Cheap Thrills: The Price of Leisure and the Global Decline in Work Hours

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Recreation prices and hours worked have both fallen over the last century. We construct a macroeconomic model with general preferences that allows for trending recreation prices, wages, and work hours along a balanced-growth path. Estimating the model using aggregate data from OECD countries, we find that the fall in recreation prices can explain a large fraction of the decline in hours. We also use our model to show that the diverging prices of the recreation bundles consumed by different demographic groups can account for much of the increase in leisure inequality observed in the United States over the last decades.

I. Introduction

Hours worked have declined substantially over the last hundred years. Nowadays, American workers spend on average 2,000 hours a year at work, while their 1900 counterparts worked 50% more. Over the same

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period, technological progress has increased labor productivity and wages, and so the decline in hours is often attributed to an income effect through which richer households choose to enjoy more leisure time. Indeed, Keynes (1930) prophesied that "the economic problem may be solved [. . .] within a hundred years" and that therefore there would be no need to work long hours to satisfy one's desire for consumption. Another important change occurred over the same period, however. New technologies such as television and the internet have brought a virtually unlimited trove of cheap entertainment that occupies a growing portion of households' leisure time (Aguiar et al. 2021). The impact of these technologies is clearly visible in the price data. For instance, the Bureau of Labor Statistics (BLS) documents that the (real and quality-adjusted) price of a television set has fallen about 1,000-fold since the 1950s, while computers are about 50 times cheaper than they were in the mid-1990s. Similarly, the inflation-adjusted price of admission to a (silent, black and white) movie in 1919 is roughly equal to the current monthly cost of a streaming service providing essentially unlimited access to movies and television shows. Overall, the aggregate price index tracking recreation goods and services in the United States has fallen by more than half in real terms since 1900.

It is natural to think that cheaper recreation might have contributed to the decline in work hours. Becker (1965) argued that complementarity between certain consumption goods and the time required to consume them is crucial for understanding how households allocate their time, in particular between market work and leisure activities. Accordingly, if recreation goods and services are complementary to leisure, a decline in their price would push households to work less. We incorporate this insight into a macroeconomic model in which trending relative prices can make hours worked decline along a balanced-growth path. We estimate the model using data from 42 OECD countries and find that the fall in recreation prices is important to explain the cross-country variation in the fall of hours worked. We also show that recreation prices can help to account for the growing leisure inequality across demographic groups within the United States, where we take advantage of more detailed disaggregated data to discipline the model.

We begin our analysis by reviewing key stylized facts. First, we show that hours per worker have been declining in the United States at a steady pace since 1900, apart from large movements around the Great Depression and

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the Second World War.[1] Hours per capita have also fallen over that period, although the decline is concentrated in the first part of the twentieth century. After 1950, the large increase in female labor force participation has kept that measure mostly flat. In contrast, the decline in male hours per capita has continued over that period. The American Time Use Survey shows that self-reported leisure time has also been increasing, for both men and women, since the 1960s (Aguiar and Hurst 2007; Robinson and Godbey 2010).[2] This last piece of evidence shows that the increase in women's market hours is more than compensated by the decline in their nonmarket work hours, so that their leisure time has been on the rise. The trends observed in the United States are also visible in other developed countries. We look at the evolution of work hours in 42 OECD countries and find that hours per worker have declined virtually everywhere, while hours per capita have fallen in 33 countries.

This decline in work hours in the United States over the last 120 years was accompanied by a large, well-documented increase in wages, as well as by a large decline in recreation prices. We extend early work by Owen (1970) using recent data from the BLS to show that the real price of recreation goods and services has been decreasing at a steady pace of about -0.75% per year since 1900. This trend is also clearly visible in our multicountry sample. Indeed, real recreation prices have fallen in all the countries that we consider, with an average annual decline of -1.48%. We conclude from these data that the simultaneous decline in work hours and real recreation prices is a widespread phenomenon that affected a broad array of developed countries.

To account for these facts, we construct a macroeconomic model in which both recreation prices and wages can affect labor supply decisions. At the heart of our analysis is a household that values recreation time and recreation goods and services, as well as standard (i.e., nonrecreation) consumption goods. To be consistent with well-known long-run trends, we build on the standard macroeconomic framework of balanced growth and assume that all prices and quantities in the economy grow at constant, but potentially different, rates. Importantly, and in contrast to the standard balanced-growth assumptions, we do not assume that hours worked remain constant over time, but instead allow them to decline at a constant rate. For our analysis to be as general as possible, we follow the approach of Boppart and Krusell (2020) and keep the household's preferences mostly unrestricted, only requiring that they be consistent with

[1] Similar evidence is presented in a number of studies, including Owen (1971), Lebergott (1993), Fogel (2000), Greenwood and Vandenbroucke (2005), and Boppart and Krusell (2020).

[2] Ramey and Francis (2009) also provide evidence that leisure time per capita has increased between 1900 and 2005. Their estimates are somewhat smaller than those of Aguiar and Hurst (2007), mostly because of a different classification of child-related activities.

balanced growth. We characterize the general form that a utility function must take in this setup, and show that it nests the standard balanced-growth preferences with constant hours of King, Plosser, and Rebelo (1988), as well as the more general preferences of Boppart and Krusell (2020), which allow for hours to decline over time through the income effect of rising wages. In addition, we show that in the class of economies that we study the growth rates of hours, recreation consumption, and nonrecreation consumption are loglinearly related to those of the wage rate and the real price of recreation items.

We use this theoretical framework to quantify the importance of falling recreation prices and rising wages in explaining the decline in hours worked. Our model has several key advantages when it comes to making contact with the data. First, since we keep the household's preferences quite general, our empirical strategy does not hinge on a specific utility function, but instead remains valid under several functional forms that have been proposed in the literature. Second, there is no need to fully specify the production sector of the economy. We only need wages and recreation prices to grow at constant rates for our analysis to be well grounded. Third, the system of equations derived from the model can be estimated using standard techniques and allows for a straightforward identification of the key structural parameters of the economy. Finally, the model provides a set of cross-equation restrictions that impose more structure on the estimation compared to standard reduced-form techniques. In particular, these restrictions allow us to use consumption data to discipline the estimation of the effect of recreation prices on work hours.

We estimate the structural relations implied by the model using our multicountry data. We find that a decline in recreation prices is associated with a large and statistically significant increase in leisure time. Specifically, a 1 percentage point decline in the growth rate of real recreation prices is associated with about a 0.2 percentage point decline in the growth rate of hours per capita. Rising wages are also strongly associated with a decline in hours worked, such that the income effect dominates the substitution effect in the estimated model. These findings are robust to various changes in specifications and to the inclusion of additional controls in the estimation. Finally, we perform back-of-the-envelope calculations and find that the fall in the price of recreation goods and services, on its own, can explain a large fraction of the decline in hours worked observed in the cross section of countries. Our favorite specification suggests that the recreation channel has been about a third as important as the income effect as a driver of the decline in work hours.

While our main focus is on aggregate variables, we also use our model to better understand changes in hours worked across US households. The motivation for this inquiry comes from the large increase in leisure inequality that has been observed in the data since 1985 (Aguiar and Hurst 2009). Indeed, leisure time has grown the most among groups that have experienced the slowest growth in wages (e.g., the less educated). This pattern is hard to reconcile with the dominating income effect of wages that we found in our cross-country analysis. Over the same period, however, the price of recreation goods and services consumed by less-educated households has declined significantly, which might have driven them to consume more leisure.[3] In contrast, more-educated households consume a disproportionate number of recreation items (mostly services) that have become more expensive. As a result, their leisure time has been roughly stable during the last decades.

One advantage of using these disaggregated data is that they allow us to construct two instrumental variables to tackle potential endogeneity issues. In the spirit of Bartik (1991), we construct a first instrument, for wages, that uses location-specific industry employment shares to tease out fluctuations in local wages that are driven by national movements. We also construct a second instrument, for recreation prices, using variation in the type of recreation goods and services that are ex ante consumed by different demographic groups. Using data from the Consumer Expenditure Survey, we document that, for instance, individuals without a high school diploma consume a disproportionate number of "Audio and Video" items, while those with more than a college education consume relatively more of "Other Services," which includes admissions, fees for lessons, club membership, and so forth.[4] Importantly, the national price indexes for these items have diverged markedly in our sample, creating substantial variation in the price of the recreation bundles consumed by different demographics. We use a shift-share approach to construct an instrument that takes advantage of this variation.

Using these two instruments, we estimate the structural equations implied by our model on household-level data. We find a strong positive effect of recreation prices on hours worked, suggesting not only that the relationship visible in the cross-country data survives at the individual level but might also have a causal interpretation. We also find a strong negative impact of wages on hours worked, so that the income effect dominates the substitution effect in this disaggregated sample as well. Overall, we find that the drop in recreation prices was a key driving force behind the increase in leisure inequality predicted by the estimated

[3] Consistent with this interpretation, Aguiar et al. (2021) show that the increased leisure time of young men is strongly associated with their consumption of online streaming and video games.

[4] Three roughly equally important subcategories account for the bulk of "Other Services." They are (1) admissions to spectator amusements, such as sports and live entertainment, (2) fees for amusement parks and campgrounds, and (3) club memberships and participant sports.

model, with wage trends actually pushing in the opposite direction of reducing leisure inequality.

Literature.—Our empirical results update and extend an early analysis by Owen (1971), who finds strong evidence of complementarity between leisure time and recreational goods and services in the United States (see also Gonzalez-Chapela 2007). Owen attributes one-quarter of the decline in hours worked over the 1900–1961 period to the declining price of recreation items, and the remaining three-quarters to the income effect of rising wages. An important difference with our approach is that we build a general balanced-growth model that allows us to impose cross-equation restrictions on the joint evolution of hours and consumption in our empirical analysis. We also investigate the impact of recreation prices at the household level using instruments to handle endogeneity issues.

Our findings are also consistent with Aguiar et al. (2021), who show that the increased leisure time among young men is strongly associated with the consumption of leisure goods and services made available due to the advent of cheap new media technologies, such as online streaming and video games. In a recent paper, Fenton and Koenig (2018) argue that the introduction of televisions in the United States in the 1940s and 1950s had a substantial negative effect on labor supply decisions, especially for older men. Kopecky (2011) focuses on the reduced labor market participation of older men and argues that retirement has become more attractive due to the decline in the price of leisure.

Greenwood and Vandenbroucke (2005) consider a static model of the impact of technological changes in the long-run evolution of work hours through three channels: rising marginal product of labor (the income effect), the introduction of new time-saving goods (the home production channel), and the introduction of time-using goods (the leisure channel). The second effect, in particular, is important for accounting for the entry of women into the labor force, which makes the long-run decline of work hours per person (rather than hours per worker) less pronounced. Vandenbroucke (2009) evaluates the impact of recreation prices in a static model with worker heterogeneity. In a calibration exercise over the 1900–1950 period, he finds that 82% of the decline in hours worked can be attributed to the income effect and only 7% to the declining price of recreation goods. The small impact of recreation prices comes from the fact that leisure goods and leisure time are perfect substitutes in his calibrated economy. In contrast, in our estimated model we find that leisure time and leisure goods are complements.

