Economic Growth and the Current Account

Autarky vs Openness in a Neoclassical Growth Model
Financial Autarky vs Openness

• During the 1950s and the 1960s the domestic financial systems of most countries were subject to capital account restrictions.

• Capital account restrictions were gradually lifted and in the last forty years global financial trading has grown exponentially, leading to a new era of financial globalisation.

• This lecture compares financial openness with autarky in an extended neoclassical growth model, with adjustment costs for investment.

• We can thus compare both the evolution of savings and investment in the transition towards the balanced growth paths, and the balanced growth paths themselves, under the two alternative regimes.
Conclusions from the Literature

• “Despite periodic crises, global financial integration holds significant benefits and probably is, in any case, impossible to stop—short of a second great depression or third world war. The challenge for national and international policymakers is to maintain an economic and political milieu in which the trend of increasing economic integration can continue.” Obstfeld (1998).

• “There is little evidence that economic growth and capital account openness are positively correlated across countries. But there is lots of evidence that opening the capital account leads countries to temporarily invest more and grow faster than they did when their capital accounts were closed.” Henry (2007).
Openness in the Neoclassical Growth Model

• In the closed economy neoclassical growth model it is habitually assumed that savings determine the investment rate. This is a useful simplifying assumption for most purposes, but not for studying open economies.

• In an open economy, the current account is determined by the difference between savings and investment. In order to model the dynamics of the current account in a non-trivial fashion, one needs an investment function which is independent of the savings function.

• In this lecture, we use a neoclassical growth model of a competitive economy, augmented by the \( q \) theory of investment. Consumers choose individually optimal consumption plans, and firms choose individually optimal investment (and employment) plans, under the two alternative regimes of financial autarky and openness.
A Preview of the Conclusions

• The analysis of the extended neoclassical model of a small economy indicates that on the balanced growth path both capital and output (GDP) per capita are the same under financial autarky and openness.

• However, there are significant differences under the two alternative regimes during the adjustment path to the steady state. These differences arise because of the dynamics of savings, investment and the current account and the accumulation of net foreign assets under financial openness.

• The dynamics of the current account under financial openness depend on the initial capital stock. Thus, the initial capital stock has implications for steady state consumption and the relationship between gross domestic product (GDP) and gross national income (GNI) per capita along the balanced growth path.
An “Emerging” Economy under Financial Autarky and Openness

• We first consider an “emerging” small economy, whose initial capital stock is below its steady state equilibrium, under the assumption that the rest of the world is on a balanced growth path.

• For such an economy, the real interest rate under financial openness will be at its steady state value, and below the corresponding path of real interest rates under autarky. As a result, under financial openness, there will be full consumption smoothing and both per capita consumption and investment will be higher during the adjustment process than under autarky.

• During the transition to the balanced growth path, under financial openness, the economy runs current account deficits (as savings are lower and investment is higher) and accumulates foreign debt. As it approaches the balanced growth path, the process of foreign debt accumulation slows down, and the economy converges to a position of external balance. On the balanced growth path, output (GDP) per capita is the same as under autarky, but national income (GNP) and consumption per capita are lower than under autarky, as domestic residents have to pay interest on the foreign debt they have accumulated during the transition.
Financial Openness and the Welfare Implications of Inter-temporal Trade

• There are benefits from financial openness and inter-temporal trade for this economy, as, during the transition path, the path of the world real interest rate differs from the path of autarky real interest rates.

• Under financial openness, an “emerging” economy can engage in beneficial additional inter-temporal trade, trading off higher consumption in the short run, for lower consumption in the long run. This is welfare improving as this option is not available under autarky.

• For as long as the autarky real interest rate differs from the world real interest rate, these welfare benefits exist.
A “Developed” Small Economy under Financial Autarky and Openness

• For an economy with an initial capital stock that exceeds the steady state capital stock (a “developed” economy), the opposite would apply.

• Under financial openness it will initially experience trade and current account surpluses, and in the steady state it will end up with positive net foreign assets rather than foreign debt.

• Consumption per effective unit of labor will be higher than under autarky in the steady state, because the country receives interest payments on the foreign assets it has accumulated.

• Although steady state GDP per capita is the same under financial autarky and openness, GNP per capita is higher than GDP per capita under openness, as the country receives interest on the assets it has accumulated vis-a-vis the rest of the world.
Interdependent Economies

• We also consider the process of adjustment in a two country world, in which two otherwise similar economies have different initial capital stocks.

• One economy is assumed “emerging”, in that it has a relatively lower initial capital stock, and the other is assumed “developed”, in that it has a relatively higher initial capital stock.

