EC916: Topics in Global Finance

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Lecture - 2 -

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Happy New Year!

This Week: Outline

1. Small Endowment Economy

2. Adjustment to Output / Income Shocks

Small Endowment Economy - Autarky

- 2-period endowment economy - output is given and equal to Q_1 and Q_2.
- Optimisation problem of the representative household:

$$\max U(C_1, C_2) = U(C_1) + \beta U(C_2)$$

$$\text{st} \quad \underbrace{C_1 + \frac{C_2}{1+r}}_{\text{the present discounted value of consumption}} = \underbrace{Q_1 + \frac{Q_2}{1+r}}_{\text{the present discounted value of the endowment stream}}$$

- Inter-temporal **Euler equation** is the same as (**??**):

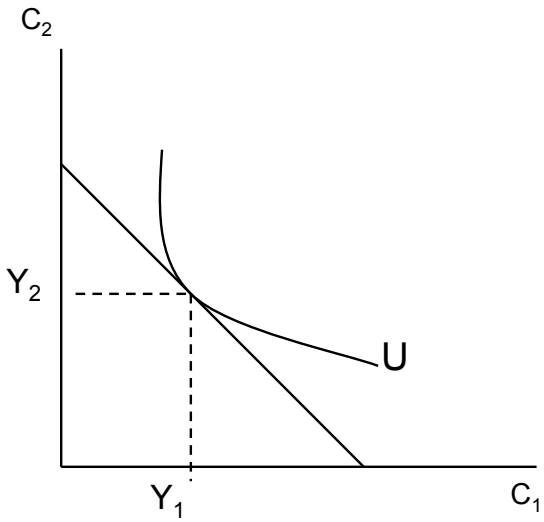
$$U'(C_1) = (1+r)\beta U'(C_2)$$

- In the autarky equilibrium $C_1 = Q_1$ and $C_2 = Q_2$.
- The equilibrium autarky interest rate (r^A) is given by

$$U'(C_1) = (1+r^A)\beta U'(C_2)$$

This is the **autarky price of future consumption in terms of present consumption.**

Small Endowment Economy - Autarky



- We can graph the budget constraint as $C_2 = Q_1(1+r) + Q_2 - C_1(1+r)$.
- **In autarky** : $C_1 = Q_1$ and $C_2 = Q_2$.
- **In an open economy**: $C_1 \neq Q_1$ and $C_2 \neq Q_2$.
- For example, if $\beta = 1/(1+r)$ and $C_1 = C_2 = \bar{C}$ (smooth consumption), but $Q_1 < Q_2$.
- Then, the country borrows $\bar{C} - Q_1$ on $t = 1$, repays $(1+r)(\bar{C} - Q_1)$ on $t = 2$. Consumes $C_2 = Q_2 - (1+r)(C_1 - Q_1)$.
- In $t = 1$, the country borrows $\rightarrow$ Current account is deficit: $CA_1 < 0$.

Small Endowment Economy under Financial Openness

Open Economy

- The current account equals the increase in net foreign assets

$$CA_t = B_{t+1} - B_t = Q_t + rB_t - C_t$$

- CA in period 1:

$$CA_1 = B_1 - B_0 = Q_1 + rB_0 - C_1 \qquad \text{(and} \quad B_0 = 0)$$

- CA in period 2:

$$CA_2 = Q_2 + rB_1 - C_2 = -(Q_1 - C_1) = -B_1 = -CA_1 \qquad \text{(and} \quad B_2 = 0)$$

- A CA deficit today must be offset by a CA surplus in the future.

