ECON4925 – Resource Economics
Lecture on Resource Rent Taxation

Diderik Lund
Department of Economics
University of Oslo

16 November 2016

Outline of lecture

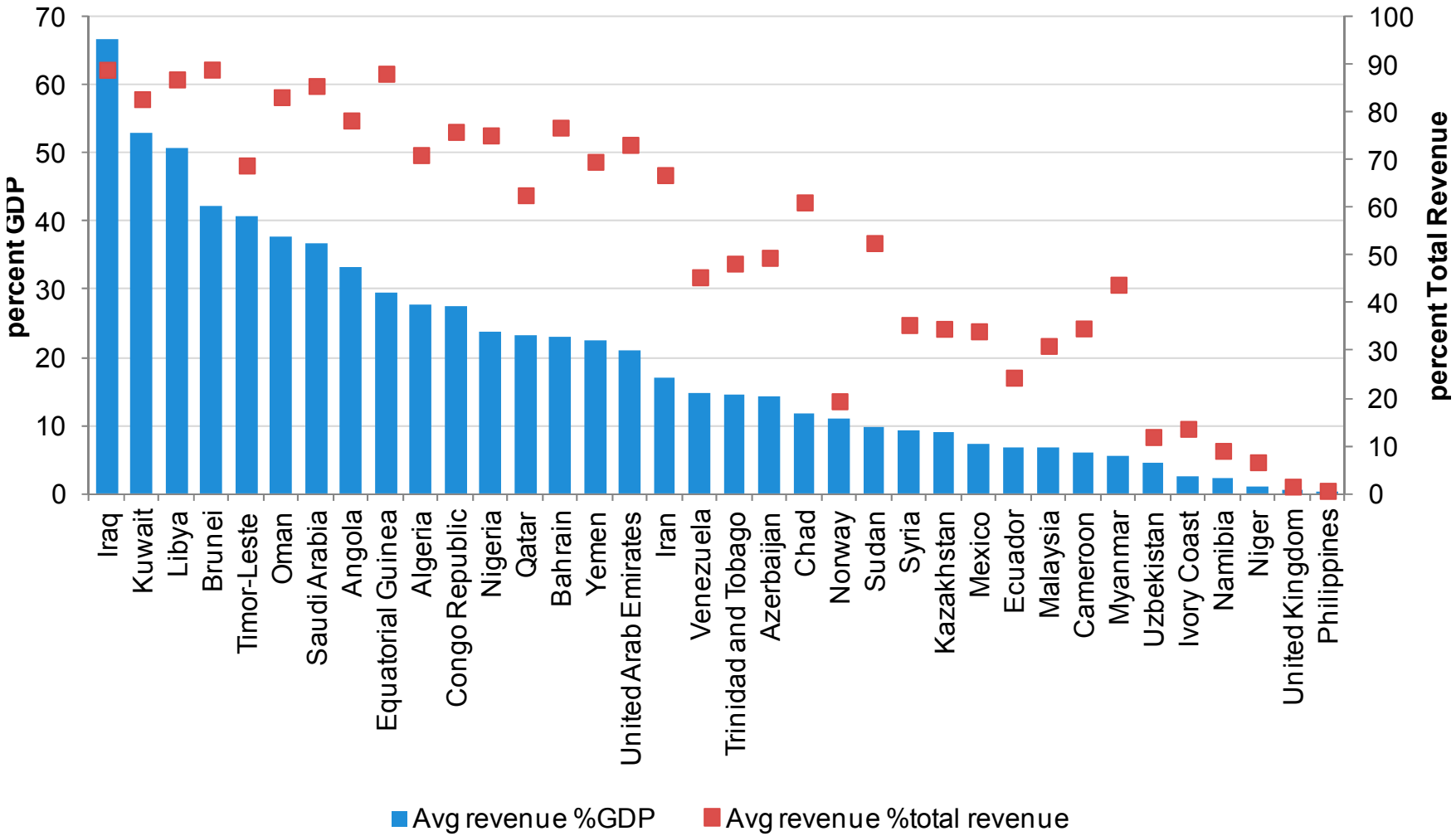
Three main parts, each corresponding to one item from reading list

