EFFORT AND LEISURE IN THE WORKPLACE

FRANCISCO ALCALÁ*†

Abstract. Workers' effective labor input is the product of hours worked times work intensity. The existing limited evidence suggests that differences in average work intensity across countries and over time can be large and have a notable impact on relative TFP. These differences are typically assumed to be an exogenous cultural trait. This paper provides a simple theory that explains these differences as a consequence of differences in underlying productivity and consumption opportunities: for any given effective labor input, it is *rational* to work longer hours at lower intensity in poorer economies. The model implies that cross-country welfare comparisons that account for differences in leisure time but not in work intensity overstate welfare differences between rich and poor countries.

Keywords: labor supply; work intensity; labor productivity; industriousness.

JEL Classification: J22, O12.

Date: October 1, 2017.

*Universidad de Murcia, Ivie, and CEPR. Contact: alcala.paco@gmail.com.

†I thank seminar participants at ITAM (México) and the MOVE Barcelona Macroeconomic Workshop for their helpful comments, and I am grateful for the hospitality of the Economics Department at Columbia, where part of this project was conducted. Financial support by the Ministerio de Economía y Competitividad, project ECO2014-53419-R, is gratefully acknowledged.

1. Introduction

Workers' effective labor input is the product of hours worked times work intensity (pace and attentiveness). Although the latter component of effective labor is difficult to estimate and is often ignored by the macroeconomic literature, some evidence suggests that differences in average work intensity across countries and over time can be large and have a significant impact on TFP, comparative advantage, and growth (Denison (1962), Clark (1987a) and (1987b), Leamer (1999)).

Cross-country differences in work intensity are typically explained as an exogenous local cultural trait: *industriousness*. Certainly, local culture and social norms shape the effort that is considered fair value for the wage rate being paid and can strongly influence individuals' incentives to exert effort. Complementarities in production also affect these incentives and increase the social component and inertia of work intensity. However, it is unlikely that cultural traits that have a substantial economic impact, such as industriousness, are completely independent of the economic environment in the long run.[1] Moreover, average work intensity also appears to change over time, within countries, along with development (Denison (1962)). How do different economic environments induce workers to combine hours worked and work intensity in different proportions?

Technological change affects the optimal combination of working hours and intensity from both the labor demand and labor supply sides. For example, from the labor demand side, more capital-intensive technologies demand relatively higher work intensity (Leamer (1999)). From the labor supply side, different technologies provide different consumption opportunities that can change the optimal combination of leisure and work intensity. This paper focuses on the latter determinant: the labor supply. It provides a simple theory explaining long run differences in work intensity across countries and over time (even when performing a similar task with a similar technology) as a result of the

[1]In fact, there is growing evidence of a long-run connection between culture and the economic environment; see Fernandez (2011) for a survey of the literature. In the concluding words of Raquel Fernandez, "...cultural preferences and beliefs have a life of their own in the sense that, even when removed from the environment in which they originated, they continue to exercise influence over individual outcomes. The evidence also shows, however, that there is some convergence over time both in economic outcomes and in attitudes. This indicates, not surprisingly, that culture changes in response to a new environment."

workers' rational response to different consumption opportunities.[2] Crucially, while an *exogenous industriousness* would predict that hours worked and work intensity move in the same direction (hours worked and work intensity are two similar dimensions from the point of view of the attitude towards work), this paper's model is consistent with the empirical evidence suggesting that these two variables move in opposite directions: workers in richer societies tend to work fewer hours but more intensively.

The two key assumptions of the theory are that consumption requires time (Becker (1965); e.g., individuals need time to listen to a concert, travel for pleasure, or play with a video game) and that much of consumption can only be carried out outside the workplace. Labor supply choices involve comparing the disutility of working more hours with that of exerting more effort per hour, taking into account that working more hours also has an opportunity cost in terms of leisure. Hence, because of the complementarity between consumption and leisure, in richer societies, it is optimal to substitute a higher work intensity for long working hours.

The model highlights the different nature of leisure in rich and poor countries and how this affects labor productivity. While in rich countries, leisure is mostly associated with the consumption of goods and services, in poor countries, leisure is mostly associated with socializing and relaxing.[3] Now, while most goods and services can only be consumed outside the workplace, socializing and relaxing can, to some extent, also be enjoyed in the workplace, though at the cost of reduced work intensity. Therefore, in poorer countries, there is less incentive to work at high intensity to be able to leave the workplace sooner, thereby preferring longer working hours and lower intensity. Put it somewhat differently, because working at high intensity is increasingly painful, it is optimal to combine work with *leisure in the workplace* (e.g., chatting with coworkers or relaxing having a coffee or smoking a cigarette) as long as leisure in the workplace has a similar quality to leisure outside the workplace. However, this condition is unlikely

[2]The link between wages and work intensity over the business cycle can lead to a different relationship than the link over the long run, which is the one analyzed in this paper. See Lazear, Shaw and Stanton (2016) for the link over the business cycle.

[3]For example, between 1965 and 2003, the leisure time allocated to socializing decreased in the US by 2.8 hours for the least educated individuals and by 5.4 hours for the most educated, as income and consumption increased (Aguiar and Hurst (2007)).

to hold in rich countries where workers can afford to combine out-of-workplace leisure with the consumption of many more goods and services.[4]

The simple theory has two important additional implications. First, optimal work intensity choices reinforce the impact of the more *fundamental forces* determining productivity, such as geography and institutions. Greater work intensity not only increases TFP but, as explained by Leamer (1999), also further stimulates industrialization by raising the profitability of capital and, thereby, attracting more capital.[5] Second, the analysis is relevant for cross-country welfare comparisons, which is the subject of a growing literature that accounts for determinants of welfare other than income and consumption, such as life expectancy, inequality, and leisure (e.g., Nordhaus and Tobin (1973), Becker, Philipson and Soares (2005), Fleurbaey and Gaulier (2009), and Jones and Klenow (2016)). The analysis is this paper suggests that accounting for differences in work intensity would likely reduce measured welfare inequality across countries. In particular, the lower average pace and stress in the workplace in the less developed countries can compensate, at least to some extent, for the longer working hours.[6] Unfortunately, we lack the information needed to assess cross-country differences in average work intensity and their welfare implications. Nevertheless, it is possible to develop an illustrative quantitative example using Denison (1962)'s assessment of the simultaneous large reduction in hours worked and increase in work intensity that occurred in the US between the last third of the 19^{th} century and the middle of the 20^{th} century. The

[4]Interestingly, a number of innovative companies such as Google are exploring ways to increase the opportunities for leisure and consumption in the workplace by building *play areas* (see "Looking for a Lesson in Google's Perks," *The New York Times*, March 15, 2013, http://www.nytimes.com/2013/03/16/business/at-google-a-place-to-work-and-play.html?).

