Ugandan oil – a blessing or a curse?

John Hassler (IIES), Per Krusell (IIES), Abulaziz Shifa (Syracuse U)
and Daniel Spiro (U Oslo)

September 2013

Background – who are we?

- We are macroeconomists - working with various topics related to growth and business cycles.

Background – who are we?

- We are macroeconomists - working with various topics related to growth and business cycles.
- Recent year, a focus on climate-economy and natural resources in a long-run macro perspective.

Background – who are we?

- We are macroeconomists - working with various topics related to growth and business cycles.
- Recent year, a focus on climate-economy and natural resources in a long-run macro perspective.
- IGC asked us to apply a similar long-run macro perspective to questions arising due the discovery of oil in Uganda.

Background – Uganda's oil

- Has found substantial but uncertain amounts of oil at fairly low extraction costs.

Background – Uganda's oil

- Has found substantial but uncertain amounts of oil at fairly low extraction costs.
- A (possibly) reasonable estimate is that 1.8 billion barrels can be extracted. At a price of \$100/barrel and extraction + transportation + exploration costs of \$15-20/barrel this amounts to a profit of around \$140 billion.

Background – Uganda's oil

- Has found substantial but uncertain amounts of oil at fairly low extraction costs.
- A (possibly) reasonable estimate is that 1.8 billion barrels can be extracted. At a price of \$100/barrel and extraction + transportation + exploration costs of \$15-20/barrel this amounts to a profit of around \$140 billion.
- This is over \$4000 per capita or 8 times current GDP/capita.

Background – Uganda's oil

- Has found substantial but uncertain amounts of oil at fairly low extraction costs.
- A (possibly) reasonable estimate is that 1.8 billion barrels can be extracted. At a price of \$100/barrel and extraction + transportation + exploration costs of \$15-20/barrel this amounts to a profit of around \$140 billion.
- This is over \$4000 per capita or 8 times current GDP/capita.
- In a wealth fund of Norwegian style, this would yield a permanent yearly income equal to 1/3 of current GDP. A lot – but not in itself making all current and future Ugandans rich.

Background – Uganda's oil

- Has found substantial but uncertain amounts of oil at fairly low extraction costs.
- A (possibly) reasonable estimate is that 1.8 billion barrels can be extracted. At a price of \$100/barrel and extraction + transportation + exploration costs of \$15-20/barrel this amounts to a profit of around \$140 billion.
- This is over \$4000 per capita or 8 times current GDP/capita.
- In a wealth fund of Norwegian style, this would yield a permanent yearly income equal to 1/3 of current GDP. A lot – but not in itself making all current and future Ugandans rich.
- 10 years of zero growth instead of 3% that is not recovered reduces welfare/consumption as much as the oil increases it. Catch-up much more valuable than oil!

What we do

- Analyze the trade-off between:

What we do

- Analyze the trade-off between:
  1. Extracting oil now or in the future.

What we do

- Analyze the trade-off between:
  1. Extracting oil now or in the future.
  2. Consumption and investment.

What we do

- Analyze the trade-off between:
  1. Extracting oil now or in the future.
  2. Consumption and investment.
- The analysis is done formally in a stylized but quantitative general equilibrium growth model.