- (First some motivation and preliminary remarks, delineations, definitions)
- Taxes in Hotelling-type models (Perman et al. 2011, sect. 15.7)
  - Tax on gross revenue, neutral or not
  - Tax on net revenue, neutral or not
  - Limitations of analysis
- Four types of taxes and other fiscal arrangements (Lund 2009) with strengths and weaknesses of each
  - Auctioned fixed fee (also known as signature bonus)
  - Tax on gross revenue
  - Tax on corporate income
  - Tax on natural resource rent
- Resource rent taxation in Norway (for petroleum) and elsewhere (Lund 2014)
  - Historical development in Norway towards neutral rent taxes
  - Compare to situation in other countries
  - Ongoing debate in Norway

Large government revenue from petroleum in some countries

(Source: International Monetary Fund (2012), "Fiscal regimes for extractive industries: design and implementation")

Figure 5. Petroleum: Government Revenue by Country 2001–10



Large government revenue also from minerals, or mixed, in some countries

Figure 6. Mining: Government Revenue by Country, 2001–10

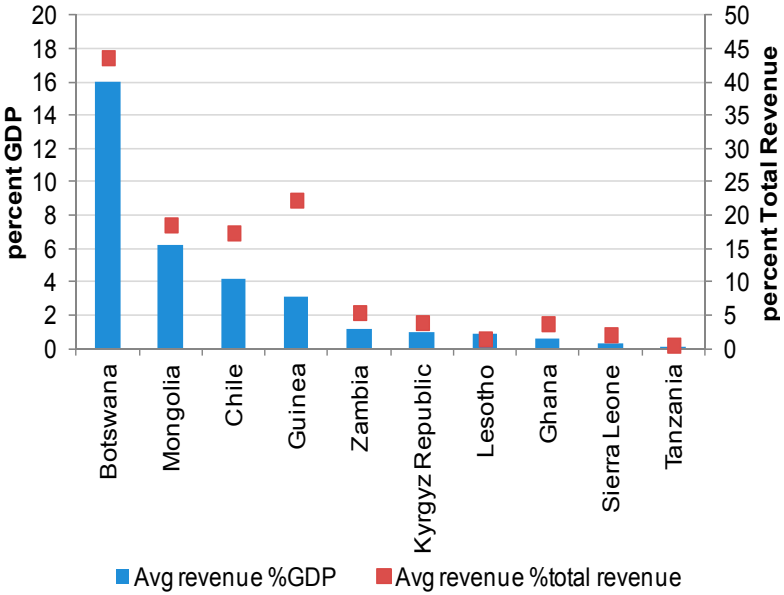
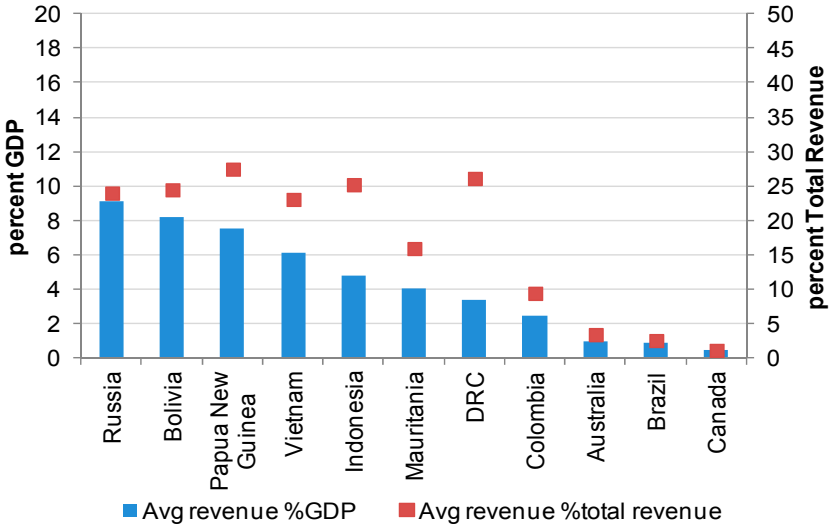
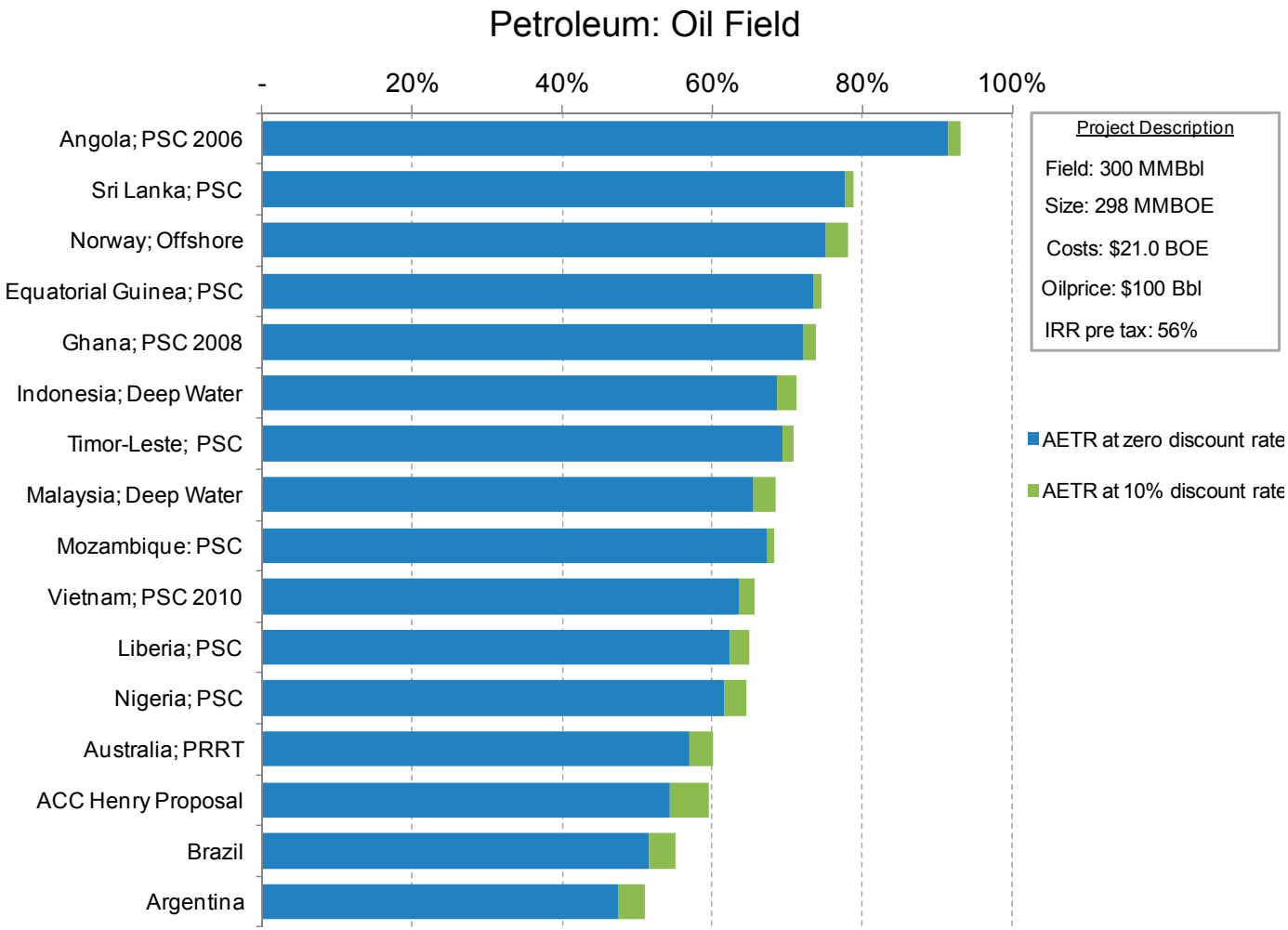


