Taxes, Transfers and the Macroeconomy

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Abstract

Taxes and transfers are widespread institutions among middle income and high income countries. In this chapter I survey main aggregate features of such institutions and features of the labor market. To study the relation between taxes and transfers and labor market outcomes I survey some important results in the literature. The main selection criteria for this survey is the use of general equilibrium models.

Keywords: taxes and transfers, general equilibrium, heterogeneous agents, life cycle, idiosyncratic risk

1 The Macroeconomic Importance of Taxes and Transfers

Since WWII the size of government has been increasing around the world. Not only it increased due to the war efforts of the countries involved in the great war (and later efforts on reconstruction) but also due to the creation and expansion of the welfare state. Despite the foundations of the welfare state go back to the late 19^{th} century, dramatic increases on its share of GDP is a more recent phenomenon. These dramatic increases have come hand by hand with increases in taxation, in particular income taxes, payroll taxes and consumption taxes.

First social security law was signed in Germany in 1883, establishing sickness insurance for workers and financed with a payroll tax. France stablished a voluntary unemployment insurance scheme in 1905. Almost at the same time, the United States introduced work injury coverage. However a proper Social Security Law was not signed until 1935, followed by additions and amendments that continue nowadays. As time went by, many countries followed through with generous and comprehensive insurance schemes.

Nowadays public social expenditure accounts for more than 20% of GDP across OECD countries. It also accounts for roughly half of total government expenditure. To demonstrate the relevance of taxes and transfers, I will present some stylized facts that will allow the reader to grasp the important role of government taxes and transfers at the macroeconomic level. Given the limited size of this chapter I will present only aggregated data, however we should have in mind that behind this aggregation lays a huge degree of heterogeneity in the institutions that give rise to these aggregate numbers. As we know, "devil is in the details."

From all type of government expenditures that there are, I will focus on social expenditure[1][2] because they are most likely to affect people's labor market behavior directly and most research analyses this expenditure. One item that will be left behind is spending in education. Despite public education is a very important item in government expenditure and despite it is key to understanding cross country macroeconomic performance, it would make the discussion too sparse and diverse. This could make us miss the main point, which is that taxes and transfers exert a powerful source of distortion over competitive labor markets and it may, or it may not, increase the welfare of people in different countries.

1.1 Facts on Taxes and transfers and Labor Supply

1. Average tax rates have been increasing over time across countries. McDaniel (2007) provides a methodology to compute average tax rates across OECD coun-

[1] I will also present some evidence of the importance public employment as a transfer program

[2] By social expenditure I understand: social security, unemployment, health and cash transfers in general

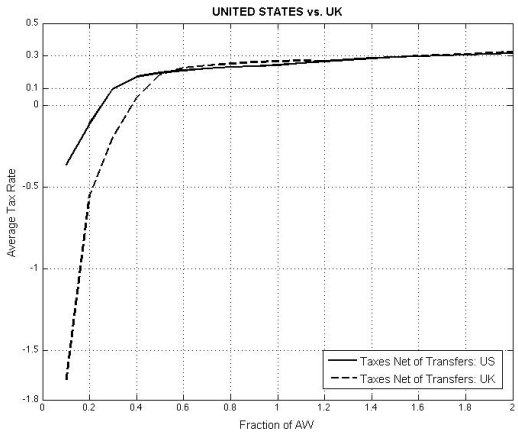
tries. Using her numbers we see that taxes on income (including payroll taxes) in core European countries, Scandinavian countries, UK and US have risen between 1950 and 2010 from 13% to 37%, 15% to 34%, 16% to 27% and 10% to 14% respectively. Similarly taxes on consumption have risen for the same countries and in the same order from 12% to 19%, 13% to 29%, 12% to 18% whereas in the US have remained flat. Corporate taxes have been flat or decreasing over time for all countries in my sample.

2. There are large differences in average taxes across countries, regardless the period of time considered. In 2005 the average tax over income and wages was 41% in Belgium but it was 20% in the US only. Similarly average tax rate over consumption for the same year was 31% in Sweden whereas in the US it was 7.5%.
Considering that public debt have been rising for these countries as well, the share of tax and transfer programs have been increasing dramatically over time. A lower bound can be set if we assume that transfers have to adjust to taxes every period. The share of tax revenues over GDP averaged 35% across OECD countries with a minimum of 17% for Mexico and a maximum of 48% for Denmark. The actual figure would be even bigger if the stock of public debt would have been properly accounted. In particular if financial obligations to future cohorts of the population entitled to social transfers were taken into account.

3. Not only there are large differences in average taxes across OECD countries and in different points in time but there are also large differences in progressivity of income tax schedules. The differences are even more striking when we take also into account progressivity of transfers (such as social security and unemployment insurance). In countries like Canada, families earning less than 10% the average income of the economy, receive almost 20% of extra income in subsidies. A family earning more than twice the average income in the economy, has to pay 26% of income in taxes according to OECD Taxing Wages data. This is the rule rather than the exception across OECD countries.
On top of progressivity of taxes we have to add progressivity of transfers, missing this feature may misguide the analysis of the effects of taxes and transfers. Figure 1 illustrates a striking example using UK and US. Both countries have similar tax schedules, which would lead us to conclude that shape of taxes can not account for differences in labor market outcomes. However when progressivity of transfers is taken into account, we get a very different picture. The UK subsidizes the income poor more heavily than US does.