What we do

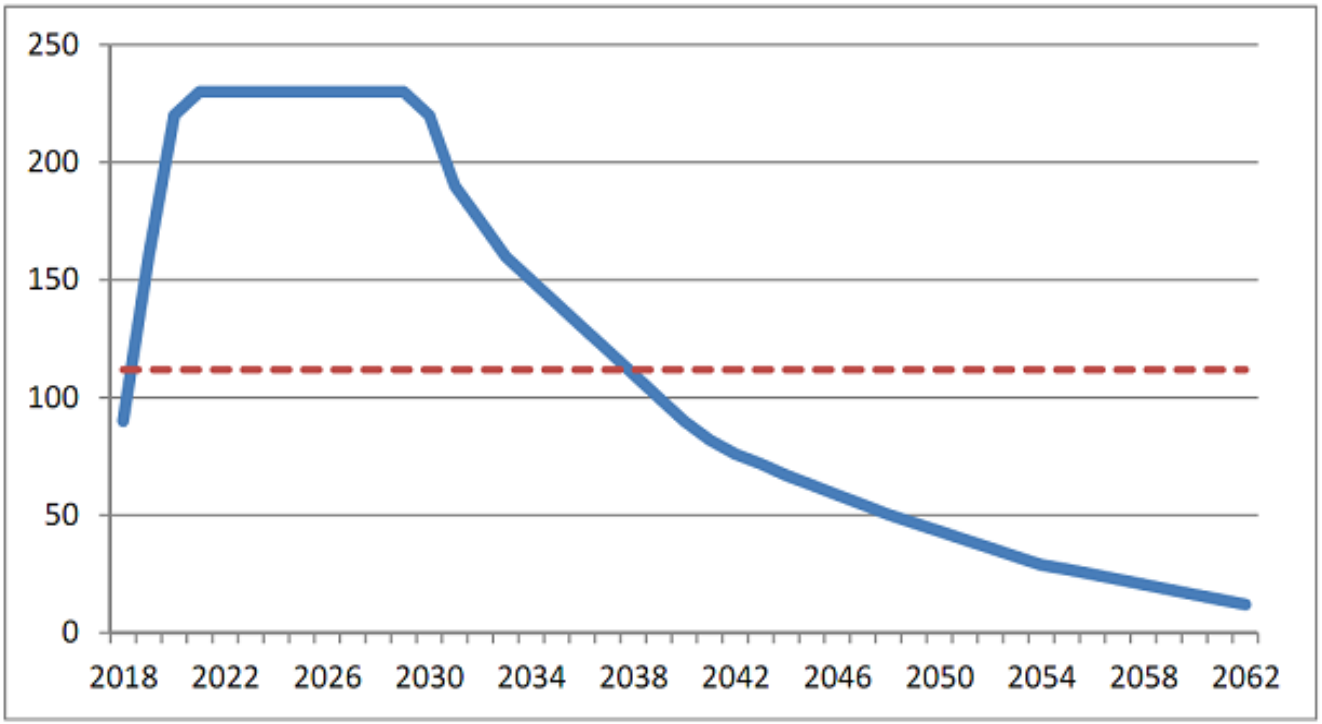
- Analyze the trade-off between:
  1. Extracting oil now or in the future.
  2. Consumption and investment.
- The analysis is done formally in a stylized but quantitative general equilibrium growth model.
- Other considerations outside the model are discussed somewhat less formally.

Extracting now or in the future?

- Cannot extract everything immediately. Tullow's extraction path assumed to maximize extraction speed.

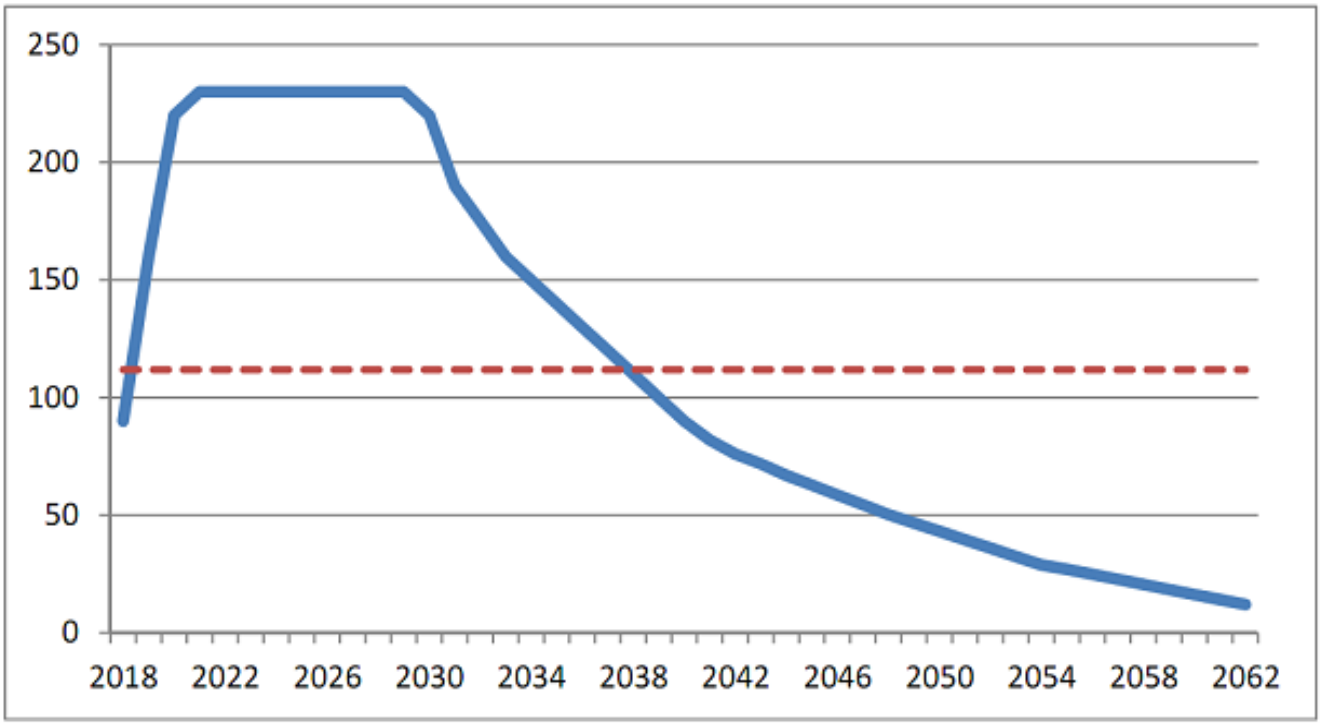
Extracting now or in the future?

