Department of Economics
Queen's University

ECON239: Development Economics
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Midterm Exam — Answer Key
Monday, October 25, 2010

Section A (50 percent)**:** Discuss the validity of THREE (3) of the following statements. In your answer define or explain as precisely as possible any terms or concepts which are underlined, with particular reference to the context in which they are being used. You should aim to make each answer no longer than a single side (two sides if double-spaced), and you should include diagrams and/or real-world examples where appropriate. All questions have equal value.

A1. Suppose there are two goods produced in the world: DVDs, which are traded internationally, and hair cuts, which are not. Assume that transport costs are negligible. The following table shows information on the consumption and prices of DVDs and hair cuts in the USA and China:

Country	DVDs Consumed	Hair Cuts Consumed	Price of DVDs in Local Currency	Price of Hair Cuts in Local Currency
USA	**9**	**4**	**2**	**4**
China	**3**	**4**	**10**	**10**

The value of the purchasing power parity exchange rate depends on whether a US or a world–wide basket of goods is used to compute it.
The PPP rate is usually defined as the number of units of a country's currency required to purchase the same quantity of goods and services in the local (developing country) market as \$1 would buy in the US (2 marks). Formally, we can calculate this as (1 mark)

$$\text{PPP exchange rate for China} = \frac{\text{Cost of representative basket of goods and services in US}}{\text{Cost of same basket of goods and services in China}}$$

Using the US basket of goods:
To buy the US basket (9 DVDs and 4 haircuts) in the US would cost

$$(9 \times 2) + (4 \times 4) = 34 \text{ US\$}$$

To buy the US basket (9 DVDs and 4 haircuts) in China would cost

$$(9 \times 10) + (4 \times 10) = 130 \text{ RMB}$$

So the PPP exchange rate (using the US basket) is (3 marks)

$$\text{PPP}_{US} = \frac{130}{34} = 3.82$$

Using the world basket of goods (12 DVDs and 8 haircuts):
To buy the world basket in the US would cost

$$(12 \times 2) + (8 \times 4) = 56 \text{ US\$}$$

In China this basket would cost would cost

$$(12 \times 10) + (8 \times 10) = 200 \text{ RMB}$$

So the PPP exchange rate (using the World basket) is (3 marks)

$$\text{PPP}_{World} = \frac{200}{56} = 3.57$$

(Note that for this calculation it does not matter whether we use the whole world basket or half the world basket (6 DVDs and 4 haircuts), as long as we use something proportional to the world basket.) Obviously, the two approaches yield different results and would (1 mark) also yield different degrees of income disparity (using only the Chinese basket would give a third ratio). There is no "correct" method for computing PPP rates in this example, so the best we can do is consider the range of values that we get. Most PPP estimates use a basket that corresponds to US consumption patterns (but discard "luxury items").

A2. The head–count ratio is a better target measure of poverty than the poverty gap index because it is likely to lead to less of a bias in poverty reduction policies towards individuals who are already close to the poverty line.

The headcount ratio is simply the fraction of a given population that is below some well-defined poverty line (2 marks) . Given that the resources of policy–makers are limited, the fact that it is cheaper to shift those just below the poverty line up to it, than it is to shift up those well below it, will imply a "bigger bang for the buck" in targeting the "not–so poor" (2 marks). This potential bias illustrates the importance of thinking carefully about formulating target measures for policy. An alternative target measure that avoids this bias is the poverty gap index which measures the depth of poverty: the amount of income needed to raise those below the poverty line up to it (3 marks). This is often expressed as a percentage of total economywide income – the poverty gap ratio. If this were the target measure then policies that increase the incomes of the very poor would have an equal impact on the measure as those that increase the incomes of the not-so poor (2 marks). This is not to say that measures like the poverty gap ratio are immune from their own problems. For example, a country with high average income may have a low PGR (implying high inequality), even though the depth of poverty is the same as a relatively poor country (1 mark).

