counterparts. Prior to 2000s, it was the other way around. Third, the fraction not working for both groups increased dramatically during the 2000s with the fraction increasing most for YM. The fraction of young men sitting idle for an entire year increased prior to the Great Recession, increased sharply during the Great Recession and has barely recovered through the most recent data. As of 2015, nearly 15 percent of all young men who are not in college full time did not work during the entire year. Again, the patterns in Figure 3 reinforce that the decline in employment has been larger for young men relative to older men.

2.2 Hours Worked by Age-Sex-Education Group

Table 2 reports annual hours worked using CPS data for different age-sex-education groups during the 2000s. We focus on four years: 2000, 2007, 2010, and 2015. Panel A looks at those individuals with less than a bachelor's degree while panel B looks at those with a bachelor's degree or more. Across all age, sex, and education groups in Table 2, less educated younger men (LEYM) experienced the largest decline in market work hours in both levels and percentage change. Between 2000 and 2015, LEYM reduced their market work hours

Figure 3: Fraction of Men Who Report Working Zero Weeks During the Year by Age, March CPS



Note: Figure shows the share of men aged 31-55 (squares) and men aged 21-30 (triangles) who report working zero weeks during the prior year. Data from the March supplement of the Current Population Survey. Individuals under the age of 25 reporting attending school full time are dropped from the sample. See text for additional details.

by 242 hours per year. During that same time period, less educated older men (LEOM) reduced their market work hours by 190 hours per year. Less educated men (both young and older) also experienced larger market work hours during the 2000s relative to both higher educated men and less educated women. For example, less educated women (both young and old) and higher educated men (both young and old) experienced declines in market work hours by about 130-140 hours per year during the 2000s. Higher educated women saw very little change in their annual work hours during the 2000s. Additionally, the main differences between young and older (conditional on sex and education) occur primarily for less educated men. The decline in market work hours is roughly similar for younger and older less educated women and for younger and older higher educated men.

In Appendix Tables A1, we document similar patterns using the Census and American Community Surveys (ACS). Aside from showing that the above CPS results are found in other data sets, these data allow us to explore the robustness of our results to excluding all full-time students, not only those less than 25 years old. As seen from these tables, our results are unchanged even when we exclude students over the age of 25. This is not too surprising given that very few individuals over the age of 25 report being full-time students.

Table 2: Annual Hours Worked By Age-Sex-Education Group

(a) Education < 16

	Men		Women	
Year	21-30	31-55	21-30	31-55
2000	1,801	1,953	1,311	1,397
2007	1,691	1,859	1,227	1,346
2010	1,436	1,658	1,080	1,241
2015	1,559	1,763	1,167	1,258
Change 2000-15	-242	-190	-144	-139
Pct. Change	-14.4%	-10.2%	-11.7%	-10.5%

(b) Education ≥ 16

	Men		Women	
Year	21-30	31-55	21-30	31-55
2000	1,926	2,274	1,661	1,591
2007	1,851	2,204	1,646	1,600
2010	1,778	2,101	1,518	1,573
2015	1,804	2,129	1,593	1,626
Change 2000-15	-122	-145	-68	35
Pct. Change	-6.6%	-6.6%	-4.2%	2.1%

Note: Table shows annual hours worked in 2000, 2007, 2010, and 2015 using data from the March CPS. Annual hours are calculated by multiplying self-reported weeks worked last year by self-reported usual hours worked per week last year. As a result, year t hours refer to the reported hours worked by year $t+1$ respondents. Sample excludes individuals under the age of 25 who report being full time students. See text for additional details.

Appendix Table A2 shows trends in hours worked for young men by race during the 2000-2015 period. As seen from the table, while there are levels differences, the trends in hours worked are nearly identical between black and white young men. In the same table we also examine hours worked trends between young men who live in center cities within an MSA, young men who live outside center cities within an MSA, and young men who live outside of an MSA. While young men within a center city experienced declines in hours worked, the delcines were much larger for those outside of center cities and those in rural areas. As of 2015, hours worked are now quite similar between young men living in all three broad location types while in 2000 young men in center cities worked much less than the other two areas. From these results we conclude that that the patterns we document in Tables 1 and 2 are broad based and not driven by any one race or location type.

3 Wages, Cohabitation, Consumption and Well-Being

The previous section documented that younger men – particularly less educated young men – experienced the largest declines in market work and the largest increase in leisure during the 2000s. The goal of the remainder of the paper is to help shed light on why young men in general, and less educated young men in particular, experienced such large declines in market work during the 2000s particularly relative to their older male counterparts. Many traditional labor demand stories for the declining labor market outcomes of men during the 2000s have been shown to affect older men more so than younger men.[6] This may be consistent with younger workers being more elastic with respect to sectoral declines. In this section, we use additional data on wages, cohabitation, and life satisfaction to provide a sharper picture of young men and the consequences of their declining labor hours.

3.1 Trends in Real Wages

In this sub-section we document that despite younger men experiencing much larger labor market declines during the last fifteen years relative to older men, the evolution of wages was nearly identical between the two groups. To construct wages we use data from the March CPS. Specifically, we divide self-reported individual labor income earned during the prior year by self-reported annual hours worked during the prior year. To make real wages

[6]For example, Charles et al. (2016) exploit local variation in manufacturing shares in 2000 to show that declining manufacturing in the U.S. from 2000-2007 had a larger effect on the employment outcomes of older workers (those between 35 and 54) relative to younger workers (those between the ages of 21 and 34).

we deflate our nominal wage series using the June CPI-U. Our primary CPS wage sample is nearly identical to the CPS sample used for employment and hours described above with the main exception being that we also exclude individuals who report zero or negative labor earnings during the prior year.[7] Once these sample restrictions are imposed, we trim the top and bottom one percent of the overall wage distribution within each year.

Panel (a) of Figure 4 plots the evolution of log real wages for young men relative to older men during the 2000-2015 period. Each real wage series is normalized to zero in 2000 such that all subsequent years are interpreted as log deviations in real wages from year 2000. Unlike the evolution of hours during the 2000s, the evolution of wages was nearly identical between young men and older men over the last 15 years. Real wages for both groups fell by about 5 log points during the entire 2000-20015 period. Any slight difference between the two wage series can be attributable to the inclusion of higher educated men. Panel B of Figure 4 shows the real wage evolution of less educated young and older men. The two lines are essentially on top of each other in all years between 2000 and 2015. The fact that there were no relative declines in wages between young and older men during this period despite large relative declines in hours is suggestive that young men received a relatively larger labor supply shock during this period.

One caveat about our wage series shown in Figure 4 is that we are making wage comparisons over time for a given group using repeated cross section data. It is well known that the changing composition of the work force over time can bias time series trends in wages derived from repeated cross section data.[8] In Appendix Figures A1 and A2, we explore a number of alternative constructs to address this challenge. In particular, we adjust wages for demographics to control for the changing composition of the work force. Moreover, we also construct an index imputing wages for non-employed individuals using the 33rd percentile of the observed wage distribution from the respective demographic cells. We find that these adjustments suggest a larger decline in real wages over our time period. Nevertheless, the adjustments generate no difference in real wage trends between younger and older men, consistent with the data presented above.

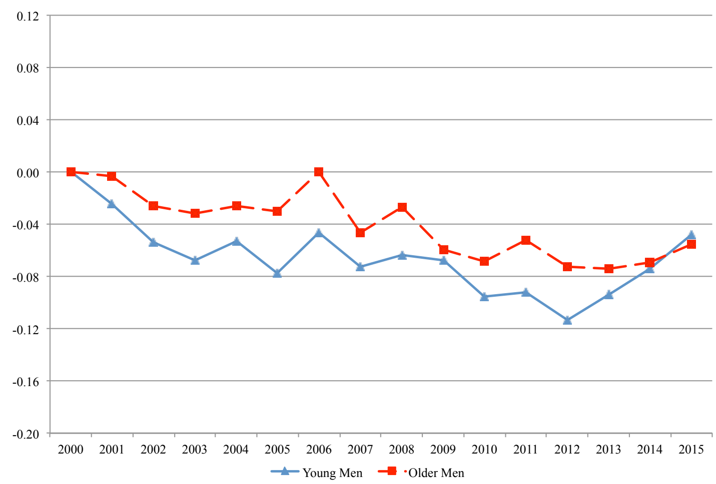
3.2 Trends in Cohabitation and Consumption

How do young men fund their consumption when not working? In this sub-section we show that family transfers are important for understanding resources available to young men. Table 3 uses data from the 2000 Census and the 2001-2015 American Community Surveys (ACS) to document cohabitation patterns of less-educated young men during the

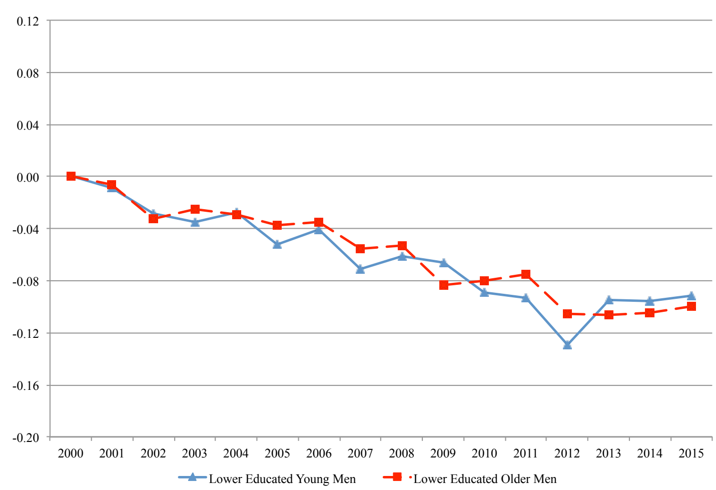
[7]Negative labor earnings are possible for those with business or farm income.
[8]See, for example, Solon et al. (1994).

Figure 4: Hourly Real Wage Index for Men By Age, March CPS

(a) All Men



(b) Men Ed<16



Note: Figure shows hourly real wage index for young men (squares) and older men (triangles). Hourly wages are reported as annual earnings last year divided by annual hours worked last year. See text for additional details. We deflate wages using the June CPI-U. We convert the series to an index by setting year 2000 values to 0. All other years are log deviations from year 2000 values. Data from the March supplement of the Current Population Survey.

Table 3: Fraction of Young Living With Parent or Close Relative

	Men 21-30		Women 21-30	
	All	Ed<16	All	Ed<16
2000	0.23	0.34	0.20	0.22
2007	0.27	0.39	0.26	0.28
2010	0.31	0.44	0.29	0.32
2015	0.35	0.49	0.34	0.38
Change 2000-15	0.12	0.15	0.14	0.16

Note: Table shows the fraction of men and women age 21-30 cohabitating with their parents/step-parents or other close non-spouse relatives (siblings, grandparents, etc.). Data come from the American Community Survey.

2000s. The 2000 Census and subsequent ACS surveys have any overlapping set of questions and file structure which makes them comparable over time. Our Census/ACS samples are defined similar to our CPS samples in that we exclude any individual under the age of 25 that reports full-time school enrollment.[9]

The Census/ACS ask each respondent their relationship to the household head. A household head is the person (or persons) that owns or rents the housing unit. In Table 3, the first column shows the trend in young men that report living in a household where their parent, step-parent, or other close relative (sibling, grandparent, uncle, aunt) is the household head. The second and third columns repeats the findings just LEYM and high educated young men (HEYM), respectively. In 2000, 23 percent of all young men, 34 percent of LEYM, and 17 percent of HEYM lived with a close relative. By 2015, there were dramatic increases in cohabitation propensities with close relatives for young men. For example, by 2015, 35 of all young men and 49 percent of less educated young men lived with a close relative.[10] Columns 4 and 5 show the patterns for young women. Young women historically are less likely to live with parents. However, even young women showed a sharp increase in the propensity to cohabite with a close relative. There is no doubt that all young individuals displayed a sharp propensity to live with parents or other close relatives during the 2000s.

Table 4 shows detailed cohabitation patterns from the Census/ACS for young men by employment status. The top panel pools together data from the beginning of the 2000's,

[9]To further fascilitate comparison with the CPS, we also exclude those individuals residing in group quarters for our Census/ACS analysis.

[10]Most of these trends reflects an increase in living with one's parent.

2000-2003, while the bottom panel does so for the most recent available years, 2012-2015. Each panel shows patterns for all working young men (column 1), all non-working young men (column 2), less educated working young men (column 3) and less educated non-working young men (column 4). A few things are of note from Table 4. First, the non-employed are much more likely to live with their parents than the employed. In 2012-2015, 67 percent of non-working men report living with a parent or close relative. Only 12 percent of non-working men in recent years report living on their own. Second, conditional on employment status, there was a dramatic increase in the propensity to live with parents and other close relatives during the 2000s. In the early 2000s, 26 percent of employed young men and 46 percent of non-employed young men lived with a parent or close relative. By 2012-2015, those shares were 37 percent and 67 percent, respectively. Finally, there is not much difference in cohabitation propensities conditional on work status between all young men and less educated young men.

Putting the above facts together highlights that the trends in cohabitation over time shown in Table 3 reflect an increase in non-employment for young men during the 2000s and an increase in cohabitation conditional on employment status. Additionally, from the 2012-2015 ACS (bottom panel, bottom row of Table 4) only 12 percent of non-working young men are married, or live with a partner. A similarly small fraction report living in a household with a child. The fact that they are not married nor have children suggests that government programs are not a major explanation for their reduced labor market attachment. Young single childless men do not receive welfare programs like SNAP. Their lack of work experience means many are not receiving unemployment benefits. Disability take-up is also rare for this age group. Combining these result with the ones highlighted above shows that parents and other close relatives are the ones that provide the vast amount of consumption support (at least in terms of housing) for non-employed young men. These non-working young men are able to maintain some level of consumption despite not working because of the support provided by close relatives (primarily their parents).

Even young men not cohabitating with their parents still may receive support from their parents. To examine this, we use biannual surveys from the Panel Study of Income Dyanmics during the 2001 to 2013 periods. An advantage of the PSID is that it is possible to see transfers in the form of help from relatives, beyond the important component of cohabiting with a parent or relative. We highlight a few takeaways from our PSID analysis.[11] First, for young men that do not live with relatives, help from relatives is still fairly common, with about 20 percent of households reporting such help. But these transfers are typically small.

[11] A full description of our PSID sample can be found in the Data Appendix. We wish to highlight that, like above, we excluce individuals under the age of 25 who report being a full time student from our analysis.

