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DEPARTMENT OF ECONOMICS

EMPIRICAL EFFECTS
OF COMMODITY AND INCOME TAX REFORMS

DOCTOR OF PHILOSOPHY DISERTATION

ELENA E. SAVVA

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ELENA E. SAVVA

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The present doctoral dissertation was submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy of the University of Cyprus. It is a product of original work of my own, unless otherwise mentioned through references, notes, or any other statements.

<div align="right">Elena E. Savva</div>

Abstract

Taxes constitute the main source of revenue for countries while the tax system has important implications on social welfare; hence it has heavily drawn economists' attention. The following thesis focuses on specific tax policy reforms which occurred in the Republic of Cyprus in order to empirically examine important research points that have always triggered the interest of both policy makers and academics. The first objective of the present thesis is to study who bears the burden of taxes by examining a Value Added Tax (VAT) policy reform concerning food products of basic need. The second objective is to study how a series of income taxation reforms affects labour supply. The last objective is to justify the differences which exist in the labour market between different populations via work incentives created through the tax system.

In the first chapter we study the reaction of prices to the imposition of taxes, an area which has received a rather limited empirical attention compared to the theoretical part. We consider the VAT reform which occurred in Cyprus on January 10, 2011 whereby the VAT rate for food products of basic need changed, to be a great opportunity to empirically exploit the general insights into tax shifting behaviour. Since the tax rate of other food products did not change, we use the dif-in-dif method in order to compare the prices of those two groups of products for a six month period; before and after the policy implementation. Moreover, other factors involved in the production process which may affect the prices of goods controlled. According to the findings of the subject thesis, the increase of the VAT rate from 0% to 5% passes onto consumers through higher prices but at a lower rate than the VAT increase for the first two months. However, until the end of the first semester the increase in prices equals to the VAT increase. Findings such as that the VAT increase passes onto consumers in the form of higher prices may be useful for the assessment of proposals concerning the harmonisation or increase of the VAT rates across Europe for food products of basic need.

Studies which relate to reforms that affected both men and women and give the opportunity to identify the reaction of both demographic groups do not exist. In the second chapter of this

study we aim to fill in the aforementioned literature gap by examining a series of unique income tax reforms which occurred in Cyprus during the period 2003-2009 and similarly affected the marginal tax rates of both males and females. Specifically, these reforms include the extensions of all tax bands and the increase of the tax-free income. We adopt the grouping estimator identification methodology proposed by Blundell et al. (1998) to control various endogeneity estimation problems and identify the behavioural parameters of interest. Our findings support positive labour supply wage elasticities and negative non-labour income elasticities for both genders. The aforementioned results could be taken into consideration by policy makers who evaluate reforms to enhance labour supply independently of gender.

In the last chapter of the thesis we study whether the labour supply differences which exist among countries result from population preferences or from the existing income tax systems and their specific features. In order to minimise the impact of population preferences we select Cyprus, Greece and Italy, which share similar cultural preferences based on ancestry, language and cultural indices compared to other European countries but at the same time exhibit noticeable differences in labour market preferences. To investigate the extent to which the differences in labour supply are justified by the different income tax systems of the three countries, we swap their tax systems using micro simulation procedure by changing the tax rates and bands as practised in each country to get the respective labour supply response of each population. For the labour supply estimation we use the discrete choice model. The results suggest that a more generous system increase work incentives and a less generous system reduces work incentives. Therefore, labour supply differences could be justified by the work incentives created by the tax systems.

Περίληψη

Το φορολογικό σύστημα έχει προσελκύσει αρκετά το ερευνητικό ενδιαφέρον καθώς έχει σημαντικές επιδράσεις στην ανθρώπινη συμπεριφορά και αποτελεί την κύρια πηγή εσόδων των χωρών. Η παρούσα διατριβή μελετά συγκεκριμένες φορολογικές πολιτικές μεταρρυθμίσεις που έλαβαν χώρα στην Κυπριακή δημοκρατία τις τελευταίες δεκαετίες με σκοπό να εξετάσει σημαντικά ερευνητικά θέματα που ανέκαθεν έλκυαν το ενδιαφέρον τόσο τους ακαδημαϊκούς όσο και τους φορείς πολιτικών μεταρρυθμίσεων. Ως εκ τούτου η έρευνα έχει τρεις κύριους στόχους. Πρώτον, να εξετάσει ποιος επωμίζεται το βάρος της φορολογίας χρησιμοποιώντας την πολιτική μεταρρύθμιση που επιβλήθηκε στον συντελεστή του ΦΠΑ στα τρόφιμα πρώτης ανάγκης. Δεύτερον, να μελετήσει την επίδραση στη προσφορά εργασίας χρησιμοποιώντας μια σειρά μεταρρυθμίσεων στην άμεση φορολογία των ατόμων. Τρίτον, να διερευνήσει κατά πόσον οι διαφορές που υπάρχουν στο εργατικό δυναμικό μεταξύ των πληθυσμών μπορούν να δικαιολογηθούν μέσα από τα κίνητρα που δημιουργούνται από κάθε φορολογικό σύστημα.

Στο πρώτο κεφάλαιο, μελετάμε σε εμπειρικό επίπεδο την επίδραση της επιβολής των φόρων στις τιμές των αγαθών. Το εν λόγω θέμα μελετήθηκε εις βάθος σε θεωρητικό πλαίσιο εν αντιθέσει με την προσοχή που έλαβε στο εμπειρικό μέρος. Θεωρήσαμε τη φορολογική μεταρρύθμιση του 2010 στον συντελεστή του ΦΠΑ ως μια καλή ευκαιρία να μελετήσουμε την επίδραση της φορολογίας στις τιμές των προϊόντων και κατ' επέκταση τη φορολογική επίπτωση στους καταναλωτές. Κατά τη συγκεκριμένη μεταρρύθμιση τα τρόφιμα πρώτης ανάγκης άλλαξαν φορολογικό συντελεστή από 0% σε 5%. Χρησιμοποιώντας ως δεδομένα τις τιμές αυτών των προϊόντων και ταυτόχρονα τις τιμές των προϊόντων τα οποία ανέκαθεν φορολογούνταν με 5% δημιουργούμε δυο ομάδες προϊόντων με σκοπό την σύγκριση τους. Η μέθοδος που χρησιμοποιούμε είναι η μέθοδος των διαφορών και επικεντρωνόμαστε σε μια περίοδο έξι μηνών πριν και μετά την μεταρρύθμιση. Ταυτόχρονα, ελέγχουμε επιπρόσθετους παράγοντες οι οποίοι μπορούν να επηρεάσουν τις τιμές των αγαθών και αποτελούν το κόστος παραγωγής. Σύμφωνα με τα αποτελέσματα, η αύξηση του ΦΠΑ από 0% σε 5%, περνά στους καταναλωτές σε μικρότερο βαθμό από την αύξηση του ΦΠΑ για τους δυο πρώτους μήνες, ωστόσο, μέχρι το τέλος του πρώτου εξαμήνου οι τιμές αυξάνουν όσον και η αύξηση του

ΦΠΑ. Το γεγονός ότι η αύξηση του ΦΠΑ περνά στους καταναλωτές υπό την μορφή ψηλότερων τιμών μπορεί να είναι χρήσιμο για την αξιολόγηση προτάσεων όσον αφορά την εναρμόνιση ή αύξηση του ΦΠΑ στα τρόφιμα πρώτης ανάγκης σε άλλες Ευρωπαϊκές χώρες.

Στο δεύτερο κεφάλαιο, εκμεταλλευόμαστε μια σειρά μεταρρυθμίσεων όσον αφορά την φορολογία του εισοδήματος που έλαβαν χώραν στην Κύπρο κατά την χρονική περίοδο 2003-2009, οι οποίες επηρέασαν κατά τον ίδιο τρόπο τους οριακούς φορολογικούς συντελεστές και για τα δυο φύλα. Έρευνες που να ασχολήθηκαν με μεταρρυθμίσεις που επηρέασαν και τις δυο δημογραφικές ομάδες δεν υπάρχουν και η παρούσα μελέτη έρχεται να προσθέσει στην υφιστάμενη βιβλιογραφία. Συγκεκριμένα, αυτές οι μεταρρυθμίσεις περιλάμβαναν την επέκταση σε όλα τα φορολογικά κλιμάκια σε συνδυασμό με την αύξηση του αφορολόγητου εισοδήματος. Για να εκτιμήσουμε τις παραμέτρους συμπεριφοράς για το κάθε φύλο υιοθετούμε την μέθοδο των Blundel et al. (1998). Σύμφωνα με τα αποτελέσματα διαπιστώνουμε πως οι συγκεκριμένες μεταρρυθμίσεις επηρεάζουν την προσφορά εργασίας τόσο στην συμμετοχή αλλά και στις ώρες εργασίας σε σχέση με άλλες μελέτες που συνήθως υποστηρίζουν αλλαγή μόνο στην συμμετοχή. Συγκεκριμένα τα αποτελέσματα δείχνουν πως τόσο οι παντρεμένοι άντρες όσο και γυναίκες ανταποκρίνονται θετικά σε μεταβολές του καθαρού ωριαίου μισθού και αρνητικά στις μεταβολές του εισοδήματος εκτός εργασίας. Τα αποτελέσματα μπορούν να φανούν ενδιαφέρον για χώρες που μελετάνε πως να ενισχύσουν την προσφορά εργασίας μέσω πολιτικών μεταρρυθμίσεων.

Στο τρίτο κεφάλαιο, ερευνούμε κατά πόσον τα κίνητρα που δημιουργούνται από το φορολογικό σύστημα μπορούν να εξηγήσουν τις διαφορές που υπάρχουν όσον αφορά την προσφορά εργασίας μεταξύ των χωρών. Για να περιορίσουμε όσον γίνεται τον παράγοντα προτιμήσεων λόγω διαφορετικής κουλτούρας επικεντρωνόμαστε κυρίως στην Νότια Ευρώπη. Έπειτα, επιλέγουμε τρεις συγκεκριμένες χώρες για να μελετήσουμε το εν λόγω ερώτημα, την Κύπρο, Ελλάδα και Ιταλία, οι οποίες σύμφωνα με συγκεκριμένους δείκτες είναι πιο κοντινές από άποψη κουλτούρας. Στην συνέχεια εκτιμούμε τις ελαστικότητες για την κάθε χώρα κάτω από το υφιστάμενο φορολογικό της σύστημα και κατόπιν κάτω από το φορολογικό σύστημα των άλλων δύο χωρών. Σύμφωνα με τα αποτελέσματα τα κίνητρα που δημιουργούνται από το φορολογικό σύστημα φαίνεται να εξηγούν την συμπεριφορά των ατόμων στην προσφορά εργασίας. Πιο ευνοϊκό φορολογικό σύστημα παροτρύνει την συμμετοχή στην αγορά εργασίας

και την αύξηση των εργατοωρών. Λιγότερο ευνοϊκό σύστημα μειώνει την συμμετοχή στην αγορά εργασίας και μειώνει τις ώρες εργασίας.

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Contents

List of Tables

List of Figures

Chapter 1

Empirical Evidence on the Incidence of a VAT Increase in the Food Retail Market

1.1. Introduction

Sales taxation is heavily used all around the world, through different kinds of tax. In the European Union, the Value Added Tax (VAT) system along with general taxes, constitute a major source of revenues. For instance, in most European countries VAT is the most important among indirect taxes and accounts for about 40%-60% of the total indirect revenues. Moreover, sales taxes are quite easy to collect and it is assumed that they do not generate distortions, as they are paid only by consumers. However, it is noted that the burden of sales taxes does not only fall on the persons who have the legal obligation to pay but may shift to producers as well. Nevertheless, this may differ depending on the variety of goods. In this respect a fundamental question is brought to light, for both policy makers and academics, concerning the VAT reform: who finally bears the burden of taxes, consumers or producers? Debates in Europe are based on the effects of tax harmonisation and mostly the way in which prices relate to taxes. Even though it is a crucial subject, the empirical part suffers in contrast to the attention that the theoretical part has received. This chapter seeks to provide answers to the aforementioned question by studying the reform of the VAT rate in the food sector in Cyprus using econometric estimations. We consider this political reform as a good opportunity to empirically exploit the general insights into tax shifting behaviour.

Cyprus used to follow a standard political procedure until it became a member of the EU in 2004 and Cypriot legislation regarding the VAT policy needed to be tailored to meet the Community acquit. Traditionally the food products of basic need belong to the category of

zero percent tax rate. In general, the food sector taxes in Cyprus are separated into three categories. The first category is comprised of the basic food products necessary for daily nutrition which are included in the "housewife's shopping basket", such as milk, bread, pasta etc. The second category is the luxury goods composed of products which are not considered to be necessary for the daily diet, like chocolate, juice, manufactured drinks etc. The third category includes the alcoholic beverages, soft drinks, beer and wine. Following a vote of the House of Representatives in December 14, 2010, the Cypriot government changed the tax rate for the basic food products from 0% to 5% on January 10, 2011. VAT history of food products is shown in Table A1 of the Appendix A.

A number of theoretical papers have studied the question of sales tax shifting on prices. The relation between the price elasticities of supply and demand and the structure of the market are the crucial determinants of how taxes affect prices. The interesting part of this particular VAT reform is that due to the fact that first need products are essential to a household, retailers would not hesitate to increase the price of the subject products at the same rate or even beyond the VAT increase rate. In this respect, such increase in prices is expected to adversely affect low earners since they will have to spend a much bigger share of their income to meet their basic needs compared to high earners. The change in the tax rate for the basic need items is what we seek to analyse with the present chapter and specifically emphasise on the impact of taxation by using product price data. The present study aims to present empirical results which could be taken into consideration by policy-makers of European countries[1] who have not still imposed any VAT on basic need products and are examining whether to introduce such reform or not.

The structure of the chapter is as follows: Section 1.2 presents a review on the existing literature. Section 1.3 describes the econometric approach employed in this research. Section 1.4 describes the data we use and Section 1.5 presents the relevant results. Finally, Section 1.6 displays our conclusions.

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[1] Ireland, Malta and United Kingdom are countries which until today have not imposed VAT on first need products.

1.2. Literature Review

The existing theoretical literature is quite detailed on how sales taxes shift prices. According to Kotlikoff and Summers (1987), many factors determine how taxes are shifted in a particular industry, including the responsiveness of supply and demand to changes in price. In general, the more inelastic is the demand for a specific product the bigger is the part of the tax paid by consumers. On the other hand, the more inelastic is the supply of a specific product the more tax the producer pays. Many researchers have dealt with the market structure including Besley (1989), Dellipala and Keen (1992), Katz and Rosen (1985), Seade (1985) and Stern (1987). An important implication of this literature is that in an imperfectly competitive market, various degrees of price shifting are possible in the long run while price over shifting is not a distinct possibility, i.e. the price increase of a taxed commodity can be higher than the amount of the tax increase. These results contradict those emerging from a competitive market model in which prices for a specific commodity increase just by the amount of the tax if the long run supply curve is horizontal and by less than the amount of the tax if the long run supply curve is upward sloping.

In contrast to the theoretical literature, this issue is rather limited empirically. Most academic studies for sales tax incidence use the assumption that prices fully reflect taxes. Therefore, the main empirical question left to deal with is the impact of price increase on members of different income groups (Pechman and Okner, 1974, Metcalf, 1994).

There have been few empirical studies designed to examine the full price shifting hypothesis. Harris (1987) examines the shift on cigarette prices before and after an increase in the federal excise tax in 1983, reaching to the conclusion that an 8 cents tax per pack leads to a price increase of 16 cents per pack. Besley and Rosen (1999) following a similar approach to Poterba (1996), evaluate the impact of taxes on the price of specific commodities in different U.S. cities by controlling the impact of other factors such as costs. The subject study uses quarterly price indices for commodities of a large group of U.S. cities, constructed by the American Chamber of Commerce Researches Association (ACCRA). The authors select 12 commodities and 155 cities, from 1982-1990, based on the fact that the commodities and cities were included in the data set for a sufficiently long period. For tax data, they use all sales taxes

imposed on the commodity on a state, country, and local level issued by the Significant Features of Fiscal Federalism, published by the Advisory Council on Intergovernmental relations. In addition, information by one firm named Vertex, Inc. is used. Cost data are derived by factors such as rental, wage and energy. Rental cost is defined as the rental value of a typical two-bedroom apartment; wage cost is defined as the minimum labour charge for a home service such as a washing machine repair while energy cost is defined as the price of one gallon of unleaded gasoline. Even though there is a large number of potential models available to link taxes with prices in different market structures, in this particular article they use the simple model of semi logarithmic equation to relate prices to taxes and costs by including city and time factors. The results of the relevant study indicate that more than half of the existing commodities exhibit price over shifting behaviour including bananas, bread, sugar, milk, soda and boys' underwear. For some of the commodities, however, taxes shift prices on a one to one basis. The aforementioned findings are consistent with the predictions of the theoretical literature of imperfect competition which seem to represent a reasonable simulation of the retail sector. Likewise, Hall (1988) found that many markets, and particularly the retail market, are not competitive and taxes which fall under those markets are likely to be more regressive.

Another important research was done by William, Ringel and Stech (1999) for taxes in the tobacco industry which shows that a 100% increase in tax was passed to consumers in the form of higher prices. Researchers use states that have changed taxes as Treatment group and they compare price movements over time with states with no tax changes. They use data of average retail cigarette prices per state, from The Tax Burden on Tobacco published by The Tobacco Institute (1998). Tax rates are calculated as state plus federal excise taxes on cigarettes. Data are collected for a 12-year period (1985-1996) for all states and the District of Columbia. For this research they use a simple OLS estimation controlling both state and year effects. They estimate two versions of the OLS model. In version 1 they use nominal prices and taxes since states change nominal excise tax rates. In version 2 they use the CPI to translate all prices into real values. For version 1, a nominal tax change results in an increase of $1.01 on average retail price, while the relevant coefficient for version 2 is 0.92. The relatively small difference between nominal and real values support the fact that excise taxes are solely imposed on consumers in the form of higher retail prices.

A more recent research was done by Carbonnier (2007) who studied the impact of two French VAT reforms using the price index in two different markets. The first reform was done in September 1, 1987, on car sales when the VAT rate was reduced from 33.33% to 18.6% and in September 1, 1999 when the VAT rate on housing repair services was reduced from 20.6% to 5.5%. In his study he uses monthly consumer price index (CPI) time series built by the National Institute of Statistics and Economics Studies (INSEE) for the three years around the reforms. Moreover, price indices for rent and energy are used to control the impact of production costs. He constructed a new extra index for all goods other than the one he had studied. Weight coefficients of the class indices in the general index building were used for the index under examination. Regression estimates were adjusted to the White method for the estimation of standard errors and avoidance of heteroskedasticity. The main purpose of the study was to estimate consumers' share, in other words the tax burden paid by the consumers, which also represents how taxes affect prices. The results show that the consumers' share in the housing repair service market is significantly higher than the consumers' share in the car market. More specifically consumers pay 77% of sales taxes on housing repair services while on the other hand the share paid by consumers for new cars is 57%.

While the aforementioned papers studied the effect of tax rate variations in different markets, the present chapter studies the effect of tax rate variations in the retail food market following a reform in Cyprus whereby VAT was imposed on specific commodities. We will focus on a short period before and after the reform, since the imposition of the VAT on first need products was a relatively recent policy reform in Cyprus. In addition, since Cyprus is a small economy we use the same tax rate across the country which contradicts other studies which had to include local and state taxes as well. In order for the commodities to have the same production costs we selected goods which are locally produced. Finally, we use specific goods which cover daily nutrition needs for individuals in a household, which is a factor that was not included in previous studies. Taking into consideration that the taxes imposed on the aforementioned commodities are more regressive, the results of the present study might constitute an important benchmark for the evaluation of VAT policies in various countries.

1.3. Tax Reform and Data
1.3.1. Tax Reform

Cyprus faced the prospect of accession in the European Union hence created the need for harmonising Cypriot legislation concerning VAT to the European acquit. The 6th community directive, beyond the amendments and directives, constitutes the basis for implementing a uniform policy similar to the other members of the European Union for the collection and enforcement of the VAT. This attempt for harmonisation of the VAT legislation began in 1990 with the introduction of a sales taxes law which was finally applied in 1992. However, during the years the European acquit for VAT was enriched with new decisions and instructions by the Court of European Communities. Those changes led to the re-writing of the legislation to be in accordance with the European law. At the beginning of 2001, the Cyprus VAT legislation and regulations were, at a great degree, harmonised with the European acquit. The specific regulations were implemented on the 1st of February 2002.

By 1st of May 2004, the VAT legislation was modified in such way so that it would include the adjustments regarding the intra-community transactions, for the inclusion of Cyprus in the Europe Union. When Cyprus became a member of the EU in 2004 the Cypriot tax rate had to change however the Cypriot government asked for an extension in which some categories of products (first need products) would remain under zero percent tax rate in order to smoothen the transition. For compliance reasons, the Cypriot government changed the tax rate from 0% to 5% by the 10th of January of 2011, following a vote of the House of Representatives on the 14th of December 2010. In general, the food taxes in Cyprus are separated into three categories. The first category is comprised of the basic food products necessary for daily nutrition which are included in the "housewife's shopping basket", such as milk, bread etc. The second category is the luxury goods composed of products which are not considered to be necessary for the daily nutrition, like chocolate, manufactured drinks etc., which were always taxed with the 5% tax rate. The third category included the alcoholic beverages, soft drinks beer and wine, which were always taxed with the regular tax of each period. The reform which we study in this chapter is concerned the first category of products, which are considered essential for the daily diet of the individuals and probably taxes on this kind of goods would be more aggressive.

1.3.2. Data

1.3.2.1. Price Data

For the analysis, we collect prices for specific products which belonged to the category with 0% tax rate and changed to 5% and prices for products which always belonged to the category with 5% tax rate. The price data used are extracted from the Ministry of Industry and Tourism based on Price Observatory of large supermarkets[2] from all districts in Cyprus. The main purpose of Price Observatory is to protect consumers and ensure healthy competition, therefore every month they collect prices for a great variety of products from 12 large supermarkets all over Cyprus. Even though data series are available from 2007 till present, for the current analysis the price data we use are monthly figures from June 2010 to June 2011 to focus only on the six months prior and six months following the 2010 VAT reform in Cyprus and limit the effect of other factors irrelevant to taxation on price. For each product a monthly average price is calculated in logs. Summary statistics of the products are listed in Table 1.1. An aspect of the table which is noteworthy is that commodities are narrowly defined with specific brand names. Furthermore, each group includes homogenous products with respect to the way of production.

To start with a little thought experiment, Figure 1.1 shows price fluctuations of the commodities[3] included in the Treatment group and the Control group with the red line separating the time before and the time after the VAT reform. It appears that after the VAT reform, all products of the Treatment group exhibit an ongoing upward trend in price. On the other hand Control group products do not follow the same pattern. At least for the first month Control group products exhibit a variation in price trends with not all products showing a price increase after the VAT reform. It is noted that for some products of the Control group the increase in price is insignificant, with the exception of cases where the increase in price is high for a specific month after the VAT reform, 1L juice for example. After a six month period, the specific products exhibit usual behaviour and unstable trends with many price fluctuations and periods with high prices. It should be taken into account however that such reform is expected

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[2] Athienitis, Alphamega, Carrefour, Debenhams, E&S, Kokkinos, Karseras, Metro, Orfanides, Sarris and Stelios.
[3] Products which were always subject to 5% VAT rate and products which were subject to 0% VAT rate and changed to 5% VAT rate.

to affect prices of other goods as well, besides the products directly affected by the policy change.

1.3.2.2. Cost Data

As previously mentioned, we add the prices of primary materials used in the production procedure such as fuel oil, electricity, wages and barley prices in order to calculate the cost of production. Monthly prices for fuel oil were collected from the Energy department of the European committee. Monthly electricity prices were collected from the Electricity Authority of Cyprus. We also use monthly barley prices from the Department of Agriculture. In contrast to the other factors we use quarterly wages from the Statistical Service of Cyprus. All prices are in logs.

Finally, we collected data regarding the general Consumer Price Index (CPI), food CPI and CPI for non-alcoholic beverages from the Statistical Service of Cyprus. Goods and services included in the CPI are classified into 12 categories and are categorised based on the Classification of Individual Consumption According to Purpose (COICOP). We collected prices for the first category, which is divided into food and non-alcoholic beverages, to observe their trends but they were not introduced to the model as control variables. Figure 1.2 exhibits the values of general CPI, food CPI and non-alcoholic beverages CPI for the six month period prior and six months period following the VAT reform. The general CPI shows an upward trend in prices during the second month of the reform and onwards. Food CPI index exhibits a higher increase in prices from the first month of the reform and onwards. In the aforementioned category however, not only products which had a change in their tax rate are included. Non-alcoholic beverages CPI noted a small increase in prices until the third month following the reform, then exhibited a decrease for one month and then again increased to previous price levels. Last but not least, all figures of the CPI show a price level decrease for one or two months prior to the introduction of the VAT reform, with the most significant decrease being observed in the food products category.

1.4. Econometric Framework

This section empirically evaluates the effect of increase of the VAT rate in Cyprus for first need products from 0% to 5%. Following the inclusion of Cyprus in the EU in 2004, tax rate in Cyprus had to be adjusted and harmonised to the Community acquit. Prior to the aforementioned adjustment the first need products had 0% tax rate. Cyprus government asked for an extension in which certain products would remain under 0% tax rate in order to smoothen the transition. After five years of grace and specifically on December 14, 2010, Cyprus government voted for a change of the tax rate from 0% to 5%, a change which was in effect from January 10, 2011.

To estimate the VAT increase effect on prices we use the difference in difference method (dif-in-dif). We took advantage of the fact that other food categories remained under the same tax rate. By using the dif-in-dif method we are able to compare the different tax rate groups of products. In this respect, we created two groups of products, the Treatment group and the Control group. Treatment group is composed of products whose tax rate changed from 0% to 5% while the Control group is composed of other food items that were already subject to 5% VAT tax rate. All products included in the relevant groups are presented in Table A2 of Appendix A. Treatment group includes basic food items which constitute an essential daily nutrition source such as milk, coffee, yogurt etc. The Control group contains commodities like bottle water, juices etc. The selection of all commodities was based on the availability of data for the study period and also on the homogeneity of the production procedure for each group. Furthermore, all products selected for the sample of the present research are produced in Cyprus in order to eliminate the effect of import costs and other additional fees. By using this model we aim to compare the price reaction in each category and capture the change among them. From the beginning of our analysis, we created dummy variables for each month following the VAT reform, in order to capture the average increase of the price for all goods. In order to capture the price increase for goods which belong to the Treatment group, we created interaction terms. The interaction term is the multiplication between the Treatment group variable and monthly variables following the reform. Since we have multiple observations for each product in our data set at various points in time, we choose panel data

analysis using as panel variable the product code. The codes of the products are described in Table A3 of Appendix A.

With the selection of panel data analysis for the precise model structure we have two choices: a fixed effect model or a random effect model. Fixed effect model accounts for time-invariant characteristics of the individual or entity that may influence the predictor variables by removing those characteristics from the predictor variables outcome in order to reach to the net effect. In this case each product has its own characteristics that may or may not influence the predictor variables. In our model we already capture the characteristics of the entities (products) with the use of dummies hence time-invariant characteristics are already controlled. Since we have time effect, for which we also want to control time-invariant characteristics, it appears that the random effect model is the most suitable choice. In order to evaluate our choice we run a Hausman Test where the null hypothesis is that the preferred model is the random effect vs. the alternative the fixed effect. Finally, we use the Breusch and Pagan (1980), and the Lagrange Multiplier (LM) test for random effects. The LM test compares a random effect regression to a simple OLS regression. Our results for the above aforementioned tests support the use of a random effect model.

Aside from VAT, we also need to control for other factors that may affect prices such as the cost of production. For all products we use the same factors to calculate the cost of production. For this purpose the cost is represented by adding up the prices for fuel oil, wages and electricity. We also use barley prices for products included in the Treatment group since barley is used as a raw material for the production of most of the products included in the subject group.

The model that we use has the following form:

$$\ln \Pr ice_{it} = a_0 + a_1 Treatment + b_1 Afterreform_{it} + c_i (Afterreform_{it} * Treatment) + d_i Cost_{it} + v_{it} + e_{it} \quad (1.1)$$

where the cost variable includes the prices for fuel oil, wages, electricity and barley. Variable v_{it} represents the random effect and e_{it} the error term. The key parameter for tax incidence is c_i. In interpreting its value, c_i presents the variation of tax-inclusive prices for the products of the Treatment group following the reform.