Small Endowment Economy under Financial Openness

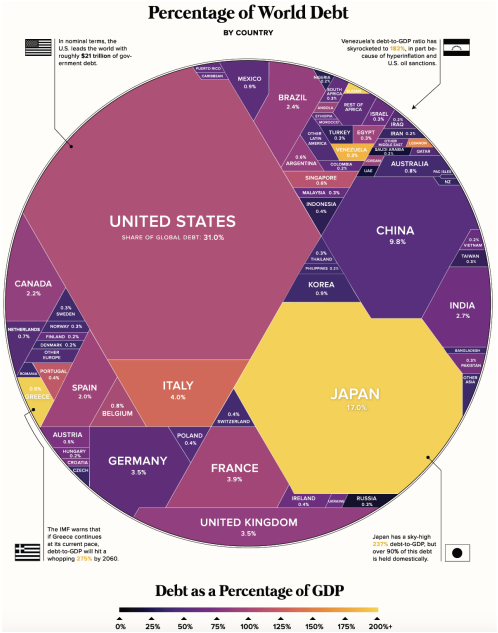
- Financial openness allows **inter-temporal trade** and can increase welfare, as it allows consumption to differ from income.

- Example:
  - If the home price of future consumption is relatively low (i.e. $\frac{1}{1+r^A} < \frac{1}{1+r} \Leftrightarrow r^A > r$) because the country wants to consume more today, future consumption is cheap at home.

  - In this case, the home country "import" present consumption and "export" future consumption; i.e. the country runs a CA deficit in period 1 and a surplus in period 2. Put it differently, the country borrows internationally in period 1.

Open Economy Equilibrium

- Note that CA deficits/surpluses are not necessarily bad.
- The country's welfare increases by running a deficit in period 1.


Percentage of World Debt
BY COUNTRY
In nominal terms, the U.S. leads the world with roughly $21 trillion of government debt.
Venezuela's debt-to-GDP ratio has skyrocketed to 182%, in part because of hyperinflation and U.S. oil sanctions.
UNITED STATES
SHARE OF GLOBAL DEBT: 31.0%
CHINA 9.8%
JAPAN 17.0%
GERMANY 3.5%
FRANCE 3.9%
UNITED KINGDOM 3.5%
ITALY 4.0%
SPAIN 2.6%
CANADA 2.2%
INDIA 2.7%
KOREA 0.9%
BRAZIL 2.4%
MEXICO 0.9%
AUSTRALIA 0.8%
SINGAPORE 0.5%
MALAYSIA 0.3%
INDONESIA 0.4%
THAILAND 0.3%
PHILIPPINES 0.3%
TAIWAN 0.3%
VIETNAM 0.2%
BANGLADESH 0.3%
ISRAEL 0.3%
IRAN 0.2%
TURKEY 0.3%
EGYPT 0.2%
QATAR
ARGENTINA 0.6%
COLOMBIA 0.2%
SWEDEN 0.3%
NORWAY 0.3%
FINLAND 0.2%
DENMARK 0.2%
NETHERLANDS 0.7%
PORTUGAL 0.4%
GREECE 0.5%
BELGIUM 0.8%
SWITZERLAND 0.4%
AUSTRIA 0.5%
HUNGARY 0.2%
CROATIA
CZECH
POLAND 0.4%
IRELAND 0.4%
RUSSIA 0.2%
The IMF warns that if Greece continues at its current pace, debt-to-GDP will hit a whopping 275% by 2060.
Japan has a sky-high 237% debt-to-GDP, but over 90% of this debt is held domestically.
Debt as a Percentage of GDP
0%
25%
50%
75%
100%
125%
150%
175%
200%+

Small Endowment Economy

CRRA preferences:

- $U = \frac{C^{1-\frac{1}{\sigma}}}{1-\frac{1}{\sigma}}$, σ is the elasticity of inter-temporal substitution.
- Euler equation

$$C_2 = C_1(1+r)^{\sigma}\beta^{\sigma} \tag{1}$$

- Consumption in $t = 1$ becomes

$$C_1 = \frac{1}{1+(1+r)^{\sigma-1}\beta^{\sigma}}\left(Y_1 + \frac{Y_2}{1+r}\right) \tag{2}$$

- The equilibrium price of future consumption in terms of present consumption is

$$\beta\left(\frac{Y_1}{Y_2}\right)^{\frac{1}{\sigma}} = \frac{1}{1+r^A}$$

Small Endowment Economy

The shape of the saving schedule

- Replace C_2 into Euler Equation and implicitly differentiate wrt r

$$u'(C_1) = \beta(1+r)u'[(1+r)(Y_1 - C_1) + Y_2]$$

$$\frac{dC_1}{dr} = \frac{\beta u'(C_2) + \beta(1+r)u''(C_2)(Y_1 - C_1)}{u''(C_1) + \beta(1+r)^2 u''(C_2)}$$