- Cannot extract everything immediately. Tullow's extraction path assumed to maximize extraction speed.



Extracting now or in the future?

- Cannot extract everything immediately. Tullow's extraction path assumed to maximize extraction speed.



- Still policy choice how fast to extract. Basic principle. Compare to alternatives the return on leaving oil in ground, given by

$$\frac{P_{t+1} - c_{t+1}}{P_t - c_t}.$$

How sensitive is the value to extraction speed?

- Under standard theoretical assumptions (Hotelling), the world market oil price should increase at a rate given by alternative investment opportunities.

How sensitive is the value to extraction speed?

- Under standard theoretical assumptions (Hotelling), the world market oil price should increase at a rate given by alternative investment opportunities.
- Then, timing is irrelevant.

How sensitive is the value to extraction speed?

- Under standard theoretical assumptions (Hotelling), the world market oil price should increase at a rate given by alternative investment opportunities.
- Then, timing is irrelevant.
- However, in a long historic perspective, oil prices have grown surprisingly slowly.

How sensitive is the value to extraction speed?

- Under standard theoretical assumptions (Hotelling), the world market oil price should increase at a rate given by alternative investment opportunities.
- Then, timing is irrelevant.
- However, in a long historic perspective, oil prices have grown surprisingly slowly.
- Delaying can then be costly. With constant real oil prices (reasonable?).

How sensitive is the value to extraction speed?

- Under standard theoretical assumptions (Hotelling), the world market oil price should increase at a rate given by alternative investment opportunities.
- Then, timing is irrelevant.
- However, in a long historic perspective, oil prices have grown surprisingly slowly.
- Delaying can then be costly. With constant real oil prices (reasonable?).
  1. The Tullow extraction profile implies almost half of value is lost.

How sensitive is the value to extraction speed?

- Under standard theoretical assumptions (Hotelling), the world market oil price should increase at a rate given by alternative investment opportunities.
- Then, timing is irrelevant.
- However, in a long historic perspective, oil prices have grown surprisingly slowly.
- Delaying can then be costly. With constant real oil prices (reasonable?).
  1. The Tullow extraction profile implies almost half of value is lost.
  2. A slower (constant) extraction path reduces the value to 40% (3/4 of the Tullow profile value).

How sensitive is the value to extraction speed?

- Under standard theoretical assumptions (Hotelling), the world market oil price should increase at a rate given by alternative investment opportunities.
- Then, timing is irrelevant.
- However, in a long historic perspective, oil prices have grown surprisingly slowly.
- Delaying can then be costly. With constant real oil prices (reasonable?).
  1. The Tullow extraction profile implies almost half of value is lost.
  2. A slower (constant) extraction path reduces the value to 40% (3/4 of the Tullow profile value).
  3. Postponing extraction a year, reduces value by the rate of real interest rate (4%).

How sensitive is the value to extraction speed?

- Under standard theoretical assumptions (Hotelling), the world market oil price should increase at a rate given by alternative investment opportunities.
- Then, timing is irrelevant.
- However, in a long historic perspective, oil prices have grown surprisingly slowly.
- Delaying can then be costly. With constant real oil prices (reasonable?).
  1. The Tullow extraction profile implies almost half of value is lost.
  2. A slower (constant) extraction path reduces the value to 40% (3/4 of the Tullow profile value).
  3. Postponing extraction a year, reduces value by the rate of real interest rate (4%).
- Oil prices are uncertain, creates a precautionary motive for extracting and placing in a safer assets. Replace a one-asset portfolio with a diversified. A factor in favor of not delaying extraction.