[5]Leamer (1999)'s analysis refers to *effort*, defined as the product of hours worked times work intensity. However, his analysis appears to be particularly relevant for differences in work intensity, rather than in hours worked, because fewer hours per worker can usually be compensated for by increasing the number of shifts using a particular machine, whereas lower work intensity can rarely be compensated for by increasing the number of workers per machine. A notable historical example in this respect is the Ford Motor Company, which in 1914 moved from having two nine-hour shifts to three eight-hour shifts to run the factory continuously (see http://www.nytimes.com/learning/general/onthisday/big/0105.html#article). In fact, later in the paper, Leamer assumes that hours worked are constant across workers and, thus, all of the variation in work effort is due to differences in work intensity.

[6]Nevertheless, the dispersion of work intensity across occupations in poor countries may be larger than that in more developed countries. Therefore, at the individual level, the highest levels of work intensity in poor countries could be greater than the highest levels in rich countries, even if average work intensity is lower.

model in this paper is calibrated to match this historical experience and used to show that cross-country differences in work intensity could in some cases be important for welfare comparisons, similar to the importance of differences in leisure, which Jones and Klenow (2016) have shown to be considerable.

The remainder of the paper is organized as follows. Section 2 presents the model and derives the main result. Section 3 considers some additional interpretations and implications. First, this section discusses the different nature of leisure at different stages of development and the reinterpretation of work intensity as the reciprocal of leisure in the workplace. Second, it develops a quantitative model to demonstrate the potential importance of accounting for work intensity differences in cross-country welfare comparisons. Section 4 concludes.

2. Hours Worked and Work Intensity: Some Evidence

Assessing differences in work intensity is difficult because it requires comparing the output of workers performing an identical task, having identical skills, and using identical technology in firms with identical managerial capacity. The existing evidence, though limited, suggests that cross-country differences in work intensity are large and positively correlated with income. A classical reference is Clark (1987a), who compares productivity in cotton mills across countries in 1910 while controlling for differences in inputs, technology, management, and workers' training or inherent abilities. He reports that one worker in New England performed as much work as 1.5 British, 2.3 German, and nearly 6 Greek, Japanese, Indian, or Chinese workers. Similarly, Clark (1987b) documents very large differences in productivity across Europe in wheat threshing and reaping among workers using an almost identical technology (which had been nearly unchanged for centuries), with many of them being hired and paid piece rates, thereby concluding that differences in the pace of work represented the major cause of productivity differences.

Ashenfelter (2012) reports prices and wage rates collected from McDonald's restaurants in over 60 countries, which operate with a highly standardized technology and protocol for employee training and work.[7] He provides data on Big Macs per Hour

[7] Average management capacities widely vary across countries (Bloom et al. (2012)), which makes particularly interesting to compare productivity across multinationals' *twin plants* located in different countries. Note that the optimal management practices are not necessarily those that maximize per

Worked (BMPH), which is the hourly wage of a crew member at McDonald's (the McWage) divided by the price of a Big Mac. Note that if labor and product markets are competitive, then the BMPH reflect the physical productivity of a worker. Cross-country differences in the number of BMPH are large and highly correlated with the countries' per capita income. For example, for 2007, Ashenfelter (2012) finds ratios of the BMPH in Canada, Russia, South Africa, China, Mexico, and India relative to its US value to be 0.91, 0.49, 0.34, 0.24, 0.22, and 0.15, respectively. Because differences in BMPH across countries cannot be explained by differences in skills, physical capital, or overall management capacity, the differences are likely to reflect, at least in part, differences in the intensity of work.

Self-reports on stress and speed at work point in the same direction.[8] Figure 1 is based on the Eurofund's Working Conditions Survey 2005, which provides data on 30 European countries (we exclude Turkey, as it likely features the strongest cultural differences from the other European countries in the sample). It shows a positive relationship between (the log of) PPP per capita GDP and work stress/intensity, as measured by the percentage of workers answering "Rarely ever" to the question "Do you have enough time to get the job done?". The coefficient of correlation is 0.64. Similar qualitative results are obtained using other questions in the survey such as "Does your job involve working at very high speed?". In turn, using the PWT9 data (Feenstra and Timmer (2015)) on average annual hours worked by persons engaged and the Eurofound's Working Conditions Survey, Figure 2 shows that hours worked and intensity tend to move in opposite directions. The PWT9 does not provide data on average hours worked in Croatia, thereby reducing the sample to 29 countries. The

hour labor productivity because higher work intensity has a cost in terms of the workers' utility and, therefore, in terms of the compensation to be paid. A different marginal rate of substitution between consumption and work intensity in a different country may imply a different optimal organization of work. As Stigler (1976) notes in his critique of Leibenstein (1966)'s X-efficiency, apparent managerial inefficiency and non-maximizing behavior can sometimes be explained by differences in motivations that include factors other than output and income. In this respect, it is interesting to recall the experiences of the International Labour Office's Productivity Demonstration Missions conducted circa the 1950s, which taught firm managers in developing countries more efficient ways to organize work. Despite the large productivity gains that could be obtained, the new techniques did not spread. In fact, in a number of cases, the international officers found a reversion to the former, less efficient practices when demonstration projects were revisited after a year or more (Kilby (1962)).

[8]Green and McIntosh (2001) discusses the research showing that self-reported work intensity is positively correlated with productivity measures.