Ngai and Pissarides (2008) construct a model in which leisure time rises on a balanced-growth path due to a complementarity between leisure and “capital goods” (such as entertainment durables), as well as marketization of home production. Building on this, Boppart and Ngai (2021) provide a model in which both leisure time and leisure inequality increase along a balanced-growth path due to the growing dispersion in labor market productivity. Boerma and Karabarbounis (2020) argue that the rising productivity of leisure time combined with cross-sectional heterogeneity in preferences (or "nonmarket productivity") is responsible for these trends.

Two recent papers have studied the impact of free entertainment on labor supply decisions. Greenwood, Ma, and Yorukoglu (2021) construct a model in which digital advertisement finances the provision of free leisure goods. In the model of Rachel (2021) hours fall along the balanced-growth path as the quality of "free" leisure improves due to technological innovation driven by producers' demand for consumer attention.

Our work departs from the existing literature in several ways. On the theoretical side, we generalize recent work by Boppart and Krusell (2020), who characterize the class of preferences that are consistent with balanced growth and declining work hours. We extend their preferences to include different types of consumption goods with different complementarity with leisure time. As a result, we can jointly investigate the importance of wages and other relative prices as drivers of the decline in work hours. On the empirical side, we investigate the impact of recreation prices in both aggregate data in a broad cross section of countries and in disaggregated data in the United States. We also use instruments to tease out the causal impact of recreation prices and wages.

The next section provides an overview of the data. We then introduce the model and provide our main theoretical result in section III. In section IV we estimate the structural relationships derived from the model. The implications of the model for rising leisure inequality are discussed in section V. The last section concludes.

II. Trends in Working Hours, Recreation Prices and Wages

We begin by presenting aggregate data for the United States and a cross section of countries. We document three important trends that hold in almost all the countries in our sample over the last decades: (1) hours worked have fallen, (2) the price of recreation goods and services has declined substantially in real terms, and (3) real wages have increased. These trends will serve as motivation for the model that we describe in the next section.

Most of our US data are standard and come from well-known sources. One exception is the data on real recreation prices, which come from Owen (1970) and the Bureau of the Census (1975) for the earlier part of our sample, and the Bureau of Labor Statistics (BLS) for more recent data. Data for other countries come primarily from the Total Economy Database, the OECD, and Eurostat. A detailed description of the data is in appendix A.

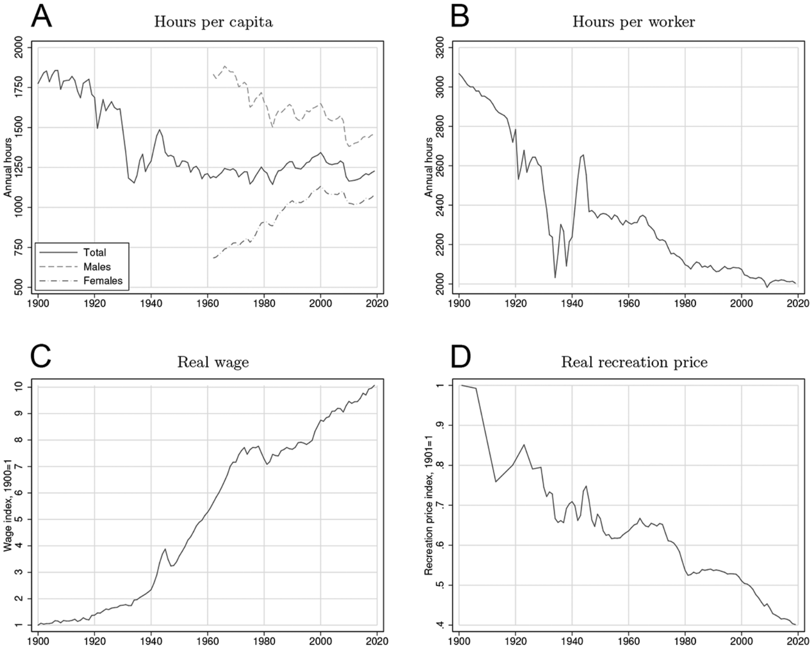

Fig. 1.—Hours, wages, and recreation price in the United States. *A*, Annual hours worked over population (20 years and older). Sources: Lebergott (1961) (hours, 1990–1947), Kendrick (1973) (hours, 1948–1961), US Census (population, 1900–1961), and Annual Social and Economic Supplement (total, male and female hours per capita, 1962–2019). *B*, Annual hours worked over number of employed. Sources: Bureau of the Census (1975) (1900–1947) and BLS (1947–2019; retrieved from Federal Reserve Economic Data). *C*, Real labor productivity. Sources: Lebergott (1961) (real gross national product divided by hours, 1900–1929) and BEA and BLS (real compensation of employees, divided by hours and CPI, 1929–2019; retrieved from Federal Reserve Economic Data). *D*, Real price of recreation goods and services. Sources: Owen (1970) (real recreation price, 1900–1934), Bureau of the Census (1975) (real price of category "Reading and Recreation," 1935–1966), BLS (real price of category "Entertainment," 1967–1992), and BLS (real price of category "Recreation," 1993–2019). Series coming from different sources are continuously pasted.

A. *Evidence from the United States*

Figure 1 shows the evolution of work hours, wages, and recreation prices in the United States. The solid blue line in figure 1*A* shows how hours per capita have evolved between 1900 and 2019. Over the whole period, hours have fallen significantly from about 1,750 annual hours per adult person in 1900 to about 1,200 hours per person today.[5] While the figure

[5] Here, we define adults as individuals above 20 years old. The trends are similar if we divide total hours by the population older than 15 or by the working age population (25–64 years old) instead.

shows an overall reduction in hours, all of the decline actually took place before 1960. But these aggregate statistics are somewhat misleading as they conceal substantial heterogeneity between men and women, whose hours are shown in red and green in figure 1*A*. As we can see, the second half of the twentieth century saw a large increase in women's hours, presumably due to a rise in labor force participation, which clearly contributed to the stagnation of the aggregate hours per capita series.[6] At the same time, male hours per capita have kept declining. In the more recent period, between 2000 and 2019, hours have declined for both men and women.

The evidence in figure 1*A* might suggest that women are working much more in 2019 than in 1960, but the figure only reports hours worked in the marketplace. Total work hours, which also include home production, have been declining since at least the 1960s for both men and women. To show this, we follow Aguiar and Hurst (2007) and Aguiar et al. (2021) and use the American Time Use Survey to construct measures of market work, total work (including market work, home production, and nonrecreational childcare), and leisure for men and women between 16 and 64 years old (excluding full-time students). These series are presented in figure 2. Between 1965 and 2017, total annual work hours have declined by 416 (8.0 hours per week) for women and by 502 (9.7 hours per week) for men. According to that metric, women work substantially less now than 50 years ago.

The decline in hours worked is also clearly visible when looking at hours per worker, instead of per capita. This series is presented in figure 1*B*. Except for large fluctuations around the Great Depression and the Second World War, that measure has been on a steady decline, from more than 3,000 annual hours per worker in 1900 to about 2,000 today.[7]

What are the drivers behind this long-run decline in hours? Clearly, people are now richer than in 1900 and it might be that at higher income levels they prefer enjoying leisure to working. Indeed, figure 1*C* shows that real hourly wages have gone up 10-fold since 1900. Theoretically, this large increase in wages could lead to an increase in labor supply, if the standard

[6] This increase in female labor force participation is well documented and was likely driven by several factors. Many women were probably kept away from market work because of discriminatory social norms. As these norms evolved, the stigma of women in the labor force faded and female participation increased. In addition, technological improvements made it easier to perform nonmarket work—mostly done by women—leaving more time for market work (Greenwood et al. 2005). Goldin and Katz (2002) also document that the adoption of contraceptives might have affected women's decisions to pursue higher education. Hsieh et al. (2019) find a large impact of occupational convergence between men and women on output growth between 1960 and 2010.

[7] Using decennial data from the Census, McGrattan and Rogerson (2004) also find that hours per worker have declined and hours per capita have increased in the United States since 1950. Lebergott (1961) and Whaples (1991) document a decline in work hours since 1830 (see also fig. 1 in Vandenbroucke [2009]). Lebergott (1961) shows that this decline has happened in all industries. Table 1 in Huberman and Minns (2007) shows that the decline in hours per worker goes back to at least 1870 in Australia, Canada, the United States, and Western Europe.

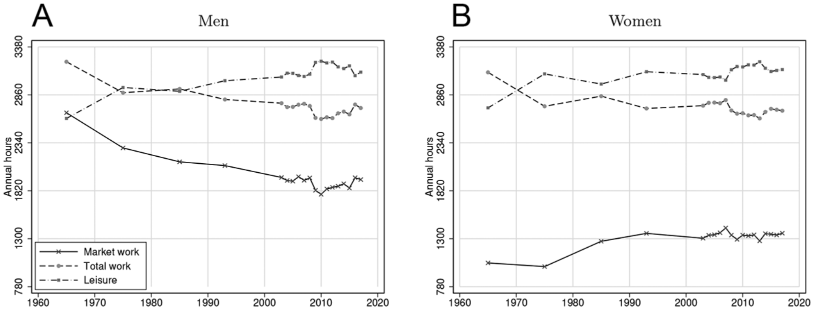

FIG. 2.—Annual hours spent on market work, total work, and leisure in the United States. Market work includes any work-related activities, travel related to work, and job search activities. Total work includes market work, home production, shopping, and nonrecreational child care. Leisure is any time not allocated to market and nonmarket work, net of time required for fulfilling biological necessities (8 hours per day). Sample includes people between 16 and 64 years old who are not full-time students. Sources: American Time Use Survey, Aguiar and Hurst (2007), and Aguiar et al. (2021).

substitution effect dominates, or to its decline, if the income effect dominates instead.

Like the benefit of working, the cost of enjoying leisure has also undergone a massive change over the last century. To show this, we plot in figure 1*D* the real price of recreation goods and services since 1901, where the price of all consumption goods and services is used as deflator. Items in that category follow the BLS classification and include goods and services that are associated with leisure time, such as video and audio equipment, pet products and services, sporting goods, photography, toys, games, recreational reading materials, and recreation services (such as admission to movies, theaters, concerts, and sporting events). As we can see, recreation prices have experienced a steep decline, falling by about 60% in real terms since 1901. If recreation goods and services are complementary to leisure time, a decline in their price would incentivize households to consume more leisure. As a result, they could play an important role in the decline in hours worked.

B. Evidence from a Cross Section of Countries

The trends observed in the US economy are also visible in international data. To show this, we gather data on hours worked, real recreation prices, and wages from a variety of sources, such as the OECD, Eurostat, and national statistical agencies. To avoid inconsistencies and arbitrary choices when allocating consumption items to different categories, we rely on the classification of the OECD and Eurostat. These organizations track the price of "Recreation and Culture" items, which we use as our main recreation price index. This category includes items such as audiovisual, photographic, and information processing equipment, reading materials, package holidays, various other recreation goods (such as musical instruments, toys, sporting goods, and pet and garden products), and recreation and cultural services. For several countries, we are able to augment these data using price series from national statistical agencies. We restrict the sample to countries with at least 15 years of data for recreation prices. Our final sample covers 42 countries and 1,215 country-year observations.[8]

Figure 3 shows the evolution of hours worked, recreation prices, and wages for a selected group of countries in our sample (app. B contains analogous graphs for all countries). The black curves represent the global movements in these quantities, for all countries in our sample, estimated as year fixed effects from regressing each variable on a set of country and year fixed effects. While there is some heterogeneity across countries, the figure shows a clear overall decline in both hours and recreation prices, and an increase in real wages. Across the full sample, we find that per capita hours have been declining at an average rate of 0.44% per year and hours per worker have been declining at a rate of 0.45% per year. At the same time, real wages have been increasing by 2.00% per year, and real recreation prices have been declining by 1.09% per year.[9]

To show how widespread these patterns are, table 4 (in app. A.3) provides the list of countries in our sample along with their individual average growth rates for hours, wages, and recreation prices. We observe, first, that there has been a broad decline in hours worked throughout our sample. Hours per capita have had a negative growth rate in 33 countries out of 42. The decline is even more pronounced when looking at hours per worker, which have declined in all but three countries (Lithuania, Luxembourg, and Turkey). Second, the growth in real wages is positive for all countries except Mexico, which experienced a large decline in real wages in the 1980s due to very high inflation rates.