Figure 7. Mining and Petroleum: Government Revenue by Country, 2001–10

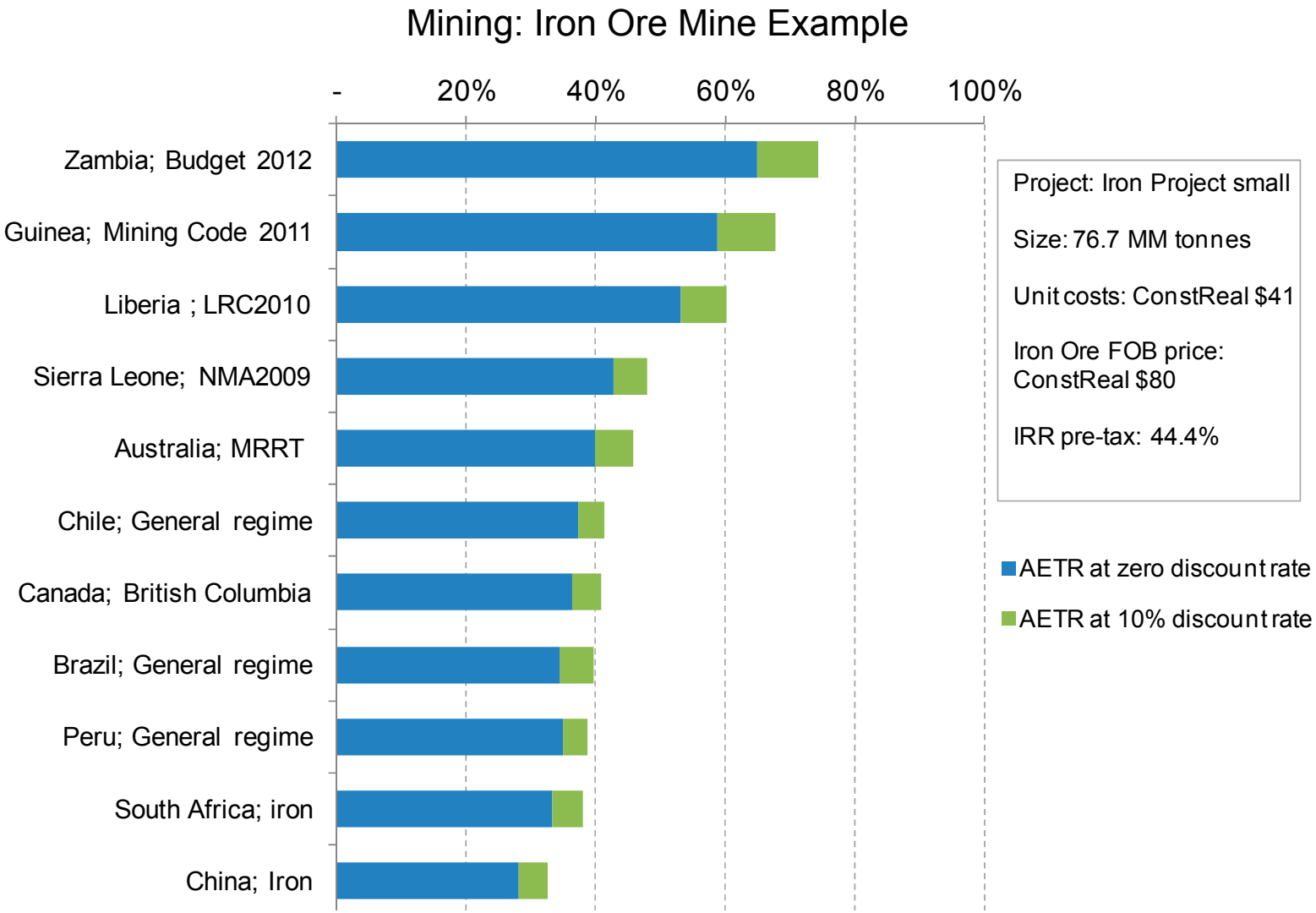


High tax rates on petroleum activities in some countries

Figure 4. Average Effective Tax Rates (AETR) for Petroleum and Mining



High tax rates on mining activities in some countries



Preliminaries, why resource taxes

- Some overlap with ECON4622 – Public Economics II
  - But here, no previous knowledge of tax theory is required
  - And here, more focus on developments of real-world tax systems
- Here, only non-renewable resources; oil, natural gas, coal, minerals
- Consider country with resource extraction, selling at exogenous world price
- *Resource rent* is net value after all factors are paid their opportunity cost
  - Capital regarded as one of the factors; paid "normal" return to capital
  - Uncertainty: Distinguish ex ante (market value or expert valuation) and ex post
- What are justifications for government to appropriate part of resource rent?
  - Resource rent can be taxed away without distorting firms' decisions
  - Resource rent tax can be seen as payment to government for resource value
  - Distributional concern: Large revenues might end up in hands of few
- Objective of government: Maximize social welfare (assuming democracy)
- Today: No discussion of externalities from activity (see ECON4910)
- Without externalities, maximize total net value
  - Obtain this by neutral tax; no distortions to firms' maximization?
- Or maximize tax revenue? (Foreign owners, or other taxes distortionary)
  - Is this a different objective, or impose neutral tax at 99%?
  - Firms maximize total net value; government takes 99% of this?

Preliminaries, some features of resource extraction

- Observe huge differences in time and space and between different resources
  - Technology, geology, profitability, time span of operations, etc.
  - Uncertainty about all of these elements also vary in time and space
  - Technology may be easily available or known to few, patented, developing fast
- Also differences in ownership: Private or government, more or less concentrated