Table 4: Cohabitation Patterns by Employment Status: Men 21-30

(a) Pooled 2000-2003 Census/American Community Survey Data

	All Men 21-30		Education < 16	
Living Status	Employed	Non-Employed	Employed	Non-Employed
Head: Single	0.25	0.19	0.22	0.17
Head: Live with Spouse/Partner	0.41	0.26	0.40	0.26
Not Head: Live with Parent/Close Rel.	0.26	0.46	0.29	0.49
Not Head: Live with Others	0.09	0.08	0.09	0.08

(b) Pooled 2012-2015 Census/American Community Survey Data

	All Men 21-30		Education < 16	
Living Status	Employed	Non-Employed	Employed	Non-Employed
Head, Single	0.23	0.12	0.20	0.11
Head, Live with Spouse/Partner	0.28	0.12	0.27	0.12
Not Head: Live with Parent/Close Rel.	0.37	0.67	0.42	0.69
Not Head: Live with Others	0.12	0.09	0.12	0.08

Note: Table shows the fraction of men for different cohabitation arrangements by employment status over time. Data come from the American Community Survey (ACS). Sample excludes those under the age of 24 who report being a full time student. Household head refers to the individual or the individuals partner (either married or unmarried) that owns or rents the housing unit. Specifically, for the household head we classify anyone who is reported as being the household head, the spouse of the household head, or the unmarried domestic partner of the household head. Panel A pools together ACS data from 2000-2003 while panel B pools together ACS data from 2012-2015.

Specifically, the reported parental transfers (including zeros) averaged only 1.5 percent of those households' average earnings over the sample period. Second, as anticipated by the discussion above, government transfers are reasonably small for households headed by young men. Government transfers (e.g., unemployment benefits, SSI benefits) averaged 2.9 percent of household earnings for these households, while tax credits (EITC, child credits, etc.) averaged another 1.9 percent. A spike did occur in unemployment benefits during the Great Recession, reaching 1.8 percent of average earnings, compared to less than 1 percent for all years before and after the Great Recession. Finally, the PSID data shows that government transfers are much more important for households where young men live with parents or other relatives. Across the seven PSID waves, government transfers plus other government credits averaged about $6,800 per household in 2009 dollars; this represented 15.7 percent of average earnings for these households. These transfers have increased substantially with time. By the 2013 survey (calendar year 2012), transfers/credits equaled 22.1 percent of average household earnings for households that are cohabitating with a young man. The government payments presumably contribute toward spending by the young men in these households, even if they are not the direct beneficiary. In fact, easily the most important government payment for these households, both in terms of level and trend growth, are social security income benefits. For these payments the young men are unlikely to be the direct recipient.

In Appendix Table 4, we further explore the potential insurance parents provide to their children using PSID expenditure measures. In particular, we track expenditures in households with young men relative to expenditures in households with older men. Given the different relative trends in hours worked documented above, it is useful to examine whether there are different trends in relative consumption. The analysis, however, is complicated by the fact that expenditures are measured at the household level while our analysis on employment and hours concerns individuals. We take the standard approach of deflating household expenditures by a measure of household scale (equivalence units), cognizant that this imposes the assumption that expenditures are split equally between the parent and the dependent. The PSID data indicate that younger men's consumption, adjusted for household size, does not decline relative to households containing older men. In particular, households containing a younger man experienced a decline in after-tax income of 6.6 percent between 2000 and 2012, but recorded less than a one percent decline in consumption. Households containing men age 31-55 experienced a smaller decline in income but a larger decline in expenditure. Restricting attention to less educated men, households with younger and older men reported the same decline in income (10 percent) and roughly similar declines in consumption (5 percent for younger men and 7 percent for older men). While the mapping of household expenditure to individual consumption is always difficult, and the composition of households vary over time, we view the consumption data as reinforcing the cohabitation trends as additional evidence that parents and close relatives are providing significant consumption insurance to young men during the 2000s.[12]

3.3 Trends in Well-Being

Before concluding this section, we use data from the General Social Survey (GSS) to examine trends in reported life satisfaction for young non-college men relative to other groups. The GSS is a nationally represented bi-annual survey that is designed to assess attitudes and beliefs of US residents. As part of the GSS, respondents are asked to report their overall level of happiness. In particular, the survey has consistently asked individuals the following question: "Taken together, how would you say things are going these days – would you say that you are very happy, pretty happy, or not too happy?" We create a happiness index that takes the value of 1 if individuals report that they are either "very happy" or "pretty happy," and takes value 0 otherwise. As with the ATUS, we pool together waves of the GSS in constructing our happiness index over time given the survey's modest sample size.[13] We examine three time periods: 2001-2005 (which includes the 2002 and 2004 waves), 2006-2010 (which includes the 2006, 2008, and 2010 waves), and 2011-2015 (which includes the 2012 and 2014 waves).

Table 5 tracks the trends in happiness for men of differing ages, the first two rows for all education groups, the latter two excluding those with 4 or more years of college. Jumping to the third row, the happiness of young non-college men actually increased by 7 percentage points (from 81 percent to 88 percent) since the early 2000s. Despite the small sample sizes, this increase is statistically significant at the 5 percent level. So, in conjunction with a steep decline in their employment rate, reported life satisfaction has increased for these young men. Furthermore, among young non-college men, both the employed and non-employed exhibit increases in happiness.[14] This pattern for young men stands in stark contrast to older workers. The last row of Table 5 documents that happiness fell sharply for older non-college men since the early 2000s. This group has experienced a large decline in work hours as well. In the early 2000s, older non-college men reported being happier on average than did younger non-college men. That relationship flipped by the 2011-2015 period. The deterioration of measures of well being for older workers has been studied recently by Case

[12] Section x.x in the Online Appendix provides full details for these results.

[13] During the 2000s, each wave of the GSS has between 2,000 and 4,000 respondents.

[14] Over the same period, reported happiness of young college men and young college women remained roughly constant. Again, this occurred despite falling employment rates for both groups.

Table 5: Reported Happiness During the 2000s for Different Age-Sex-Skill Groups, General Social Survey

	Fraction Reporting "Very Happy" or "Pretty Happy"				
	(1) Pooled 2001-2005	(2) Pooled 2006-2010	(3) Pooled 2011-2015	Diff (3)-(1)	p-value of difference
Men, Ed = All, 21-30	0.839 (n=249)	0.854 (n=507)	0.892 (n=343)	0.053	0.060
Men, Ed = All, 31-55	0.886 (n=630)	0.854 (n=1,528)	0.847 (n=903)	-0.039	0.031
Men, Ed < 16, 21-30	0.813 (n=193)	0.828 (n=372)	0.881 (n=244)	0.068	0.048
Men, Ed < 16, 31-55	0.883 (n=426)	0.828 (n=1,043)	0.813 (n=594)	-0.069	0.023

Note: See text for details.

and Deaton (2015). Table 5 adds to this literature by showing that, in contrast to older workers, young non-college individuals experienced a rise, rather than decline, in measured happiness over the past 15 years.

While by no means conclusive, these results are consistent with computer technology broadly, and video games in particular, increasing the value of leisure time for younger workers. Put differently, we should suspect forces, beyond reduced demand for their labor services, have affected the choices and well-being of young non-college men, as a decline in demand for one's labor should be no source of cheer.

4 The Changing Composition of Leisure Since the Early 2000's

The above results document that young men experienced a much larger decline in work hours relative to older men without any difference in relative wages during the 2000s. Additionally, we document that parents and relatives provide at least some partial insurance to these young men primarily through cohabitation. If labor demand shocks were solely driving differences in hours worked for young men relative to older men during this period, we should expect to see differences in relative wages. Our goal now is to examine whether differential labor supply shifts can help explain some of the difference in hours worked between young and older men.

To do so, we begin by establishing a set of facts with respect to how different demographic groups allocated their time during the 2000s using data from the American Time Use Survey (ATUS). A detailed discussion of our ATUS sample is provided in our Data Appendix. However, we wish to note that the sampling frame of the ATUS is those who have exited the CPS a few months prior. Given this, we impose the same sample restriction on our ATUS sample as we did for our CPS sample described above. In particular, we excluded those under the age of 25 who report being a full time student. Also, the ATUS only started in 2003. Given this, we track the evolution of time use changes from the mid-2000s through 2015. Finally, the ATUS records individual time use during one day in detailed 15 minute intervals. This means we only have one 24 hour time diary for each individual.

We begin by splitting the day's activities into six broad time use categories: market work, job search, home production, child care, education, and leisure.[15] All categories include any associated commuting time. Our home production measure includes time doing household chores, preparing meals, grocery shopping, obtaining other goods and services, doing home and vehicle maintenance, and caring for other adults. As in Aguiar and Hurst (2007) and Guryan et al. (2008), we separate out home production from time spent caring for, educating, or playing with children. We refer to this measure as child care time. Education time includes any time an individual spends on activities associated with their *own* education such as time spent attending college, taking courses, or doing homework associated with course work. Finally, job search includes activities such as sending out resumes, going on job interviews, researching details about a job, asking about job openings, or looking for jobs in the paper or the Internet.

Our total leisure category includes the following five sub-categories: recreational computer time; television and moving watching; socializing; adjusted eating, sleeping and personal care; and other leisure. A few comments are needed on our leisure classifications. First, recreational computer time includes any time an individual spends on email (for pleasure), playing computer games, surfing the web, browsing web sites, leisure time on smart phones, online chatting, engaging in social media and unspecified leisure computer use. Often, we will highlight the video/computer game subcomponent of recreational computer time.[16] Time

[15]We define our categories analogously to Aguiar et al. (2013) though they also included an "other" category that captures time spent on own medical care and other unclassified time use. Our Data Appendix details the exact activities included in our broad time use categories.

[16]The ATUS has a category of time use called "playing games". This category includes video games, but

spent on the computer for work or non-leisure activities (like paying bills) are embedded in other time use categories and are not a part of our recreational computer measure. Time spent on television and watching movies includes all time watching structured video programs on a variety of platforms. This includes traditional television and movie watching as well as watching streaming platforms like Netflix and videos on youtube. Time spent socializing includes any time entertaining friends or family, going to parties, hanging out with friends, visiting friends and family, going on dates, and attending or participating in civic or religious activities. The "other leisure" category includes all remaining leisure activities such as reading, relaxing, listening to music, going to the theater, exercising, playing sports, and engaging in hobbies.

Time spent eating, sleeping and on personal care (ESP) has both a biological and leisure component. Individuals need a minimum amount of ESP to survive. However, each of these activities can also be enjoyed as a leisure activity. We assume that the biological (non-discretionary) component of combined ESP is 7 hours a day. Our adjusted ESP measure is therefore total weekly hours spent on these categories minus 49 hours per week. We choose 49 as this threshold because, among persons ages 21 to 55 in the ATUS, 95 percent report at least 7 hours per day for ESP. Additionally, no demographic group we consider ever averaged less than 7 hours per day on ESP. We explored alternative levels of non-discretionary ESP (such as substracting off 6, 8 or 9 hours per day) and found no sensitivity to this choice.

4.1 Trends in Broad Time Use Categories

Table 6 shows trends in time use for different demographic groups during the 2000s. The top panel reports data for men while the bottom panel reports women. Within each panel, we explore samples that include all education groups (the first two columns), samples that include only less educated individuals (the middle two columns) and samples that include only more educated individuals (the last two columns). Focusing on the top panel of Table 6, Column 1 shows the change in average hours per week spent on each of our six broad categories for YM. To increase power, we group together data from the 2004-2007 period and from the 2012-2015 period. When analyzing trends during the 2000s, we take differences between the two pooled time periods.[17] YM and OM, on average, reduced their time spent

also includes playing cards as well as traditional board games like checkers, Scrabble, etc. The time use data do not allow us to distinguish playing the Scrabble board game from time spent on video games. As we document below, there was a very large increase in playing games during the 2000s, particularly for young men. We equate this increase with an increase in video game time. However, we realize that we may be identifying a Scrabble boom as opposed to a video game boom.

[17]Even though the ATUS starts in 2003, we begin our analysis in 2004 because of slight changes in the survey methodology between 2003 and 2004. Starting in 2004, indivdiuals were prompted to report any time eating if they did not mention such time on their own. Not surprisingly, we see a large discrete jump in

on market work by about 2.7 and 1.1 hours per week, respectively. According to the ATUS, the decline in market work for YM was about 80 hours per year larger than the decline in market work for OM between 2004 and 2015 (1.6 * 52). This difference in declining work hours between younger and older men is slightly larger than the difference in hours worked found in the CPS and Census/ACS datasets described above.

What is also of note from Table 6 is that the decline in market work is matched by a nearly identical increase in leisure time for both younger and older men. As a result, during the mid-2000s through 2015, young men experienced a roughly 70 hour per year increase in leisure relative to older men. The relative decline in market work between young and older men is not being offset by relative differences in the combined time spent on job search, education, home production or child care.

The middle columns of Panel (a) show similar patterns for less educated men. The time use trends for market work in the ATUS for less educated men also match well the hours worked trends in the CPS and Census/ACS for this group described above. While it is true to that education time increased by about 0.8 hours per week for LEYM, home production time fell for this group by roughly the same amount. The net effect of these changes is that the decline in hours worked for LEYM is matched nearly one-for-one with an increase in leisure time. The time use results further emphasize that less educated young men are both working less and taking more leisure than their older counterparts.

While the market work trends in the ATUS match well those in the CPS for less educated men, they match much less well for higher educated men. As seen by comparing Columns 1 and 5 of Table 6, the decline in market work for higher educated young men was roughly 70 hours per year *more* than the decline in market work for less educated young men during the 2000s.[18] This is at odds with *both* the CPS and Census/ACS data (shown in Appendix Table A1) where higher educated young men had a roughly 100 hours per year *smaller* decline in market work hours than did LEYM. Additionally, the decline in market work for higher educated young men in the ATUS was roughly 200 hours per year *more* compared to higher educated older men in the ATUS. This is also at odds with both the CPS and Census/ACS data where the decline in market work hours for higher educated young and older men were nearly identical. After exploring this thoroughly, we concluded that the small sample sizes for higher educated young men in the ATUS resulted in a sample that is not representative of higher educated young man more broadly during this time period. Within the ATUS, there are only about 160 higher educated young men per year (compared to about 500 less

eating time between 2003 and 2004 (relative to other years). To create consistent measures over time use during the 2000s, we therefore exclude the 2003 data from our analysis.

[18]To get these difference, we multiply the hours per week differences displayed in Table 6 by 52.

