The Relationship Between Changes in Income Tax Rates and the Motivation to Work

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Doctoral Thesis Summary

Tomas Bata University in Zlín

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Faculty of Management and Economics

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The Relationship Between Changes in Income Tax Rates and the Motivation to Work

Vztah mezi změnami sazeb daně z příjmů a motivace pracovat

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ABSTRACT

Taxes are related to wages in two ways. First, taxes directly reduce after-tax wages, which leads to direct economic effects, referred to in the economics literature as the income effect and the substitution effect. Second, there is a psychological effect. Taxes can have a psychological effect that can increase or decrease the motivation to work. In this paper, behavioural theories are developed and demonstrated and these show that workers at high and low levels of pay behave differently when tax rates change. One theory posits that to survive, workers must maintain a subsistence level of income. A change in taxes changes the minimum number of hours of work required to maintain this subsistence level of income. The second theory prescribes that the utility for leisure is not constant, but is an increasing function of income. This is due to the larger opportunity set of activities available at higher levels of income. The theories can be demonstrated by considering the changes in hours worked in reaction to changes in labour income tax rates. In countries with low wage rates, as labour income taxes increase, the motivation to work increases, because workers have to work more to maintain a minimum level of income. In countries with high wage rates, as labour income taxes increase, the motivation to work decreases, because workers have a high preference for leisure. The theories are tested using a time-series cross-section of data covering 15 countries for 50 years. The findings imply that wage levels and preferences for leisure/work can account for the differences in changes in hours worked in response to changes in tax rates.

ABSTRAKT

Daně souvisí se mzdami dvěma způsoby. Za prvé, daně přímo snižují konečnou výši platu, což je přímý ekonomický dopad, který je v ekonomické literatuře uveden jako důchodový a substituční efekt. Druhým je psychologický efekt. Výše daní může zvýšit nebo snížit motivaci pracovat. V této práci jsou vypracovány behaviorální teorie, které ukazují, jak se pracující chovají při změně daňové sazby při různých stupních výše platu. Jedna teorie předpokládá, že pracující musí mít pro přežití minimální příjem. Změna v daňové sazbě mění minimální počet hodin práce potřebný pro přežití či pro zachování životní úrovně. Druhá teorie předpokládá, že užitek z volného času není konstantní, ale je rostoucí funkcí příjmu. Toto je díky větší příležitosti pro volnočasové aktivity dostupných při vyšší úrovni příjmu. Za účelem prokázání těchto teorií jsou zvažovány změny počtu odpracovaných hodin ke změnám daňových sazeb z příjmu z pracovního poměru. V zemích s nízkými platy při zvyšování daňových sazeb z příjmu roste motivace pracovat, protože pracující musí pracovat více pro dosažení minimálního příjmu. V zemích s vysokými mzdami při zvyšování daňové sazby motivace k práci klesá, protože pracující mají vyšší preference týkající se volnočasových aktivit. Teorie jsou testovány použitím průřezu časových řad dat zahrnujících 15 zemí v průběhu 50 let. Zjištění naznačují, že změny úrovně mezd a preferencí pro volný čas/práci mohou představovat rozdíly mezi odpracovanými hodinami v reakci na změny daňových sazeb.

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LIST OF ABBREVIATIONS

BD	Benefit Duration
BRR	Benefit Replacement Rate
CONTROLS	Control Variables
CT	Current Taxes on Income and Wealth
DICE	Database for Institutional Comparisons in Europe
EP	Employment Protection
EXP	Government consumption and expenditures
GAP	Output Gap
GDP	Gross domestic product
HOURS	Hours Worked
INCOME	Average Income

LHD	Low and High Wages Dummy
LMID	Labor Market Institutions Database
OECD	The Organisation for Economic Co-operation and Development
PMR	Product Market Regulation
PPP	Purchasing Power Parity
RO	Research Objective
RQ	Research Question
SNA	System of National Accounts
TAXES	Average Income Tax Rates
TAUC	Consumption Tax Rate
TAUK	Capital Tax Rate
TD	Theory Dummy
TED	Total Economy Database
UD	Net Union Density
UK	United Kingdom
USA	United States of America
WID	World Wealth and Income Database

1. INTRODUCTION

1.1 Background

If the government raised the income tax rate and your net wages went down, what would you do? Would you work more hours to maintain your standard of living? On the other hand, perhaps you would work less, knowing that now giving up an hour of work is not forgoing as much income. This motivation to work comes from a combination of both needs and wants. In the classic economic sense, the needs are food, clothing, and shelter. Wants are luxury goods that make life pleasant and more enjoyable. Income taxes affect the ability to afford both needs and wants. Income taxes increase the cost of needs and wants, where the cost is the amount of work necessary to earn the amount necessary to pay for the needs and wants. Conversely, taxes decrease the opportunity cost of leisure. It is the balance and trade-offs between needs, wants, and leisure that cause people at different levels of income to react differently to taxes. This research examines how the labour supplied by workers at different levels of income is affected by taxes.

1.2 Research gap

The study of the relationship between income taxes and labour supply, or the motivation to work, has a history in economics going back almost 100 years. Yet despite this long history, the basic theories, the income effect and the substitution effect, remain unchanged since the 1920s (Knight, 1921; Pigou, 1920). The income effect and the substitution effect are used to explain how workers will react when tax rates are changed. The income effect refers to income taxes reducing after-tax wages, so individuals must work more to maintain the same level of income. The substitution effect means that when income taxes reduce after-tax wages people will work less because the opportunity cost of leisure decreases. These effects make opposite predictions, and little is known about the conditions under which one effect will apply or dominate the other. One explanation for the lack of applicability of economic theory comes from the argument that the effect of income taxes on the motivation to work is a psychological phenomenon (Lewis, 1982). The psychology-based perspective differs sharply from conventional economic approaches (Earl, 1990), because labourers face a complex trade-off between work and leisure (Brown et al., 1976). Therefore, the research gap comes from standard economic theory (income and substitution effects), because these economic explanations offer simple and easy to understand predictions, yet they do not explain which effect will apply to individuals in dissimilar conditions, particularly workers with low and high wages.

1.3 Research question

RQ: How does the relationship between income taxes and the motivation to work vary between workers at low and high wage rates?

1.4 Research objective

RO: Determine if the impact of income taxes on the motivation to work varies between workers at low and high wage rates.

1.5 The importance of the study

Every government periodically considers the impact of raising or lowering income taxes. Previous research has been unable to provide much guidance on the effect of tax rate changes due to the competing predictions of the income and substitution effect, and no clear theory for when each might apply. To overcome the limitation of previous research, two new behavioural theories are proposed, referred to as the Hierarchy of Pecuniary Needs and the Differing Utility of Leisure. The Hierarchy of Pecuniary Needs is inspired by Humanistic Psychology, and uses the needs and wants of an individual to explain how they will react to tax rate changes at low and high wage rates. The Differing Utility of Leisure introduces the new idea that the utility of an hour of leisure varies depending on a worker's income level. This idea shows that the traditional approach of measuring the opportunity cost of leisure only considers half of the cost-benefit equation. When the benefit, or utility, of an hour of leisure is also considered, predictions regarding the reaction to tax rate changes become clearer.

1.6 The structure of the study

Following from the above, the rest of this research is organized as follows. Chapter 2 reviews the previous literature on income taxes and the motivation to work. Chapter 3 provides theory development and hypothesis formulation. In this section, the gap of prior research is filled through the introduction of the two new theories, the Hierarchy of Pecuniary Needs and the Differing Utility of Leisure. The first theory, the Hierarchy of Pecuniary Needs, shows that income level is an important factor when examining an individual's motivation to work. At low wage rates, the work/leisure decision is driven solely by the need to survive. When a worker is making only a subsistence level of income, an increase in income taxes causes the worker to increase their hours worked. For these workers the utility of an hour of leisure is almost irrelevant. Only when income levels rise above the subsistence level of income can a worker forgo an hour of work for an hour of leisure. However, it is at this point that the theory of the Differing Utility of Leisure applies. Even when the opportunity to choose an hour of leisure arises, a worker at low wage rates might forgo that hour of leisure for an additional hour of labour because their utility from an hour of leisure is low. The opportunity set of activities available to workers with low wage rates is small when compared to the opportunity set of activities available to workers with high wage rates. Thus, at high wage rates, a worker might forgo an hour of work for leisure despite the higher opportunity cost of the leisure, due to the increased utility from an hour of leisure. This is an entirely new way to explain the work/leisure decision, considering both the cost and benefit of leisure at varying wage rates. Once the theories are developed, a simulation is used to show how workers will respond to tax rate changes depending on their income level, the cost of basic needs, their cultural or group preference for income or leisure, and their individual preference for income or leisure. Eight scenarios from the simulation are used to show how the two theories apply and that the results of the simulation match the theoretical predictions. Chapter 4 presents model specifications and data. The econometric model chosen to test the predictions of the theory and simulation is a first-differenced panel data model. This is primarily because the research question is about analysing changes in tax rates and changes in hours worked, which occur over time within each country. Data to test the hypothesis empirically using the econometric model is gathered from 15 countries over 50 years. Chapter 5 describes and analyses the main results of the study. In this section, the models are shown to meet all of the necessary econometric assumptions, and the results are fully and completely revealed, even when initial results do not fully support the theories developed. Although the empirical results are mixed, the theory is found to hold in about half of the countries. In addition to standard statistical tables, graphs are used to help clearly communicate the economic implications of the findings. Chapter 6 discusses the results of the study. Chapter 7 concludes with some policy implications of new behavioural theories and directions for future work. The results of the research provide motivation for further work, to refine the theoretical predictions and include new factors for when the theory is more likely to hold and when it is not.