A3. The Harrod-Domar model provides a useful approximation of the likely impacts of foreign aid on an economy's growth rate.

(4 marks) The Harrod–Domar model is a formal theory that offers a simple formula stating at what rate an economy must save, s, in order to attain a per capita income growth rate of g, given a population growth rate, n, a rate of physical depreciation, δ, and a capital–income ratio, θ:

$$s = \theta(n + g^* + \delta).$$

Foreign aid can then be thought of as an attempt to fill the gap between this target savings rate and the actual savings rate of the economy. If the actual level of domestic saving is S^D and aggregate income is Y, the aid needed to achieve the target above is assumed to be given by

$$A = sY - S^D = \theta(n + g^* + \delta)Y - S^D$$

In principle, then the Harrod-Domar model does provide a guide of the impact of foreign aid on investment and, in turn, on an economy's growth rate. In practice (as discussed by Easterly), however, this model has done a very poor job of predicting the effects of foreign aid on growth. Firstly, the impact of aid on investment in many countries has been small — much of the aid has been consumed in one way or another, rather than invested in growth–promoting activities. The assumption that aid will be simply added to domestic saving in order to raise investment, rather than substituted, ignores important incentives and institutional factors that have been important (2 marks). Secondly, the statistical relationship between investment and growth over shorter periods has also been rather weak (1 mark). In addition, to these practical problems, several key assumptions of the model are inconsistent with observed facts. In particular, the model implicitly assumes that there are constant returns the capital, and that there is surplus labour available (2 marks). As Easterly argues, neither assumption holds water, at least in the long run. A vivid example of this is the case of Zambia (1 mark).

A4. Potential settler mortality rates from the period of colonization by European powers are useful in assessing the impact of cross–country institutional differences on economic performance, because they are an exogenous source of variation in political and legal institutions.

Cross–country institutional differences refers to differences in the humanly–devised constraints that structure incentives in economic transactions. These can include aspects of the political system (e.g. degree of democracy, constraints on executive power, etc.), the extent and effectiveness of the legal system in supporting and enforcing contracts, elements of the socio-economic infrastructure (e.g. land rights, social insurance systems, etc.). There are a number of indices (based on scores and rankings applied by various organization) available that purport to measure institutional quality across countries, and these are typically highly correlated with per capita income (2 marks) . However, it is generally difficult to assess the direction of causation between these two measures — is it that better institutions lead to higher income per capita, or do richer

countries have better institutions simply because they can afford them ? Ideally, in order to determine the causal role of institutions, we need an exogenous source of variation — some measurable factor that is an important determinant of the variation in institutional quality, but which is clearly not itself determined by the level of per capita income of a country. (2 marks)

The article by Acemoglu, et al. (2001) represents an attempt to measure the impact of differences in institutional quality by using potential settler mortality rates as an exogenous source of variation in legal and political institutions. Their argument is that where settler mortality rates were low, European powers moved in and colonized those countries and brought their institutions with them, whereas where mortality rates were high they tended to extract (human and natural) resources at arms length rather than settle there. In these extractive situations, they set up institutions (e.g. political power structures) that were designed to ease extraction of resources, rather than to protect the economic and political rights of citizens. (4 marks) They argue that these high and low quality institutions persist today in many countries. Acemoglu et al. argue that as much as 75% of the variation in current income per capita of these ex–colonies can be accounted for by the differences in institutional quality that resulted from differences in settler mortality rates (1 mark). Note that the mortality rates faced by settlers were not the same as those faced by indigenous peoples who had developed some immunity to the local diseases over time. Therefore, it is not the case that countries with high rates of disease are just poorer. (1 mark)

A5. The evidence that sharecropping results in low productivity suggests that people in the rural sector of many developing countries are not rational.

The tenancy arrangement of sharecropping has been common in various countries of the world for centuries, although it is less prevalent now than in the past. It refers to the practice where tenants pay landowners a specified share of their output instead of, or in addition to a fixed rental payment (2 marks). In economics, rationality consists of two assumptions: (1) that individuals act in their own self interest and (2) that they can figure out the consequences of their own and other people's actions (2 marks).