Table 6: Impact of Computer and Gaming Technology on Growth in Leisure for Between 2004-2007 to 2012-2015, By Various Demographic Groups

(a) Changes in Time Allocation

	All		Education < 16		Education ≥ 16	
Change 2004-2015 (Hours per Week)	21-30	31-55	21-30	31-55	21-20	31-55
Market Work	-2.7	-1.1	-2.7	-2.0	-4.1	0.0
Job Search	0.4	0.1	0.3	0.2	0.5	0.1
Home Production	-0.6	-0.9	-0.8	-0.3	0.5	-1.9
Child Care	-0.4	0.4	-0.1	0.4	-0.7	0.3
Education	0.7	0.0	0.8	0.0	0.1	-0.1
Leisure	2.5	1.2	2.5	1.6	3.4	1.0

(b) Women

	All		Education < 16		Education ≥ 16	
Change 2004-2015 (Hours per Week)	21-30	31-55	21-30	31-55	21-20	31-55
Market Work	-0.5	-0.5	-2.2	-0.9	-0.3	-0.4
Job Search	0.1	0.1	0.2	0.1	0.1	0.1
Home Production	-1.4	-1.8	-1.5	-1.8	-0.1	-1.6
Child Care	-1.2	0.2	0.0	0.1	-2.2	0.0
Education	0.6	-0.1	0.7	-0.1	0.2	-0.3
Leisure	1.6	1.9	1.9	2.3	1.8	1.9

Note: Table shows the change in time use for different age-sex-education groups by major time use category between 2004-2007 and 2012-2015. To increase sample sizes, we pool together data from the 2004-2007 ATUS and then pool together data from the 2012-2015 ATUS. The table shows the difference between the two pooled samples for different age-sex-skill groups (in hours per week). Time use categories are defined in text.

educated young men per year). The small sample sizes make us cautious with respect to interpreting the time use trends for higher educated young men. Given this, we focus our results throughout the remainder of the paper on either a sample of all young men or less educated younger men.[19]

Panel (b) shows the time use patterns for women by age and education. Comparing Panel A to Panel B a few things are noticeable. First, while the declines in market work were smaller for older women relative to older men, the increases in leisure were systematically larger for the older women. The reason for this is that older women experienced much larger declines in home productions relative to their older male counterparts during the 2000s. This is just an extension of the declines in home production time experienced by older women during the last half century (see Aguiar and Hurst (2007)). Second, unlike the patterns for men, the increases in leisure for young women were nearly identical to the increases in leisure for older women. It is the young men who systematically had the largest leisure gains during the 2004-2015 period.

4.2 Trends in Computer Time

Table 7 shows hours per week in various leisure categories for young men in the pooled 2004-2007 ATUS data and then again in the pooled 2012-2015 ATUS data. As with the ATUS sample used in Section 4.1, we exclude all individuals under the age of 25 that report being enrolled full time in school. Repeating the results from Table 6 in the top row of Table 7, YM and LEYM increased their leisure time by 2.5 hours per week from the mid 2000s through 2015. In an accounting sense, most of the increase in leisure time was driven by increased time spent on recreational computer activities. Specifically, for YM and LEYM recreational computer time increased by 1.9 and 2.0 hours per week, respectively. This increase represents 76 percent of the increase in total leisure time for YM and 80 percent of the increase in leisure time for LEYM. In terms of recreational computer time, most of the increase for these young men was in video game playing (roughly 1.5 hour per week). What is also striking from Table 7 is how most of the other time use categories did not change during the 2004-2015 period despite total leisure time increasing dramatically. For example, these young men did not significantly alter much their time spent TV/moving watching, socializing or other leisure activities during the 2000s. For both all young men and less educated young men, the remaining leisure time increase was primarily driven by increased

[19] It is also worth noting that there was about an 8 percentage point increase in the fraction of individuals with a bachelor's degree or more during the 2000s within the ATUS. This composition shift results in the increase in leisure for all young men to be less than the average of the increase in leisure for less educated young men and the increase in leisure for higher educated young men.

time on ESP.

Table 7: Leisure Activities for Men 21-30 (Hours per Week): By Education

Activity	Ed=All 2004-2007	Ed=All 2012-2015	Ed=All Change	Ed<16 2004-2007	Ed<16 2012-2015	Ed<16 Change
Total Leisure	61.1	63.6	2.5	61.9	64.5	2.5
Adj. Eating/Sleeping/P. Care	24.3	24.9	0.6	24.2	25.3	1.1
Total Recreational Computer Time	3.3	5.2	1.9	3.5	5.5	2.0
Video Game	2.0	3.4	1.4	2.3	3.8	1.5
TV/Movies/Netflix	17.3	17.2	-0.1	18.5	18.0	-0.5
Socializing	7.8	8.0	0.2	7.8	8.0	0.2
Other Leisure	8.3	8.2	-0.1	8.0	7.7	-0.3

Note: Table shows the average hours per week spent in various leisure activities all men between the ages of 21 and 30 (left panel) and all men between the ages of 21 and 30 with less than a bachelors degree (right panel). The sub-components of leisure sum to total leisure time. The first column in each panel shows data pooled over the 2004 through 2007 waves of the American Time Use Survey. The second column in each panel shows data pooled over the 2012-2015 waves. See the text for a discussion of the various leisure categories. Video game time is a subcomponent of total computer time.

Table 8 shows the leisure patterns for young men by employment status. Several things are worth noting. First, the non-employed, not surprisingly, have much more leisure time. As shown in Aguiar et al. (2013), the greater time at leisure for the non-employed constitutes more than half of the time accounted for by their reduced hours at market work compared to those employed. Second, the employed experienced an increase in leisure since 2004 of 1.9 hours per week, primarily driven by falling hours spent on home production. This decline in home production time continues a trend that started in the 1960s. Of the increase in leisure for the employed, roughly 70 percent can be attributed to increased recreational computer time (1.3/1.9). As with the results above which combined both the employed and non-employed, the bulk of the increase in recreational computer time was due to video game playing.

Turning to the non-employed, we see that average leisure hours actually fell since 2004. This partly reflects a composition shift in the pool of non-employed, as they now constitute a much bigger share of these young men. As seen in the last row of Table 8, the non-employed in the 2012-1015 period were much more likely to allocate time to both their own education

Table 8: Leisure Activities for Men 21-30 (Hours per Week): By Employment Status

	Employed			Non-Employed		
Activity	2004-2007	2012-2015	Change	2004-2007	2012-2015	Change
Total Leisure	57.8	59.7	1.9	86.6	82.3	-4.3
Adj. Eating/Sleeping/P. Care	23.6	23.9	0.3	30.1	29.9	-0.2
Total Recreational Computer Time	3.0	4.3	1.3	5.5	9.7	4.2
Video Game	1.9	2.9	1.0	3.5	5.9	2.4
TV/Movies/Netflix	16.0	15.5	-0.5	27.6	25.1	-2.5
Socializing	7.5	7.8	0.3	10.6	8.9	-1.7
Other Leisure	7.7	8.1	0.4	12.9	8.7	-4.2
Job Search and Education	1.9	1.9	0.0	9.6	14.0	4.4

Note: Table shows the average hours per week spent in various leisure activities for men between the ages of 21 and 30 by employment status. The sub-components of leisure sum to total leisure time. The first column of each panel shows data pooled over the 2004 through 2007 waves of the American Time Use Survey. The second column of each panel shows data pooled over the 2012-2015 waves. See the text for a discussion of the various leisure categories. Video game time is a subcomponent of total computer time.

and their job search. The increased time on education and job search exactly offsets the decline in leisure time. Given that these individuals did not work in the market and they are not doing that much home production, the increase in education time and job search must come from a decline in leisure time. However, despite the overall decline in leisure time for non-employed young men during the 2000s, time spent on recreational computers (video games) increased for this group by 4.2 (2.4) hours per week.

The time diaries only record activities from one day. Most individuals do not report spending time on that many activities during a given day. For example, even for the sample of non-working, young men during the 2012-2015 period, 60 percent report no recreational computer time during the prior day. However, those who do report recreational computer time spend a lot of time on that activity. During 2012-2015, conditional on having positive leisure computer time, the average time spent by non-working young men during the prior day on such computer related activities was 3.4 hours per day. During this period, 11 percent of individuals spent at least 4 hours during the prior day, 8 percent spent at least 5 hours during the prior day, and 5 percent spent at least 6 hours during the prior day on recreational computer activities.

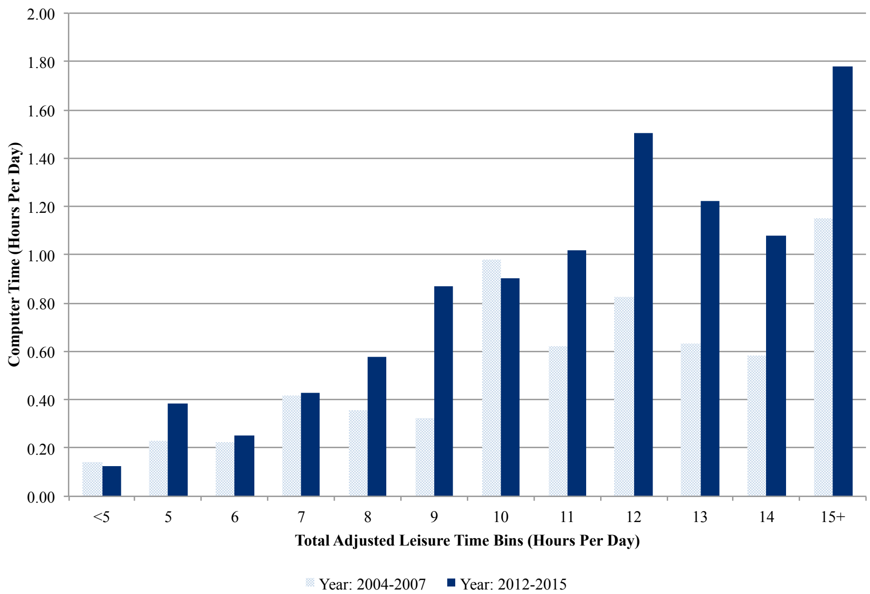
Figures 5 and 6 use the detailed ATUS data to further examine how the composition of leisure time has changed during the 2000s for young men holding total adjusted leisure time fixed. In Figure 5, we group all young men in both 2004-2007 and in 2012-2015 by their total adjusted leisure time. We deviate from above in that we present both adjusted leisure time and recreational computer time in units of hours per day as opposed to hours per week. We prefer using hours per day when we discuss individual as opposed to group variation because that is the way the data are collected. Aside from the first and the last bins, each of the other adjusted leisure bins span a range of one hour per day. We use the beginning part of each range to designate the bin. For example, the "5" bin includes all young men with adjusted leisure between 5 and 6 hours per day. The first bin includes young men with less than 5 hours per day of adjusted leisure while the last bin includes those with more 15 or more hours per day of adjusted leisure. On the y-axis, we report the average hours per day of leisure computer time for individuals within each bin. The light shaded lines (on the left within each bin) reflect the data from 2004-2007 while the darker shaded lines reflect data from 2012-2015.

As seen from the figure, computer time has systematically increased during the 2000s holding total leisure fixed. This is most pronounced at higher levels of leisure. For example, young men taking between 9 and 10 hours of leisure per day more than doubled their computer time between 2004 and 2015 (from roughly 0.3 to 0.9 hours per day). One implication of the model we develop below is that increases in utility generated from time spent on recreational computer activities will manifest itself as an increase in computer time holding total leisure time fixed. Figure 5 shows some preliminary evidence that such patterns hold in the data.

The variation across individuals in their adjusted leisure in Figure 5 reflects differences in market work status, whether the individual is sampled on the weekend or during a weekday, and other individual variation. Individuals, for the most part, take more leisure on the weekends. Additionally, as shown in Table 8, those that are not working take more leisure than those that are working. To isolate how much of the patterns in Figure 5 are due to shift towards non-working individuals between the 2004-2007 period and the 2012-2015 period, we split the analysis by work status. In the left panel of Figure 6, we examine working men while the right panel examines non-working men. Instead of showing detailed hour per week leisure bins, we define leisure quartiles based on the adjusted leisure of young working men in 2004-2007 (left panel) and young non-working men in 2004-2007 (right panel). We hold these bins fixed when we examine the respective 2012-2015 patterns.[20] The higher leisure

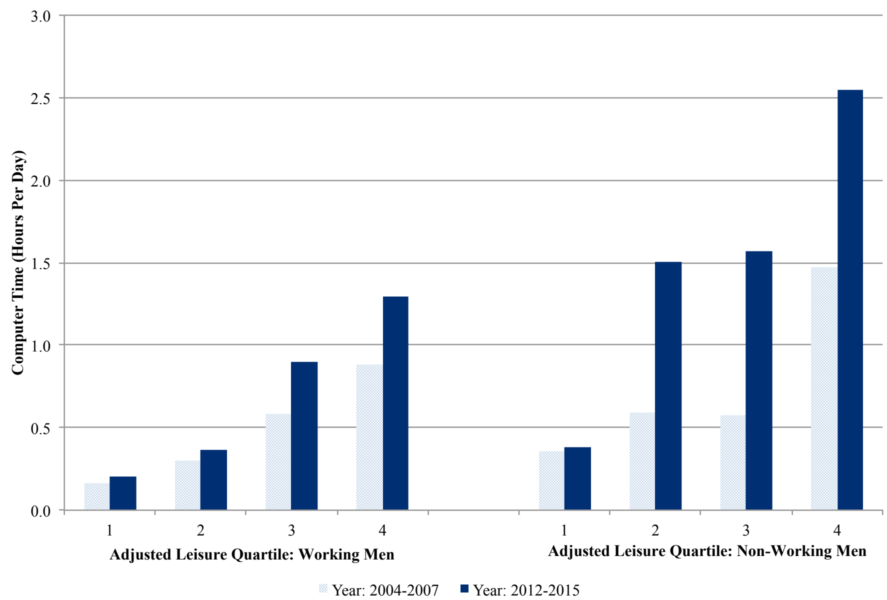
[20]Conditional on work status, the distribution of adjusted leisure time was very similar between the pooled

Figure 5: Hours Per Week on Recreational Computer Activities by Total Adjusted Leisure Time, Young Men



Note: Figure shows the average time spent on recreational computer usage (including video games) across individuals in different total adjusted leisure bins. We express recreational computer time in hours per day. Aside from the first and last bin, each of the other adjust leisure bins span a range of one hour per day. We use the beginning part of each range to designate the bin. For example, the 5 bin includes individuals who have adjusted leisure between 5 and 6 hours per day. The first bin is less than 5 hours per day while the last bin is 15 or more hours per day. The light shaded line (on the left) uses data from the 2004-2007 sample while the darker shaded line uses data from the 2012-2015 sample.

Figure 6: Hours Per Week on Recreational Computer Activities by Total Adjusted Leisure Time, Young Men



Note: Figure shows the hours per week spent in computing time for different adjusted leisure quartiles for young men by working status. The left panel shows data for working men while the right panel shows data for non-working men. The adjusted leisure quartiles are defined for working and non-working men separately. To ease comparison across times, we use the 2004-2007 sample to define the adjusted leisure quartiles thresholds and then apply those thresholds to the 2012-2015 data. Conditional on work status, the adjusted leisure quartile thresholds were very stable over time. For working men, the 25th, 50th, and 75th percentiles of the adjusted leisure distribution in 2004-2007 were 5.8, 8.3, and 12.9 hours per day, respectively. For non-working men, the 25th, 50th, and 75th percentiles of the adjusted leisure distribution in 2004-2007 were 9.7, 12.9, and 16.3 hours per day, respectively.

quartiles for working young men are disproportionately skewed towards individuals whose time diary day was a weekend. As seen from Figure 6, computer time conditional on total adjusted leisure time shifted up for both working and non-working men during the 2000s. Again, the data in Figure 5 indicates that computer time increased for both working and non-working men during the 2000s conditional on a given amount of total leisure.