4. Most of tax revenues are raised through distortionary taxation levied on the household. Taxes on income and wages account for two thirds of government revenue and this number has remained fairly constant since 1980's.

FIGURE 1. Tax and Transfer Schedule: UK vs. US



5. The share of social expenditure over total government expenditure have been rising over time for every OECD country. In the period of 1980-2010 the OECD average have gone from 42% to 49%. It has also risen from 18% to 24% as a share of GDP on average. Most of this expenditure is social security, with policy changes and demographics being major culprits. However there are other social expenditure programs that may be also important for people decisions, such as disability insurance and unemployment insurance.

There are large differences in the size of social expenditures across countries as well, with Mexico at the bottom of the group with social expenditure accounting for 8% of GDP and France at the top, with social expenditure accounting for 32% of GDP. These differences turn huge when I convert these numbers into per capita PPP$2000. In 1980 average expenditure per person-year was 3600 whereas this number was 7600 in 2009. When we look at the cross sectional distribution of per capita expenditure we see a similar ranking of countries with Mexico at the bottom, spending 1200 and Norway spending 10700, a ten-fold difference.

Even though more than half of government expenditure is accounted for by social expenditure there are other important items. I will consider two: public employment and final government consumption. This last item is defined by the OECD national accounts manual as all the expenditure incurred to produce in kind transfers and public goods and services[3].

[3]The use of the term wasteful is frequently used, but it does not imply that people in a country do not value it. It only indicates that it is a subtraction from the expenditure side of the national accounts.

6. Expenditure on wages of public employees accounts for a quarter of total government expenditure. This item is half of the size of social expenditure over GDP on average and it equals in importance with expenditure in education or healthcare. It has remained constant over time but there are significant cross country differences: Japan spends 15% of total government expenditure whereas Sweden spends 30%.

7. Governments are on average the biggest employers across the OECD. Civil service contracts usually have a low lay-off probability and a rigid employment ladder, so they may be an important source of distortions in the labor market. Of course there are large differences in the share of public employment over total employment across OECD countries. For example, Japan civil service accounts for 7% of the employed population, whereas Scandinavian countries averages 29%.

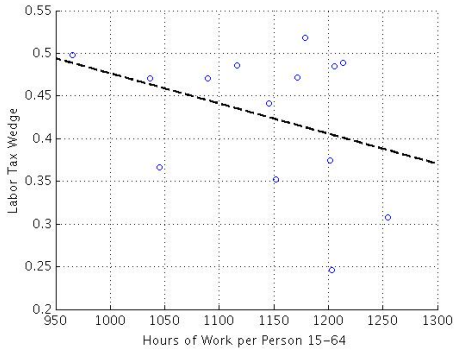
8. Final government expenditure has been increasing over time, rising from 19% to 22% on average in the period between 1980-2010. There are large differences across OECD countries as well, with Mexico at the bottom with 12% of GDP in 2010 and Denmark at the top accounting for 30% of GDP.

Given the large size of taxes and transfers and its cross country differences, a natural assumption to be made is that there exist a structural relation between tax and transfer programs and hours of work in the aggregate, over the life cycle and across countries.

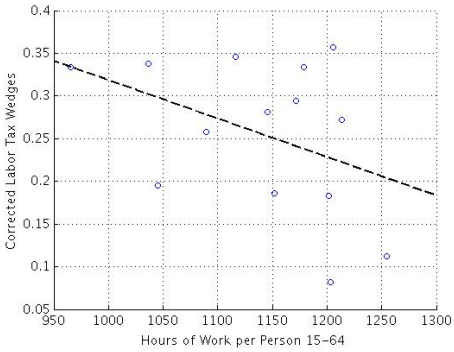
9. There are large differences across countries, and along time, in hours of work. This is well documented in the literature and I refer the reader to existing papers. An incomplete list of them would include: Ohanian & Raffo (2012), Ohanian et al. (2006 & 2008), Rogerson (2006) and McGrattan & Rogerson (2004). All document drastic changes in hours of work.

10. There is a negative relation between hours of work per person aged 15-64 and taxes. This correlation holds independently of the position of each country over the business cycle. This is relevant given the recent financial crises named as the "great recession". Taking data for available countries in 2009 the correlation of this measure of hours of work and a measure of tax distortions on labor markets known as the "tax wedge" is -.35, when I correct for final government expenditure, this correlation drops to -.41 as theory predicts. Note that these are unconditional correlations. It is also very important to note that I am using total hours of work, despite there is a huge literature that treats hours of work of men apart from hours of work of females as they show a very different labor market behavior along time and across countries.

