$$u(C_1) - v(l_1) + \beta(u(C_2) - v(l_2))$$

$$C_1 + \frac{C_2}{1+r} = wl_1 + \frac{wl_2}{1+r}$$

The optimality conditions are:

$$u'(C_1) = \beta u'(C_2)(1+r)$$

$$wu'(C_1) = v'(l_1)$$

$$wu'(C_2) = v'(l_2)$$

Income/Substitution effects.

Lump-sum Taxation.

Tax rates and price distortions. FWT wont hold.

Marginal tax rate.

Optimal Taxation

Social Planner Problem: imagine initial equilibrium in a perfectly competitive economy. According to the First Welfare Theorem, this equilibrium is Pareto efficient. By distorting relative prices, taxation distorts the equilibrium away from its initial Pareto optimal level.

Above argument ignores externalities (which could mean initial equilibrium is not Pareto optimal). Objective: design tax system to get us as close as possible to initial equilibrium.

Ramsey rule/Principle: tax rate should be inversely proportional to elasticity of supply/demand.

In other worlds, "tax stuff that can't move" (much).

In this sense, a property tax is a good tax (although it is a tax on capital.)

The best tax is a lump-sum "head tax" where people simply pay a fixed amount to the gov. Although efficient, this is regressive.

Note the implicit cost to government expenditure: typically tax *rates* are raised to finance it, and such changes are distortionary. Lump-sum taxes, while efficient, are uncommon. (The new Irish property tax is an exception.)

Europe/US hours differential. Most explanations relate to the rise in tax rates in France and Germany.

1. Higher tax rates and then the government purchases services for you. (There is no income effect in aggregate, so we are left with a pure substitution effect). See example 3 in lecture 1 slides.

2. Taxation and redistribution (Pure income effects for relatively poor as they receive transfers from rich).

3. Substitution effect of lower real wage dominates (but hours tend to fall slowly over time, as real wages rise). So this seems unlikely.

4. Preferences; the French, say, simply place greater value on leisure (or, equivalently, suffer greater disutility from labour). Retirees. Prime-age workers. Participation.

5. Unions and labour market regulation. This is similar to above: in the long run, union demands and regulations (imposed by elected politicians) likely reflect societal preferences.

Ricardian Equivalence

$$G_1 + \frac{G_2}{1+r} = T_1 + \frac{T_2}{1+r}$$

$$\max_{C_1 \geq 0, C_2 \geq 0} u(C_1) + \beta u(C_2)$$

subject to

$$C_1 + \frac{C_2}{1+r} + T_1 + \frac{T_2}{1+r} = Y_1 + \frac{Y_2}{1+r}$$

But the rational consumer knows that $G_1 + \frac{G_2}{1+r} = T_1 + \frac{T_2}{1+r}$. Equivalently, we can combine the agent and government constraints, so overall, the consumer solves:

$$\max_{C_1 \geq 0, C_2 \geq 0} u(C_1) + \beta u(C_2) \quad \text{subject to}$$

$$C_1 + \frac{C_2}{1+r} + G_1 + \frac{G_2}{1+r} = Y_1 + \frac{Y_2}{1+r}$$

Expansionary fiscal contraction

- Lower government expenditure heralds lower future taxes and hence the PDV of future income rises. As a result, consumption rises (by permanent income hypothesis).

- Another channel: expected lower future government expenditure leads to expected lower future interest rates (as governments borrow less), which again raises the present value of future income.

- Fiscal contractions means less distortionary taxation in future and hence higher GDP.

- Also, a fiscal contraction could reduce the likelihood of a future fiscal crisis (which could be economically costly). Expected future income rises.

Expansionary Fiscal Contraction: PIH Keynesian View

$$Y = C + I + G$$

$$Y = \alpha Y + I + G$$

$$Y = \frac{Y + I + G}{1 - \alpha} \Longrightarrow \frac{\partial Y}{\partial G} = \frac{1}{1 - \alpha}$$

Another way to look at Ricardian Equivalence is to consider value of transfer. Suppose the government gives you T today. But next period, the government must pay back $(1+r)T$. That is, they must tax *you* to pay this back. In presented discounted terms this policy therefore increases your lifetime wealth by

$$T + \frac{-(1+r)T}{1+r} = 0$$

There is no income effect. By contrast, in Keynesian economics, you would spend most of the tax break in the first period. With the permanent income hypothesis, because the PDV of lifetime income doesn't change, consumption remains the same.

Some reasons for failure of RE

- Finite lifetimes: you won't live to incur the future tax (in practice, however, most people do live sufficiently long to pay burden). Also, people have bequest motives, so they might leave higher bequests to ensure children can pay back future tax burden.