- With CRRA utility function

$$\frac{dC_1}{dr} = \frac{(Y_1 - C_1) - \sigma C_2/(1+r)}{1 + r + (C_2/C_1)}$$

- A rise in r has an ambiguous effect in C_1:
  a. **Substitution effect:** $\sigma C_2/(1+r)$, reduces C_1 due to the increase in its relative price.
  b. **Terms-of-trade effect:** $Y_1 - C_1$ on welfare
     - if $C_1 > Y_1$, the $\uparrow$ in the int. rate makes the country poorer, $\downarrow C_1$.
     - if $Y_1 > C_1$, the $\uparrow$ in the int. rate makes the country richer, $\uparrow C_1$.
  - The sign of $\frac{dC_1}{dr}$ depends on the size of a. and b.

Small Endowment Economy

The shape of the saving schedule

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Small Endowment Economy

Substitution, Income and Wealth Effects

- Recall optimal consumption in $t = 1$ is (2)

$$C_1 = \frac{1}{1 + (1+r)^{\sigma-1}\beta^{\sigma}} \left(Y_1 + \frac{Y_2}{1+r} \right)$$

- 3 ways in which an interest-rate change can affect consumption:
  - i) Substitution effect: an $\uparrow$ in r makes savings more attractive, $\downarrow C_1$.
  - ii) Income effect: an $\uparrow$ in r allows higher consumption, given the present value of lifetime resources.

  $\rightarrow$ Whether $i)$ or $ii)$ dominates depends on $(1+r)^{\sigma-1}$.
    - If $\sigma > 1$, substitution effects dominates ($\downarrow C_1$).
    - If $\sigma < 1$, income effect dominates ($\uparrow C_1$).
    - If $\sigma = 1$, they cancel out (log ut. function).
  - iii) Wealth effect: change in lifetime income: $Y_1 + \frac{Y_2}{1+r}$ ($\downarrow C_1$).
- Income and wealth effect are identified as the terms-of-trade effects (ToT).
- The impact of Δr on C_1 depends on which effects dominates.

Small Endowment Economy

Savings (or current Account) in the first period are given by

$$S_1 = Y_1 - C_1$$

Replacing C_1 for the expression we just derived we have that

$$S_1 = Y_1 - \frac{1}{1 + (1+r)^{\sigma-1}\beta^{\sigma}} \left(Y_1 + \frac{Y_2}{1+r} \right)$$

$$S_1 = \frac{1}{1 + (1+r)^{\sigma-1}\beta^{\sigma}} \left([(1+r)^{\sigma-1}\beta^{\sigma}]Y_1 - \frac{1}{1+r}Y_2 \right) \tag{3}$$

In autarky, savings in the first period must be zero. This is a representative agent economy and the household cannot borrow or lend domestically. To obtain the autarky interest rate, we solve for the interest rate that makes savings equal to zero.

Small Endowment Economy

Capital Account Openness

- Under CRRA function, the current account in $t = 1$ is defined as

$$CA_1 = S_1(r) = Y_1 - C_1(r) = \left(\frac{1}{1 + (1+r)^{\sigma-1}\beta^{\sigma}} \right) \left[\left(\frac{1+r}{1+r^A} \right)^{\sigma} - 1 \right] \frac{Y_2}{1+r}$$

  where r^A is the autarky interest rate and r is the world interest rate.

- A country that opens to international capital flows in $t = 1$ will experience a:
  - CA deficit ($CA_1 < 0$) if the autarky rate exceeds the world rate $r^A > r$. The home price of present consumption is high and the country borrows to consume more today.
  - CA surplus ($CA_1 > 0$) if the world rate exceeds the autarky rate, $r > r^A$. The home price of future consumption is high so the country prefers to lend and consume more in a future.