FIGURE 2. Tax Distortions and Hours of Work per Person 15-64



(a) Taxes



(b) Taxes less Gov. Exp.

11. There are large cross-country differences in labor supply over the life cycle. These differences are particularly big for people approaching retirement age across countries, although cross country differences in hours of work of young people are also big.

12. These large cross-country differences of hours of work are highly correlated with cross country differences in social security features, such as entitlement age, replacement rate and mean tests over social security earnings[4].

Both facts 11 and 12 would take a lot of space to document in detail. Alonso-Ortiz (2012) and Erosa et al. (2012) describe the main features of social security programs and how they relate to differences in labor supply at older age. Next I will review some papers of these growing literature. The selection of papers is a matter of chance and choice, and any important omission will be my own fault.

1.2 Literature Summary

Since the beginning of 2000's a growing literature building on Prescott (2002) has been trying to understand the role that taxes and transfers play on the allocation of aggregate resources. Prescott (2002) builds on the observation that hours of work per person were high in countries like France, Germany, Japan and the UK in the 1970's relative to the US, whereas hours of work per person were low in the 1990's relative to the US. Even thought there could be many different explanations to these phenomena, taxes used to be low in European countries in the 1970's relative to the

[4]Mean tests are taxes over social security earnings that accrue if a person wants to work and collect social security benefits at the same time

US and the opposite were true in the 1990's. Prescott (2002) asks whether taxes can be important into explaining cross country differences in hours of work using the neoclassical growth model, finding that it is very likely so.

There have been two critics to Prescott's work. A strand of literature argues that in order to get big effects on cross country differences in hours of work, an implausibly high inter-temporal elasticity of labor supply (IES) is needed. Influential papers using aggregate data (Hansen & Singleton (1983), Hall (1988)) find that inter-temporal labor decisions are insensitive to changes in interest rates, implying that the (IES) is close to zero. Other papers from the micro-econometric literature find low IES that would not back up Prescott's results (MaCurdy (1981), Browning et al. (1985), and Altonji (1986)). To rebut these critics it has been argued that the micro IES need not be the same as the macro IES (Imai & Keane (2004), Guvenen (2006), Prescott, Rogerson & Wallenius (2007) Keane & Rogerson (2011) and Erosa et al. (2011)) The core of this rebuttal consist off separating total labor hours into an intensive margin (hours per worker) and extensive margin (employment rate). They argue that microeconomic research has focused on labor supply of prime age males where there is not much variation in labor supply. However when labor force participation decisions are considered (such as retirement decisions) an IES as small as what it is found in the micro literature imply large IES at the macro level, restating Prescott's results. Another critique comes from observing Scandinavian countries: if high taxes are related to low hours of work per person, countries like Sweden, Norway and Denmark whom have the highest taxes among OECD countries have hours of work in the upper range, relative to the US. In Prescott (2002) taxes are rebated lump sum but in the real world they are spent in a very different way. There is growing evidence that how you spend taxes is key to understand how many hours of work per person a country supplies (Rogerson (2007).) As it will come clear in the next section, whether taxes are spend on social security, production of public goods or hiring public employees may result in a very different allocation of labor compared to lump-sum rebates.

A different concern that may arise is that the neoclassical growth model may not be the best framework to quantify the role of taxes into explaining cross country differences in hours of work. A relevant departure from the neoclassical growth model takes into account that people suffer uninsurable idiosyncratic risk during their working lives (Aiyagari (1994).) In that framework precautionary savings arise and if people may also choose hours of work, they have to decide to what extent they use asset markets or labor supply to insure against this risk (Flodén & Lindé (2001), Domeij & Flodén (2005), Low (2006) and Pijoan-Mas (2006)). The use of either instrument depends on the IES and the amount of uninsurable idiosyncratic risk people face. The higher the IES it is expected that people will rely more on changing labor market behaviour to cope with idiosyncratic risk.

An important caveat is whether the risk that seems to be observed by the econometrician is true risk to the individual. There is a long literature trying to back up how much labor income risk is unpredictable but it would take too much space to summarize their findings (see Guvenen (2009) and Guvenen & Smith (2010) for a literature review in length) but the larger the amount of uninsurable risk the larger the scope for precautionary savings or working longer hours to cope with it.

The structure of the chapter will be as follows. Section 2 introduces a basic framework to understand how taxes, transfers and labor supply relate in general equilibrium. Section 3 discusses the role of idiosyncratic labor income risk to evaluate the impact of taxes and transfers on labor supply with infinite horizon. Section 4 turns to a life cycle model with idiosyncratic labor income risk to understand how different transfer programs impact labor supply in the intensive and extensive margin. Finally, Section 5 concludes.

2 Taxes, Transfers and Equilibrium Hours of Work

The aim of this section is to show that taxes may have a big effect on labor supply. Furthermore, how these taxes are spent will prove key to understanding cross country differences in labor supply (as in Rogerson (2007).) I begin illustrating theses relationships using a very simple model.