- Also differences in political/institutional traditions; war or peace; corruption
- Differences have lead to different taxes (rates and systems) in different countries
- Example: Norwegian petroleum
  - Owned by state; oil companies apply for license areas; mandatory partnerships
  - Both state and private-sector, Norwegian and foreign, companies participate
  - Gradual development of exploration expertise, drilling technology, etc.
  - Gradual development into deeper waters, harsher climate
  - Oil and/or gas found offshore after seismic surveys and exploratory drilling
  - Facilities for extraction and transportation require huge investment ("development")
  - How much to explore, and how much to extract, are important decision variables
  - When to extract, not always an important decision; often, extract as soon as possible
  - Indifference at margin, between extraction now or later, not often observed
  - Long time lags between exploration, development, and (long) extraction period
  - Large uncertainties in geology, technology, and prices; exacerbated by time lags

Two different taxes in Hotelling models (Perman et al. 2011, sect. 15.7)

- Extraction with constant average (and marginal) extraction cost, c
- No uncertainty
- Net revenue per unit is $p_t = P_t - c$, where P_t is output price at time t
- Case 1: Net revenue taxed at a constant, proportional tax rate, α
  - After-tax net revenue per unit is $(1-\alpha)p_t$
  - Firm's optimal choice requires this to grow exponentially at rate i, the interest rate
  - This implies $(1-\alpha)p_t = (1-\alpha)p_0 e^{it}$
  - But then also $p_t = p_0 e^{it}$, which is condition for social optimum
  - Tax does not distort the socially optimal extraction path
- Case 2: Gross revenue taxed at a constant, proportional tax rate, α
  - Perman et al. now redefine $p_t = (1-\alpha)P_t - c$, the after-tax net revenue
  - For this to increase exponentially at the rate i, we need

$$[(1-\alpha)P_t - c] = [(1-\alpha)P_0 - c]\, e^{it} \Leftrightarrow \left(P_t - \frac{c}{1-\alpha}\right) = \left(P_0 - \frac{c}{1-\alpha}\right) e^{it}$$