Small Endowment Economy

Other cases

- Log utility:
  - Optimal consumption in $t = 1$: $C_1 = \frac{1}{1+\beta}\left(Y_1 + \frac{Y_2}{1+r}\right)$.
  - Consumption is a constant fraction of lifetime wealth.
  - Substitution and Income effects cancel out. Only the wealth effects remains. ($\uparrow r, \downarrow C_1, \uparrow S_1$)
  - After financial opening, $CA_1 = \frac{1}{1+\beta}\left(\frac{r-r^A}{(1+r)(1+r^A)}\right)Y_2$.
- If $\beta = \frac{1}{1+r}$, optimal consumption path: $\bar{C} = \frac{[(1+r)Y_1+Y_2]}{2+r}$, and $C_1 = C_2$.
- If $\beta > \frac{1}{1+r}$, then $u'(C_1) > u'(C_2)$ (as $u'(C_1) = \beta(1+r)u'(C_2)$), implication?

Small Open Economy with Investment

- Assume no depreciation: $K_{t+1} = K_t + I_t$
- The change in total domestic wealth ($B_t + K_t$) is given by

$$B_{t+1} + K_{t+1} - (B_t + K_t) = Y_t + rB_t - C_t$$

- The CA becomes

$$CA_t = B_{t+1} - B_t = \underbrace{Y_t + rB_t - C_t}_{S_t} - I_t$$

- Define national savings as $S_t = Y_t + rB_t - C_t$
- The current account is the difference between savings and investment

$$CA_t = S_t - I_t$$

Small Open Economy with Investment

- CA in period 1

$$CA_1 = B_2 = Y_1 - (C_1 + I_1) \qquad \text{(since} \quad B_1 = 0)$$

- CA in period 2

$$CA_2 = -B_2 = Y_2 + r\,B_2 - (C_2 + I_2) \qquad \text{(since} \quad B_3 = 0)$$

$$B_2 = \frac{C_2 + I_2 - Y_2}{1 + r}$$

- Inter-temporal budget constraint:

$$C_1 + I_1 + \frac{C_2 + I_2}{1 + r} = Y_1 + \frac{Y_2}{1 + r}$$

$\rightarrow$ **The present value of consumption and investment is limited by the present value of output.**

Small Open Economy with Investment

- Assume Y_1 given, and $Y_2 = A_2 K_2^{\alpha}$
- Inter-temporal constraint solved for C_2

$$C_2 = (1+r)[Y_1 - C_1 - I_1] + Y_2 - I_2$$

$$C_2 = (1+r)[Y_1 - C_1 - I_1] + A_2 K_2^{\alpha} - I_2$$

- Use $K_2 = K_1 + I_1$ and $K_2 = -I_2$ (as $K_3 = 0$), we get $I_2 = -(K_1 + I_1)$.

  Then

$$C_2 = (1+r)[Y_1 - C_1 - I_1] + A_2(K_1 + I_1)^{\alpha} + K_1 + I_1$$

Small Open Economy with Investment

- Under CRRA utility function, the FOC for C_1 and I_1 are

$$C_2 = C_1 \beta^{\sigma} (1 + r)^{\sigma} \tag{4}$$

$$\alpha A_2 K_2^{\alpha - 1} = r \tag{5}$$

$\rightarrow$ *Investment is independent of domestic consumption preferences!*

- Graph the Production Possibility Frontier (PPF):