2. LITERATURE REVIEW

2.1 Some critical remarks

Testing the theory developed in this research requires a few conditions. First, there must be changes in tax rates. A change in tax rates is required for the taxpayers to react to and change their hours worked. The change in tax rates can be thought of as a sort of “natural experiment” to which workers’ reactions can be gauged. However, tax rates within a country change infrequently, making it difficult to collect more than a few data points on how workers react, even with a long time series. In addition, tax reform is often accompanied by other structural or macroeconomic changes. These confounding events make it difficult to determine if the change in hours worked is due to the tax rate changes or other factors.

One condition that is required to test theory in this paper is the ability of workers to adjust the number of hours that they work. If this is limited due to the influence of unions, for example, then even if tax rates changes workers might not change the number of hours that they work. The additional control variables tested in the model vary between countries, but not within country. In order to test the influence of control variables on the reaction to tax rate changes, a between-countries design must be used. In summary, using a between-country design instead of a within-country design has the advantages of more tax rate changes, the ability to rule out most confounding events and other factors, and to test which control variables mitigate or intensify workers' reactions to tax rate changes. However, one advantage of testing within country is that country-specific variables are held constant. When testing between countries there are cultural differences and structural factors such as legal systems, social programs, and other control variables that add complexity to the natural experiment that exists when countries change their tax rates. An advantage of a within-country design is that almost all country-specific factors are eliminated. This might allow the reaction to tax rate changes to be isolated and free from alternative explanations. Between the two possible designs, this study uses the between-countries methodology due to the ability to test the control variables, which are of great interest.

In addition to the above reasons, when the disparity in income worldwide is observed, it is difficult to test the effect of tax rate changes on workers with different income levels within one country. Although there is some variance in wages within country, it is small compared to the between-country variance in wages. One criticism of previous research, particularly survey studies, is that they focus almost exclusively on the short run (Van Paridon, 1992). Dalamagas and Kotsios (2012) provide that a tax-induced decrease in the motivation to work is less in the short run than it is in the long run.

There has been significant criticism of experimental approaches to testing the relationship between taxes and the motivation to work (Swenson, 1988; Rupert and Fischer, 1995; Sillamaa, 1999a, b, c; Gamage et al., 2010; Djanali and Sheehan-Connor, 2012; Hayashi et al., 2013; Fochmann and Weimann, 2013; Keser et al., 2015; Rick et al., 2017; Kessler and Norton, 2016; Pántya et al., 2016). For example, in experiments the designs used do not allow researchers to observe the impact of potential taxes on the motivation to work. Experimental research often suffers from a lack of external validity (Kirchler, 2007). Moreover, as discussed above, the experimental research on the effect of income taxes on the motivation to work has shown conflicting results. For example, while Djanali and Sheehan-Connor (2012) show the positive effects between income tax and motivation to work, Kessler and Norton (2016) find a negative association.

Unlike previous research in this area, the theory was first developed and demonstrated using a simulation. After this proof-of-concept, empirical tests were performed to confirm that workers' reactions to tax rate changes depend on wage level and other factors. The results show the trade-offs between the income effect and the substitution effect, and how they depend on income level.

3. THEORY DEVELOPMENT AND HYPOTHESIS FORMULATION

3.1 The Hierarchy of Pecuniary Needs

Previous empirical research has found that increasing taxes reduces the motivation to work (Prescott, 2004; Davis and Henrekson, 2004; Ohanian et al., 2008; Manski, 2014). However, the opposite effect, that increasing taxes will cause workers to increase the number of hours that they work, was proposed in the early twentieth century by Pigou (1920) and Knight (1921). The Hierarchy of Pecuniary Needs, developed here, builds on Maslow's Hierarchy of Needs (Maslow, 1943) and demonstrates theoretically why increasing taxes can increase the motivation to work.

Although Maslow's Hierarchy of Needs has been criticized (Kaur, 2013) and difficult to prove empirically (Graham and Messner, 1998), the logic it conveys can be applied to the motivation to work. Any individual's basic needs, both psychological and physical, must be satisfied in order for that individual to survive. A minimum amount of nutrition and protection from the elements, plus the will to survive, are necessary. For these, an individual must exert effort. Once the basic needs are satisfied for an individual, then other needs can be pursued, such as providing basic needs for family members, or pursuing pleasurable activities such as hobbies or leisure. To the extent that these needs have a cost, they affect the motivation to work. This hierarchy can be imagined as an economic parallel to the psychological hierarchy of needs in the humanistic approach to psychology. This is the Hierarchy of Pecuniary Needs, as shown in Figure 3.1.

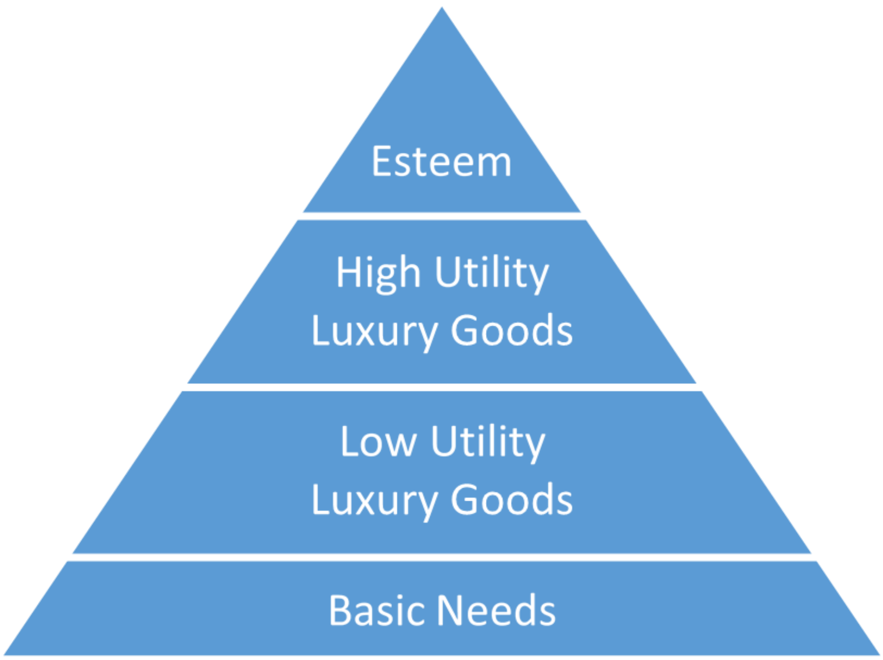

Fig. 3. 1: Hierarchy of Pecuniary Needs

Source: Own elaboration

As shown in Figure 3.1, the Hierarchy of Pecuniary Needs has "Basic Needs" as its base. This is the cost of the goods and services needed to survive, both from a physical and psychological perspective. The line between Basic Needs and Low Utility Luxury Goods is the subsistence level of income. After a worker pays for basic needs, they can start to pay for luxury goods, or "wants". The least expensive of these are the low utility luxury goods, which have a ready supply and low demand, keeping them affordable. Higher utility luxury goods are in lower supply and higher demand, making them less affordable. After luxury goods are acquired, income has utility for individuals due to the esteem it provides, or the "Veblen Effect" (Veblen, 1899) discussed in the literature review. This includes both self-esteem and the respect and admiration of others. In the sections that follow, a framework is developed that allows predictions based on the economic model, but extended to explain which effect will apply to individuals in different circumstances.

Based on the Hierarchy of Pecuniary Needs presented above, the number of hours that a person will work is the maximum of two functions:

1. The number of hours worked needed to pay for the cost of basic "survival" needs, the subsistence level of income. The minimum number of hours that an individual must work in a period, h_1, is the subsistence level of income for the period divided by the hourly wage rate. The slope of this function between wages and hours worked is negative. The number of hours required to work to pay for subsistence level of income decreases as pay increases.
2. The second function is based on an individual's preference for income and leisure. Workers prefer more of both, but they must choose between them, because an hour of work is one less hour of leisure, and vice versa. Workers will choose the number of hours of work, h_2, which maximizes their utility. This trade-off means that the slope of the function is positive, the number of hours worked increases as pay increases. This reflects the increasing opportunity cost of leisure as wages increase.

These two functions combine to form a complex model where each individual has a unique subsistence level, a unique preference function for work and leisure, and a unique wage rate. Non-wage income and government subsidies or social programs are not explicitly part of the model, but implicitly reduce the number of hours necessary to cover basic needs. The subsistence level of income is equal to the gross cost of basic needs minus net non-wage income and government transfers.

The number of hours per week necessary to cover each worker's basic needs, h_1, is calculated along with the number of "optimal" hours, h_2, given each individual's work/leisure preference. The actual number of hours worked, h_3, is the greater of these two amounts. That is because even if a worker has 100% preference for leisure, there is a minimum quantity of hours that they will work to pay for basic needs. These functions can be described generally as follows:

$$h_1 = \frac{Basic\ Needs}{w} \tag{3.1}$$
$$h_2 = maxU(w * h, T - h) \tag{3.2}$$

where:

h = work hours per period
w = hourly after-tax wage
Basic Needs = minimum subsistence level per period
U is a utility function
T = total hours per period
T – h = leisure hours per period

The actual hours worked, h_3, is the maximum of h1 and h2.

$$h_3 = max\{h_1, h_2\} \tag{3.3}$$

This theory can be used to demonstrate numerous situations. For example, it is possible that (3.1) and (3.2) do not intersect. Consider two groups of workers, a group with low wages and a group with high wages. Although the terms “low” and “high” are relative, they can be defined for the purposes of the theory of the Hierarchy of Pecuniary Needs. Low wages are defined as wages close to the subsistence level of income. For workers with low wages the work-leisure decision is impacted at the margin by the potential for falling below the subsistence level of income. High wages are defined as wages far above the subsistence level of income. For workers with high wages the work-leisure decision is not impacted at the margin by the potential for falling below the subsistence level of income.