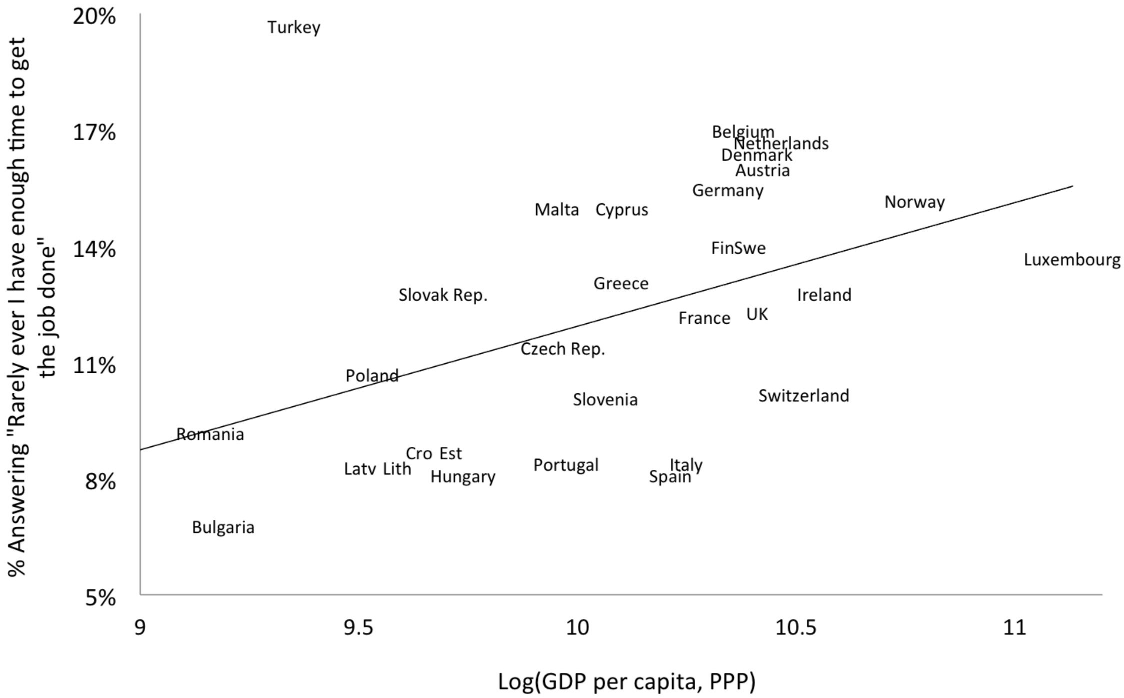

Figure 1: GDP Per Capita and the Proxy for Work Intensity Based on Self-Reports

Note: Work Intensity is proxied by the percentage of workers answering "Rarely ever" to the question "Do you have enough time to get the job done?". Data on 30 countries in 2005.
Sources: WDI, World Bank, and European Working Conditions Survey, Eurofound.

coefficient of correlation between the measure of work intensity and hours worked is -0.41.

The existing historical evidence for the US supports the hypothesis that hours and work intensity follow a divergent path, also within countries, in the long run. Building on a long string of case studies, Denison (1962) argued that the initial hours reductions from the six-day, sunup to sundown, standard that took place between the latter half of the 19th century to 1929 occasioned no loss in total output and might probably increased it. Hence, as work hours decreased, work intensity increased in a similar proportion (see also the references in Pencavel (2015) for illustrative particular cases). Moreover, Denison estimated that, at the weekly hours prevailing in 1929 (49 hours), a reduction in hours would still be fully offset by intensity gains that would leave output unchanged. Between 1929 and 1957, when hours worked went from 2,529 hours a year to 2,069, Denison conjectured a lower bound to the offset of 50-percent and an upper

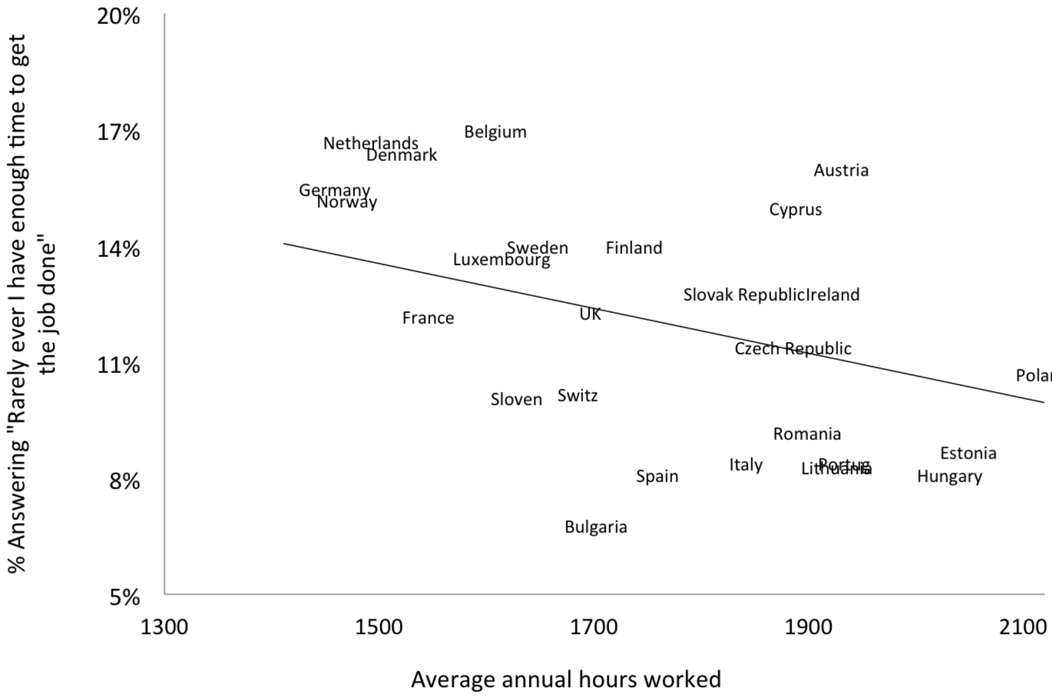

Figure 2: Hours Worked and the Proxy for Work Intensity Based on Self-Reports

Note: Work Intensity is proxied by the percentage of workers answering "Rarely ever" to the question "Do you have enough time to get the job done?". Data on 29 countries in 2005.
Sources: PWT9 and European Working Conditions Survey, Eurofound.

bound of 100-percent. Based on the data on England, Clark (1987a, p. 171) also suggests that "the same forces that created national differences in the efficiency of labor could be operating over time".