  - Here, tax is similar to an increase in unit cost from c to $\frac{c}{1-\alpha}$
  - Perman et al. conclude: Tax leads to higher initial gross price, lower rate of increase in gross price, and longer time to exhaustion of stock; not a neutral tax
  - That conclusion assumes that all countries in world oil market apply same tax
  - More relevant: Discuss effects of taxation in one country, with P_t exogenous
  - Then, firms adjust to exogenous P_t path, and taxes affect timing decisions

Taxes affect other decision apart from timing

- Most literature on resource taxation does not concentrate on timing
- Several reasons not to restrict attention to Hotelling-type timing models
  - Tax analysis in Hotelling models typically assumes all countries have same taxes
  - Most countries regulate timing through pace of licensing or other contracts
  - After license or contract, firms typically start extraction as soon as possible
  - After installing extraction & transportation capacity, may want to use it maximally
  - Whether want to use maximally depends on cost of temporary slow- or shut-downs
  - Norwegian petroleum: Hardly ever slowed down in expectation of higher future prices
  - May be different in onshore extraction, and, in particular, in fracking
- For Norwegian petroleum, main decisions by firms are
  - Intensity and extent of exploration efforts
  - Scale of extraction and transportation capacity (possibly zero)
  - Final shut-down of activities
- First and second of these: decreasing returns to scale
- Consider simple model, invest in period 0, produce in period 1, $\max_I \left(\frac{P_t f(I)}{1+i} - I \right)$
- Tax on net revenue is either $\tau(P_t f(I) - I(1+i))$ in period 1, or $\tau P_t f(I)$ in period 1 with deduction τI in period 0, both with NPV equal to $\tau \left(\frac{P_t f(I)}{1+i} - I \right)$
- In either case, firm maximizes $\max_I (1-\tau) \left(\frac{P_t f(I)}{1+i} - I \right)$; no distortion
- (Show yourself:) Tax on gross revenue with no deduction for I will distort

Four types of fiscal arrangements

- Fiscal arrangements are anything that brings revenue to government
- Taxes are special type of fisc. arr., tied to ex post outcome of activity, and applied to all or a broad class of participants
- Four types to be considered here
  - Auctioned fees (signature bonuses) to be paid up front
  - Taxes on gross revenues, typically called "royalties" (although not by Perman et al.)
  - Corporate income taxes, typical tax on firms' profits, applied in all sectors in most countries
  - Resource rent taxes, on net revenue, see bottom of previous page
- Second and fourth of these are distortive and neutral, resp.; already shown
- Will explain how the two others work, and what are pros and cons of all four
- The four types may be combined, which is quite common
- Before going into more details on fiscal arrangements, consider two general problems
- "Time consistency" and "base erosion and profit shifting"
- Important for tax policy, in addition to standard problems of efficiency and equity

Problem of time consistency

- Potential lack of time consistency restricts design of fiscal arrangement
- Private-sector firms are invited to participate because they have technology that government does not have, perhaps also better access to capital and/or labor
- Government announces fiscal arrangement (taxes, auction) before firms act
- Typically, firms need to make large investments to start activity
- Can firms trust that authorities do not increase taxation after investment?
- Under most constitutions, governments are allowed to increase taxes
- Some governments have tried to commit not to raise taxes, e.g., by contracts
  - Disputed whether this is really legally binding
  - Experience from Denmark: May be politically infeasible to uphold commitment
- Problem partially alleviated if activity extends far into future
  - Government will care about its own reputation; no unexpected tax increases
  - Less tempting to damage reputation if government needs to attract firms in future
- Implications for choice of fiscal arrangement (taxes, auctions):
  - Good reasons to maintain constant system, build reputation
  - Reason not to rely on high early payment, as in auctions: Government will be tempted
  - Similar reason not to rely on payments very late: Firms may defect; bankruptcy

Base erosion and profit shifting (BEPS)