The consumption investment trade-off

- Should the oil be consumed or invested?

The consumption investment trade-off

- Should the oil be consumed or invested?
- If a country is well connected to international financial markets, the question separates into two different ones:

The consumption investment trade-off

- Should the oil be consumed or invested?
- If a country is well connected to international financial markets, the question separates into two different ones:
  1. How to invest to maximize discounted sum of income. Straightforward answer: Invest in all projects with a return higher than borrowing cost.

The consumption investment trade-off

- Should the oil be consumed or invested?
- If a country is well connected to international financial markets, the question separates into two different ones:
  1. How to invest to maximize discounted sum of income. Straightforward answer: Invest in all projects with a return higher than borrowing cost.
  2. How much to consume now vs. save for future consumption. Trade-off depends on expected income of future generations and how much we care about them.

The consumption investment trade-off

- Should the oil be consumed or invested?
- If a country is well connected to international financial markets, the question separates into two different ones:
  1. How to invest to maximize discounted sum of income. Straightforward answer: Invest in all projects with a return higher than borrowing cost.
  2. How much to consume now vs. save for future consumption. Trade-off depends on expected income of future generations and how much we care about them.
- With no access to international capital markets, the questions cannot be separated. Consumption and investment have to be taken from current income. Investment cannot be financed with foreign borrowing.

The consumption investment trade-off

- Should the oil be consumed or invested?
- If a country is well connected to international financial markets, the question separates into two different ones:
  1. How to invest to maximize discounted sum of income. Straightforward answer: Invest in all projects with a return higher than borrowing cost.
  2. How much to consume now vs. save for future consumption. Trade-off depends on expected income of future generations and how much we care about them.
- With no access to international capital markets, the questions cannot be separated. Consumption and investment have to be taken from current income. Investment cannot be financed with foreign borrowing.
- Then, a positive wealth shock can have a large impact on optimal investment.

The consumption investment trade-off

- Should the oil be consumed or invested?
- If a country is well connected to international financial markets, the question separates into two different ones:
  1. How to invest to maximize discounted sum of income. Straightforward answer: Invest in all projects with a return higher than borrowing cost.
  2. How much to consume now vs. save for future consumption. Trade-off depends on expected income of future generations and how much we care about them.
- With no access to international capital markets, the questions cannot be separated. Consumption and investment have to be taken from current income. Investment cannot be financed with foreign borrowing.
- Then, a positive wealth shock can have a large impact on optimal investment.
- Truth in between, hard to say exactly where. We will analyze both extremes.

A formal model

- A standard growth model with two types of capital, private and public.

A formal model

- A standard growth model with two types of capital, private and public.
- Catch-up – total factor productivity growth high initially but falls slowly over time.

A formal model

- A standard growth model with two types of capital, private and public.
- Catch-up – total factor productivity growth high initially but falls slowly over time.
- We allow a investment inefficiency in the accumulation of private and public capital. A fraction of investment is lost and not turned into new capital.

A formal model

- A standard growth model with two types of capital, private and public.
- Catch-up – total factor productivity growth high initially but falls slowly over time.
- We allow a investment inefficiency in the accumulation of private and public capital. A fraction of investment is lost and not turned into new capital.
- Private sector initially 25% lost, public sector 50%. Both fall towards zero over time.

Conclusions from model

- Due to

Conclusions from model

- Due to
  1. high growth (catch-up),

Conclusions from model

- Due to
  1. high growth (catch-up),
  2. high but falling investment inefficiencies, and