Real recreation prices have also been declining worldwide. As the table shows, we find a negative growth rate for all countries in our sample, and these growth rates are statistically different from zero at the 1% level in all cases. The coefficients are also economically large. Even for the country with the slowest decline (Ireland), recreation prices have gone down by 0.4% per year. Compared to the other countries in our sample,

[8] Data on hours worked come from the Total Economy Database of the Conference Board. We compute hours per capita by dividing total hours worked by population between 20 and 74 years old, and similarly for hours per worker. Population and labor force statistics by age and sex are from the OECD. We use the OECD and Eurostat compensation of employees divided by hours as our main measure of wages. We adjust all prices for inflation using country-specific all-item consumer price indices. More information about how the data set is constructed is provided in app. A.

[9] We compute these growth rates by running a pooled regression of a given variable of interest x_{lt} in country l at time t on the a time trend and a set of country fixed effects α_l, so that $\log x_{lt} = \alpha_l + \gamma^x t + \varepsilon_{lt}$. The coefficient γ^x therefore provides a measure of average growth rates for variable x across countries.

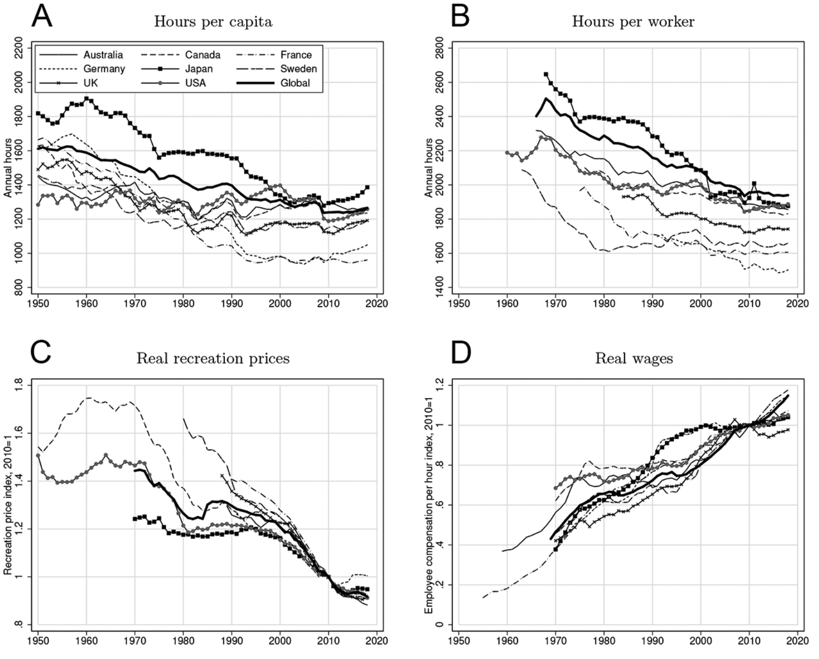

Fig. 3.—Hours, wages, and recreation prices for a selected group of countries. The black lines show the year fixed effects from regressions of the corresponding variables on a set of country and year fixed effects, with all countries included. Regressions are weighted by country-specific total hours. For panels A and B, the levels of the lines are normalized to match the all-country weighted average in 2015. *A*, Annual hours worked over population between 20 and 74 years old. Sources: Total Economy Database and OECD. *B*, Annual hours worked over number of employed between 20 and 74 years old. Sources: Total Economy Database and OECD. *C*, Price of consumption for OECD category "Recreation and Culture," normalized by price index for all consumption items. Base year = 2010. Sources: OECD, Eurostat, and national statistical agencies. *D*, Real compensation of employees divided by hours worked. Base year = 2010. Sources: OECD, Eurostat, and Total Economy Database.

the United States experienced a relatively slow decline in real recreation prices (−0.7% per year). Only four countries (Ireland, Japan, Luxembourg, and Norway) went through slower declines.[10]

C. Balanced-Growth-Path Facts for Consumption

To better understand the relation between these trends, we develop in the next section a labor supply model in which recreation prices can

[10] In app. B, we show the time series of recreation goods and recreation services separately. We find that the overall decline in recreation prices is entirely driven by recreation goods. We also find that trends in the price of recreation services are more heterogeneous across countries, which is not surprising given that services are less tradeable than goods and thus more driven by country-specific factors.

affect hours worked. Since our goal is to explain economic changes that occur over long time horizons, we adopt the standard macroeconomic framework for this type of analysis, namely that of balanced growth. This framework implies that all prices and quantities grow at constant, but perhaps different, rates. We make however one important departure from standard balanced-growth-path assumptions and allow hours worked to decline over time in contrast to the usual requirement that they remain constant.

In a recent paper, Boppart and Krusell (2020) show that—except for the evolution of hours—stylized balanced-growth facts, as outlined by Kaldor (1961), remain valid for the United States today. However, these facts do not distinguish between different types of consumption. Since our modeling strategy will assume that the consumption of recreation and nonrecreation items evolve in such a way that their ratio remains constant over time, we therefore provide some evidence to show that this assumption is justified for the United States and our sample of countries.

For the United States, we use consumption data from the National Income and Product Accounts (NIPA) tables and construct a measure of recreation consumption that follows the BLS classification. We then compute the share of recreation in total consumption expenditure and plot that measure as the solid blue line in figure 4*A*. As we can see, this share has remained roughly constant over the last hundred years, moving from about 6% in 1929 to 7% today.[11]

When constructing our measure of recreation consumption, we follow the classification used by the BLS and exclude information processing equipment (i.e., computers), which might also be used for work or education. The NIPA tables, however, classify those expenditures as part of recreation consumption. We therefore provide an alternative measure, displayed in red in figure 4*A*, that follows that classification. In this case, the share of recreation expenditure increases slightly over our sample. We also construct expenditures on recreation goods and services using data from the Consumer Expenditure (CE) Survey, as in Aguiar and Bils (2015). That measure is also shown, in green, in figure 4*A*. Although it is only available since 1980, it has remained fairly stable since then.

[11] Our finding that the share of recreation consumption has been roughly constant is in contrast with earlier work by Kopecky (2011), who uses data from Lebergott (2014) and finds an increasing recreation share over the twentieth century. Two important differences between the data sets are responsible for the different conclusions. First, our sample includes additional data from 2000 to 2019, a period over which the recreation share has declined by more than 1 percentage point. Second, Lebergott (2014) finds a large increase (from 3 to 6 percentage points) in the recreation share between 1900 and 1929 (fig. 3 in Kopecky [2011]). Unlike the rest of the time series, these data are not from the Bureau of Economic Analysis (BEA), but are imputed from a variety of sources. For instance, adjusted sectoral wages are used as a proxy for the consumption of recreation services. While we cannot rule out a small increase in the recreation share since 1900, we view the data available starting in 1930 as more reliable for estimating its overall trend.

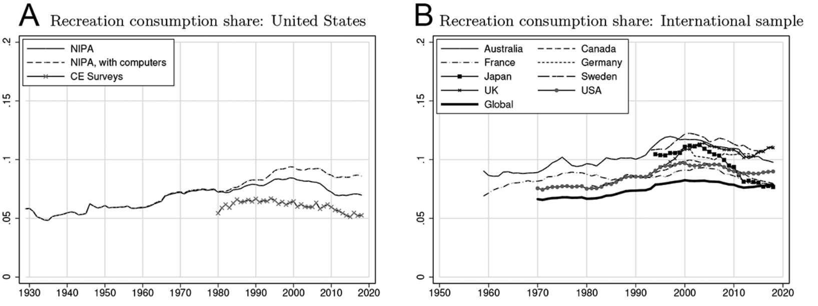

FIG. 4.—Recreation consumption share. *A*, Share of recreation consumption in total consumption for the United States. Sources: NIPA and CE Surveys. *B*, Share of recreation consumption in total consumption for a selected group of countries. The black line shows the year fixed effects from a regression of the recreation consumption share on a set of country and year fixed effects, with all countries included. The regression is weighted by country-specific total hours. The level of the line is normalized to match the all-country weighted average in 2015. Sources: OECD and Eurostat.

Since our analysis is not limited to the US economy, we also compute the recreation consumption shares for other countries in our sample, using data from the OECD and Eurostat. Our measure of recreation consumption corresponds to the "Recreation and Culture" category and includes the same goods and services as the recreation price data that was discussed in section II.B. Figure 4*B* shows that measure for a selected group of countries together with the all-country average in black. We include the same figure for all countries in appendix B. While there is some variation across countries, the recreation shares stay fairly constant over time, in line with our modeling assumption.

III. Model

To better understand the relation between recreation prices, wages, and hours worked, we construct a labor supply model that is general, microfounded, and that can be easily brought to the data. To do so, we adopt a standard balanced-growth framework. In what follows, we therefore assume that prices and quantities grow at constant, but perhaps different, rates. As we have discussed, that framework offers a good description of the evolution of the US economy over the long run, so that we can be sure that our model economy does not clash with important regularities in the data.

A. *Problem of the Household*

At the heart of our analysis is a household that maximizes some period utility function u. Our main mechanism operates through the impact of cheaper recreation goods and services on labor supply decisions. We therefore include these items, denoted by d, directly into u. The utility function also depends on the consumption of other (nonrecreation) goods and services c, and on the amount of time worked h. Since it plays a central role, we keep the utility function as general as possible, only assuming that it be consistent with balanced growth. We will show below that this assumption imposes some structure on the shape of the utility function. Importantly for our mechanism, the utility function is free to feature some complementarity between leisure time and recreation consumption, such that, for instance, the purchase of a subscription to an online streaming service can make leisure time more enjoyable, which can then push the household to work less. It follows that with such a complementarity a decline in recreation prices can lead to a decline in work hours.

The household maximizes its lifetime discounted utility

$$\sum_{t=0}^{\infty} \beta^t u(c_t, h_t, d_t), \tag{1}$$

subject to a budget constraint

$$c_t + p_{dt} d_t + b_{t+1} = w_t h_t + b_t(1 + r_t), \tag{2}$$

where w_t denotes the wage, p_{dt} the price of recreation goods, r_t the interest rate, and b_{t+1} the asset position of the household at the end of period t.[12] Since time worked h_t is constrained by the size of the (normalized) time endowment, we assume $h_t \leq 1$, but we focus on interior solutions, so this inequality never binds.