The evidence suggests that sharecropping tenancy relationships lead to lower productivity than fixed rental agreements, because they offer low incentives for effort and investment. Given that sharecropping is so persistent, one might think that this implies that people in the rural sector are not acting rationally. However, most economists think it is more likely that the institution of share-cropping serves an important purpose in terms of sharing risk. Proponents of the Chicago school of thought argue that landlords and tenants can agree on the efficient level of effort, but then adopt a sharecropping arrangement to minimize the transactions cost associated with risk bearing. However, this view is inconsistent with the low productivity if sharecropping and ignores the difficulty of monitoring efort. According to the new institutional school, sharecropping is best viewed as the result of a trade–off between risk and incentives. To see this, suppose that the landlord is risk–neutral, but Tenant is risk–averse. In this case, according to the Chicago school view we would expect to see a wage contract. However, suppose that the Landlord cannot

directly monitor the effort of the Tenant, and he cannot infer effort due to the risk in production described above (effort here is a "hidden action"). The **incentive–constrained** or **second–best** efficient value of the output share is the one where the marginal gains (due to reduced efficiency losses) and marginal cost (due to greater risk) of increasing it any further are just equalized. Note that this must generally give a share of output to the tenant which is less than one, so that this outcome is not as productive as a fixed rental contract. However, its the best outcome possible given the informational constraint (6 marks).

Section B (50 percent)**:** Answer ONE (1) of the following **Long Questions.**

B1. Consider the following version of the Solow growth model. Suppose the relationship between output per worker, y, and capital per worker, k, at any point in time is represented by

$$y = f(k),$$

where the function $f(\cdot)$ is increase in k and concave. Suppose also that there is no technological change, population growth is n, the savings rate is s and the rate of depreciation of capital is δ.

(a) Explain why the model economy is in a steady–state when the capital stock per worker satisfies

$$sf(k) = (n + \delta)k.$$

Illustrate this situation on a diagram.

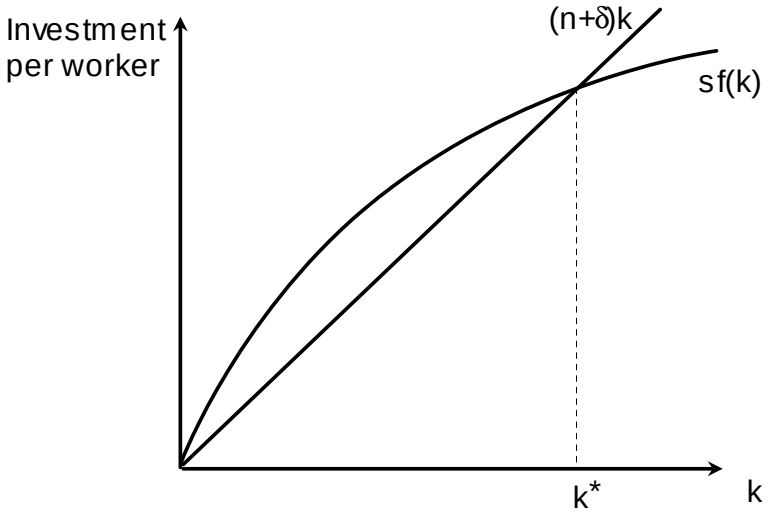
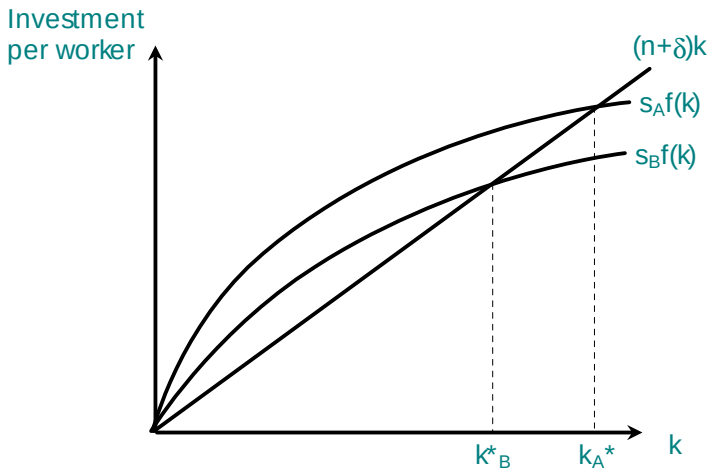