For the hypothetical group of workers at very low wages, $h_1 > h_2$, because workers are at the subsistence level of income, working only to cover their basic needs. In this case $h_3 = h_1$. In this example, increasing taxes, which decreases net wages, will cause these workers to work more hours to cover their basic needs. On the other hand, in a hypothetical group of workers earning high wages, $h_1 < h_2$. Workers are working many hours more than enough to cover their basic needs. In this case $h_3 = h_2$. When taxes increase, everyone works less because they now prefer the lower cost of leisure. Thus, h_3 might be downward sloping for groups of workers with high wages and upward sloping for groups of workers with low wages.

3.1.1 Simulation

In order to demonstrate this model, a simulation was constructed in Excel, where taxes, the subsistence level of income, wage rate, and preference functions are set differently for each person using random variables. The simulation modelled in Excel allows the variables in the functions to be changed to demonstrate different scenarios.

The primary variable of interest is taxes, and whether changing tax rates increases or decreases the motivation to work. Taxes make the opportunity cost of leisure lower, because after-tax wages decrease. Labourers do not have to give up as much income in order to have an hour of leisure. Increasing the tax rate has a similar effect as lowering the labourer's preference for work.

In the simulation, each individual's utility function, the preference for work or leisure, is a combination of two variables. The first is the scenario preference for income, which is the same for all individuals, and varies from 1 to 5.

The second variable that determines the preference for work/leisure in the simulation is individual-specific. In some scenarios it is randomly determined, and in others it is random but correlated with income.

After utility is determined, each subject is randomly assigned a cost of basic needs. The sum of these divided by the worker's pay rate is the minimum number of hours that each subject must work to survive. Because wages and the subsistence level of income are randomly determined (within specified ranges), the minimum number of hours that each subject must work is different for each worker.

When taxes are applied, it changes the wage and the variables dependent upon wages, but nothing else. Therefore, the number of hours required to work to pay for basic needs increases, the number of "optimal hours" decreases, and the change in actual hours worked, increases or decreases depending on each subject's individual situation.

There were eight scenarios demonstrated using the simulation, varying the wage variable from low to high, varying the overall utility for leisure from low to high, and changing the individual utility for leisure from random to random but correlated with income. The results of each simulation can be seen in the graphs that follow. Each shows how workers at different wage levels react to a change in tax rates under the varying conditions set above.

As shown in the figures, as wages increase, poor individuals work more after a tax rate increase if their wages are near the subsistence level of income. As their wages increase, the change in hours is positive, but smaller. Once workers are above the subsistence level of income they reduce their hours when tax rates increase. The exception is when the individual's utility function is correlated with income. In these scenarios some low and high wage workers increase their hours when taxes increase, although the effect is stronger for low wage workers than it is for high wage workers.

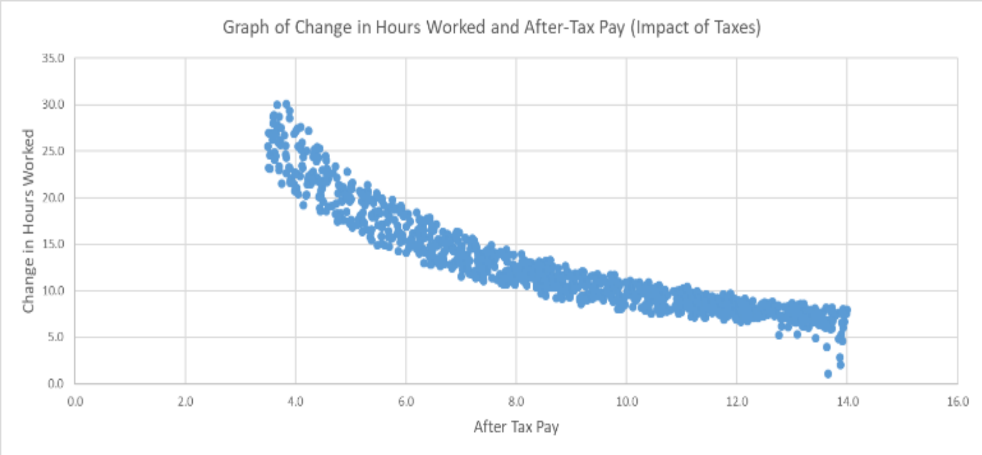

Fig. 3. 2: Graph of Change in Hours Worked and After-Tax Pay Scenario 1, Low Wages, Taxes = 30%, Utility Function Value = 1 (High Preference for Leisure)

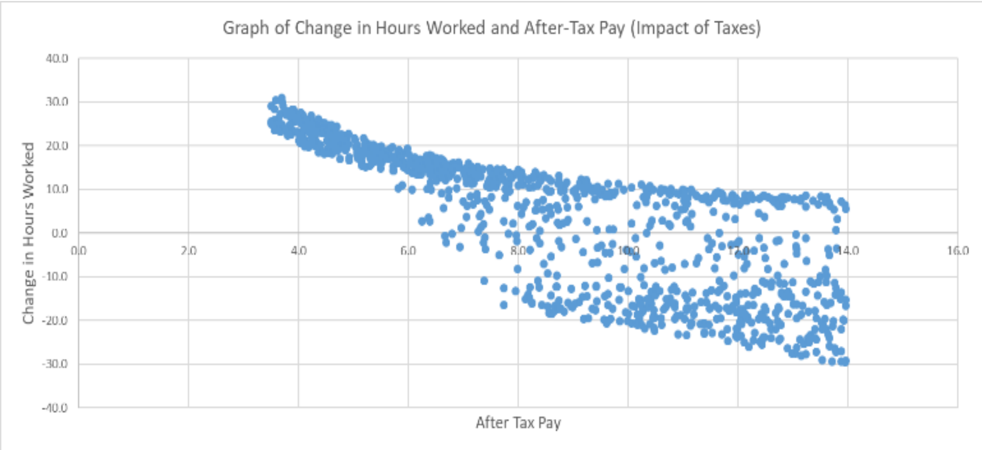

Fig. 3. 3: Graph of Change in Hours Worked and After-Tax Pay Scenario 2, Low Wages, Taxes = 30%, Utility Function Value = 5 (High Preference for Income)

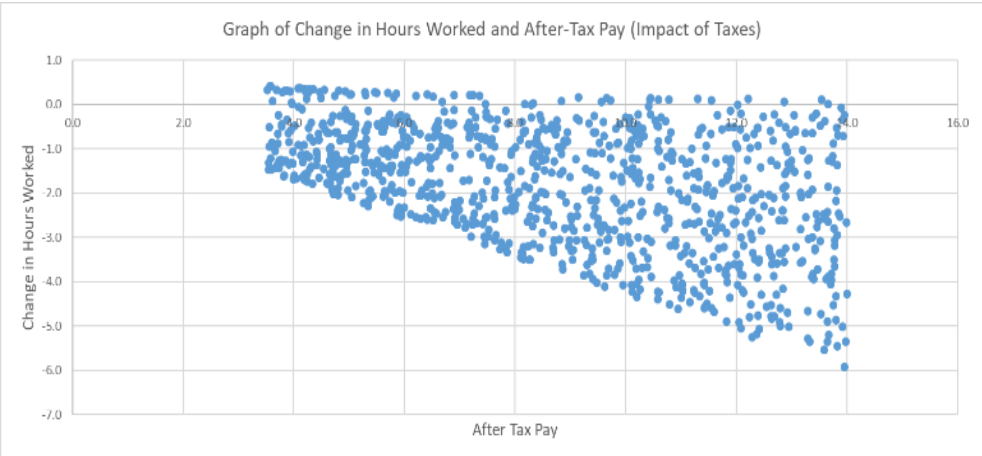

Fig. 3. 4: Graph of Change in Hours Worked and After-Tax Pay Scenario 3, High Wages, Taxes = 30%, Utility Function Value = 1 (High Preference for Leisure)

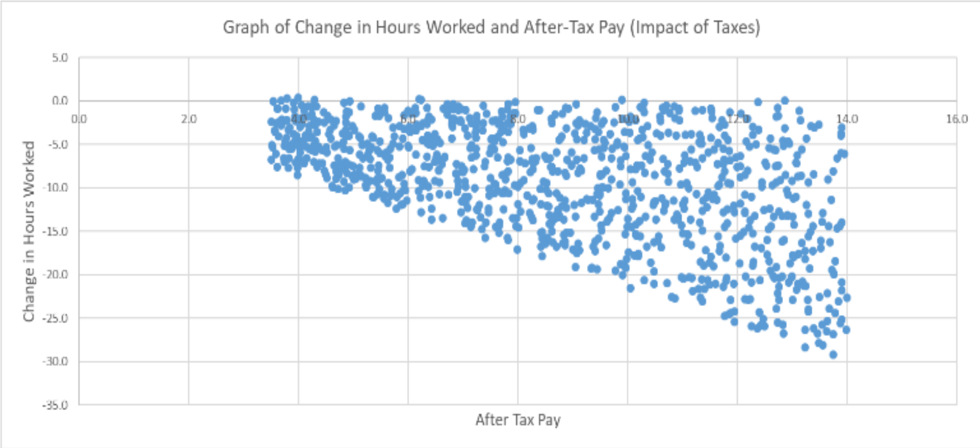

Fig. 3. 5: Graph of Change in Hours Worked and After-Tax Pay
Scenario 4, High Wages, Taxes = 30%,
Utility Function Value = 5 (High Preference for Income)