- (Terminology used by the OECD, G20, and other international bodies)
- These two concepts describe how multinational firms may avoid taxation
  - Also relevant within country when one sector (e.g., oil) has higher tax rate
- Particularly relevant when tax rates are very high and costs deductible
- Base erosion refers to anything that erodes (reduces) the tax base
- "Shifting" means moving; profit shifting means profit is moved elsewhere
  - Actual profit may occur in a high-tax sector, but is moved, escaping high tax
  - In accounts, profit instead reappears in a low-tax or no-tax sector
- Counteracted by OECD guidelines, requiring "arm's length" pricing
- Profit may be shifted from medium-tax sector to low-tax sector (Starbucks, Google)
- Even more to gain from shift from high-tax sector to (very) low-tax sector
- Mechanisms for moving profits away from high-tax sector
  - Transfer pricing
    - ★ Sell products to related (e.g., sister) company in low-tax sector
    - ★ Buy input factors from related company in low-tax sector
    - ★ Of these two, prices of (often standardized) products more easily monitored
    - ★ For authorities, problem is bigger on cost side, less easily monitored
  - But also, real transfers
    - ★ E.g., test new equipment where cost is deductible against highest tax rate
    - ★ E.g., train new personnel where deductible against highest tax rate
    - ★ These are less easily counteracted by authorities

Auctioned fee, pros and cons

- Auctioned fee (sometimes called signature bonus):
  - Potential participants bid for licenses, awarded to highest bidder
  - (ECON4820: Avoid winner's curse: Highest bidder pays second-highest bid)
  - Ideally, competition forces bidder to pay its estimate of net value
  - Also, the bidder who has best technology will give highest bid
- Three main advantages:
  - Efficiency: Can hope that most efficient firm gives highest bid
  - Government revenue: Can hope that payment equals ex ante net value
  - Transfer pricing problem eliminated: No incentive for firms' profit shifting
- Potential problems with auctioned fees:
  - Not clear that competition is sufficient to force bid up close to net value
  - If competition, may have opposite problem: Most optimistic bid exceeds net value
  - Auctioned fee adds to capital requirement; problematic if capital rationing
    - ★ Particularly problematic if activity in itself requires very high investment
  - Uncertainty about future taxation and regulation will reduce bids
    - ★ Before auction: Announce tax rules and commit to keep them unchanged
    - ★ Whether successful, depends on reputation and legal situation
    - ★ Political pressure to impose taxation if P_t goes up considerably
    - ★ Known as "windfall profits taxes"
- Many countries have concluded to use taxation instead of auctions
- Some countries try to combine taxation and auctions
- Another alternative may be bidding over tax rates; highest bidder wins

Corporate income taxes (CIT)

- In Norway, all corporations pay CIT at a rate of 25 percent
- Something similar is applied in most countries, with rates 10 – 40 percent
- CIT is similar to tax on net value (or "rent"), in that costs are deductible
- But one important difference: I is not deductible when incurred
- (The following discussion assumes a positive interest rate, $i > 0$)
- Instead, I is deductible over time, "depreciation allowances"
- Explanation of difference between rent tax and CIT in two-period model:
  - Showed that rent tax required deduction of I in period 0 or $I(1+i)$ in period 1
  - In two-period model, a CIT will allow deduction of I in period 1
  - This is somewhat less valuable to firm, depending on interest rate
  - Difference in deductions in period 1: Rent tax allows $I(1+i)$, CIT allows I
  - Intention that CIT taxes not only rent, but also normal return to capital ($i * I$)
  - This explains why the difference between deductions in period 1 is $i * I$
- Discussion whether normal return to capital should be taxed (in general)
  - In Norway, Scheel commission, NOU 2014:13
  - Intention that CIT gives same effect on return to capital as for financial investment
  - E.g., if i is 8 percent and tax rate is $\tau = 25$ percent, after-tax return is 6 percent
- Since normal return to capital is taxed, Norway combines 25 percent CIT with 53 percent petroleum rent tax, with higher deductions allowed in rent tax
- When P_t falls, so that rent goes to zero, oil companies will pay only CIT