A solution to the household's problem is a sequence $\{c_t, h_t, d_t, b_{t+1}\}_{t=0}^{\infty}$ such that the household maximizes discounted utility (1) subject to the budget constraint (2) given a sequence of prices $\{p_{dt}, w_t, r_t\}_{t=0}^{\infty}$ and some initial asset holding b_0. A balanced-growth allocation is a solution to the household problem when wages and recreation prices grow at constant rates, such that $w_t = w_0 \gamma_w^t$ and $p_{dt} = p_{d0} \gamma_{p_d}^t$ for some positive γ_w and γ_{p_d}, and when the interest rate is constant $r_t = r > 0$. In the rest of the paper, we focus on balanced-growth allocations.

For the bulk of our analysis, we take the growth rates γ_w and γ_{p_d} as exogenous. In appendix C.1, we provide a fairly standard microfoundation for these quantities that involves the production sector of the economy. In that setup, γ_w and γ_{p_d} depend exclusively on the productivity growth rates and are not affected by the preferences of the household on a balanced-growth path.

[12] The model uses nonrecreation consumption as the numeraire. However, a price index for these items is not readily available for all the countries in our sample, so in our empirical exercises we normalize nominal terms by all-item price indexes. The discrepancy between the two is unlikely to be large because recreation expenditures typically account for less than 10% of the overall consumption spending. In the United States, where these data are available, the all-item and nonrecreation price series follow each other closely.

On a balanced-growth path, c_t, d_t, and h_t also grow at constant (endogenous) rates, which we denote by g_c, g_d, and $g_h \leq 1$, where the last inequality follows since hours worked are naturally bounded by the time endowment. These growth rates might depend, in turn, on the growth rates of the fundamentals γ_w and γ_{p_d}, and perhaps on other features of the economy. The budget constraint of the household imposes some restrictions on these endogenous growth rates. Specifically, for (2) to be satisfied in every period, each term must grow at the same rate and it must therefore be that

$$g_c = \gamma_{p_d} g_d = \gamma_w g_h. \tag{3}$$

B. Balanced-Growth Preferences

Another set of restrictions on the endogenous growth rates comes from the preferences of the household. For instance, under the utility function introduced by King, Plosser, and Rebelo (1988), hours worked h_t remain constant over time which, with (3), implies that consumption and the wage grow at the same rate: $g_c = \gamma_w$. Boppart and Krusell (2020) generalize these preferences to let hours worked decline on a balanced-growth path so that the growth rate of consumption can take the more general form $g_c = \gamma_w^{1-\nu}$, where ν is a parameter of the utility function. In our case, the growth rate of consumption might also be affected by the growth rate of recreation prices, γ_{p_d}, and we therefore consider the more general form

$$g_c = \gamma_w^{\eta} \gamma_{p_d}^{\tau}, \tag{4}$$

where η and τ are constants that have to be determined.

We can combine (3) and (4) to characterize the growth rates of all the endogenous quantities in terms of the constants η and τ such that

$$g_c = \gamma_w^{\eta} \gamma_{p_d}^{\tau}, \tag{5a}$$

$$g_d = \gamma_w^{\eta} \gamma_{p_d}^{\tau-1}, \tag{5b}$$

$$g_h = \gamma_w^{\eta-1} \gamma_{p_d}^{\tau}. \tag{5c}$$

Given these restrictions, we can formally define the properties of a utility function that is consistent with balanced growth in this economy:[13]

[13] The following definition is a generalization of assumption 1 in Boppart and Krusell (2020). Notice from (5a) that when $\eta < 0$ higher wage growth leads to lower consumption growth. Also, from (5c) it follows that when $\tau < 0$, higher growth in the price of recreation goods leads to smaller growth in work hours. We focus on the more empirically plausible economies with $\eta > 0$ and $\tau > 0$.

Definition 1 (Balanced-growth preferences). The utility function u is *consistent with balanced growth* if it is twice continuously differentiable and has the following properties: for any $w > 0$, $p_d > 0$, $c > 0$, $\gamma_w > 0$, and $\gamma_{p_d} > 0$, there exist $h > 0$, $d > 0$, and $r > -1$ such that for any t,

$$-\frac{u_h\left(c\left(\gamma_w^\eta \gamma_{p_d}^\tau\right)^t, h\left(\gamma_w^{\eta-1}\gamma_{p_d}^\tau\right)^t, d\left(\gamma_w^\eta \gamma_{p_d}^{\tau-1}\right)^t\right)}{u_c\left(c\left(\gamma_w^\eta \gamma_{p_d}^\tau\right)^t, h\left(\gamma_w^{\eta-1}\gamma_{p_d}^\tau\right)^t, d\left(\gamma_w^\eta \gamma_{p_d}^{\tau-1}\right)^t\right)} = w\gamma_w^t, \tag{6}$$

$$\frac{u_d\left(c\left(\gamma_w^\eta \gamma_{p_d}^\tau\right)^t, h\left(\gamma_w^{\eta-1}\gamma_{p_d}^\tau\right)^t, d\left(\gamma_w^\eta \gamma_{p_d}^{\tau-1}\right)^t\right)}{u_c\left(c\left(\gamma_w^\eta \gamma_{p_d}^\tau\right)^t, h\left(\gamma_w^{\eta-1}\gamma_{p_d}^\tau\right)^t, d\left(\gamma_w^\eta \gamma_{p_d}^{\tau-1}\right)^t\right)} = p_d\gamma_{p_d}^t, \tag{7}$$

and

$$\frac{u_c\left(c\left(\gamma_w^\eta \gamma_{p_d}^\tau\right)^t, h\left(\gamma_w^{\eta-1}\gamma_{p_d}^\tau\right)^t, d\left(\gamma_w^\eta \gamma_{p_d}^{\tau-1}\right)^t\right)}{u_c\left(c\left(\gamma_w^\eta \gamma_{p_d}^\tau\right)^{t+1}, h\left(\gamma_w^{\eta-1}\gamma_{p_d}^\tau\right)^{t+1}, d\left(\gamma_w^\eta \gamma_{p_d}^{\tau-1}\right)^{t+1}\right)} = \beta(1+r), \tag{8}$$

where $\eta > 0$ and $\tau > 0$.

These equations are the usual first-order conditions of the household. The first one states that the marginal rate of substitution between hours h_t and consumption c_t must equal the wage w_t, the second equation implies that the marginal rate of substitution between leisure goods d_t and consumption c_t must equal the relative price of leisure goods p_{dt}, and the third equation is the intertemporal Euler equation. Definition 1 imposes that these optimality conditions must be satisfied in every period t, starting from some initial point $\{c, h, d, p_d, w\}$ and taking into account the respective growth rate of each variable provided by (5).

The following proposition describes the class of utility functions that are consistent with balanced growth:

Proposition 1. The utility function $u\ (c, h, d)$ is consistent with balanced growth (definition 1) if and only if (save for additive and multiplicative constants) it is of the form

$$u(c, h, d) = \frac{\left[c^{1-\varepsilon} d^\varepsilon v\left(c^{1-\eta-\tau} h^\eta d^\tau\right)\right]^{1-\sigma} - 1}{1-\sigma}, \tag{9}$$

for $\sigma \neq 1$, and

$$u(c, h, d) = \log\left(c^{1-\varepsilon} d^\varepsilon\right) + \log\left[v\left(c^{1-\eta-\tau} h^\eta d^\tau\right)\right], \tag{10}$$

for $\sigma = 1$, and where v is an arbitrary twice continuously differentiable function, $\eta > 0$, and $\tau > 0$.

Proof. The proof is in appendix F.

This proposition establishes necessary and sufficient conditions on the shape of u so that it is consistent with balanced growth. They are the only restrictions that we impose on the utility function, such that our empirical analysis remains general and does not hinge on a particular choice of u.

Of course, several utility functions that satisfy (9) and (10) make little economic sense. Additional restrictions would need to be imposed so that, for instance, u is increasing in c and d, and decreasing in h. But we do not need to explicitly specify these restrictions. For our analysis to hold, we only need that the household maximizes some version of (9) and (10), and that the first-order conditions are necessary to characterize its optimal choice.[14]

Several utility functions that have been used in the literature are nested in (9) and (10). For instance, the standard balanced-growth preferences of King, Plosser, and Rebelo (1988), in which labor remains constant, can be obtained by setting $\varepsilon = 0, \tau = 0$, and $\eta = 1$. To allow for a nonzero income effect of rising wages on the labor supply, we can instead set $\varepsilon = 0$, $\tau = 0$, and $\eta \neq 1$ to get the preferences of Boppart and Krusell (2020). The functional form (9) and (10), however, does not nest some other utility functions that have recreation goods and services as an input. For instance, the preferences used by Vandenbroucke (2009) and Kopecky (2011) do not allow for balanced growth and are therefore not a special case of (9) and (10).

Proposition 1 extends theorem 1 in Boppart and Krusell (2020) to an environment with different consumption goods that can have different complementarity with leisure time. This flexibility is important in our context to properly match the empirical patterns between wages, recreation prices, and the consumption of recreation and nonrecreation items.

C. *The Impact of Wages and Recreation Prices*

Proposition 1 shows that the constants η and τ introduced as placeholders in (4) come directly from the utility function. As such, they are structural parameters and do not depend on other (perhaps endogenous) economic variables whose presence might lead to endogeneity issues in our estimation. Taking the logarithm of (5), we can therefore write the system of three equations

$$\log g_c = \eta \log \gamma_w + \tau \log \gamma_{p_d}, \tag{11a}$$

$$\log g_d = \eta \log \gamma_w + (\tau - 1) \log \gamma_{p_d}, \tag{11b}$$

$$\log g_h = (\eta - 1) \log \gamma_w + \tau \log \gamma_{p_d}, \tag{11c}$$

to be estimated in the following section.

[14] Our analysis goes through even if the utility function (9) and (10) is not concave. In this case, the first-order conditions are not sufficient to characterize a solution to the household's optimization problem but they are still necessary. As a result, they are satisfied at the household's optimal decision and we can use them to characterize the balanced-growth path and derive the system of equations that we estimate.

These equations show that the logarithms of the growth rates of the endogenous variables c_t, d_t, and h_t are linear functions of the log growth rates of the exogenous variables w_t and p_{dt}, and that the preference parameters η and τ characterize these relationships. These parameters therefore capture the intensity of standard income and substitution effects, triggered by changes in prices, that are at work in the model.

Equation (11c) plays a central role in our exploration of the causes behind the decline in work hours. The first term on the right-hand side captures how rising wages affect the supply of labor. When $\eta - 1 < 0$, higher wage growth leads to more leisure growth through a standard income effect: richer households substitute consumption with leisure. When instead $\eta - 1 > 0$, the substitution effect dominates, and the household takes advantage of the higher wage rate to work more and earn additional income. The second term on the right-hand side of the equation captures the impact of recreation prices on labor supply decisions. In particular, when $\tau > 0$, a decline in the price of recreation goods and services incentivizes the household to enjoy more leisure and work less.