The possibility that firms could keep output almost unchanged while reducing hours worked (with no changes in technology) has sometimes been explained by an automatic mechanical impact on productivity: having fewer hours worked leads to lower fatigue and fewer accidents.[9] This paper argues that rational choice can also explain this pattern: at early stages of development and with long working hours, if consumption opportunities are expanding (and if work intensity is not near its physical limits), then workers should be willing to increase the pace of work in exchange for reduced hours.

[9]For example, Pencavel (2015) analyzes data on munitions workers during WWI whose weekly hours could exceed 90 hours. He shows that beyond a certain threshold number of hours, output would be less than proportional to hours worked due accidents and fatigue. However, this evidence on the determinants of labor productivity appears to correspond to extreme time and working circumstances in which decreasing labor productivity was a matter of physical human limits.

3. The Model

3.1. **Setting.** Individuals are endowed with one unit of time, which is allocated between hours at work (denoted $h \in [0,1]$) and leisure (denoted s, $s = 1 - h$). There is a single good that can only be consumed outside the workplace.[10] Production depends on the *effective labor* input, which is the product of hours worked and work intensity (denoted $i \in [0,1]$), i.e., effective labor $= i{\cdot}h$. Work intensity is observable, and the wage w^e refers to the pay per unit of effective labor (thus, the wage per unit of time is equal to $w^e{\cdot}i$). Denoting consumption by $c \geq 0$ and taking the price of the good as the *numeraire*, the individual's budget and time constraints are, respectively,

$$c \leq h{\cdot}i{\cdot}w^e, \tag{1}$$

$$s + h = 1. \tag{2}$$

Consumers' utility is given by a C^2 strictly concave function $U(c,s,h,i) : \mathbb{R}_+ \times [0,1]^3 \to \mathbb{R}$. For any two arguments z and v in the utility function, I use the following notation: $U_z \equiv \partial U/\partial z, U_{zv} \equiv \partial^2 U/\partial z \partial v$, $\eta_z \equiv \frac{z}{U}U_z$, $\rho_z \equiv -zU_{zz}/U_z$. Utility satisfies the following assumptions:

Assumptions:

A1: $U_s > 0, U_h < 0, U_i < 0$; $U_{cc} \leq 0, U_{ss} \leq 0, U_{hh} \leq 0, U_{ii} \leq 0$;

A2: $U_{ch} = U_{ci} = U_{sh} = U_{si} = 0$; $U_{cs} > 0, U_{hi} \leq 0$;

A3: **a)** $U_c(0,s,h,i) > -U_i(c,s,h,0) > 0$, $U_c(0,s,h,i) > -U_h(c,1,0,i) + U_s(c,1,0,i) > 0$; **b)** $-U_i(c,s,h,1) > U_c(c,s,h,i)$, $-U_h(c,0,1,i) + U_s(c,0,1,i) > U_c(c,s,h,i)$;

A4: $U_i + U_{ii}i < U_{hi}h - U_{cs}ch/i$, $\quad U_h + U_{hh}h + U_{ss}h - U_s - cU_{cs} < U_{hi}i$;

A5: $U_i + iU_{ii} < (\rho_c - 1)U_c c/i$, $\quad -U_{cs}ch + U_{hi}ih < (\rho_c - 1)U_c c$.

Assumption A1 is straightforward. The equalities in Assumption A2 are a simplifying assumption separating the utility impact of consumption and leisure from the disutility of hours worked and work intensity. Assumption $U_{cs} > 0$ conveys the complementarity between consumption and leisure, whereas $U_{hi} \leq 0$ implies that the disutility of hours worked may increase as work intensity increases (and vice versa). Assumption A3.a implies that consumers always prefer to consume something rather than to consume

[10] It would be enough to assume that consumption provides more utility if enjoyed outside the workplace.

nothing and work with zero intensity or zero hours (while allocating to leisure all their time); while Assumption A3.b implies that, rather than working at their physical maximum (in terms of intensity or hours, i.e., $i = 1$ or $h = 1$), consumers always prefer to consume somewhat less and work below their physical maximum. This assumption will guarantee that the solution to the utility maximization problem is an interior point. Assumptions A4 and A5 impose several mild requirements on the curvature of utility that are sufficient to guarantee the comparative statics results that follow. Primarily, Assumption A4 requires that the cross effects U_{hi} and U_{cs} are sufficiently small (relative to the own effects), whereas a sufficient (but not necessary) condition for A5 is $\rho_c \geq 1$.

3.2. **Equilibrium and comparative statics.** Note that the utility function is strictly concave, the feasible set given by (1) and (2) is compact and convex, and Assumption A3 guarantees that the consumers would never choose $c = 0$, $h = 0$, $s = 1$, $i = 0$, $h = 1$, $s = 0$, or $i = 1$. Therefore, for any $w^e > 0$, there exists a unique and strictly positive interior solution to the utility maximization problem. Moreover, the budget constraint is always satisfied with equality because working fewer hours or with less intensity always increase utility. Thus, the optimal values of c, s, h, and i are given by the solution to the system of equations formed by the budget and time constraints (with equality) together with the following first-order conditions:

$$\eta_i = \eta_h - \eta_s \frac{h}{1-h}, \tag{3}$$

$$-\eta_i = \eta_c, \tag{4}$$

where $\eta_c = \eta_c(c, s)$, $\eta_s = \eta_s(c, s)$, $\eta_h = \eta_h(h, i)$ and $\eta_i = \eta_i(h, i)$. Equation (3) balances out the negative effects of the two available alternatives for raising income: increasing intensity or hours. Increasing either intensity or hours by 1 percent increases income by 1 percent. However, increasing intensity by 1 percent reduces utility by η_i-percent, whereas increasing hours by 1 percent directly reduces utility by η_h percent and decreases leisure time by $h/(1-h)$ percent, which implies an additional reduction in utility of $\eta_s \cdot h/(1-h)$ percent. Equation (4) balances out the utility impact of increasing work intensity and consumption.