Figure 1: The Solow Model: Steady State

The right–hand side of this equation is the economy's break–even level of investment — where new investment is high enough to just offset the negative effects of depreciation and population growth on the capital stock per worker. The equation states that the capital stock per work is such that the actual investment per worker is just equal to this break–even level, so that the capital stock per worker does not change over time. Once the economy has reached this situation, there is no tendency for the capital stock per worker to change over time, so that the economy is in steady–state.

(b) Suppose there are two such economies (A and B). The two economies have identical values of n and δ and face the same production relationship, $f(\cdot)$. However, country A has a higher savings rate than B: $s_A > s_B$. Explain using a diagram what this implies for the relative steady–state levels of capital and output per worker in each country.

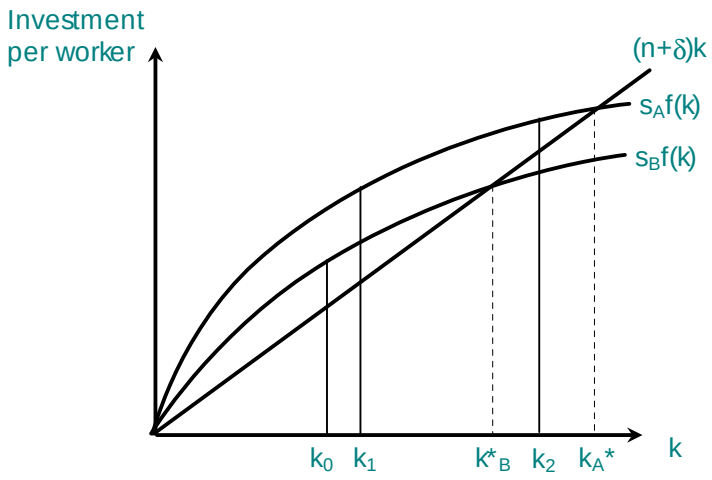
As illustrated in Figure , the steady-state capital stock per worker in economy A exceeds that in country B: $k_A^* > k_B^*$.



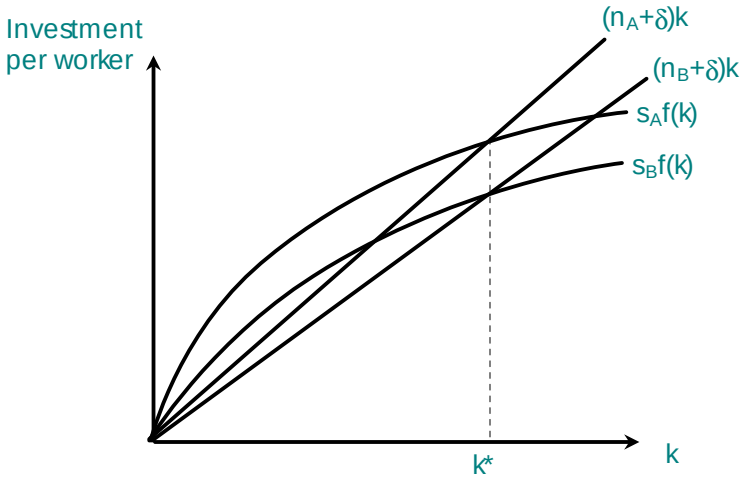
(c) (Suppose that, in addition to having a higher savings rate, economy A starts out with a higher capital stock per worker than country B. Which economy grows fastest ? Explain with the aid of a diagram.