1.5. Results

We begin by discussing the estimates of equation (1.1), and then analyse some alternative specifications to assess the robustness of the results.

1.5.1. Results of the Canonical Specification

Firstly, we estimate equation (1.1) for the six month period prior and the six month period following the VAT reform from June 2010 until June 2011. In this specification we control all variables concerning the cost of production. Almost all coefficients of the control variables are proven to be insignificant and especially the coefficients of the wages and electricity variables, hence, they are totally removed from the model. An interesting observation however emerged from the barley prices variable. Barley prices seem to affect both Treatment and Control group products. We examined the direct effect of barley prices on products included in the Treatment group but the results proved to be insignificant.

Table 1.2 displays the results of the estimation. Column I describes the timing of the price adoption of the new VAT rate for the first semester of 2011 as a whole. Variable 'After6months' refers to all products, six months after the VAT reform and variable 'Treatafter6months[4]', refers to the products which belong only to the Treatment group for the first semester of 2011. By this first specification, it is observed that on average, prices of the Control group products did not exhibit any significant increase after the policy implementation. On the other hand, the prices of the Treatment group products (Treatafter6months) were increased by an average of 5% at a 1% significance level, compared to the same group of products prior to the VAT reform, supporting the case that the burden of the VAT increase was passed onto the consumers in the form of higher prices.

Column II reports the average VAT effect for each month after the reform instead of the first semester of 2011 as a whole. Variable 'TreatmentAftermonth1' captures the average price increase of the Treatment group products for the first month following the reform and we use

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[4] Interaction term= Treatment x Aftersixmonths

the respective variables for each month. We observe that during the first month, immediately after the VAT reform, the prices of the Treatment group products exhibit a significant increase of 3%. It is noted that during the five months period following the reform, prices are 3 to 4 percent higher compared to the prices prior to the VAT policy reform but without exceeding the VAT increase rate. Until the end of the first semester prices increase at about 5% at a 1% significance level, indicating that the cost of the VAT reform is mainly paid by consumers through higher prices. We run the same model including a variable representing the one month period before the policy introduction in order to control any price increase that might have occurred prior to the reform, however the coefficient has proven to be insignificant. Finally, we use the same specification separately for each month to capture the increase in prices of the Control group products. These results are consistent with the conclusion derived from the variable of the first semester as a whole which showed that no significant change occurred in the prices of the Control group products for any month following the reform. In this respect the results allow us to support that the price increase of the affected group is solely due to the change of the VAT policy. The results are also supported by Figure 1.1. Treatment group products seem to respond instantly to the increase of the VAT rate in contrast to Control group products which do not exhibit significant price increase immediately after the reform.

Specifications I and II also support that the tax shifting on the prices of the specific products is very fast. For instance, in the first two months following the reform taxes appear to be shifted by more than 60% and by the end of the first semester by 100%. These empirical results are consistent with the theoretical results of imperfect competition hypothesis where various degrees of shifting are possible, while over shifting is not a distinct possibility.

1.5.1.1. Efficiency of the Results

A standard assumption made in panel-data models is that the error terms are independent cross-sectional. The specific assumption is used for identification purposes rather than descriptive accuracy. In order for the results to be accurate, we tested the specific option. In the context of large T and small N, the Lagrange Multiplier test statistic, proposed by Breusch and Pagan (1980), can be used to test cross-sectional dependence. However, because in this case the time-series dataset we use has the form of small T and large N, the Breusch-Pagan

test is not valid. In this case we use Friedman's test chi-squared distributed statistic (1937) to check cross-sectional dependence. Friedman's test (1937) is also used in balance data cases like in our case. Results in Table 1.2 suggest that the error terms are independent cross-sectional. At this point it should be reminded that we correct for heteroskedasticity and serial autocorrelation.

Furthermore, it is equally important to deal with the effectiveness of the dif-in-dif method that we use in the analysis. According to Angrist and Krueger (1998) the key is to run the same model in the absence of the intervention. Therefore, we run the same model for June 2009 - June 2010 which corresponds to the one year period prior to the VAT reform. No significant increase is observed in any of the group of products during the aforementioned period. We run various models with all cases leading to the same conclusion; none of the results seem to be significant. Table A4 in the Appendix A, page 95, presents the relevant results. Consequently, the increase in prices can be justified by the VAT reform and not by a time trend.

1.5.2. Alternative Specifications

To check the robustness of the results we initially run the above model using different control variables. We generate interaction terms among the cost variables and the time before and after the VAT reform in order to check if any changes of those controls could justify the increase in the product prices but none of the results have proven to be significant. We also generate interaction terms for the Treatment and Control group products with the cost variables in order to examine whether any price increase could be justified by the cost variables or not. As already mentioned, the interaction value of Treatment group products with barley prices is not significant. The same applies for the rest of the interaction terms.

We also estimated equation (1.1) for a longer period than six months, and more precisely we concentrated on the one year period prior and one year after the specific VAT reform. We used a longer period rather than 6 months in order to check if the increase in prices that exhibited in the first two specifications is due to seasonal effects. Column III and IV of the Table 1.2 display the relevant results. Specifically Column III, reports the results for the first and the second semester of 2011 separately. According to the findings, Control group products do not exhibit any significant increase in prices neither in the first nor in the second semester

of 2011. On the other hand, the products of the Treatment group in the first semester note a significant increase of 5% in their prices supporting the conclusion of the previous two estimations that the VAT increase passes to consumers in the form of higher prices. For the aforementioned products the second semester of 2011 exhibits a significantly higher increase in prices and specifically higher than the increase of the VAT rate, reaching to 10%. The same pattern seems to be followed in the estimation results of Column IV.

Estimation IV captures the changes for the Treatment group products for each month separately just like estimation II but for a longer period. According to the findings of the first six months, a higher increase is noted than the increase observed in estimations I and II. More specifically, from the first month of the reform the increase is 4% higher and from March and onwards the increase is higher than 5%. Until the end of the year, prices exhibit a significant increase of almost 11% at a 1% significance level, indicating that VAT over shifts prices. For the products of the Control group no significant increase is noted neither when using month variables nor when using semester variables. The main difference between estimation IV and estimation II is that for each month following the VAT reform in estimation IV prices are about 2% higher than the corresponding prices in estimation II. However, it should be noted that estimation IV covers a longer period than estimation II while it includes other factors apart from the VAT which may affect the increase in prices, such as the cost variables as a separate variable or as a combination with time or Treatment group. None of the abovementioned variables seem to explain the high increase in price of the products included in the Treatment group. We run the same estimation for the same period prior to the VAT reform but no increase in prices is exhibited for neither of the groups of products once again ruling out the time factor.

The specifications III and IV are suggesting that the tax shifting, when using longer period continues from the previous period and is significantly higher for the additional period. Over shifting in such kind of products is not a distinct possibility because they are considered first need goods for the daily nutrition and their demand is more inelastic. Despite the prices of the products, consumers will continue purchasing them in order to cover their basic needs.

Finally, we estimated the model with more disaggregated data. We use product prices for each district, rather than one price for each product for every month like estimations I-IV. Column V in Table 1.2 presents the relevant results with district variables representing the 5 main regions of Cyprus; Nicosia, Limassol, Larnaca, Paphos and Famagusta. The coefficients of the region variables were proven to be insignificant which seems to be a rational result. Since Cyprus is a small country the distances between the various districts is not considered a determining factor that could affect prices at a significant rate. Immediately after the implementation of the VAT reform the results exhibit a lower increase in prices for the Treatment group products compared to the previous estimations. After the third month the results seem to be very close to the results of the initial models I-II. However, prices increase by exactly 5% the fifth month following the VAT reform and at the end of the semester the increase reaches 6%. Finally, in this case and while using the first semester as one variable, a significant price increase of 1% is noted for the Control group products but when using monthly variables the prices do not exhibit any significant increase.

Based on the various estimations, models I and II, constitute the most appropriate model choices since the subject models focus on the results six months prior and six months following the VAT reform. In this respect, the effect of other factors on prices is minimised and any price increase could be justified by the VAT increase. Moreover, the same results are supported from the other specifications as well. Specifications III to IV, which cover a longer period, that of 12 months before and after the policy implementation, support the results found in specifications I and II; consumers bear the burden of the VAT in the form of higher prices. However, it is noted that for the months following the first semester the price increase exceeds the VAT increase. These results are also consistent with the theoretical literature of imperfect competition which seems to constitute a reasonable simulation of the retail market (Hall, 1988). Under imperfect competition over shifting is not a distinct possibility. On the other hand, it would be worthy to investigate the mechanism using longer period specifications which is something that may explain the overshooting noticed in prices and consequently end with a closer look on the results between the various models. Longer period specifications are something that we intend to examine in the nearest future.

1.6. Conclusion

A time-honoured question in public finance is how prices react to the imposition of taxes. Although a majority of theoretical literature exists on this subject, there has been little empirical work. In this chapter, we use the VAT policy reform in Cyprus to empirically investigate the subject. Specifically, we assemble a panel of monthly data for two groups of commodities for a six month period prior to and six month period following the relevant reform. At the same time, we control for other factors that may affect prices such as production cost.

The analysis shows that during the first two months, the increase of the VAT rate from 0% to 5% for first need products is passed onto consumers in the form of higher prices but at a lower rate than the increase of the VAT. By the third month of the reform we notice higher increase in prices and until the end of the first semester the increase is equal to the increase of the VAT rate. In general, the VAT increase did not immediately pass onto consumers as a total but it was spread throughout a longer period and even after the six month period following the VAT reform. The total pass-through is estimated to be higher than 5% after the first semester of the reform.

The findings that the VAT increase passes onto consumers after a few months in the form of higher prices and in some cases prices increase more than the VAT increase, are also consistent with the theoretical literature of imperfect competition which seems to constitute a reasonable simulation of the retail market (Hall, 1988). As already mentioned in the literature review section, under imperfect competition various shifts in prices are possible because there are both price and profit effects. Since prices are set above marginal cost, an increase in cost due to a change in taxation is not necessarily reflected in an identical increase in price (Besley, 1989, Dellipala and Keen, 1992, Katz and Rosen, 1985, Seadde, 1985, Stern, 1987).

However, there are limitations like in other studies that someone should consider. The limitations relate to the sample data. One may expect that general equilibrium effects to change the prices of the products in the Control group through substitution effect. However, under the circumstances of this study the Control group we selected is the best choice as we

tried to minimise the substitution effect factor by using only drinkable products in the Control group and eatable products in the Treatment group. Also, another important issue that is worth examining for is the mechanism of 12 month period estimations which may explain the price over shifting behaviour noticed up to the end of the second semester.

To the extent that our findings for first need products are generally valid, taxes imposed on them are likely to be more regressive compared to other products. Such findings might be important for the assessment of proposals for the harmonisation or increase of the VAT rates across Europe. In the same way, these findings can be important for the evaluation of proposals concerning the introduction of Value Added Tax to the United States.

1.7. Tables

Table 1.1: Descriptive Statistics

Item	Mean	S.D.	Min	Max
Charalabides Milk, 1L	0.160	0.035	0.116	0.204
Lanites Milk, 1L	0.166	0.029	0.128	0.204
Christes Milk, 1L	0.198	0.038	0.124	0.244
Pittas Challoumi, 225gr	0.998	0.043	0.968	1.129
Cristes Challoumi Light	2.599	0.026	2.559	2.643
Christes Yogurt, 300gr	0.558	0.044	0.488	0.629
Pittas Fresh Cream 200ml	-0.093	0.057	-0.150	0.018
Mitsides Pastas	0.163	0.046	0.105	0.254
Coffee Laikos, 200gr	0.580	0.030	0.534	0.620
Coffee Charalambous, 200gr	0.596	0.025	0.565	0.627
Sugar, 1Kg	-0.019	0.120	-0.183	0.195
Lanites Orange Juice, 1L	0.300	0.036	0.249	0.352
Kean Orange Juice, 1L	0.208	0.015	0.186	0.233
Ena Orange Juice, 1L	0.281	0.028	0.259	0.372
Lanites Orange Juice, 9x250ml	1.460	0.034	1.390	1.506
Kean Orange Juice, 9x250ml	1.412	0.014	1.380	1.427
Kean Lemon Squash, 1L	0.533	0.010	0.521	0.558
Lanites Orange Juice, 1L	0.561	0.081	0.430	0.657
Lanites Lemon Juice, 0,33cl	-0.512	0.041	-0.575	-0.468
Kykkos Water	0.917	0.034	0.818	0.947
HVH Water	1.138	0.008	1.123	1.150
Agros Water, 6x1.5L	0.872	0.021	0.850	0.916
Number of Observations	13	13	13	13

Note: All prices are in logs. For each product we have the average monthly price for the 6 months period before and after the reform. Datasets come from Ministry of Industry and Tourism.

Table 1.2: Results

Variables	I		II		III		IV		V	
Treatment	-0.104	(0.282)	-0.104	(0.284)	-0.121	(0.276)	-0.121	(0.279)	-0.115	(0.121)
Aftrer6months	0.003	(0.013)	0.009	(0.013)	0.005	(0.015)	-		0.017**	(0.007)
After12months	-		-		0.005	(0.017)	0.026	(0.018)	-	
Treatafter6months	0.054***	(0.018)	-		0.059***	(0.016)	-		-	
Treatafter12months	-		-		0.101***	(0.017)	-			
Treatafter1	-		0.036**	(0.016)	-		0.045**	(0.019)	0.021**	(0.009)
Treatafter2	-		0.031**	(0.015)	-		0.045**	(0.020)	0.027***	(0.010)
Treatafter3	-		0.049***	(0.017)	-		0.064***	(0.023)	0.041***	(0.012)
Treatafter4	-		0.037**	(0.017)	-		0.064***	(0.017)	0.041***	(0.011)
Treatafter5	-		0.041**	(0.018)	-		0.069***	(0.017)	0.051***	(0.015)
Treatafter6	-		0.057***	(0.017)	-		0.085***	(0.017)	0.061***	(0.013)
Treatafter7	-		-		-		0.087***	(0.016)	-	
Treatafter8	-		-		-		0.085***	(0.017)	-	
Treatafter9	-		-		-		0.091***	(0.017)	-	
Treatafter10	-		-		-		0.108***	(0.018)	-	
Treatafter11	-		-		-		0.109***	(0.018)	-	
Treatafter12	-		-		-		0.104***	(0.018)	-	
LnFueloil	0.057	(0.036)	0.024	(0.040)	-0.104**	(0.038)	-0.128*	(0.049)	0.017	(0.026)
LnBarley	0.030**	(0.014)	0.032**	(0.014)	0.018	(0.023)	0.053*	(0.028)	0.025**	(0.011)
Region2	-		-		-		-		0.066	(0.185)
Region3	-		-		-		-		0.043	(0.183)
Region4	-		-		-		-		0.032	(0.192)
Region5	-		-		-		-		-0.072	(0.182)
Constant	0.122	(0.287)	0.320	(0.287)	0.064	(0.294)	0.721	(0.336)	0.289	(0.218)
N	286		286		528		528		1219	
Cross Sectional Dependence Test	Pr = 0.291		Pr = 0.492		Pr = 0.110		Pr = 0.101		-	

Note: Standard errors are in the parentheses. All estimations control for the cost of production. We test for cross sectional dependence using the Friedman's test chi-squared distributed statistic (1937). Friedman's test suggests that the error terms are independent cross-sectional and more supported by models I and II. *, **, *** significant at 10%, 5% and 1% significant level, respectively.

1.8. Figures

Figure 1.1: Prices Before and After the Reform

(a)
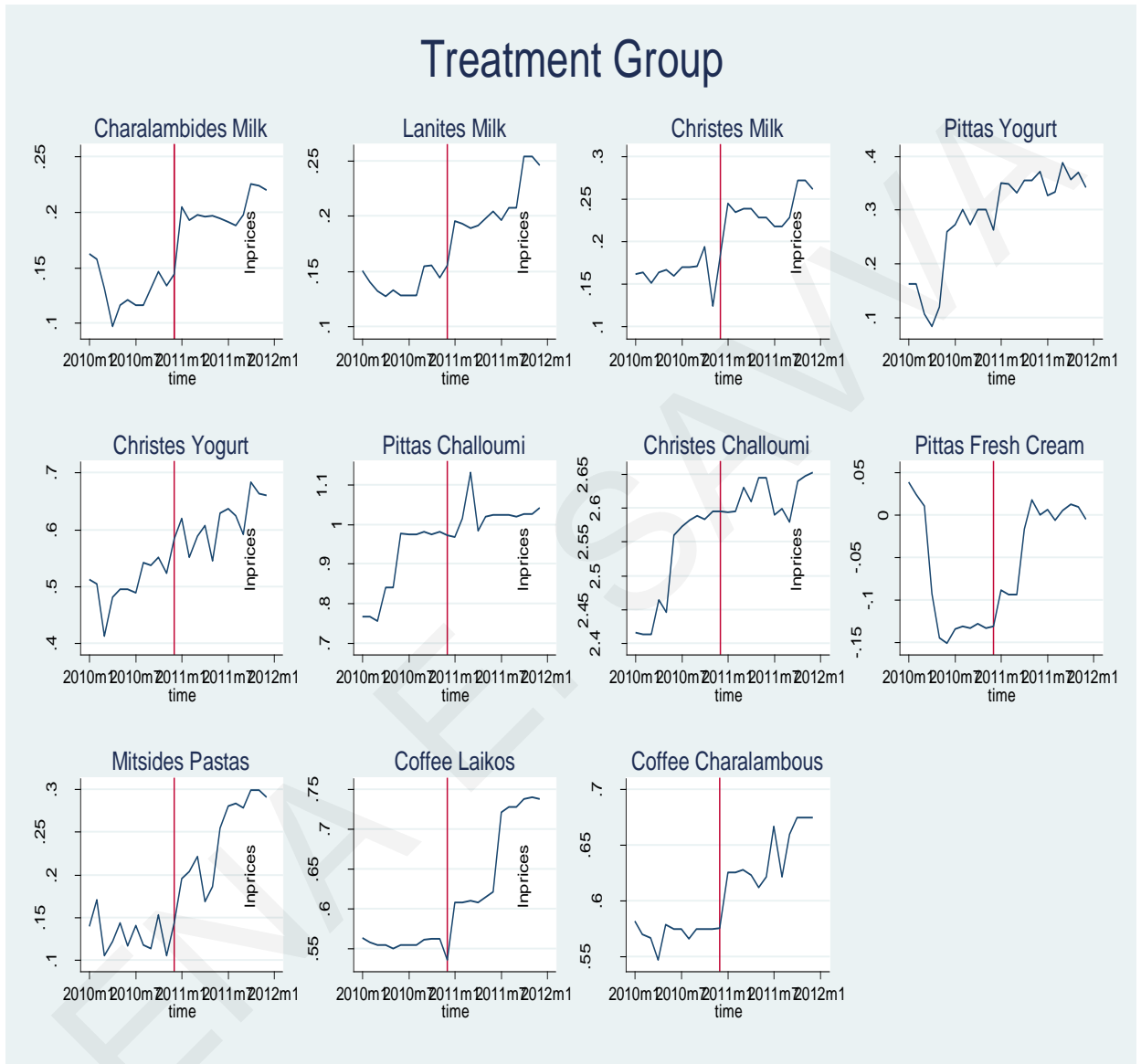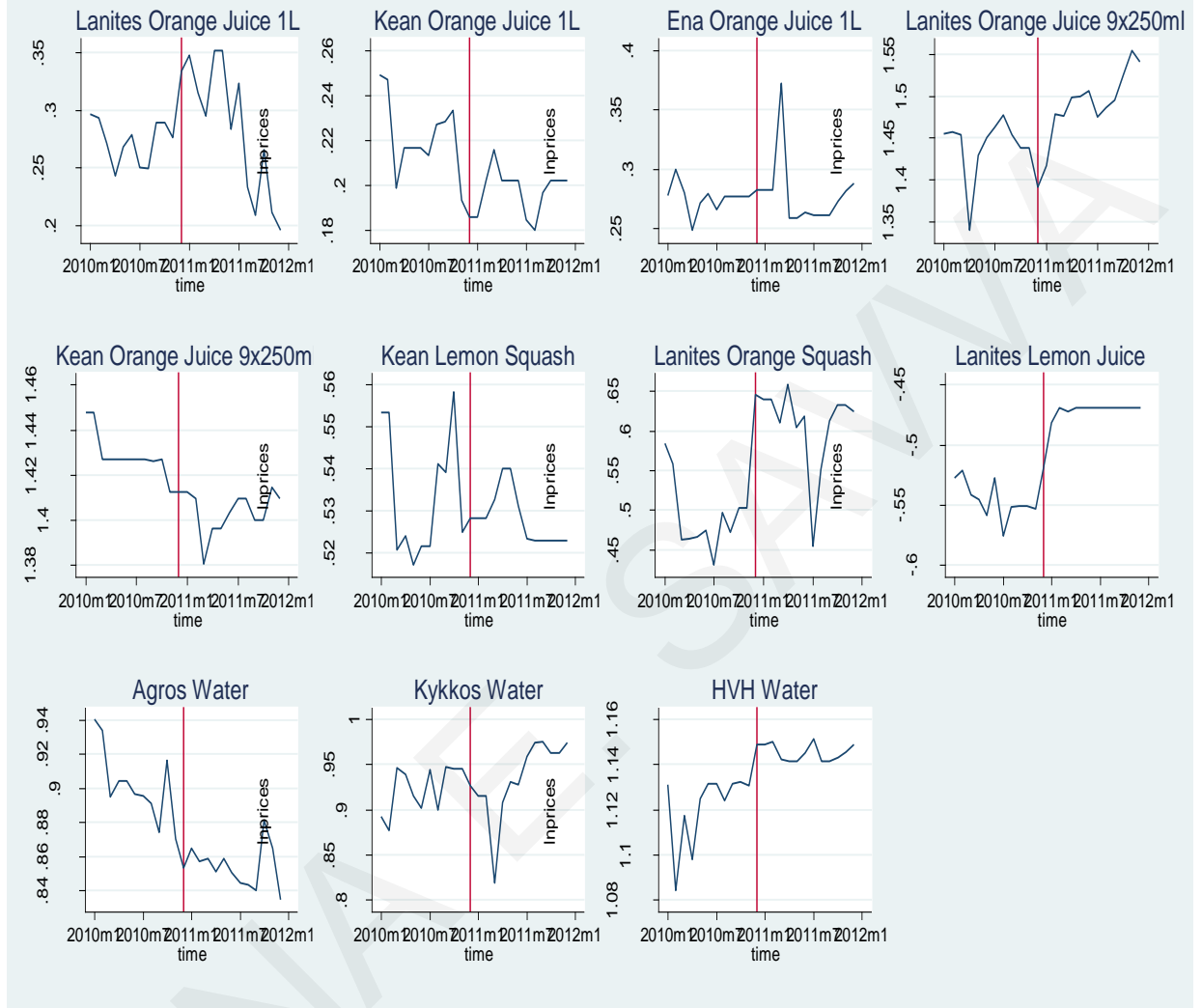
(b)

Note: Prices of: (a) Treatment group products (b) Control group products for the period June 2010-June 2011. All prices are in logs. Datasets used for the construction of the figures come from Ministry of Industry and Tourism, based on Price Observatory.

Figure 1.2: CPI Trends
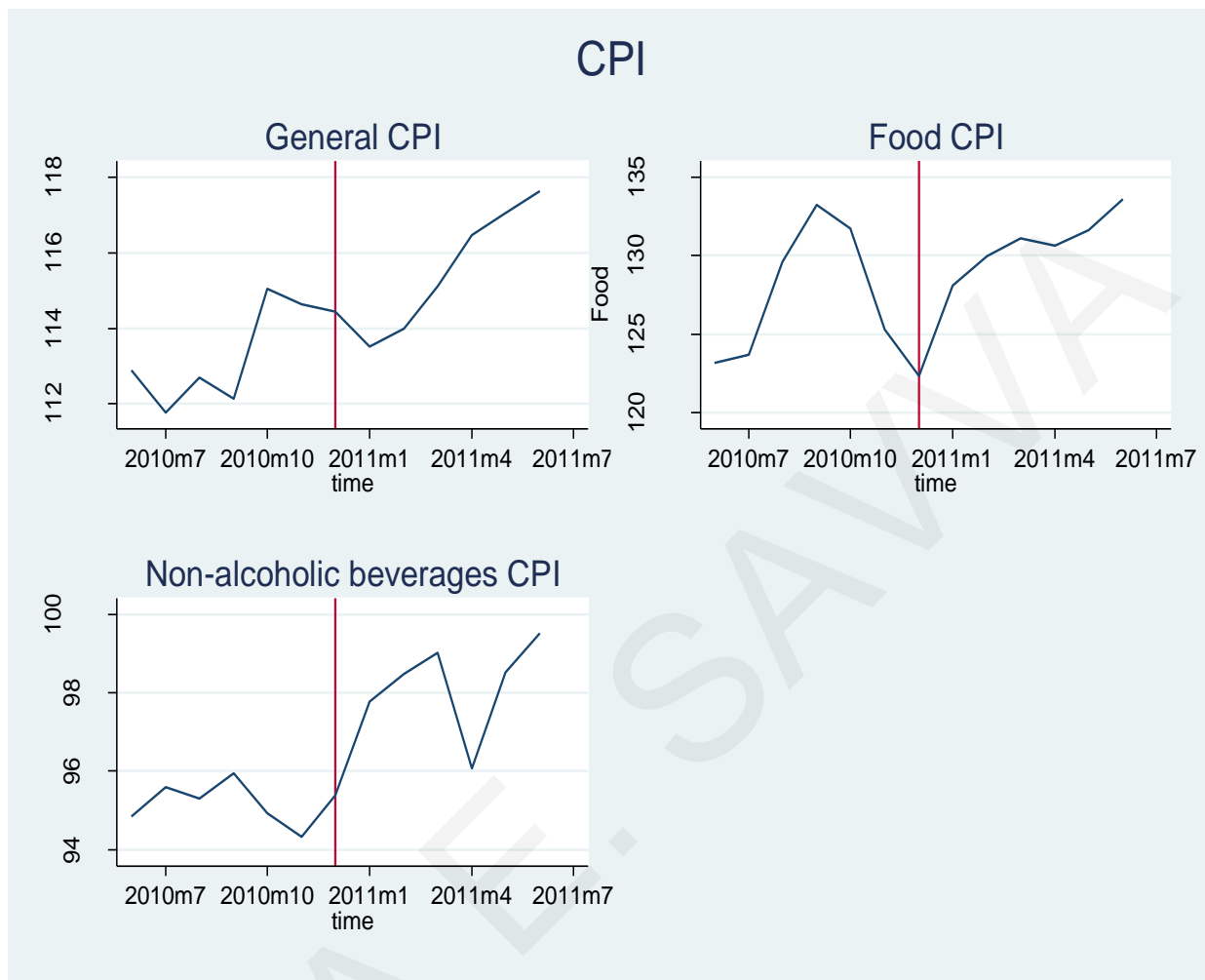
Note: General CPI, food CPI and non-alcoholic beverages CPI for the period June 2010-June 2011. Datasets used for the construction of the figures come from Statistical Service of Cyprus.

Chapter 2

Estimation of Male and Female Labour Supply Elasticities Using Income Tax Free and Bracket Reforms

2.1. Introduction

The response of labour supply to changes in after tax wages and non-labour income has attracted significant research attention. The identification of these behavioural parameters is important in evaluating tax and benefit policy reforms. Many countries are reviewing their tax-systems in order to create incentives for individuals to enter the workforce and, in particular, to encourage women into the labour force. Over the years, different methodologies and the experience of various countries have been adopted to identify the labour supply wage and income elasticities.

In general, there is no consensus in the literature about the magnitude of these labour supply behavioural responses. Alternative methodologies have been adopted (Blundell and MaCurdy, 1999). An established finding, however, is that own wage labour supply elasticities are largest for married women but small, and in some cases negative, for men. In general, the labour supply response of men and women has been examined separately. Recently, though, Bargain, Orsini and Peichl (2014) presented evidence on labour supply elasticities of both males and females for 17 European countries and the US using a common empirical approach, discrete choice methodology, and cross section data. Their findings suggest that the estimates are modest and more comparable than those found in the literature and international differences are small. Any differences across countries appear to be due to difference in individual and

23

social preferences and have little to do with selection to marriage, differences in tax and benefit systems and social preferences.