$$C_2 = A_2 K_2^{\alpha} + K_2 = A_2 K_2^{\alpha} + K_1 + Y_1 - C_1$$

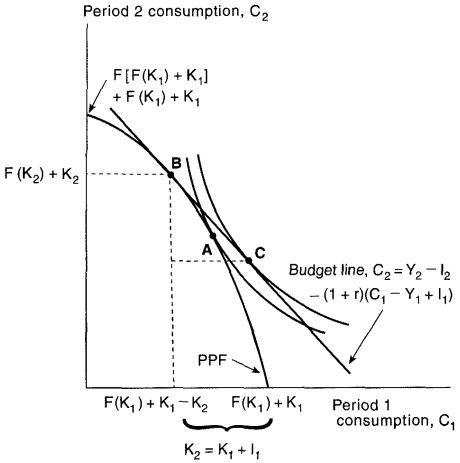
Small Open Economy with Investment

Financial Openness

- Let $r < r^A$.
- Production will occur at a point were $F'(K_2) = r$, which implies that $K_2 > K_2^A$.
- Opening up to financial flows generates some extra investment
- Consumption occurs at a point where the relative price of future to current consumption is tangent to the indifference curve, which implies that $C_1 > C_1^A$.
- Investment and first period consumption increase, the country runs a current account deficit in period 1.

Small Open Economy with Investment

Open Economy Equilibrium with Investment



SOURCE: Obstfeld and Rogoff (1996)

- Gains from trade in financial assets
  - Gains from smoothing the path of consumption.
  - Borrow to increase investment.

Small Endowment Economy- Extension 1

Temporary vs. permanent output changes

- Assume $\beta(1+r)=1$, then the consumption path should be constant.
- If $Y_1 = Y_2$ then no current account imbalance.

$\rightarrow$ Temporary: If Y_1 increases, the price of future consumption becomes relatively more expensive ($r^A < r$). The country runs a CA surplus in 1 and a deficit in 2.

$\rightarrow$ Permanently: If both Y_1 and Y_2 increase by the same amount, the inter-temporal price does not change. CA is not affected.

$\rightarrow$ **Permanent changes in output don't affect the CA, temporary changes do**

($\uparrow Y \rightarrow$ CA surplus, and $\downarrow Y \rightarrow$ CA deficit).

Small Endowment Economy- Extension 2

Government

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

$$CA_t = B_{t+1} - B_t = Y_t + rB_t - C_t - G_t$$

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

- Agents have only $Y_1 - G_1$ and $Y_2 - G_2$ available for consumption
- A temporary increase in G_1 lowers output available for consumption in 1 and creates a CA deficit (if CA initially in equilibrium)
- A permanent increase in G has no effect in CA.

The Interest Rate Parity Condition

- We assume that there is **free capital mobility**, which means that households can borrow and lend freely in the international financial market.
- Let r^* be the world interest rate. Then, free capital mobility guarantees that the domestic interest rate be equal to the world interest rate. That is,

$$r_1 = r^*$$

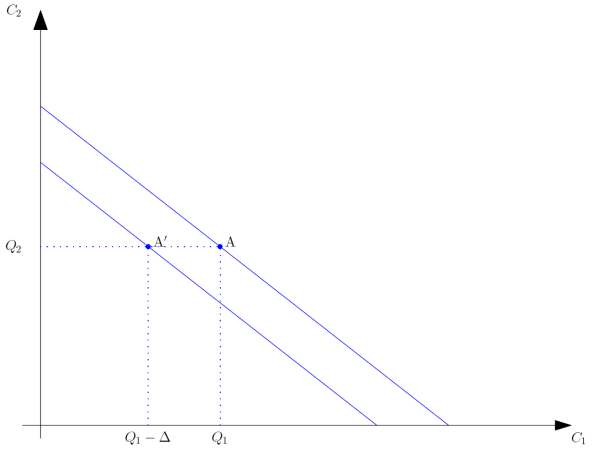
  We will refer to this condition as **the interest rate parity condition**.
- Any difference between r_1 and r^* would give rise to **an arbitrage opportunity** (we will talk more later) that would allow someone to make infinite profits.
- For instance, if $r_1 > r^*$, then one could make infinite amounts of profits by borrowing in the international market and lending in the domestic market.
- Similarly, if $r_1 < r^*$, unbounded profits could be obtained by borrowing domestically and lending abroad. These arbitrage opportunities disappear when $r_1 = r^*$.

Adjustment to Temporary Output Shocks

- Assume that output in period 1 falls from Q_1 to $Q_1 - \Delta < Q_1$ and output in period 2, Q_2 is unchanged.

- How does this temporary output decline affect the intertemporal budget constraint?