In general, this is ambiguous. Suppose country B starts out at k_0. Then the increase in its capital stock per worker is given by the vertical distance between its savings function and the break–even investment line. If country A starts out at k_1 (a little above k_0) then clearly this increment to its capital stock is much larger and it will grow fastest. However, if country A starts out at k_2 (closer to its own steady–state), then this increment is small and country B will grow fastest.

(d) Suppose that, in addition to having a higher savings rate, economy A also has a higher population growth rate than economy B: $n_A > n_B$. Is it possible that both



economies have the same steady–state output per worker? Explain.
Yes, it is possible. Figure illustrates a situation where the positive affect of a higher savings rate on Country A is exactly offset by the negative affect of higher population growth.



(e) If $\delta = 0.1$, $s_A = 0.3$, $s_B = 0.2$, $n_A = 0.05$ and $n_B = 0.02$, which economy has the highest steady–state output per worker? Explain using a diagram of the production function.
The steady–state output–capital ratio is given by

$$\frac{Y}{K} = \frac{f(k)}{k} = \frac{n+\delta}{s}$$

For country A this is given by

$$\frac{0.05+0.1}{0.3} = 0.5$$

and for country B it is given by

$$\frac{0.02 + 0.1}{0.2} = 0.6$$

As illustrated in Figure, due to diminishing returns, a *lower* output–capital ratio is associated with *higher* output per worker. Therefore country A has the highest steady–state output per worker.

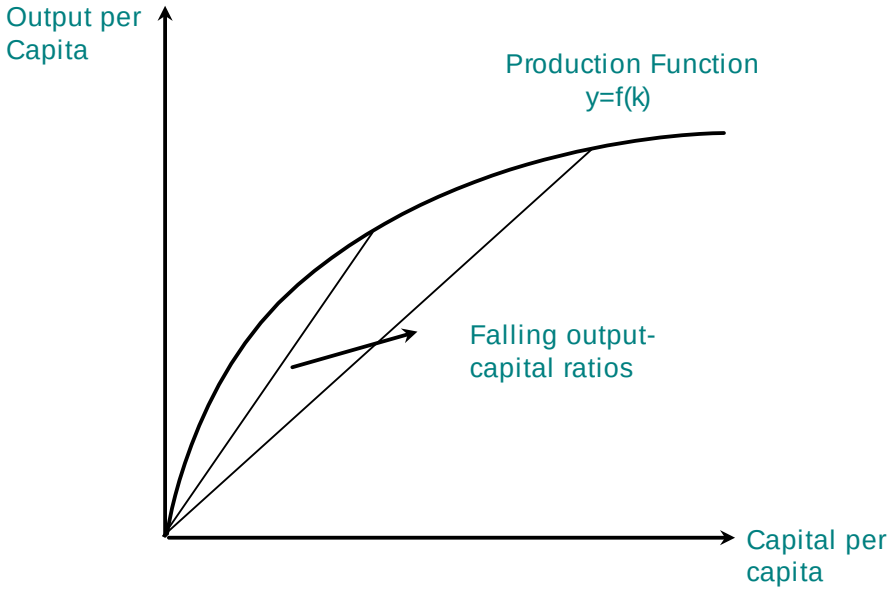


Figure 2: Diminishing Returns to Capital per Worker

B2. A plot of land is owned by a Landlord but worked by a Tenant. If the Tenant provides effort L she incurs a cost $C(L)$, which increases at an increasing rate with L. The value of output from the plot is given by the production function

$$y = g(L) + x,$$

where $g(L)$ increases at a decreasing rate with L, and x represents random variations in output due to climatic conditions. The Landlord can observe the output produced by the Tenant, but cannot monitor or infer the amount of effort she exerts.

(a) Using the above information, write down the incomes of the two parties under (1) a wage contract, (2) a rental contract and (3) a sharecropping contract.