We can analyze this consumer equilibrium as follows. Using the time and budget constraints (always with equality) to substitute for s and c, respectively, in (3) and fully differentiating yields

$$(5)\quad \left(U_i + iU_{ii} - hU_{hi} + h^2 w^e U_{cs}\right) di \\ = \left(U_h + hU_{hh} - iU_{hi} + hU_{ss} - U_s - cU_{cs}\right) dh - U_{cs} h^2 i \, dw^e.$$

Note that $U_i + iU_{ii} - hU_{hi} + h^2 w^e U_{cs} < 0$ (see Assumption A4). Thus, by the Implicit Function Theorem, I can define a mapping $i = \mu(h, w^e)$, such that for any $w^e > 0$ and $h \in [0, 1]$, the pair $(h, \mu(h, w^e))$ satisfies (3) and the budget and time constraints. Moreover, Assumptions A2 and A4 imply $\mu_h > 0$ and $\mu_{w^e} > 0$. Note that the complementarity between consumption and leisure $U_{cs} > 0$ is crucial for $\mu_{w^e} > 0$ and, therefore, for the comparative statics that follow. Similarly, using the budget and time constraints to substitute for c and s in (4) and fully differentiating yields

$$(6)\quad -\left[U_i + iU_{ii} + (1 - \rho_c) U_c w^e h\right] di \\ = \left[(1 - \rho_c) U_c w^e i - cU_{cs} + iU_{hi}\right] dh + (1 - \rho_c) U_c h i \, dw^e,$$

where $U_i + iU_{ii} + (1 - \rho_c) U_c w^e h < 0$ (see Assumption A5). Thus, by the Implicit Function Theorem, I can define a mapping $i = \phi(h, w^e)$, such that for any $w^e > 0$ and $h \in [0, 1]$, the pair $(h, \phi(h, w^e))$ satisfies (4) and the budget and time constraints. Moreover, Assumption A5 implies $\phi_h < 0$, whereas if and only if $\rho_c \geq 1$ we have $\phi_{w^e} \leq 0$. Figure 3 depicts the mappings $i = \mu(h, w^e)$ and $i = \phi(h, w^e)$. For any wage $w^e > 0$, these two mappings determine the equilibrium values of h and i.

Now consider the impact of a wage increase in Figure 3. An increase in w^e always shifts the $\mu(h, w^e)$ schedule upwards, whereas, as already noted, the impact on $\phi(h, w^e)$ depends on the curvature of utility with respect to consumption (a wage increase shifts the $\mu(h, w^e)$ schedule to the left if and only if $\rho_c > 1$). Thus, as in the standard analysis of the labor supply, the impact of wages on work intensity cannot be determined solely on theoretical grounds. However, it is apparent from Figure 3 that if the impact of the wage increase on hours worked is positive or sufficiently small (i.e., if hours worked in the new equilibrium are sufficiently close to h_0), then the higher wage leads to greater work intensity. Formally, because $di/dw^e = \mu_{w^e} + \mu_h (dh/dw^e)$, if dh/dw^e is positive or sufficiently small in absolute terms, then $di/dw^e > 0$. This result can be summarized as follows:

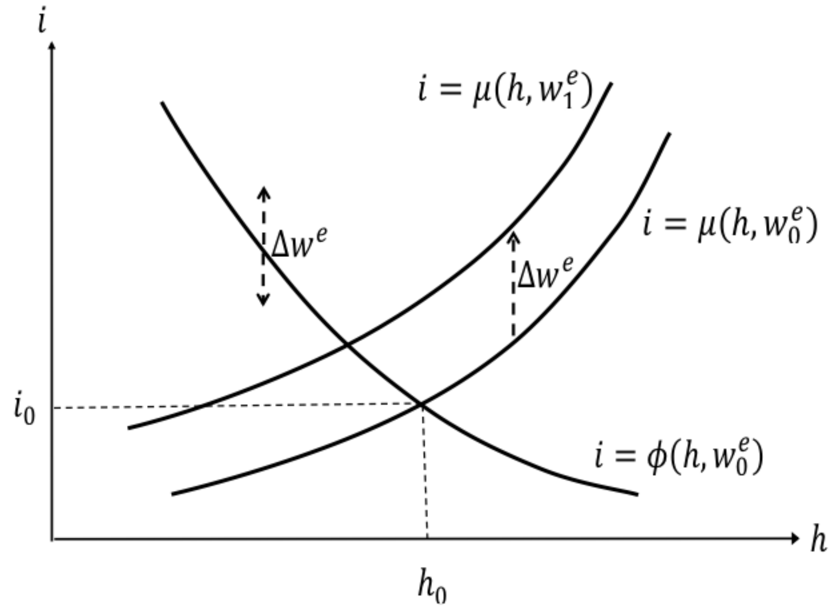

Figure 3: Hours Worked and Work Intensity

Proposition. *Let Assumptions A1-A5 hold. If the long-run impact of wages on hours worked is positive or moderately negative, then higher wages lead to higher work intensity.*

Note that a sufficient condition for the impact of wages on hours worked to be moderately negative is that ρ_c is sufficiently close to 1, which is a frequent assumption in macroeconomics. Moreover, the empirical literature tends to find a small negative long-run relationship between men's hours worked and wages (see Pencavel (1986), Ramey and Francis (2009), and Ashenfelter, Doran, and Schaller (2010)), which is also the pattern that appears to hold across countries (using per capita income as a proxy for the wage level).[11] With a small negative long-run impact of wages on hours, the corollary of the proposition is that hours worked and work intensity move in opposite directions.

Finally, note that the exogenous variable used in the analysis is the wage per unit of effective labor w^e because this wage measure reflects the exogenous changes in labor productivity. However, this wage is not directly observable. Nevertheless, if higher w^e

[11]For example, the unconditional elasticity of hours worked with respect to per capita PPP GDP using the last available year (2011) in the Penn World Table 8.1 (Feenstra, Inklaar, and Timmer (2015)) is -0.09, with a 95 percent confidence interval of $[-.14, -.033]$. This PWT 8.1 provides data on hours worked for 52 countries.

leads to greater work intensity, then there is also a positive link between the *hourly wage* ($= w^e \cdot i$) and work intensity. Moreover, if working hours are only modestly affected in the long run by increases in w^e, then there is also a positive link between the *annual wage* ($= w^e \cdot i \cdot h$) and work intensity.