Labour supply elasticities have been difficult to be identified because of various simultaneity and endogeneity issues. It is for this reason that natural policy reforms have been exploited to identify these behavioural responses. Blundell, Duncan and Meghir (1998) showed that tax reforms, which provide exogenous variation in after tax wages, can improve the identification of these behavioural parameters. Most studies exploited policy reforms which were expected to affect women and, therefore, uncovered the behavioural response of this demographic group. Researches which relate to reforms that affected both men and women and give the opportunity to identify the response of both demographic groups are non-existent.

This study aims to fill this gap in the literature. Specifically, it contributes to this literature by exploiting a series of unique and different income tax reforms which affected similarly the marginal tax rates of both males and females. In contrast, the tax and benefit reforms that occurred in other countries affected mostly married women's marginal tax rates and non labour income. Consequently, most of the research concentrated on identifying the women's labour supply elasticities. The reforms studied in this chapter took place in Cyprus between 2003 and 2009, which has a progressive individual tax system. These reforms involved an increase of about 27% in the level of tax free income each individual is allowed and a 42% increase in the range of earned income which, by 2009, was taxed with a lower marginal tax rate whereas in 2003 it was taxed with the highest marginal tax rate[1]. Therefore, they provide us with an exogenous variation in individual after tax wage and non-labour income and allow us to identify the labour supply elasticities of both men and women at the same time. We concentrate on married individuals, who constitute the biggest part of our sample, to conduct the empirical estimation. We use the Cyprus Family Expenditure Survey data that are available in 2003 and 2009 to estimate these behavioural parameters of interest. We adopt the grouping estimator identification methodology proposed by Blundell et al. (1998) to correct for various endogeneity and estimation problems and identify the behavioural parameters of interest. We find positive labour supply own wage elasticities and negative non-labour income

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[1] These reforms are different from those that occurred in other EU member states which involved both a decrease in the personal income tax for the low-income groups, and a decrease of the tax base, or an increase in the income tax rates for high income groups, and an expansion of the tax base.

elasticities for both married men and married women. However, married women's labour supply wage and income elasticities are twice as high as that of married men's. The evidence can be useful to countries considering the adoption of similar tax reforms.

In Section 2.2 we very briefly review the relevant literature. In Section 2.3 we briefly describe the income tax changes, which occurred over the period of interest, and their effect on the marginal income tax rates faced by individuals. We also present the individual data used to conduct the empirical analysis. In Section 2.4, we present the identification strategy and the empirical model that is estimated. Section 2.5 presents the empirical findings for married men and married women. Finally, Section 2.6 concludes.

2.2. Brief Literature Review

Research on men's labour supply elasticities is scarce. In general, however, the wage elasticity estimates found are very small and almost zero. Ashenfelter and Heckman (1974) found that the uncompensated wage elasticity for US married men was 0.06 and their income elasticity -0.11. Pencavel (1986) found a negative correlation between labour supply and wages for all male age groups prior the retirement, and positive correlation for the very young. Regarding tax benefit reforms, Moffitt (2002) found a positive effect of labour market participation decision among low educated men and no effect upon highly educated and wealthy men. MaCurdy, Green and Paarsch (1990) exploited reforms that took place using US data and found the wage elasticity for married males aged between 25-55 to be between 0.24 and 0.032 and income elasticity around -0.01.

More recently, Meghir and Phillips (2008) studied the reforms in UK during the 1980's which mainly involved changes in marginal tax rates and benefits which found almost no change in men's hours of work. However, the participation rate of men with low or medium education was found to be more sensitive to tax reforms. The elasticity of labour force participation for this group was found to be positive in contrast to the elasticity of individuals with high levels of education which was found to be almost zero.

Using Swedish data and non-parametric methodology, Blomquist and Newey (2002) also reported low wage elasticity (not higher than 0.08) for married men aged 20-60[2]. Some studies, however, noted higher labour supply wage elasticity for men. For example, Flood and MaCurdy (1992) used Swedish data for married men aged 25-65 estimated the wage elasticity between -0.25 to 0.21 but, similar to other research, found low income elasticity in the range 0.04 to -0.1. This study adopted the Hausman (1981) approach and estimated a cross sectional regression equation of working hours on after tax wage and virtual income, instrumenting both explanatory variables. Their methodology also took into account the differently sloped segments of the kinked budget curve by linking the choice of segment to the indirect utility function. Most of the research concentrated on the female's labour supply behavior since it also has important implications on marriage, fertility and divorce behavior as well as on the distribution of family earnings and male-female wage differentials. Most of the available evidence suggests that the female labor supply is relatively more affected by wage and income changes than the male labour supply (Killingsworth, 1983, Killingsworth et al., 1986). Besides adopting the usual structural discrete choice model, many studies exploited specific policy reforms which were expected to affect women and identified their response to exogenous variations in net wages using a difference-in-difference approach. Eissa (1995) used the U.S. Tax Reform Act of 1986 (TRA86) which eliminate many tax shelters and broaden the tax base as a measure of comparison of how married women respond to changes in taxation. In that specific reform the top marginal tax rate were reduced more than the marginal tax rates of those down the income distribution. This study applied the difference-in-difference estimator and compared the behavior of wives married to high earning husbands to that of wives of lower earning husbands. The findings suggested that the two groups under examination were affected differently by the reform.

A basic assumption of the difference-in-difference approach is that the composition of the two groups vis a vis preference for work do not change as a result of the reform. However, the household position in the income distribution is to an extent endogenous. In order to address this issue Blundell et al. (1998) proposed an alternative methodology and showed that tax

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[2] The Sweden tax system underwent many changes before 2000 with marginal tax rates reaching a historical high in 1980 and a low in 1991. For this reason, many researchers used these reforms to evaluate the labour supply responses.

changes can be used to estimate labour supply wage elasticities. The advantage of this methodology is that it combines a structural approach along with instrumental variables, exploiting the changes in the net wage rate because of the tax reforms. The identification strategy relies on comparing the labour supply responses over time for different groups defined by cohort and education level. This approach exploits the differential growth of marginal wages between these groups. The various changes reflect the differential impact of the reforms on these groups as well as the differential growth in real wages.

Blundell et al. (1998) applied their proposed methodology and uncovered the behavioural parameters of interest using the tax reforms that occurred in the UK during the 1980's which decreased the marginal tax rates and abolished the high tax rates. These tax reforms affected mainly married women through changes in their net marginal wages and unearned income. The reform affected the wages of men who face higher tax rates and hence their wives unearned income which includes their partner's wage income. They used repeated cross sections of the UK FES over the period 1978-1992 and restricted their sample to married females age 20-50. They found the uncompensated wage elasticity for married females to be in the range of 0.13-0.37 depending on the age of the youngest child. The estimated income elasticity for this demographic group was found between -0.19 and 0. In this chapter, we adopt the methodology of Blundell et al. (1998).

2.3. Tax Reforms and Data
2.3.1. The Tax Reforms

Cyprus has always had an individual tax system which taxes the income of each spouse separately. Also, each individual is allowed a tax-free amount and beyond that amount their earned income is taxed with the analogous tax rate. What distinguishes the Cyprus income tax system, from most other European income tax systems, is the high income tax free amount that each individual is allowed and the lower marginal income tax rates.

Table 2.1 gives the details of the income tax legislation from 2000 until today. Until 2002 the income tax and benefit system in Cyprus was very complicated with child tax credits and other deductions which could be claimed by married individuals (husband and wife) depending on their level of income. Therefore, the tax system was not purely individualistic but had aspects

of joint taxation. In 2002, however, the Cyprus income tax and benefit system underwent substantial reforms which made the system much simpler and abolished child tax credits and various deductions. This tax law became effective starting 1st February 2003 and made the tax system more individualistic since child tax credits were abolished and a cash child benefit payment was given to parents with children. Between 2003 and 2009 a number of tax reforms took place which involves increases in the level of the tax free income, which is subject to zero marginal income tax rate, and expansions in the rest of the income tax brackets for which a positive marginal tax rate applied. Figure 2.1 plots the income tax brackets and marginal tax rates which were applicable in 2003 and 2009. It is these reforms that the present study exploits to identify the labour supply elasticities of both married men and married women.

As Table 2.1 shows, in 2003 there were four income tax brackets and the level of tax free income was €15377. The corresponding marginal tax rates which applied, for each income tax band, were 0%, 20% 25% and 30%. In 2004, the level of the tax free income was raised to €17086 and by 2008 the tax free income was raised to €19500. In addition, all taxable income ranges were extended and the marginal tax rates which applied to each one remained the same as in 2003. Therefore, between these two periods the level of the tax free income each individual was allowed increased by €4123, which represents 27% of the tax free income in 2003. As such, this additional earned income was taxed at 20% whereas in 2009 it was taxed at 0%. Second, by 2009, there was an increase of about 42% in the level of earned income which was taxed with a lower marginal tax rate (that is 25%) whereas in 2003 it was taxed with the highest marginal tax rate of 30%. Third, in 2009 income earned above €20503 and below €25630 was taxed with a 20% marginal tax rate whereas in 2003 it was taxed at 25%. As a consequence, for each euro earned in 2009, below the threshold of €36300, a lower marginal tax rate of about 5% applied compared to 2003 whereas a 10% decrease applied for income between €25629 and €28000. For taxable income above €36300 the marginal tax rate remained the same between these two years.

The tax reforms, over the period under examination, decreased the effective tax rates faced by individuals since the marginal tax rates decreased for taxable income between €15377 and €36300. Hence, it is expected that there was an increase in the net labour income of all working individuals and more so of individuals in the middle of the income distribution whose

labour supply decision, on the intensive margin (i.e. hours) and extensive margin (i.e. participation), is expected to be affected.

2.3.2. The Data

Our empirical analysis uses the individual data provided by the Cyprus Family Expenditure Survey. The data is collected by the Department of Statistics and Research of the Republic of Cyprus every few years and contains information about the employment status, the level and sources of income and any useful information about the living standards of the population. Each survey has twelve month duration. Over the period that these substantial reforms took place there are two cross sections of the Cyprus Family Expenditure Survey that can be used. The first survey took place in 2003, in the beginning of the reform period, and the second one in 2009, at the end of the reform period and before the economic crisis affected the Cyprus economy. In fact, there is no other publicly available survey after 2009 which we can use.

We concentrate on a homogenous group of individuals in order to avoid heterogeneity in work preferences. We use the observations on married men and married females which constitute the biggest part of the observations. Specifically, we concentrate on married males and married females who are either the head or the spouse of the head of the household. We keep individuals who are employees or inactive and whose age is 20 and above and younger than 66. One may support that having such wide range of age sample may create problems due to the decision of early retirement. This is mostly related to women population. However, we end up with this specific choice in order to have a bigger sample. Nevertheless, it will be useful to do some robustness checks after the estimations to examine whether the estimates are robust to the choice of age range. Also, the self-employed individuals are dropped from the sample to avoid econometric issues including measurement error in labour income. The total sample is composed of 2372 married men and 3221 married women between ages 20 and 66.

In the Cyprus Family Expenditure Survey data, individuals are not asked directly about their usual work hours and hourly wage rate. Rather individuals are asked to report either how many months or how many weeks they have been working. For individuals who report their working hours in months, we compute their usual working hours in weeks first multiplying by 4.35 which is the mean number of weeks for a regular year. Afterwards, we multiply the

number of weeks worked by each individual by 5 days and 8 hours to obtain the individual's annual "usual" working hours. For each working period, the working income is reported respectively either weekly or monthly. To get the annual income we multiply the reported income by the reported working weeks or by the reported working months respectively. Afterwards, we divide the annual earnings by the annual working hours to compute the individual's net hourly wage. By transforming both working hours and employment earnings in annual form the measurement error related to the wage error is cancelled. However, there is probably a measurement error that relates mostly to part time workers which is unclear information in the survey and may bias to a degree the wage rate; it may downwards the wages. The individual's education can be either one of the following: primary education, secondary education and with some or completed university education.

Tables 2.2-2.3 report the descriptive statistics of key variables for married males and married females respectively for 2003 and 2009. More than 99% of married males are head of household. Similarly, more than 99% of married females are the spouse of the head of household. The labour force participation rate is very high among married males and over this period remained stable. In contrast, the labour force participation rate of married females is much lower and increased on average by about 4% over this period. Concentrating on the working population, the mean annual working hours of married males remained the same whereas the mean annual working hours of married working females increased over this period. On average, the percent of females working in the public sector increased significantly whereas the percent of married men working in the public sector remained stable. The hourly net wage of both working males and females increased over this period. Furthermore, for purpose for this analysis the wages have been adjusted for inflation.

The composition of the working population changed. These changes may be due to the reform and/or changes over time. Specifically, the percent of working married males and females with basic education decreased between 2003 and 2009 by about 5% and 6% respectively. Consequently, the working population, on average, has a higher level of education in 2009 compared to 2003. In particular, the percent of working married females with higher education increased by 6%. These trends are also reflected in the partner's level of education in each sample. On average, the fertility rates decreases over this period. Non-labour income, which

includes the partner's labour income, was on average higher for females compared to males and increased for both over this period. The percent of married females living in rural areas increased by about 4% whereas the percent of married men who live in rural areas remained the same between these two periods.

Table 2.4 reports the average labour force participation rates for the whole sample and by education group for 2003 and 2009 depending on whether married males and married females lived in urban or rural area. Overall the participation rates of males in rural and urban areas were about the same. Differences, however, are observed between the different educational groups. In 2009, the labour force participation rate of low educated married males in urban areas decreased whereas in rural areas it remained about the same. In rural areas, the labour force participation rate of married males with high education decreased in 2009 relative to 2003. Married females with low education living in rural areas had a higher participation rate than those living in urban areas. The opposite applied for the average participation rates of medium and high educated married females. In 2009, the overall participation rate of married females increased moderately in urban areas and a bigger increase is observed in rural areas. By education group, the participation of married females with low and medium education living in urban areas increased between 2003 and 2009. An increase in the participation rate of medium educated married females was observed in rural areas over this period. Individuals in all education groups living in urban areas worked more hours than those living in rural area both in 2003 and 2009. Both in urban and rural areas, highly educated married males worked more hours and low and medium educated married males worked fewer hours in 2009 than in 2003. Between 2003 and 2009, we observe that married high educated females in urban areas worked more hours whereas the opposite holds for high educated married females living in rural areas. In 2009, low and medium educated married females in urban areas worked fewer hours whereas those living in rural areas increased greatly their average working hours.

Table 2.5 reports the distribution of individuals by their level of taxable income. Compared to 2003, in 2009 there was an increase in the proportion of married males with taxable income greater than the 2009 tax free income (€19500) whereas among married females there was an increase in the percent of individuals with taxable income above the 2003 tax free income (€15377).

2.4. Identification Strategy and Empirical Model

It is well known that estimation of the labour supply equation using OLS leads to inconsistent wage and non-labour income parameter estimates because the hourly wage and other income may be correlated with the error term due to the effect of unobservables, such as the individual's preferences or ability. Our econometric analysis corrects for this endogeneity by adopting the methodology proposed by Blundell et al. (1998) which exploits the exogenous variation in after tax wage and non-labour income caused by the tax reforms and enables the identification of behavioural responses to the tax reform.

The main assumption of this identification strategy is that the population can be separated into groups in such a way that the average unobserved difference in labour supply between these groups can be fully accounted by the group effects. After the group effects are taken into account, however, there is still unexplained variation in the net wages between the groups caused by the tax reforms which guarantee the identification of the wage and non-labour income elasticities.

In this study, we rely on cross sectional variation in order to control for the presence of common shocks since we have data from two cross sections; one cross section is at the beginning and the other at the end of the period that these tax reforms took place. Since the tax reforms are expected to have had an exogenous effect on the individual's after tax wages and other income, a good estimation method will have to rely on comparing various population groups with the same characteristics who have been affected in different ways by the reform for reasons that are exogenous to labour supply. For this reason, we group individuals according to their education level and the cohort they belong. In this way, we capture the different growth in marginal wages between groups because of the reform and also due to the differences in real wages because of education and cohort effects.

We separate the individuals in our sample into groups based on the cohort group and education level they belong. We define four cohort groups based on the individual's date of birth with a ten year interval between them. The four cohorts consist of individuals born in 1938-1948, 1948-1957, 1958-1968, and 1968-1978 respectively. The three education groups are defined as those who completed primary school, those with some or completed secondary

school and those with some university or a university degree. In this way, we define 12 groups with each one having an adequate number of observations in each cell. An exception are the cells of married men with low education born between 1958-1968 and 1968-1978 for which the number of observations are small and are dropped. By using the specific method and by separating the data from the cohort they belong we capture the whole spectrum of the sample used; aged above 20 years old and younger than 65 years old. Therefore, we can cover the extreme cases that may result from the sample used, such as individuals who are too young or too old which is something that needs to be taken into consideration when examining labour supply behaviour. However, as it has already been mentioned we missed observations for low educated men born between 1958-1978, who basically are the younger individuals and probably the group effect for them would be the same or smaller compared to older individuals at the same level of education.

2.4.1. Empirical Model

We estimate the traditional labour supply equation adopting the two step method (Heckman, 1974) to correct for self-selection into work. The estimation method we adopted is similar to that of Blundell et al. (1998). Bosch and van der Kaauw (2012) adopted a similar approach to study the impact of a Dutch reform which took place in 2001 on female labour supply.

First, we estimate the labour market participation decision of individual i, at time t,

$$\Pr(P_{it} = 1) = \Phi(\alpha_0 + \alpha_1 y_{it} + \alpha_2 Z_{it} + a_3 X_{it}) \tag{2.1}$$

where $P_{it} = 1$ denotes participation of the individual in the labour market, y_{it} is the individual's non-labour income, which includes the partner's wage income, and X_{it} is a vector of observed individual characteristics which includes interactions of cohort dummies with education dummies (i.e. group dummies), interactions of education dummies with rural area dummy, number of children in different age groups, partner's level of education, regional dummies and a variable whether the partner works.

In order to capture the effects of the reform, vector Z_{it} includes interactions of the post reform dummy with the education dummies. The post reform dummy takes the value of 1 for

33

observations in 2009 and zero for observations in 2003. In addition, we allow for the tax reforms to have a differential impact on the labour force participation of individuals depending on their level of education and whether they lived in urban or rural area since the data suggested that, over this period, the average participation rates and working hours of individuals with a different level of education exhibited differences between urban and rural areas. So, Z_{it} also includes interactions of the post reform dummy with the education dummies and the rural dummy. The variables in Z_{it} are our key identifying (i.e. excluded) instruments. In equation (1), $\Phi(\ )$ is the distribution function for the standard normal.

Second, we estimate the ln hours equation of individual i at time t,

$$\ln h_{it} = \gamma_0 + \gamma_1 \ln w_{it} + \gamma_2 y_{it} + \gamma_3 Z_{it} + \gamma_4 \widehat{X_{it}} + \varepsilon_{it} \qquad (2.2)$$

where $\ln w_{it}$ is the after tax marginal hourly wage of individual i at time t. In order to account for the endogeneity of the after tax hourly wage and non-labour income both of these variables are instrumented.

Equation (2.2) is estimated using 2SLS. So, at the first stage the following ln net wage and non-labour income equations are specified,

$$\ln \omega_{it} = \beta_0 + \beta_1 Z_{it} + \beta_2 \widehat{X_{it}} + \varepsilon_{it}^{\omega} \qquad (2.2.1)$$

$$y_{it} = \delta_0 + \delta_1 Z_{it} + \delta_2 \widehat{X_{it}} + \varepsilon_{it}^{\nu} \qquad (2.2.2)$$

In equations (2.2), (2.2.1) and (2.2.2), vector $\widehat{X_{it}}$ includes the variables in X_{it}, dummies for sector of employment and the inverse mills ratio obtained from equation (2.1) to correct for selection into work. In addition, it includes interactions of the dummy variable which denotes whether the individual works in public sector with education dummies[3]. As in equation (2.1), Z_{it} includes the additional or identifying instrumental variables mentioned above. These instrumental variables allow the effect of the tax reforms on net wage and non-labour income

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[3] The earnings and working conditions of individuals with the same level of education working in the private and public sector in Cyprus have also been found to differ significantly by Christofides and Pashardes (2002).

to be different across educational groups living in rural and urban areas. We shall present the tests for the relevance and validity of these additional instruments later[4] in the next section.

A key identifying assumption of the adopted methodology is that between 2003 and 2009 there are no other shocks that affected the labour supply of married men and women other than the specific reforms. This is an outcome of having only two cross sections to conduct the empirical analysis. Also, the adopted identification strategy does not require the education choice to be unrelated to preferences of work but that the unobservables and education can be described by a fixed group effect which is the same across groups.

The parameter, γ_1 denotes the uncompensated labour supply wage elasticity. We can obtain the non-labour income elasticity by dividing γ_2 with the average level of other income y_{it}.

2.5. Empirical Results

We fit the empirical model, presented above, requesting heterosckedastic standard errors and testing for our identifying restrictions. We present the estimates and tests below separately for married males and married females. The key findings suggest that both males' and females' labour supply wage elasticities are positive. However, married women's responses to changes in after tax wages is twice as high as that of married men's. Also, the non-labour income elasticities are negative and, on average, about twice as high for married females than married males.

2.5.1. Married Males' Labour Supply Elasticities

Table 2.6 presents the marginal estimates of the participation, net wage, other income and labour supply (hours) equations, we defined above, for married males. Ninety nine percent of the sample are the head of the household. Wooldridge's score test of overidentifying restrictions, which is robust to heterosckedasticity, has a p value of 0.595 and supports that we cannot reject the null that all instruments are valid at the 5%.

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[4] Including the interactions of the rural dummy with the education and post reform dummies does not affect the parameters of interest but improves their significance level in the case of men.

The marginal estimates of the participation equation (2.1) suggest that, after the reform, married males with low and medium education living in rural areas had about 1% higher probability to participate in the labour market relative to prior to the reform. We do not observe a significant change in the probability to work after the reform for those living in urban areas, which also supported by the sample data. Married males with higher level of non labour income had a lower probability to work. This means that a higher non-employment income makes married males more reluctant to participate in the labour market. Also, married male with a medium or high educated partner had a higher probability to work than married males with a low educated partner. This is probably due to the fact that individuals with high educated partners are also medium and high educated individuals.

As expected, the estimates of the net wage equation (2.2.1) suggest that after the reform the net wages of all education groups increased. This increase was the same for both those living in urban and rural areas. This is a rational result since the specific reform reduced the marginal tax rates and increased the tax free income for all income groups, despite where they live. The group effects are overall found to be significant and positive suggesting that, compared to the wages of low educated individuals born before 1948, the ln net wages of all cohort-education groups was either the same or higher. In particular, compared to the reference group, the ln net hourly wages of high educated individuals were significantly higher and, as expected, more so for older cohorts than younger cohorts. Married males working in the public sector have higher net wages than those working in the private sector with the same level of education. The public sector is of a major importance for the Cyprus government given the amounts invested in it, every year. The wages in the public sector exceed by far those in the private sector and at significant higher levels.

The estimates of the labour supply (hours) equation (2.2) suggest that the uncompensated wage elasticity equals to 0.06, suggesting a 6% increase in working hours due to 1% increase in wages. Whereas the non-labour income elasticity is -0.048 (estimated at the sample mean unearned income), meaning that the relevant change due to an increase of unearned income is -4.8%. Therefore, the increase in other sources of income, apart from labour, minimises the incentives to labour supply. The estimates are similar to the results of other studies concerning men's labour supply elasticities where usually the wage elasticities found are very small and close to zero while income elasticities are low and negative.

2.5.2 Married Females' Labour Supply Elasticities

Table 2.7 presents the estimation results of the participation, net wage, non-labour income and hours equations for married females. Ninety nine percent of the sample is the spouse of the household. Wooldridge's score test of overidentifying restrictions has a p value of 0.298 which suggests that we cannot reject the null that all instruments are valid at the 5%.

The marginal estimates of the participation equation (2.1) suggest that, before the tax reforms, medium and high educated women living in rural areas had between 12%-15% lower probability to work than those living in urban areas. This is probably due to the fact that there are fewer opportunities in rural areas than in urban areas. After the reform, however, medium educated married females living in rural areas had 12% higher probability to participate in the labour market compared to prior to the reform. The aforementioned results are also supported by the sample data and related to the fact that more incentives were created after the reform which affected positively their participation decisions. We do not observe any significant change in the probability to work after the reform for those living in urban areas.

As expected, the estimates of the ln net wage equation suggest that after the reform the net wages of all education groups increased. This increase was the same for both married females living in urban and rural areas.

Compared to low educated women born in cohort 1968-1978, all other groups had higher or similar ln net wages. In particular, compared to the reference cohort, high educated women in all cohorts had a significantly higher ln net wages and the difference was greater for older cohorts than younger cohorts. More specifically, the wages of women with higher levels of education vary between 20% to 50% higher than the reference group. All else equal, individuals working in the public sector have higher net wages than those in the private sector with the same level of education, which also reported in Christofides and Pashardes (2002). As it has already been pointed out, the results were also supported by married males. In the wage equation, the coefficient of the mills ratio is positive and significant suggesting that errors terms are positively correlated.

The response of labour supply for married women to changes in net wages and other income is greater than the response of married men. Specifically the uncompensated wage elasticity is 0.15, suggesting a 15% increase in working hours if wages note an increase of 1%. The non-

labour elasticity is -0.072 (estimated at the sample mean of non-labour income), which is double compared to men. Therefore, the increase of other sources of incomes apart from labour, is a greater deterrent factor for women rather than men. Furthermore, the existence of very young children affects negatively the working hours for mothers as well. It is noted that married women, is the most heavily studied group in the literature. The main reason is probably the fact that most of the policy reforms used in many countries concern families with children. In general, there is a wide range of results found for women, which are usually higher than men and significantly different from zero, also supported by this study.

2.6. Conclusion

Female labour supply elasticity estimates have mostly been estimated using natural policy experiments whereas evidence on the males' labour supply elasticities is almost non-existent. In this chapter we investigate the labour supply behavior for both men and women exploiting a series of policy reforms which reduced substantially the marginal tax rates faced by both. The reforms involved extensions of all income tax brackets accompanied with an increase in the level of tax free income and provide us with an exogenous variation to identify the labour supply wage and non-labour income elasticities for both males and females at the same time. We find that policy reforms affected individual labour supply behavior both on the intensive and extensive margin. Previous research found that financial incentives affect the extensive rather than the intensive margin. Specifically, the income tax reforms increased significantly the probability of low and medium educated married males and, in particular, medium educated married females living in rural areas to participate in the labour market. The findings suggest that both married men and married women's working hours respond positively to changes in net hourly wage and negatively to changes in non-labour income. However, compared to married men, married females working hours are found to be twice as responsive to both changes in net wages and non-labour income. The results in this chapter are useful for countries considering reforms in the income tax system to create incentives to enter the labour market since are found to have positive effects to individuals independently by their gender.

2.7. Tables

Table 2.1: Income Tax From 2000-2011

%	Taxable Year						
	2000-2001	2002	**2003**	2004-2006	2007	**2008-2010**	Since 2011
0%	0-10252	0-15377	**0-15377**	0-17086	0-18368	**0-19500**	0-19500
20 %	10253-15377	-	**15378-20503**	17087-25629	18369-26910	**19501-28000**	19501-28000
25 %	-	-	**20504-25629**	25630-34172	26911-35197	**28001-36300**	28001-36300
30 %	15378-20503	15378-20503	**Over 25630**	Over 34173	Over 35198	**Over 36301**	36301-60000
35 %	-	-	**-**	-	-	**-**	Over 60001
40 %	Over 20504	Over 20504	**-**	-	-	**-**	-

Note: All prices are in euro. Columns 3 and 6 describe the two years we study. Information comes from the Tax Department of Cyprus.