Table 9 shows that the change in computer usage during the 2000s was primarily concentrated among young men. The top rows of Table 10 repeat total leisure time, recreational computer time, and video game time for YM during the 2004-2007 period and the 2012-2015. The last column presents the change between the two time periods. The remaining rows show the same three variables for older men, young women, and older women. While YM increased their recreational computer time by 1.9 hours per week during the 2004-2015 period, the increase was only 0.1 hours per week, 0.7 hours per week, and 0.5 hours per week for older men, young women, and older women, respectively. While young and older women increased their computer time slightly during the 2000s, none of the increase was concentrated in video games. The increase was primarily concentrated in activities like social media. The results in Table 10 suggest that the increased computer time (in general) and video game time (in particular) was a young male phenomenon.

5 Leisure Luxuries and Labor Supply

In this section, we present a framework that generates a leisure demand system which maps how leisure time allocated to a specific activity varies with total leisure time. We then show that this leisure demand system can be used to uncover relative changes in preferences or technology for one leisure activity relative to other leisure activities. We then use our derived "Leisure Engel Curves", along with the time use data discussed above, to calculate the extent to which improvements in recreational computing and video gaming has shifted the labor-leisure tradeoff of young men.

5.1 Computer Prices and Computer Expenditures During the 2000s

To help motivate our exercise, we provide some evidence on how the relative price of computer goods relative to other goods has evolved during the last 15 years. This provides some context on how technology has likely increased more for computer and video game activities relative to other activities. Appendix Figure A3 shows the evolution of the composite CPI, the "computer and peripheral equipment"component of the CPI, and the "toys and games"

2004-2007 data and the pooled 2012-2015 data.

Table 9: Computer Time and Video Game By Age-Sex-Skill Groups During the 2000s, American Time Use Survey

	(1) Pooled 2004-2007	(2) Pooled 2012-2015	(3) Diff (3)-(2)
	Men 21-30, Ed=All		
Total Leisure	61.1	63.6	2.5
Recreational Computer	3.3	5.2	1.9
Video Games	2.0	3.4	1.4
	Men 31-55, Ed=All		
Total Leisure	57.0	58.1	1.1
Total Recreational Computer	2.1	2.2	0.1
Video Games	0.9	0.8	-0.1
	Women 21-30, Ed=All		
Total Leisure	58.4	60.0	1.6
Total Recreational Computer	1.5	2.2	0.7
Video Games	0.8	0.8	0.0
	Women 31-55, Ed=All		
Total Leisure	56.1	58.0	1.9
Total Recreational Computer	1.6	2.1	0.5
Video Games	0.6	0.7	0.1

Note: Table shows the average hours per week spent in computer time and video game time by various age-sex-skill groups. The first column shows data pooled over the 2004 through 2007 waves of the American Time Use Survey. The second column shows data pooled over the 2012-2015 waves. Video game time is a subcomponent of total computer time.

component of the CPI. We normalize all three indices to be 100 in January of 2000. While the composite CPI experienced 40 percent inflation between 2000 and 2015, the price of computer goods has fallen to one-tenth its 2000 price level. Gaming expenditures are not part of the computer and peripheral equipment category. Instead, video and online games are a component of "toys and games" which also experienced a large relative price decline during the 2000s. Combining published deflator series for "toys and games" with information on the importance of its subcategories (provided to us by the BLS), we calculate a deflator for "video games and accessories" from 2008 onward. Our estimates show that the price of video games and accessories fell by about 12 percent *per year* between 2008 and 2015. Collectively, the price data suggest large technological gains in the computer and gaming industries since 2000 relative to other industries.

Our base model below treats leisure consumption as solely a function of time inputs, as opposed to combining time and expenditure inputs. As a rough approximation, this assumption matches computer and video game consumption, as the expenditure component of computer and video game consumption is relatively small on the margin compared to the time component. According to a recent surveys, 96 percent of U.S. residents between the ages of 18 and 29 in 2010 own a cellphone, 88 percent own a computer, and 62 percent own a game console.[21] Additionally, industry data reports that total spending on video and computer games was about $16.5 billion in 2015 for the US and that about 150 million Americans report playing some form of video or computer game during 2015.[22] This translates to an average of about $100 per year per person playing video or computer games. This should not be surprising given that subscriptions to online video game services average about $10 to $15 per month, the typical packaged video game costs around $50, and the average game app costs about $0.55.[23] Once purchasing the hardware - a computer, a smart phone or a video game console - the marginal cost in terms of playing video and computer games is very small. While the expenditure component of video and computer game activity is small on the margin, the time inputs are quite large. This serves as motivation for our modeling choices below where the quality increase in computer and video game activities leads individuals to have higher utility associated with given time inputs.

[21] Data from Pew Research Center report "Technology Device Ownership: 2015" file:///C:/Users/fehurst/Downloads/PI_2015-10-29_device-ownership_FINAL.pdf. The report also provides data from historical surveys.

[22] Data come from Entertainment Software Association which represents companies that publish computer and video games. Sales figures include revenues from physical video game sales, downloaded video games, mobile apps, social network gaming, and online gaming subscriptions.

[23] For example, the popular online game World of Warcraft charges roughly a $12/month fee, while popular console gaming companies like Xbox One and PlayStation charge monthly subscription fees of about $5/month. The Apple App Store reports the average price of a iOS gaming app as 55 cents. Pokeman Go, which was a worldwide sensation, was released for free.

5.2 Leisure Demand System

This section provides a framework that is useful to organize our analysis of the empirical patterns. The key feature is a variety of leisure activities, some of which are "leisure luxuries." With the framework in hand, we can explore how shifts in the allocation of time across different leisure activities shed light on changes in labor supply, both in terms of its level as well as its elasticity with respect to wage changes.

Consider a static problem in which an agent decides how to allocate time between market work and several leisure activities. The agent enjoys utility over a consumption good c, which is the numeraire, and time spent on leisure activities, h_i, $i = 1, ..., I$:

$$U(c, h_1, ..., h_I) = u(c) + \sum_{i=1}^{I} \theta_i \frac{h_i^{1-\frac{1}{\eta_i}}}{1 - \frac{1}{\eta_i}}.$$

Note that each activity has a unique elasticity η_i. Moreover, the θ_i represent preference shifters for various activities. This simple functional form eases exposition and estimation, but does require some caveats.

The separability between consumption and leisure implies that, conditional on a fixed amount of leisure time, how one allocates time over activities is independent of the level of consumption. This separability is consistent with the fact that the marginal unit of, for example, television watching or video game playing, does not require additional expenditure. However, there are fixed costs (equipment, games, cable subscriptions, etc.) that are not captured in this specification. At a more practical level, we do not have micro data on how individuals jointly allocate time and complementary expenditures. The separability assumption allows us to estimate the leisure demand system without taking a stand on how expenditures co-vary with time allocation, much like consumption demand systems are frequently estimated without controlling for complementary time inputs into various consumption commodities. In a similar spirit, the preference shifter θ_i is introduced as an exogenous quality of the leisure activity that captures the state of technology, while in practice technological innovations are typically embedded in associated hardware and software.

A second feature of the functional form for utility is that leisure activities are additively separable from each other. This reflects that the marginal value of watching television is not affected by the time spent, say, playing sports or sleeping. While this is a natural assumption, it does require care in deciding which activities are grouped together as perfect substitutes and which are not.

The agent faces a wage w in terms of the consumption good and has non-labor income, including transfer income, of y. The agent's problem is:

$$\max_{c,\{h_i\}_{i=1}^I} U(c, h_1, ..., h_I) \tag{1}$$
$$\text{subject to}$$
$$c \leq wn + y$$
$$\sum_i h_i + n \leq 1$$
$$n \geq 0.$$

The individual's time endowment is normalized to 1. We omit the constraints that $h_i \geq 0$ as the functional forms ensure these never bind.

Given the separability between consumption and leisure, we can consider the sub-problem of allocating leisure time across activities given total leisure H:

$$v(H) \equiv \max_{\{h_i\}_{i=1}^I} \sum_i \theta_i \frac{h_i^{1-\frac{1}{\eta_i}}}{1-\frac{1}{\eta_i}}$$
$$\text{subject to}$$
$$\sum_i h_i \leq H.$$

Let μ denote the multiplier on the total leisure constraint, and the first-order conditions are:

$$\theta_i h_i^{-\frac{1}{\eta_i}} = \mu. \tag{2}$$

The time constraint will hold with equality, and substituting in (2) we have:

$$H = \sum_i \theta_i^{\eta_i} \mu^{-\eta_i}. \tag{3}$$

Given H, there is a unique positive solution μ to (3). The envelope condition implies that $v'(H) = \mu$, and (3) implies v is strictly concave.

Returning to the original problem (1), we have:

$$\max_{c,H} u(c) + v(H)$$
$$\text{subject to}$$
$$c \leq w(1-H) + y$$
$$H \in [0,1].$$

Assuming an interior solution, we have the familiar optimality condition:

$$v'(H) = wu'(c). \tag{4}$$

Define ϵ as the elasticity of total leisure with respect to w, holding the marginal utility of consumption constant (the Frisch elasticity of leisure). Specifically:

$$\epsilon \equiv -\frac{d\ln H}{d\ln w}\bigg|_c = -\frac{v'(H)}{Hv''(H)}. \tag{5}$$

Differentiating and manipulating equations (2) and (3), we derive the following:

$$\epsilon = \sum_i s_i \eta_i, \tag{6}$$

where $s_i = \frac{h_i}{H}$ is the share of total leisure devoted to activity i. Thus the Frisch elasticity of leisure is a weighted average of the individual activity elasticities, with the weights given by the share of time devoted to each activity. In this environment, one should keep in mind that the Frisch elasticity is not a structural parameter, but will in general vary with the level of H.[24] In particular, as H increases, the shares devoted to high-η luxuries increase, which from (6) raises the Frisch elasticity of leisure. For example, an increase in non-labor income y results in an increase in leisure time, H, through an income effect. Moreover, it also makes the agent more elastic to changes in wages.

A key moment in our empirical work is how additional leisure time is allocated across

[24] There are close antecedents to this result in the consumption literature where there are multiple consumption goods. In particular, Crossley and Low (2011) discuss the restrictions necessary for a constant elasticity of inter-termporal substitution in a demand system involving multiple consumption goods. Browning and Crossley (2000) demonstrate the link between relative income elasticities and willingness to substitute inter-temporally. Both points have clear parallels to our current discussion of multiple leisure goods and labor supply elasticities.

activities at the margin. In the model, a set of steps similar to the derivation of ϵ yields:

$$\beta_i \equiv \frac{d \ln h_i}{d \ln H} = \frac{\eta_i}{\epsilon}. \tag{7}$$

This derivative is taken with respect to H while holding constant θ_i, $i = 1, ..., I$. Equation (7) indicates that the slope of an activity's Engel curve, denoted β_i, is given by the activity's own elasticity relative to the weighted average of all elasticities. Note that β_i is not a constant parameter, unless all activities have the same η_i. Otherwise, Engel curves must be inherently nonlinear, as the activity with the highest η_i must eventually dominate and its slope converge to one. Activities with a greater η_i increase disproportionately with total leisure time. That is, high η_i activities are "leisure luxuries." Our notion of a leisure luxury good is very similar to the notion of a consumption luxury good in traditional models of consumption demand systems. The distinction is that total expenditure is time rather than goods.

The Engel curve elasticities can be used to shed light on the link between the relative time spent on different leisure activities and the marginal utility of leisure. For exposition, let I denote the activity of interest, which in the empirical analysis will be recreational computer use and video games. Let $j \neq I$ be a "reference activity." In the empirical implementation, we shall consider several alternatives as the reference. From the respective first-order conditions (2), we have:

$$\begin{aligned}
\ln \theta_I - \ln \theta_j &= \frac{\ln h_I}{\eta_I} - \frac{\ln h_j}{\ln \eta_j} \\
&= \epsilon^{-1} \left(\beta_I^{-1} \ln h_I - \beta_j^{-1} \ln h_j \right),
\end{aligned}$$

where the second line uses the definition of β_i, $i = j, I$, from equation (7). Differencing over time, and holding β_i, $i = j, I$ and ϵ constant, we obtain a measure of relative technological change:

$$\Delta \ln \theta_I - \Delta \ln \theta_j = \epsilon^{-1} \left(\beta_I^{-1} \Delta \ln h_I - \beta_j^{-1} \Delta \ln h_j \right). \tag{8}$$

Figure 7 provides a graphical interpretation for how we map changes in relative leisure time to changes in θ_i. On the horizontal axis is $\ln H$ and the vertical axis log leisure time for activities j and I. We begin with the points associated with period t, denoted $\ln H_t$ on the horizontal axis and $\ln h_{i,t}$, $i = j, I$ on the vertical axis. These two points will be our base-year allocation of leisure time. As depicted, the agent spends more time on activity I than j, although this is not relevant for any calculation.

Through the period-t points, we extend leisure Engel curves with respective slopes β_i,

$i = j, I$. We have chosen I to denote the relative leisure luxury, and thus the line through $(\ln H_t, \ln h_{t,I})$ has a steeper slope. For the diagram (and the empirical implementation), we hold the slope of each curve fixed as we vary $\ln H$, and thus the depicted Engel curves are the linear approximation to the true non-linear leisure Engel curves. The Engel curves predict time spent on the two activities holding constant θ_i, $i = j, I$ at period t's level. Any deviation from the Engel curve is interpreted as shifts in θ_i.

For example, the figure also depicts data from a second period, $t+1$, with coordinates $(\ln H_{t+1}, \ln h_{t+1,i})$, $i = j, I$. To simplify the diagram, we do not indicate $\ln H_{t+1}$ on the horizontal axis. As drawn, total leisure in period $t+1$ is higher than in period t, and, moreover, leisure has shifted towards activity I and away from j relative to that predicted by the Engel curves. We can translate the observed points $h_{j,t+1}$ and $h_{I,t+1}$ to their respective Engel curves to obtain a measure of relative technology change. Doing so provides generates the implied $\Delta \ln \theta_I - \Delta \ln \theta_j$, scaled by the parameter ϵ.

With this procedure, in Section 6 we will use our estimated β_i and observed shifts in time allocation to measure the relative increase in technology for computers and video games. Note that the procedure behind equation (8) and Figure 7 does not tell us to what extent θ_I increased versus θ_j decreased. To make progress, we need a reference activity that is stable over time. In our empirical work, we will explore several alternatives.