2.1 A Static Model of General Equilibrium

Suppose an economy populated by a representative firm, a government and a representative household. The firm is characterized by a technology that uses labor as its only input. For expositional purposes I will assume a Cobb-Douglas function

$$y = Al^{1-\alpha} \tag{1}$$

Given this technology the objective of the firm is to maximize profits (π^*,) which are owned by the household.

In the real world there are many different taxes and transfer programs, following complicated rules that cannot be modeled in this simple framework. However, it will be shown that, despite its simplicity, this model is able to accurately predict labor supply behavior across countries.
The government sets taxes and transfers. Taxes can be lump-sum (T,) income taxes (τ_y) and consumption taxes (τ_c) in any combination. Taxes on income are proportional and taxes on consumption are "ad valorem." From the transfers side,

government may distribute tax proceeds as lump-sum transfers back to the household (Ω), it may also buy private consumption (G) to produce a public good or it may throw it away as non-productive bureaucratic expenses, inefficiency or even corruption[5]. The government may hire public employees as well. We assume that if the government demands public employment (L_g) it pays the equilibrium wage rate. Given all these tax and transfer programs, the government is defined by a budget constraint

$$T + \tau_c c^* + \tau_y y^* = \Omega + g y^* + w^* L_g \tag{2}$$

Note that this budget constraint subsume all type of expenditures presented on the previous section. For example, in this model social security transfers would be lump-sump transfers and government expenditure may include health expenditure, expenditure on materials, investment in public capital and so on.

The representative household is characterized by a utility function

$$u(c, h, G) = \gamma \log(h) + \log(c) + \Psi \log(G) \tag{3}$$

that depends on consumption (c,) leisure (h) and government expenditure (G.) She tries to maximize its utility subject to a budget constraint

$$(1 + \tau_c)c = (1 - \tau_y)w(l + L_g) + (1 - \tau_y)\pi^* - T + \Omega \tag{4}$$

where $H = h + l + L_g$. From solving the representative household problem we obtain a key relation between the marginal relation of substitution and net wages

$$\frac{(1 + \tau_c)c^*}{H - l^* - L_g} = (1 - \tau_y)(1 - \alpha)\frac{y^*}{l^*} \tag{5}$$

where H is total time available for leisure and work (l^*). I imposed clearing in the labor market which guarantees clearing in the product market as well. Solving (5) for equilibrium labor supply l^* provides a fundamental relation between hours of work and taxes and transfers

$$l^* = \frac{(1 - \alpha)(H - L_g)}{1 - \alpha + \gamma \frac{(1+\tau_c)(1-g)}{1-\tau_y}} \tag{6}$$

Note that we can write down all distortions but public employment into a sufficient statistic that it is commonly known as the "labor wedge"

$$1 - \tau = \frac{1 - \tau_y}{(1 + \tau_c)(1 - g)} \tag{7}$$

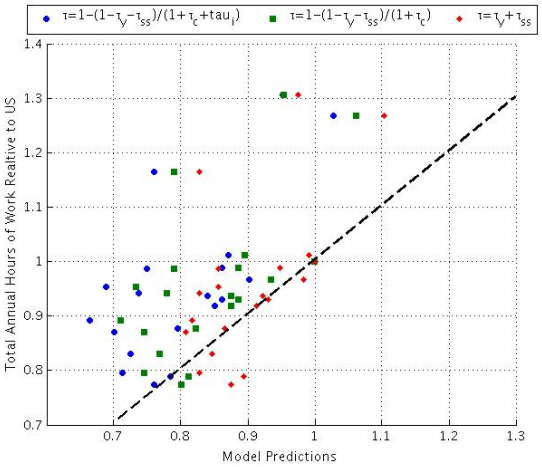
[5]To achieve analytical solutions I assume $G = gy$

It is also possible to study the behavior of total hours of work including people working in the public sector

$$L^* = l^* + L_g = \frac{(1-\alpha)H + \frac{\gamma}{1-\tau}L_g}{1-\alpha+\frac{\gamma}{1-\tau}} \tag{8}$$

Equation (7) contains the main testable implications: countries with larger labor wedge will supply less hours of work than in the US, with two caveats. If a given country has a large share of final government expenditure or a large size of public employment relative to the united states that will increase labor supply relative to the US. Figure 4 shows how well does this simple model predicts cross country labor supply relative to the US, compared with data for 2005. The scatter plot presents

FIGURE 3. Model Predictions



predictions for three different computation of the labor wedge. As this is a static model I first consider that taxes on investment are consumption taxes and taxes on capital income are taxes on profits and labor income. Finally I take into account taxes that directly distort labor markets. When broad definitions of the labor wedge are considered the model systematically over-predicts labor supply relative to the US. In this simple model there is not capital accumulation and capital accumulation is also distorted. As capital and labor are complements, abstracting from capital contributes to over-predicting labor supply.