Table 2.2: Descriptive Statistics for Sample of Married Males

Variables	2003				2009			
	ALL		WORKING		ALL		WORKING	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Participation	0.989	0.101	1.000	0.000	0.973	0.161	1.000	0.000
Hours (annual)	-	-	2030.003	229.166	-	-	2027.800	235.048
Ln hours	-	-	7.603	0.201	-	-	7.601	0.197
Net hourly wage rate	-	-	9.898	5.022	-	-	11.954	6.221
Ln net hourly wage rate	-	-	2.193	0.433	-	-	2.376	0.459
Non-labour income (annual)	9636.493	9950.095	9469.245	9672.095	12611.770	12873.760	12715.040	12791.340
Number of children 1-3	0.326	0.606	0.327	0.606	0.155	0.410	0.157	0.413
Number of children 4-6	0.274	0.533	0.273	0.532	0.150	0.395	0.152	0.398
Number of children 7-12	0.619	0.886	0.622	0.888	0.374	0.656	0.378	0.658
Number of children 13-18	0.573	0.851	0.576	0.854	0.472	0.758	0.478	0.762
Number of children	1.793	1.555	1.800	1.554	1.152	1.143	1.166	1.146
Number of Additional Adults	2.276	1.443	2.276	1.440	1.624	0.929	1.630	0.934
Low education	0.196	0.397	0.196	0.397	0.144	0.351	0.141	0.348
Medium education	0.485	0.499	0.486	0.499	0.506	0.500	0.508	0.500
High education	0.317	0.465	0.317	0.465	0.349	0.476	0.350	0.477
Age	44.489	9.794	44.404	9.757	46.673	9.504	46.552	9.447
Partner with low education	0.220	0.414	0.219	0.413	0.161	0.367	0.156	0.363
Partner with medium education	0.469	0.499	0.469	0.499	0.462	0.498	0.467	0.499
Partner with high education	0.305	0.460	0.305	0.460	0.365	0.481	0.366	0.482
Head	0.994	0.076	0.994	0.071	0.988	0.107	0.989	0.099
Spouse	0.005	0.076	0.005	0.071	0.011	0.107	0.010	0.099
Public sector	0.306	0.461	0.309	0.462	0.297	0.457	0.305	0.460
Living in rural area	0.292	0.455	0.292	0.454	0.305	0.460	0.308	0.462
Larnaca region	0.158	0.365	0.158	0.365	0.197	0.398	0.197	0.398
Limassol region	0.281	0.450	0.280	0.449	0.278	0.448	0.275	0.447
Nicosia region	0.417	0.493	0.419	0.493	0.379	0.485	0.382	0.487
Paphos region	0.089	0.285	0.090	0.287	0.093	0.291	0.092	0.289
Number of Observation	1359		1345		1122		1092	

Note: The datasets are provided by the Cyprus Family expenditure Survey.

40

Table 2.3: Descriptive Statistics for Sample of Married Females

	2003				2009			
	ALL		WORKING		ALL		WORKING	
Variables	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Participation	0.617	0.486	1.000	0.000	0.651	0.476	1.000	0.000
Hours (annual)	-	-	1934.148	379.194	-	-	1956.279	360.988
Ln hours	-	-	7.532	0.314	-	-	7.544	0.323
Net hourly wage rate	-	-	6.562	3.916	-	-	8.742	5.254
Ln net hourly wage rate	-	-	1.725	0.561	-	-	2.005	0.574
Non-labour income (annual)	14898.9200	13066.530	16723.760	12375.110	18738.550	16567.190	20925.140	16221.510
Number of children 1-3	0.294	0.586	0.317	0.601	0.123	0.368	0.137	0.388
Number of children 4-6	0.241	0.509	0.278	0.548	0.132	0.376	0.156	0.410
Number of children 7-12	0.571	0.864	0.605	0.849	0.336	0.628	0.379	0.656
Number of children 13-18	0.548	0.846	0.588	0.857	0.423	0.727	0.458	0.734
Number of children	1.656	1.581	1.789	1.500	1.015	1.134	1.132	1.098
Number of Additional Adults	2.263	1.456	2.253	1.436	1.634	0.922	1.634	0.934
Low education	0.278	0.448	0.185	0.389	0.197	0.398	0.120	0.326
Medium education	0.457	0.498	0.460	0.498	0.473	0.499	0.464	0.499
High education	0.264	0.441	0.353	0.478	0.328	0.469	0.414	0.492
Age	43.473	10.919	0.120	0.325	45.542	10.462	43.270	9.665
Partner low education	0.241	0.428	0.471	0.499	0.161	0.368	0.116	0.321
Partner medium education	0.450	0.497	0.321	0.467	0.481	0.499	0.499	0.500
Partner high education	0.266	0.442	0.009	0.094	0.300	0.458	0.361	0.480
Head	0.006	0.081	0.990	0.094	0.014	0.119	0.015	0.125
Spouse	0.993	0.081	0.262	0.439	0.985	0.119	0.984	0.125
Public sector	0.162	0.368	0.272	0.445	0.196	0.397	0.300	0.458
Living in Rural area	0.309	0.462	0.147	0.355	0.333	0.471	0.309	0.462
Larnaca region	0.170	0.375	0.271	0.444	0.190	0.392	0.190	0.393
Limassol region	0.278	0.448	0.425	0.494	0.283	0.450	0.254	0.435
Nicosia region	0.398	0.489	0.099	0.299	0.374	0.484	0.414	0.492
Paphos region	0.09	0.296	0.233	0.423	0.097	0.296	0.084	0.278
Number of Observation	1786		1103		1447		943	

Note: The datasets provided by the Cyprus Family expenditure Survey.

Table 2.4: Participation Rate and Annual Hours: Married Males and Females in Urban and Rural Areas

	MALES							
	URBAN				RURAL			
Participation	2003		2009		2003		2009	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Low Education	0.987	0.115	0.909	0.289	0.992	0.092	0.988	0.108
Medium Education	0.993	0.081	0.968	0.175	0.986	0.119	0.995	0.073
High Education	0.989	0.105	0.984	0.124	0.986	0.119	0.943	0.234

	FEMALES							
	URBAN				RURAL			
Participation	2003		2009		2003		2009	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Low Education	0.382	0.487	0.427	0.497	0.445	0.498	0.374	0.485
Medium Education	0.641	0.480	0.614	0.487	0.574	0.496	0.692	0.463
High Education	0.845	0.362	0.835	0.372	0.741	0.441	0.770	0.423

	MALES							
	URBAN				RURAL			
Annual Hours	2003		2009		2003		2009	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Low Education	2016.562	229.243	1998.203	242.625	1975.145	323.692	1919.476	418.032
Medium Education	2048.528	202.127	2037.228	208.799	2004.738	259.872	1990.610	287.898
High Education	2047.746	194.673	2068.248	143.520	2015.800	250.447	2056.364	166.920

	FEMALES							
	URBAN				RURAL			
Annual Hours	2003		2009		2003		2009	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Low Education	1979.414	340.496	1921.745	385.549	1655.524	547.733	1736.316	502.509
Medium Education	1970.579	352.550	1963.772	355.035	1848.970	432.500	1908.280	425.673
High Education	1992.075	297.097	2015.195	284.505	1994.095	266.692	1974.805	304.936

Note: We provide the information for each group according their education and either living in urban or rural area.

Table 2.5: Distribution of Taxable Income: Married Males and Females in 2003 and 2009

Taxable Income	MALES		FEMALES	
	2003	2009	2003	2009
	Mean	Mean	Mean	Mean
Taxable Income <15377	0.36	0.24	0.82	0.71
15377<Taxable Income<19500	0.24	0.18	0.06	0.08
19501<Taxable Income <36300	0.33	0.48	0.10	0.17
Taxable Income>36300	0.07	0.10	0.02	0.04

Note: We calculate the distribution of individuals according to the level of their taxable income.

Table 2.6: Selected Parameter Estimates for Married Males

Variable	Participation		Ln Wage		Non-Labour Income		Ln Hours	
	Parameter	T-ratio	Parameter	T-ratio	Parameter	T-ratio	Parameter	T-ratio
Ln net hourly wage rate	-	-	-	-	-	-	0.061	2.16
Non-Labour Income	-0.000	-2.81	-	-	-	-	-0.000	-1.96
Low education post reform	-0.073	-1.59	0.187	2.49	-12300.590	-5.57	-	-
Medium education post reform	-0.020	-1.65	0.225	7.30	-1092.677	-1.51	-	-
High education post reform	-0.009	-0.83	0.214	6.48	2227.170	2.81	-	-
Low education post reform rural	0.008	3.35	-0.035	-0.33	14400.560	6.35	-	-
Medium education post reform rural	0.009	3.95	-0.063	-1.23	5824.648	5.14	-	-
High education post reform rural	-0.014	-0.50	0.081	1.06	-4263.444	-2.4	-	-
Partner medium education	0.011	2.67	0.097	3.35	4490.240	6.56	0.006	0.41
Partner high education	0.010	2.35	0.170	5.23	9453.484	12.8	0.035	1.59
Larnaca region	0.005	1.33	-0.056	-1.37	1116.217	1.41	0.071	2.52
Limassol region	0.004	0.82	-0.026	-0.65	942.371	1.23	0.078	2.86
Nicosia region	0.013	1.97	-0.029	-0.70	3996.397	4.52	0.085	3.05
Paphos region	0.007	2.14	-0.060	-1.40	2372.491	2.49	0.064	2.06
Number of children 1-2	0.001	0.50	0.050	1.73	783.130	1.41	-0.013	-0.93
Number of children 3-6	-0.001	-0.51	0.076	2.85	985.801	1.77	0.010	0.78
Number of children 7 -12	0.000	0.11	0.079	3.03	1310.519	2.49	-0.012	-0.97
Number of children 13-18	0.002	1.11	0.059	2.35	1979.146	3.93	-0.005	-0.44
Number of additional adults	0.007	1.90	0.009	1.39	537.913	3.66	-0.002	-0.53
Mills ratio	-	-	-0.212	-0.69	78744.430	6.31	0.076	0.56
Cohort 1938-1948 medium education	-0.006	-0.47	0.070	1.08	-2594.612	-2.83	-0.005	-0.19
Cohort 1938-1948 high education	-0.071	-1.25	0.473	6.30	-8761.372	-4.74	-0.010	-0.40
Cohort 1948-1958 low education	-0.004	-0.53	0.031	0.75	-2575.356	-4.17	-0.009	-0.37
Cohort 1948-1958 medium education	-0.003	-0.29	0.167	3.45	-2572.491	-3.23	0.006	0.27
Cohort 1948-1958 high education	-0.003	-0.27	0.374	6.76	-2006.188	-1.9	0.012	0.49
Cohort 1958-1968 medium education	-0.000	-0.05	0.088	1.86	-3703.179	-4.74	0.010	0.46
Cohort 1958-1968 high education	0.002	0.36	0.314	5.72	-1321.762	-1.39	0.003	0.12
Cohort 1968-1978 medium education	-0.004	-0.39	-0.033	-0.65	-5697.874	-6.47	-0.008	-0.35
Cohort 1968-1978 high education	0.005	0.86	0.110	2.01	-2370.241	-2.3	0.004	0.20
Rural low education	0.003	0.62	0.038	0.88	-931.809	-1.32	-0.038	-1.43
Rural medium education	-0.006	-0.67	-0.013	-0.43	-1914.120	-3.69	-0.013	-1.03
Rural high education	0.001	0.12	-0.100	-1.96	-2318.905	-2.8	-0.004	-0.31
Public sector low education	-	-	0.115	2.19	142.329	0.23	0.062	2.56
Public sector medium education	-	-	0.145	5.95	1019.973	2.35	0.027	2.55
Public sector high education	-	-	0.184	6.50	1246.343	1.78	0.018	1.78

Table 2.7: Selected Parameter Estimates for Married Females

Variable	Participation		Ln Wage		Non-Labour Income		Ln Hours	
	Parameter	T-ratio	Parameter	T-ratio	Parameter	T-ratio	Parameter	T-ratio
Ln net hourly wage rate	-	-	-	-	-	-	0.152	4.57
Non-Labour Income	-0.000	-2.99	-	-	-	-	-0.000	-2.09
Low education post reform	-0.040	-1.23	0.218	2.96	3086.834	2.56	-	-
Medium education post reform	-0.024	-0.57	0.181	4.88	-4118.834	-4.85		-
High education post reform	0.009	0.17	0.255	7.64	1181.35	1.54	-	-
Low education post reform rural	-0.119	-1.54	-0.182	-1.59	-23371.28	-8.70	-	-
Medium education post reform rural	0.119	2.54	0.215	3.24	22701.02	10.39	-	-
High education post reform rural	0.047	0.58	0.097	1.23	7419.794	4.13	-	-
Partner medium education	0.025	1.03	-0.003	-0.09	4970.706	7.34	0.023	0.77
Partner high education	0.029	0.91	0.036	0.95	8213.737	11.43	0.028	0.88
Larnaca region	-0.107	-2.28	-0.217	-4.16	-17831.51	10.03	0.126	2.33
Limassol region	-0.128	-2.74	-0.216	-3.92	-20852.38	10.31	0.145	2.59
Nicosia region	-0.025	-0.57	-0.058	-1.28	4848.867	-4.94	0.191	4.22
Paphos region	-0.092	-1.74	-0.120	-2.28	15060.7	-9.15	0.172	3.25
Number of children 1-3	-0.028	-0.82	-0.079	-3.16	-12647.81	10.48	-0.051	-2.60
Number of children 3-6	0.051	1.44	0.000	0.02	-1465.287	-4.08	0.012	0.81
Number of children 7 -12	0.018	0.56	-0.039	-2.64	-5839.857	-9.93	0.002	0.21
Number of children 13-18	0.044	1.56	-0.044	-3.09	-2234.009	-6.58	0.015	1.57
Number of additional adults	0.047	0.95	0.021	2.17	3751.236	9.25	0.013	1.62
Cohort 1938-1948 low education	-0.250	-2.61	-0.207	-1.05	50987.26	10.05	0.076	0.58
Cohort 1938-1948 medium education	-0.161	-1.52	-0.099	-0.54	-32543.46	-9.28	0.053	0.45
Cohort 1938-1948 high education	0.097	0.98	0.596	3.31	20829.14	7.48	0.002	0.02
Cohort 1948-1958 low education	-0.08	-0.94	0.028	0.17	-15030.45	-8.26	0.068	0.58
Cohort 1948-1958 medium education	0.068	0.77	0.249	1.50	15267.49	8.73	0.100	0.86
Cohort 1948-1958 high education	0.216	3.27	0.606	3.40	42625.24	10.98	0.096	0.74
Cohort 1958-198 low education	0.006	0.07	0.085	0.50	2910.447	2.83	0.009	0.08
Cohort 1958-1968 medium education	0.139	1.73	0.295	1.75	27727.2	10.37	0.070	0.58
Cohort 1968-1978 high education	0.280	5.20	0.511	2.77	55536.54	10.68	0.165	1.20
Cohort 1968-1978 medium education	0.177	2.39	0.246	1.43	32858.66	9.84	0.103	0.83
Cohort 1968-1978 high education	0.326	6.99	0.469	2.45	119884.9	10.50	0.138	0.96
Rural low education	0.040	0.92	0.044	0.67	61473.83	6.29	-0.107	-2.72
Rural medium education	-0.153	-2.50	-0.191	-2.75	-23371.28	-8.98	0.039	1.35
Rural high education	-0.102	-2.18	-0.194	-3.94	22701.02	10.88	-0.028	-1.00
Public sector low education	-	-	0.242	3.00	1081.758	1.07	0.103	2.47
Public sector medium education	-	-	0.421	12.06	105.6003	0.14	-0.013	-0.59
Public sector high education	-	-	0.380	9.41	642.719	1.07	0.041	1.73
Mills ratio	-	-	0.752	4.39	119884.9	11.15	0.146	0.99
Partner working	0.215	7.28	0.180	4.25	47344.75	19.70	0.120	1.68

2.8. Figures

Figure 2.1: Income Tax Brackets and Marginal Tax Rates in 2003 and 2009
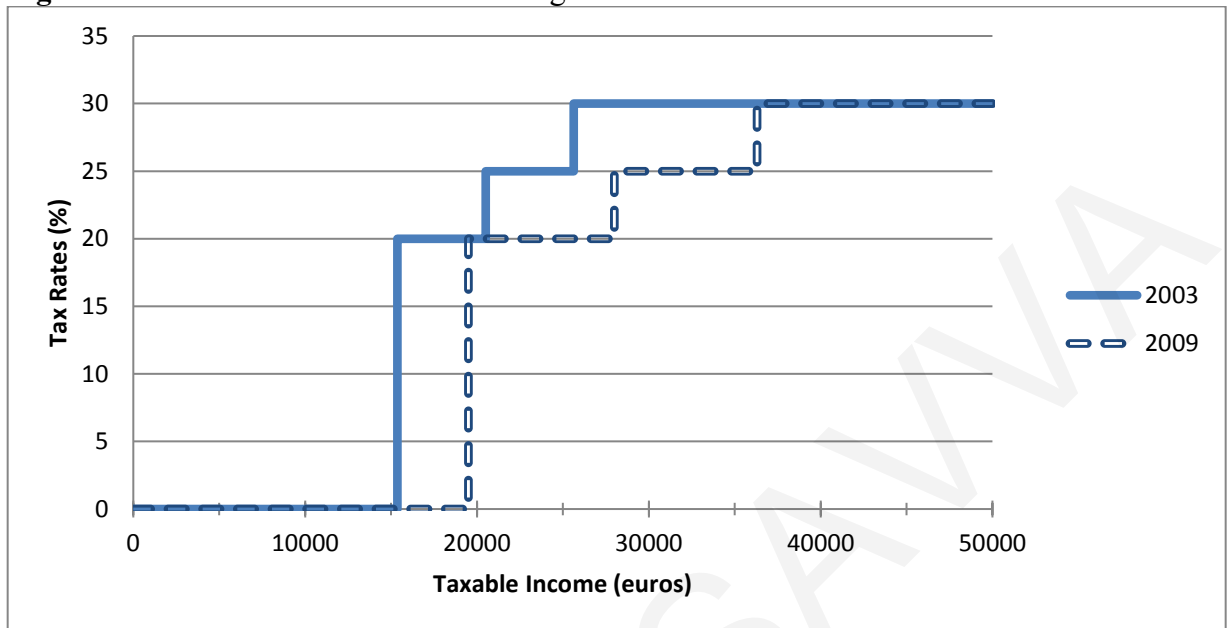
Note: Information used for the construction of the figure comes from the Tax Department of Cyprus.

Chapter 3

Can Labour Supply Differences Among Southern European Countries be Justified by the Income Tax System?

3.1. Introduction

It is observable that in many European countries a considerable variation in the levels and trends of aggregate labour supply exists (Prescott, 2004, Rogerson, 2006, 2009, Ohanian, Raffo and Rogerson, 2007 and many others). Based on the findings of the existing literature, it seems that people in Southern and especially in Eastern countries work more hours than people in Northern countries, although the participation rates in many cases are following the opposite pattern (Bick, Bruggemann and Fuchs-Schundeln, 2014). Much of the variation across the existing findings is due to different methodological choices, including the type of data used (register data or interview-based surveys), the selected demographic group (e.g., single parents) and the period of observation. Although, the most important source of variation is the type of the estimation method.

Beyond these differences in the empirical part, there is still an unanswered question: do the differences exist between countries because of their ancestry differences and their cultural backgrounds or by the different work incentives that the tax-transfer systems create? It is undeniable that the tax system constitutes an essential factor for boosting economic growth that has long been under investigation by policy makers and researchers. Following the financial crisis where many European countries faced several difficulties in consolidating their budgets as well as promoting economic growth, one approach that was followed by several countries was the reconsideration of their respective tax system design and especially labour taxation. Many studies have tried to justify the differences in labour supply among countries,

by examining whether these differences exist uniformly in the populations or whether they are due to the various tax systems (Bargain, Orsini and Peichl, 2014). The main subject of this literature focuses on policy differences and differences in secular trends resulting from populations' different preferences.

Our research concentrates on the stylised differences that exist among populations and examines whether differences in labour supply result from population preferences or from the existing income tax systems and their specific features. This chapter focuses on the Southern part of Europe. In order to minimise the impact of gene differences and population preferences, based on ancestry, language and cultural indices, we selected Cyprus, Greece and Italy which share common cultural background and similar preferences, compared to other neighbouring European countries, but at the same time exhibit noticeable differences[1] in their labour market behaviour. Furthermore, the selection of the specific countries was based on the fact that they use the same progressive, individual tax system. However, it is noted that the tax system the three aforementioned countries use differs in specific features with the most important one being the untaxed income. Cyprus has a more generous tax system since the tax rates are lower than the ones in Greece and Italy. Most importantly, the tax free income in Cyprus is significantly higher compared to Greece while in Italy the institution of the tax free income does not exist. Finally, for this study we restricted the sample to single men and women without children in order to minimise the effect of other factors on labour supply and investigate the factor of the income taxation. It has been observed by existing studies that singles without children hardly react to changes compared to married individuals or single parents (Bargain, Orsini and Peichl, 2014, Bargain et al., 2009, Euwals and Van Soest, 1999, Haan and Steiner, 2005).

To net out any possible measurement differences arising from data, periods and methods we use a harmonise approach. We make use from a unique set of data with comparable variable definitions and we estimate for each country the same structural labour supply model. Afterwards, to investigate to what extent those differences in labour supply behaviour are justified by the different features of the income tax systems of the three countries we swap

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[1] According to ILO stylised facts the participation rates for the year 2007 for Cypriot men are 72.5 and 55.2 for women with the respective rates for Greece being 64.1 and 42.5. In Italy the relevant participation rates are 60.4 for men and 37.7 for women.

their tax-benefit systems using micro-simulation procedure by changing the tax rates and bands as practiced in each country. Taking into consideration that the countries selected for the present study share similar preferences, the impact of the factor population preferences is controlled and minimised. In this respect, by using the swapping method it is expected that the response of the population to any changes in the tax system will be the same with regards to labour supply, whether these are positive or negative.

The results show that by interchanging these features of the tax scheme, the participation rates and working hours increase as the disposable income increases while the labour supply decreases as the disposable income decreases. It is evident that these institutional characteristics could justify the differences in labour market between the three countries. In general, a generous tax system increases work incentives. Therefore, it increases participation rates and working hours. On the other hand, a less generous system has an adverse effect since it reduces work incentives.

The chapter is organised as follows: in Section 3.2 we review existing literature on labour supply in general across countries and the use of micro simulation regimes. In Section 3.3, we describe the main differences in the characteristics of the sample countries used in this study associated with their tax institutions and culture. A brief review of the data used is described in Section 3.4. In Section 3.5 we develop the empirical approach adopted and in Section 3.6 we present the estimation results and simulation results under the various tax systems. Finally, Section 3.7 concludes.

3.2. Literature Review

A large literature has emerged motivated by the observation that aggregated labour market outcomes differ significantly across European and OECD countries. A lot of studies try to justify these differences using the tax system of each country (Prescott, 2004, Blanchard, 2006, Alesina et al., 2006, Blundell et al., 2013, among others). The principal object is to examine the size of the wage and income elasticities.

A great variation of results has been observed by the existing empirical evidence available for European demographic groups which could be justified to some extent by the different

methods and types of data sets used in each case. Even studies examining the same country report contrasted results with different orders of magnitude due to the implementation of different methods (e.g., the Hausman approach in Bourguignon and Magnac, 1990, discrete-choice models in Bargain and Orsini, 2006). Moreover, married women, a demographic group that has been heavily examined, exhibit higher wage elasticities when using the Hausman approach, instrumenting wages and non-labour income than when implementing the discrete choice models with the set of a finite choice of hours. In any case, women in couples still appear to exhibit the highest wage and income elasticity estimates among all demographic groups while the relevant estimates for men in couples are usually very small. Wage and income elasticity estimates obtained through discrete-choice models are somewhat easier to compare with other studies but differences still exist, most likely driven by the selection criteria of the demographic group and the type of the used data. For instance Laroque and Salanie (2002) used administrative data compared to Bargain and Orsini (2006) who used household surveys.

A recent study (Bargain, Orsini and Peichl, 2014) aims to fill the gap and achieve results suitable for international comparisons. In this case an international comparison of labour supply elasticities was done across 17 European countries and the US using a common empirical approach. For their research they used the discrete choice model. Their results illustrate that differences in labour supply behaviour might indeed reflect different consumption-leisure preferences which contradicts to some extent with the view of Prescott (2004) who supports that redistributive tax benefit systems completely determine differences in labour supply behaviour. Furthermore, they report that the cross-country elasticity difference is relatively small, or at least it is much smaller than previous studies have shown. For the disposable income calculation they use EUROMOD, a static tax-benefit micro simulation model, that currently covers 19 Member States of the European Union, 15 Member States prior to 2004 and 2007 enlargements, plus Estonia, Hungary, Poland and Slovenia.

Micro simulation models are very popular nowadays and are commonly used by economists to analyse various policy problems especially in the field of tax-benefit systems. Among them, Blundell et al. (2000) develop a full structural model of discrete-hours labour supply and estimate the impact of the transition from the Family Credit (FC) to the Working Families Tax

Credit (WFTC) both on couples and on single females. Another example is Netherlands, Van Soest and Das (2001) who apply the discrete hours setting to estimate the labour market impact on female labour supply using different tax reform scenarios. Additionally, Aaberge, Colombino, and Strøm (2004) use a micro econometric labour supply model to simulate behavioural responses of married couples to the replacement of the Italian tax system of 1993 by three alternative tax transfers regimes. A few years later Orsini (2006) estimated the effects of the tax-benefit reform on Belgium labour supply in contrast to other policy reforms which took place in other European countries.

Dearing, Hofer, Lietz, Winter-Ebmer and Wrohlich (2007) investigate whether the fact that mothers in Austria work more hours than mothers in Germany is due to the different design of the tax system or due to their behavioural preferences in general. The main factors under investigation are the different definitions of the tax unit and the parental leave benefit scheme, which is more generous in Austria. The subject study uses micro-simulation techniques and more specifically a "swap" of the current tax-benefit systems in the two countries. Firstly, they estimate the actual labour supply in Germany and Austria. Afterwards, they simulate for each country the introduction of the tax-benefit rules of the other country and predict labour market outcomes under the simulated scenarios. The main assumption is that all the benefits and income thresholds are taken from one country to the other. Based on their empirical results, the main differences can be justified by the different work incentives the different tax-benefit system promotes. Their results support that labour force participation of German mothers would rise considerably if Germany introduced Austria's income tax and parental leave benefit institutions. However, it is noted that a remaining part of the differences cannot be explained by the particular institutional characteristics.

This "swap" method is also commonly used to examine policies concerning child poverty. Levy, Lietz and Southerland (2007) compare the tax benefit support of children in Austria, Spain and the UK. Also, Levy et al. (2009) examines the impact of a reduction reform of non-refundable tax credit in Poland and estimates the results if instead of that reform the government in Poland had implemented policies of other countries. Specifically, all 2005 Polish child policies are eliminated and replaced by the policies followed in Austria, France and the United Kingdom. The monetary amounts which resulted from the policies "borrowed"

by the other countries were scaled by GDP per capita ratio. The tax concessions also scaled, but no adjustment was made to the tax schedule or the tax base. All systems of the above countries reduced poverty risk in almost all types of households compared to the Polish system.

Following the referred literature, the rest of this study focuses on the use of micro simulation techniques and the EUROMOD model in order to define to what extent differences in labour supply behaviour can be justified by the different features of the income tax systems. Initially, we use a common model between Cyprus, Greece and Italy in order to get the labour supply elasticities which correspond to their own tax-benefit system and subsequently use the same model under the scenario of swapping the tax-benefit system between the three countries.

3.3. Differences between Countries
3.3.1. Tax Systems Characteristics and Differences

To begin with, it is noted that Cyprus, Greece and Italy have an individual income tax system that is progressive. However, there are differences between the tax systems of these three countries. In Cyprus, the amount of tax free income is always higher compared to the other countries. Greece follows with a significantly lower amount of tax free income and last but not least comes Italy which since 2007 has no tax free income. For the purpose of this study we focus on the year 2007 which is the year right before the great recession of 2008 and right after 2006 where a great reform occurred in Italy (Schindler, 2009; Pellegrino and Vernizzi, 2010; Ceriani, Figari and Fiorio, 2012; Ceriani and Gigliarano, 2010). More details about the tax rates history of each country is presented in Appendix B. The sample of interest is restricted to single people without children. By using this sample we focus on tax system differences, specifically the tax free income and tax rates of the three countries, while any policies concerning children and families affecting labour supply are avoided. Any given information about the tax system rules and benefits is about to that specific population group, which is the focus of this chapter. Graph 3.1 presents the tax rates for the year 2007 for each of the three countries respectively.