• If the two economies establish inter-temporal trade, the world real interest rate will be determined between the initial autarky real interest rates in the two economies.

• In the “emerging” economy real interest rates will fall compared to autarky, causing an increase in investment and a fall in savings, and thus a current account deficit. In the “developed” economy real interest rates will rise, causing a fall in investment and a rise in savings, and a corresponding current account surplus.

• In the steady state, both economies will converge to the same GDP per capita with external balance, but the “emerging” economy will be a net debtor vis-a-vis the rest of the world, i.e vis-a-vis the “developed” economy, which will be a net international creditor. Steady state GNP per capita and steady state consumption will be lower in the “emerging” economy compared to the “developed” economy, which as a net international creditor receives income from its positive net asset holdings.

• Although both economies derive benefits from financial openness, financial openness cannot neutralise the economic head start of the initially “developed” economy.
A Representative Household Model of a Growing Economy

We assume an economy populated by infinitely lived identical households. Each household has a growing number of members, each of which supplies one unit of labor.

Household $j$ chooses a consumption path to maximise,

$$U_j = \int_{t=0}^{\infty} e^{-(\rho-n)t} \ln c_j(t)dt$$

subject to the instantaneous budget constraint,

$$a_j(t) = (r(t) - n)a_j(t) + w_j(t) - c_j(t)$$

and the household’s solvency (no-Ponzi game) condition,

$$\lim_{t \to \infty} -\int_{s=0}^{t} (r(s) - n)ds \quad a_j(t) = 0$$
The Inter-temporal Budget Constraint of the Representative Household and the Euler Equation for Consumption

Integrating the asset accumulation equation of the representative household, and using the solvency condition, under the assumption that the initial per capita non-human wealth of the household is equal to \( a_j(0) \), yields the familiar inter-temporal budget constraint, that the present value of per capita consumption must equal the present value of per capita labor income plus the initial per capita non-human wealth.

\[
a_j(0) + \int_{t=0}^{\infty} w_j(t)e^{rs} dt = \int_{t=0}^{\infty} c_j(t) e^{rs} dt
\]

The maximization problem of the representative household yields the following first order conditions for household and aggregate consumption

\[
\cdot c_j(s) = (r(s) - \rho)c_j(s)
\]

\[
\cdot \dot{C}(t) = (r(t) - \rho + n)C(t)
\]
Production, Employment, Investment and Instantaneous Profits of Firms

Producers are competitive firms, employing capital and labor to produce a homogeneous commodity. The production function of firm $i$ at time $t$ is assumed Cobb Douglas with constant returns to scale, and is given by,

$$Y_i(t) = AK_i(t)^\alpha (h(t)L_i(t))^{1-\alpha}$$

The efficiency of labor grows at an exogenous rate $g$, which measures the rate of technical process. We thus assume that,

$$h(t) = e^{gt}$$

In order to determine the production, employment and investment decisions of firms we first define the instantaneous profit function of firm $i$. This is given by,

$$Y_i(t) - w(t)L_i(t) - \left[ 1 + \phi \left( \frac{I_i(t)}{K_i(t)} \right) \right] I_i(t)$$
The Optimization Problem of Firms

Each firm chooses an employment and an investment plan to maximise,

\[ \int_{s=t}^{\infty} e^{-\int_{z=t}^{s} r(z) dz} \left( Y_i(s) - w(s)L_i(s) - \left[ 1 + \frac{\phi}{2} \left( \frac{I_i(s)}{K_i(s)} \right) \right] I_i(s) \right) ds \]

subject to its production function and the capital accumulation equation,

\[ \dot{K}_i(s) = I_i(s) - \delta K_i(s) \]

Since firms are competitive, they take the path of real wages and real interest rates as exogenously given.
Optimal Employment and Investment

From the first order conditions for the maximisation subject to the production function and the capital accumulation equation, we get,

\[ w(t) = (1 - \alpha) A \left( \frac{K_i(t)}{L_i(t)} \right)^{\alpha} h(t)^{1-\alpha} \]

\[ q_i(t) = 1 + \phi \left( \frac{I_i(t)}{K_i(t)} \right) = 1 + \phi \left( \frac{\dot{K}_i(t)}{K_i(t)} + \delta \right) \]

\[ \left( r(t) + \delta - \frac{\dot{q}_i(t)}{q_i(t)} \right) q_i(t) = \alpha A \left( \frac{K_i(t)}{L_i(t)} \right)^{\alpha-1} h(t)^{1-\alpha} + \frac{\phi}{2} \left( \frac{\dot{K}_i(t)}{K_i(t)} + \delta \right)^2 \]

\[ \lim_{s \to \infty} \int_{z=t}^{s} r(z) \, dz \]

\[ q_j(s) K_j(s) = 0 \]
Interpretation of First Order Conditions

These first order conditions have well known interpretations:

• The first states that firms will hire labor until the marginal product of labor is equal to the real wage.