We can also take the analysis a step further and ask how much of the observed change in total leisure, $\Delta \ln H_t$, can be attributed to improvements in leisure technology. In particular, consider an increase in θ_I between periods t and $t+1$. [25] First, recalling that $v'(H) = \mu$ and differentiating (3), we have:

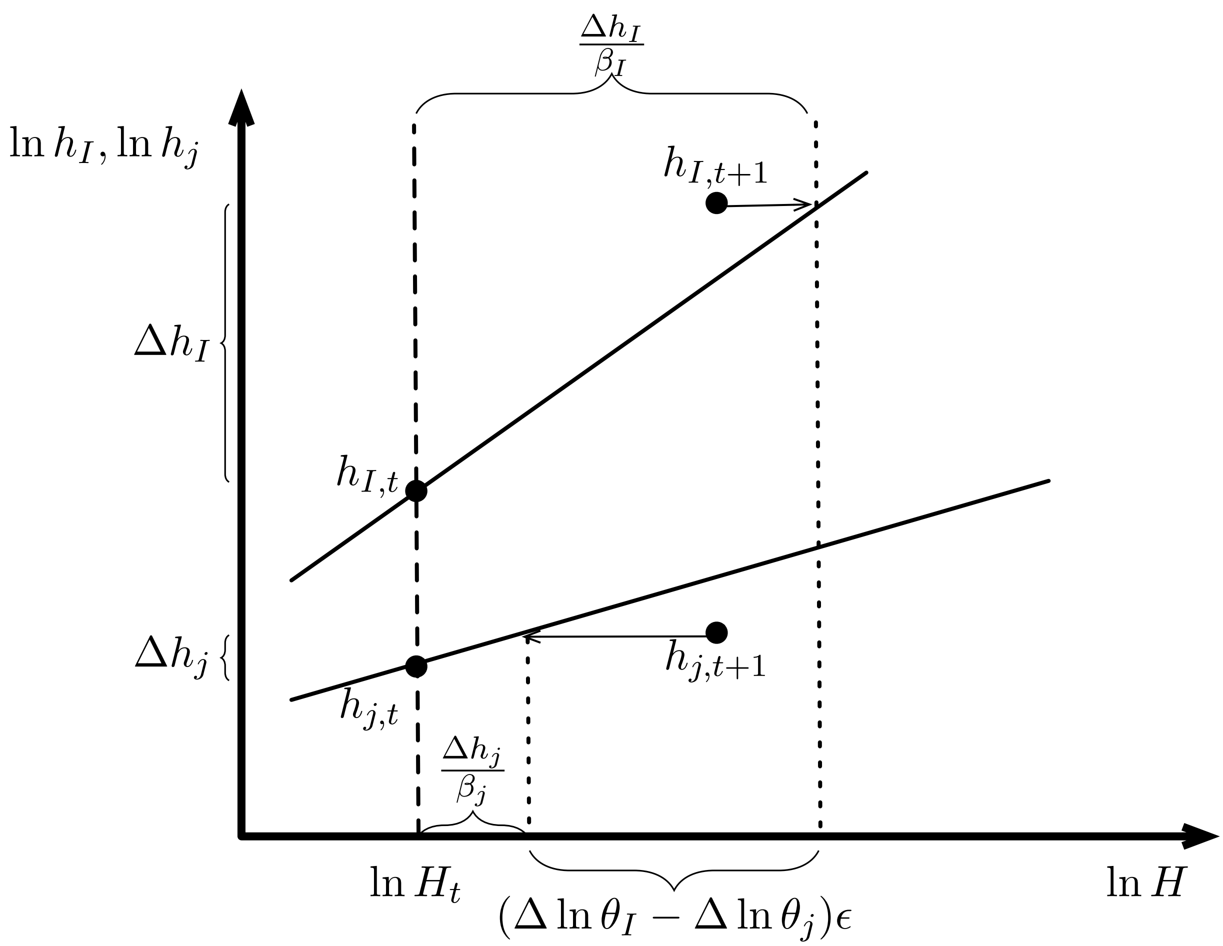
$$\left.\frac{d \ln v'(H)}{d \ln \theta_I}\right|_H = \frac{s_I \eta_I}{\sum_i s_i \eta_i} = \frac{s_I \eta_I}{\epsilon} = s_I \beta_I.$$

This is the change in the marginal value of leisure holding constant total leisure time H. An increase in θ_I raises the marginal utility, and the extent to which marginal utility rises is governed by how important that activity is in terms of its contribution to the overall elasticity.

Now consider the effect of a shift in θ_I on leisure time. To explore this, we need to take

[25] One note on functional forms is that we introduce θ as a multiplicative shifter outside the iso-elastic term. This unambiguously raises the marginal return to that activity, but whether it increases utility depends on whether $\eta_i \gtrless 1$. Alternatively, we could introduce θ as a technology shifter inside the iso-elastic function; that is, raise θ_i to the power $1 - 1/\eta_i$. One thing to keep in mind is that a more productive technology introduced in this way has an ambiguous effect on the demand for inputs. If $\eta_i \geq 1$, the two approaches have the same implications. However, if $\eta_i < 1$, the strong diminishing returns implies an improvement in leisure technology lowers demand for inputs. As the focus in the empirical work is on a leisure luxury, the unambiguous case of $\eta_i \geq 1$ is appropriate.

Figure 7: Using Leisure Engel Curves to Infer Shifts in Leisure Technology



a stand on what happens to consumption. We explore two extremes. We first assume c remains constant, with any loss in labor earnings offset by an increase in non-labor income–that is, the individual is perfectly insured. Secondly, we assume $y = 0$, so the agent is "hand-to-mouth" and consumes $w(1 - H)$. In both cases, we hold w constant.

In the former case, with consumption insulated, we differentiate (4) to obtain:

$$\left.\frac{d\ln H}{d\ln\theta_I}\right|_{c,w} = -\frac{d\ln v'(H)/d\ln\theta_I}{d\ln v'(H)/d\ln H} = s_I\beta_I\epsilon. \tag{9}$$

Thus the impact of a shift in technology is pinned down by the share of time allocated to the relevant activity times its elasticity.

If the agent is not compensated for foregone earnings, the impact on leisure will be mitigated by the income effect. In particular, if $c = w(1 - H)$ and $\sigma = -u''(c)c/u'(c)$, we have:

$$\left.\frac{d\ln H}{d\ln\theta_I}\right|_{c=w(1-H)} = \frac{s_I\beta_I}{\epsilon^{-1} + \sigma\left(\frac{H}{1-H}\right)}. \tag{10}$$

Using these expressions, we can explore how the observed shifts in time allocation affect total leisure. In particular, take the case of an increase in θ_I between t and $t+1$, holding constant all other θ_j, $j \neq I$, as well as consumption and wages. From (9), we have:

$$\begin{aligned} \Delta H|_{c,w} &\approx \frac{d\ln H}{d\ln\theta_I}\Delta\ln\theta_I \\ &= s_I\left[\Delta\ln h_I - \frac{\beta_I}{\beta_j}\Delta\ln h_j\right], \end{aligned} \tag{11}$$

where the second line uses equation (8) and the assumption that $\Delta\theta_j = 0$. Note that the Frisch elasticity term, ϵ, cancels in this expression. More importantly, the right hand side of the expression can be recovered from time diaries and the estimated Engel curves.

The hand-to-mouth calculation based on equation (10) is similar:

$$\Delta H|_{c=w(1-H)} \approx \frac{s_I\left[\Delta\ln h_I - \frac{\beta_I}{\beta_j}\Delta\ln h_j\right]}{1 + \epsilon\sigma\left(\frac{H}{1-H}\right)}. \tag{12}$$

In contrast to the constant-consumption calculation (11), this calculation requires taking a stand on ϵ and σ.

In the next two sub-sections, we will estimate β_i, and then use equations (11) and (12) to explore to what extent improvements in leisure technology shifted the "leisure supply curve."

5.3 Estimating Leisure Engel Curves

In this section, we use the ATUS time diaries to estimate the leisure demand system. Given that time diaries cover only one day, an individual's time diary will contain many zeros, even though the respondent likely spends time on that activities over the course of a week or month. We address this issue by aggregating over similar individuals in a state and time period, where similar refers to demographic cells defined by our two age groups, two education levels, and two genders. Given the small sample at the state level, we divide time into three four-year periods: 2003-2006, 2007-2010, and 2011-2014.[26] We weight the states by the number of observations in the state during the first time period. This minimizes the impact of smaller states that have few observations. Standard errors are clustered at the state level.

Recall that β_i defined in (7) represents the first-order response of activity i to an increase in total leisure time. Recall further that in general the leisure Engel curves will be non-linear. In the consumption literature, there are two primary approaches to approximate Engel curves. The most widely used approximation is Deaton and Muellbauer (1980)'s Almost Ideal Demand System (AIDS), which posits that the share of time allocated to an activity is linear in the log of total leisure time. Specifically,

$$s_{ikt} = \alpha_{i,k} + \delta_{i,t} + \gamma_i \ln H_{k,t} + \varepsilon_{ikt}, \tag{13}$$

where $s_{ikt} = h_{ikt}/H_{kt}$ denotes the share of total leisure time H_{kt} devoted to activity i in period t and state k; $\alpha_{i,k}$ is a state fixed effect; $\delta_{i,t}$ is a time fixed effect; and $\ln H_{k,t}$ is log leisure time in state k for time-period t. The estimation is conducted for each activity and each demographic sub-population separately; that is, all parameters vary with demographics, which is suppressed in the notation. From our estimated $\hat{\gamma}_i$, we recover an estimate of $\beta_i = d\ln h_i/d\ln H$:

$$\hat{\beta}_i = 1 + \frac{\hat{\gamma}_i}{\bar{s}_i}, \tag{14}$$

where $\bar{s}_i$ is the share devoted to activity i averaged across the three time periods and fifty states. A leisure luxury is defined as $\gamma_i < 0$, which implies $\beta_i > 1$.

This specification embeds an assumption regarding how the θ_i vary. Specifically, we assume that θ_i shifts uniformly for all agents across states, and hence will be absorbed in the time fixed effect. In the case of computers and video games, the assumption of common technology seems justifiable, given the widespread and rapid diffusion of these technologies during the 2000s throughout the US.[27] Note, our specification does allow for

[26] Our strategy here follows Aguiar, Hurst and Karabarbounis, 2013, who provide further discussion.

[27] We tried to find regional variation in the availability of high speed internet technology to use as a

different preferences for leisure activities across states (α_{ik}). However, we maintain that these preference differences are fixed over time.

The residual term in (13) captures idiosyncratic (at the state-time level) variation in preferences for particular activities. The identifying assumption is that these are uncorrelated with total leisure time. In particular, we are assuming that these taste shocks average out over activities such that they do not shift the choice of total leisure time. This embeds the assumption regarding a common θ_i. As a robustness, we will "instrument" for aggregate leisure, as discussed below.

Table 10 shows our estimates of γ_i using data for young men. We examine five broad leisure categories: total computer, TV/movies, socialization, adjusted eating-sleeping-personal care, and other leisure. We also break video gaming out from the broader recreational computer category. The first column of Table 10 includes time fixed effects and the second includes both time and state fixed effects. The third column reports the implied β_i using (14) and the first column's estimated $\hat{\gamma}_i$.

As seen from Table 10, computers and video games are leisure luxuries. Focusing on the results in Column 1 and the implied β_i in Column 2, the estimated γ_i for Recreational Computer is 0.08, which implies a β_i of 2.11. Breaking out video games and dropping other computer use from the category generates an implied elasticity of 2.43. The point estimates suggest that video game time is the most luxurious leisure activity for young men. TV/Movie watching has an estimated leisure elasticity of 1.32. All other activities have elasticities close to or less than 1. Sleep, eating, and personal care is a leisure necessity ($\hat{\beta}_i = 0.58$), while socializing and other leisure are neither a luxury nor necessity.

The estimates of γ_i are quite similar between Columns 1 (no state fixed effects) and Column 2 (with state fixed effects), suggesting that differing tastes for activities across states do not bias our estimated elasticities. However, the estimates with state fixed effects have larger standard errors reflecting that only within state variation is being used. The final column of 10 reports the estimates from a log-linear specification for comparison:[28]

$$\ln h_{ikt} = \delta_{i,t} + \beta_i \ln H_{kt} + \varepsilon_{ikt}. \tag{15}$$

The estimated elasticities from the log-log specification track those of the AIDS specification quite closely.

potential instrument for computer access. However, according to reports from the FCC, all MSAs had at least some individuals with high speed internet as far back as 2000.

[28] A challenge of the log-log specification is that some of the smaller time categories in the smaller states are zero, and hence are dropped from the regression. Given the smaller samples in the log-log specification, we do not include state fixed effects in the reported estimates; however, including state fixed effects for the computer and video games categories does not have a substantial impact on the estimates.

Table 10: Estimates of Leisure Engel Curves by Leisure Category, All Men Age 21-30, American Time Use Data

	AIDS Specification			Log-Linear Specification
	$\hat{\gamma}_i$	$\hat{\gamma}_i$	Implied β_i	$\hat{\beta}_i$
Recreational Computer	0.08	0.12	2.11	2.00
	(0.03)	(0.05)		(0.42)
Video Games	0.07	0.12	2.43	2.40
	(0.03)	(0.04)		(0.61)
TV/Movies/Netflix	0.09	0.06	1.32	1.33
	(0.03)	(0.06)		(0.14)
Socializing	0.00	0.03	1.02	1.15
	(0.03)	(0.05)		(0.26)
ESP	-0.17	-0.22	0.58	0.54
	(0.04)	(0.05)		(0.13)
Other Leisure	-0.004	0.000	0.97	0.81
	(0.03)	(0.04)		(0.22)
Time Fixed Effects	Yes	Yes	Yes	Yes
State Fixed Effects	No	Yes	No	No
Number of Obs.	150	150	150	(†)

Note: The first three columns of the table show the results of regression of the share of leisure time on different leisure activities against log total leisure for young men. Each row is a separate regression. The last column show the results of a regression of log time spent on a given leisure activity against the log of average total leisure for young men. Each observation is a state-year cell. We aggregate the data to three time periods: 2004-2007, 2008-2011, and 2012-2015. We weight the state regressions by the number of observations within each state. The first and fourth columns only include time fixed effects while the second column includes both time and state fixed effects. Standard errors clustered at the state level are reported in parentheses. See the text for additional details.
†: Number of observations in log-linear specification vary across activities due to zero time spent on some activities for some state-time cells.

Table 11 shows the estimates of γ_i and the implied β_i for recreational computer use for other demographic groups. Column 1 of Table 11 indicates that the implied elasticity for computers is 2.03 for less-educated younger men, which is similar to the 2.11 reported for all younger men in Table 10. However, the estimates for other demographic groups differ markedly from less-educated younger men. Column 2 reports younger men with a college degree have an elasticity of 0.95; older men (Column 3) have an elasticity of 0.50. The elasticities for women are also less than 1. Recreational computer use in general, and video games in particular, is a leisure luxury for younger men, but not for other demographic groups.