A temporary decline in output and the IBC

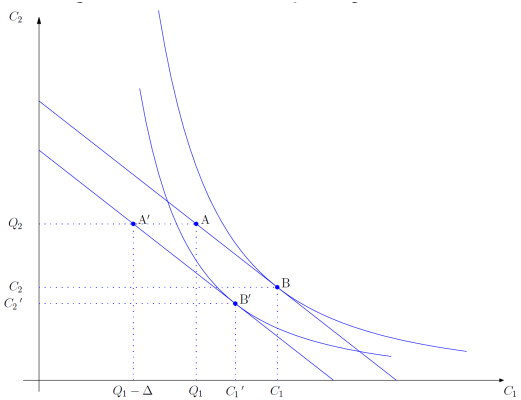


A is the endowment point before the shock (Q_1, Q_2). A' the endowment point after the shock $(Q_1 - \Delta, Q_2)$. The temporary decline in output shifts the intertemporal budget constraint down and to the left.

Adjustment to a temporary decline in output

- How will the household adjust to the temporary negative output shock?
- Assume that both C_1 and C_2 are *normal goods* (i.e., goods whose consumption increases with income).
- Then the household would want to cut both C_1 and C_2. By also cutting C_2, the household does not need to cut C_1 by Δ but by less.
- The next figure illustrates the adjustment.

Adjustment to a temporary decline in output



B is the optimal pre-shock consumption path. B' is the optimal post-shock consumption path

Adjustment to a temporary decline in output

- In smoothing consumption over time, the country runs a larger trade deficit in period 1 (recall that it was running a trade deficit even in the absence of the shock) and finances it by acquiring additional foreign debt.
- Thus, the current account deteriorates.
- In period 2, the country must generate a larger trade surplus than the one it would have produced in the absence of the shock in order to pay back the additional debt acquired in period 1.
- The important principle to take away from this example is that temporary negative income shocks are smoothed out by borrowing from the rest of the world rather than by fully adjusting current consumption by the size of the shock.

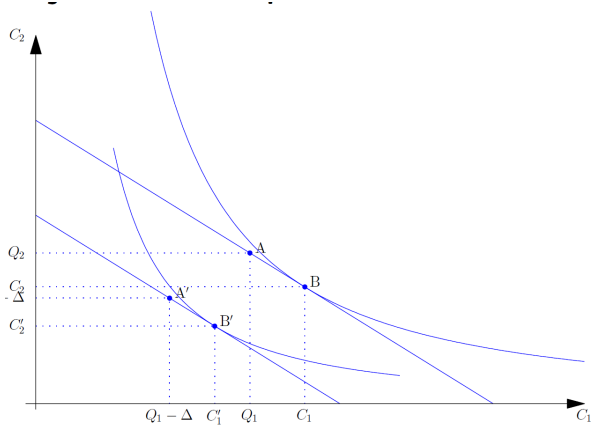
Adjustment to Permanent Output Shocks

- Suppose Q_1 and Q_2 both fall by Δ.

- In general the decline in consumption should be expected to be close to Δ, implying that a permanent output shock has little consequences for the trade balance and the current account.

- The figure on the next slide illustrates this point.hock.

Adjustment to a permanent decline in output



A is the pre-shock endowment point, (Q_1, Q_2). A' is the post-shock endowment point, $(Q_1 - \Delta, Q_2 - \Delta)$.

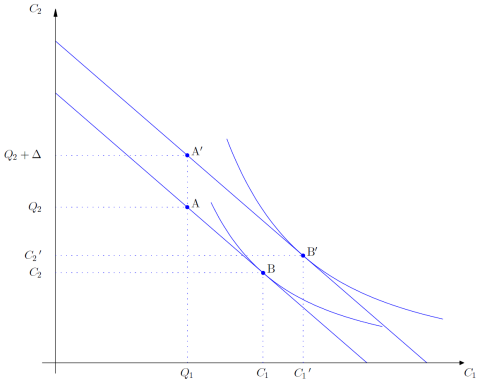
Adjustment to Permanent Output Shocks in output

- Comparing the effects of temporary and permanent output shocks on the current account, the following general principle emerges:
- Economies tend to finance temporary shocks (by borrowing or lending on international capital markets) and adjust to permanent ones (by varying consumption in both periods up or down).
- Thus, temporary shocks tend to produce large movements in the current account while permanent shocks tend to leave the current account largely unchanged.