2.2 Prescott (2002)

Prescott (2002) derives his results using the neoclassical model of growth. Compared to the static model, this model allows to study economies with distortions on capital

and economies that may be not in the balanced growth path at all times.
Technology is characterised with a Cobb-Douglas production function

$$y_t = k_t^{\alpha} \left(A_t l_t^{1-\alpha} \right)$$

that is used by a representative firm to produce a homogeneous product that can be consumed or invested

$$y_t = c_t + i_t$$

capital accumulates following a geometric law of motion

$$k_{t+1} = (1 - \delta)k_t + i_t$$

where $0 < \delta < 1$ is the depreciation rate. In this economy, there is a representative consumer that maximizes an infinite flow of utility

$$u(c, h, G) = \sum_{t=0}^{\infty} \{\gamma \log(h_t) + \log(c_t) + \Psi \log(G_t)\}$$

where $H_t = h_t + l_t + L_t^g$, subject to a budget constraint

$$(1 + \tau_t^c)c_t + (1 + \tau_t^i)i_t = (1 - \tau_t^y)(w_t(l_t + L_t^g) + r_t k_t)$$

The equilibrium in this economy is unique and determined by an inter-temporal efficiency condition (equivalent to equation (5)), an Euler equation, the government budget constraint and the resource constraint.
Prescott (2002) uses equation (5) only to map any economy's data into a simple equation which holds out of the balanced growth path of any economy. In his work he abstracts from public employment and government expenditure. Equation (8) in his paper shows the accounting relation that predicts cross country differences in hours of work, given differences in the tax wedge.

$$\frac{l_{it}}{H_{it}} = \frac{1 - \alpha}{1 - \alpha + \frac{c_{it}}{y_{it}} \frac{\gamma}{1 - \tau_{it}}} \tag{9}$$

Assuming preferences are constant across countries. Prescott shows that a careful measure of tax wedges and the consumption output ratio would predict differences in hours of work across countries. Based on the work of Mendoza et al. (1994) he constructs a measure of tax wedges that is consistent with his model[6]. Table 1 summarizes his findings It is striking how well differences in tax wedges, when tax proceeds are rebated lump sum, are able to predict differences in hours of work, conditional on consumption to output ratio. The intuition is that in a perfect foresight

[6]McDaniel (2007) provides improved measures of tax rates that can be used to calculate labor wedges. Results hold under both measures.

TABLE 1. Tax, Transfers and Labor Supply

		Labor Supply		
Period	**Country**	**Actual**	**Predicted**	**Error**
1993-1996	Germany	19.3	19.5	-0.2
	France	17.5	19.5	-2
	Italy	16.5	18.8	-2.3
	Canada	22.9	21.3	1.6
	UK	22.8	22.8	0
	Japan	27	29	-2
	US	25.9	24.6	1.3
1970-1974	Germany	24.6	24.6	0.0
	France	24.4	25.4	-1.0
	Italy	19.2	28.3	-9.1
	Canada	22.2	25.6	-3.4
	UK	25.9	24	1.9
	Japan	29.8	35.8	-6.0
	US	23.5	26.4	-2.9

Table 2, Prescott (2002)

Labor supply is measured in hours worked per person 15-64 per week

model as the neoclassical model of growth, consumption to output ratio is a sufficient statistic of the distribution of future states. This accurateness is something we would not have achieved assuming countries were in the balanced growth path.

The Euler equation is not used at all in Prescott (2002) but it can be used to do development accounting. It is a well documented fact (Hall & Jones (1999), Caselli (2005) and Hsieh & Klenow (2010)) that differences in labor and capital are able to account for differences in GDP per capita of rich countries. However it can not account for differences in the world income distribution as their order of magnitude is 40 (Parente & Prescott (1993)). Restuccia & Urrutia (2001) use the neoclassical growth model to study how differences in taxes account for differences in savings rates. They show that these rates can be predicted with precision, even though taxes can not account for differences in GDP per capita across countries. What we learn is that differences in taxes and transfers account for differences in the allocation of aggregate factors of production: labor and capital. Will these results change if idiosyncratic labor income risk and incomplete markets are introduced?

3 Taxes and Transfers under Uncertainty and Incomplete Markets

The neoclassical growth model assumes a representative agent but in the real world we observe a lot of heterogeneity along many dimensions: for example income and wealth. This heterogeneity may have implications for labor supply and savings decisions taken by risk averse people. In particular, if there are no markets to trade contingent claims on every state of nature. Hugget (1993) acknowledges that this feature may be key to account for the equity premium puzzle (Mehra & Prescott (1985)). Similarly, Aiyagari (1994) writes down a model where individuals suffer from uninsurable idiosyncratic risk, they are subject to borrowing constraints and markets are incomplete. He realises that these two features may account for why people "over-save" with respect to what the neoclassical model would predict. Pijoan-Mas (2006) extend Aiyagari model to study its implication on labor supply decisions. The importance of this extension is that people may not only use savings decisions to self-insure against risk but they may choose to work longer hours when they get an array of good shocks to insure against the possibility of an array of bad shocks[7]. They may also choose to work longer hours in face of an array of bad shocks to compensate for lost labor income as they would be able to supply less efficiency units of labor for the same number of hours worked. The quantitative importance of these mechanisms depends crucially on two things: the IES and the persistence of shocks.