Table 11: Estimated Computer Time Engel Curve by Age-Sex-Skill Groups, AIDS Specification

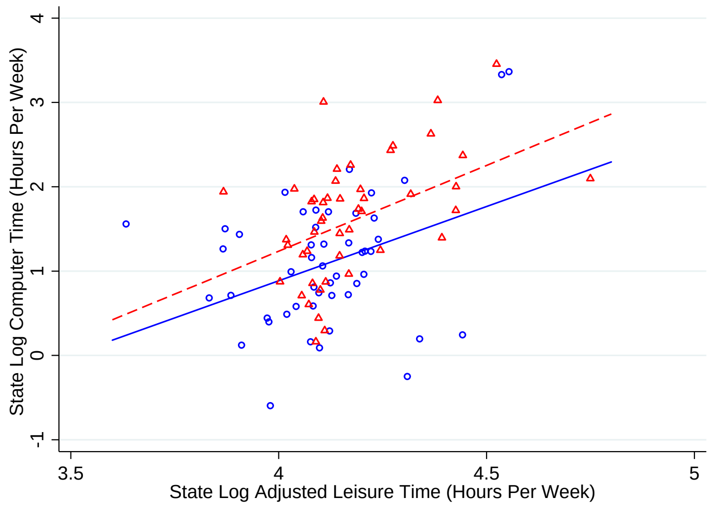
	Men 21-30 Ed<16	Men 21-30 Ed $\geq$ 16	Men 31-55 Ed: All	Women 21-30 Ed: All	Women 31-55 Ed: All
Recreational Computer ($\hat{\gamma}_i$)	0.08	-0.004	-0.02	-0.01	-0.004
	(0.03)	(0.03)	(0.02)	(0.03)	(0.02)
Implied β_i	2.03	0.95	0.50	0.77	0.88
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes
State Fixed Effects	No	No	No	No	No
Number of Obs.	150	150	150	150	150

Note: Table shows the results of a regression of share average time spent on recreational computer activities by different sex-skill-age groups on the log of average total leisure for that group. Each observation is a state-year cell. We aggregate the data to three time periods: 2004-2007, 2008-2011, and 2012-2015. We weight the state regressions by the number of observations within each state. The first column only includes time fixed effects while the second column includes both time and state fixed effects. Standard errors clustered at the state level are reported in parentheses. See the text for additional details.

We have performed a number of robustness checks on the estimated elasticity of video games with respect to total leisure time. We have allowed γ_i to vary by time period. The F-test that the coefficient is the same across the three time-periods has a p-value of x.x. We have also found no evidence that including higher order terms in total log leisure affects the estimated β.

In Appendix Table A4, we present an additional exercise to address the concern that shifts in the state-level taste for computers is driving the change in total leisure; that is, the orthogonality assumption that ε_{ikt} is independent of $\ln H_{kt}$ is violated. To correct for this, we use state level movements in the employment of men 41-55 as a proxy for state level changes in leisure of young men. The assumption is that differential shifts in employment of older men across states is not driven by changes in the relative taste for computers and video games. As we show in this appendix table, our results are nearly the same when we

Figure 8: Log Adjusted Leisure vs. Log Computer Time for Young Men, State Averages for 2004-2007 and 2012-2015 Time Periods



Note: Figure shows estimated Leisure Engel curves using cross state variation using pooled 2004-2007 data (circles and solid line) and pooled 2012-2015 data (triangles and dashed line). The x-axis displays log of adjusted leisure time (in hours per week) averaged over individuals within each state during the given time period. The y-axis displays log computer timer (in hours per week) averaged over individuals within each state during the given time period. For each of the two time periods, there are approximately 48 observations (one for each state). We have less than 50 observations for each time period because roughly 2 states in each time period had such small samples that there were no individuals using computer time during the given time period. The lines represented the weighted regressions of the state observations where each state is weighted by underlying number of time use observations we have in each state. The slope and intercept associated with the 2004-2007 data are, respectively, 1.76 (0.67) and -6.15 (2.78) with standard errors in parenthesis. The slope and intercept associated with the 2012-2015 data are, respectively, 2.03 (0.91) and -6.90 (3.75) with standard errors in parenthesis.

use older men change in hours as a proxy for the young men's change in hours.

We conclude this section by offering a visual sense of the data we use to estimate β_i. Figure 8 is a scatter plot of log recreational computer time against total log leisure time. Each point represents a state average. Circles depict our first time period $(2004-07)$ and triangles our last time period $(2012-15)$. The two trend lines have slopes of 1.76 and 2.03 for the first and last time periods, respectively. The p-value of the test that the slopes are equal is x.x. That is, the hypothesis that at each level of total leisure, the time allocated to recreational computer usage has shifted up proportionally over time cannot be rejected. This is the empirical counterpart to the discussion of Figure 7.

6 Leisure Luxuries and Leisure Supply During the 2000s

As described in Section 5.2, we can use the estimated leisure Engel curves to infer the relative shift in the quality of leisure activities and the corresponding impact on total leisure. We now perform a simple exercise that calculates how much the large shift in leisure time toward gaming/computer leisure may have contributed to the overall decline in labor supply over the past decade. While our focus is on younger men, we provide calculation for other demographic groups as well. In all calculations, we allow parameters to be demographic group-specific, including the Engel curve elasticities and share parameters.

Table 12 details our calculations. Panel (a) contains data on shifts in time allocation using the time diaries. Column 1 reports the average fraction of time allocated to leisure activities for various demographic groups, where a share is average hours per week divided by total hours available.[29] The numbers reported in Column 1 indicate that all demographics groups have roughly similar leisure time clustered around 50 percent of available time.

Column 2 reports the log change in leisure between 2004-07 and 2012-15. In this column we see the divergence in leisure over time, with younger men reporting an increase of 0.042 log points, which exceeds the 0.024 and 0.032 of older men and less-educated women, respectively. Younger men also devote substantially more of their leisure time to computers, which is reported in Column 3, and reported a much large increase in the time allocated to recreational computer use (Column 4).

The discussion of equation (11) emphasized that we can only identify shifts in leisure technology in relative terms. That is, we must select a reference activity. For our benchmark, we use a weighted average of non-computer activities.[30] In particular, let

$$\Lambda \equiv \sum_{i \neq I} \frac{s_i}{1 - s_I} \left(\frac{\beta_I}{\beta_i} \right) \ln h_i. \tag{16}$$

Table 12 Column 5 reports $\Delta \ln \Lambda$ for our demographic groups. The weighted growth in other leisure categories is an order of magnitude below that of recreational computer use for younger men. Below, we will also perform calculations using ESP as the reference activity as well as other leisure activities excluding TV/Movies.

Panel (b) of Table 12 uses equations (11), (9), and (10), and the data from panel (a) as

[29] More precisely, we assume each individual has 119 hours per week to freely devote to various activities, which is 24*7 minus the 49 hours per week that we take to be required for sleeping and personal care. The leisure categories correspond to those reported in Table 10. In addition we have added civic/religious activity (averaging 1.6 hours for PAM, 1.3 for LEYM) to social activities. The time diaries include a small amount of "unclassifiable" time, typically less than one to one and a half hours per week. We assume that this residual time is allocated to different activities (leisure, working, etc.) in proportion to their relative shares, so that it has no effect on H. The shares reported in Table 12 are an average of the shares for the first and last time

Table 12: Impact of Computer and Gaming Technology on Growth in Leisure for Between 2004-2007 to 2012-2015, By Various Demographic Groups

(a) Changes in Time Allocation

	(1) Share of Time in Leisure H	(2) Growth in Leisure $\Delta \ln H$	(3) Computer Share in Leisure s_I	(4) Growth in Computer $\Delta \ln h_I$	(5) Reference Growth $\Delta \ln \Lambda$
Men 21-30	0.53	4.2%	0.068	46.9%	4.1%
Men 21-30 Ed < 16	0.54	4.2%	0.070	45.4%	5.5%
Men 31-55	0.49	2.4%	0.037	4.8%	0.1%
Women 21-30	0.50	3.2%	0.031	35.8%	2.4%

(b) Implied Shifts in Technology and Leisure Supply

	(6) Implied Increase in Technology $\Delta \ln \theta_I$	(7) Impact of $\Delta\theta$ on Leisure Supply (Constant c) $\Delta \ln H\|_{c,w}$	(8) Impact of $\Delta\theta$ on Leisure Supply (Hand-to-Mouth) $\Delta \ln H\|_{c=w(1-H)}$
Men 21-30, Ed = All	20.3%	2.9%	1.4%
Men 21-30, Ed < 16	19.7%	2.8%	1.3%
Men 31-55, Ed = All	8.4%	0.2%	0.1%
Women 21-30	42.1%	1.0%	0.5%

Note: In panel (a), Column (1) is fraction of time in leisure, computed as a Tornqvist index of 2004-07 and 2012-15 shares. Column (2) is the log change in time allocated to leisure between 2004/07 and 2012/15. Column (3) is fraction of leisure devoted to recreational computer usage and video games, computed as a Tornqvist index of 2004-07 and 2012-15 shares. Column (4) is the log change in time allocated to computer usage and video games between 2004/07 and 2012/15. Column (5) is the weighted average of the log change in time allocated to other leisure activities, defined by equation (16). In panel (b), Column (6) evaluates equation (8) using Columns (4) and (5), the estimated Engel curve elasticity of recreational computers, and a leisure Frisch elasticity of one. Column (7) evaluates equation (9). Column (8) evaluates equation (10) assuming the inter-temporal elasticity in consumption is equal to the leisure Frisch elasticity.

well as the estimates from Table 10, to infer shifts in technology and leisure supply. From (11), we have

$$\Delta \ln \theta_I - \sum_{i \neq I} \frac{s_i}{1 - s_I} \Delta \ln \theta_i = \beta_I^{-1} \epsilon^{-1} \left(\Delta \ln h_I - \Delta \ln \Lambda \right). \tag{17}$$

Our normalization is that technology in other activities is constant over time; that is $\Delta \ln \theta_i = 0$ for $i \neq I$. Column 6 of Table 12 reports the implied increase in recreational computer technology. For example, the first row reports a change of 18.2%. This is obtained by taking the relative increase in leisure time devoted to computers (46.9% minus the reference activity's 4.1%) and dividing by our estimate of β_i (2.11) as well as the leisure Frisch elasticity ϵ, which we set to one for all groups. The numbers for the other rows of Column 6 are computed in the same fashion.

Columns 7 and 8 compute the shift in leisure supply, using equations 9 and 10, respectively. Column 7 reports the shift in leisure supply assuming constant consumption and wages. This calculation does not utilize preference parameters other than the estimates of β_i. Column 8 uses the "hand-to-mouth" assumption that all changes in leisure are reflected in a drop in labor income. This calculation requires the product of the leisure Frisch elasticity, ϵ, and the coefficient of relative risk aversion, σ, which governs the curvature over consumption. For our calculations, we take this product to be one, so that the Frisch elasticity equals the inter-temporal elasticity of substitution.

The numbers reported in Columns 7 and 8 are sizable for younger men. For young men as a group, the implied shift in leisure supply is nearly three percent holding consumption constant, and 1.4% assuming consumption adjusts one-for-one with lost labor income. The numbers are essentially the same when we focus on the sub-group of younger men with less than a college degree. For comparison, total leisure time increased 4.2% for younger men, and thus the shift due to computer and video game technology is equivalent to one-third to more than two-thirds of the overall increase. The comparable numbers for older men and women are significantly smaller.

We have also computed the implied change in θ_I and associated shift in leisure supply using ESP as our reference activity (as opposed to the weighted average of all other goods). It is plausible that there has been little change in the technology for this activity, and thus ESP provides a natural reference activity to identify the shifts in computer technology. ESP is also a relatively large share of leisure, averaging roughly 40% of total leisure over the pooled sample. For younger men, time allocated to ESP increased by 9.4% between 2004-07 and

periods (2004-07 and 2012-15, respectively).

[30] Specifically, the activities reported in Table 10; namely, TV, socializing, and ESP.

2012-15. Scaling by ESP's Engel elasticity of 0.58 (Table 10 Column 3), the implied $\Delta \ln \theta_I$ is 17.7%. This compares to the benchmark estimate of 20.3. The implied shifts in leisure supply are 2.6% (holding consumption constant) and 1.2% ("hand-to-mouth"), compared to the benchmark's 2.9% and 1.4%.

A second alternative reference activity we consider is the weighted average of all other leisure activities excluding TV/Movies. In particular, we compute an index similar to (16), but dropping TV from the summation. It may be argued that TV watching may be more of a substitute with gaming and computer activities than other leisure activities like socialization and exercise and sports. The increase in this index for younger men is 6.4%, which is a littler higher than the 4.1% of our benchmark $\Delta\Lambda$. This implies a slightly smaller increase in θ_I; namely, 19.2% compared to 20.3%. The implied shift in leisure is 2.8% and 1.3% for insured and hand-to-mouth, respectively, compared to the benchmark estimates of 2.9% and 1.4%. With this alternative reference basket, the induced shift in leisure remains roughly one-third to two-third of the observed increase, depending on whether we assume consumption is constant or not. These numbers, and the ones obtained using ESP as the alternative, reflect that our main estimates are not sensitive to the choice of reference activity.

With some assumptions, we can translate the shift in leisure supply to a shift in market labor supply. Keep in mind that we are "shifting" leisure and labor supply always holding wages constant. Our analysis, therefore, lends itself to estimating shifts in the labor supply curve. How this shift is translated into prices (wages) versus quantities in a labor market equilibrium depends on the slope of the labor demand schedule . To provide quantitative context for the shift in labor supply induced by computer technology, we compare it to the observed decline in market hours, keeping in mind that the latter is a combination of the shift in labor supply and movements along the supply curve (as well as changes in labor demand).

For younger men, Table 12 indicates that for a given level of consumption and wages, relative improvements in computer and video game technology induced a shift in the leisure supply curve of 2.9%. As leisure is 53% of total time, we scale by $H/(1-H)$ for an implied decline of non-leisure time of 3.3%. That is, the predicted decline in total work (both home-production and market work) is a little more than three percent. If we assume that – at the margin – leisure is drawn proportionally from market and non-market work, we have a predicted decline in market work of 3.3% as well. In the ATUS sample, market work for younger men fell 7.0%. Thus, the size of the induced shift in leisure from computer and video games is roughly 47% of the observed decline in market hours. Using the "hand-to-mouth" leisure increase of 1.4%, we predict a decline in market work of 1.5%, or 22 percent of the observed decline. The corresponding induced declines in market work for less-educated younger men are also 3.3 and 1.5 percent, while the observed decline is 7.5%. Thus, computer technology improvements have shifted the labor supply curve (at a given wage) by an amount roughly 20 to 44 percent of the observed decline in market work for LEYM. If labor demand was perfectly elastic, our results suggest that between 20 and 44 percent of the decline hours work for young men can be explained by these computer technology improvements. Given that labor demand is less than perfectly elastic implies that this this range is an upper bound on how much increased computer technology can explain the declining work hours of young men during the 2000s.

7 Conclusion (under construction)

References

Acemoglu, Daron, David Autor, David Dorn, Gordon Hanson, and Brendan Price, "Import Competition and the Great US Employment Sag of the 200s," *Journal of Labor Economics*, 2016, *34*, S141–S198.

Aguiar, Mark and Erik Hurst, "Measuring Trends in Leisure: The Allocation of Time over Five Decades," *Quarterly Journal of Economics*, 2007, *122*, 969–1006.

_ , _ , and Loukas Karabarbounis, "Time Use during the Great Recession," *American Economic Review*, 2013, *103*, 1664–96.

Autor, David and David Dorn, "The Growth of Low-Skill Service Jobs and the Polorization of the US Labor Market," *American Economic Review*, 2013, *103*, 1553–97.