Anticipated Income Shocks

- Consider now the case that in period 1 households learn that their endowment, Q_2, will be higher in period 2.
- What will be the effect of this news on: consumption, the domestic interest rate, the trade balance, and the current account?
- The figure in the next slide depicts the adjustment to an anticipated increase in Q_2 equal to $\Delta > 0$. The intertemporal budget constraint shifts up by Δ.
- The increase in the period-2 endowment causes an increase in period-1 consumption from C_1 to C_1'.
- Because the endowment in period 1 is unchanged, the period-1 trade balance and current account deteriorate.
- Thus, good news about the future lead to a deterioration of the current account. This shows that current account deficits are not necessarily an indication of a weak economy.

Adjustment to an anticipated increase in output

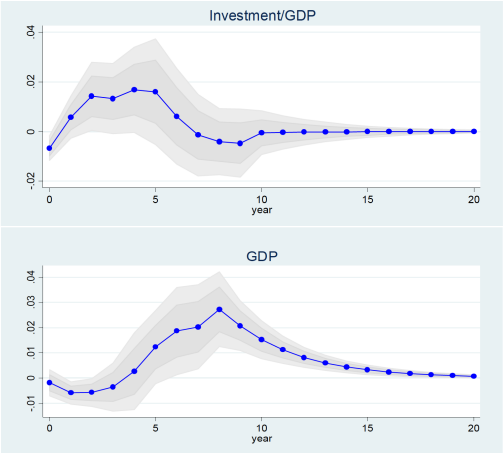


Some Empirical Evidence on the Inter-temporal Approach to the Balance of Payments

Arezki et al. (2015) analyse the macroeconomic effect of large oil discoveries

- Why look at large oil discoveries?
  - Clearly identified shock - relatively rare events
  - Significant increase in future output
  - Delay between discovery and production (4-5 years) - shocks to $\mathbf{future}$ output, requires investment
- So, future (but not current) output increases and temporary increase in investment

Macroeconomic Effect of Large Oil Discoveries



Increase in investment in first 5-6 years
Increase in output in years 5 to 13

Macroeconomic Effect of Large Oil Discoveries

Increase in investment in first 5-6 years
Increase in output in years 5 to 13

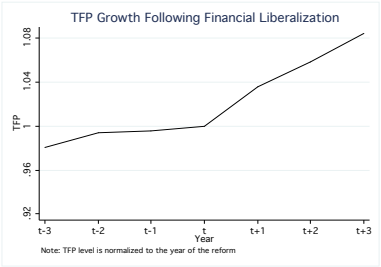
- What would be the predictions of inter temporal approach to the balance of payments?
  - Increase in future output $\rightarrow$ higher consumption (both current and future)
  - Increase consumption (with no increase in current output)$\rightarrow$ lower savings in initial years
  - Lower savings and higher investment $\rightarrow$ current account deficit in initial years
  - Afterwards, higher savings and a current account surplus to pay back initial borrowing

Macroeconomic Effect of Large Oil Discoveries

Capital Account Openness and Aggregate Productivity

Financial integration can increase aggregate productivity: $Y = A\,F(K, L)$:

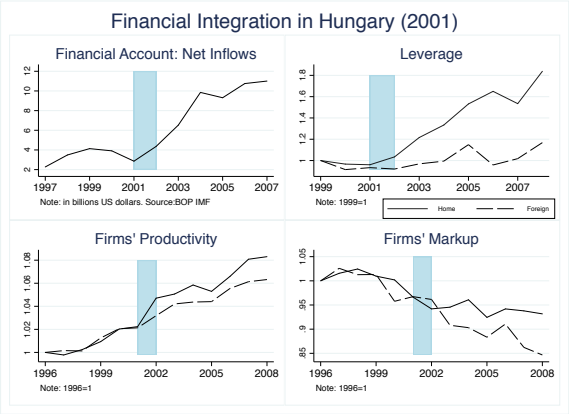
- A is a main source of differences in income per capita across countries (Caselli 2005).
- Cross-country studies find increases of about 3pp per year after the liberalisation (Bekaert et al 2011, Bonfiglioli 2008, Chari et al 2012).