At first glance, it is obvious that the difference of tax free income in Cyprus, which is approximately €20000 per individual, is almost double compared to Greece. In Greece, despite the fact that the relevant amount is low, it increases to €1500 for employees and pensioners. On the other hand, in Italy tax is imposed on income from the first euro earned. Nevertheless, in Italy there are tax credits depending on the annual income received[2].

Apart from the tax free income, significant differences exist on the tax rates of the three countries. Once again Cyprus' tax system is more generous compared to the other countries. The highest tax rate in Cyprus is up to 30 percent compared to Greece and Italy which is 40 and 43 percent respectively. However, the income that is subject to those tax rates varies at some degree between the three countries. The taxable income in Cyprus is comprised of employment earnings and rental income[3]. For Greece the taxable income is comprised of earnings from employment, rental income, sickness benefits and private transfers. Finally, Italy's taxable income is comprised of employment income, unemployment benefits, fringe benefits, rental[4] income and the cadastral value of buildings[5].

Nevertheless, the definition of sickness and unemployment benefits differs in amount and duration between the three countries. In Cyprus in order for an insured individual to be qualified for sickness and unemployment benefits, 26 weeks must pass, at least from the day of sickness or unemployment respectively. In case the aforementioned condition is met, insured individuals may receive the subject benefits for 156 working days and may be qualified again or may extend unemployment and sickness benefits subject to returning to work for at least 13 weeks. The amount of the benefits is calculated on the basis of the weekly mean of paid and credited insurance earnings of the insured person during the previous contribution year, which includes a basic and a supplementary amount. The weekly benefit is equal to 60% of the weekly mean of the basic insurance earnings and the supplementary benefit is equal to 50% of the weekly mean of supplementary insurance earnings. On the other hand, in order for claimants in Greece to be qualified for the unemployment benefit they need to have worked and paid contributions for either 80 days per year over the last two years, of

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[2] The maximum amount for the year 2007 that someone can get is €1338 to €1840 depending on the amount of income received.
[3]From which 20% is exempted from the tax base.
[4]The taxable rental income amounts to 85% of the gross rental income.
[5] Cadastral income is re-evaluated by 5% for other properties that do not receive rental income.

which 125 days must be in the last 14 months, or 200 days in the last two years excluding the last two months. In 2007, the relevant benefit was €367.38 per month and the benefit duration is a function of contributory record; it is payable for 12 months at most with the average duration being 7 months. The sickness benefit, which is also subject to tax, depends on the employee's insurance class during the last month prior to the disease. The duration depends on the insurance days and it is between 182 to 720 days maximum. The daily amount for the first 15 days is 25% of the daily wage corresponding to the person's insurance class and increases to 50% from day 16 and onwards.

Finally, the unemployment benefit for Italians is granted to insured employees who have made unemployment contributions for at least 2 years or 52 weeks in the two years period prior to the date of work suspension. The unemployment benefit and its duration differ based on the age of the employee. The benefit is eligible for less than 7 months for employees younger than 50 years old, and 10 months for those older than 50 years old. The benefit amount is 50% of previous monthly income for months 1-6, 40% for months 7-9 and 30% for following months. The sickness benefit in Italy is called sickness leave and it is given to employees suffering from any disease which may cause them inability to work. The subject benefit lasts no more than 180 days per year and it is equal to 50% of the daily wage for the first 20 days and 66.66% for the subsequent days of sickness.

Besides the personal income tax there are also taxes imposed on capital income. In Greece the interest income is subject to a tax rate of 10% and there is additional tax on rental[6] proceeds depending on the property squares. For Italy, apart from the tax on interest, which is set at 27%, bonds and dividends tax exists which is set at 12.5%. In Cyprus there is special contribution for defense, an interest tax and dividends at 10% and rental income tax at 15%. However, if the total annual income does not exceed the amount of €11.960, individuals in Cyprus have the right to be refunded the amount of the withhold contributions for defense, on interest that exceeds the amount which corresponds to 3%. Table 3.1 summarises the tax system characteristics of each country.

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[6]An additional tax of 1.5% if square meters are less than 300 and 3% above 300.

Likewise the unemployment and sickness benefits, there are also some other kind of benefits that can be claimed by single individuals, in each country. In Cyprus, there is the public assistance benefit which refers to individuals with income that is not enough to cover their basic and special needs and a rent subsidy. The rent subsidy is available to refugees' citizens and is between 66-133 euros per month, depending of their income level. About the public assistance benefit, the Social Welfare Services calculate the income needed in order to cover the basic and specific need and compare with the actual income; the difference is paid as public assistance benefit. The monthly minimum threshold for the year 2007 was €379.31. Something analogous exists in Italy and is called minimum insertion income. This policy was introduced in 1999 as an experimental policy to tackle poverty and social exclusion. Eligible individuals must either do not have any income or have an income below the fixed threshold. For the relevant year, the threshold was 278.88 euros. In Greece, there is a rent subsidy too which depends on contributory records. Single applicants need to have at least 10 years of contributions and is equal to €115. In addition, there exists a benefit for young persons aged 20-29. It is paid to persons aged 20-29 on condition that these are out of work and remain in the unemployed records for one year. The benefit is payable for a period of five months; for 2007 it was €73.37 per month.

In order to end up with the net disposable income, all relevant taxes along with social insurance contributions are subtracted from the gross disposable income and the various benefits[7] are added.

3.3.2. Ancestry, Language and Culture

A large bibliography exists dealing with cultural differences among people. To capture relations between populations, geneticists have devised summary measures called genetic distances. One of the most widely used genetic distance measure, firstly suggested by Sewall Wright (1951), is called Fixation Index (F_{ST}). F_{ST}, measure is a summary measure of differences in allele frequencies across a range of neutral genes and captures the length of time from which two populations are separated from each other. When two populations split, random genetic mutations result in genetic differentiation over time. The longer the separation

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[7] The unemployment and sickness benefits calculated for each country according the analogous tax-benefit system.

time is, the greater the genetic distance computed from a set of neutral genes is. In other words, F_{ST} genetic distance is a direct measure of relatedness between populations. The first data on genetic distance was provided by Cavalli-Sforza et al. (1994), and it was available at the level of populations. It was therefore necessary to match genetic groups to countries. Spolaore and Wacziarg (2009) did so by using ethnic composition data in each country by Alesina et al. (2003), who listed 1,120 country ethnic categories constructing in this way measures of genetic distance between countries, rather than groups. Two such measures were constructed with the first one being the distance of the plurality of ethnic groups of each country in pairs, i.e. groups with the largest shares of each country's population. Second, is the measure of the weighted genetic distance. Many countries, such as the United States or Australia, are made of sub-populations that are genetically distant and for which both genetic distance data and data on the share of each genetic group are available. The interpretation of these measures reflects the expected genetic distance between randomly selected individuals, one from each country. For plurality groups, weighted genetic distance is highly correlated with genetic distance, their correlation is 93.2%. Besides genetic distances, three more measures are used to separate cultural preferences between countries. That is the linguistic distance, the religious preferences distance and the cultural preferences distance. Cultural distance preferences are based on answers to questions from social surveys which were used as indicators for respondents' cultural norms.

For the purpose of this research we mainly focus on the genetic distance and the cultural preferences indices. According to those indices Cyprus, Greece and Italy share very common cultural traits compared to other European countries. Table 3.2 displays the specific variables for Cyprus, Greece and Italy. A more detailed table displaying all European countries is included in Appendix B Table B4. In Table B4 the variable of weighed genetic distance for Cyprus ranges from 0.0001 to 0.1002, the weighted linguistic distance ranges between 0.4584 to 0.9983 and the weighted religious distance from 0.4433 to 0.9203. The smallest the figure is between the two countries the more common characteristics they share based on the variable of interest. Finally the cultural distance preferences variable ranges from -49.9063 to 27.0468. Once again, small differences indicate that the countries share similar cultural preferences.

3.3.3. Labour Market Institutions

In the economics literature some labour market institutional indicators have proven to be capable of explaining at a great extent the differences in the structure, the dynamic of wages and (un)employment rates across countries. In many cases labour market institutions have received much blame for having contributed to high unemployment rates in Europe. Specifically, the three types of labour market institutions which mainly affect the labour market outcomes are Minimum Wages (MW), Unemployment Insurance (UI) and Employment Protection Legislation (EPL).

Most of the theoretical and the empirical bibliography concentrate on minimum wage, exhibiting lots of disagreements on how affects the employment factors. The debates in this area on one hand suggest the reduction of employment in the event of a rise in the minimum wage (Brown et al., 1999). On the other hand, many studies contradict those findings and support that employment increases when the minimum wage changes (Katz and Krueger, 1992, Card and Krueger, 1994). Referring to the question countries of this research the minimum wage in Cyprus is higher compared to Greece, while in Italy there is no a legislation about minimum wage. In Cyprus the minimum wage for the year 2007 was set to 835 euros at hiring and to 887 euros after the six months of employment. However, the minimum wage legislation not covers all occupations. Is applied to eight categories; sales stuff, clerical workers, auxiliary healthcare stuff, auxiliary staff in schools, security guards and caretakers.

On the other hand the minimum wage legislation in Greece is different for workers in the private sector and workers in the public sector. In the public sector is determined by law, according to the government's annual income policy. In the private sector the National General Collective Labour Agreement sets the overall minimum wages for white and blue collar workers. The amount of minimum pay varies depending on a workers years of service and family status. For the selection group of this research the minimum monthly wage of blue-collar workers was between 587-725 euros and the respectively wage for white-collar workers was between 657-843 euros. Following the crisis, the minimum wage was reduced further, as an under examination measure for exiting crisis (Dedoussopoulos et al., 2013, Matsaganis, 2011, Koukiadaki and Kretsos, 2012). In contrast to Cyprus and Greece there is no minimum wage amount in Italy, as the amount one is paid is agreed upon through collective bargaining

agreements on a job to job basis. Although, the wages must be proportionate to the quantity of work done and high enough to provide a minimum subsistence for the worker.

The unemployment insurance (UI) benefits affect post-unemployment outcomes. The basic microeconomic search model predicts that higher benefits raise expected reemployment wages via higher reservation wages. More generally, it is plausible that more generous UI may improve the quality of job matches by allowing further investment in job search, thus resulting in higher wages and longer employment spells. As we mentioned before, the unemployment benefit varies in duration and amount between the three aforementioned countries. In Greece the relevant amount is stable and for the year 2007 was set to €367.78 per month and is payable for 12 months at most with the average duration being 7 months. On the other hand, in Italy and in Cyprus the benefit amount depends on the previous income of the claimants. In Italy is equal to 40% of the previous monthly income and is eligible for less than 7 months for employees younger than 50 and 10 months for those older than 50 years old. The relevant benefit in Cyprus is equal to 60% of the weekly mean of the basic insurance earnings and a supplementary benefit equal to 50% of the weekly mean of supplementary insurance earnings. The insured individuals may receive the subject benefits for 156 working days.

Finally, the employment protection legislation (EPL) has many dimensions. It includes laws pertaining to severance pay and advance notification of layoffs, restrictions on valid reasons for worker dismissals, restrictions pertaining to the selection of whom to layoff in case of collective dismissal, rules governing the use of fixed-terms contracts and restrictions concerning temporary work agencies. In all the aforementioned countries there exist laws and regulations about the employment protection which should be followed by employers that aim to protect employees. Most of the regulations deal with the notification procedures in the case of dismissal of a worker or in case of the employer being insolvent, the amount of the severance pay and mostly covers the problems that may arise for the employee interest.

3.4. Data

The empirical analysis for all countries is based on the 2007 wave of the European Community Statistics on Income and Living Conditions (EU-SILC)[8]. The datasets are representative samples of households with detailed information on household income, working hours and demographic characteristics. The datasets at use have been assembled within the framework of the EUROMOD[9] project (Sutherland, 2007) combined with tax-benefit simulations for the year 2007. Datasets have been harmonised in the sense of similar income concepts together with comparable variable definitions.

For the estimation of labour supply we restricted the sample on two selections, single men and single women with no children. The specific sample is chosen because it is expected to be more reluctant to react to changes compared to other samples such as married couples and single parents. As already pointed out before, this chapter focuses on the tax free income and tax rate differences between the three chosen countries which affect work incentives. By choosing individuals with no children there is no reason to control other policies that affect individuals such as child benefit and child tax credits. For the purpose of this study we use only households where adults are available to the labour market with age ranging from 25 to 65 and are neither disabled nor retired. The self-employed and farmers are excluded as their labour supply decisions probably differ from those of salary based workers. Table 3.3 presents the descriptive statistics for the subject sample focusing on the idealistically chosen year 2007.

The variables corresponding to weekly disposable income and non-labour income define the net income per week for each individual. The disposable income is comprised of the income an individual receives from employment and benefits after the social insurance and the income taxes are subtracted. The non-labour income includes income generated from other sources apart from employment, such as property income, rental income and dividends.

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[8] The Greek EU-SILC is prepared by the Greek National Statistical Office "PDB". The Italian version of the EU-SILC was made available by ISTAT. The Cypriot EU-SILC is collected by the Department of Statistics and Research of the Republic of Cyprus.

[9] EUROMOD is maintained, developed and managed by the Institute for Social and Economic Research (ISER) at the University of Essex, in collaboration with national teams from the EU member states.

Male and female wage rates are calculated by dividing the reported monthly earnings by the actually reported working hours of an individual. The variables regarding part time and full time employees are according to the hours histograms and the respective discrete choices selected for this research. For this analysis the discrete choices are 0, 30 and 40 hours, hence part time workers are considered those who belong to the discrete choice of 30 hours and actually work less than 34 hours in respect to the total sample. Respectively, full time workers are the individuals under the choice of 40 hours who work more than 34 hours in respect to the total sample. Variables regarding education are constructed based on the education status of the individual. Therefore, higher education refers to individuals who have completed university, medium education includes the people who have completed secondary school and low education group includes individuals who have completed primary school. The variable concerning the "Number of persons in the house" indicates the total number of people who live in the same household with the individual. The variable "Head" is a dummy variable which takes value 1 when the individual is the owner of the household and the corresponding responsible person for the household and 0 otherwise. The sample used in this research suggests that at a high percentage individuals who may be single with no children live in the same household with other people. An important characteristic is also the fact that the percentage of people who are responsible for their houses ranges between 20% to 30%. Finally, the variable "Living in urban area" describes the percentage of people who live in more congested areas.

At first glance the difference between the working hours and the participation rates between the three countries is noticeable. The difference between Cyprus and the other two countries is remarkable. In Cyprus those numbers are constantly higher in comparison with the other two countries. An interesting observation that can be found in the summary statistics is the differences between the various levels of education. The level of education affects the labour supply of men and probably women too. Likewise, the probability of participating in the labour market might be affected by the level of education. Specifically, individuals with high-level education have higher probability of participating in the labour market. Cyprus compared to the other countries has the highest percentage of individuals with higher education in all demographics groups while Greece follows. An interesting case is the case of Italy where the highest education status reached is composed of individuals who have some or completed

secondary school. Furthermore, age has a negative and increasing effect on the extensive and the intensive margin, e.g. older individuals have lower probability of participating in the labour force than younger individuals; as the age increases the probability of employment decreases even more. It is obvious that differences exist in working area relevant to the extensive and the intensive margin[10].

3.5. Econometric Model and Methodology
3.5.1. The Labour Supply Model

Most studies mainly focus on results derived from the Hausman model, Blundell and MaCurdy (1998) and Evers et al. (2008). However, the traditional approach is usually restricted to the case of piecewise linear and budget sets. Also, the quasi-concavity of the utility function is implicitly imposed a priori. Apart from that, there is an issue on handling joint labour supply decisions for couples or participation decisions. On the other hand the use of instrument variable procedures solves the main problem of endogeneity of the observed wages and virtual incomes without imposing any parametric restrictions. However, to find proper and valid instruments that are generally accepted is not an easy task.

Most recent studies are usually based on the use of the discrete-choice model as it appears to solve many of the issues occurred by the use of continuous labour supply models of Hausman (1981). The discrete choice approach is based on the concept of random utility maximisation (Van Soest, 1995, Hoynes, 1996, among others). The explicit parameterisation of consumption-leisure preferences is required in order for the utility to be evaluated at each discrete point which can be estimated directly by maximum likelihood estimation techniques. There is no need to imposed tangency conditions as the model is in principle very general. The labour supply decisions are reduced in choosing among a discrete set of possibilities, e.g., inactivity, part-time and full-time. In this respect, there is no need to restrict preferences and in particular to impose their convexity. This solves several problems encountered by the

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[10] The differences were much more significant when using a more aggregate sample, although for reasons already mentioned, the specific sub-sample has been chosen.

Hausman method. The discrete choice model includes non-participation as one of the options in order to directly estimate both extensive and intensive margins. This is an important factor since most labour supply adjustments occur around this margin (Heckman, 1993, Eissa and Hoynes, 1998). The complete effect of the tax-benefit system is easily accounted for, even in the presence of non-convexities in budget sets. Work costs, which also create non-convexities, are handled relatively easily. The only restriction to the model is the imposition of increasing monotonicity in consumption, which seems to constitute a minimum requirement for meaningful interpretation and policy analysis.

In this chapter we follow the approach of Van Soest (1995), Aaberge et al. (1995, 1999), Hoynes (1996), Blundell et al. (2000), Eissa and Hoynes (2004), Eissa et al. (2008), Labeaga et al. (2008) as it is used in the Bargain, Orsini and Peichl (2014) article. The discrete choice model of labour supply is based on the assumption that an individual may choose among a finite number h+1 of working hours (h corresponds to positive hours and h=0 corresponds to non-participation); each hour h=0,...,k corresponds to a given level of disposable income yij and each discrete bundle of leisure and income provides a different level of utility. The utilisation of such models has become standard practice as it provides a straightforward method to account for taxes and benefits, hence nonlinear and non-convex budget sets and the joint labour supply of spouses.

The theoretical labour supply basis originates from the standard assumption that individual i maximises a quasi-concave utility function:

$$U = U(y, h; Z) \tag{3.1}$$

where y represents income, h hours of work and Z represents individual characteristics. Consumers maximise utility subject to usual budget constraint, which is defined in terms of gross real wages, w, total household non-labour income, μ, and the tax system T (h, w, μ, Z). If no fixed costs exist, the budget constraint is estimated by the following equation:

$$\mu = wh + \mu - T(h, w, \mu, Z) \tag{3.2}$$

where T(h, w, μ, Z) are tax payments subtracted from benefits.

Consumer's problem then takes the following form:

$$Max_h U(y,h;Z) \text{ s.t. } \mu = wh + \mu - T(h,w,\mu,Z) \tag{3.3}$$

The solution to equation (3.3) is not such an easy task because T (.) is non-linear, however it is always possible to optimise for a given marginal tax rate by obtaining a parametric Marshallian labour supply function. Nevertheless, the discrete choice model approach starts by specifying utility U (.) and its parameters instead of estimating the Marshallian labour supply parameters. Below, a flexible quadratic utility function is adopted:

$$U^*(y,h,Z) = a_{yy}y^2 + a_{hh}h^2 + a_{yh}yh + b_y(Z)y + b_h(Z)h + \varepsilon_{hi} \tag{3.4}$$

for the singles subsample which constitutes the sample for this research. The variables h and Z represent hours and demographic characteristics of the individuals respectively. The parameters of income and hours may be linear functions of individual demographic characteristics thus:

$$b_y = b_{y0} + b_y^{'}Z + u_i \tag{3.5}$$
$$b_h = b_{h0} + b_h^{'}Z_h + u_i$$

These functional forms are easily handled and allow a wide range of potential behavioural responses because of the alternatives. The terms b_y and b_h also incorporate unobserved heterogeneity, in the form of normally-distributed term u_i, in order for the model to allow random taste variation and unrestricted substitution patterns between alternatives. The normality assumption is mainly made for purposes of convenience but it could in principle be replaced by a more flexible distribution.

3.5.2. Econometric Methodology

We estimate the parameters of utility function (3.4) for two different subsamples of the population according to their gender and select the sample consisting of only potential wage-earners. Nevertheless, since it is likely that marital status may significantly affect labour supply, we only concentrated to the singles sample. For the estimation of a discrete choice model, we must first decide the finite set of hours $h_i \in \{h_1, h_2, \ldots, h_{k_i}\}$, according to which individuals choose their working hours. The suitable number of intervals is evaluated by examining the histograms of hours for both genders of singles. Having decided the choice set, we have K_i alternative values for hours for agent i, which determines the total income for the individual:

$$y[h_i] = w_i h_i + \mu - T(h_i, w_i, \mu; Z_i) \text{ for } h \in \{h_1, h_2, \ldots, h_{Ki}\} \quad (3.7)$$

for all possible combinations of h. The variable w_i represents the gross wage of an individual. To take into account the unobserved market wage rates for non-working individuals, we adopt a common approach, Heckman procedure (1974), of estimating the wage equation for each gender and using estimated wages as if they were true values of unobserved wages. The individual maximises utility as practiced in function (3.4) over the set of hours $h_i \in \{h_1, h_2, \ldots, h_{k_i}\}$. To estimate utility we must add stochastic terms to the utility function. In what follows, we only add shocks to the state or hours regime for each of the possible choices, which we assume to be generated by extreme value distributions. Following these assumptions, we derive the choice probability for agent i from:

$$\Pr[h_i = h^j, Z] = \Pr[U_{ij} > U_{ik} \forall k \neq j, k \in \{1, 2, ..K\}]$$
$$= \frac{\exp[U(y_{ij}, T - h^j; Z)]}{\sum_{k=1}^{K} \exp[U(y_{ik}, T - h^k; Z)]} \quad (3.8)$$

where $U(.) = U^*(.) - \varepsilon_i$.

Under the hypothesis of independent errors, the log-likelihood function can be written, as:

$$\ln \Phi_s = \sum_{i=1}^{N} \sum_{k=1}^{K} d_k [\ln \Pr(h_i = h^{ki}; Z_i] \tag{3.9}$$

The variable d_k represents (1, 0) dummies: $d_k = 1$ if $(h_i = h^{ki})$. All the parameters included in the utility functions are estimated by maximum likelihood. Another important issue is the presence of fixed costs i.e. the costs an individual must pay in order to work, such as childcare costs or travelling expenses. Although, in this case there are no exist fixed costs related to children, because of the sample used, we incorporated fixed costs to check if the fit would improve. We assume that fixed costs depend on observed characteristics and in this case interacted with education levels. Those parameters proven insignificant and didn't affect the elasticities results[11].

Finally, for each discrete choice j and for each individual i, the disposable income estimated by equation (3.7) is obtained by aggregating all sources of income and the amount of benefits which the individual is entitled to, the taxes and social contributions it should pay. These tax-benefit calculations are performed using tax-benefit simulation models and the information about income and socio-demographic characteristics. For this purpose we use the EUROMOD model, a tax-benefit calculator designed to exactly simulate the redistributive systems of members of the European Union. It provides a complete picture of the redistribution and the incentives to work generated by European welfare regimes. It is a multi-country micro simulation model which has been designed to be flexible enough to take into account the particularities of different national policies and at the same time provide a common framework for the implementation of policies. In this respect, it guarantees the comparability of the results and also the transferability of policies across countries, therefore making it possible to analyze the effects on population from the implementation of policies of country A to country B. It provides a wide range of analysis, for international comparative research, on the effects of policies and policies reform on income, welfare, poverty, inequality and social inclusion. Therefore, by using micro simulation methods under the same model we are able to investigate the differences between countries and provide answers on whether those

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[11] Estimates with fixed costs are available upon request.

differences are due to different tax systems or due to the different preferences of the individuals between countries.

As already mentioned before, this study focuses on the tax free income and tax rate differences that exist between the selected countries and how these affect work incentives. In order to find out whether and to which extent these structural differences contribute to the justification of the different employment patterns of singles without children, several simulation models are performed. Firstly, for all countries we predict the estimations under their tax system and secondly we swap the tax system[12] of each country with the other. What actually is being swapped between the question countries are just the tax rates and brackets as practiced in each country, leaving the definition of taxable income as it. Therefore, the main differences that exist between the three countries which are the tax free income and the marginal tax rates covered by the simulations. Using the structural parameters from the labour supply estimation, we then predict the labour market outcomes under the simulated scenarios. The fact that the analysis concerns neighbouring European countries which share a tax system with common characteristics based on specific indices is expected to minimise the factor preferences to a big extent and may allow us to focus on the differences that exist between the three aforementioned tax systems.

3.6. Results
3.6.1. Labour Estimation Results

Firstly, the set of labour supply alternatives for each individual must be identified by examining the data of working hours in order to estimate the model. Graph 3.2 (a) presents hours of work distributions for single men and 3.2 (b) for single women based on their country of residence. The discrete choice model approach takes into account the fact that hours of work are heavily concentrated on particular hours, such as zero hours of work, full time and part time. In this case for the three countries the choice set is 0, 30 and 40 hours. Choice set "0" corresponds to zero hours of work which means no participation in the labour force. The other choices correspond to the intervals 1-34 hours representing part time choice and >34 hours representing full time choice. It may be argued that part time choice is described more sufficiently by less than 30 hours per week than the interval, which is less than 34 hours.

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[12] Adopt the tax rate schedule as it is in country A and apply it to country B and vice versa.

However, for this analysis the specific interval was the best choice. Furthermore, different discrete choice hours were also used but ended up with the aforementioned choice since it appeared to be a better fit to the model. The results of this choice will be presented in the next stage.

Before we proceed with the estimation of the model we firstly run a two-step Heckman equation to take into account unobserved market wage rates for non-working individuals. In order to have bigger sample, we predict wages for each gender regardless of their marital status, which proved to be a better fit for the wages. Afterwards, we use the estimated wages as if they were true values of unobserved wages. Traditionally the imputation of the wage rates is based on the estimation of the expected market wage given a set of observed characteristics. Therefore, the wage equation depends on the age, education and family status; men with more dependent people in the household or men in couples are known to earn more than single men. Married women with many children usually stop working and at the same time, wage is positively correlated with age. A similar specification is also used in Bargain et al. (2014). We choose three educational groups for comparability purposes with low, medium and high education attained, since higher education mostly affects positively the wage rate of the individual. The Heckman selection correction basically relies on participation probit as an approximation of the extensive margin of the labour supply model. Participation depends on the same variables with wages plus detailed information about children and non-labour income. The latter corresponds to other sources of income besides labour income, which according to the findings of the literature is affecting negatively the participation probability.

Tables 3.4 and 3.5 display the results of the Heckman-corrected wages estimations for each country for men and women separately. The summary statistics of the respective sample used for the wage estimations appear in Appendix B, Table B5 and B6. Most of the wage equations coefficients are significant and exhibit the expected sign. For instance, higher education results in higher predicted wages. This is valid in all three countries for both genders. The relationship between age and wage is positive as well but diminishing in age. For Greek women the opposite relationship is exhibited.

In the participation equation, we see that many of the coefficients are significant. We notice that people with higher education have higher probabilities to participate in the workforce compared to low educated people. Coefficients representing the age of children have the expected positive effect, with the probability of participation rates increasing while younger children grow older. Furthermore, the coefficient of non-labour income has also the expected sign. The participation probability decreases compared to non-labour income increase and this appears to be the case in all three countries. Finally, the inverse Mills ratio is mostly positive except in the case of Italian women which suggest that the error terms in the selection equation are positively correlated.

The model presents the results of estimated wage rate for workers and non-workers while taking into account biased selection. By using the above model, we estimate the predicted wages for individuals working and afterwards we adopt these amounts to individuals with missing wages. According to the findings, the amounts of actual and predicted wages for individuals who work are very close.

Finally, we obtain estimates for the parameters of utility function (3.4) by optimising equation (3.9). We consider education as the observable entering vector capturing differences in preferences. Table 3.6 reports the maximum likelihood estimates for the choice model of labour supply. Estimations are conducted for each country separately but under the same specification.

The main assumption of the model is satisfied in all three countries case; the second derivatives of the utility function with respect to income and hours are negative. Therefore, the coefficients which can be interpreted as parameters of the utility function lead to plausible results as far as the theoretical predictions are concerned. Furthermore, the variables about education and age which affect income and hours are significant in some cases. As expected, individuals with high-level education affect positively their income utility. On the other hand, work preferences decrease with age. It is noted that we cannot really compare preferences across countries directly, thus we directly focus on the comparison of the labour supply elasticities.