From (11c), it is clear that $\eta - 1$ and τ capture some notion of labor supply elasticity. Specifically, $\eta - 1$ and τ capture how the *permanent* growth rate of hours changes in response to *permanent* changes in the growth rate of wages and recreation prices on a balanced-growth path. It is hard however to map these parameters into common elasticities considered in the literature (Frisch, Marshallian, Hicksian), which relate the impact of a change in *current* wages to a change in *current* hours. We can compute, for instance, the Frisch elasticity under our preferences, and, while it does depend on η and τ, it also depends on other features of the model that we do not attempt to estimate. It follows that we cannot directly compare η and τ to the vast literature that estimates standard labor supply elasticities.[15]

Overall, the results of this section provide a clear path to empirically evaluating the role of the decline in recreation prices in driving hours worked. From (11), we know that g_c, g_d, and g_h are related loglinearly to γ_w and γ_{p_d}, so that we can estimate these relationships through standard techniques. Furthermore, these relationships are structural, so that we can be sure that our estimation captures deep parameters that are unaffected by changes in policy. The system of equations (11) also shows that the relationship between hours worked and leisure prices is invariant to various features of the utility function, such as the function v and the parameters ε and σ. As a result, we can be confident that our empirical strategy is robust to a broad class of utility functions. Finally, our analysis does

[15] We can show that the Frisch elasticity is constant over a balanced-growth path in our model but its exact value depends on the product $c^{1-\eta-\tau}h^{\eta}d^{\tau}$, which is also constant on a balanced-growth path.

not hinge on a particular set of assumptions about the production sector of the economy, as long as w_t and p_{dt} grow at constant rates. As such, it is robust to different production technologies, market structures, and so forth.

IV. Estimating the Model on Cross-Country Data

We now estimate the model on the cross section of OECD countries. To do so, we use the data on hours, wages, and recreation prices introduced in section II, as well as consumption data from the OECD and Eurostat.[16]

A. *Data and Specification*

Denote by $\Delta\log c_i$, $\Delta\log d_i$, and $\Delta\log h_i$ the average annual growth rates of nonrecreation consumption, recreation consumption, and hours worked in country i.[17] We use a generalized method of moments (GMM; Hansen 1982) that allows us to impose the key cross-equation restrictions implied by (11) without the need to make any additional assumptions about the distribution of the shocks and so forth. Our benchmark specification is

$$\Delta\log c_i = \alpha^c + \eta\Delta\log w_i + \tau\Delta\log p_i^d + \varepsilon_i^c, \tag{12a}$$

$$\Delta\log d_i = \alpha^d + \eta\Delta\log w_i + (\tau - 1)\Delta\log p_i^d + \varepsilon_i^d, \tag{12b}$$

$$\Delta\log h_i = \alpha^h + (\eta - 1)\Delta\log w_i + \tau\Delta\log p_i^d + \varepsilon_i^h, \tag{12c}$$

where $\Delta\log w_i$ and $\Delta\log p_i^d$ are the growth rates of real wages and real recreation prices, and where the ε's are error terms. We also include the constants α^c, α^d, and α^h to absorb potential aggregate changes in the data that were not explicitly included in the model. In particular, we think that these constants can absorb the secular increase in women labor force participation (positive α^h), which might have triggered a substitution from home-produced goods to their market analogues (positive α^c and α^d). In appendix C.3, we discuss several potential origins for these constants and error terms, including measurement errors, long-run trends in the disutility of work, and changes in the social stigma associated with working women.

[16] See app. A.2 for details about the consumption data. Since the model does not feature population growth, we normalize consumption variables and hours by the population between 20 and 74 years old. We show robustness of our results to this normalization in app. D.2.

[17] We remove the Great Recession years (2008 and 2009) from the sample as they are clear outliers that can substantially change the estimate of steady-state growth rates given the small number of years available for some countries. See app. D.2 for the results without excluding the Great Recession.

The results of the estimation are presented in table 1. Column 1 shows the estimated coefficients τ and $\eta - 1$ when wages are measured as GDP per hour. In column 2, we use real compensation per hour instead. We can see that the results are similar across columns. Overall, we find a significantly positive coefficient τ, which, from (12c), is consistent with cheaper recreation items having a negative impact on hours per capita.

We also find a negative and strongly significant value for $\eta - 1$, which is consistent with a dominant income effect of rising wages on hours worked. We note that estimating the full system of equations (12) is important for this last result, since a simple regression of hours growth on the growth of wages and recreation prices does not find a significant coefficient for wages (see table 7, in app. D.1). When jointly estimating the three equations, the consumption data together with the model restrictions impose enough discipline to make the income effect visible. To understand why, notice from (12) that a dominating substitution effect ($\eta - 1 > 0$) implies that consumption growth reacts more than one for one to a change in wage growth. Intuitively, when $\eta - 1 > 0$, higher wages not only lead to additional income keeping hours fixed, but they also raise hours worked leading to an extra increase in income. That additional income then leads to a larger increase in recreation and nonrecreation consumption, as equations (12a) and (12b) show. The data reject such a strong effect of wage growth on consumption, and so the estimation finds that the income effect dominates.

Finally, table 1 also shows that the constant α^h is positive and significantly different from zero. This constant absorbs aggregate changes such as the secular increase in female labor force participation and other demographic

TABLE 1
GMM Estimation of the Structural Model (12)

	(1)	(2)	(3)
τ	.312***	.214**	.171**
	(.090)	(.087)	(.081)
$\eta - 1$	−.473***	−.445***	−.403***
	(.069)	(.053)	(.049)
α^h	.014***	.011***	.010***
	(.002)	(.002)	(.001)
Wages	GDP/hour	Employee compensation/hour	Employee compensation/hour
Same constant	No	No	Yes
J-test: *p*-value	.035	.023	.075
Observations	41	41	41

Note.—Results of iterative GMM estimation of (12). Column 3 reports results when the constants in (12) are the same, $\alpha^c = \alpha^d = \alpha^h$. Robust standard errors in parentheses. Variables are constructed using all years except for 2008 and 2009. Work hours are measured in per capita terms. Population includes individuals between 20 and 74 years old. The "*J*-test: *p*-value" row reports *p*-values of Hansen's *J*-test of overidentifying restrictions.

** Significant at the 5% level.

*** Significant at the 1% level.

trends that are not explicitly included in the model. In appendix C.3, we show that some of the microfoundations for the constants in (12) imply that they are the same across equations; that is, $\alpha^c = \alpha^d = \alpha^h$. We therefore estimate (12) with common constants (col. 3) and find that the results are similar.

Notice that the system (12) is overidentified due to cross-equation restrictions. We can test the validity of these restrictions via Hansen's *J*-test. Table 1 reports the corresponding *p*-values. They imply that the restrictions cannot be rejected at the 1% level but can be rejected at the 10% level. One reason for that might be the simplicity of the benchmark model, as it incorporates only two types of consumption. In section IV.B, we allow for three types of consumption and find that this extended model cannot be rejected at any conventional significance level.

It would be tempting to evaluate our values of τ and η through the lens of the empirical literature, but, as discussed before, τ and η only relate indirectly to standard labor supply elasticities. There are however two papers that consider the type of permanent elasticities captured by τ and η. The first one is Owen (1971), which estimates the impact of recreation prices on work hours in earlier US data. Owen's estimation procedure is quite different from ours, but if we do a back-of-the-envelope calculation we find that his estimates would correspond to $\eta = 0.872$ and $\tau = 0.267$, which are not too far from the numbers in table 1.[18] We can also compare our value of η to that of Boppart and Krusell (2020). In their model, ν controls the link between wage growth and hours growth. Mapping it into our model implies $1 - \eta = \nu$. They find $\nu = 0.2$, which implies an estimate of η that is a bit larger than ours.

For our estimation of (12) to properly measure the preference parameters η and τ it must be that the error terms in these equations are uncorrelated with the other right-hand-side variables, namely, the growth rates in wages and recreation prices. Ideally, we would like these last two quantities to be driven by orthogonal shocks to the production side of the economy. One potential worry is that shocks to the preferences of the household might jointly affect, say, the growth rates of wages and hours worked, thereby creating an endogeneity problem. We explore this possibility in appendix C.3 and show that this type of issue is not a problem in our setting. Given the production structure that we describe in appendix C.1, the growth rates of wages and recreation prices are only

[18] Owen (1971) estimates his model in levels and finds that 25% of the decline in work hours is due to recreation prices and 75% is due to rising wages. Using his tables A1 and A3, we can compute, using his notation, $\Delta \log L = \log[(168 - 108.8)/(168 - 91.6)] = -0.2551$ (change in weekly work hours), $\Delta \log P_R = \log(96.0/121.9) = -0.2389$ (change in relative price of recreation), and $\Delta \log W = \log(202.0/45.0) = 1.5016$ (change in real hourly wage rate). Then $(\eta - 1)\Delta \log W = 0.75 \Delta \log L$ implies that $\eta = 0.8725$, and $\tau \Delta \log P_R = 0.25 \Delta \log L$ implies that $\tau = 0.2670$.

pinned down, on a balanced-growth path, by total-factor productivity (TFP) growth, even when the preferences of the representative household also vary over time.

B. *Robustness*

We provide robustness for the results of table 1 in appendix D.2, where we conduct a subsample analysis and investigate the following changes in specifications: (1) using working age population (between 25 and 64 years old) to define per capita variables, (2) restricting the sample to countries with at least 20 years of recreation price data, (3) using hours per worker instead of per capita, and (4) including the Great Recession years in the sample. In almost all cases, the results are essentially unchanged with cheaper recreation items and higher wages still associated with fewer hours worked.

1. Household Durables

We can also extend our theoretical framework to allow for other types of consumption to influence how households allocate their time. The existing literature (e.g., Greenwood, Seshadri, and Yorukoglu 2005) argues that the decline in the price of household durable goods, such as household appliances, has had a substantial impact on labor supply decisions by making housework less time intensive. In this subsection we evaluate the importance of that mechanism for our results by augmenting the utility function to also depend on the consumption of household items, which we denote by a, with its associated relative price p^a. Following the same steps as in our main model (see app. C.2 for details), we can derive the system of equations

$$\Delta \log c_i = \alpha^c + \eta \Delta \log w_i + \tau \Delta \log p_i^d + \delta \Delta \log p_i^a + \varepsilon_i^c, \tag{13a}$$

$$\Delta \log d_i = \alpha^d + \eta \Delta \log w_i + (\tau - 1) \Delta \log p_i^d + \delta \Delta \log p_i^a + \varepsilon_i^d, \tag{13b}$$

$$\Delta \log a_i = \alpha^a + \eta \Delta \log w_i + \tau \Delta \log p_i^d + (\delta - 1) \Delta \log p_i^a + \varepsilon_i^a, \tag{13c}$$

$$\Delta \log h_i = \alpha^h + (\eta - 1) \Delta \log w_i + \tau \Delta \log p_i^d + \delta \Delta \log p_i^a + \varepsilon_i^h, \tag{13d}$$

which takes into account that cheaper household items might affect labor supply decisions, as we can see from (13d). The preference parameter δ captures the importance of that mechanism.