The role of taxes and transfers in this set up may change, interacting in a non trivial way with risk and people's labor supply and savings decisions. For example, differences in the progressivity of taxes and transfers change the amount of risk that someone is experiencing ex-post, thereby affecting their choices on how much to save and work. Also the manifold of differences in the rules that govern the allocation of transfers may be key to account for cross country differences in labor supply and differences in its distribution over the life cycle. There are many transfer programs that kick in only in case income falls below a consumption floor, or social security programs in which pension accrual depends on many individual features, such as age, income, assets, marital status, labor marked duration spells and so on.

3.1 Precautionary Savings or Working Longer Hours

Consider an economy populated by a continuum of ex-ante identical individuals of measure one. Individuals live forever and when the are borne to the economy they

[7]These array of bad shocks will happen with probability one in an infinite horizon model as the idiosyncratic risk stochastic process shows mean reversion

suffer from a realization of an idiosyncratic shock to their efficiency units of labor[8], z, where

$$\log(z') = \rho \log(z) + \epsilon' \tag{10}$$
$$\epsilon' \xrightarrow{i.i.d.} N(0, \sigma_\epsilon^2)$$

and prime symbol refers to variables next period. Individuals make labor supply (l), consumption (c) and asset accumulation decisions (a') given their state variables: assets (a) and a idiosyncratic shock to labor productivity (z). The recursive representation of the individual decision problem would be

$$v(a,z) = \max_{c,l,a'} \left\{ \frac{c^{1-\sigma}-1}{1-\sigma} + \lambda \frac{(1-l)^{1-\nu}-1}{1-\nu} + \beta E_{z'|z}\left[v(a',z')\right] \right\} \tag{11}$$

subject to:

$$c + a' = wzl + (1+r)a - T(c, wzl, ra) + \Omega(c, wzl, ra)$$

$$a' \geq 0, c \geq 0$$

and subject to (10,) where T and Ω are generic tax and transfer programs that depend on consumption, labor income and savings' returns. These taxes and transfers may be progressive or they may be proportional taxes coupled with lump-sum transfers as well. Furthermore, these functions are general enough to capture any tax and transfer schedule found across countries.

Production takes place in a representative firm that maximizes profits subject to a standard Cobb-Douglass production function. In equilibrium, product markets, capital markets and labor markets clear[9]:

$$\int_{A\times Z} a'(a,z)\mu(da,dz) = K \tag{12}$$

$$\int_{A\times Z} zl(a,z)\mu(da,dz) = L \tag{13}$$

where $a'(\bullet)$ and $l(\bullet)$ are policy functions for asset accumulation and labor decisions, $\mu(\bullet)$ is a measure of agents with assets a and a realization of idiosyncratic shock z in the product space of assets and productivities $A \times Z$. There are many technical details that I am leaving behind. The interested reader may consult Aiyagari (1994), Pijoan-Mas (2006) or a recent account of this literature in Guvenen (2011)

Pijoan-Mas (2006) calibrates this model to the US economy. He finds that a very similar model accounts very well for the distribution of labor income and hours of

[8]This shock is uncorrelated across individuals, therefore there are no insurance opportunities

[9]Invoking Walras Law we just need to present equilibrium conditions on capital and labor markets

work across asset quintiles, however the model is not able to account for US wealth distribution[10].

With this model he is able to quantify the importance of the precautionary savings versus working longer hours. For his benchmark calibration individuals work on average 15% more and hold a stock of capital 18% higher than in the complete markets version of the model. Therefore individuals work an inefficiently high number of hours. Key to his results are the IES (ν) and the variance and persistence of idiosyncratic shocks.

3.2 Taxes and Transfers in an Incomplete Markets Model

If the amount of risk an individual face is related to her labor supply decisions, it may also interact with taxes and transfers. Consider as an illustration a very simple tax and transfer program in which there is a proportional tax on labor income and tax proceeds are divided equally across people in the economy, regardless of their idiosyncratic characteristics. With such system, progressivity arrises as those whom suffered from an array of good shocks to their efficiency units of labor would pay more taxes than what they receive in terms of transfers. Similarly, those under an array of bad shocks would be receiving more transfers than what they have paid in terms of taxes. This feature distorts the amount of risk an individual perceives and it would be expected that their labor supply decisions change.

Alonso & Rogerson (2011) build on this intuition and using the model laid down in the previous section, they quantify whether cross country differences in taxes account for differences in hours of work as in Prescott (2002.) They find that taxes and transfers still explain differences in labor supply. The effect is actually stronger because of the working longer hours mechanism. For a change in taxes from .30 to .50 the representative agent model would find a drop in hours worked of 21%, whereas in the heterogeneous agent model would be of 27%. A drawback of the representative agent model is that any distortionary tax reduces welfare. This is no longer true in a heterogeneous agent economy. They find that the US is laying close to the welfare maximizing tax rate, so that increasing taxes to Continental Europe would reduce welfare; americans are therefore "happier". A final implication of the model is that the apparent productivity catch up of European countries to the US may be an illusion. In the presence of high taxes only the most productive work as the least productive would be living on lump sum transfers. This creates a selection effect that shows up as higher measured labor productivity.