Before we proceed with the elasticities in order to check the ability of the model to fit the data, we computed the average probabilities for each category of hours and compared them with the observed frequencies. According to Table 3.7, the model is able to replicate observed frequencies quite well since, the gap between them is lower than 1% which shows that the predicted hours mean is very close compared to the actual hours mean. We also tried including 4 and 5 discrete choice hours and different intervals but the gap between the actual and the predicted frequencies was pretty high compared to the 3 discrete choice hours; refer to Table B7 in Appendix B. For the aforementioned test we used Cyprus data with male and female observations but since Cyprus is used as the base country and the gap between them was very high we report other choices results only for Cyprus. However, we tried more choices for the other countries as well but still the gap was greater compared to the three choice hours model.

In the present nonlinear model, the labour supply elasticities cannot be derived analytically but can be calculated by numerical simulations using the estimated model. For wage (income) elasticities, we predict the change in average working hours and in participation rates following a marginal uniform increase in wage rates (non-labour income). The elasticities are calculated by simulating a 10% increase in gross wages (non-labour income) using the following formula:

$$\varepsilon_i = \frac{E[h/y^{after}] - E[h/y^{before}]}{E[h/y^{before}]} \cdot \frac{1}{0.1} \tag{3.10}$$

where h is the predicted hour. Finally, Tables 3.8 and 3.9 present the elasticities for each gender and for each country separately. Bootstrapped confidence intervals are also reported in the main elasticity results.

Despite the large increase in the number of single individuals without children over the last few decades, the labour supply behaviour of single women and men has received relatively little attention. This is true especially when we compare the vast literature on labour supply of married women to single mothers (Blundell and MaCurdy, 1999). The main reason is probably the fact that most policy reforms used to estimate labour supply effects in the US and the UK

concern families with children. In this respect the present study seeks to add valuable findings to existing literature by providing new estimates for single, childless individuals.

As illustrated in Tables 3.8 and 3.9, Italian and Cypriot women exhibit lower participation elasticities compared to men, although the numbers are very close. On the other hand Greek women exhibit higher participation elasticity compared to men. Almost in all cases women exhibit higher results in wage elasticity except Italian women. In general, wage elasticity is relatively small in all cases and ranges from 0.002 to 0.2.

When comparing the results between the three countries based on their gender, it was noticed that Cypriot men exhibit the highest participation elasticity and Italian men the highest wage elasticity. On the other hand, Greek men exhibit significantly low wage elasticity. As far as women are concerned, Greek women exhibit the highest participation and wage elasticity since they appear to respond to changes at a higher degree compared to Cypriot and Italian women. Finally, income elasticities are reported in Tables 3.8 and 3.9. As it is often observed in the labour supply literature, income elasticities are negative and very close to zero for a majority of countries. The findings seem to agree with the existing literature exhibiting negative and small income elasticities.

Existing studies on single, childless individuals are very limited as already mentioned above. Hann and Steiner (2006) using German data estimated hours' elasticities for men ranging from 0.02 to 0.2 and for women between 0.08-0.3. They also reported participation elasticity for men at 0.1 and women at 0.2. More recently, Bargain, Orsini and Peichl (2014) reported elasticities for several countries where the wage elasticity estimates range between 0 to 0.06 for men and -0.01 to 0.03 for women. The participation elasticity was estimated to range from 0.05 to 0.58 for men and 0.08 to 0.62 for women respectively. As far as the countries used in this study are concerned, they found similar results. More specifically, according to their results for Italian men those elasticities are estimated at 0.2 and 0.02 respectively. On the other hand the results for Italian women are significantly higher with values of 0.58 and 0.05 respectively. Finally, for Greek population, they reported higher participation elasticity for women with a value of 0.43 and lower participation elasticity for men with a value of 0.15 which are close to our estimations. For the wage elasticity they reported -0.01 for women and 0.05 for men. Our results seem to be in line in some cases with the aforementioned results although participation elasticity is a bit lower for Greek and Italian men. This is possibly due

to the fact that this research covers a more recent time period and the sample includes single individuals with no children, who have increased significantly overtime and constitute a large part of the population.

3.6.2. Simulation Results

As we have pointed out before, this chapter concentrates on the differences which exist between the Cypriot, the Italian and the Greek tax systems, on the amount of the tax free income and the tax schedule rates in general. Cyprus has the highest tax free income and the lowest tax rates compared to Greece and Italy. In order to find out whether and to what extent these structural differences contribute to the explanation of the different employment patterns, we perform several simulation models. Firstly, we change the tax system schedule rates imposed in Cyprus with Greek and Italian tax schedules. In both cases we just adopt the tax rates and bands as they are in the other two countries. Finally, we follow the same technique for the other two countries and we change the tax rates and the bands with the ones of the simulation country. Table 3.10 presents the simulation results for the weekly disposable income and Table 3.11 the labour supply effect.

According to Table 3.10 the introduction in Cyprus a new tax system by adopting the characteristics either of the Greek or the Italian tax system decreases the disposable income compared to the existing one. This especially applies for individuals who already participate in the workforce. However, the relevant decrease is lower in case of the adoption of the Greek tax system compared to the adoption of the Italian tax system. The weekly disposable income for part time workers for both genders decreases approximately by 5% under the Greek tax system and by 20% under the Italian tax system. The same pattern applies in the case of full time workers. The changes of the disposable income under a less generous tax system than the already existing one is expected to reduce the relevant disposable income. The reason behind this is that the tax free income is minimised and the marginal tax rates increase, especially under the Italian tax system where the tax free area does not exist at all. On the other hand the adoption of the Cyprus tax system in Greece or in Italy increases their disposable income. The disposable income for Greeks increases at about 4% and this applies mostly to full time workers. Further increases are noted for the Italian people where the disposable income

71

increases at about 20%. As a result, it appears that under the Cypriot tax system joining the work force becomes more attractive for Greeks and especially for Italians. This is due to the fact that the Cypriot tax system is more generous compared to the Italian and the Greek tax system since the final disposable income is obviously higher. On the other hand, the decrease of the weekly disposable income for Cypriot people in case of using a less generous tax system, such as the Greek or Italian, creates less incentives to join the workforce especially under the Italian one.

Table 3.11 illustrates the labour supply resulting from the change in disposable income due to policy simulations. In the case of Cyprus the introduction of a new tax system decreases the labour force participation rate and working hours. This especially applies when using the Italian tax system where under those rules the decrease in disposable income is around 20%. The participation rate for women decreases by 9%, meaning that the proportion of women in the labour market decreases by 9% due to the change in their disposable income. A significantly higher decrease is observed for men at 15%. This is due to the fact that the disposable income for men not participating in the labour force decreases by 9% more, compared to women. On the other hand, for full time workers, working hours decrease less than 1% per week regardless of their gender. Moreover, a noticeable decrease in the working hours of part time men is exhibited at about 8%. These results are consistent with the results presented earlier concerning labour supply elasticities, where men exhibit higher elasticities compared to women. In all the cases, for both men and women, their income effect dominates the substitute effect, since their working hours and their participation rates decrease as an immediate response to the decrease of their disposable income.

The Cyprus tax system will obviously create more labour incentives since under this legislation the disposable income increases and according to the simulation results this seems to be supported by both the Italian and the Greek population, thus the participation rate increases for both genders. It is noted that the response of Italians and especially Italian men is more intensive compared to Greeks. This is due to the fact that the change in the amount of the final disposable income is significantly higher for Italians compared to Greeks. Under a more generous tax system Greeks' participation rate increases by just 1%. An insignificant increase is noted on weekly working hours. An interesting observation is for Italian men who under the

Cypriot tax system increase their participation rate at 7%. The participation rate increases for Italian women too but at about 2% less. Therefore, the adoption of a new system more generous than the existing one will enhance the work incentives since the substitution effects dominate the income effects. On the other hand, under the adoption of a less generous system than the Cypriot tax system but still more generous than their base tax system, Italian people seem to respond positively in the same way. Specifically, the participation rate and the weekly working hours increase for both genders under the Greek tax system. Finally, the adoption of a less generous system in Greece, such as the Italian one, decreases the participation rate and the weekly working hours for both men and women. A noteworthy observation is the significant response of women in the workforce where the participation rate decreases at 14% in comparison to men which the respective rate is lower than 1%.

Moreover, we want to investigate whether the simulations will change by taking into consideration the GDP per capita for each country. More specifically we use the GDP per capita ratio in order to adjust the tax bands of each country to the country that it will be used in respectively. The GDP per capita ratio is given by the GDP per capita from the country that the tax system will be adopted divided by the GDP per capita of the country that will be used in. Afterwards, we use the adjusted tax bands to the EUROMOD model to get the analogous results as before. Tables 3.12 and 3.13, present the simulation results for disposable income and labour supply respectively. The differences when comparing the results for disposable income between Tables 3.10 and 3.12, are not significant. Firstly, when using the adjusted Greek tax system in Cyprus, the change in disposable income in response to the simulation is slightly smaller than before. On the other hand, when using the adjusted Italian tax system the difference is slightly higher, nearly 1%. Nevertheless, when using the adjusted Cypriot or Greek tax in Italy, the disposable income still increases and is about 1% to 2% greater especially for full time workers. However, in the case of Greece adopting the adjusted Italian system, a higher decrease is noted on one hand and on the other hand a lower decrease is noted when adopting the adjusted Cypriot tax system. Therefore, the changes in disposable income are similar to the changes observed when using the original tax bands of each country and no significant changes occur. The Table 3.13 displays the relevant labour supply results which are nearly the same with the results of Table 3.11 where tax bands are used without counting for GDP per capita. In both tables, the changes which occur under the scenario of a new tax

system in working hours and participation rates are very similar. However, there are some cases where differences exist, although these are less than 0.5%. Either by using the original tax bands of each country or the adjusted tax bands, the effect on the results is insignificant meaning that this will not affect the final labour supply results. The results still support the increase in labour supply under a more generous tax system and the opposite under a less generous system.

Even though changing from a less generous system to a more beneficial system will enhance the working incentives there are also other effects related to taxation that should be considered by a country before adopting any system. As we know government charges citizens with taxes in order to fund various welfare and public expenditures. Therefore, the optimal solution for an economy is to keep government resources high enough in order to cover the public needs but at the same time low enough to cater for the welfare of their citizens. Hence, the final fiscal effects resulting from a relevant change in the tax system also contributes to its assessment. Table 3.14 presents the government resources and expenditures which correspond to a country from the base tax system and how the resources and expenditures change in case of adopting a new tax system. Since in this analysis we only swap tax rates and bands between the aforementioned countries the tax benefits related to the sample used remain the same under each scenario. As already mentioned, in order to minimise the effect of the other factors in labour supply we use only singles without children but unfortunately, the benefits which concern them are not simulated. Therefore, the benefits under any tax system are not affected and remain stable as in the base tax system. The relevant benefits that concern the specific sample are the housing benefit, the social assistance benefit, sickness benefit and unemployment benefit. The EUROMOD uses the relevant amounts as given by the original data in monthly form. Therefore, since the total expenditures cannot be simulated and remain stable under each scenario, the final fiscal effects could not be calculated. Nevertheless, we describe the relevant results from the revenues perspective.

As it was expected a new tax system in Cyprus, which is less generous than the existing one, has two dimensions; working hours and participation rates decrease which is an adverse effect but at the same time government revenues increase. Under the Greek tax system the government revenues are doubled and under the Italian system the taxes are fivefold. The

Greek tax system besides the lower tax free area applies also higher tax rates compared to the Cypriot system. These changes in case of the adoption of Italian tax system are much more intense; there is no tax free area and taxes imposed from the first euro are earned. Additionally, the adoption of a more generous tax system in Greece and Italy affects positively the welfare of individuals since they pay lower taxes but at the same time the government resources decrease. This change minimises the resources for Greece and a further decrease is noted in case of Italy adopting the Cypriot tax system. As before, we also calculate the government revenues when the tax bands are adjusted by using the GDP per capita ratio for each country. Table 3.15 displays the relevant results. There are differences when comparing the results between the two tables. In the case of Cyprus, the government revenues still increase under the scenario of a new tax system. However, under the adjusted Italian tax system the increase is greater than before and a bit lower under the adjusted Greek tax system. At the same time, in Greece the government revenues note a higher increase under both simulated adjusted tax systems. Moreover, the changes in fiscal effects for Italy are more intense now than before. More specifically the tax revenues is 115.518 euros less under the adjusted Cypriot system and 151.366 euros less under the adjusted Greek tax system. However, in all cases the adoption of a more beneficial system such as the Cypriot tax system, increases labour supply in both countries but at the same time decrease the economic resources which is an adverse effect for the governments. This doesn't mean however, that the resources of a government just increase or decrease; chain influences exist that need to be taken into consideration. Someone may argue that a country's revenue decreases from taxes and at the same time, since more individuals are in the workforce, the social benefits that the government needs to pay back to cover the needs of the individuals also decrease. Likewise, the adoption of Italian system from Greece increases the overall taxes for the country but at the same time the overall taxes decrease under the Cypriot tax system. Vice versa the adoption of Greek system from Italy decrease the overall taxes that the government gains. As a result and as already mentioned since the benefits cannot be simulated and do not change under each tax system, the final fiscal effects cannot be derived. In this respect, the final implication from the side of a fiscal effect cannot be derived in order to characterise a tax system.

The choice of the specific countries was made based on their geographical location but mostly on cultural indices. By comparing countries which share similar cultures, we expect that the effect of the preferences factor is limited. Therefore, the simulation results of labour supply

after swapping their tax systems are expected to be justified by the tax system features. Based on the simulation results people in general tend to move according to the work incentives created by the tax system since more generous tax systems increase their participation rates and working hours. On the other hand a less generous system creates less work incentives. Although the results of the present study exhibit that the relevant populations respond as expected, one other aspect that needs to be taken into consideration is the degree of response of each population. We notice that Cypriot men exhibit the greatest response under a less generous system compared to Greek men. On the other hand, as far as female population is concerned, Greek women exhibit the greatest response under such possibility. However, under a more generous tax system the response of Italians is significantly greater compared to Greeks, with the response of Italian men being greater than Italian women.

Even though the different degree of response of the populations to labour supply could be justified by the different labour income which results by the respective tax system, probably other demographic factors matter as well such as education, age, employment status and the wage rate. For instance, in the sample used in the specific chapter, significantly different levels of education exist. According to the summary statistics, Cypriots and Greeks have the highest percentage of people with higher education attained. On the other hand, most Italians hold a gymnasium or a lyceum degree. It will be useful to estimate what part of the difference in labour supply behaviour is due to the tax system and which part could be due to demographics factors. This could be accomplished in a similar decomposition like the one already followed but now will concentrating on the demographics characteristics. For instance, the sample for each choice hour could be divided into more groups according to their education level and get the new responses after swapping each system. However, the impact of the demographic factors in labour supply is an aspect we aim to examine in future work.

3.7. Conclusion

Employment patterns differ significantly across European countries. These differences have often been attributed to institutional characteristics and in particular to the work incentives created by the tax-transfer system. In this study we compare three countries, Cyprus, Greece and Italy which share similar cultures and have very similar tax systems. Still, we find differences in the employment behaviour of single men and women concerning their working

hours and their participation rate. People in Cyprus exhibit higher employment rates and more working hours compared to the other two countries. A closer look at institutional differences between the three countries shows that the differences in employment patterns can be well explained by the different work incentives the income tax transfer systems create. The main differences between their tax systems are the concepts of the tax free income, which in Cyprus is more generous compared to Greece while in Italy such institution does not exist, as well as the tax schedule rates which are lower in Cyprus.

In this chapter we use the discrete labour supply model based on tax-transfer models for the three countries to test whether those characteristics of the tax-transfer system can explain labour supply differences in these countries. We firstly estimate labour supply under their existing tax-benefit system as it is for single men and women without children for the three countries. The results from the first part of the estimation show that the participation rates increase as the level of education increases. Also, the coefficient regarding the age of the children exhibits the expected results with the probability of participation increasing as the younger children grow older. The participation probability decreases as the non-labour income increases and this appears to apply to all three countries. The estimation of the utility function supports the main assumption of the model in all three countries; the second derivatives of the utility function with respect to income and hours are negative. Secondly, we made a swap between their tax-benefit systems using micro-simulation procedure by changing the tax rates and bands as practiced in each country. Based on the findings, the labour supply would decrease if Cyprus adopted a new tax system which would diminish the disposable income. On the other hand, Greek and Italian labour supply would increase if their existing tax system would be replaced by a new more generous tax system similar to the Cypriot one.

Taking into consideration that the data sample used in this chapter minimises and controls the effect of the population preferences factor, the empirical results support the hypothesis that the employment patterns can in fact be justified by the different work incentives created by the different characteristics of the tax system. In conclusion, in case of a policy reform and restructuring of a country's tax system the aforementioned effects should be taken into account to avoid any adverse effects in labour supply. The present findings could consist

source of inspiration for countries that wish to enhance labour supply by restructuring their tax system with the implementation of a policy with a higher tax free income.

As observed in other studies there are limitations in this chapter as well. The limitations relate mostly to the fact that the tax system regulations do not completely swap between the relevant countries. Since, we wanted to minimise the differences between the tax systems of the aforementioned countries we concentrated to a specific sample of the population, singles without children; we only swap the tax rates and bands as practiced in each country. Also, because the relevant benefits for the specific sample couldn't be simulated in EUROMOD model, the fiscal effects cannot be calculated. Therefore, the final implication from the perspective of fiscal effects cannot be derived.

3.8. Tables

Table 3.1: Country's Characteristics

Characteristics/Countries	Cyprus	Greece	Italy
Taxable income	Employment income +Rental from property	Employment income+ Rental from property + Private transfers+ Sickness benefit	Employment income +Rental from property +Unemployment benefit +Fringe benefits +Cadastral value of buildings
Unemployment benefit	60% weekly basic insurance earnings + 50% weekly mean complementary insurance earnings / duration 6 months	€367.38 / the average duration being 7 months.	50%of previously monthly income for months 1-6, 40% for months 7-9, 30% or the following months/ is eligible less than 7 months for employees younger than 50 and 10 months for those older than 50 years old
Sickness benefit	60% weekly basic insurance earnings + 50% weekly mean complementary insurance earnings / duration 6 months	25% of the daily wage for the first 15 days and 50% from the day 16 and after / duration between 182 to 720 days	50% of the daily wage for the first 20 days and 66.66% for the subsequent days of sickness / duration no more than 180 days each year
Tax on interest income	10%	10%	27%
Tax on bonds and dividends	15%	-	12.5%

Note: These characteristics are based on the year 2007 legislation rules. Sources: EUROMOD county reports.

Table 3.2: Presents the Weighted Distance between Country 1 to Country 2

Country_1	Country_2	Weighted Genetic Distance, F_{ST} F_{ST}	Weighted Linguistic Distance	Weighted Religious Distance	Cultural Distance Preferences
Cyprus	Greece	0.0001	0.4584	0.4433	-49.9063
Cyprus	Italy	0.0079	0.9725	0.8096	-45.6735
Greece	Italy	0.0080	0.9660	0.7821	-53.9630

Note: Data comes from Spolaore and Wacziarg (2016), and Spolaore and Wacziarg (2015).

Table 3.3: Descriptive Statistics: Singles without Children

2007/Singles(25-65)						
Variables/Countries	Men			Women		
	Cyprus	Greece	Italy	Cyprus	Greece	Italy
Participation Rates	0.94	0.92	0.92	0.91	0.88	0.90
Weekly Working Hours	39	37	35	36	34	32
Age	31.3	33	34.7	34	32	35
Part time workers	8.5	13.4	14.6	12.5	16.8	27.9
Full time workers	85	78.1	78	77.6	72	62
Individual weekly disposable income	185	146	218	165	137	209
Individual weekly Non-labour income	2.3	4.7	10.7	22.1	6.8	12
Weekly income of the other household members	347	245	332	227	220	311
Wage rate	8.2	7.3	11.1	6.6	6.8	10.4
Number of persons in the house including the individual	2.1	1.9	2.2	1.8	2.1	2.2
Head	0.24	0.29	0.3	0.27	0.2	0.3
Basic School Education	0.08	0.15	0.06	0.09	0.04	0.04
Gymnasium Lyceum Education	0.49	0.57	0.78	0.32	0.53	0.73
Higher Education	0.41	0.26	0.15	0.58	0.41	0.22
Living in Urban area	0.61	0.44	0.34	0.74	0.55	0.36
Number of Observations	306	581	2294	255	368	1780

Note: EUSILC data set 2007. The datasets at use have been assembled within the framework of the EUROMOD project (see Sutherland, 2007) and are combined with tax-benefit simulations for year 2007.

Table 3.4: Wage Estimations: Men

Variables	Cyprus Coefficient	Greece Coefficient	Italy Coefficient
Wage			
Age	1.203 (2.56)	1.140 (3.06)	0.262 (3.02)
Age square	-0.011 (-2.11)	-0.010 (-2.45)	-0.000 (-0.30)
Other adults in the household	0.443 (0.26)	-0.791 (-0.87)	-0.669 (-2.39)
Other adults in the household square	-0.104 (-0.29)	0.050 (0.28)	0.059 (0.83)
Medium Education	2.266 (1.34)	4.406 (3.55)	4.653 (9.21)
High Education	8.522 (4.63)	9.842 (6.95)	12.510 (22.27)
#Children 0-2	0.437 (0.28)	0.468 (0.49)	0.623 (2.30)
Constant	-23.262 (-2.25)	-22.671 (-2.70)	-2.446 (-1.19)
Participation			
Age	0.012 (1.99)	-0.000 (-0.13)	-0.006 (-2.48)
Non labour income	-0.000 (-2.73)	-0.000 (-1.68)	-0.000 (-2.68)
Non labour income square	0.000 (0.94)	0.001 (0.81)	0.000 (0.54)
Medium Education	0.239 (1.33)	0.269 (2.16)	0.552 (7.69)
High Education	0.470 (2.21)	0.423 (2.76)	0.606 (6.08)
#Children 0-3	0.382 (1.78)	0.013 (0.11)	0.242 (3.21)
#Children 4-6	-0.001 (-0.01)	0.898 (2.58)	0.333 (3.22)
#Children 7-12	0.230 (1.49)	0.217 (1.68)	0.125 (2.13)
#Children 13-18	0.482 (2.47)	0.337 (2.54)	0.277 (4.42)
Constant	1.095 (3.22)	1.374 (5.55)	1.360 (9.72)
Mills ratio	24.814 (1.88)	17.195 (1.72)	5.171 (1.83)
Number of observations	1918	1983	8095

Note: Two-step Heckman model. T-statistics reported in parentheses. Prices are rounded to 3 decimals.

Table 3.5: Wage Estimations: Women

Variables	Cyprus	Greece	Italy
	Coefficient	Coefficient	Coefficient
Wage			
Age	0.578 (0.58)	-1.776 (-2.26)	0.036 (0.08)
Age square	-0.002 (-0.08)	0.056 (2.92)	- 0.001 (0.10)
Other adults in the household	0.519 (0.48)	-0.513 (-1.35)	0.184 (0.80)
Other adults in the household square	-0.068 (-0.26)	0.095 (1.24)	-0.132 (-2.21)
Medium Education	5.011 (6.36)	3.404 (6.36)	3.231 (8.73)
High Education	13.241 (12.79)	9.476 (11.97)	7.903 (15.92)
#Children 0-2	-0.558 (-0.76)	0.739 (1.46)	0.454 (2.01)
Constant	-18.299 (-1.37)	16.395 (1.58)	3.038 (0.53)
Participation			
Age	0.093 (3.10)	0.159 (5.19)	0.178 (11.55)
Age square	-0.001 (-4.14)	-0.002 (-5.89)	-0.002 (-13.58)
Non labour income	-0.000 (-3.99)	-0.000 (-1.13)	-0.000 (-0.92)
Non labour income square	0.001 (2.42)	-0.001 (-0.25)	0.000 (0.17)
Medium Education	0.376 (4.39)	0.285 (3.08)	0.520 (9.82)
High Education	0.995 (9.43)	1.093 (9.92)	1.258 (16.70)
#Children 0-3	-0.433 (-5.04)	-0.391 (-4.77)	-0.177 (-4.03)
#Children 4-6	-0.234 (-2.55)	-0.137 (-1.41)	-0.215 (-4.31)
#Children 7-12	-0.185 (-3.36)	-0.192 (-2.88)	-0.225 (-6.49)
#Children 13-18	-0.052 (-0.98)	0.0765 (1.10)	-0.148 (-4.25)
Constant	-0.460 (-0.72)	-2.224 (-3.60)	-2.341 (-7.38)
Mills ratio	9.238 (5.17)	1.427 (1.04)	-2.122 (-3.02)
Number of observations	2203	1875	8450

Note: Two-step Heckman model. T-statistics reported in parentheses. Prices are rounded to 3 decimals.

Table 3.6: Labour Estimation Results for Single Men and Single Women

Men			
	Cyprus	**Greece**	**Italy**
Variables	Coefficient	Coefficient	Coefficient
Income2	-0.000 (-1.32)	-0.005 (1.35)	-0.001 (-0.19)
Hours2	0.006 (5.34)	0.004 (8.34)	0.003 (16.68)
Income x Hours	-0.001 (-0.62)	-0.000 (-2.45)	-0.000 (-2.51)
Income	0.021 (1.44)	0.011 (1.75)	0.002 (1.09)
x Age	-0.000 (-0.08)	-0.000 (-0.76)	-0.001 (-0.01)
x High Education	0.008 (1.19)	-0.001 (-0.77)	0.001 (-2.09)
x Urban Area	-0.000 (-0.04)	-0.001 (-0.43)	0.001 (0.75)
Hours	-0.235 (-2.51)	-0.127 (-2.87)	-0.080 (-3.43)
x Age	0.000 (0.02)	-0.000 (-0.45)	-0.001 (-1.09)
x Urban Area	-0.013 (-0.46)	0.005 (0.35)	-0.003 (-0.34)
Log-Likelihood	-151.85	-382.8	-1516.6
Number of observations	918	1743	6882
Women			
Variables	Coefficient	Coefficient	Coefficient
Income2	-0.020 (-1.60)	-0.000 (-2.53)	-0.004 (-1.24)
Hours2	0.003 (5.45)	0.003 (5.74)	0.001 (5.39)
Income	0.024 (1.50)	0.038 (2.58)	-0.004 (-1.40)
x Age	0.001 (2.28)	-0.000 (-1.39)	0.000 (1.35)
x Urban Area	-0.005 (-1.77)	0.000 (0.13)	0.000 (0.28)
x Gymnasium Education	-0.027 (-1.89)	-0.001 (-0.15)	0.002 (2.13)
x Higher Education	-0.032 (-2.17)	0.092 (1.25)	0.003 (2.06)
Hours	0.029 (0.53)	-0.203 (-3.69)	0.050 (2.06)
x Age	-0.004 (-4.20)	0.001 (1.07)	-0.001 (-2.72)
x Urban Area	0.034 (1.62)	-0.015 (-0.60)	0.004 (0.44)
Log-Likelihood	-147.45	-272.6	-1533.4
Number of observations	765	1104	5340

Note: Model estimated by Simulated Maximum Likelihood using Halton sequences (100 draws). T-statistics reported in parentheses. Prices are rounded to 3 decimals.

Table 3.7: Observed vs Predicted Frequencies

	Cyprus		Greece		Italy	
Male	Observed	Predicted	Observed	Predicted	Observed	Predicted
H1	0.062	0.062	0.082	0.083	0.070	0.077
H2	0.088	0.088	0.135	0.135	0.149	0.145
H3	0.849	0.849	0.781	0.781	0.779	0.778
Hours	39.34	39.35	37.2	37.3	35.63	35.64
Gap %	0.02%		0.2%		0.002%	
Female						
H1	0.091	0.090	0.111	0.117	0.090	0.090
H2	0.133	0.133	0.168	0.161	0.286	0.287
H3	0.776	0.775	0.720	0.721	0.623	0.624
Hours	35.69	35.7	34.3	34.2	31.6	31.70
Gap %	0.02%		0.3%		0.3%	

Note: The predicted hours are calculated using the predicted frequencies for each discrete choice hour.