We estimate the system (13) via GMM. The price and consumption data for household items comes from the OECD and Eurostat. This group of goods and services includes such items as household appliances, furniture, household textiles and utensils, garden tools and equipment,

TABLE 2
GMM Estimation of the System of Equations (13)

	(1)	(2)	(3)
τ	.137**	.169***	.369***
	(.063)	(.058)	(.076)
$\eta - 1$	−.406***	−.266***	−.372***
	(.067)	(.055)	(.055)
δ	−.173*	−.123	−.055
	(.095)	(.088)	(.091)
α^h	.008***	.006***	.012***
	(.002)	(.001)	(.001)
Wages	GDP/hour	Employee compensation/hour	Employee compensation/hour
Same constant	No	No	Yes
J-test: *p*-value	.212	.200	.019
Observations	41	41	41

Note.—Results of iterative GMM estimation of (13). Column 3 reports results when the constants in (13) are the same, $\alpha^c = \alpha^d = \alpha^a = \alpha^h$. Robust standard errors in parentheses. Variables are constructed using all years except for 2008 and 2009. Work hours are measured in per capita terms. Population includes individuals between 20 and 74 years old. The "*J*-test: *p*-value" row reports *p*-values of Hansen's *J*-test of overidentifying restrictions.
* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

and goods and services for routine household maintenance. The results are presented in table 2. Reassuringly, we still find a significantly positive coefficient τ, implying a positive association between growth in recreation prices and hours worked. The magnitude of the coefficient is somewhat smaller than what is reported in table 1, such that the effect of recreation prices is attenuated by the presence of household items. While the estimate for δ is at most marginally significant, its negative sign is in line with the idea that cheaper household items push toward less housework and more market work hours, in line with the literature. Finally, we again find that the income effect of wages dominates the substitution effect, as the coefficient $\eta - 1$ is significantly negative.

2. Reduced-Form Estimation

While it is straightforward to extend the model to include additional types of consumption, we cannot control for some other mechanisms without deeper changes to the model that might break the balanced-growth assumption. In app. D.1, we however provide results from reduced-form exercises that involve estimating only equation (12c)—the one that links hours growth with the growth in wage and recreation prices—using ordinary least squares. In this reduced-form exercise, we can easily control for additional mechanisms that might have affected labor supply decisions, such as the increase in female labor force participation and variations in the share of young men in the population (Aguiar et al. 2021). Controlling for these changes, we still find a strong and significant association between recreation prices and work hours. In contrast, the coefficient that captures the impact of wage growth on hours is close to zero and statistically insignificant in the majority of the specifications.

C. Economic Impact

What do our estimates imply for the importance of wage growth and the fall in recreation prices in driving the global decline in work hours? In order to answer this question, we can perform a back-of-the-envelope calculation using the values of the estimated coefficients from column 2 of table 2, which are $\tau = 0.17$, $\eta = 0.73$, and $\delta = -0.12$. We choose the richer model that includes consumption of household items as benchmark because it cannot be rejected by the *J*-test. Furthermore, this specification uses employee compensation per hour, which is arguably a more precise measure of wages than GDP per hour.

From table 4 (in app. A.3), we see that the annual growth rate of wages has been 2.45% across the countries in our sample, and that the equivalent number for recreation prices is −1.48%. We also compute the average growth rate of the price of household items and find it to be −1.55%. Our results therefore suggest that wage growth has pushed for a decline in the growth rate of hours of about $2.45\ \% \times 0.27 \approx 0.66\ \%$ per year. Similarly, the decline in recreation prices can account for a decline in hours growth of about $1.48\ \% \times 0.17 \approx 0.25\ \%$ per year. The decline in the price of household items, at the same time, pushes for an increase of $1.55\ \% \times 0.12 \approx 0.19\ \%$ in work hours growth. These calculations suggest that the recreation channel has been about a third as important as the income effect as a driver of the decline in work hours. Interestingly, this relative importance of the recreation channel is quite close to the one found by Owen (1971) for the United States over the 1900–1961 period.

Put together, the effects of growing wages and declining real prices of recreation and household items imply that the average annual growth rate of work hours should be about −0.72%, more than the actual annual movement in hours per capita (−0.32%) observed since 1950 and reported in table 4 (app. A.3). What explains this discrepancy? Clearly, the intercept α_h reported in table 2 plays a nontrivial role, capturing for instance the entry of women into the labor force. We can filter out that effect by looking at male employment in the United States, for which data are readily available. From figure 1*A*, we see that male hours per capita have gone down by about 0.25% per year since 1979. From the Current Population Survey, we find that the median real weekly earnings for males have been essentially unchanged over the same period, so that wage growth had approximately no impact on male labor supply decisions over that period.

Since recreation prices have gone down by 0.70% a year in the last 40 years in the United States, the predicted impact of the decline in recreation prices ($-0.70 \times 0.17 = 0.12$ % per year) can explain about 50% of the decline in male work hours.

V. Implications for Cross-Household Trends and Leisure Inequality

While our main focus is on the relation between hours, recreation prices, and wages at the aggregate level, our general preference specification also makes quantitative predictions for the labor supply decisions of individual households. In this section, we employ our structural model to investigate the role of recreation prices in driving work hours in the cross section of households. This exercise is motivated by the marked increase in US leisure inequality in recent decades—with less-educated individuals working fewer and fewer hours compared to their more-educated counterparts (see, among others, Aguiar and Hurst [2009] and Attanasio, Hurst, and Pistaferri [2014]). This fact is documented in figure 5. Figure 5*A* shows the evolution of work hours for individuals with a high school diploma or less, and for those with at least a college degree. Between 1965 and 1985 the hours of these two groups have gone down by almost exactly the same amount. After 1985, however, individuals that have at most a high school education have seen their work hours go down relative to their college-educated counterparts. Figure 5*B* shows similar patterns for total leisure time. Since this increase in leisure inequality was accompanied by a growing skill premium (see fig. 5*D*), these trends are hard to reconcile with the dominating income effect that we found in our county-level estimation.[19] However, as we show in this section, the price of recreation items that less-educated individuals tend to consume has declined significantly over the recent decades, making leisure effectively more attractive for them. Therefore, our mechanism can potentially reconcile the simultaneous increase in leisure inequality and in the skill premium.

One key advantage of investigating the impact of recreation prices on work hours at the individual level is that these disaggregated data are sufficiently rich to allow us to construct instrumental variables for wages and recreation prices, and to therefore alleviate potential endogeneity concerns. Below, we first describe the data and the instruments. We then estimate the model-implied three-equation system (11) applied to synthetic households.

[19] Bick, Fuchs-Schundeln, and Lagakos (2018) find that high-income adults tend to work more than low-income adults in rich countries, even though the income effect appears to dominate in the cross section of countries as well as in the evolution of hours over longer time periods.

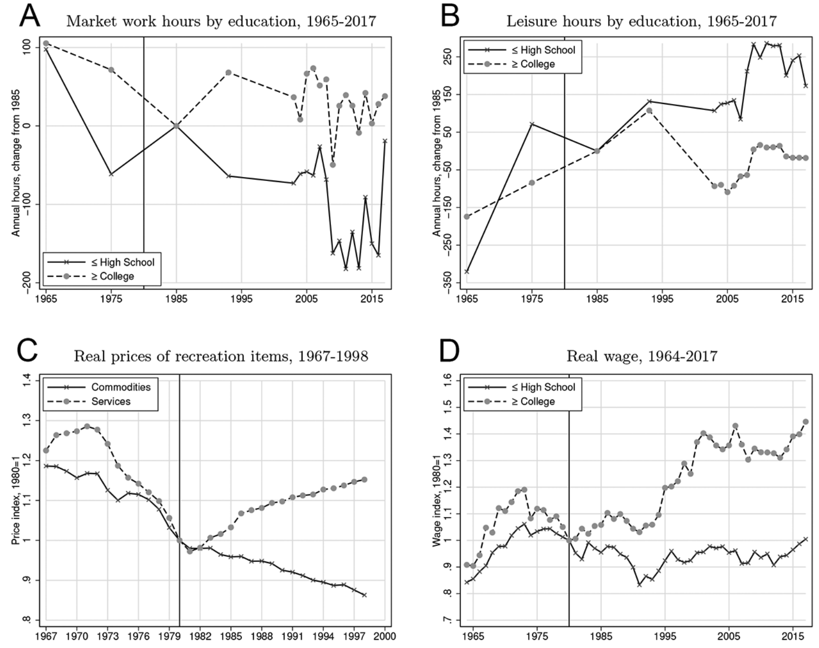

FIG. 5.—Work hours, leisure hours, recreation prices, and wages. The vertical black lines denote the start of the detailed consumption and price data. *A*, *B*, Evolution of work and leisure annual hours for individuals with no more than high school diploma and at least 4 years of college. Market work includes any work-related activities, travel related to work, and job search activities. Leisure is any time not allocated to market and nonmarket work (home production, shopping, nonrecreational child care), net of time required for fulfilling biological necessities (8 hours per day). Sample includes people between 25 and 64 years old who are not full-time students. Sources: American Time Use Survey, Aguiar and Hurst (2007), and Aguiar et al. (2021). *C*, Real US-wide price of recreation commodities and services. Source: BLS. *D*, Real hourly wage for individuals with no more than high school diploma and at least 4 years of college. Sample includes people between 25 and 64 years old who are not full-time students. Source: Annual Social and Economic Supplement.

A. Data

Our instrumental strategy, described below, requires detailed data at the locality-demographic-industry level. To construct the needed measures of hours and earnings at that level, we use data from the US Census (years 1980 and 1990) and the Census's American Community Surveys (2014–2018 five-year sample). In what follows, we denote the years 1980 and 1990 as $t = 0$ and $t = 1$, respectively, while the 2014–2018 period is $t = 2$. Later, we will use the data from $t = 0$ (the "preperiod") to construct the instruments, while the data from $t = 1$ and $t = 2$ will be used to compute the growth rate of the variables of interest. One key advantage of the Census data is that they cover a large sample of the US population, which allows us to exploit variation across 741 commuting zones, defined as in Autor, Dorn, and Hanson (2019). As in Aguiar and Bils (2015), we limit our analysis to individuals between the ages of 25 and 64, and split them into 15 demographic groups based on age and education.[20] Overall, such demographic-locality split implies 11,115 groups. We exclude groups with less than 50 individual observations, leaving us with 10,469 groups.

Data on recreation and nonrecreation consumption come from the interview part of the CE Survey. We follow Aguiar and Bils (2015) in constructing and cleaning the sample. We use the CE data between 1980 and 1988 as the $t = 0$ period, and the 1989–1991 and 2014–2018 periods serve as $t = 1$ and $t = 2$, respectively. Since the CE has on average only 1,484 annual observations, we pool observations across 1980 and 1988 to reduce noise. The results are largely unchanged if we use a shorter pooling period instead.

B. *Specification*

We adapt the three-equation system (11) implied by the model to the household-level data.[21] Our main specification takes the form

$$\Delta\log c_g = \alpha^c + \eta\Delta\log w_{gl} + \tau\Delta\log p_g^d + \varepsilon_{gl}^c, \tag{14a}$$

$$\Delta\log d_g = \alpha^d + \eta\Delta\log w_{gl} + (\tau - 1)\Delta\log p_g^d + \varepsilon_{gl}^d, \tag{14b}$$

$$\Delta\log h_{gl} = \alpha^h + (\eta - 1)\Delta\log w_{gl} + \tau\Delta\log p_g^d + \varepsilon_{gl}^h, \tag{14c}$$

where $\Delta\log x_{gl}$ denotes the log growth rate of a variable x for households in an age-education group g in location l between 1990 and the 2014–2018 period. As before, c is nonrecreation consumption, d is recreation consumption, h is hours worked, w is the real wage, and p^d is the real price of recreation items. All variables in (14) are demographic- and location-specific except for the consumption data, which are not rich enough at the local level, and recreation prices, which are not available at the local level. We instead construct demographic-specific prices by using the demographic-specific consumption shares of various types of recreation items together with the aggregate prices of these items. Note that the system (14) is purely cross-sectional, with no time dimension. The identification therefore comes from variations across localities and demographic groups, and aggregate trends are absorbed by the constants.