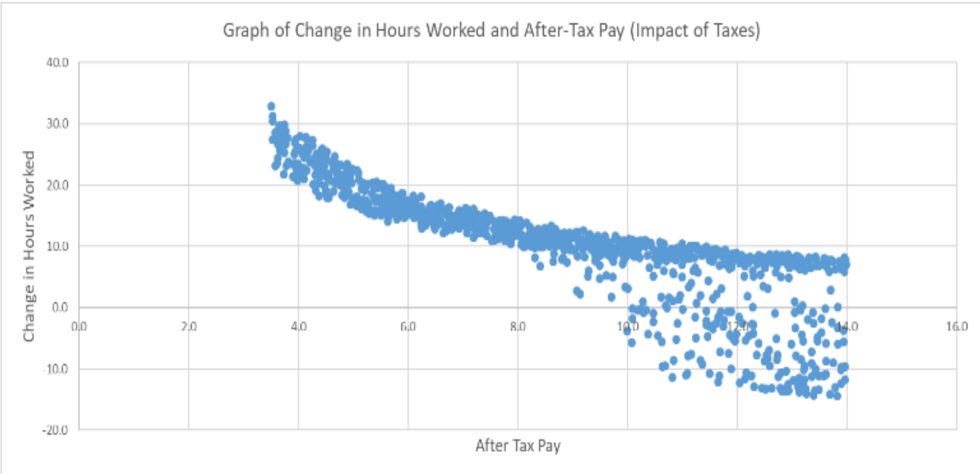

Fig. 3. 6: Graph of Change in Hours Worked and After-Tax Pay
Scenario 5, Low Wages, Taxes = 30%,
Utility Function Value = 2.5

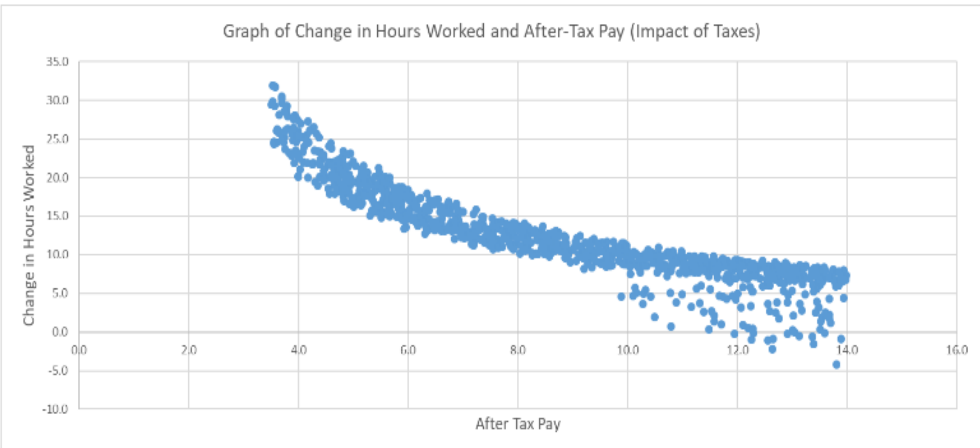

Fig. 3. 7: Graph of Change in Hours Worked and After-Tax Pay
Scenario 6, Low Wages, Taxes = 30%,
Utility Function Value Correlated with Income

(Increased Preference for Leisure with Increased Income)

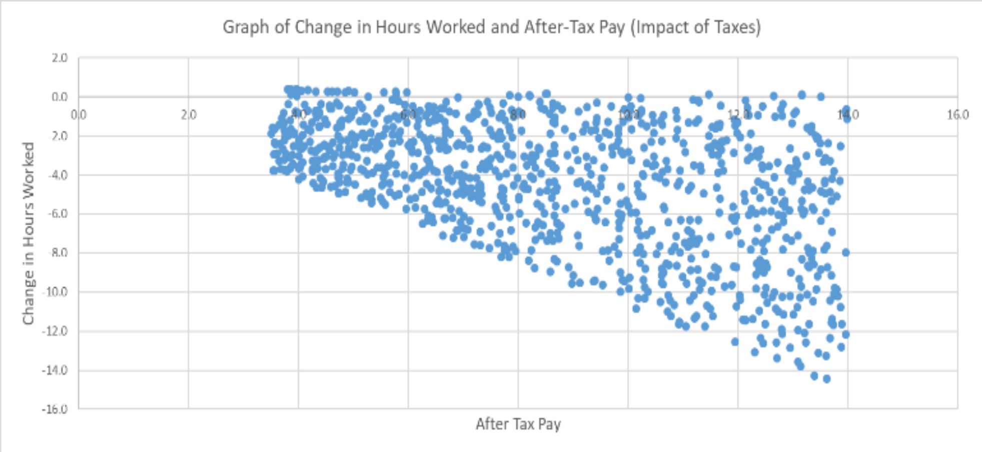

Fig. 3. 8: Graph of Change in Hours Worked and After-Tax Pay
Scenario 7, High Wages, Taxes = 30%,
Utility Function Value = 2.5

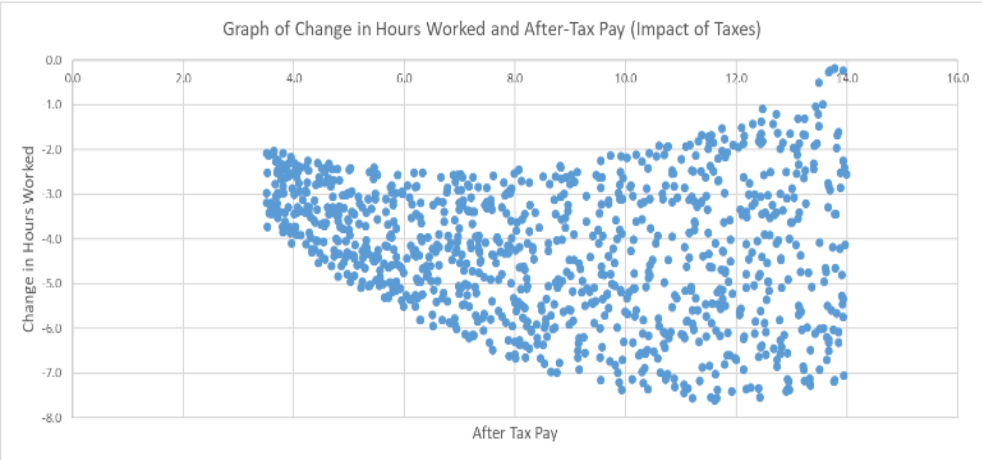

Fig. 3. 9: Graph of Change in Hours Worked and After-Tax Pay
Scenario 8, High Wages, Taxes = 30%,
Utility Function Value Correlated with Income
(Increased Preference for Leisure with Increased Income)

3.2 Differing Utility of Leisure

Imagine it is your day off. You wake up early, enjoy a leisurely breakfast of eggs, toast, and coffee, sitting outside on your patio enjoying the sunshine and listening to the birds sing. After breakfast, you get in your car and drive to the beach for the day, or for a hike in the mountains. You have a picnic lunch with wine and cheese, and then dinner at a white tablecloth restaurant with fresh food imported from around the world.

Alternatively, imagine it is your day off, but from a different perspective. You wake up early to the sounds of your neighbours screaming and dogs barking. Breakfast is cold cereal eaten standing at the sink looking out the window at the wall of the building next door. You walk to the nearest park, overgrown with weeds, and homeless people sleeping in the protected areas around the trees. The noise of traffic and airplanes overhead makes it hard to relax. For lunch you grab a fast-food hamburger and eat it next to a table of rowdy teenagers. Dinner is pizza in front of the television.

In each scenario above, the quantity of leisure time both individuals take is the same. However, one could argue that the individual in the first scenario received greater utility from their day of leisure than the individual in the second scenario. This is the advantage that wealth provides, an increased utility from leisure, and therefore a higher preference for leisure. If the utility from leisure is low for a worker with low wages, then they might prefer work more than someone with a much higher wage, despite the traditional measure of the "cost" of leisure as being the opportunity cost, which is equal to the net wage. This effect is previously untested in the literature, and can be demonstrated with the simulation presented earlier.

In order to demonstrate this effect, a change was made to the simulation, where the likelihood of a preference for income or leisure is correlated with the workers' wages. Utility is still randomly determined, but the higher a worker's wage, the more likely it is that the utility for leisure will be high. This reflects the larger opportunity set for leisure that high-wage earners enjoy compared to low wage earners. The impact of this change on the graphs presented earlier is interesting.

3.2.1 Hypothesis Development

The Differing Utility of Leisure makes similar predictions as the Hierarchy of Pecuniary Needs. However, where the Hierarchy of Pecuniary Needs requires some workers to have low wages for the slope between changes in taxes and changes in hours to vary between workers with different wages, the Differing Utility of Leisure predicts that even if all workers are above the subsistence level of income, the slope between changes in taxes and changes in hours will vary between workers with different wages.