Table 3.8: Male Elasticities

	Cyprus	Greece	Italy
Wage Elasticity (increase 10%)			
Participation	0.4 (0.31-0.56)	0.1 (0.09 - 0.13)	0.3 (0.30- 0.32)
Hours	0.01 (-0.005-0.034)	0.002 (-0.001- 0.005)	0.02 (0.022- 0.023)
Income Elasticity			
Participation	-0.111 (-0.233- 0.010)	-0.24 (-0.381 - -0.110)	-0.133 (-0.17- -0.094)
Hours	-0.007 (-0.017-0.002)	-0.023 (-0.035 - -0.011)	-0.018 (-0.022- -0.014)

Note: Wage (income) elasticities are computed numerically as the responses to a 10% uniform increase in wage rates (unearned income). Numbers in parentheses refer to 95%-confidence intervals derived using the bootstrap-method (100 repetitions).

Table 3.9: Female Elasticities

	Cyprus	Greece	Italy
Wage Elasticity (increase 10%)			
Participation	0.2 (0.018-0.36)	0.3 (0.19-0.49)	0.2 (0.17-0.24)
Hours	0.02 (-0.001-0.03)	0.02 (-0.006-0.052)	0.01 (0.010-0.014)
Income Elasticity (increase 10%)			
Participation	-0.12 (-0.23- -0.018)	-0.18 (-0.328 - -0.040)	-0.05 (-0.07 - -0.04)
Hours	-0.013 (-0.025- -0.001)	-0.02 (-0.041 - -0.010)	-0.006 (-0.008- -0.004)

Note: Wage (income) elasticities are computed numerically as the responses to a 10% uniform increase in wage rates (unearned income). Numbers in parentheses refer to 95%-confidence intervals derived using the bootstrap-method (100 repetitions).

Table 3.10: Simulation Results: Average Individual Weekly Disposable Income.

		Base Tax System	Greek Tax System	Percentage Change %	Italian Tax System	Percentage Change %
Policy Simulation for Cyprus						
Male	Non Participation	7.95 (#57)	7.93	-0.25%	6.95	-12.5%
	Part Time	237 (#96)	224	-5.5%	184	-22.3%
	Full Time	308 (#765)	283	-8.1%	241	-21.7%
Female	Non Participation	26.37 (#69)	26.36	-0.03%	25.5	-3.3%
	Part Time	206 (#120)	196	-4.8%	165	-19.9%
	Full Time	261 (#576)	242	-7.3%	210	-19.5%

		Base Tax System	Cypriot Tax System	Percentage Change %	Italian Tax System	Percentage Change %
Policy Simulation for Greece						
Male	Non Participation	9.86 (#144)	9.88	+0.20%	8.49	-13.8%
	Part Time	188 (#273)	193	+2.65%	152	-19.1%
	Full Time	240 (#1326)	250	+4.16%	198	-17.5%
Female	Non Participation	10.71 (#123)	10.72	+0.1%	9.08	-15.2%
	Part Time	176 (#216)	178	+1.1%	142	-19.3%
	Full Time	224 (#765)	229	+2.2%	186	-16.9%

		Base Tax System	Cypriot Tax System	Percentage Change %	Greek Tax System	Percentage Change %
Policy Simulation For Italy						
Male	Non Participation	33.3 (#486)	36.5	+10%	35.4	+6.3%
	Part Time	277 (#1161)	331	+20%	312	+13%
	Full Time	345 (#5235)	419	+21%	385	+12%
Female	Non Participation	32.2 (#483)	34.5	+7%	33.9	+5%
	Part Time	265 (#1644)	317	+20%	300	+13%
	Full Time	329 (#3213)	401	+22%	370	+12%

Note: The average weekly disposable income under the scenario of the other country's system is calculated using the EUROMOD model. Numbers of observations in parentheses after #.

Table 3.11: Simulation Results: Labour Supply

		Base	Greece tax system	Percentage Change %	Italian tax system	Percentage Change %
Policy Simulation for Cyprus						
Male	Non Participation	0.062 (#57)	0.062	+0.33% (0.64)	0.072	+15.21% (9.12)
	Part Time	0.088 (#96)	0.089	+1.46% (1.95)	0.080	-8.52% (-10.84)
	Full Time	0.849 (#765)	0.847	-0.17% (-1.60)	0.846	-0.36% (-1.96)
Female	Non Participation	0.090 (#69)	0.090	+0.27% (0.27)	0.098	+9.00% (4.06)
	Part Time	0.133 (#120)	0.133	-0.08% (-0.29)	0.132	-0.72% (-2.31)
	Full Time	0.776 (#576)	0.776	-0.01% (-0.12)	0.769	-0.92% (-3.57)

		Base	Cyprus tax system	Percentage Change %	Italian Tax system	Percentage Change %
Policy Simulation for Greece						
Male	Non Participation	0.082 (#144)	0.082	-0.61% (-1.84)	0.083	+0.26% (0.70)
	Part Time	0.135 (#273)	0.135	-0.21% (-0.88)	0.129	-5.00% (-50.93)
	Full Time	0.781 (1326)	0.782	+0.10% (1.98)	0.788	+0.84% (21.91)
Female	Non Participation	0.117 (#123)	0.118	-1.13% (3.48)	0.134	+14.00% (7.91)
	Part Time	0.161 (#216)	0.163	+1.39% (6.37)	0.149	-6.90% (-11.81)
	Full Time	0.721 (#765)	0.717	-0.49% (-5.88)	0.715	-0.80% (-2.19)

		Base	Cyprus tax system	Percentage Change %	Greek Tax system	Percentage Change %
Policy Simulation for Italy						
Male	Non Participation	0.070 (#486)	0.065	-7.21% (-52.00)	0.067	-4.10% (-50.85)
	Part Time	0.149 (#1161)	0.149	-0.32% (-8.20)	0.151	+0.83% (28.78)
	Full Time	0.779 (#5235)	0.785	+0.71% (48.51)	0.781	+0.21% (25.90)
Female	Non Participation	0.090 (#483)	0.088	-2.21% (-9.88)	0.088	-1.70% (-14.80)
	Part Time	0.286 (#1644)	0.288	+0.72% (19.46)	0.288	+0.57% (25.36)
	Full Time	0.623 (#3213)	0.622	-0.01% (-0.49)	0.622	-0.01% (-1.06)

Note: For labour supply results we used the simulated disposable income for each country as calculated by EUROMOD model. Numbers in parentheses refer to a bootstrap t-ratio derived using the bootstrap-method (100 repetitions).Numbers of observations in parentheses after #.

Table 3.12: Simulation Results: Average Individual Weekly Disposable Income when Tax Bands adjusted using GDP per capita

Policy Simulation for Cyprus						
		Base Tax System	Greek Tax System	Percentage Change %	Italian Tax System	Percentage Change %
Male	Non Participation	7.95 (#57)	7.93	-0.25%	6.95	-12.5%
	Part Time	237 (#96)	226	-4.6%	183	-22.7%
	Full Time	308 (#765)	286	-7.1%	240	-22.0%
Female	Non Participation	26.37 (#69)	26.37	-0.03%	25.5	-3.2%
	Part Time	206 (#120)	196	-4.8%	164	-20.3%
	Full Time	261 (#576)	245	-6.1%	208	-20.3%
Policy Simulation for Greece						
		Base Tax System	Cypriot Tax System	Percentage Change %	Italian Tax System	Percentage Change %
Male	Non Participation	9.86 (#144)	9.88	+0.2%	8.45	-14.3%
	Part Time	188 (#273)	192	+2.2%	150	-20.2%
	Full Time	240 (#1326)	249	+3.7%	194	-19.1%
Female	Non Participation	10.7 (#123)	10.7	+0.09%	9.08	-15.1%
	Part Time	176 (#216)	177	+0.56%	141	-19.8%
	Full Time	224 (#765)	229	+2.23%	181	-19.2%
Policy Simulation For Italy						
		Base Tax System	Cypriot Tax System	Percentage Change %	Greek Tax System	Percentage Change %
Male	Non Participation	33.3 (#486)	36.6	+9.9%	35.5	+6.6%
	Part Time	277 (#1161)	335	+20.9%	317	+14.4%
	Full Time	345 (#5235)	426	+23.4%	390	+13.1%
Female	Non Participation	32.2 (#483)	34.5	+7.4%	34	+5.6%
	Part Time	265 (#1644)	320	+20.7%	303	+14.3%
	Full Time	329 (#3213)	407	+23.7%	374	+13.6%

Note: The average weekly disposable income under the scenario of the other country's system is calculated using the EUROMOD model. Numbers of observations in parentheses after #.

Table 3.13: Simulation Results: Labour Supply when Tax Bands adjusted using GDP per capita

		Base	Greece tax system	Percentage Change %	Italian tax system	Percentage Change %
Policy Simulation for Cyprus						
Male	Non Participation	0.062 (#57)	0.062	+0.08% (0.17)	0.072	+15.20%(10.09)
	Part Time	0.088 (#96)	0.089	+1.62% (2.28)	0.081	-8.41% (-10.13)
	Full Time	0.849 (#765)	0.847	-0.16% (1.62)	0.846	-0.38% (-2.00)
Female	Non Participation	0.090 (#69)	0.090	+0.31% (0.28)	0.098	+9.00% (4.01)
	Part Time	0.133 (#120)	0.133	-0.13% (-0.46)	0.132	-0.74% (-2.26)
	Full Time	0.776 (#576)	0.776	-0.01% (-0.06)	0.769	-0.92% (-3.51)
Policy Simulation for Greece		Base	Cyprus tax system	Percentage Change %	Italian Tax system	Percentage Change %
Male	Non Participation	0.082 (#144)	0.082	-0.57% (-1.82)	0.082	+0.31% (0.79)
	Part Time	0.135 (#273)	0.135	-0.21% (-0.89)	0.128	-5.21% (-50.99)
	Full Time	0.781 (1326)	0.782	+0.99% (1.95)	0.788	0.88% (20.74)
Female	Non Participation	0.117 (#123)	0.118	-1.12% (3.55)	0.133	+14.00% (6.87)
	Part Time	0.161 (#216)	0.163	+1.33% (6.75)	0.147	-8.58% (-11.83)
	Full Time	0.721 (#765)	0.717	-0.46% (-5.81)	0.719	-0.29% (-0.67)
Policy Simulation for Italy		Base	Cyprus tax system	Percentage Change %	Greek Tax system	Percentage Change %
Male	Non Participation	0.070 (#486)	0.065	-7.86% (-33.66)	0.067	-4.91% (-25.78)
	Part Time	0.149 (#1161)	0.149	-0.59% (-10.27)	0.151	+0.69% (16.48)
	Full Time	0.779 (#5235)	0.785	+0.82% (30.95)	0.781	+0.31% (14.23)
Female	Non Participation	0.090 (#483)	0.088	-2.43% (-8.99)	0.088	-2.11% (-12.95)
	Part Time	0.286 (#1644)	0.288	+0.76% (18.07)	0.288	+0.59% (24.20)
	Full Time	0.623 (#3213)	0.623	-0.00% (-0.00)	0.623	-0.01% (0.71)

Note: For labour supply results we used the simulated disposable income for each country as calculated by EUROMOD model. Numbers in parentheses refer to a bootstrap t- ratio derived using the bootstrap-method (100 repetitions).Numbers of observations in parentheses after #.

Table 3.14: Fiscal Effects-Monthly Government Revenues and Expenditures from Taxes

Country	Government Revenues			Government Expenditures
Policy Simulation for Cyprus				
Cyprus	Base Tax System	Greek Tax System	Italian Tax System	Base Tax System
	40764	82600	240500	30500
Policy Simulation for Greece				
Greece	Base Tax System	Cypriot Tax System	Italian Tax System	Base Tax System
	125720	77740	400600	65269
Policy Simulation for Italy				
Italy	Base Tax System	Cypriot Tax System	Greek Tax System	Base Tax System
	3105560	940153	1901890	1057834

Note: The amounts are in euros.

Table 3.15: Fiscal Effects-Monthly Government Revenues and Expenditures from Taxes when Tax bands adjusted using the GDP per capita

Country	Government Revenues			Government Expenditures
Policy Simulation for Cyprus				
Cyprus	Base Tax System	Greek Tax System	Italian Tax System	Base Tax System
	40764	80401	312088	30500
Policy Simulation for Greece				
Greece	Base Tax System	Cypriot Tax System	Italian Tax System	Base Tax System
	125720	79931	468646	65269
Policy Simulation for Italy				
Italy	Base Tax System	Cypriot Tax System	Greek Tax System	Base Tax System
	3105560	824635	1750524	1057834

Note: The amounts are in euros.

3.9. Figures

Graph 3.1: Tax Rates 2007
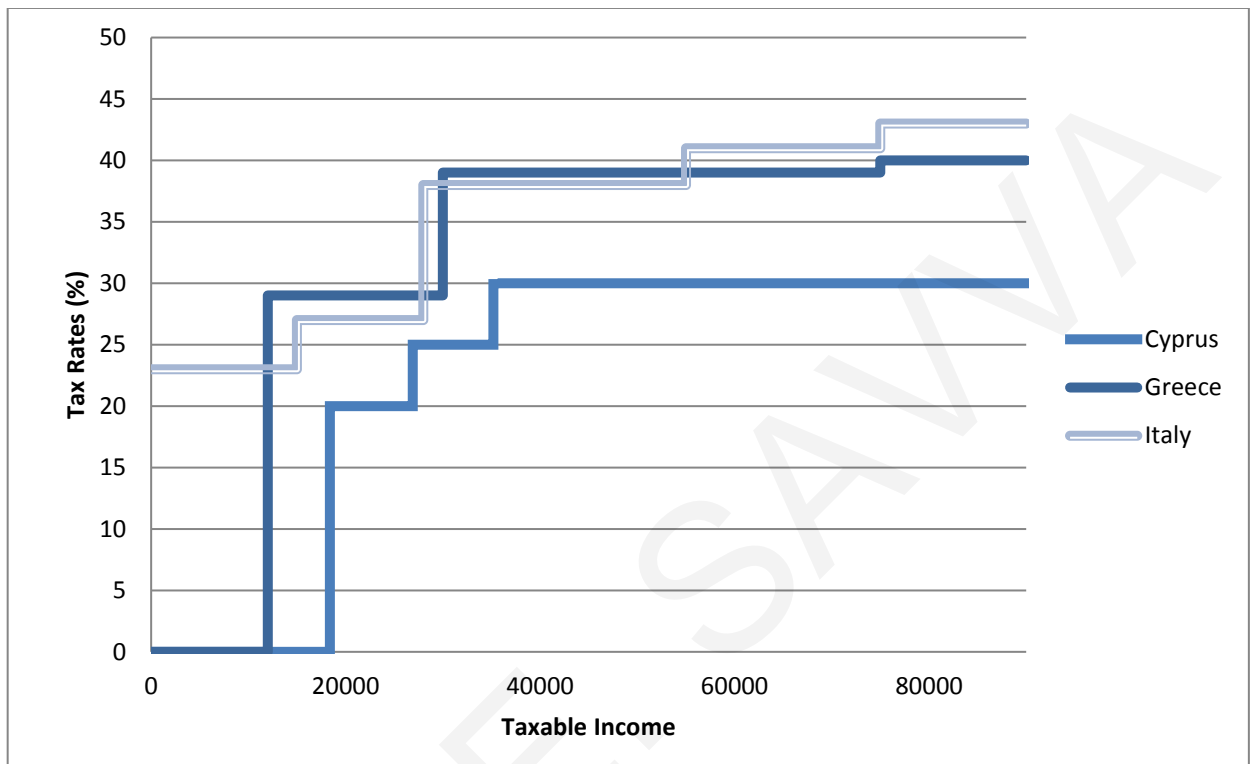
Sources: Information used for the construction of the figure comes from EUROMOD Country Reports.

Graph 3.2: Weekly Hours of Work for Singles: Cyprus, Greece and Italy

(a)   (b)
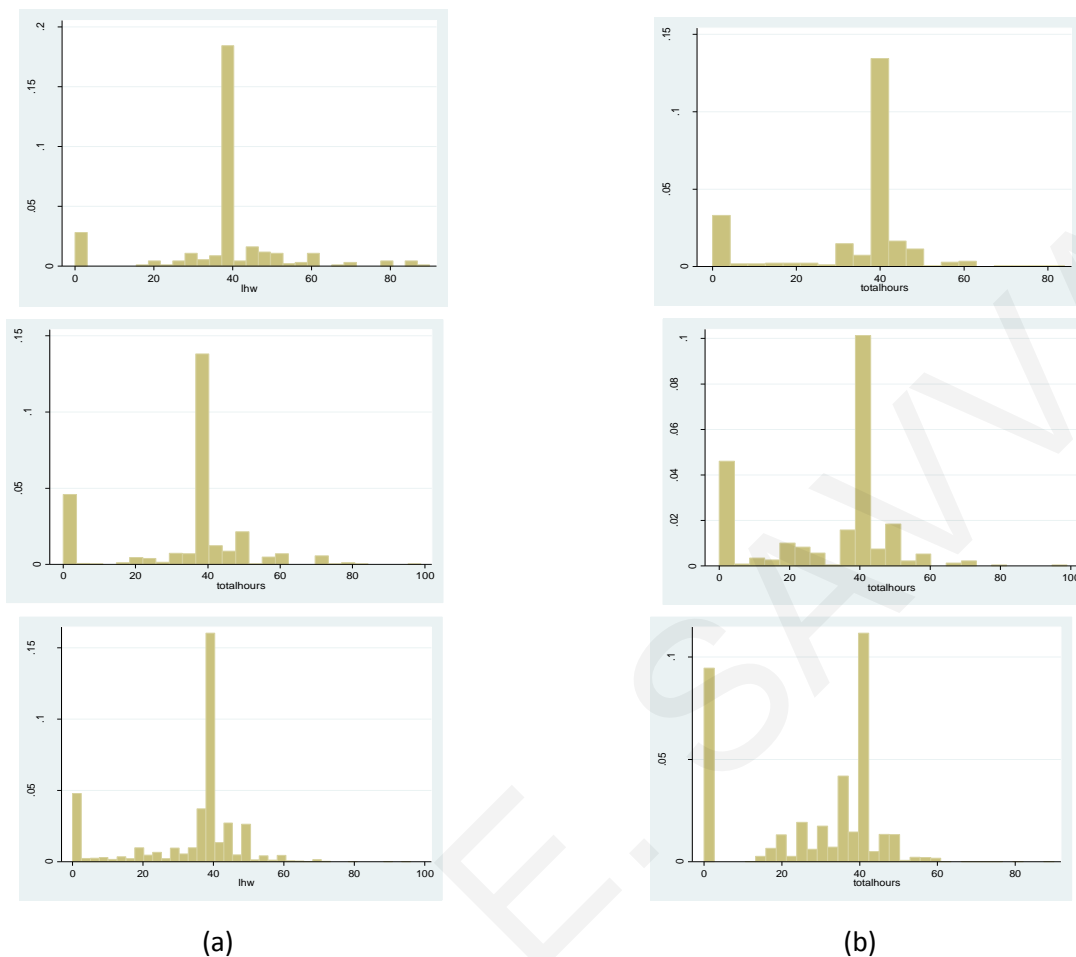
Note: The datasets used come from EUSILC 2007. The Greek EU-SILC is prepared by the Greek National Statistical Office "PDB". The Italian version of the EU-SILC was made available by ISTAT.

Chapter 4

Conclusions

The present dissertation mainly focuses on specific reforms which occurred during the last decades in the Republic of Cyprus in indirect taxation, the Value Added Tax (VAT), and in direct taxation which is subject to employment income. The first objective aims to investigate the indirect effects on economic growth via VAT and through labour supply responses. The second objective in this thesis is to justify the labour supply differences which exist between different populations using the work incentives which emerge due to tax system. Firstly, we contribute in the literature concerning tax incidence behaviour through empirical estimations since this matter is extensively studied from a theoretical perspective. Secondly, we provide a research about the behavioural responses of both genders simultaneously in order to fill in the gap in the labour supply literature which generally focuses on policy reforms that affected mostly women. Thirdly, we contribute a clearer picture regarding differences in the labour market between different populations.

By now a large theoretical literature exists on how sales tax shifts prices, although this issue is a crucial subject suffering empirically. In the first chapter we contribute to the literature of tax incidence by studying a VAT reform which occurred in Cyprus in the food retail market. We consider this political reform as a good opportunity to empirically exploit the general insights into tax shifting behaviour. The specific reform concerns first need products that are considered necessary for the daily nutrition. Therefore, their demand is more inelastic compared to other kinds of goods and taxes that fall on them are expected to be more aggressive. In this respect, such increase in prices is expected to adversely affect low earners since they will have to spend a much bigger share of their income to meet their basic needs compared to high earners. The change in the tax rate for the basic need items is what we seek to analyze with the present chapter and specifically emphasize on the impact of taxation by

using product price data. Because in this reform other food categories remained under the same tax rate we took advantage of it and we use the dif-in-dif method for the estimation. According to the findings the tax passes onto consumers until the end of the first semester after the policy implementation in the form of higher prices. However, the price increase does not exceed the tax rate increase at least for the first semester. This analysis it contributes to the existing literature because adds valuable empirical results which is an aspect that still suffers mostly because of the lack of the data. Furthermore, is a research about products that considered necessary for the daily nutrition which directly affects the welfare of all individuals' and especially low earners. The findings may be important for the evaluation of proposals for harmonisation or increase of the VAT across Europe. Also there are countries that still have 0% tax rate for basic food products such as Malta, Ireland and UK. Likewise, there are limitations in other studies that someone should consider. The limitations relate to the sample data. Someone may argue that the prices of the Control group products may also be affected by the reform through substitution effect. However, under the circumstances of this study the Control group we selected is the best choice as we tried to minimise the substitution effect factor by using only drinkable products in the Control group and eatable products in the Treatment group. Moreover, the mechanism used under the longer period specifications may need to be revised at some extent, which is something that we intend to do in the nearest future.

In the second chapter, we exploit a series of unique and different income tax reforms which affected similarly the marginal tax rates of both males and females. In the existing literature researches which relate to reforms that affected both genders and give the opportunity to identify the response of both demographic groups do not exist. This study aims to fill this gap in the labour supply literature. Specifically, it contributes to this literature by exploiting a series of unique and different income tax reforms which affected similarly the marginal tax rates of both males and females. In contrast, the tax and benefit reforms that occurred in other countries affected mostly married women's marginal tax rates and non labour income. Consequently, most of the research concentrated on identifying the women's labour supply elasticities. The reforms studied in this chapter took place in Cyprus between 2003 and 2009, which has a progressive individual tax system. These reforms involved an increase of about 27% in the level of tax free income each individual is allowed and a 42% increase in the range

of earned income which, by 2009, was taxed with a lower marginal tax rate whereas in 2003 it was taxed with the highest marginal tax rate. Therefore, they provide us with an exogenous variation in individual after tax wage and non-labour income and allow us to identify the labour supply elasticities of both men and women at the same time. We adopt the grouping estimator identification methodology proposed by Blundell et al. (1998) to correct various endogeneity and estimation problems and identify the behavioural parameters of interest. We find that policy reforms affected individual labour supply behavior both on the intensive and extensive margin. Previous research found that financial incentives affect the extensive rather than the intensive margin. Specifically, the income tax reforms increased significantly the probability of low and medium educated married males and, in particular, medium educated married females living in rural areas to participate in the labour market. The findings suggest that both married men and married women's working hours respond positively to changes in net hourly wage and negatively to changes in non-labour income. However, compared to married men, married females working hours are found to be twice as responsive to both changes in net wages and non-labour income. The results in this chapter are useful for countries considering reforms in the income tax system to create incentives to enter the labour market since are found to have positive effects to individuals independently by their gender.

In the third chapter, we investigate how the differences between different populations can be justified by the work incentives that emerge by the tax system. This chapter focuses on Cyprus, Greece and Italy which share common culture background based on ancestry, language and cultural indexes but at the same time exhibit noticeable differences in their labour market behaviour. In this way the factor population preferences is controlled allowing us to investigate if those differences could be explained by the different tax systems of the aforementioned countries. To net out any possible measurement differences arising from data, periods and methods we use a harmonise approach. We make use from a unique set of data with comparable variable definitions and we estimate for each country the same structural labour supply model. Afterwards, to investigate to what extent those differences in labour supply behaviour are justified by the different features of the income tax systems of the three countries we swap their tax-benefit systems using micro-simulation procedure by changing the tax rates and bands as practiced in each country. Taking into consideration that the countries selected for the present study share similar preferences, the impact of the factor population

preferences is controlled and minimised. In this respect, by using the swapping method it is expected that the response of the population to any changes in the tax system will be the same with regards to labour supply, whether these are positive or negative. The results show that by interchanging these features of the tax scheme, the participation rates and working hours increase as the disposable income increases while the labour supply decreases as the disposable income decreases. It is evident that these institutional characteristics could justify the differences in labour market between the three countries. In general, a generous tax system increases work incentives. Therefore, it increases participation rates and working hours. On the other hand, a less generous system has an adverse effect since it reduces work incentives. The main conclusion of the chapter supports the hypothesis that the employment patterns can by justified by the different work incentives created by the different characteristics of the tax system. The main contribution of this research is the methodology that being used which is a combination of various techniques and the use of the specific indexes which controls the factor population preferences. The findings could be useful for countries that wish to enhance labour supply by restructuring their tax system with the implementation of a more generous tax system with higher tax free income and lower marginal tax rates. However, there are limitations in this chapter as well. The limitations relate mostly to the fact that the tax system regulations do not completely swap between the relevant countries. In order to minimise heterogeneity preferences and other policies effects we concentrate to a specific sample of the population, singles without children; we only swap the tax rates and bands as practiced in each country. Also, because the relevant benefits for the specific sample couldn't be simulated in EUROMOD model, the fiscal effects cannot be calculated. Therefore, the final implication from the perspective of fiscal effect cannot be derived in order to characterise a tax system.

In future, we plan to focus mostly on the labour supply differences that exist among countries and proceed to further research that relates to it. In the third chapter, we found a variation in the responsiveness degree of the populations to the different tax systems which could be justified by the different labour income which results by the respective tax systems. However, other demographic factors matter too such as education, age, employment status and wage rate of which the impact we plan to study in the near future.

References

Aaberge, R., U. Colombino, and S. Strom, 1999, Labor Supply Responses and Welfare Effects from Replacing Current Tax Rules by a Flat Tax: Empirical Evidence from Italy, Norway and Sweden, Journal of Population Economics 13, 5959-621.

Aaberge, R., U. Colombino, and S. Strom, 2004, Do More Equal Slices Shrink the Cake? An Empirical Investigation of Tax-Transfer Reform Proposals in Italy, Journal of Population Economics 17, 767-785.

Aaberge, R., J. Dagsvik, and S. Strom, 1995, Labor Supply Responses and Welfare Effects of Tax Reforms, Scandinavian Journal of Economics 97, 635-659.

Alesina, A., and E. Spolaore, 2006, Conflict; Defense Spending, and the Number of Nations, European Economic Review 50, 91-120.

Alesina, A., E. Glaeser, and B. Sacerdote, 2006, Work and Leisure in the United States and Europe: Why So Different?, National Bureau of Economic Research vol. 20, pp. 1-101 (MIT Press).

Alesina, A., A. Devleeschauwer, W. Easterly, S. Kurlat, and R. Wacziarg, 2003, Fractionalization, Journal of Economic Growth 8, 55-194.

Angris, J.D., and A.B. Krueger, 1999, Empirical Strategies in Labor Economics, ed.: Handbook of Labor Economics vol. 3, pp. 1278-1357 (Elsevier: Amsterdam, New-York and Oxford).

Ashenfelter, O., and J.J. Heckman, 1974, The Estimation of Income and Substitution Effects in a Model of Family Labour Supply, Econometrica 42, 73-85.

Bargain, O., and T. Callan, 2009, Analyzing the Effects of Tax-Benefit Reforms on Income Distribution: A Decomposition Approach, Journal of Economic Inequality 8, 1–21.

Bargain, O., and K. Orsini, 2006, In-Work Policies in Europe: Killing two Birds with One Stone?, Labour Economics 13, 667-697.

Bargain, O., K. Orsini, and A. Peichl, 2014, Comparing Labour Supply Elasticities in Europe and the US: New Results, Journal of Human Resources 49, 723-838.

Besley, T.J., 1989, Commodity Taxation and Imperfect Competition: A Note on the Effects of Entry, Journal of Public Economics 40, 359-367.

Besley, T.J., and H.S. Rosen, 1999, Sales Taxes and Prices: An Empirical Analysis, National Tax Journal 52, 157-178.