• The second is the condition linking the shadow price of installed capital to the gross investment rate.

• The third states that the user cost of capital (on the left hand side) is equal to the marginal product capital, which consists of the marginal product of capital in current production, plus the reduction of future investment costs.

• The final condition is the transversality condition that the present value of the future capital stock, as time goes to infinity, tends to zero.
Aggregate First Order Conditions for Employment and Investment

\[ w(t) = (1 - \alpha) A k(t)^\alpha e^{gt} \]
\[ q(t) = 1 + \phi \left( \frac{\dot{k}(t)}{k(t)} + g + n + \delta \right) \]
\[ \left( r(t) + \delta - \frac{\dot{q}(t)}{q(t)} \right) q(t) = \alpha A k(t)^{(1-\alpha)} + \frac{\phi}{2} \left( \frac{\dot{k}(t)}{k(t)} + g + n + \delta \right)^2 \]

where, \[ k(t) = \frac{K(t)}{h(t)L(t)} = \frac{K(t)}{e^{(g+n)t}} \]
The Adjustment Path and the Steady State under Financial Autarky

• We define as financial autarky, the regime under which the economy cannot borrow or lend internationally.

• Under financial autarky, equilibrium in the goods market requires that domestic consumption plus investment are continuously equal to total domestic output.

• Thus, financial autarky is a regime in which the economy behaves as a closed economy, and domestic investment is always equal to domestic savings.

• The properties of the model under financial autarky are well known from the standard Ramsey-Cass-Koopmans model with adjustment costs for investment (see Abel and Blanchard 1983).
The Model: Financial Autarky

\[
y(t) = Ak(t)^\alpha
\]

\[
\dot{c}(t) = (r(t) - \rho - g)c(t)
\]

\[
w(t) = (1 - \alpha)Ak(t)^\alpha e^{gt}
\]

\[
q(t) = 1 + \phi \left( \frac{\dot{k}(t)}{k(t)} + g + n + \delta \right)
\]

\[
\left( r(t) + \delta - \frac{\dot{q}(t)}{q(t)} \right) q(t) = \alpha Ak(t)^{-\alpha(1 - \alpha)} + \frac{\phi}{2} \left( \frac{\dot{k}(t)}{k(t)} + g + n + \delta \right)^2
\]

Financial Autarky

\[
y(t) = Ak(t)^\alpha = c(t) + q(t) \left( \dot{k}(t) + (g + n + \delta)k(t) \right)
\]
Steady State under Financial Autarky

\[ r_E = \rho + g \]
\[ q_E = 1 + \phi(g + n + \delta) \]
\[ k_E = \left( \frac{aA}{\rho + g + \delta + \phi(\rho - n)(g + n + \delta) + (\phi / 2)(g + n + \delta)^2} \right)^{\frac{1}{1-\alpha}} \]
\[ y_E = Ak_E^\alpha \]
\[ \omega_E = e^{-gt}w_E = (1 - \alpha)Ak_E^\alpha \]
\[ c_E = Ak_E^\alpha - (g + n + \delta)q_Ek_E \]
Fig. 1 Dynamic Adjustment under Financial Autarky

\[ q = 0 \] Steady State Investment Schedule

\[ q_e = 1 + \phi (g + n + \delta) \]

\[ k_0 \]

\[ k_E \]

\[ \dot{c} = 0 \] Steady State Consumption Schedule

\[ \dot{k} = 0 \] or \[ c = Ak^\gamma - q (g + n + \delta) k \]

Steady State Equality between Savings and Investment
Fig. 2 The Time Paths of Output and Consumption under Financial Autarky
The Model: Financial Openness

\[ y(t) = A k(t)^\alpha \]

\[ r^* = \rho + g \]

\[ c(t) = \bar{c}(k_0) = (\rho - n) \left( k(0) + \int_{t=0}^{\infty} w(t) e^{-(\rho + g - n)t} dt \right) \]

\[ w(t) = (1 - \alpha) A k(t)^\alpha e^{gt} \]

\[ q(t) = 1 + \phi \left( \frac{\dot{k}(t)}{k(t)} + g + n + \delta \right) \]