[20] The age groups are “25–34 years old,” “35–49 years old,” and “50–64 years old.” The education groups are “less than high school,” “high school,” “some college,” “4 years of college,” and “more than college.” We exclude individuals serving in the armed forces and institutional inmates.

[21] While we have so far used the model to study aggregate economies, we can also think of (11) as describing the labor supply decisions of an individual household. In particular, no assumptions about whether the economy is closed or open are needed.

C. *Identification*

A potential issue, which is perhaps more acute in this setting compared to the cross-country analysis above, is the endogeneity of the variables that enter both the left-hand and the right-hand sides of our structural equations (14). One set of concerns comes from the fact that the recreation price index is constructed as a consumption-share-weighted average of underlying recreation items, and that the weights might be affected by other economic variables that are not directly accounted for by our model. As a result, shocks that affect the consumption shares might lead to spurious correlations that could bias our estimates of the structural parameters. For instance, if a productivity shock makes televisions cheaper, households might substitute toward TV watching and away from relatively more expensive recreation, such as live sports events. This would lead to a larger decline in the recreation price index that we use in the estimation than warranted by the productivity shock alone. Similarly, if changes in income push households to consume cheaper recreation items, a sudden decline in employment opportunities might show up as a decline in recreation prices and interfere with the estimation. Additional issues can arise if certain recreation goods behave as “leisure luxuries,” such that their consumption increases with leisure time (Aguiar et al. 2021). In that case, growing leisure time, perhaps because of falling labor demand, might be increasingly allocated to these items, and as a result we would observe a decline in the price of the leisure basket together with a fall in work hours. Another set of endogeneity concerns might arise from labor supply shocks, which are outside of our model but might be present in the data. For instance, a preference shock that makes households enjoy leisure more might lead to a drop in hours and an increase in wages, leading to reverse causality in our estimation of the relationship between wages and hours. We describe in appendix C.3 how this type of reverse causality is not a concern in the closed-economy model of section IV. In that case wage growth is equal to TFP growth, and changes in preferences have no impact on that growth rate. The link between wages, recreation prices, and TFP is perhaps more tenuous in this disaggregated setup.

Since we are not modeling these effects explicitly, we want to ensure that they do not bias our estimates of η and τ, and invalidate the interpretation of these coefficients as structural parameters. In this subsection, we describe how we construct two instrumental variables for wages and recreation prices that allow us to identify these structural parameters by imposing additional orthogonality conditions in the GMM estimation. Our wage instrument relies on differences in sector-level employment across US localities and across demographic groups, as is relatively standard in the literature (Bartik 1991). In the same spirit, we construct a novel instrument for recreation prices that takes advantage of differences in recreation consumption bundles, across households with different demographic characteristics, that predate the sample period used in our estimation (i.e., in the preperiod). We split all recreation consumption expenditures into the seven subcategories used by the BLS to build price indexes: Audio-Video, Sports, Pets, Photo, Reading, Other Goods (including toys and musical instruments), and Other Services (including admissions, fees for lessons and instructions, and club memberships).[22]

1. Instrument for Recreation Prices

To motivate our instrument for recreation prices, we first show that, in the United States, there are large differences in the types of recreation goods and services that are consumed by households with different demographic characteristics, such as education and age. For instance, figure 6*A* shows how households whose heads are between 25 and 34 years old and do not have a high school diploma allocated their recreation spending in the period between 1980 and 1988. Figure 6*B* provides the same information for households whose heads have more than a college degree and who are between 50 and 64. We see that the consumption baskets vary substantially across these demographics. In particular, young and less-educated households spend disproportionally more on "Audio-Video" items, while older and more educated households spend more on "Other Services." Figures 6*C* and 6*D*, which provide the same shares over the 2010–2018 period, show that these differences remain in the most recent decade and, if anything, have become starker.

While figure 6 shows that different households consume different baskets of recreation items, the prices of these items have also evolved very differently over the last three decades. As we can see from figure 7, the real price of "Audio-Video" items, disproportionately consumed by young and less-educated households, has declined by 60% since 1980. In contrast, the average price of items in the "Other Services" category, mostly consumed by older and more-educated households, has increased by about 20%. As a result, the price of the typical recreation basket has evolved very differently across demographic groups.

We use this variation to construct the shift-share instrument

$$\Delta\log p_g^{d,\mathrm{IV}} = \sum_j \frac{d_{jg}^0}{\sum_i d_{ig}^0} \Delta\log p_j^{d,\mathrm{US}}, \tag{15}$$

[22] When constructing recreation consumption baskets across demographic groups, we use the demographic characteristics of the household's reference person. Our measures of wages and hours from the Census are at the individual level. Our results are similar if we instead use hours and wage data for the household heads only (see app. E.3).

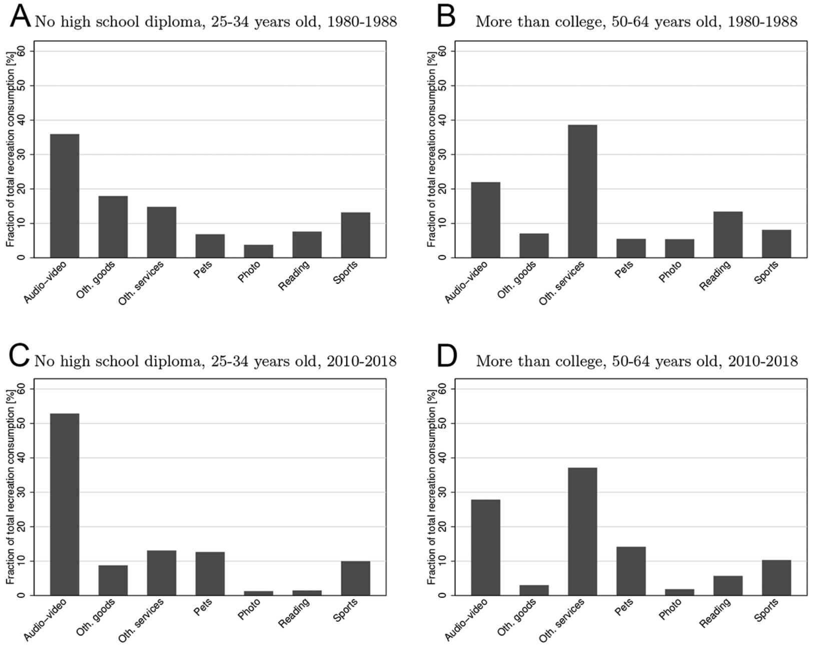

FIG. 6.—Share of recreation spending across education and age groups. Shown are shares of different items in total recreation consumption, constructed by pooling observations for the two periods 1980–1988 and 2010–2018. Source: Consumer Expenditure Survey.

where $\Delta \log p_j^{d,\mathrm{US}}$ denotes the change in the nationwide price of recreation items of type j between the periods $t = 1$ and $t = 2$. The quantity d_{jg}^0 denotes the consumption expenditure on recreation items of type j by individuals in demographic group g in period $t = 0$. As (15) shows, the instrument captures how nationwide changes in prices $\Delta \log p_j^{d,\mathrm{US}}$ affect the price of the recreation bundle for a household of given demographic characteristics.[23]

For this instrument to be relevant, it must be that growth in the demographic-specific recreation prices $\Delta \log p_g^d$ in (14) is correlated with the initial composition of the basket of recreation consumption, as captured by the shares $d_{jg}^0/\Sigma_i d_{ig}^0$ in (15). Figure 6 suggests that this is indeed the case. As the figure shows, these shares are quite persistent over time

[23] A similar approach is used by Acemoglu and Linn (2004) to instrument for changes in demand for new drugs, as they interact expenditure shares of individual goods with demographic changes in order to capture shifts in market sizes over time. As shown by Goldsmith-Pinkham, Sorkin, and Swift (2020) in the context of the standard Bartik instrument, this construction is essentially equivalent to a difference-in-differences research design. Goldsmith-Pinkham, Sorkin, and Swift (2020) also discuss the implicit assumptions under which the exclusion restriction is satisfied.

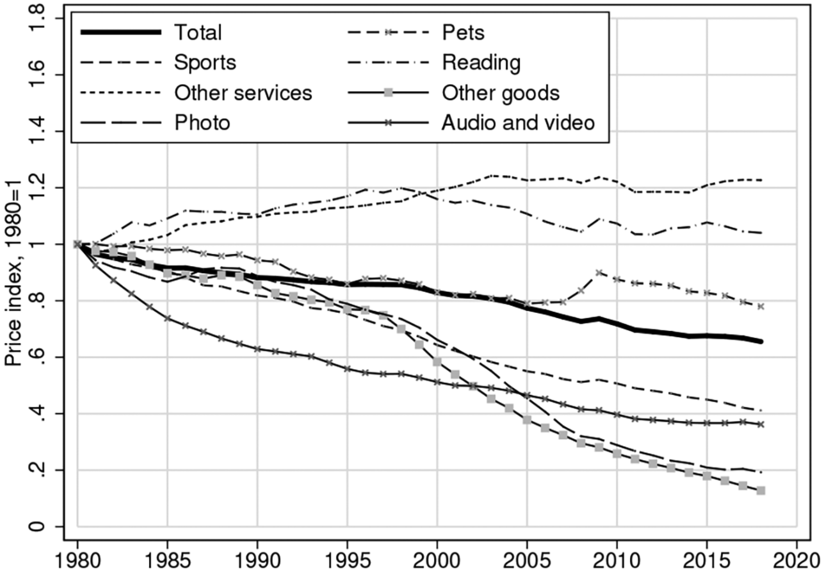

FIG. 7.—Real US-wide price of various recreation goods and services. Source: BLS.

and, as a result, the initial basket should be a good predictor of the growth in the price of the basket going forward. Since there are large differences in the growth of the price of different recreation items (as shown in fig. 7), the instrument (15) should vary substantially across demographic groups and be strong.[24]

For that instrument to be valid, it must be that the consumption shares $d^0_{jg}/\Sigma_i d^0_{ig}$ are exogenous, that is, uncorrelated with the error terms in the reduced-form equations (14). We think that this assumption is likely to hold for several reasons. First, we make sure to compute the shares in a preperiod ($t = 0$) to minimize their correlation with any potential omitted variables at $t = 1$ and $t = 2$, the period over which the growth rates are computed. Second, we view the consumption shares as being largely driven by differences in preferences (which, in particular, explains their persistence over time, as shown in fig. 6). For instance, college might introduce students to the theater, leading some of them to consume theater plays after graduation. These deep-seated preferences are unlikely to be related to random shocks that would also affect the error terms in (14). Of course, other economic outcomes such as the prices of different recreation items and household income might also affect the shares. However, in that

[24] We confirm this formally by showing that the first-stage *F*-statistics are large. As it is unclear how to compute *F*-statistics when doing the structural estimation of the system (14), we report them for the one-equation reduced-form estimation in app. E.2.

case the shares would be mainly affected by the *levels* of these variables at time $t = 0$ and not by the *changes* in these variables between $t = 1$ and $t = 2$, which would be more likely correlated with the error terms.