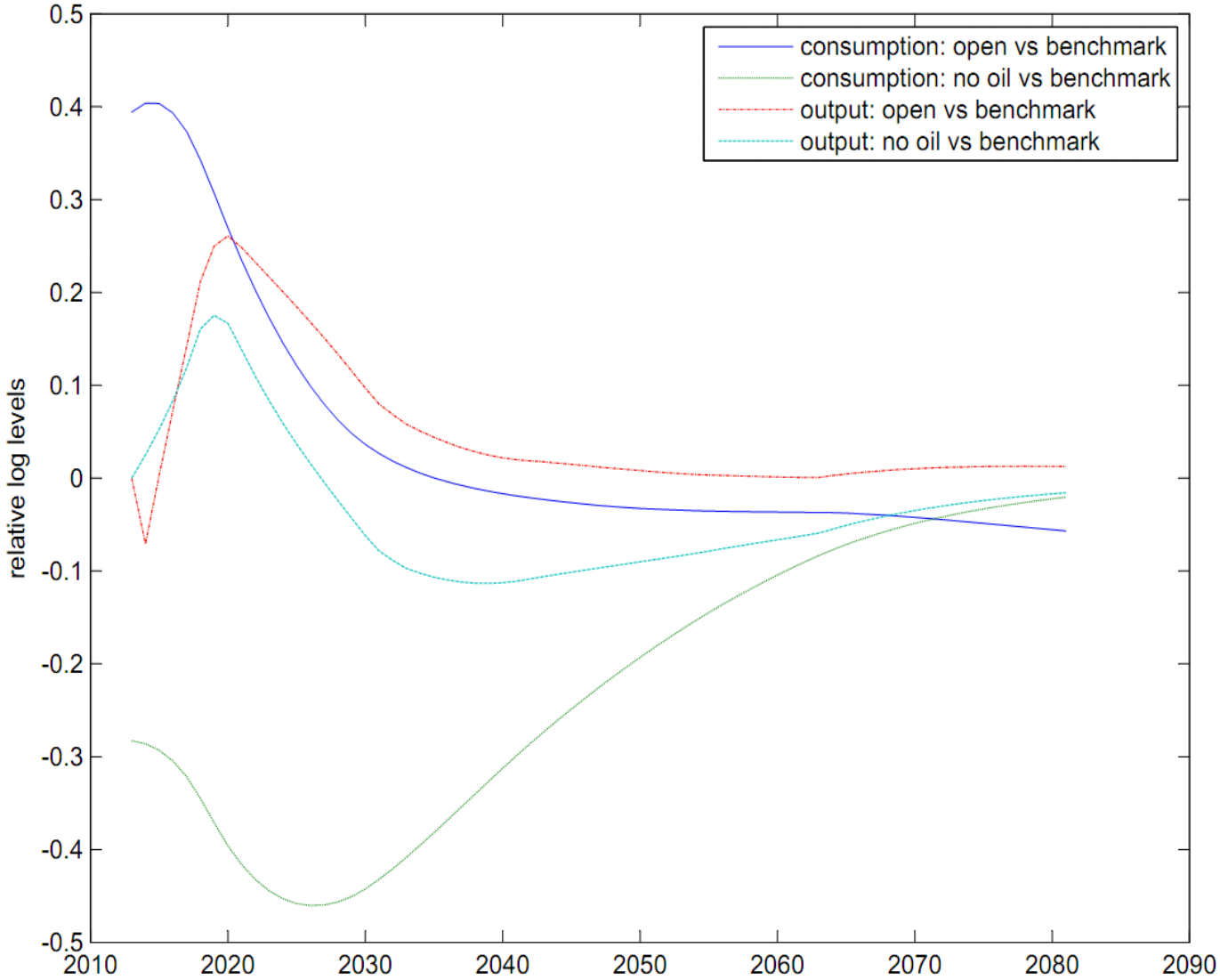
Conclusions from model

- Due to
  1. high growth (catch-up),
  2. high but falling investment inefficiencies, and
  3. imperfect access to international capital markets,

Conclusions from model

- Due to
  1. high growth (catch-up),
  2. high but falling investment inefficiencies, and
  3. imperfect access to international capital markets,
- a substantial share of oil revenues should be consumed as they accrue and foreign borrowing should be used.

Consumption and output relative to closed economy with fast oil extraction



Other considerations: gold may turn into sand

- The model is reasonably robust, but abstracts from many important considerations. TFP growth and reduced investment inefficiency *not* exogenous!

Other considerations: gold may turn into sand

- The model is reasonably robust, but abstracts from many important considerations. TFP growth and reduced investment inefficiency *not* exogenous!
- Recall: 10 years of no growth that puts Uganda on a permanently lower growth path has a cost equal to the value of the oil.

Other considerations: gold may turn into sand

- The model is reasonably robust, but abstracts from many important considerations. TFP growth and reduced investment inefficiency *not* exogenous!
- Recall: 10 years of no growth that puts Uganda on a permanently lower growth path has a cost equal to the value of the oil.
- In a majority of countries that find valuable resources, economic stagnation follows discovery. Risks mostly in political arena. Corruption and increasing social tension.