The key question for reference-dependent preferences is, what determines the reference point? Kirchler et al. (2009) point out that taxpayers could adopt different reference points to assess their decision outcomes. The new behavioural theories presented here (Hierarchy of Pecuniary Needs and Differing Utility of Leisure) explain how the process works. At low wages the preference is almost irrelevant to the decision to work more or less, because workers must work more to maintain a subsistence level of income. At higher wages the individual's preference for leisure is important in the decision to work more or less, but it varies with wages.

Following from the above discussions, it is hypothesized that:

Hypothesis: *The relationship between income taxes and the motivation to work varies between income levels. When wages are low, hours increase as income* *taxes increase, and when wages are high, hours decrease as income taxes increase.*

4. METHODOLOGY AND DATA

4.1 METHODOLOGY

4.1.1 Model specification

To study the relationship between income taxes and the motivation to work requires a model with change in hours worked as the dependent variable and changes in tax rates as the independent variable. Because the theory predicts that the reaction will differ between high and low income groups, a between-country design is used. Countries will be split into high and low groups based on the average income in the countries. This split will be represented in the model as a dummy variable, with the hypothesis test being the interaction between the change in tax rates and the dummy variable. Letting *t* index time (years) and *i* index countries, the baseline model estimated is based on the following equation by first differencing:

$$\Delta HOURS_{it} = \beta_0 + \beta_1 \Delta TAXES_{it} + \beta_2 \Delta INCOME_{it} + \beta_3 LHD + \beta_4 \Delta TAXES_{it} * LHD + \varepsilon_{it} \tag{4.1}$$

Where $\Delta HOURS_{it}$ is the changes in hours worked; $\beta_0$is the intercept for time periods; $\Delta TAXES_{it}$is the changes in income tax rate; $\Delta INCOME_{it}$ is the changes in average income; LHD is a dummy variable coded “1” if the average income is above the median and coded “0” if the average income is below the median; and $\Delta TAXES_{it} \times LHD$ is an interaction term.

To test the hypotheses regarding the relationship between income taxes and the motivation to work using a between-country design, the regression analysis used is based on first difference methodology with time effects (including year dummies) and standard errors clustered by country. All regressions are robust to heteroscedasticity, autocorrelation, and cross-sectional dependence. In the dataset, T=60 and N=15, therefore dummy variables for each time period will be suppressed. The methodology applied to the current analysis is appropriate for natural experiments of exogenous events such as changing taxes or other government policies, and changes in the environment such as individuals, families, firms, or cities (Wooldridge, 2015). Triest (1998) notes that research on the behavioural effects of taxation need to find a way to distinguish the effect of tax changes from other changes in the economic environment that coincide with tax changes.

4.2 Data

This section presents the data used in the empirical tests for hours worked, average income, and income tax rates, as well as other control variables across countries. The dependent variable in the models is the motivation to work, measured by the number of hours worked. The key explanatory variables are average income and tax rates. Control variables used in the models are employment protection, net union density, benefit replacement rate, benefit duration, output gap, government consumption, product market regulation, consumption tax rates, and capital tax rates.

The data necessary for these variables comes from a variety of sources, as outlined below. Many of them are available for long periods and several countries. However, a few variables constrain the number of years and number of countries used. Most of the control variables are available beginning in 1960, so this is the first year used in the empirical tests. Tax rates estimated by several researchers were considered for use in the analysis. The tax rates calculated by McDaniel (2007, 2017) provide the longest time series, beginning in 1950. Because the McDaniel tax rates are available in 1960, matching the control variables, they were selected for use in the analysis. The McDaniel tax rates also have the advantage of being available for 15 countries (see Table 4.1 for a list of countries). Therefore, the dataset used to examine the relationship between income taxes and the motivation to work consists of a sample that includes 15 OECD countries, for the period from 1960 to 2010.

Table 4. 1 Countries included in the analysis

Australia	France	Spain
Austria	Germany	Sweden
Belgium	Italy	Switzerland
Canada	Japan	United Kingdom
Finland	Netherlands	United States

Source: Own elaboration

The dependent variable used in all regression models is the average annual hours worked. The hours worked data are taken from independent and publicly available sources. The data sources are The Conference Board Total Economy Database, Labor Market Institutions Database (LMID), OECD Labour Statistics Database, World and Wealth Income Database, DICE Database, Groningen Growth, System of National Accounts, and World Bank online database.

Based on the average income variable, the workers in each country were divided into low and high income groups based on the average income in the countries over the 50 year sample period. The low and high income classification is shown in Table 4.2

Table 4. 2 Low/High Income Classification

Low	Avg. Income		High	Avg. Income
Belgium	25.806		Australia	26.852
Finland	22.311		Austria	26.059
France	25.060		Canada	27.503
Italy	24.447		Germany	27.538
Japan	21.346		Netherlands	30.890
Spain	19.718		Sweden	25.951
United Kingdom	25.128		Switzerland	40.151
Median	25.951		United States	34.703

Source: Own elaboration

Note: Average income shown is the PPP average income over the period 1960-2010.

5. RESULTS

5.1 Descriptive Statistics

Table 5.1 and 5.2 contain descriptive statistics of all variables, with original and Winsorized values. All variables were Winsorized at 5% of each tail of the distribution to control for outliers and influential observations.

Table 5. 1 Summary statistics (original values)

Variable	Obs	Mean	Std. Dev.	Min	Max
ΔHOURS	750	-8.495243	16.81097	-98.145	78.3265
ΔTAXES	750	.0028933	.0106918	-.04	.05
ΔINCOME	750	.4474914	.9035118	-7.297832	6.469626
TD	765	.4666667	.499214	0	1
LHD	765	.5333333	.499214	0	1
TD*LHD	765	.1333333	.340157	0	1
ΔTAXES*TD	750	.0012533	.0067594	-.04	.05
ΔTAXES*LHD	750	.0012667	.0078109	-.03	.05
ΔTAXES*TD*LHD	750	.0001467	.0030753	-.02	.02
ΔEP	750	.0049377	.0356332	-.3716184	.2400001
ΔUD	750	-.0014442	.0129727	-.1679814	.065
ΔBD	750	.0153563	.0742812	-.2227055	.8142453
ΔBRR	750	.0047731	.0287603	-.091875	.18375
ΔGAP	750	-.0549845	1.913354	-9.261699	4.797097
ΔEXP	750	.0061473	.6044483	-1.716691	2.74866
ΔPMR	750	-.0645053	.1281674	-.9614763	.1108452
ΔTAUC	750	.0009276	.0095003	-.0551372	.0618257
ΔTAUK	750	.000872	.0151957	-.0815732	.0804831

Table 5. 2 Summary statistics (Winsorized values)

Variable	Obs	Mean	Std. Dev.	Min	Max
ΔHOURS	750	-8.322377	14.01896	-36.9522	15.2194
ΔTAXES	750	.00316	.0088006	-.01	.02
ΔINCOME	750	.4623759	.6263248	-.978003	1.489545
TD	765	.4666667	.499214	0	1
LHD	765	.5333333	.499214	0	1
TD*LHD	765	.1333333	.340157	0	1
ΔTAXES*TD	750	.00132	.0056362	-.01	.02
ΔTAXES*LHD	750	.0014667	.0066363	-.01	.02
ΔTAXES*TD*LHD	750	.0001867	.002871	-.01	.02
ΔEP	750	.0033614	.0169978	-.0200001	.0630303
ΔUD	750	-.0013441	.0084655	-.0161812	.018
ΔBD	750	.0103468	.0361981	-.021878	.1397436
ΔBRR	750	.0030783	.0164809	-.0225	.0495313
ΔGAP	750	-.040255	1.731169	-3.836365	2.338828
ΔEXP	750	-.0029519	.5206094	-.975158	1.021963
ΔPMR	750	-.0571128	.0987795	-.3397379	.0007143
ΔTAUC	750	.0008837	.0068493	-.0129605	.0148209
ΔTAUK	750	.0009813	.0125322	-.0265822	.0230132

Source: Own elaboration

Notes: Observations are by country for each year from 1961 to 2010. *HOURS* is annual hours worked per worker. *INCOME* indicates average annual income (in thousands of euros adjusted to PPP). *TAXES* is the average tax rate on labour income (annually, percent). *EP*, *UD*, *BRR*, *BD*, *GAP*, *EXP*, *PMR*, *TAUC* and *TAUK* are employment protection (range), net union density (percent), benefit replacement rate (percent), benefit duration (ratio), output gap (measured by the gross domestic product, GDP), government consumption (percent), product market regulation (summary indicator), and consumption and capital tax rates (percent), respectively. Dummy variables and interaction terms are not included in the Winsorizing process. The interaction terms are calculated after Winsorizing the Δ*TAXES* variable.

5.1 Baseline Model Results

In Table 5.3, Model A presents the results of the baseline model. As shown in the methodology section, the baseline model is used to test the hypothesis through the interaction term between the change in taxes and the dummy variable for high and low wage groups. The dependent variable in the model is the change in average hours worked. The only two variables in the model that are significant are the constant term and the coefficient on the change in average annual income. Both results are as expected. The coefficient on the constant term is negative, indicating that the long-term trend is a decline in hours worked. This has been true in general worldwide for the past 100 years, and has been documented numerous times in the labour economics literature. The second significant variable is the change in income, where the coefficient is positive. This is likely an artefact of the relationship between hours and income, that as hours increase, so does income. The positive coefficient reflects this dynamic. In the baseline model there is no significant effect of $\Delta TAXES$ $(\beta = -69.72, p = 0.378)$, or the interaction between taxes and the low/high wage dummy variable, ΔTAXES*LHD $(\beta = -2.208, p = 0.983)$. Thus, theory that there would be a significant difference in the reaction to a tax rate change between high and low wage groups does not hold. There is no significant difference in the reaction to a tax rate change between low and high wage workers.