The Tenant's income is : $I_t = -F + (1 - \alpha)[g(L) + x] - C(L)$.

The Landlord's income is : $I_l = F + \alpha[g(L) + x]$.

The contract specifies alternative values of F and α, *before* the two parties know what the value of x will be. We can represent three alternative types of contract in this framework:

(1) A **wage contract** : $F < 0$ and $\alpha = 1$
– the Landlord pays a fixed wage, $-F$, to the Tenant in return for a specified level of effort and receives all the output herself. The wage is determined in the labour market.
(2) A **rental contract** : $F > 0$ and $\alpha = 0$
– the Tenant rents the plot from the Landlord for a fixed amount F and receives all the output himself. The rent is determined in the land rental market.
(3) A **sharecropping contract** : $F =?$ and $0 < \alpha < 1$.
– the two parties divide up the output, with the Tenant getting a share $1 - \alpha$ and the Landlord receiving α. A fixed payment, F, may also be made from one party to the other, the net value of which will depend upon market wages and rental rates. However, this contract is not a pure market contract: factors other than price matter.

(b) In each of these contracts describe how the risk is allocated between to two parties. What about the incentives faced by the Tenant to exert effort ?
(1) In the wage contract, the Landlord faces all the risk and the Tenant none, but the incentives faced by the Tenant are weak.
(2) In the rental contract, the incentives faced by the Tenant are strong, but he now bears all the risk and the Landlord bears none.
(3) In the share–cropping contract, both parties bear some risk. The smaller the value of α, the more risk the Tenant faces and the less is borne by the Landlord. The incentives faced by the Tenant are weaker than under a rental contract but stronger that under the wage contract, and decrease with α.

Assume that the Landlord is risk–neutral, but the Tenant is risk–averse. This risk-aversion is represented as a cost which increases at an increasing rate with the Tenant's share of output.

(c) With the aid of a diagram, explain how the theoretical constrained–efficient output share received by the Tenant, $1 - \alpha^*$, and the associated effort level, L^*, are determined in a sharecropping contract.
Given the parameters of the contract, α and F, the Tenant will choose his effort level so that his private marginal cost equals his private marginal benefit:

$$MC(L) = (1 - \alpha)MB(L).$$

This is the Tenant's **incentive constraint**: it tells the Landlord how he will have to increase the output share $1 - \alpha$ in order to encourage more effort. In particular, $1 - \alpha$ is an increasing function of the desired effort level. However, the increase in $1 - \alpha$ needed to attain more effort, also increases the cost of risk faced by the Tenant. The increment in the cost of risk necessary to attain each additional unit of effort is given by the marginal cost of risk (MCR) curve illustrated in Figure 3.

The incentive–constrained or second–best efficient value of α is the one where the gains and losses of decreasing it any further are just equalized, α^*. For any $\alpha > \alpha^*$ the increase in productive efficiency resulting from an increase in the share exceeds the increase in the cost imposed due to additional risk. For any $\alpha < \alpha^*$ the reduction in productive efficiency resulting from an decrease in the share is less than the decrease in the cost imposed due to additional risk. When $\alpha = \alpha^*$, the reduced production efficiency loss caused by increasing the share, AB, is just equal to the additional welfare cost due to risk, CD.