4. Further Discussion and Implications

4.1. **Low work intensity as leisure in the workplace.** Economic analysis makes a sharp distinction between work and leisure and assumes that all time spent in the workplace is work. However, a non-trivial fraction of the time spent in the workplace –at least, in some occupations and communities– is not allocated to real work but to leisure activities such as chatting with coworkers, dealing with personal issues and chores, checking personal e-mail or relaxing and having a coffee or a cigarette. However, even if a fraction of the time spent in the workplace is allocated to leisure, there is a crucial difference between *leisure in the workplace* and *regular leisure*: most consumption goods and services cannot be consumed at the workplace even when not working.

Within this paper's model, it is straightforward to analyze the optimal allocation of time at the workplace between *real work* and *leisure* by means of a reinterpretation of the work intensity variable. Let r, $0 < r < 1$, be the share of the time in the workplace that is allocated to leisure activities (such as chatting, having a coffee or checking personal e-mail). Now, rewrite the expressions in the model by substituting $1 - r$ for i. Thus, the utility function is $U(c, s, h, [1 - r]) : \mathbb{R}_+ \times [0, 1]^3 \to \mathbb{R}$, the effective labor input is equal to the product $h \cdot (1 - r)$ and the budget constraint is $c \leq h \cdot (1 - r) \cdot w^e$. Note that the complementarity between consumption and leisure is restricted to leisure outside the workplace (i.e., $U_{cs} > 0$ but $U_{cr} = 0$). Then, the same arguments used to prove the proposition in the previous section now imply that if wages have a moderately negative effect on the labor supply, then higher wages prompt workers to shift leisure from the workplace to outside the workplace and, thus, that hours worked and leisure at work should be positively correlated. These two implications are consistent with the findings of Burda, Genadek, and Hamermesh (2016) using the American Time Use Survey, which has a battery of questions about what workers are doing while at work. These authors find that the fraction of *work time not working* significantly increases with the length of the workweek. They also find that, conditional on hours of work, those with higher weekly earnings spend a smaller fraction of their time at the workplace in non-work.

This interpretation of low work intensity as leisure in the workplace also provides a interesting perspective on the relationship between work and leisure at different stages of development. In low-income countries, much of the leisure time outside the workplace is spent on activities such as socializing and relaxing that, to some extent, can also be enjoyed in the workplace. Hence, because non-stop work is increasingly painful (i.e., the marginal disutility of work intensity is increasing), it is rational to combine small spells of work and leisure in the workplace (which leads to staying at work for longer hours) instead of shifting all of one's leisure time to outside the workplace. Combining multiple spells of work and leisure in the workplace reduces the disutility of supplying a given amount of effective labor, albeit at the cost of less leisure outside the workplace. However, as communities become richer and consumption opportunities expand, the value of leisure outside the workplace increases due to its complementarity with consumption. Therefore, richer communities prefer to reduce leisure in the workplace to increase regular leisure.

Notwithstanding, some recent developments could reshape the interaction among consumption opportunities, hours spent in the workplace, and work intensity in the future. For example, the availability of the Internet for personal use in the workplace can lead to lower work intensity and longer hours in the workplace. By opening new possibilities for working from home, the Internet also improves the scope for alternating between work and leisure. Moreover, as noted in the Introduction, a number of leading innovative companies such as Google are increasing the opportunities to combine consumption and leisure in the workplace.

4.2. **Work intensity with exogenous hours.** In the short run, hours worked and work intensity may differ from the optimal combination analyzed in Section 3 due to factors such as legislation and adjustment costs that exogenously fix working hours. Although the focus of this paper is the long run equilibrium in which hours and intensity adjust to an optimal combination, it is interesting to briefly consider how work intensity (and, therefore, labor productivity) endogenously responds to exogenous changes in working hours. In this respect, Pencavel (2015) among others documents that each individual's per hour productivity decreases as the number of weekly hours increases.[12] Similarly, Burda, Genadek, and Hamermesh (2016), note that "Whether because of boredom, fatigue or something else, the marginal effect of additional work time on non-work activities is increasing for most employees as the workday lengthens."

The model, in fact, predicts that each worker's output per hour decreases with exogenous increases in work hours. The reason is that longer hours lead to lower work intensity. The first order condition of the utility maximization problem with respect to work intensity, given an exogenous number of hours, is again given by equation (4). Therefore, the mapping $i = \phi(h, w^e)$, where $\phi_h < 0$, also describes the response of work intensity to exogenous changes in work hours. Hence, because of the combination of factors embodied in Assumption A5,[13] having to work more hours induces a reduction in work intensity. Consequently, output per hour of work decreases with the number of (exogenously stipulated) hours of work.

4.3. **Calibration and welfare comparisons.** As shown by the literature cited in the Introduction, a number of dimensions other than income are relevant for cross-country welfare comparisons (e.g., life expectancy, inequality, and leisure). Could differences in average work intensity also be relevant? We currently lack the information needed to assess the welfare implications of cross-country differences in work intensity. However, it is possible to use Denison (1962)'s historical assessments of the US economy to calibrate a quantitative model and show that differences in work intensity can be important for welfare comparable to the importance of differences in leisure.

Going back to the full model of simultaneous choice of work intensity and hours, consider the following utility function:

$$U(c, s, h, i) = \beta c + \frac{1}{1-\alpha}\left(\frac{s}{c}\right)^{1-\alpha} + \ln(1-h) + \varepsilon \ln(1-i),$$

where $\beta > 1, \alpha > 2, \varepsilon > 0$. and $b > c^{a-2}s^{1-a}$ (this latter condition requires that the units in which consumption is measured be sufficiently large). The second term in this

[12]Note that this decreasing marginal productivity at the individual level is unrelated to the standard analysis of a decreasing aggregate marginal productivity of labor, which is usually explained in terms of adding decreasingly productive jobs or decreasingly skilled workers.