One possibility for the lack of results in the baseline model that theory predicts is that there are other factors that determine the motivation and/or ability to work. By adding the $CONTROLS_{it}$ variables, the baseline model becomes the overall model with nine control variables.

$$\Delta HOURS_{it} = \beta_0 + \beta_1 \Delta TAXES_{it} + \beta_2 \Delta INCOME_{it} + \beta_3 LHD + \beta_4 \Delta TAXES_{it} * LHD + CONTROLS_{it} + \varepsilon_{it} \quad (5.1)$$

In Table 5.3, Table B shows the results from the overall model with control variables. The results in the overall model are similar to the baseline model. The only variables in the model that are significant are the constant term and the coefficient on the change in average annual income, plus the three control variables, change in union density, change in output gap, and change in government expenditures. The negative coefficient on the change in union density means that as union density changes, the number of hours worked moves in the opposite direction. Therefore, an increase in union density decreases the number of hours worked. The positive coefficient on the change in output gap means that as output gap changes, the number of hours worked moves in the same direction. Therefore, an increase in output gap increases the number of hours worked. The negative coefficient on the change in government expenditures means that as government expenditures changes, the number of hours worked moves in the opposite direction. Therefore, an increase in government expenditures decreases the number of hours worked.

Table 5. 3 Baseline Model

	Model A	Model B
ΔTAXES	-69.72	-46.44
	(0.378)	(0.566)
ΔINCOME	4.978***	2.431*
	(0.000)	(0.021)
LHD	0.465	-0.0295
	(0.662)	(0.978)
ΔTAXES*LHD	-2.208	-21.76
	(0.983)	(0.829)
ΔEP		-55.40
		(0.170)
ΔUD		-123.1*
		(0.046)
ΔBD		1.642
		(0.917)
ΔBRR		-28.04
		(0.362)
ΔGAP		1.087**
		(0.008)
ΔEXP		-3.604**
		(0.003)
ΔPMR		-4.059
		(0.492)
ΔTAUC		23.54
		(0.730)
ΔTAUK		31.04
		(0.423)
Constant	-15.24***	-14.52***
	(0.000)	(0.000)
Observations	750	750
R^2	0.251	0.284

Source: Own elaboration

Note: Standard errors are robust to heteroscedasticity, cross-sectional dependence, and serial correlation. Year dummies are included in the model, but not reported in the table. P-values are in parentheses.* p<0.05, ** p<0.01, *** p<0.001

In the overall model there is no significant effect of $\Delta TAXES$ ($\beta = -42.53, p = 0.420$), or the interaction between taxes and the low/high wage dummy variable, ΔTAXES*LHD ($\beta = -21.76, p = 0.829$). Thus, theory that there would be a significant difference in the reaction to a tax rate change between high and low wage groups does not hold. The results from the overall model warrant further investigation. Therefore, each country will be examined separately to determine in which countries, if any, theory holds, and in which countries it does not. For the individual country analysis, a variant of the baseline model will be used. This simple model is the same as the baseline model, except that there is no dummy variable for wages, and no related interaction term.

$$\Delta HOURS_t = \beta_0 + \beta_1 \Delta TAXES_t + \beta_2 \Delta INCOME_t + \varepsilon_t \quad (5.2)$$

Tables 5.4 and 5.5 show 15 results from the individual country analysis using the simple model. Theory predicts that for high wage workers, as taxes increase the number of hours worked decreases, and for low wage workers, as taxes increase the number of hours worked increases. Likewise, theory predicts that for high wage workers, as taxes decrease the number of hours worked increases, and for low wage workers as taxes decrease the number of hours worked decreases.

Table 5. 4 Individual country analysis, low wage group

	BEL	FIN	FRA	ITA	JPN	ESP	UK
ΔTAXES	-295.7	116.0	-23.55	112.5	-468.9	-272.2	-643.6**
	(0.205)	(0.444)	(0.941)	(0.633)	(0.125)	(0.181)	(0.002)
ΔINCOME	5.207	2.741	3.939	2.040	14.65***	3.756	11.27***
	(0.152)	(0.223)	(0.454)	(0.592)	(0.000)	(0.344)	(0.001)
Constant	-10.81***	-10.16***	-14.21***	-8.497**	-11.81***	-8.688**	-11.40***
	(0.001)	(0.000)	(0.000)	(0.003)	(0.000)	(0.002)	(0.000)
Observations	50	50	50	50	50	50	50
R^2	0.0882	0.0351	0.0124	0.00913	0.274	0.0539	0.413

Source: Own elaboration

* p<0.05; ** p<0.01; *** p<0.001

Table 5. 5 Individual country analysis, high wage group

	AUS	AUT	CAN	GER	NED	SWE	CHE	USA
ΔTAXES	75.45	-23.12	-250.3	-228.1	-157.5	-451.3*	-140.6	197.6
	(0.764)	(0.917)	(0.263)	(0.279)	(0.361)	(0.027)	(0.574)	(0.301)
ΔINCOME	2.554	14.85***	5.384	10.29**	1.202	2.905	3.270	12.63***
	(0.509)	(0.000)	(0.070)	(0.001)	(0.639)	(0.333)	(0.135)	(0.000)
Constant	-6.966**	-15.54***	-10.52***	-19.21***	-8.404***	-5.503	-9.306***	-11.28***
	(0.005)	(0.000)	(0.000)	(0.000)	(0.000)	(0.056)	(0.000)	(0.000)
Observations	50	50	50	50	50	50	50	50
R^2	0.0154	0.250	0.0936	0.235	0.0216	0.106	0.0616	0.548

Source: Own elaboration

* p<0.05; ** p<0.01; *** p<0.001

Theory only holds for two low wage countries, Italy and Finland. In these two countries, when taxes increase, so do the hours worked. While in the other countries (Belgium, France, Japan, Spain, UK) ΔTAXES is negative (hours go down when taxes go up), contrary to what theory predicts. However, with the exception of the United Kingdom, none of the coefficients is significantly different from zero. As predicted by theory, in the high wage countries of Sweden, Canada, Germany, Netherlands, Switzerland, and Austria, the coefficient on ΔTAXES is negative (hours go down when taxes go up). In the other high wages countries, Australia and United States, the coefficient on ΔTAXES is positive (hours go up when taxes go up). However, except for Sweden, none of the coefficients are significantly different from zero. This lack of significance could be due to the low power of the tests. In order to increase the power of the tests, the data will be pooled with a dummy variable, *TD*, coded zero in the countries where theory was found to hold at the country-level, and coded one in the remaining countries, where theory did not hold. Interaction terms are added for the new dummy variable, so theory can be tested between high and low wage groups, where theory holds and where it does not. As in the previous models, *LHD* is dummy variable to distinguish between low and high wages. The resulting expanded model is:

$$\Delta HOURS_{it} = \beta_0 + \beta_1 \Delta TAXES_{it} + \beta_2 \Delta INCOME_{it} + \beta_3 TD + \beta_4 LHD + \beta_5 TD * LHD + \beta_6 \Delta TAXES_{it} * TD + \beta_7 \Delta TAXES_{it} * LHD + \beta_8 \Delta TAXES_{it} * TD * LHD + \varepsilon_{it} \tag{5.3}$$

The results from the expanded model are shown in Table 5.6, Model C.

In the subset of countries identified in the individual country analysis as countries where theory does not work, the reaction to tax rate changes is exactly the opposite of what is predicted by theory presented earlier. For the low wage group, the average number of hours worked decreases when there is a tax rate increase, and for the high wage group, the average number of hours worked increases when there is a tax rate increase.

In order to test theory in the presence of other factors that affect the motivation to work, an expanded model with control variables is used to test the previous results.

$$\Delta HOURS_{it} = \beta_0 + \beta_1 \Delta TAXES_{it} + \beta_2 \Delta INCOME_{it} + \beta_3 TD + \beta_4 LHD + \beta_5 TD * LHD + \beta_6 \Delta TAXES_{it} * TD + \beta_7 \Delta TAXES_{it} * LHD + \beta_8 \Delta TAXES_{it} * TD * LHD + CONTROLS_{it} + \varepsilon_{it} \tag{5.4}$$

The results of the expanded model with controls variables are shown in Table 5.6, Model D. The results are essentially unchanged after adding the control variables to the model. For workers with low wages where theory works, the coefficient on the change in taxes is positive and significant, as predicted by theory. As shown by the interaction term between the LHD dummy variable and the change in taxes (ΔTAXES), the difference in the reaction between high and low wage workers is statistically significant.