Bick, A., B. Bruggemann, and N. Fuchs-Schundeln, 2014, Labour Supply along the Extensive and Intensive Margin: Cross-Country Facts and Time Trends by Gender, Goethe University Frankfurt, Working Paper.

Blanchard, O., 2007, Comment on "Do Taxes Explain European Employment? Indivisble Labor, Human Capital, Lotteries, and Savings", NBER Macroeconomics Annual 2006, 21, 225-232.

Blomquist, S., and W. Newey, 2002, Nonparametric Estimation with Non-linear Budget Sets, Econometrica 70, 2455–2480.

Blundell R., 2000, Work lnitiatives and 'In-Work' Benefit Reforms: A Review, Oxford Review of Economic Policy 16, 27-44.

Blundell, R., and T. MaCurdy, 1999, Labour Supply: A Review of Alternative Approaches, ed.: Handbook of Labor Econometrics vol. 6A, pp. 1559-1695 (Elsevier: Amsterdam).

Blundell R., A. Bozio, and G. Laroque, 2013, Labour Supply Responses and the Extensive Margin: The US, UK and France, Fiscal Studies 34, 1–29.

Blundell, R., A. Duncan, and C. Meghir, C., 1998, Estimating Labor Supply Responses Using Tax Reforms, Econometrica 66(4), 827-861.

Blundell, R., A. Duncan, J. McGrae, and C. Meghir, C., 2000, The Labour Market Impact of the Working Families Tax Credit, Fiscal Studies 21, 65-74.

Bosch N., and B. Van Der Kaauw, 2012, Analyzing Female Labor Supply Evidence from a Dutch Tax Reform, Labour Economics 19, 271-280.

Bourguignon, F., and T. Magnac, 1990, Labour Supply and Taxation in France, Journal of Human Recourses 25, 358-389.

Breusch, T.S., and A.R. Pagan, 1980, The Lagrange Multiplier Test and Its Applications to Model Specification in Econometrics, Review of Economic Studies 47, 239-253.

Brown, C., 1988, Minimum Wages, Employments, and the Distribution of Income, ed.: Handbook of Labour Economics vol. 3B, pp. 2101-2163 (Elsevier: Amsterdam).

Carbonnier, C., 2007, Who pays sales taxes? Evidence from French VAT reforms, 1987-1999, Journal of Public Economics 91, 1219-1229.

Card, D., and D. Krueger, 1994, Minimum Wages and Employment: A Case Study of the Fast Food Industry in New Jersey and Pennsylvania, America Economy Review 84, 722-793.

Cavalli-Sforza, L., P. Menozzi, and A. Piazza, 1994, The History and Geography of Human Genes, Princeton: Princeton University Press.

Centre for Tax policy and Administration, 2006, Tax Policy Reforms in Italy, Organization for Economic Co Operation and Development.

Ceriani, L., F. Figari, and C. Fiorio, 2012, Italy 2007-2010, EUROMOD Country Report, EUROMOD version F6.2.

Ceriani, L., and C. Gigliarano, 2010, Italy 2005-2008, EUROMOD Country Report, EUROMOD Version F3.0.

Christofides, L.N., and P. Pashardes, 2002, Self/Paid-Employment, Public/ Private Sector Selection, and Wage Differentials, Labour Economics 9, 737-762.

Dearing, H., H. Hofer, C. Lietz, R. Winter-Ebmer, and K. Wrohlich, 2007, Why Are Mothers Working Longer Hours in Austria than in Germany? A Comparative Micro simulation Analysis, Fiscal Studies 28, 463-495.

Dedoussopoulos, A., V. Aranitou, F. Koutentakis, and M. Maropoulou, 2013, Assessing the Impact of the Memoranda on Greek Labour Market and Labour Relations, International Labour Organization.

Delipalla, S., and M. Keen, 1992, The Comparison between Ad Valorem and Specific Taxation under Imperfect Competition, Journal of Public Economics 49, 351-367.

Eissa, N., 1995, Taxation and Labor Supply of Married Women: The Tax Reform Act of 1986 as a Natural Experiment, NBER Working Paper No. 5023.

Eissa, N., and H. Hoynes, 1998, The Earned Income Tax Credit and the Labour Supply of Married Couples, NBER Working Paper 6856.

Eissa, N., and H. Hoynes, 2004, Taxes and the Labour Market Participation of Married Couples: the Earned Income Tax Credit, Journal of Public Economics 88, 1931-1958.

Eissa, N., H.J. Kleven, and C.T. Kreiner, 2008, Evaluation of four Tax Reforms in the United States: Labor Supply and Welfare Effects for Single Mothers, Journal of Public Economics, 795-816.

Euwals, R., and A. Van Soest, 1999, Desired and Actual Labour Supply of Unmarried Men and Women in the Netherlands, Labour Economics 6(1), 95-118.

Evers, M., R. de Mooij, and D. van Vuuren, 2008, The Wage Elasticity of Labor Supply: A Synthesis of Empirical Estimates, De Economist 156, 1, 25-43.

Flood, L., and T. MaCurdy, 1992, Work Disincentive Effects of Taxes: An Empirical Analysis of Swedish Men, Carnegie-Rochester Conference Series on Public Policy 37, 239-277.

Friedman, M, 1937, The Use of Ranks to Avoid the Assumption of Nomrality Implicit in the Analysis of Variance, Journal of the American Statistical Association 32, 675-701.

Haan, P., and V. Steiner, 2005, Distributional and Fiscal Effects of the German Tax Reform 2000: A Behavioral Micro simulation Analysis, Journal of Applied Social Science Studies 125, 39-49.

Hall, R.E., 1988, The Relationship Between Price and Marginal Cost in U.S. Industry, Journal of Political Economy 96, 921-947.

Harris, R.E., 1987, The 1983 Increase in the Federal Cigarette Excise Tax, Tax Policy and the Economy 1, 87-111.

Hausman, J.A., 1985, Taxes and Labor Supply, ed.: Handbook of Public Economics vol. 1, pp. 213-263 (Elsevier: Amsterdam).

Heckman, J., 1974, Shadow Prices, Market Wages, and Labor Supply, Econometrica 42, 679-694.

Hoynes, H.W., 1996, Welfare Transfers in Two-Parent Families: Labour Supply and Welfare Participation Under the AFDC-UP Program, Econometrica 64, 2, 295-332.

Katz, M.L., and D. Krueger, 1992, The Effect on the Minimum Wage on the Fast-Food Industry, Industrial and Labour Relations review 46, 6-21.

Katz, M.L., and H.S. Rosen, 1985, Tax Analysis in an Oligopoly Model, Public Finance Quarterly 13, 3-20.

Killingsworth, M, 1983, Labor Supply, New York: Cambridge University Press.

Killingsworth, M., and J. Heckman, 1986, Female Labor Supply: A Survey, ed.: Handbook of Labor Economics vol. 1, pp. 103-204 (Elsevier: Amsterdam).

Kotlikoff, L.J., and L.H. Summers, 1987, Tax Incidence, ed.: Handbook of Public Economics vol. II, pp. 1043-1092 (Elsevier: Amsterdam).

Koukiadaki, A., and L. Kretsos, 2012, Opening Pandora's Box: The Sovereign Debt Crisis and Labour Market Regulation in Greece, Industrial Law Journal 41, 276-304.

Koutsampelas, C., and A. Polycarpou, 2012, Cyprus 2007-2010, EUROMOD Country Report, EUROMOD Version F6.0.

Labeaga, J.M., X. Oliver, and A. Spadaro, 2008, Discrete Choice Models of Labour Supply, Behavioural Microsimulation and the Spanish Reforms, The Journal of Economic Inequality 6, 247-273.

Leventi, C., M. Matsaganis, and P. Tsakloglou, 2010, Greece 2005-2008, EUROMOD Country Report, EUROMOD Version F3.0.

Leventi, C., M. Matsaganis, and P. Tsakloglou, 2012, Greece 2005-2008, EUROMOD Country Report, EUROMOD Version F6.0.

Levy, H., C. Lietz, and H. Sutherland, 2007, Swapping Policies: Alternative Tax-Benefit Strategies to Support Children in Austria, Spain and the UK, Journal of Social Policy 36, 625-647.

Levy, H., L. Morawski, and M. Myck, 2009, Alternative Tax-Benefit Strategies to Support Children in Poland, EUROMOD at the Institute for Social and Economic Research, Chapter 6.

MaCurdy, T., D. Green, and H. Paarsch, 1990, Assessing Empirical Approaches for Analyzing Taxes and Labor Supply, Journal of Human Resources 25, 415-490.

Matsaganis M., 2011, The Welfare State and the Crisis: the Case of Greece, Journal of European Social Policy 21, 501-512.

Meghir, C., and D. Philips, 2008, Labour Supply and Taxes, Institute for Fiscal Studies Working Paper 08/04.

Metcalf, G., 1994, Lifecycle vs. Annual Perspectives on the Incidence of a Value Added Tax, Tax Policy and the Economy 8, 45-64.

Moffitt, R., 2002, Economic Effects of Means-Tested Transfers in the U.S., NBER Working Paper No. 8730.

Ohanian, L.E., A. Raffo, and R. Rogerson, 2007, Work and Taxes: Allocation of Time in OECD countries, Economic Review Q III, 37-58.

Orsini, K., 2006, Tax-Benefits Reforms and the Labour Market: Evidence from Belgium and other EU countries, Faculty of Economics and Business, Department of Economics, Working Paper ces606.

Pechman, J.A., and A.B. Okner, 1974, Who Bears the Tax Burden?, Washington D.C.: Brookings Institution.

Pellegrino, S., and A. Vernizzi, 2010, The 2007 Personal Income Tax Reform in Italy: Effects on Potential Equity, Horizantal Inequity and Re-Ranking, Department of Economics and Public Finance, Working Paper No. 14.

Pencavel, J., 1987, Labor Supply of Men: A Survey, ed.: Handbook of Labor Economics vol.1, pp. 3-102 (Elsevier: Amsterdam).

Poterba, J.M., 1996, Retail Price Reactions to Changes in State and Local Sale Taxes, National Tax Journal XLIX, 165-176.

Prescott, E.C., 2004, Why Do Americans Work So Much More than Europeans?, Quarterly Review issue July, 2-13.

Rogerson, R., 2006, Understanding Differences in hours worked: Review of Economic Dynamics, Elsevier for the Society for Economic Dynamics 9, 365-409.

Rogerson, R., 2009, Market work, Home work, and Taxes: A cross- country Analysis, Review of International Economics 17, 588-601.

Schindler M., 2009, The Italian Labour Market: Recent Trends, Institutions and Reforms Options, International Monetary Fund.

Seade, J., 1985, Profitable Cost Increases and the Shifting of Taxation: Equilibrium Responses of Market to Oligopoly, The Warwick Economics Research Paper Series No. 260.

Sewall, W., 1949, The Genetical Structure of Populations, Annals of Eugenics 15, 323-354.

Spolaore, E., and R. Wacziarg, 2009, Ancestry, Language and Culture, in V. Ginsburgh, and S., Weber, ed.: Palgrave Handbook of Economics and Language vol.1, pp.174-211 (Elsevier: London).

Stern, N.H., 1987, The Effects of Taxation Price Control and Government Contracts in Oligopoly and Monopolistic Competition, Journal of Public Economics 32, 133-158.

Van Soest, A., 1995, Structural Models of Family Labor Supply: A Discrete Choice Approach, Journal of Human Resources 30, 63-88.

Van Soest, A., and M. Das, 2001, Family Labor Supply and Proposed Tax Reforms in the Netherlands, De Economist 149, 191-218.

William N.E., J. S. Ringel, and D. Stech, 1999, Tobacco Taxes and Public Policy to Discourage Smoking, Tax Policy and the Economy 13, 1-56.

Appendices

Appendix A

Table A1: VAT History for Food Stuff Sector

	5% Tax Rate
01/02/2002 - Until today	• Not bottled water, ice cream and nuts.
19/10/2007- Until today	• Kinds of pastry cooking. • Manufactured drinks, fruit drinks, not included soft drinks, alcoholic drinks, beer and wine. • Ingredients used in the manufacture of food supplements and food substitutes, which are not included in the term "food", syrups, flavored and/ or colored, concentrates, extracts, powders or other materials used for making beverages, except of powders, crystals, granules or other products in another form used for making tea, coffee, cocoa, and milk substitutes. cocoa and milk substitutes.
10/01/2011-Until today	• All food for human consumption except alcoholic beverages, beer, wine and soft drinks (always with the normal tax rate of each period).

Note: Information was extracted by the Tax Department of Cyprus.

Table A2: Treatment and Control Group Products

Treatment Goods	Control Goods
Charalabides Milk, 1L	Lanites Orange Juice, 1L
Lanites Milk, 1L	Kean Orange Juice, 1L
Christes Milk, 1L	Ena Orange Juice, 1L
Pittas Challoumi, 225gr	Lanites Orange Juice, 9x250ml
Cristes Challoumi Light	Kean Orange Juice, 9x250ml
Christes Yogurt, 300gr	Kean Lemon Squash, 1L
Pittas Fresh Cream 200ml	Lanites Orange Squash, 1L
Mitsides Pastas	Lanites Lemon Juice, 0,33cl
Coffee Laikos, 200gr	Kykkos Water
Coffee Charalambous, 200gr	HVH Water
Sugar, 1Kg	Agros Water, 6x1.5L

Note: Treatment group contains the products whose tax rate changed from 0% to 5%. Control group contains other food items already subject to 5% tax rate.

Table A3: Products

Product	Code
Charalabides Milk, 1L	1001
Lanites Milk, 1L	1002
Christes Milk, 1L	1003
Christes Yogurt, 300gr	1021
Pittas Challoumi, 225gr	1101
Cristes Challoumi Light	1103
Pittas Fresh Cream 200ml	1122
Mitsides Pastas	1203
Coffee Laikos, 200gr	1601
Coffee Charalambous, 200gr	1602
Sugar, 1Kg	1614
Lanites Orange Juice, 1L	1718
Kean Orange Juice, 1L	1719
Ena Orange Juice, 1L	1720
Lanites Orange Juice, 9x250ml	1721
Kean Orange Juice, 9x250ml	1722
Kean Lemon Squash, 1L	1723
Lanites Orange Squash, 1L	1724
Lanites Lemon Juice, 0,33cl	1725
Kykkos Water	1727
Agros Water, 6x1.5L	1726
HVH Water	1729

Note: Contains all the products and their codes as collected by the Ministry of Industry and Tourism.

Table A4: Results during a Period without a Reform

Variable	I
Treatment	-0.039 (0.045)
Afterall	0.000 (0.006)
Treatafter1	0.010 (0.008)
Treatafter2	0.006 (0.008)
Treatafter3	-0.011 (0.012)
Treatafter4	-0.004 (0.019)
Treatafter5	0.005 (0.022)
Treatafter6	0.038 (0.032)
LnFueloil	-0.124 (0.0398)
LnBarley	0.004 (0.025)
Constant	1.396 (0.263)
N	285

Note: Results of the estimation of equation (1.1) for the period June 2009-June 2010. Standard errors are in parentheses. Control for cost of production.

Appendix B

B.1. Tax systems description

B.1.1. Tax system of Cyprus

An important characteristic of the Cypriot income tax system is that each individual is considered as a separate tax unit i.e. the income of one spouse does not affect the income tax liability of the other. The tax system is progressive with a high non-taxable earnings allowance and three tax brackets beyond this of 20%, 25% and 30%. After the 2002 major reform of the tax system in Cyprus, almost all tax credits and deductions were abolished. Since then a cash child benefit was given to parent with children. In addition, incomes from interest and dividends as well as from social provision became exempted from the tax base. That income tax is applied mainly on income from employment, pensions and rent (20% of rental income is exempt from the tax base). Incomes from deposits, dividends and bonds are not subject to tax in Cyprus. They are subject to the personal income tax plus special contribution for defense and property tax.

Table B1: Cyprus Tax Rates

%	Taxable Year							
	2000	2001	2002	2003	2004-2006	2007	2008-2010	2011-Now
0%	0-10252	0-10252	0-15377	0-15377	0-17086	0-18368	0-19500	0-19500
20%	10253-15377	10253-15377	-	15378-20503	17087-25629	18369-26910	19501-28000	19501-28000
25%	-	-	-	20504-25629	25630-34172	26911-35197	28001-36300	28001-36300
30%	15378-20503	15378-20503	15378-20503	Over 25630	Over 34173	Over 35198	Over 36301	36301-60000
35%	-	-	-	-	-	-	-	Over 60001
40%	Over 20504	Over 20504	Over 20504	-	-	-	-	-

Note: Information comes from the Tax Department of Cyprus.

B.1.2. Tax system of Italy

Taxation in Italy is individual and progressive. Family dimension and composition is also taken into account by the system of deductions and tax credits. In addition to direct taxation (IRPEF), there is also a regional tax. In the case of income from a salary, the employer is obligated to deduct the amount of tax payable on a monthly basis. A self-employed person must prepay income tax that will be offset on filing an annual return.

Table B2: Italian Tax Rates

%	Taxable Year			
	2002	2003	2005-2006	2007-Now
18	10329	-	-	-
23	-	15000	26000	15000
24	10329-15494			
27	-	-	-	15000-28000
29	-	15000-29000		
31	-	29000-32600		
32	15494-30987			
33	-	-	26000-33500	-
38	-	-	-	28000-55000
39	30987-69722	32600-70000	33500-100000	-
41	-	-	-	55000-75000
43	-	-	Over	Over
45	Over	Over	-	-

Note: Information is provided by EUROMOD Country Reports, Ceriani, Figari, and Fiorio, (2012) and by Ceriani, and Gigliarano, (2010).

The "no-tax area and progressivity" allowance and the tax allowances for dependent family members apply from 2003 to 2006. Everyone is allocated with a Base Personal Tax Deduction of 3,000 euro. Starting from 2007 (until 2010), no-tax-area and progressivity allowance and tax allowances for dependent family members have been substituted with a system of tax credits. The tax credits since 2007 were because of the amount of income (1338-1840 euros), the dependent wife (690-720 euros), for children older than 3 years old (900 euros), for children younger than 3 years old (800 euros) and that amount increase to 200 euros if there are more than three children in the family and 750 euros for any other dependent family member 750. Besides the personal income tax Italians they also subject to property tax, regional income tax, deposit tax, tax on dividends, bonds, government bonds and taxes on arrears and severance pay.

B.1.3. Tax System of Greece

The tax system in Greece is individual and progressive. Tax relief take the form of tax allowance (reducing the taxable income) and tax deductions. The list of allowances and deductions is revised annually, but generally includes medical expenses and elderly care, private insurance contributions, education expenses, mortgage interest repayments, rent and maintenance payments, charitable donations and household expenses. Every tax individual besides the personal tax allowance was benefited also with child allowance (1,000 for one child, €2,000 for two children, €10,000 for three children, €11,000 for four children and so on). That amount increased in 2010 (1,500 for one child, 3,000 for two children, 11,500 for three children, and 2,000 for every extra child). Besides personal income tax Greek people also subject to property tax, interest income tax, withholding tax on benefits and an additional tax on rental income. For the years until 2010 in the tax free area an extra amount of €1500 added for employees and pensioners.

Table B3: Greece Tax Rates

%	Taxable Year					
	2003-2006	2007	2008	2009	2010	2011-2012
0	0-9500	0-10500	0-10500	0-10500	0-12000	0-5000
10						5000-12000
15	9500-13000	10500-12000	10500-12000	10500-12000		
18					12000-16000	12000-16000
22						
24					16000-22000	
25				12000-30000		16000-26000
26					22000-26000	
27			12000-30000			
29		12000-30000				
30	13000-23000					
32					26000-32000	
35				30000-75000		26000-40000
36					32000-40000	
37			30000-75000			
38					40000-100000	40000-60000
39		30000-75000				
40	Over	Over	Over	Over		60000-100000
45					Over	Over

Note: Information is provided by EUROMOD Country Reports, Leventi, Matsaganis, and Tsakloglou, (2010), and by Leventi, Matsaganis, and Tsakloglou, (2012).

In 2013, a new law introduced major adjustments to personal income tax. A new tax schedule with three tax brackets introduced for income deriving from employment and pensions. Self-employment income and income from farming and rental were taxed by a separate tax schedule. In 2016, a new law introduced significant changes again to personal income tax. A new tax schedule with four tax brackets was introduced for the sum of income from employment, pensions and self-employment. The same schedule used for farming income as well.

B.2. Ancestry distance

Table B4: Weighted Distance between Cyprus and other European Countries

Country_1	Country_2	Weighted Genetic Distance	Weighted Linguistic Distance	Weighted Religious Distance	Cultural Distance Preferences
Cyprus	Greece	0.0001	0.4584	0.4433	-49.9063
Cyprus	Italy	0.0079	0.9725	0.8096	-45.6735
Cyprus	Malta	0.0084			-44.7106
Cyprus	Poland	0.0196	0.9725	0.8181	-41.0332
Cyprus	Ireland	0.0202	0.9725	0.8188	-40.5985
Cyprus	Croatia	0.0007	0.9725	0.8178	-37.8770
Cyprus	Portugal	0.0078	0.9725	0.8188	-34.0319
Cyprus	Romania	0.0112	0.9748	0.7781	-31.8829
Cyprus	Slovenia	0.0006	0.9725	0.8584	-30.0973
Cyprus	Slovakia	0.0282	0.9753	0.8579	-28.6587
Cyprus	Hungary	0.1002	0.9973	0.8207	-27.7592
Cyprus	Albania	0.0009	0.9605	0.7932	-25.8936
Cyprus	Spain	0.0202	0.9740	0.8157	-25.0447
Cyprus	United Kingdom	0.0221	0.9725	0.8466	-19.7193
Cyprus	Luxembourg	0.0178			-19.3678
Cyprus	Iceland	0.0202			-13.5338

Table continued on next page…

110

Table B4 continued

Country_1	Country_2	Weighted Genetic Distance	Weighted Linguistic Distance	Weighted Religious Distance	Cultural Distance Preferences
Cyprus	Estonia	0.0725	0.9910	0.9146	-12.0412
Cyprus	Czech Republic	0.0192	0.9725	0.9091	-9.6851
Cyprus	Switzerland	0.0178	0.9717	0.8358	-7.0748
Cyprus	France	0.0207	0.9741	0.8213	-4.5986
Cyprus	Ukraine	0.0080	0.9725	0.8985	-3.9171
Cyprus	Lithuania	0.0883	0.9725	0.8580	-0.9208
Cyprus	Latvia	0.0644	0.9725	0.9203	2.9378
Cyprus	Germany	0.0197			3.6982
Cyprus	Finland	0.1000	0.9983	0.8256	7.3997
Cyprus	Norway	0.0190	0.9725	0.8305	8.6473
Cyprus	Sweden	0.0189	0.9732	0.8318	13.8973
Cyprus	Denmark	0.0201	0.9725	0.8093	27.0468
Cyprus	San Marino	0.0076			
Cyprus	Yugoslavia	0.0118	0.9735		
Cyprus	Czechoslovakia		0.9736	0.8930	
Cyprus	Germany, Federal Republic of		0.9708	0.8618	
Cyprus	German Democratic Republic		0.9725	0.9011	

Note: Datasets come from Spolaore and Wacziarg (2016), and by Spolaore and Wacziarg (*2015).*

B.3. Description of the data

The data used in the analysis are drawn from the 2007 European Union Statistics on Income and Living Conditions (EU-SILC) database. The EU-SILC database is prepared by the Statistical Service of the Member States for Eurostat and contains information for each country of the EU25 (except Malta), plus Norway and Iceland. The dataset contains cross-section data at household and personal level. The data at household level include income, social exclusion and housing/household characteristics and the data at personal level, for each member of the household, contains information about health and employment status, the level and sources of income, and demographic, education and other personal characteristics. The

advantage of this dataset is that it contains sufficient information (hours of work, wages and socio-demographic characteristics of each member living in a household) for estimating the parameters of a neoclassical labour supply model.

The data on Cyprus contain information for 8470 individuals over 16 years old living in the country, 4040 male individuals and 4430 female individuals. For this analysis we restricted the sample containing only individuals between the age of 25 and 65 who are employees or inactive; employers or self-employed individuals are dropped from the sample to avoid income under reporting problems and problems arising from the fact that the determinants of the labour supply behavior of these persons are likely to differ from the rest of the population. We also drop individuals with incomplete or unreliable personal and occupational information. After the above restrictions we separated the data according to their family status, which 3548 are married and 573 are singles, total 4121 individuals. Furthermore, we separated the data of singles individuals according to their gender and also restricted the sample to childless individuals. Finally, after merged with the respectively EUROMOD file the data sample of singles contains 306 men and 255 women.

By the same procedure we limited the sample for the other 2 countries, Greece and Italy. The original data about Greece contain information for 12417 individuals over 16 years old living in the country, 5932 men and 6414 women. After the same restrictions we finally left with 3858 individuals, which 2904 are married and 954 are singles individuals. Concentrating just to the single and childless population of the sample it contains 581 men and 368 women. The original data about Italy contain information for 44629 individuals, 21264 men and 23365 women. After the restrictions the sample diminished to 16545 observations, which the 10318 are the married individuals and the singles are 4358. Finally, the single childless sample after combined with the respectively EUROMOD data file contains 2294 men and 1780 women.

B.4. Summary Statistics

The tables B5 and B6 below present the summary statistics for the sample that being used for the wage estimation. The data includes all the individuals aged between 25 to 65, employees or inactive, independently of their marital status.

Table B5: Summary Statistics: Men when using the entire Sample

Men			
Variables	Cyprus	Greece	Italy
Participation	0.98	0.95	0.95
Weekly hours of work	44	39	37
Other adults in the household	2.1	2.1	2.3
Number of persons in the house including the individual	3.1	3	2.9
Basic Education	0.18	0.20	0.08
Medium Education	0.50	0.52	0.78
High Education	0.31	0.26	0.12
Married	0.84	0.71	0.70
Single	0.16	0.29	0.30
Head	0.82	0.72	0.69
Couple	0.83	0.71	0.69
Age	44	41	42
#Children 0-2	0.12	0.11	0.12
#Children 0-3	0.16	0.15	0.15
#Children 4-6	0.13	0.11	0.11
#Children 7-12	0.31	0.20	0.21
#Children 13-18	0.35	0.22	0.21
Number of observations	1918	1983	8095

Note: Datasets comes from EUSILC 2007.

Table B6: Summary Statistics: Women when using the entire Sample

Women			
Variables	Cyprus	Greece	Italy
Participation	0.77	0.73	0.75
Weekly hours of work	29	27	24
Other adults in the household	1.9	1.9	2.4
Number of persons in the house including the individual	2.8	2.7	2.8
Basic Education	0.20	0.18	0.10
Medium Education	0.47	0.49	0.74
High Education	0.31	0.31	0.15
Married	0.88	0.81	0.78
Single	0.12	0.19	0.22
Head	0.14	0.19	0.29
Couple	0.75	0.71	0.70
Age	43	40	44.3
#Children 0-2	0.10	0.12	0.11
#Children 0-3	0.14	0.17	0.14
#Children 4-6	0.12	0.12	0.10
#Children 7-12	0.29	0.20	0.18
#Children 13-18	0.32	0.22	0.17
Number of observations	2203	1875	8450

Note: Datasets comes from EUSILC 2007.

B.5. Goodness of fit

Table B7 presents the results using Cypriot data for male and female observations. Since Cyprus is the base country and the gap between them was very high we report the other discrete choices just for Cyprus. We did try more choices for the other countries too, but still the gap was greater compared to the three choice hours model.

Table B7: Predicted vs Observed Frequencies using Cypriot Data

	Male		Female	
	Actual	**Predicted**	**Actual**	**Predicted**
4 choice hours				
H1	0.01	0.07	0.11	0.09
H2	0.08	0.28	0.14	0.33
H3	0.62	0.32	0.61	0.32
H4	0.19	0.31	0.12	0.23
Observed Mean Hours	38.2		36.2	
Predicted Mean Hours	37.1		35.1	
Gap	2.8%		3%	
5 choice hours				
H1	0.09	0.04	0.11	0.06
H2	0.02	0.2	0.06	0.24
H3	0.3	0.3	0.34	0.30
H4	0.4	0.27	0.44	0.25
H5	0.03	0.15	0.02	0.13
Observed Mean Hours	38.2		36.2	
Predicted Mean Hours	37.2		35.3	
Gap	2.6%		2.5%	