Other considerations: gold may turn into sand

- The model is reasonably robust, but abstracts from many important considerations. TFP growth and reduced investment inefficiency *not* exogenous!
- Recall: 10 years of no growth that puts Uganda on a permanently lower growth path has a cost equal to the value of the oil.
- In a majority of countries that find valuable resources, economic stagnation follows discovery. Risks mostly in political arena. Corruption and increasing social tension.
- Under the expectation of future prosperity, a large share of oil revenues should be spent as they accrue. But doing that might make the expectations not come true. Self-destructing expectations!

Other considerations: spending efficiency

- Windfall oil revenue may make spending decisions worse and reduce investment efficiency.

Other considerations: spending efficiency

- Windfall oil revenue may make spending decisions worse and reduce investment efficiency.
- Transparency key. Sharing agreements with oil companies and other aspects of how oil revenues are used should be public.

Other considerations: spending efficiency

- Windfall oil revenue may make spending decisions worse and reduce investment efficiency.
- Transparency key. Sharing agreements with oil companies and other aspects of how oil revenues are used should be public.
- Also Western countries have difficulties channeling public investment to the most socially productive uses. Remedies

Other considerations: spending efficiency

- Windfall oil revenue may make spending decisions worse and reduce investment efficiency.
- Transparency key. Sharing agreements with oil companies and other aspects of how oil revenues are used should be public.
- Also Western countries have difficulties channeling public investment to the most socially productive uses. Remedies
  - Delegating decisions on large infrastructure investments to independent institutions might be infeasible. But a rule requiring independent evaluation should be introduced.

Other considerations: spending efficiency

- Windfall oil revenue may make spending decisions worse and reduce investment efficiency.
- Transparency key. Sharing agreements with oil companies and other aspects of how oil revenues are used should be public.
- Also Western countries have difficulties channeling public investment to the most socially productive uses. Remedies
  - Delegating decisions on large infrastructure investments to independent institutions might be infeasible. But a rule requiring independent evaluation should be introduced.
  - A list of considered projects, runner-up.

Other considerations: spending efficiency

- Windfall oil revenue may make spending decisions worse and reduce investment efficiency.
- Transparency key. Sharing agreements with oil companies and other aspects of how oil revenues are used should be public.
- Also Western countries have difficulties channeling public investment to the most socially productive uses. Remedies
  - Delegating decisions on large infrastructure investments to independent institutions might be infeasible. But a rule requiring independent evaluation should be introduced.
  - A list of considered projects, runner-up.
  - International consulting agencies until domestic institutions are built.

Other considerations: spending efficiency

- Windfall oil revenue may make spending decisions worse and reduce investment efficiency.
- Transparency key. Sharing agreements with oil companies and other aspects of how oil revenues are used should be public.
- Also Western countries have difficulties channeling public investment to the most socially productive uses. Remedies
  - Delegating decisions on large infrastructure investments to independent institutions might be infeasible. But a rule requiring independent evaluation should be introduced.
  - A list of considered projects, runner-up.
  - International consulting agencies until domestic institutions are built.
  - Don't wait until revenues start flowing. Easier to agree on rules *ex ante*.

Other considerations: Dutch Disease

- Oil revenues leads to currency appreciation, which lowers competitiveness in other sectors.

Other considerations: Dutch Disease

- Oil revenues leads to currency appreciation, which lowers competitiveness in other sectors.
- Note, however, this happens also in a perfectly functioning economy.

Other considerations: Dutch Disease

- Oil revenues leads to currency appreciation, which lowers competitiveness in other sectors.
- Note, however, this happens also in a perfectly functioning economy.
  - A windfall income gain leads to higher domestic demand for non-tradables.

Other considerations: Dutch Disease

- Oil revenues leads to currency appreciation, which lowers competitiveness in other sectors.
- Note, however, this happens also in a perfectly functioning economy.
  - A windfall income gain leads to higher domestic demand for non-tradables.
  - The increased demand should be met by a resource allocation from internationally competing sectors to non-trading.

Other considerations: Dutch Disease

- Oil revenues leads to currency appreciation, which lowers competitiveness in other sectors.
- Note, however, this happens also in a perfectly functioning economy.
  - A windfall income gain leads to higher domestic demand for non-tradables.
  - The increased demand should be met by a resource allocation from internationally competing sectors to non-trading.
  - But real appreciation has distributional effects that may be a cause for concern. Producers of non-tradables gain.