Strength and weaknesses of the three tax types

- Tax on gross revenue is widespread in spite of distortions
- Distortions imply that parts of resource will be left in the ground
  - Despite the fact that it would be profitable to extract those parts
  - Parts left behind due to less intensive extraction (e.g., number of oil wells)
  - Other parts left behind due to early close-down of activities
- Advantage of gross revenue taxation
  - Easy administration, no need to account for (and monitor) costs
  - Early revenue, no need to wait until revenue exceeds deductions
  - Avoid profit shifting problem on the cost side (transfer pricing, real transfers)
- Rent taxes avoid distortions, except profit shifting problem
- Profit shifting problem is important reason to stop well below $\tau = 100$ percent
- Since transfer pricing is more problematic on cost side, may choose compromise
  - Compromise involves combination of rent tax and some tax on gross revenue
- Norway now combines rent tax and CIT
- Combination means normal return to capital in sector is taxed
- Distortion, some projects will be unprofitable even if profitable before tax
- Those projects would have been unprofitable under CIT (in other sectors in Norway)
- Intention of combination: total investment in Norway is efficiently allocated
- Alternative: Try to attract additional foreign capital into low-profitable oil projects

Development in Norway

Table from Lund (2014):

Table 1
Historical development of some main features of state participation and taxation.

Decade	State participation	Taxes incl. royalties
1960s	1965: State minority holding in Norsk Hydro, with shares in licenses	1965: Corporate income tax (CIT) (41.8%) and Royalty (10%, deductible in other taxes)
1970s	1972: Statoil established, 100% state owned, strongly favored in licensing	1972: Progressive royalty for oil (8–16%) 1975: Special petroleum tax (SPT) (25%) on top of CIT (50.8%) (totaling 75.8%)
1980s	1984: State's Direct Financial Interest (SDFI) (state as non-operating partner) split out from Statoil's license shares	1980: SPT rate increase to 35% (total 85.8%) 1986: SPT rate decrease to 30% (total 80.8%) 1986: Gradual phasing out of royalty started, negative royalty for new fields (15%)
1990s	1992: Statoil's carried interest during exploration abolished 1993: Statoil's sliding scale arrangement abolished in new licenses	1992: CIT reform, reduced to 28%, SPT increased to 50%, totaling 78%, negative royalty abolished
2000s	2001: Statoil partly privatized, Petoro established to take care of SDFI	2002: Loss carry-forward w/interest accumulation, possible sale of final loss position 2005: Direct refund of loss from exploration and of final loss, if any
2010s		2013: Uplift in SPT reduced somewhat

- Article refers to several authors who promote Norway as an example
  - Stable tax system, and only such distortions that are intended
  - In particular, give deductions for costs against 78 percent tax rate
  - Moreover, deductions are effective even if revenues do not materialize
- But historically the Norwegian system has varied and created distortions
- This may be understood by changes in Norway's situation over time
- Norway 1965–1986 similar to many typical resource rich nations today:
  - Important to get some of the revenue soon
  - Government not willing to take much risk through tax system
  - Worried about transfer pricing on cost side

Current debate on Norwegian petroleum taxation

- For a 78 percent tax to be non-distortive, it must be symmetric
- In particular, this is necessary due to high uncertainty
- Firms know that if they find petroleum, 78 percent of net value is taxed away
- Such tax will only be non-distortive if 78 percent of costs is covered by tax
- During exploration, this is arranged through payout of "negative taxes"
- After investment and extraction, a postponed payout happens if revenue insufficient
- Oil companies and Ministry of Finance disagree whether payout is sufficient
  - Oil companies claim to have high discount rates, thus future payout must be high
  - Ministry claims they do not need such high compensation for postponed payout
- The environmental movement claims that payouts are much too generous
- Payouts are called "subsidies of petroleum activities"
- (Some) environmentalists want to restrict petroleum activity in each license
- An alternative method is to restrict licenses, but extract efficiently in each license
- Three positions after a small reduction 2013 in deductions for investment:
  - Oil companies claim that investment-related deductions are now too low
  - Ministry of Finance claims that investment-related deductions are a bit too generous
  - Environmentalists claim that investment-related deductions are much too generous