70 countries, 1970-2004. Chinn-Ito Index of Financial Liberalisation

- Why does aggregate productivity increase following financial liberalisation?

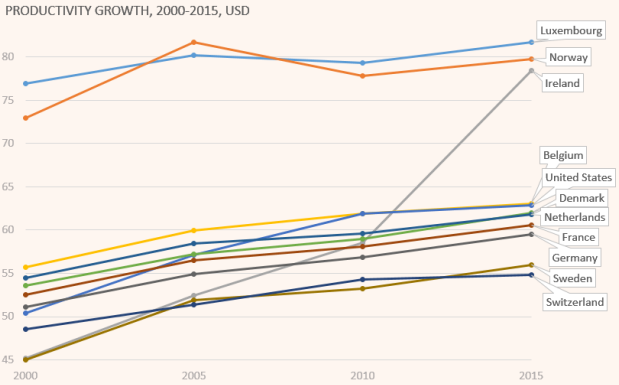
Capital Account Openness and Aggregate Productivity



- Varela (2018) [a] studies financial integration in Hungary and finds that it leads to capital inflows, increased credit and aggregate productivity growth.
- Aggregate productivity increases due to two forces:
  - Credit-constrained firms obtain more credit and can innovate more.
  - Unconstrained firms innovate more due to increased competition.
- Assess it econometrically using a diff-in-diff approach

[a] Reallocation, Competition, and Productivity: Evidence from a Financial Liberalization Episode, Review of Economic Studies (2017) 0, 1–35

TOP-10 MOST PRODUCTIVE COUNTRIES

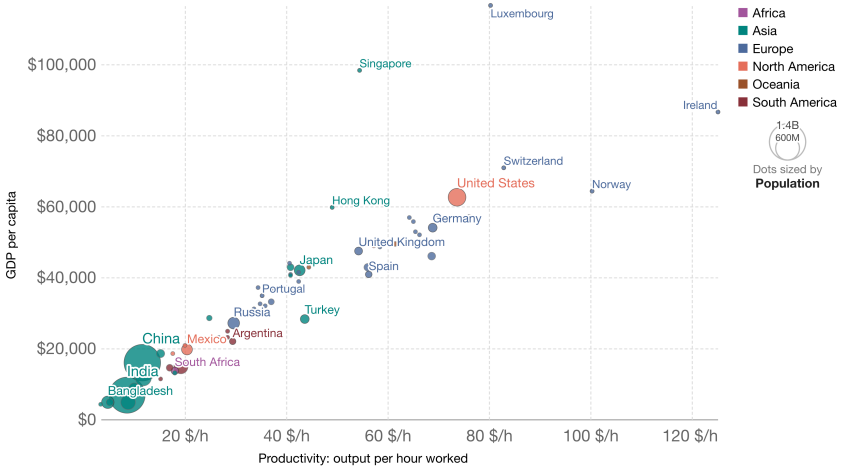


Top-10 Most Productive Countries (GDP per hour worked, USD, 2015)		
1	Luxembourg	81.7
2	Norway	79.8
3	Ireland	78.4
4	Belgium	63.0
5	United States	62.9
6	Denmark	61.9
7	Netherlands	61.8
8	France	60.6
9	Germany	59.5
10	Sweden	56.0

Source: OECD (2000-2015), Level of GDP per capita and productivity (extracted on 02 March 2017).

GDP per capita vs. labor productivity, 2019

Gross domestic product (GDP) per capita measured in international-$, versus labor productivity measured as GDP per hour worked.



Source: Data compiled from multiple sources by World Bank, Feenstra et al. (2015), Penn World Table 10.0

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