_ , _ , and Gordon Hanson, "The China Syndrome: Local Labor Market Effects of Import Competition in the United States," *American Economic Review*, 2013, *103*, 2121–2168.

_ , Frank Levy, and Richard Murnane, "The Skill Content of Recent Technological Change: An Empirical Exploration," *The Quarterly Journal of Economics*, 2003, *118*, 1279–1333.

Becker, Gary, "A Theory of the Allocation of Time," *Quarterly Journal of Economics*, 1965, *75*, 493–517.

Beraja, Martin, Erik Hurst, and Juan Ospina, "The Aggregate Impications of Regional Business Cycles," *working paper*, 2016.

Browning, Martin and Thomas Crossley, "Luxuries are Easier to Postpone: A Proof," *Journal of Political Economy*, 2000, *108*, 1022–6.

Case, Anne and Angus Deaton, "Suicide, Age, and Wellbeing: An Empirical Investigation," *NBER Working Paper*, 2015, *21279.*

Charles, Kerwin, Erik Hurst, and Matthew Notowidigdo, "Housing Booms, Manufacturing Decline, and Labor Market Outcomes," *NBER Working Paper*, 2016, *18949.*

_ , _ , and _ , "The Masking of the Decline in Manufacturing Employment by the Housing Bubble," *Journal of Economic Perspectives*, forthcoming.

Crossley, Thomas and Hamish Low, "Is the Elasticity of Intertemporal Substitution Constant?," *Journal of the European Economic Association*, 2011, *9*, 87–105.

Deaton, Angus and John Muellbauer, "An Almost Ideal Demand System," *American Economic Review*, 1980, *70*, 312–326.

Dyrda, Sebastian, Greg Kaplan, and José-Víctor Ríos-Rull, "Business Cycles and Household Formation: The Micor vs the Macro Labor Elasticity," *working paper*, 2012.

Greenwood, Jeremy and Guillaume Vandenbroucke, "Hours Worked (Long-Run Trends)," in L.E. Blume and S.N. Durlauf, eds., *The New Palgrave Dictionary of Economics*, Palgrave, 2008, chapter Hours Worked (Long-Run Trends).

Hall, Robert, "Secular Stagnation," *working paper*, 2014.

Kaplan, Greg, "Moving Back Home: Insurance Against Labor Market Risk," *Journal of Political Economy*, 2012, *120*, 446–512.

Kopecky, Karen, "The Trend in Retirement," *International Economic Review*, 2011, *52*, 287–316.

Mian, Atif and Amir Sufi, "What Explains the 2007-2009 Drop in Employment?," *Econometrica*, 2014, *82*, 2197–2223.

Mincer, Jacob, "Labor Force Participation of Married Women: A Study of Labor Supply," in "Aspects of Labor Economics," Princeton University Press, 1962.

Moffit, Robert, "The US Employment-Population Reversal in the 2000s: Facts and Explanations," *Brookings Ppaers for Economic Activity*, 2012, *Fall*, 201–264.

Solon, Gary, Robert Barsky, and Jonathan Parker, "Measuring the Cyclicality of Real Wages: How Important is Composition Bias," *The Quarterly Journal of Economics*, 1994, *109*, 1–25.

Vandenbroucke, Guillaume, "Trends in hours: The U.S. from 1900-1950," *Journal of Economic Dynamics & Control*, 2009, *33*, 237–249.

Appendix [Under Construction]

A1 Data Appendix

TBA

A2 Trends in Market Hours: Additional Tables and Figures

Appendix Table A1 shows similar patterns to those reported in Section 2 using data from the 2000 U.S. Census and the 2001-2015 American Community Surveys (ACS). The U.S. Census and ACS asks comparable questions for large cross sections of U.S. residents pertaining to demographics, family composition and labor market experiences. The Census and ACS data tracks full time school enrollment consistently during the 2000-2015 period for all individuals not just those under the age of 25. Therefore, using the Census/ACS data allows us to explore the robustness of our results to excluding all full time students as opposed to just full time students under the age of 25. Panel A of Appendix Table A1 is analogous to Table 2 but with the Census/ACS data imposing similar sample restrictions as with the CPS data. In particular, panel A excludes only full time students under the age of 25.[31] The CPS and Census/ACS data compare well in terms of annual hours worked in all years. There are two exceptions. First, similar to what others have documented in the literature, annual hours works in the 2000 CPS exceed hours worked in the 2000 Census.[32] Despite the differences in levels of hours worked in 2000, the relative changes in annual hours across sex-age-education groups are very similar. LEYM had the largest decline in annual hours worked during the 2000s. Moreover, the annual hours of LEYM decreased by 63 hours per year more than less educated older men during the 2000-2015 period. This is nearly identical to the patterns shown in Table 2. Also similar to Table 2 is the fact that both young and older higher educated men had nearly the same decline in annual hours worked during the 2000s. Second, the Census/ACS data show only a small difference in the trend in hours worked during the 2000s between young and older higher educated women. The difference was much larger in the CPS data.

Panel B of Table Appendix Table A1 explores the robustness of our results to excluding from our sample full time students over the age of 25. The patterns between Panel A and Panel B are nearly identical. Less educated young men declined their market work hours

[31] To fascilitate comparison with the CPS, we also exclude those individuals residing in group quarters for our Census/ACS analysis. We impose this restriction throughout the rest of the paper any time we use the Census/ACS data.

[32] It is well documented that employment rates in the 2000 Census are much lower than employment rates in the 2000 CPS. See, for example, Clark et al. (2003). This depresses annual hours worked in the 2000 ACS relative to the CPS. Additional differences occur between the CPS and Census/ACS hours worked measures given the different sampling frame and different way that hours worked are asked. For example, the Census/ACS ask about hours worked during the prior 12 months as opposed to the prior calendar year. Given this difference, when using the Census/ACS data, we designate year t hours as coming from year t respondents. The fact that the timing between the two data sets are not exact will also cause the hours worked measures to differ slightly.

by about 172 hours per year when all full time students are excluded. The comparable number where only full time students under 25 were excluded was 183 hours per year. This robustness exercise shows that the extent to which we cannot exclude all full time students in the CPS is not substantively affecting our conclusions about trends in market work for young men relative to older men during the 2000s.

Finally, the patterns we document in Section 2 are robust for many other demographic groups. For example, the decline in hours worked for young black men and young native born white men during the 2000-2015 period in the CPS was 12.4 percent and 12.6 percent, respectively. Appendix Figure A1 is analogous to Figure 3 except the trends are shown for young black men and young native born white men. While the fraction of young black men not working for the entire year is persistently higher than the fraction of young white men not working for the entire year, the time series trends are very similar between the two groups. For example, the fraction of native born whites who did not work the prior year was only 5 percent in 1993. As of 2015, that number is roughly 13 percent. Although not shown, we also explored the patterns based on whether the young men lived in center cities, suburbs, or rural areas. The declines were roughly similar for black and white men across all three of these location types. These results show that the declines in hours worked for young men were broad based hitting both blacks and whites regardless of whether they were living in urban or rural areas.

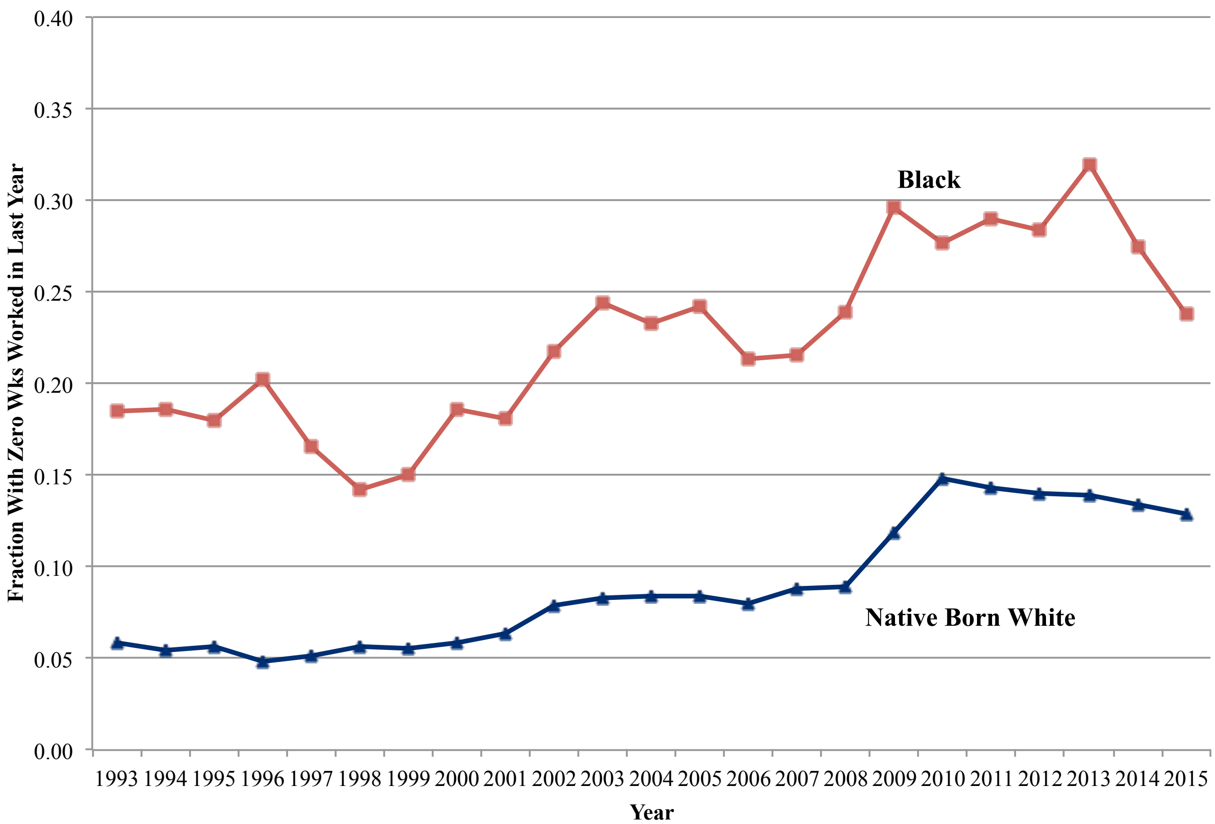
A3 Trends in Real Wages: Demographic Adjustments and Imputationd

In Appendix Figures A2 and A3 we explore the potential role of selection in biasing the conclusions from Figure 4. We detail these procedures in depth in the Data Appendix that accompanies the paper. Briefly, in Appendix Figure A2 we adjust the real wage trends for the changing nature of the demographic composition of the workforce over time. In particular, we define demographic cells in each year based on four education groups (less than high school, high school, some college, and a bachelors degree or more) and seven five-year age groups (21-25, 26-30, etc.). We then compute the average real wage within each demographic cell within each year. To compute the time series of wages for both young and older men, we hold the demographic composition fixed at year 2000 levels. In Appendix Figure A3 we go one step further. In addition to holding the demographic weights of the sample fixed at 2000 levels, we also attempt to impute the wages for those with no wage observation. Our imputation procedure assumes that those with no wage observation were drawn from the bottom part of the wage distribution for those with wages in their respective demographic cell.[33]

There are two important results from Appendix Figures A2 and A3. First, the decline in wages between 2000 and 2015 for all groups is much larger with these adjustments. This is not surprising given that those who left the labor force during the 2000s tended to come

[33] Specifically, we assign the individuals with non-positive wages the wage of the 33rd percentile of those with positive wages within their respective demographic cell. For this analysis, our sample sizes are larger because we do not exclude those with zero or negative wages. See the Data Appendix for additional details.

Figure A1: Fraction of Young Men Who Report Working Zero Weeks During Year By Race, March CPS

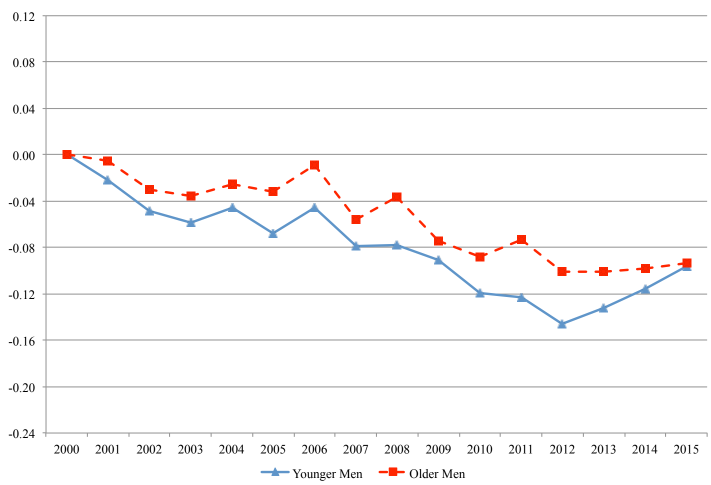


Note: Figure shows the share of men aged 21-30 who report working zero weeks during the prior year, by race. We show the series for individuals who report their race as black (squares) and for individuals who report their race as white and who report being born in the United States (triangles). Data from the March supplement of the Current Population Survey. Individuals reporting attending school full time are dropped from the sample. See text for additional details.

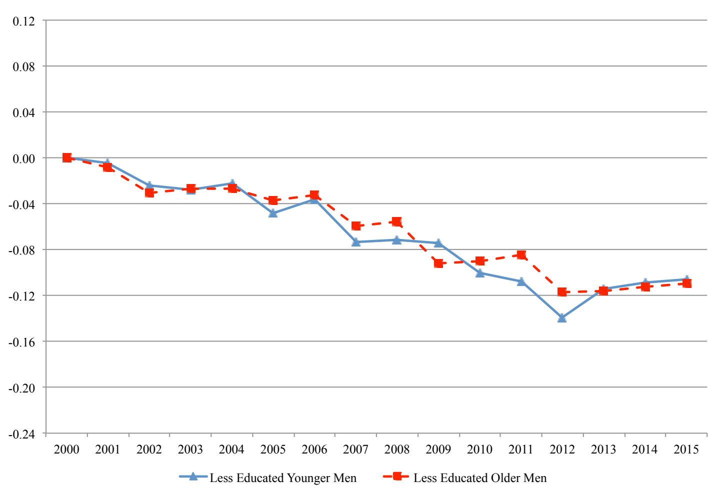
from demographic groups with lower average wages. For example, with no adjustments at all (Figure 4), less educated men experienced wage declines between 2000 and 2015 of about 10 percent. Adjusting for the changing demographic composition of the work force over time (Appendix Figure A2) and imputing the wages for those with non-positive wages (Appendix Figure A3) resulted in mean wage declines for less educated men of roughly 11 percent and 13 percent, respectively, during this time period. Second, and most importantly, with the demographic adjustments our main conclusion from Figure 4 persist. In particular, the decline in wages between young men and older men during the 2000s is identical regardless of our treatment for selection. While accounting for selection may be important for how much wages fell during the 2000s, it does not seem to be important at all for our point that the relative wage declines of young men and older men were very similar despite the large differences in hours worked between the groups.