- Myopia

- Liquidity constraints: in this case, the government tax break acts like a loan, giving you funds you need. This is especially true if the government can borrow at cheaper interest rates than you (as seems likely.)

Debt Sustainability

Key variable is $\frac{D}{Y}$

$$\triangle D = G - T + rD$$

$$\frac{\triangle D}{D} = \frac{G - T}{D} + r$$

Growth of $\frac{D}{Y}$

$$\frac{\triangle \frac{D}{Y}}{\frac{D}{Y}} = \frac{G - T}{D} + r - g$$

$$\triangle \frac{D}{Y} = \frac{G - T}{Y} + (r - g)\frac{D}{Y}$$

For stability, need $\triangle \frac{D}{Y} = 0$

$$\frac{T-G}{Y} = (r-g)\frac{D}{Y}$$

Structural deficit is deficit when economy is at potential (this should be zero). Primary surplus is $T - G$.

Bond Market Role: an important discipline device for governments.

In practice, the only way to solve significant debt problems is through *growth.* More growth means more revenues etc; by contrast, measures such as higher tax rates to finance debt can depress growth. (Likewise, a fiscal contraction can depress growth through Keynesian channels, esp. in short-run.) Sovereign crisis in Europe today is related to poor growth prospects inside eurozone. Countries outside the eurozone with higher debt burdens (e.g., Britain) have *lower* bond yields.

Extensions.

Extensive Margin; home production.

We have assumed marginal and average tax rates are equal (i.e., proportional taxation).

In general, marginal and average move together, so above analysis ok.

However, can have marginal changes without average changes.

Tax incidence: the economic burden (economic incidence) doesn't necessarily fall on the person paying the cheque (the statutory incidence). In the long run, for example, the burden/economic incidence of capital taxation falls on labour, not capital (see Ramsey model).

Marginal Tax/Average Tax. Marginal tax rates tend to rise with income, making tax systems progressive. In practice, a disproportionate amount of revenue comes from the top income levels, so raising the top marginal rates can reduce revenue. Empirically, elasticity of taxable income at the top is quite responsive to marginal tax changes; this could represent tax avoidance (a deadweight loss) too.

The marginal rate is what matters, and this is the source of the substitution effect.

For instance, suppose a person is taxed at 20 percent on income between 0 and 10000 (the "lower" rate)

and at 30 percent on income exceeding 10,000 (the "top rate").

If I earn 10000, my *marginal* rate is 30 percent, and my *average* rate is 20 percent. Now, suppose the government raises the lower rate from 20 to 24 and lowers the top rate from 30 to 27. If I am earning 10000, this *lowers* my marginal rate and *raises* my average rate. The former effect *raises* labour supply by the substitution effect, while the latter effect also *raises* labour supply by the *income* effect. Combining the effects implies I should work more. However, for people earning, say, 5000, their average *and*

marginal rate *rises*. For them, the overall effect on labour supply is indeterminate.

Important point: changes in marginal rates for some represent changes in average rates for another. One must consider how the different income band/brackets are affected – and the associated behavioural effects.

Much depends on population densities around different rates.

For a given marginal tax change, are you at the margin or *inframarginal*?

Mirlees result.

Tax rates.

Means testing (assets/income) and welfare benefits act to raise *de facto* marginal tax rates (since if you earn more, you lose benefits) at low incomes.

De facto, acts like a marginal tax (UI, Mortgage).

Mulligan Argument and Recent U.S. Labour Market.

Top rate (avoidance?)

Note that if you are working, a VAT or consumption tax acts like a tax on wages. With a wage tax, the first order condition for labour is (where we explicitly write the real wage as $\frac{W}{P}$)

$$(1-t)\frac{W}{P}u'(C) = v'(l)$$

With a VAT, we have

$$\frac{W}{(1+t)P}u'(C) = v'(l)$$

Note that both taxes reduce workers' real wages. Of course, if you are not working, you will only

be affected by the consumption tax. In this sense the tax base for a consumption tax is wider—and this is regarded as a more efficient tax. Ultimately all income is consumed, including asset income.

Note that a tax on capital can also affect labour supply: if my savings are going to be taxed, the financial reward to working is ultimately lower.

Capitalization. This refers to the idea that a tax on property, say, will be capitalized into the value of home. As a result, a property tax should lower house prices.

Laffer curve: high tax rates might reduce revenues, and vice versa. The optimal tax rate depends on the type of tax and response elasticities; for instance, with multinationals free to move, a low corporate tax rate could maximize revenues.