To further check the validity of our instrument, we can look at pretrends in the data since the 1960s. We do so in figure 5*C*, where we show the separate evolution of the real price of recreation commodities, mostly consumed by younger, less-educated individuals, and services, mostly consumed by older, more-educated individuals, between 1967 and 1998.[25] Interestingly, we see that the time series follow each other closely until about 1980 and then diverge markedly afterward. From 1982 on, the real price of recreation commodities has been on a steady decline while the real price of recreation services has been increasing. This pattern is reassuring for the exogeneity of our instrument: work hours for both college- and high-school-educated workers declined by the same amount between 1965 and 1985 (fig. 5*A*), when the prices of their recreation bundles moved together. The fact that the prices of recreation goods and services and the wages of higher and lower educated individuals start to diverge only in the 1980s also alleviates the concern that different recreation consumption shares in the preperiod might reflect prior trends in recreation prices or wages.

The patterns in figure 5 suggest a potential explanation for the recent rise in leisure inequality. As we can see from figure 5*B*, leisure time has grown the most among the less educated. These individuals have also faced the slowest growth in wages over that period so that the income effect alone would be unable to explain their relative rise in leisure time (in fact, it might suggest that the substitution effect rather than the income effect dominates). At the same time, the price of recreation items that these households tend to consume has declined significantly, making leisure effectively more attractive for them. In contrast, the real price of recreation items consumed by more-educated households has been increasing, but so have their wages. If the two effects roughly offset each other, that would explain why their leisure time has been stable over the last decades.

2. Instrument for Wages

Another potential concern is that technological progress over the past decades has moved manufacturing jobs overseas or made them obsolete and, at the same time, made recreation goods cheaper (e.g., Autor, Katz, and Kearney 2006; Autor and Dorn 2013; Bloom et al. 2019; Jaimovich

[25] Disaggregated price data for the various recreation items are not available prior to the late 1970s. The series shown in fig. 5*C* were discontinued in 1998 due to changes in the classification scheme. But importantly, and as evident from fig. 7, the diverging trends of real prices of recreation commodities and services are also present during the two latest decades.

and Siu 2020). These changes might have affected different demographic groups in different ways, thereby creating a correlation with the consumption shares. In particular, less-educated workers in the manufacturing sector have been disproportionately affected. In principle, the presence of wages on the right-hand sides of the equations in (14) would take care of any potential endogeneity having to do with employment opportunities, as long as they are indeed capturing exogenous shocks. To account for potential endogeneity in wages themselves we construct our second instrument. Here, we directly follow the approach of Bartik (1991) that is now standard in the literature.

Specifically, we use initial variation in industrial employment across localities and demographic groups together with nationwide changes in wages by industry to construct a measure of changes in wages that are driven by factors independent of local labor market conditions, such as technological growth. Our industry classification includes 34 industries, which we list in appendix A.3. Our instrument for wages is

$$\Delta \log w_{gl}^{\mathrm{IV}} = \sum_i \frac{e_{igl}^0}{\sum_j e_{jgl}^0} \Delta \log e_{ig}^{\mathrm{US}} - \sum_i \frac{h_{igl}^0}{\sum_j h_{jgl}^0} \Delta \log h_{ig}^{\mathrm{US}}, \tag{16}$$

where i denotes an industry, g is a demographic group, and l is a locality.[26] As before, the operator Δ denotes the total growth rate between $t = 1$ and $t = 2$. The variable $e_{igl} = w_{igl} \times h_{igl}$ refers to labor earnings and h_{igl} is total hours worked. As (16) shows, we construct $\Delta \log w_{gl}^{\mathrm{IV}}$ by first computing the fraction of earnings and hours worked that can be attributed to an industry i in a given locality-demographic unit (g, l) in the preperiod $t = 0$. Since these shares provide a measure of how sensitive local earnings and hours are to aggregate changes in industry i, we can then compute $\Delta \log w_{gl}^{\mathrm{IV}}$ as the growth rate in local wages that can be attributed to changes in the national factors $\Delta \log e_{ig}^{\mathrm{US}}$ and $\Delta \log h_{ig}^{\mathrm{US}}$.

D. *Estimating the Effect of Recreation Prices on Individual Labor Supply*

The estimated coefficients τ and $\eta - 1$ are presented in table 3. Column 1 shows the estimates without the instruments while column 2 shows the outcome of the instrumental variable estimation. In both cases, we find that the τ coefficients are significantly above zero, suggesting that the decline in recreation prices makes leisure time more attractive and, thus, leads to a reduction in work hours. We also find in both columns that $\eta - 1$ is estimated to be significantly negative, although its value is somewhat

[26] We show in app. E.2 that eq. (16) can be derived from the definition of labor earnings $e_{igl,t} = w_{igl,t} \times h_{igl,t}$ together with replacing the local growth rates $x_{igl,t+1}/x_{igl,t}$, for some variable x, by their nationwide equivalent $x_{ig,t+1}^{\mathrm{US}}/x_{ig,t}^{\mathrm{US}}$.

TABLE 3
GMM Estimation of the System of Equations (14)

	(1)	(2)	(3)
τ	.361***	.397***	.209*
	(.045)	(.047)	(.119)
$\eta - 1$	−.629***	−.281***	−.363**
	(.009)	(.080)	(.184)
α^h	.008***	.008***	−.0001
	(.001)	(.001)	(.002)
Instruments	No	Yes	Yes
Same constant	No	No	Yes
J-test: *p*-value	.006	.360	.027
Observations	10,469	10,469	10,469

Note.—Results of iterative GMM estimation of (14), where the growth rates are constructed using changes in variables between 1990 and 2018. Whenever the iterative procedure does not converge, a two-step procedure is used. Column 3 reports results when constants in (14) are the same, $\alpha^c = \alpha^d = \alpha^h$. Standard errors account for an arbitrary correlation within education-age groups and regions. They are reported in parentheses. Columns 2 and 3 use Bartik-like instruments for wages and recreation prices. The "*J*-test: *p*-value" row reports *p*-values of Hansen's *J*-test of overidentifying restrictions.
* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

smaller in absolute terms with the instruments. As in our cross-country analysis above, this implies that higher wage growth leads to smaller growth in work hours. In other words, the preferences of the households are such that the income effect dominates.

Overall, the household-level results of table 3 are similar to the cross-country estimates presented in table 1. Notably, not only are the signs of the coefficients the same but their magnitudes are also quite comparable across the two exercises. These results also hold using instrumental variables. We therefore find that the joint impact of wages and recreation prices on work hours is consistent across levels of aggregation and identification strategies, and helps account for the recent evolution of leisure hours across demographic groups in the United States.

We can use the estimates in table 3 to quantify the importance of recreation prices for the increase in leisure inequality between two extreme groups in our sample: young individuals without a high school degree and their older counterparts with more than a college degree. In 1990, young, less-educated individuals worked 1,153 hours per year, while older, more-educated individuals worked 1,718 annual hours, or 49% more. By 2016, the gap between these two groups had grown to 57% in the data, while the estimated model implies a gap of 59%. We find that recreation prices played a crucial role in driving this large increase in inequality. Without their impact, the model-implied gap would have *declined* from 49% in 1990 to 44% in 2016, so that according to the model recreation prices have been the key contributor to leisure inequality over the last decades, with wages actually pushing for more equal hours across demographic groups.[27]

As in the multicountry exercise, we also provide in appendix E.2 a set of ordinary least-squares regressions that focus on (14c)—the equation that captures the impact of wages and recreation prices on hours worked. In this reduced-form exercise, we add many additional controls, including (1) a rich set of demographic variables, (2) controls for the increase in disability, and (3) the share of each demographic-locality group employed in manufacturing in 1980. We find that the income effect dominates and that cheaper recreation prices is associated with fewer hours. These findings are statistically and economically significant, and are robust to using our two instruments. Overall, our results in this section confirm the importance of the rapid decline in recreation prices for the evolution of hours worked over the last decades.

VI. Conclusion

In this paper we evaluate the contribution of the rapid fall in recreation prices observed in the data in recent decades toward the concurrent decline in work hours. To do so, we build a macroeconomic model in which recreation prices and wages affect labor supply decisions. So that our results do not hinge on a specific utility function, we provide a general specification of preferences that are consistent with balanced growth, and show that it implies a set of cross-equation restrictions on the growth rates of wages, recreation prices, hours worked, and consumption of recreation and nonrecreation goods and services. We estimate these relationships using country-level data and find that a large fraction of the decline in work hours can be attributed to the falling price of recreation goods and services. We conduct a similar exercise using household-level data in the United States and find that the impact of recreation prices is also visible at that level of aggregation. In addition, we find that the differential change in the price of recreation items consumed by different demographic groups is largely responsible for the increase in leisure inequality observed in the United States over the last decades. Our results

[27] In 2016, the young and less educated worked 1111 annual hours while the older and more educated worked 1743 annual hours, or 57% more. The growths of wages and recreation prices over that period were $\Delta \log w_g = 0.013$ and $\Delta \log p_g = -0.547$ for the young, less-educated workers, and $\Delta \log w_g = 0.133$ and $\Delta \log p_g = -0.297$ for the older, more-educated ones. Using the IV coefficients from col. 2 of table 3, we find that the model-implied 2016 levels of hours are $1153 \times \exp[0.013 \times (-0.281) - 0.547 \times 0.397 + 0.189] = 1117$ for young, less-educated workers, where 0.189 is the accumulated impact of the constant over 27 years. The same number for the older, educated workers is $1718 \times \exp[0.133 \times (-0.281) - 0.297 \times 0.397 + 0.189] = 1777$, or 59% more. Repeating the same exercise without taking recreation prices into account leads to a 44% difference in 2016.

are robust to various changes in specification, the inclusion of additional controls, and to using instruments.

One advantage of our modeling strategy is that it imposes few restrictions on the preferences of the household and instead leverages the discipline imposed by the balanced-growth assumption. But balanced-growth restrictions prevent us from modeling one-time changes in the environment, such as the entry of women into the labor force. An alternative modeling strategy would be to deviate from balanced growth and to explicitly include these one-time changes in the environment. It would be interesting to see whether estimating such a model yields results similar to ours.

Another related direction for future inquiry involves more carefully modeling the allocation of time within the household. Recent evidence points to the growing importance of spending time with children, primarily among highly educated households (Guryan, Hurst, and Kearney 2008; Ramey and Ramey 2010; Dotti Sani and Treas 2016). Accounting for these mechanisms should provide a more complete picture of the forces affecting labor supply.

Finally, recent evidence by Aguiar et al. (2021) shows that young men, in particular, increasingly devote the bulk of their time to recreational activities such as video games instead of working or attending school. Our evidence together with theirs suggests that declining recreation prices might disincentivize human capital accumulation, and thus slow down the movement toward a more high-skilled workforce. Introducing this mechanism into macroeconomic models of skill acquisition, such as Kopytov, Roussanov, and Taschereau-Dumouchel (2018), might improve their performance in matching the employment data. Exploring these forces in detail is an exciting avenue for future research.

Data Availability

Code replicating the tables and figures in this article can be found in Kopytov, Roussanov, and Taschereau-Dumouchel (2023) in the Harvard Dataverse, https://doi.org/10.7910/DVN/0OMNYW.

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