Table 5. 6 Final Expanded Model

	Model C	Model D
ΔTAXES	240.4*	277.3*
	(0.027)	(0.013)
ΔINCOME	5.123***	2.487*
	(0.000)	(0.018)
TD	0.701	-0.0908
	(0.691)	(0.957)
LHD	-0.0328	-1.041
	(0.983)	(0.479)
TD*LHD	2.831	3.243
	(0.246)	(0.151)
ΔTAXES*TD	-512.5***	-527.5***
	(0.001)	(0.001)
ΔTAXES*LHD	-349.6**	-376.1**
	(0.008)	(0.004)
ΔTAXES*TD*LHD	757.4***	754.6***
	(0.001)	(0.001)
ΔEP		-34.91
		(0.375)
ΔUD		-127.4*
		(0.037)
ΔBD		0.277
		(0.986)
ΔBRR		-30.37
		(0.311)
ΔGAP		1.175**
		(0.003)
ΔEXP		-3.519**
		(0.003)
ΔPMR		-5.012
		(0.394)
ΔTAUC		25.48
		(0.709)
ΔTAUK		21.67
		(0.576)
Constant	-15.04***	-13.59***
	(0.000)	(0.000)
Observations	750	750
R^2	0.270	0.304

Source: Own elaboration
Note: Standard errors are robust to heteroscedasticity, cross-sectional dependence, and serial correlation. Year dummies are included in the model, but not reported in the table. P-values are in parentheses.
* p<0.05, ** p<0.01, *** p<0.001

In the expanded model with control variables, three control variables have coefficients that are significantly different from zero, change in union density, change in output gap, and change in government expenditures. The negative coefficient on the change in union density ($\beta = -127.4, p = 0.037$) means that as union density changes, the number of hours worked moves in the opposite direction. Therefore, an increase in union density decreases the number of hours worked. The positive coefficient on the change in output gap ($\beta = 1.175, p = 0.003$) means that as the output gap changes, the number of hours worked moves in the same direction. Therefore, an increase in the output gap increases the number of hours worked. The negative coefficient on the change in government expenditures ($\beta = -3.519, p = 0.003$) means that as government expenditures changes, the number of hours worked moves in the opposite direction. Therefore, an increase in government expenditures decreases the number of hours worked.

5.2 Marginal effects

To see the difference in change in hours worked between countries, five scenarios were constructed. The first was a steady–state scenario, where the change in taxes was assumed the mean change in income and taxes for all countries and all years. Applying the same technique to five scenarios allows for graphs that demonstrate the marginal effects. The graphs are based on the data points from five hypothetical scenarios outlined below, as shown in Table 5.7.

Table 5. 7 Marginal effects used in graph 1 and graph 2.

	Low Wages	**High Wages**
TD = 0	–36.010	–2.103
TD = 1	14.446	–22.346

	Low Wages	**High Wages**
TD = 0	–23.990	–7.563
TD = 1	0.841	–15.561

	Low Wages	**High Wages**
TD = 0	–11.970	–13.023
TD = 1	–12.764	–8.776

	Low Wages	**High Wages**
TD = 0	0.050	–18.483
TD = 1	–26.369	–1.991

	Low Wages	**High Wages**
TD = 0	12.070	–23.943
TD = 1	–39.974	4.794

Source: Own elaboration

Figure 5.1 and Figure 5.2 are helpful because they clearly show the differences between workers with low and high wages, in those countries where theory worked and those where it did not. It is interesting to note that the slope of the line is steeper for workers with low wages in both groups, where theory worked and where it did not.

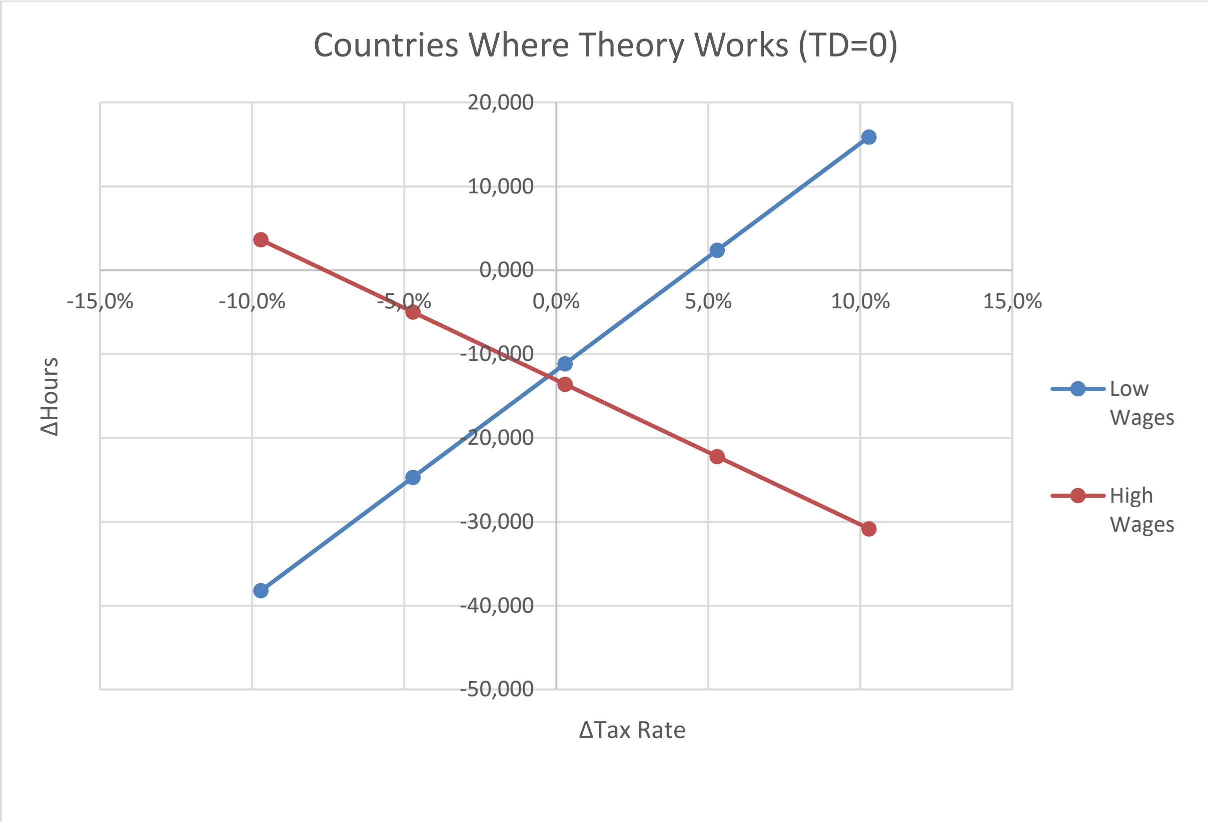

Fig. 5. 1: Theory worked
Source: Own elaboration

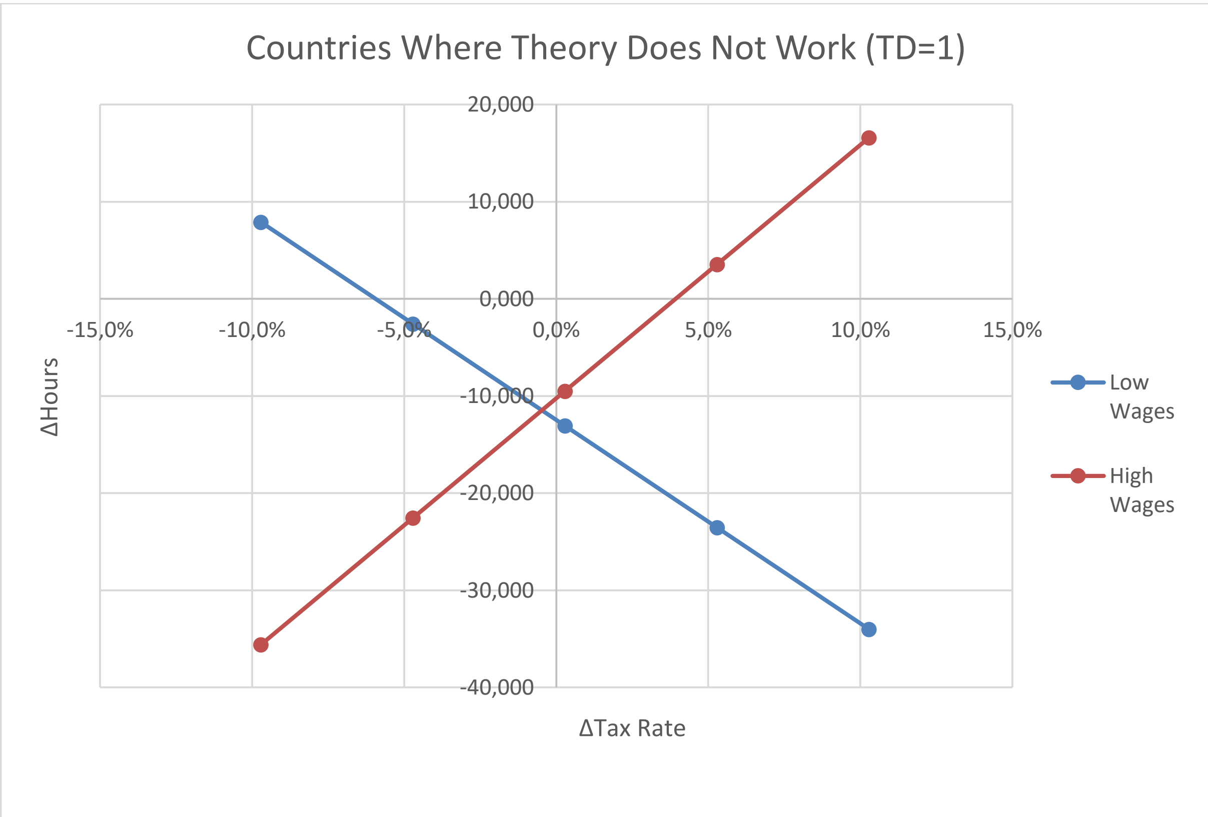

Fig. 5. 2: Theory did not work
Source: Own elaboration

6. DISCUSSION

6.1 Analysis

Using data from publicly available sources, this research uses a first differences panel data methodology to examine how changes in taxes affect work-leisure preferences. This contributes to the research on “income taxes and the motivation to work,” which has gained considerable attention in the literature, and has been recently investigated in the emerging field of economic psychology. Two novel behavioural theories are presented (Hierarchy of Pecuniary Needs and Differing Utility of Leisure) and demonstrated through simulation scenarios that show new and different patterns in several aspects of the relationship between income taxes and the motivation to work, compared to previous studies. These new behavioural theories explain why the reaction to tax rate changes differs between workers with high and low wage rates. This is applied to the study of the change in hours worked in response to tax rate changes between high and low wage workers. The analysis covers the period 1960 to 2010 in 15 OECD countries.