[13]Namely, working at high intensity is increasingly painful and exhausting ($U_{ii} < 0$ and $U_{hi} < 0$) and the marginal utility of consumption falls relatively fast (ρ_c is sufficiently high) and as leisure time decreases ($U_{cs} > 0$).

expression embodies the complementarity between consumption and leisure: if leisure s is constant, the marginal utility of consumption decreases (note that s/c is the leisure available to enjoy each unit of consumption). Maximization with respect c, s, h, and i subject to (1) and (2) yields the following first-order conditions:

$$\beta c - c^{\alpha-1}(1-h)^{-\alpha} = \frac{h}{1-h},$$

$$\frac{1}{i} = 1 + \frac{\varepsilon}{h}\frac{(1-h)^{\alpha}}{(1-h)^{\alpha-1}+c^{\alpha-1}}.$$

Now consider two economies L and H with per capita incomes such that the ratio c_L/c_H roughly matches the ratio between the US per capita income in the mid-19$^{\text{th}}$ and mid-20$^{\text{th}}$ centuries. The parameters β, α, and ε are calibrated, and the values of c_L and i_L are fixed (these two values can be seen as fixing the units in which consumption and work intensity are measured) such that the ratios of hours worked and work intensity between these two economies broadly match the corresponding ratios between the mid-19$^{\text{th}}$ and mid-20$^{\text{th}}$ century US economy. Specifically, the model is calibrated to deliver $c_L/c_H = .223$, $h_L/h_H = 3/2$, and $i_L/i_H = 2/3$. This c_L/c_H ratio corresponds to Maddison (2001)'s estimates of the US income per capita at constant prices in 1870 and 1955 ($2,435 and $10,897, respectively). The h_L/h_H ratio corresponds to the 63 average weekly hours worked in manufacturing in 1870 according to the Aldrich Report (see Whaples (2001)) and the 41 weekly hours in 1955 reported by the US Bureau of Labor Statistics. The ratio $i_L/i_H = 2/3$ is a simple scenario that is not inconsistent with Denison's appraisal that increases in work intensity could have offset the reduction in hours more than proportionally before 1929 and by no less than 50% between 1929 and 1957 (Denison 1962, p.42).[14] Less important, as the weekly time available after sleeping and basic care can be estimated at approximately 105 hours (= 7 days*15 hours) and is normalized to be equal to 1 in the time constraint (2), h_L is set as $h_L = 63/105 = 0.6$. Table 1 summarizes the calibration's targets and the calibrated parameters. The first finding generated by this exercise is that the huge simultaneous adjustment in hours

[14]Interestingly, 32% of the 167 countries whose statistics are reported in the Maddison-Project (2013) still had in 2008 a GDP per capita below that in the US in 1870, and only 28% of these 167 countries had a GDP per capita in 2008 above that in the US in 1955. It is an open question how many countries will carry out (and how many countries have already carried out) a transition from a regime of long hours and relatively low work intensity to a regime of shorter hours and high work intensity, similar to the one suggested by Denison (1962) for the US.

worked and work intensity that took place in the US between the second half of the 19th century and the mid-20th century can be explained by the model as the workers' optimal response to the increase in income that occurred over that period.

TABLE 1. Calibration and welfare

Targets			Parameters						Consum. equivalents		
c_L/c_H	h_L/h_H	i_L/i_H	h_L	c_L	i_L	β	α	ε	c_1/c_H	c_2/c_H	c_3/c_H
.223	3/2	2/3	.6	.242	.4	8.7	3.8	2.8	.37	.17	.30

Note: the values of c_n used to calculate the consumption-equivalent ratios c_n/c_H, $n = 1, 2, 3$, satisfy $U(c_n, h_n, i_n) = U(c_L, h_L, i_L)$ for each of the following three scenarios: $(h_1, i_1) = (0.6, 0.6)$, $(h_2, i_2) = (0.4, 0.4)$, $(h_3, i_3) = (0.4, 0.6)$.

Next, I conduct a consumption-equivalent welfare comparison between economies L and H in the same spirit as in Jones and Klenow (2016).[15] I consider three alternative scenarios of working hours and intensity: $(h_1, i_1) = (0.6, 0.6)$, $(h_2, i_2) = (0.4, 0.4)$, $(h_3, i_3) = (0.4, 0.6)$. From the perspective of economy L, the first scenario can be seen as increasing work intensity to the level in H, the second as reducing hours worked to the level in H, and the third as adjusting both hours worked and work intensity to the level in H. For each scenario, I calculate the consumption level c_n, $n = 1, 2, 3$, that would render utility identical to that enjoyed in economy L. That is, I calculate the values of c_n that satisfy $U(c_n, h_n, i_n) = U(c_L, h_L, i_L)$. Table 1 reports the ratios c_n/c_H, $n = 1, 2, 3$. Consider scenario 1: the numbers in Table 1 imply that to compensate a worker from L for working with the intensity prevalent in H, her consumption should be multiplied by 1.67. Thus, accounting for differences in work intensity (but ignoring the differences in hours worked), economy L's consumption-equivalent welfare is 37% of that of economy H (to be compared with the ratio in terms of income, which is 22.3%). The literature on cross-country welfare comparisons shows that differences in leisure entail substantial differences in welfare. Considering scenario 2, I find that workers in economy L would be indifferent between reducing hours worked to the level in H and reducing their consumption by 23%. Thus, accounting for the differences in hours worked (and income) but ignoring the differences in work intensity, economy L's

[15] The theoretical framework here is extremely simple in comparison to that in Jones and Klenow (2016), who conduct consumption-equivalent comparisons across 152 countries and over time taking into account differences in mortality, consumption to income ratios, leisure, and within-country inequality.

consumption-equivalent welfare is only 17% that of H (notably below the 22.3% and, therefore, increasing measured welfare inequality as emphasized by the cross-country welfare literature, e.g., Nordhaus and Tobin (1973), Fleurbaey and Gaulier (2009), and Jones and Klenow, (2016)). Finally, scenario 3 is the most complete and, thus, interesting one to compare welfare between L and H. To compensate a worker from L for working under identical conditions to those in H, her consumption should be multiplied by 1.33. This means that economy L's consumption-equivalent welfare is 30% of economy H's. Note that because productivity tends to drive work intensity and hours in opposite directions, considering only one of these two dimensions when conducting cross-country welfare comparisons (in particular, considering only leisure, which is what scenario 2 does) could lead to larger errors than omitting both dimensions.[16]

In sum, although the specific numbers I consider are largely debatable, this quantitative exercise strongly suggests that taking into consideration cross-country differences in average work intensity is important. Accounting for them would likely reduce measured welfare inequality across countries.