\[ \left( r^* + \delta - \frac{q(t)}{q(t)} \right) q(t) = \alpha A k(t)^{-(1-\alpha)} + \frac{\phi}{2} \left( \frac{\dot{k}(t)}{k(t)} + g + n + \delta \right)^2 \]

\[ f(t) = \left( (r^* - g - n) f(t) + A k(t)^\alpha - c(t) \right) - q(t) \left( \ddot{k}(t) + (g + n + \delta) k(t) \right) \]
Steady State under Financial Openness

\[ r_E = \rho + g \]
\[ q_E = 1 + \phi (g + n + \delta) \]
\[ k_E = \left( \frac{aA}{\rho + g + \delta + \phi (\rho - n) (g + n + \delta) + (\phi / 2) (g + n + \delta)^2} \right)^{\frac{1}{1-\alpha}} \]
\[ y_E = A k_E^\alpha \]
\[ \omega_E = e^{-g t} w_E = (1 - \alpha) A k_E^\alpha \]
\[ c_E = \tilde{c}(k_0) = (\rho - n) \left( k(0) + \int_{t=0}^{\infty} w(t) e^{-(\rho + g - n)t} \, dt \right) \]
\[ f_E = \tilde{f}(k_0) = \frac{-1}{(\rho - n)} \left( A k_E^\alpha - \tilde{c}(k_0) - q_E k_E (g + n + \delta) \right) \]
Fig. 3 Dynamic Adjustment of Investment and the Capital Stock under Financial Openness
Fig. 4 The Time Paths of Output, Consumption and the Trade Balance under Financial Openness, in a Small Open Economy
The Two Country Model

\[ y_i(t) = A k_i(t)^\alpha \]

\[ \dot{c}_i(t) = (r(t) - \rho - g) c_i(t) \]

\[ q_i(t) = 1 + \phi \left( \frac{\dot{k}_i(t)}{k_i(t)} + g + n + \delta \right) \]

\[ \left( r_i(t) + \delta - \frac{\dot{q}_i(t)}{q_i(t)} \right) q_i(t) = \alpha A k_i(t)^{-(1-\alpha)} + \frac{\phi}{2} \left( \frac{\dot{k}_i(t)}{k_i(t)} + g + n + \delta \right)^2 \]

\[ \omega_i(t) = w_i(t) e^{-\gamma t} = (1 - \alpha) A k_i(t)^\alpha \]

\[ \dot{f}_i(t) = \left( (r(t) - g - n) f_i(t) + A k_i(t)^\alpha - c_i(t) \right) - q_i(t) \left( \dot{k}_i(t) + (g + n + \delta) k_i(t) \right) \]

\[ i = 1, 2 \quad f_1(t) = -f_2(t) \quad k_E > k_1(0) > k_2(0) \]
Fig. 5 Dynamic Adjustment of Investment and the Capital Stock in a Two Country World
Fig. 6 The Time Paths Output, Consumption and Trade Balances in a Two Country World
Fig. 7 Simulation of Time Paths for a Small Emerging Economy
Fig. 8 Simulation of Time Paths for a Developed Economy in a Two Country World
Fig. 7 Simulation of Time Paths for an Emerging Economy in a Two Country World
Conclusions

• For an “emerging” economy, whose initial capital stock is lower than in the rest of the world, the path of real interest rates under financial openness will be below the corresponding path of real interest rates under autarky.

• As a result, under financial openness, both per capita consumption and investment will be higher during the adjustment process. During the transition to the balanced growth path, the economy thus runs current account deficits and accumulates foreign debt. As it approaches the balanced growth path, the process of foreign debt accumulation slows down, and the economy approaches a position of external balance.

• On the balanced growth path, output (GDP) per capita is the same as under autarky, but Gross National Product (GNP) and consumption per capita are lower under financial openness than under autarky, since the economy has to pay interest on the foreign debt it has accumulated during the transition.
Conclusions (continued)

• The opposite applies to a “developed” economy, whose initial capital stock is higher than the rest of the world. During the transition, the economy runs current account surpluses and accumulates net foreign assets. Steady state consumption per capita will be higher under financial openness than under autarky, as the economy receives interest on the foreign assets that it has accumulated during the transition.

• There are benefits from inter-temporal trade for both types of economies, as, during the transition path, the path of the world real interest rate differs from the path of autarky real interest rates for both economies.

• The analysis has been conducted under the assumption of commitment to the originally optimal plans and has not incorporated the problem of time inconsistency and the incentives to repudiate on foreign debt. In the absence of international commitment mechanisms financial openness may not be easy to implement and the benefits from inter-temporal trade not easily available to economies that cannot pre-commit not to repudiate on their foreign debt.