3.3 The Life Cycle Model

Many transfer programs depend on age, so a model where agents live forever might not be the right abstraction to understand their effects. As it has been documented

[10]This is a common flaw of this literature. See Castañeda et al. (2003)

in the first section of this chapter, there are markedly different labor supply behavior for specific age groups. To understand these features we need a model that include ageing individuals.

Hugget (1996) presents a variation of the infinitely lived heterogeneous agent model, extended to account for overlapping generations. As there are many variations over this model, I will write down a version similar to Erosa et al. (2012) as it will allow me to consider a wide range of different tax and transfer programs. The model will be able to capture differences in labor supply along the intensive and the extensive margin as well.

Consider a measure one of individuals that are borne to the economy with a given age, $j = 1$, and they live to a maximum of J years. As they age, they may die with certain probability that depends on age, p_j. In the steady state of this economy, there will be a constant number of people of each age, η_j. In every year of their lives, people may choose consumption $(c,)$ hours of work (l) and assets (a') to maximize their lifetime utility. Individual decision problem can be written down recursively with the following bellman equation:

$$v_j(a, z, h) = \max_{c,l,a'} \left\{ u_j(c, l, h) + \beta p_{j+1} E_{z'|z,h'|h} \left[v_{j+1}(a', z', h') \right] \right\} \tag{14}$$

subject to:

$$c + a' = w(l)zl + (1 + r)a + B - T_j(c, w(l)zl, ra, h) + \Omega_j(c, w(l)zl, ra, h)$$

and $a' \geq 0$.

This representation is very similar to equation (11) but the Bellman equation depends on a larger set of state variables. To make individual decisions interesting enough I extended previous state space to age and health[11] $(h.)$ Taxes and transfers depend on consumption, labor income, assets income, health and age. These generic functions may capture consumption floor subsidies as food stamps in the US, health related tax deductions, disability insurance and social security benefits (including health benefits.) Another important difference with the previous model is that wages per efficiency unit of labor depend on hours of work. Aaronson & French (2004) document empirically a discontinuity in the return to labor services. Actually they find that labor services' pricing function is non-convex. This non convexity is the mechanism used by Erosa et al. (2012) to generate extensive margin labor market decisions. Finally, B stands for accidental bequest as people in this economy may die with a positive probability leaving unused assets. For simplicity, it is assumed by many researchers that the government collect those assets and distribute them lump-sum to all agents in the economy[12].

[11] Other relevant states would be: human capital, marital status, number of children, whether the individual has claimed disability insurance or social security, etc...

[12] However there are many papers that deal with bequest and altruism in detail. See Fuster et al. (2008) as an example and for further references.

There is a representative firm that produces an homogenous product using a, slightly different than usual, Cobb-Douglass function

$$Y = l^{\epsilon} K^{\alpha} (Az)^{1-\alpha}$$

where $0 < \epsilon \leq 1$. If $\epsilon = 1$, workers are not subject to fatigue but otherwise, increasing the work-week length will be subject to the law of diminishing returns. With $\epsilon = 1 - \alpha$ technology collapses to the standard Cobb-Douglass, but if $\epsilon > 1 - \alpha$ hours and effective labor are imperfect substitutes and their composition may matter.

The representative firm maximizes profits choosing capital only. In this set up, profits may be positive which is at odds with the idea of reproducibility of a plant at the aggregate level. Introducing a free entry condition to firms, rules out this possibility. Under free entry, I can derive the pricing function for hours of work

$$w(l) = r \frac{1-\alpha}{\alpha} \left[\frac{\alpha l^{\epsilon}}{r} \right]^{\frac{1}{1-\alpha}}$$

see Erosa et al. (2011) for details. In practice, with this pricing function, individuals will have the incentive to withdraw from the labor force if they wanted to work less than a certain threshold l^*, generating behavior resembling retirement decisions[13]. What is left it is to examine the quantitative results of evaluating tax and transfer programs with this model.