5. Concluding Comments

Differences in work intensity across countries and time can be large and significantly affect relative TFP. Why do different communities work with different average intensity? Is low work intensity a cause of low economic development, a consequence, or both? Can working at a slow pace have a significant welfare value? Is work intensity an isolated feature of each culture or one of a series of complementary aspects that constitute their *way of life* (e.g., *industrious consumerism* versus *idle socializing*)? Can rational behavior and differences in economic opportunities help explain differences in work intensity? The very simple model in this paper provides a new perspective on these important and complex questions and should be seen only as a first step into a topic that deserves detailed future empirical work.

Work ethics are strongly affected by local culture and social and legal norms that feature long-lasting inertias. However, it is unlikely that cultural traits that have considerable economic impact are entirely independent of the economic environment. Moreover,

[16]However, other determinants of work intensity and hours, such as the marginal income tax, could affect these two variables in the same direction.

it is difficult to explain differences in work intensity in terms of an exogenous cultural trait that determines the inclination to work, given that hours worked and work intensity move in opposite directions (even when comparing similar tasks using similar technologies). This paper shows that rational choice when facing different economic opportunities can help explain the apparent positive correlation between income and work intensity across countries and over time, as well as the negative correlation between hours worked and work intensity. In particular, when working hours are long and consumption opportunities are expanding at early stages of development, workers should be willing to accept an increase in the pace of work in exchange for reduced hours. The reason is that as communities become richer, they increasingly link leisure to the consumption of goods and services, most of which can only be enjoyed outside the workplace. Thus, they draw a sharper distinction between the time and place for work and the time and place for leisure. Interestingly, the Internet and some pioneering companies are providing new opportunities for combining work, leisure, and consumption that could somewhat reverse this pattern in the future.

Work intensity choices have important consequences for output and welfare. On the one hand, they reinforce the output impact of other more *fundamental determinants of productivity* such as geography and institutions because higher fundamental productivity leads to higher work intensity. On the other hand, as work intensity tends to increase with income, accounting for the differences in intensity would likely reduce measured welfare inequality across countries. Accounting for these differences appears to be particularly important in welfare comparisons that already incorporate differences in hours worked.

References

Aguiar, Mark, and Erik Hurst (2007). "Measuring Trends in Leisure," *Quarterly Journal of Economics*, 122(3), 969–1006.

Ashenfelter, Orley (2012). "Comparing Real Wage Rates," *American Economic Review*, 102(2), 617-42.

Ashenfelter, Orley, Kirk Doran, and Bruce Schaller (2010). "A Shred of Credible Evidence on the Long-run Elasticity of Labour Supply," *Economica*, 77(308), 637-650.

Becker, Gary S. (1965). "A Theory of the Allocation of Time," *Economic Journal*, 75(299), 493–517.

Becker, Gary S., Tomas J. Philipson, and Rodrigo R. Soares (2005). "The Quantity and Quality of Life and the Evolution of World Inequality," *American Economic Review*, 95(1), 277-291.

Bloom, Nicholas, Christos Genakos, Raffaella Sadun, and John Van Reenen (2012). "Management practices across firms and countries," *Academy of Management Perspectives*, 26(1), 12-33.

Burda, Michael, Katie R. Genadek, Daniel S. Hamermesh (2016). "Not Working at Work: Loafing, Unemployment and Labor Productivity," NBER Working Paper No. 21923.

Clark, Gregory (1987a). "Why Isn't the Whole World Developed? Lessons from the Cotton Mills," *Journal of Economic History*, 47(1), 141–173.

Clark, Gregory (1987b). "Productivity Growth without Technical Change in European Agriculture before 1850," *Journal of Economic History*, 47(2), 419-432.

Denison, Edward F. (1962). *The Sources of Economic Growth in the United States and the Alternatives Before Us*, N.Y.: Committee for Economic Development.

Feenstra, Robert C., Robert Inklaar, and Marcel P. Timmer (2015). "The Next Generation of the Penn World Table," *American Economic Review*, 105(10), 3150-3182.

Fernandez, Raquel (2011). "Does Culture Matter?" in, J. Benhabib, M. O. Jackson and A. Bisin, editors, *Handbook of Social Economics*, Vol. 1A, North-Holland.

Fleurbaey, Marc, and Guillaume Gaulier (2009). "International Comparisons of Living Standards by Equivalent Incomes," *Scandinavian Journal of Economics*, 111(3), 597-624.

Green, Francis, and Steven McIntosh (2001). "The intensification of work in Europe," *Labour Economics*, 8(2), 291-308.

Jones, Charles I., and Peter J. Klenow (2016). "Beyond GDP? Welfare across Countries and Time," *American Economic Journal*, 106(9), 2426–2457.

Kilby, Peter (1962). "Organization and Productivity in Backward Economies," *Quarterly Journal of Economics*, 76(2), 303–310.

Krapf, Matthias, Heinrich W. Ursprung, and Christian Zimmermann (2014). " Parenthood and Produc

Lazear, Edward P., Kathryn L. Shaw, and Christopher Stanton (2016). "Making Do with Less: Working Harder During Recessions." *Journal of Labor Economics* 34(S1), S333–S360.

Leamer, Edward (1999). "Effort, Wages, and the International Division of Labor," *Journal of Political Economy*, 107(6), 1127–1162.

Leibenstein, Harvey (1966), "Allocative Efficiency vs. X-Efficiency," *American Economic Review*, 56(3), 392–415.

Maddison, Angus (2001). *The World Economy: A Millennial Perspective*, OECD, Paris.

Maddison-Project, (2013). http://www.ggdc.net/maddison/maddison-project/home.htm, 2013 version.

Nordhaus, William D., and James Tobin (1973). "Is Growth Obsolete?", in Milton Moss (ed.), *The Measurement of Economic and Social Performance, Studies in Income and Wealth*, NBER, vol. 38, 509–564.

Pencavel, John (1986). "Labor Supply of Men: A Survey," in O. Ashenfelter and R. Layard (ed.), *Handbook of Labor Economics*, vol. 1, 3-102.

Pencavel, John (2015). "The Productivity of Working Hours," *Economic Journal*, 125, 2052–2076.

Ramey, Valerie A., and Neville Francis (2009). "A Century of Work and Leisure," *American Economic Journal: Macroeconomics*, 1(2), 189–224.

Stigler, George J. (1976). "The Xistence of X-Efficiency," *American Economic Review*, 66(1), 213-216.