The primary finding is that theory works well in about half of the countries. For the low wage workers in this group, the average worker increases their hours when tax rates go up and decrease their hours when tax rates decrease. This matches theory proposed, that low wage workers must increase their hours when tax rates increase, to maintain a subsistence level of income. For the high wage workers, when tax rates go up the workers work less because the cost of leisure decreases, and workers with high wages have a very high utility from leisure due to a large opportunity set their wealth provides.

In the other group of countries where the new behavioural theories did not work, the findings were the opposite. For the low wage workers in this group, the average worker decreases their hours when tax rates go up and increase their hours when tax rates decrease. This matches previous theory that says that when tax rates increase workers will choose leisure due to the new lower cost of leisure. However, for the high wage workers within this group the average worker increases their hours when tax rates go up and decrease their hours when tax rates decrease. This is explained by the income effect in traditional economic research (e.g. Pigou, 1920; Robbins, 1930; Hicks, 1939, 1946), and matches some of the developing theories on reference groups, that wealthy individuals might judge themselves against even wealthier individuals (e.g. Groot and Van Den Brink, 1999; Ferrer-i-Carbonell, 2005), and when tax rates go up they increase their hours to try to stay as close to this reference group as possible.

6.2 Contribution to science and practice

The motivation for this research came from the opportunity to contribute to both science and practice. Economic psychology is a growing field due to its ability to explain behaviour where simple “rational man” arguments fall short

(Alm and Sheffrin, 2017). The complex psychological effects of taxes on behaviour make it a good field for applying relatively new techniques and ideas. The primary contributions of this work come from the new theories developed, the simulation model developed to demonstrate the theories, and the opportunities for future research presented by the results.

In order to explain the relationship between changes in income taxes rates and changes in the number of hours worked, two original theories were developed, the Hierarchy of Pecuniary Needs and the Differing Utility of Leisure. Although both predict similar reactions for groups of workers with low and high wages, they are subtly different. The Hierarchy of Pecuniary Needs primarily applies between low wage workers near the subsistence level of income and high wage workers clearly above it. Whereas the Differing Utility of Leisure applies to any workers at any two distinct wage levels, one higher than the other. In order to demonstrate the theories and the differences between them, a novel simulation was developed.

The third contribution of this work is advancing and testing new theory, as prescribed by the scientific method (e.g. McLelland, 2006, Proulx, 2004). Advancements in science occur by going through stages to reach tentative conclusions.

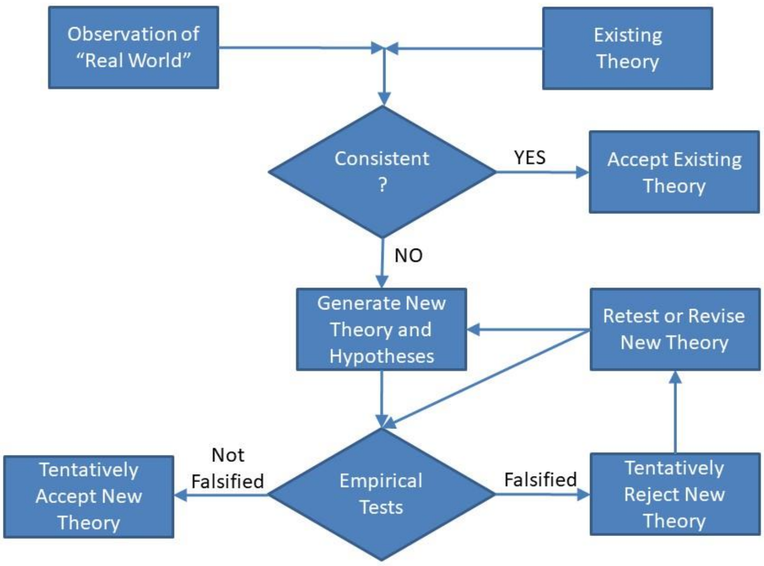

Fig. 6. 1: The Scientific Method
Source: Dehning (2010)

After completing the empirical tests with Baseline Model, it was not possible to reject the null hypothesis that the reaction to income tax rate changes was different for low and high wage groups. At this point, it was clear that the theory needed to be retested, and/or revised and new tests performed. Simple retesting would be difficult, due to the limited tax rate data available. However, testing could be performed on a subset of the data, to see if there were conditions under which the theory held. Therefore, the individual country analysis was performed, and the subsequent expanded model developed. The encouraging results of the empirical tests using the expanded model provide motivation for subsequent research, revising the existing theory, and new empirical tests.

Revising the theory will require an extensive examination of the structural, economic, and cultural factors that might influence the applicability of the Hierarchy of Pecuniary Needs and the Differing Utility of Leisure. Once the most likely factors are identified, variables will be created to represent the factors, and tested to see if they can discriminate between the two groups of countries, the ones where the theory worked and those where it did not. It is possible that this will lead to revision of the existing theory or perhaps entirely new theory. Either way, new empirical tests will be necessary to try to test the new or revised theory.

Although the empirical results of the baseline model are discouraging, it is not without optimism that additional research proceeds. In almost half the countries the theory does appear to work, and perhaps there is a systematic way to classify these countries. If so, then the results should allow policymakers to examine the characteristics of their own country to understand better the reaction workers have to changes in tax rates.

The results of this research stream will also help policymakers in setting tax policy, to understand better the potential impacts on the labour force. Increasing tax rates can result in less tax revenue if workers decrease their hours worked to more than offset the effects of the tax increase. The potential even exists that tax revenue can increase when tax rates are decreased due to increased output by labourers.

6.3 Limitations of the research

As any empirical study that uses archival data, there are some limitations. First, the sample covers 50 years, during which there were numerous periods of economic growth and contraction, changes in labour laws, changes in technology, development of robots and automation that displaced large portions of the workforce, globalization, etc. The sample also only covers 15 countries. Any conclusions drawn are limited to those countries during the time period examined. In addition, the present analysis cannot disentangle labour demand from labour supply.

There are numerous cultural factors that affect the motivation to work and the work-leisure trade-off. Although country-specific factors were included for structural differences between countries, no variables based on culture or sociological factors were included that might explain cross-country differences in the reaction to changes in tax rates. Including these variables might increase the power of the tests, and help explain the finding that theory presented only worked in about half of the sample countries.

Despite the fact that the evidence supports the new behavioural theories, there are still several challenges. The model does not intend to estimate labour supply at the extensive margin. Moreover, the motivation to work is identified with market hours in the analysis and thus it is not possible to find the distribution of work between home production and market.

It is less straightforward to make policy conclusions from the results of the current study regarding specific socio-economic characteristics and heterogeneous work-leisure preferences. Individual work-leisure preferences may only be expressed by using time-use survey data. Because the data used is measured at the country-level, individual preferences are lost. However, one should also keep in mind that time-use surveys are not available for countries in the same years, which precludes their use in between-country research. This is the reason why country level data is used, particularly national accounts based estimates.

7. CONCLUSION

7.1 Synopsis

The motivation behind this work was to improve upon the economic theories of the income and substitution effect, which have been found to be incomplete in their ability to predict how workers will adjust their hours worked in response to changes in income tax rates. Based on almost 100 years of previous research in economics and psychology, two new behavioural theories were developed, the Hierarchy of Pecuniary Needs and the Differing Utility of Leisure. Based on these two theories and a simulation designed to demonstrate them, predictions were formulated that in groups of low wage workers, changes in hours worked would be positively correlated with changes in tax rates. An increase in income tax rates would cause workers to increase the number of hours worked, and a decrease in income tax rates would cause workers to decrease the number of hours worked. Oppositely, in groups of high wage workers, changes in hours worked would be negatively correlated with changes in tax rates. An increase in income tax rates would cause workers to decrease the number of hours worked, and a decrease in income tax rates would cause workers to increase the number of hours worked.

To test the theory, data was gathered for 15 OECD countries for the period 1960-2010. This included data on income tax rates, hours worked, income levels, and several other variables that are believed to influence the relationship between income taxes and hours worked. A first differences panel data econometric model was used in empirical tests to assess whether the changes in hours worked as a response to changes in tax rates, was different for high and low wage workers.

The empirical results were mixed. The initial empirical tests using a baseline model failed to confirm the predictions made by the theories and demonstrated using a simulation. However, subsequent analysis shows the possibility of the theory being country-specific rather than being broadly applicable, and demonstrates that further research is necessary.

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