3.4 Effects of Tax and Transfer Programs over the Life-Cycle and in the Aggregate

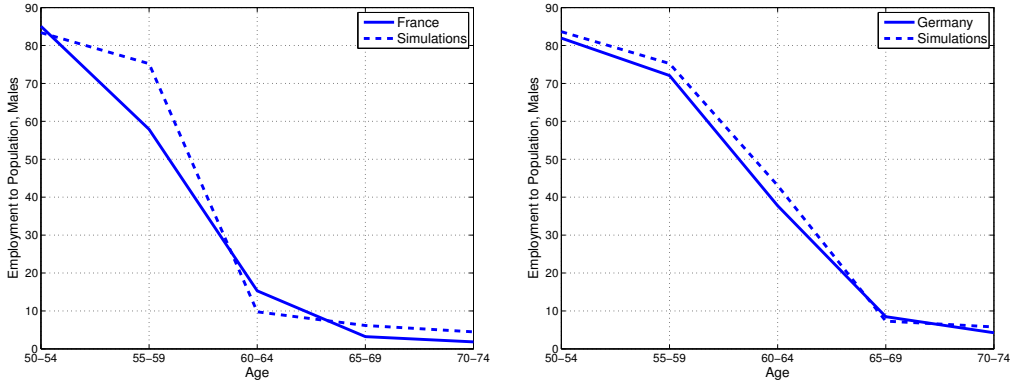
There are a bulk papers analyzing the impact of taxes and transfers over life cycle behavior in many countries. There are many papers as well studying the likely effects, in terms of aggregate allocations and welfare, of reforming tax and transfer programs. In particular, there is a lot of work done analyzing the effect of social security with its many components around the world (Gruber & Wise (2004, 2007 & 2010)) but not so much work has been done on understanding how measurable differences in tax and transfer programs account for differences in life-cycle labor supply, using a parsimonious model. I will focus on a few papers on this last strand of the literature.

Alonso-Ortiz (2011) is one of the first papers that uses a version of the model previously introduced to quantify the impact of cross-country differences in social security to account for differences in labor supply behavior of people 50+. In his paper three social security features are selected: early entitlement age to the program, average

[13]There are other ways to generate retirement decisions, either by focussing on the extensive margin only, as in Alonso-Ortiz & Rogerson (2011) or Alonso-Ortiz (2012), or introducing some utility cost of participation in the labor market, as in French (2005) and French & Jones (2011)

replacement rate[14] and whether social security entitlement rules allow to collect social security and still work.
He finds that when such a model is calibrated to the US[15] differences in those three features only, account for two thirds of the differences in retirement behavior across the OECD. Contrary to a commonly held prior, differences in entitlement age play the least role, whilst differences in replacement rate and whether you can collect benefits and work at the same time matter most. The model is also able to predict quite accurately life cycle labor supply of people 50+ as figure 4 illustrates: Even

FIGURE 4. Labor Supply of Men 50+



(a) France (b) Germany

though the model works well for females too, there are many other features that affect their labor supply, though it is more likely that these kick in early in life and not to 50+ females already in the labor force.
Erosa et al. (2012) follow a similar path and look how cross country differences in social security taxes and disability insurance rules account for differences in labor supply of people 50+. Compared to Alonso-Ortiz (2011) they include an intensive margin and disability risk. Considering disability insurance is not a trivial extension as people may consider scheduling claims to each program in order to retire earlier while maximizing benefits.
They find that social security taxes explain a substantial amount of cross country differences in elderly labor supply as in Alonso-Ortiz (2011.) Surprisingly as well, they do not find big effects of disability insurance but for a few countries. However this is not the last word on the interaction of social security and disability insurance as single country evidence points in the opposite direction. Kitao (2012) shows that the interaction between unemployment, health and disability insurance, and social

[14]Defined as the percentage of a measure of previous lifetime average wages that it is paid as pension every period, once benefits are claimed

[15]This is done to fix all variables to US levels and be able to perform a proper comparative statics analysis

security is far from trivial. This goes in the line of previous work that puts together social security and health insurance, finding that both are key to understand retirement behavior (Rust & Pheland (1997) and De Nardi et al. (2010)).
Finally, these type of life cycle models not only have implications for labor supply over the life cycle. A suitable example of this is Guvenen et al. (2012.) This paper uses a version of the model presented in this chapter, extended to account for human capital accumulation. The paper documents an increase in wage inequality in the US compared to continental European countries. Why is there cross country differences in wage inequality as well as differences over time? They find that differences in progressivity of the tax code may be behind the empirical evidence they present. A progressive tax code compress ex-post wage distribution. If there are not big wage gains at stake from human capital formation then people will have less incentives to accumulate human capital, reducing ex-ante wage inequality. The model also seems to be consistent with cross country differences in hours of work as in Prescott (2002) but their model allows them to understand the mechanisms that conduct to such results.

4 Final Remarks

This chapter intended to bring interest to Mexican economists about the analysis of taxes and transfers through models of general equilibrium. This is a fast growing area of research that lies in the intersection of Macroeconomics, Labor Economics and Econometrics. Given space constraints it is not possible to explore the relation that there is between these three areas, but I hope to have succeeded into providing some traces so the reader can explore and, more importantly, they can formulate relevant research questions.
I hope it is notable that there are more stylized facts in the introduction that theories to account for them. The shortest answer to why, is that there are still a lot to be understood on the effect that taxes and transfers may have over our life cycle and on the aggregate.
Finally, I would like to emphasize that all the evidence presented pertains to OECD countries, but there is a lot of work to be done in Latin American countries as well; both documenting the facts and proposing theories to account for them. These countries present many challenges, as the presence of a sizable informal sector and widespread corruption. One question that may rise in light of the topics presented in this chapter would be: what is the relationship between taxes and transfers and the size of the informal sector. I believe this is not only a promising area of research but a responsibility of Mexican economists, as the use of this models might enlighten policy makers to implement better policies.

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