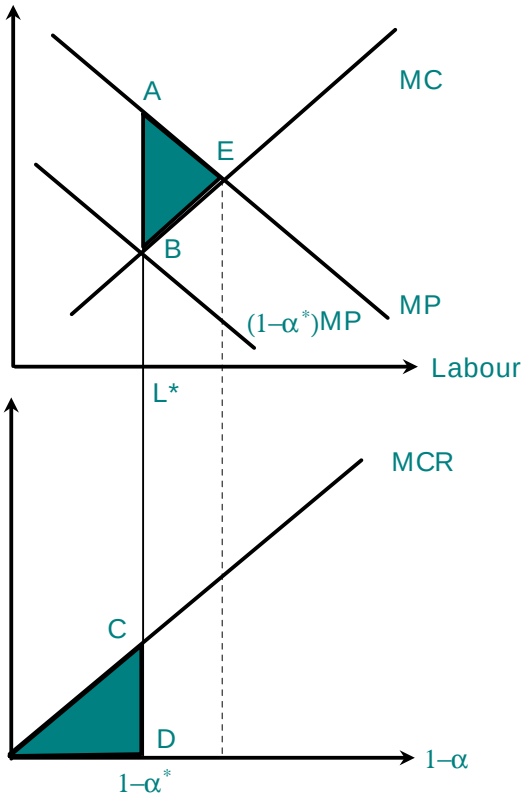


Figure 3: Constrained-efficient Sharecropping Contract

(d) Using the same diagram as in (c) illustrate the total losses (due to bad incentives and risk) under the sharecropping contract, relative to the full–information case.
The efficiency (i.e. welfare) losses are represented by the shaded areas in Figure 3.

(e) As countries become more developed, sharecropping tends to become less prevalent as a form of tenancy. How can the theory outlined above help to account for this observation? Explain your answer using a diagram.
As countries become more developed, we generally see credit markets and insurance markets improve. This implies that farmers are likely to have better access to ways of insuring themselves against risk and so the cost of risk will tend to decline. Also some innovations in agriculture

(more resistant crop varieties) may act to reduce risk directly. As illustrated in the lower panel of Figure 4, the implication is that the MCR curve shifts down. Now the original share received by the Tenant, $1-\alpha_0^*$, is no longer constrained efficient – a small reduction in α will reduce the efficiency loss by more than the increase in the cost of risk. To find the new constrained–efficient share, just reduce α (thereby shifting up the effective marginal benefit accruing the tenant) until the marginal efficiency loss is just equal to the marginal cost of risk. That is where $A'B' = C'D'$. This yields the new constrained-efficient share accruing to the tenant, $1-\alpha_1^*$, which is now higher.

Eventually, as risk is reduced enough we will tend to see fixed rental contracts emerge as a form of tenancy ($\alpha = 1$), rather than sharecropping.

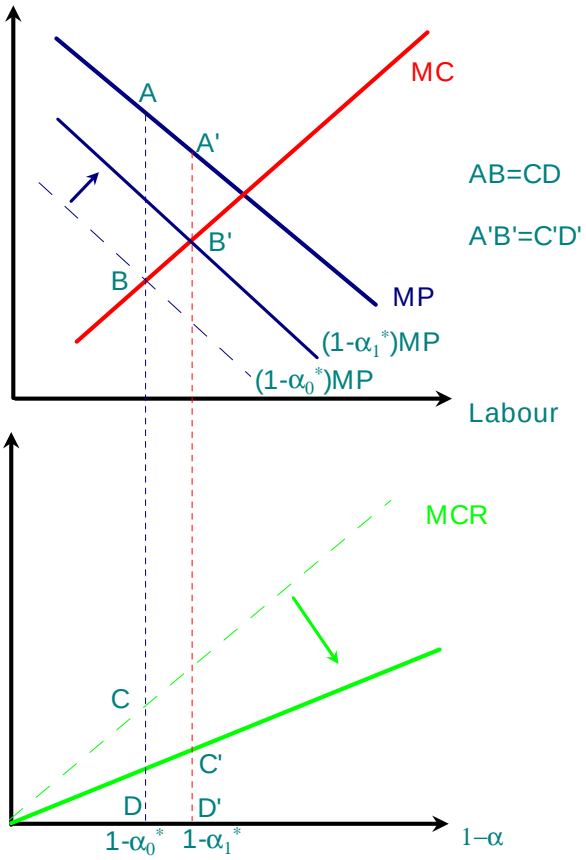


Figure 4: Effect of Reduction in Risk due to Crop Insurance

Note that another factor which may also improve with development is that agriculture becomes more productive. This will cause the MP curve to shift up and to the right, which will also cause the share received by the tenant to rise.