Figure A2: Demographically Adjusted Hourly Real Wage Index for Men By Age, March CPS

(a) All Men



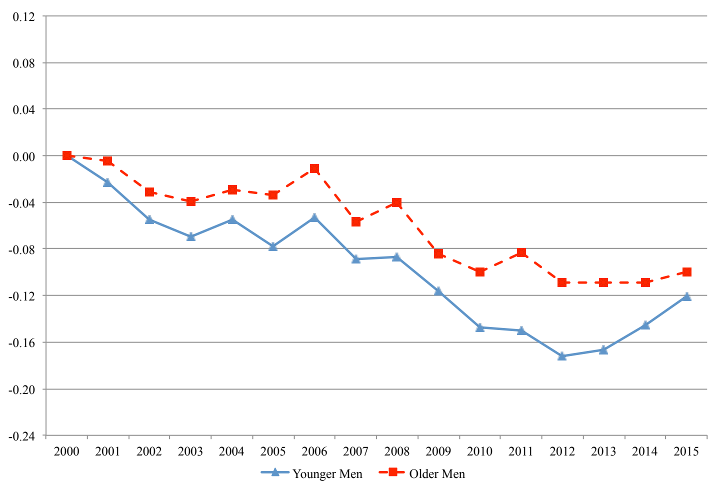
(b) Men Ed <16



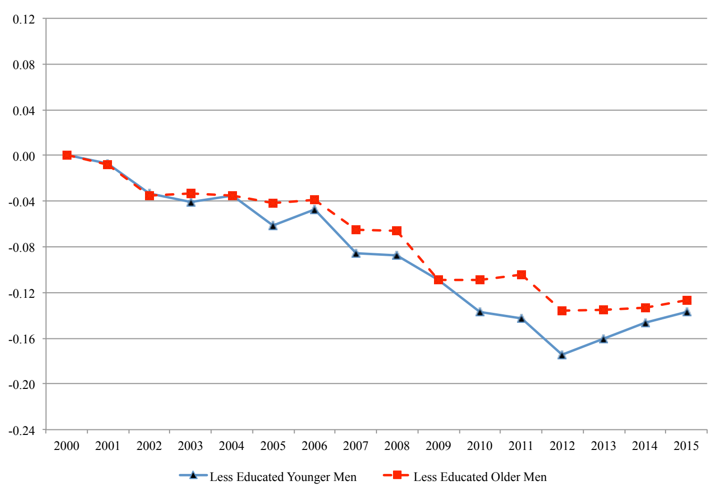
Note: Figure shows hourly real wage index for young men (triangles) and older men (squares). Hourly wages are reported as annual earnings last year divided by annual hours worked last year. We demographically adjust the wage series by defining cells based on age and education. We compute wages within each cell within each year. We then hold the cell weights fixed at year 2000 levels. The procedure holds the demographic composition fixed over the sample period. See text for additional details. We deflate wages using the June CPI-U. We convert the series to an index by setting year 2000 values to 0. All other years are log deviations from year 2000 values. Data from the March supplement of the Current Population Survey.

Figure A3: Demographically Adjusted Hourly Real Wage Index for Men By Age with Imputations for those with Missing Wages, March CPS

(a) All Men

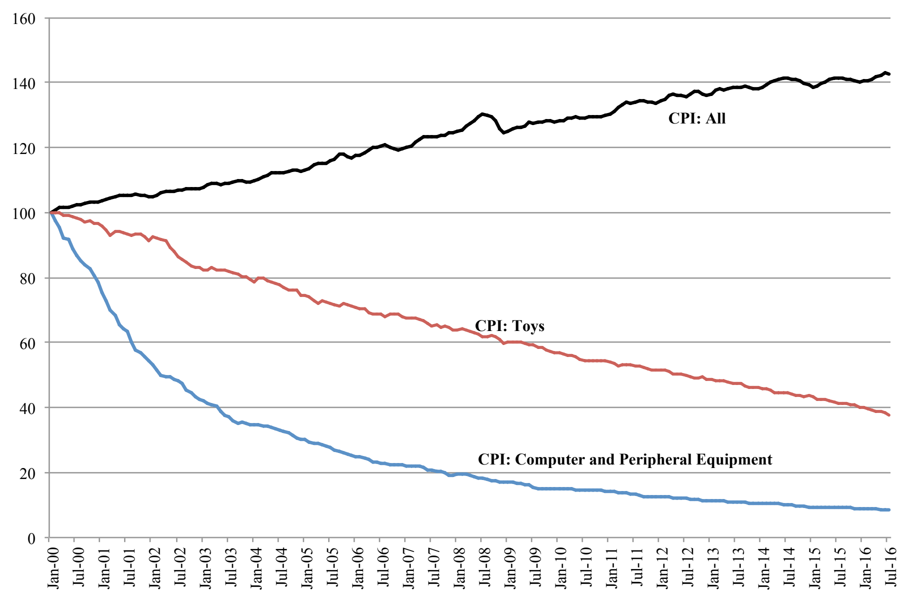


(b) Men Ed <16



Note: Figure shows hourly real wage index for young men (squares) and older men (triangles). Hourly wages are reported as annual earnings last year divided by annual hours worked last year. We demographically adjust the wage series by defining cells based on age and education. We compute wages within each cell within each year. We then hold the cell weights fixed at year 2000 levels. The procedure holds the demographic composition fixed over the sample period. In addition, we set the wages of those with no wage observation to the 33rd percentile of their respective demographic cell. The imputation crudely accounts for the potential for those who are not working to be selected from the lower part of the wage distribution. See text for additional details. We deflate wages using the June CPI-U. We convert the series to an index by setting year 2000 values to 0. All other years are log deviations from year 2000 values. Data from the March supplement of the Current Population Survey.

Figure A4: Price Index of Computer and Peripheral Equipment, Toys, and Composite CPI During the 2000s



Note: Data from BLS.

Table A1: Annual Hours Worked During the 2000s By Age-Sex-Education Groups, ACS Data

(a) Excludes Full Time Students Whose Age 24

	Men Ed<16		Men Ed≥16		Women Ed<16		Women Ed≥16	
	21-30	31-55	21-30	31-55	21-30	31-55	21-30	31-55
2000	1,749	1,884	1,937	2,197	1,231	1,314	1,630	1,560
2007	1,712	1,849	1,913	2,169	1,196	1,309	1,638	1,563
2010	1,478	1,665	1,817	2,109	1,116	1,248	1,624	1,579
2015	1,567	1,764	1,859	2,125	1,176	1,253	1,663	1,630
Change 2000-15	-183	-120	-78	-73	-55	-61	33	70
Pct Change 2000-15	-11.0%	-6.6%	-4.1%	-3.4%	-4.5%	-4.8%	2.0%	4.4%

(b) Excludes Full Time Students Whose Age 24

	Men Ed<16		Men Ed≥16		Women Ed<16		Women Ed≥16	
	21-30	31-55	21-30	31-55	21-30	31-55	21-30	31-55
2000	1,760	1,888	2,013	2,216	1,230	1,314	1,665	1,562
2007	1,732	1,855	2,002	2,189	1,195	1,310	1,692	1,564
2010	1,499	1,675	1,916	2,129	1,116	1,253	1,681	1,585
2015	1,589	1,770	1,950	2,142	1,178	1,254	1,722	1,634
Change 2000-15	-172	-118	-63	-74	-52	-60	57	72
Pct Change 2000-15	-10.3%	-6.5%	-3.2%	-3.4%	-4.3%	-4.7%	3.4%	4.6%

Note: Table shows annual hours worked from the 2000, 2007, 2010, and 2015 ACS. Annual hours are calculated by multiplying self-reported weeks worked over the last 12 months by self-reported usual hours worked per week. Given the structure of the ACS, respondents in year t report hours worked during the prior 12 months. We designate the response by respondents in survey year t as referring to hours worked in t. Sample in Panel A excludes individuals under the age of 24 (inclusive) who report being full time students. Sample in Panel B excludes all individuals who report being full time students (regardless of age). See text for additional details.

A4 PSID Consumption Measures

To continue our analysis of the potential insurance parents provide to their children (both employed and non-employed) we also examine consumption for young men based on data from the PSID. These data measure non-durable and service expenditures at the household level, while our analysis on employment and hours concerns individuals. We take a standard approach by deflating household expenditures by a measure of household scale (equivalence units). We set this scale equal to $\sqrt{n}$, where n denotes number of household members.[34] Note that we treat all household members symmetrically. Thus, in a household with a working prime-age adult plus a non-employed young man, we would allocate an equal amount of consumption to both. To the extent that the expenditure of such households are geared towards the parents, we will overestimate consumption of these young men.

In Table A2 we report the growth rate in average expenditure for all households that include young men ages 21 to 30. For comparison, we report the same for households that include men ages 31 to 55. These sets overlap to the extent young and older men are coresidents. Our measure of consumption includes expenditures on housing (either rent or imputed rental equivalence for owners, and utilities), food (both for consuming at home and away), transportation (gasoline, public transit), heath, and education. These are the NIPA-defined nondurable and service categories reported consistently within the 2001-2013 PSID samples.[35] The table also reports the growth in household after-tax income for each subgroup. Before-tax income reflects PSID responses, while household taxes are calculated using NBER TAXSIM. Both income and expenditures are deflated by each household's equivalence scale, discussed above, and the GDP deflator.

Looking at the first two column's of Table A2, we see that households with younger men displayed only a slight decline in real expenditure, 0.7 percent, despite displaying a decline in household income of 6.6 percent. The table compares results for younger and older men. We see that households with young men displayed a 4.8 higher growth in consumption than households with older men, despite displaying 2.6 percent lower growth in income. The last column of Table A2 reports growth in expenditures for households with LEYM members versus households with men aged 31 to 55, also with less than four years of college. Again we see a slightly higher growth rate in expenditures, by 1.9 percent for LEYM, while household income growth looks the same across the two groups. Repeating, it is important to recognize that the increase in cohabiting with parents we document in Table 4 can act to raise the growth rates in household income and expenditures shown in Table 6. To the extent these "kept" young men consume less than proportionately from household expenditures, Table A2 will exaggerate young men's consumption growth since 2000. With this important caveat, we see this evidence, and especially that on increased cohabiting, as suggesting that young men have insulated their consumption, at least partially, from the full force of any earnings loss.

[34]The square-root scaling factor has been adopted in recent OECD studies, for instance www.oecd.org/social/inequality.htm.

[35]Rental equivalence is imputed based on owner's reported value of home. This mapping is estimated from the BLS Consumer Expenditure Survey, which contains reponses on rental equivalence as well as value of home.

Table A2: Household Size Adjusted Real Consumption and Income Growth from 2000 to 2012, PSID

	Men: All Ed		Men: Ed<16	
	After-tax Income Growth	Consumption Growth	After-tax Income Growth	Consumption Growth
Households w/ Men 21-30	-6.6%	-0.7%	-10.0%	-4.8%
Households w/ Men 31-55	-3.9%	-5.5%	-10.0%	-6.7%
Difference	-2.6ppt	4.8ppt	-0.04ppt	1.9ppt

Note: Data reflect 2001 and 2013 PSID surveys, corresponding to calendar years 2000 and 2012. Series are deflated by household-specific equivalence scale and the GDP deflator. The household equivalent scale is equal to square root of number of household members. After-tax income is calculated by netting taxes from the before-tax income reported in the PSID, where taxes are calculated using NBER TAXSIM. The consumption measure reflects expenditures reported on rent, or imputed rental equivalence for owners, utilities, food, transportation (gasoline, public transit), heath, and education.

A5 Alternative Engel Curve Estimation

In this appendix, we explore two additional identification strategies for demand system estimation. First, we use state level movements in the employment of men 41-55 as a proxy for state level changes in leisure of young men. The identification assumption here is that relative state-level changes in θ for computer use are not correlated with relative shifts in labor supply or labor demand across states for 41-55 year old men. As shown in the prior section, middle-age men allocate little time to either (non-work) computer usage or video games. Instead, we are assuming that cross state variation in the employment of middle-age men is being driven by local labor demand shifts.[36] By isolating state-specific movements in total leisure time for young men that project on their state's movements in employment of older men, we are isolating changes in leisure for young men that are driven by changing local labor demand conditions.

Second, we focus purely on relative shifts in total leisure between non-college and college young men over time, and ask how these changes map to differential changes in computer use. The assumption here is that the preferences and technology of non-college men and college men are the same, at least with respect to computer and gaming leisure, so that changes in θ affect the two groups equally. Therefore, how the non-college group's computer time increases, vis a vis that for the college group, as its relative total leisure increases can identify the leisure Engel curve for computer usage.

Panel (a) of Table A3 implements our first alternate identification strategy. Using data from the 2007 and 2010 March CPS, we pool men ages of 41 to 55 by their state of residence

[36] Beraja et al. (2016), Charles et al. (2016), and Mian and Sufi (2014) all conclude that declines in labor demand explain cross region variation in employment during the Great Recession.

each year. We then compute average hours worked for this group by state for both 2007 and 2010. We segment states into three groups based on the percentage change in work hours for 41-55 year old men during the 2007-2010 period of the Great Recession. The "high-declining work hours" states include the 17 states with the largest hours decline for older men, while the"low-declining work hours" states are the 17 states with the smallest hours decline for these men.[37] We next compute pre-recession versus post-recession leisure and computer time use for all men aged 21-30 (from the ATUS), stratifying by these same three state groupings. We can then relate state differences in the growth in young men's total leisure and computer use on how work hours declined for older men.

There are four columns in the top panel of Table A3. The first two columns refer to states with large hours decline for older men, while the third and fourth refer to states with small hours declines. The first and third rows show (log of) average leisure for young men within each state grouping, while the second and fourth rows show (log of) their average computer time. (Rows also reflect time periods for measuring time use.) States where hours declined most for older men are also the states where leisure time of young men most increased. Leisure time increased by 7 percent for young men in states with steep declines in work hours for older workers, but by only 2 percent for states with slightest declines in work hours. Computer time increased by 59 percent and 47 percent, respectively, for young men in the two state groupings. From this, we can compute the implied β, computer time's elasticity with respect to total leisure, to equal 2.6.[38] This is close to our baseline estimate for β of 2.15 from Table 10.

[37]Although not shown, this segmentation of states also strongly predicts hours declines across states for young men. This is arguably consistent with most cross-state variation in hours for LEYM being driven by differential declines in labor demand.

[38]This reflects the differential change in computer time of 12 percent (from 0.59 minus 0.47) relative to the differential in total leisure time of 5 percent (from 0.07 minus 0.02).

Table A3: Cross-State Variation Based on Employment Decline of Older Men

	Large Hour Decline for Men 31-55		Small Hour Decline for Men 31-55	
	Log Average Leisure Time Men 21-30	Log Average Computer Time Men 21-30	Log Average Leisure Time Men 21-30	Log Average Computer Time Men 21-30
2004-2007	4.104	1.074	4.122	1.347
2011-2014	4.161	1.679	4.127	1.864
Difference	0.057	0.605	0.005	0.499

Note: Alternate estimates of the recreational computer time Engel Curve for young men. See text for details.