Tax smoothing: because high tax rates are distortionary (and associated costs *convex*), best thing is to keep tax rates low and stable. Run deficits and surpluses instead. This principle underlies the conventional wisdom of "widening the bands and keeping rates low."

Implication of convex costs to taxation: If government expenditure is higher, more expenditure is more costly. When average level of expenditure is high, average tax rates will be high. This means the marginal cost of further expenditure is high. Thus, economic costs of rising government expenditure rises disproportionately.

To prevent having to raise tax rates highly at any stage, the government should issue *contingent debt*. Contingent debt is debt where the burden of payment falls when the government

faces financing constraints (e.g., in a deep recession.) In corporate finance, this is like a bond that is convertible to equity (or a debt-equity swap.) Bohn argues that government should issue nominal debt and inflate some of it away when the government has a financing problem; this way, the nominal debt is *de facto* contingent debt (since the government can reduce payment burden in bad times.)

Intuition for Tax smoothing: because disutility of supplying labour is convex, optimal social planner solution is to equate tax rates over time. We can see this from the RBC analysis we had before. With no taxes

$$\frac{l_{t+1}}{l_t} = \left(\frac{w}{w}\right)^{\frac{1}{\sigma}} = 1 \qquad \Rightarrow l_{t+1} = l_t.$$

With taxes in period $t+1$:

$$\frac{l_{t+1}}{l_t} = \left(\frac{(1-\tau)w}{w}\right)^{\frac{1}{\sigma}} \qquad \Rightarrow l_t > l_{t+1}$$

Best thing for social planner (to avoid distorting decisions) is to set equal taxes

$$\frac{l_{t+1}}{l_t} = \left(\frac{(1-\tau')w}{(1-\tau')w}\right)^{\frac{1}{\sigma}} \qquad \Rightarrow l_{t+1} = l_t$$

This way, labour supply is equal each period. So this tax-smoothing policy brings us closer to optimal no-tax equilibrium.

This maximizes social welfare. Why? By equating taxes, this ensures the worker works the same amount in each period. The price system does not incentivize him to work too much in any given period. This would be undesirable, since the marginal disutility from working rises as you work more.

Auerbach calculation; medical expenses rising and ratio of working age to retirees falling (few workers and rising longevity.) Large fiscal gap in U.S. In the calculation, the fiscal gap is the rise in taxes necessary to ensure the government's intertemporal budget constraint holds.

One solution: raise retirement age. Productivity growth would also reduce necessary tax rises.

Political Economy: to explain why policies are often demonstrably inefficient, political economy arguments are useful. For example, why do governments tend to run persistent deficits (i.e., a "deficit bias)?

- War of attrition between special interest groups in trying to distribute burden for payment (e.g., should taxes fall on labour or capital?)

- Strategic debt accumulation to frustrate plans of political successor. Example: a more right-wing party might initiate large tax cuts to "starve the beast" and leave legacy of debt (to prevent spending on left-wing social programmes etc.) Starving the beast and reducing role of government was one motivation for Reagan deficits.

- Electoral might be myopic and fail to discern associated tax burdens. (This is related to failure of Ricardian Equivalance.)

At end of chapter, Romer presents model of multiple equilibria in bond market. Simple idea:

A high perceived probability of default can lead to high interest rates.

In turn, high interest rates make it unlikely that government can pay, and therefore induce actual default.

Sentiment therefore matters. But realistically, sentiment is typically driven by fundamentals such as low growth expectations etc.

Fiscal crises and Europe

Rudiger Dornbusch:

"*The crisis takes a much longer time coming than you think and then it happens much faster than you would have thought.*"

Eurobonds: all countries issue bonds with same interest rates, and if default occurs, burden is spread across countries. Moral hazard problem; and this effectively amounts to price-fixing and depressing market signals from bond market. Moreover, we effectively had Eurobonds at outset of euro, when all countries could borrow at German rates (look how *that* worked out.) These are not a solution to long-run structural problems in Eurozone.

New fiscal union: time/dynamically inconsistent. Stability pact was ignored.

Cost of default. Can be efficient since it means less taxation etc. Note that, by lowering debt level and stimulating growth, default can make government more creditworthy. Historically, governments have often attained access to credit markets relatively quickly.

In theory, no overall cost to default (it's a redistribution from creditors to debtors; and often from foreigners to domestic residents.)

A fiscal crisis can force governments to institute reforms that otherwise would been politically unpalatable. Fiscal crises tend to reduce investment (more uncertainty) and lead to large depreciations of real exchange rates (but latter can be desirable.)