Other considerations: Dutch Disease

- Oil revenues leads to currency appreciation, which lowers competitiveness in other sectors.
- Note, however, this happens also in a perfectly functioning economy.
  - A windfall income gain leads to higher domestic demand for non-tradables.
  - The increased demand should be met by a resource allocation from internationally competing sectors to non-trading.
  - But real appreciation has distributional effects that may be a cause for concern. Producers of non-tradables gain.
- A strongly appreciating real exchange rate may be a sign of rigid markets. Go to the root with this.

Other considerations: Dutch Disease

- Oil revenues leads to currency appreciation, which lowers competitiveness in other sectors.
- Note, however, this happens also in a perfectly functioning economy.
  - A windfall income gain leads to higher domestic demand for non-tradables.
  - The increased demand should be met by a resource allocation from internationally competing sectors to non-trading.
  - But real appreciation has distributional effects that may be a cause for concern. Producers of non-tradables gain.
- A strongly appreciating real exchange rate may be a sign of rigid markets. Go to the root with this.
- The value of opening up the economy increases after the finding of oil. Bigger gains from trade!

Other considerations: Taxes

- One potential use of oil revenues is to reduce taxes.

Other considerations: Taxes

- One potential use of oil revenues is to reduce taxes.
- Good if distortions are high.

Other considerations: Taxes

- One potential use of oil revenues is to reduce taxes.
- Good if distortions are high.
- Government revenue low (15% of GDP).

Other considerations: Taxes

- One potential use of oil revenues is to reduce taxes.
- Good if distortions are high.
- Government revenue low (15% of GDP).
- Suggests tax rates and thus distortions are low.

Other considerations: Taxes

- One potential use of oil revenues is to reduce taxes.
- Good if distortions are high.
- Government revenue low (15% of GDP).
- Suggests tax rates and thus distortions are low.
- But may also reflect high rates on small/few bases – large firms in formal sector.

Other considerations: Taxes

- One potential use of oil revenues is to reduce taxes.
- Good if distortions are high.
- Government revenue low (15% of GDP).
- Suggests tax rates and thus distortions are low.
- But may also reflect high rates on small/few bases – large firms in formal sector.
- Then distortions are high and oil revenues should partly be used for tax reductions.

Other considerations: Income volatility and Sovereign Wealth Funds

- Government consumption tends to be pro-cyclical in developing countries.

Other considerations: Income volatility and Sovereign Wealth Funds

- Government consumption tends to be pro-cyclical in developing countries.
- Oil revenues and a stabilization fund may be a way out.

Other considerations: Income volatility and Sovereign Wealth Funds

- Government consumption tends to be pro-cyclical in developing countries.
- Oil revenues and a stabilization fund may be a way out.
- Despite message from formal model, we suggest a Ugandan sovereign wealth fund.

Other considerations: Income volatility and Sovereign Wealth Funds

- Government consumption tends to be pro-cyclical in developing countries.
- Oil revenues and a stabilization fund may be a way out.
- Despite message from formal model, we suggest a Ugandan sovereign wealth fund.
- A sovereign wealth fund investing abroad and commitment to limited drain may reduce risk of bad spending.

Other considerations: Income volatility and Sovereign Wealth Funds

- Government consumption tends to be pro-cyclical in developing countries.
- Oil revenues and a stabilization fund may be a way out.
- Despite message from formal model, we suggest a Ugandan sovereign wealth fund.
- A sovereign wealth fund investing abroad and commitment to limited drain may reduce risk of bad spending.
- Good arguments for a separation into a Stabilization fund and a Future Generations fund. Different investment rules should apply. Stabilization fund might be given priority in short run.

Conclusions

- Assuming catch-up and high but falling investment inefficiencies – strong argument for letting current generations share future prosperity.
- But future prosperity is not certain manna from heaven. Gold can turn into sand, or something worse.
- Caution in consumption and borrowing is strongly suggested by history.
- Transparency in how decisions about oil of key importance.
- Oil revenues may create a double dividend making it possible to reduce distorting taxation.
- Another possible double dividend is to use some oil revenues as stabilization device. But quite difficult to avoid deficit bias – always spend instead of spend in downturn and save in upturn.
- Implement a law requiring an independent cost-benefit analysis before large public investments are undertaken.
- Institutions ensuring right use of oil revenues must be in place when oil starts to flow.