

NBER WORKING PAPER SERIES

FOREIGN-OWNED LAND

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Working Paper No. 1512

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
December 1984

I gratefully acknowledge support from the National Science Foundation under grant no. SES 8207643. The research reported here is part of the NBER's research program in International Studies. Any opinions expressed are those of the author and not those of the National Bureau of Economic Research.

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ABSTRACT

Land and capital serve not only as factors of production but as assets which households use as stores of value. Standard trade models typically recognize only the first role. In its role as an asset land reduces the amount of national savings available for capital investment.

Foreign investment affects the national economy through both asset markets and factor markets. When the share of labor in the land-using sector is large relative to the labor share in the capital-using sector, factor-market effects are likely to dominate. In this case a drop in the price of the agricultural good or a rise in the land-labor ratio attracts foreign investment, while a drop in the world interest rate raises the welfare of a capital-importing country. If the share of labor in the land-using sector is smaller, however, asset-market effects dominate. These results are then likely to be reversed. Even when trade in claims on land equalizes the domestic and world interest rates, a tax on land raises steady-state welfare.

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The issue of foreign investment in land has been the subject of some political concern.¹ Nevertheless, there is not much economic analysis of the causes and consequences of international trade in claims on land. This paper analyzes the determinants of foreign ownership of land, and its implications for national welfare.

These issues are explored in a dynamic model in which labor, land and capital are used to produce output. In addition, land and capital serve as stores of value. Each period the economy is identical to the specific factors model described, for example, by Ronald Jones (1971): A manufactured good is produced with capital and labor and an agricultural good with land and labor.

The specific-factors model has become popular in analyzing movements of capital. Richard Brecher and Ronald Findlay (1983) and T.N. Srinivasan (1983) provide examples. Unlike the two-factor Heckscher-Ohlin model, the specific-factors model does not imply that trade in commodities, unless it leads to complete specialization, removes any incentive for foreign investment. The formulation determines interior production and investment patterns simultaneously.

A limitation of the static specific-factors model as a vehicle to analyze foreign ownership of land, and foreign investment more generally, is its treatment of nationally-owned assets as exogenous in supply. In particular, the national supply of capital does not derive from national savings behavior. The role of land as a store of value that competes with capital is consequently ignored.

In the model developed in this paper individual savings determines the national capital supply. Savings behavior is the outcome of a simple life-cycle optimization like that in Paul Samuelson's (1958) overlapping generations (OLG) model.

Incorporating land and capital together in a dynamic model introduces a role for land not only as a factor of production, as in the static specific-factors model, but as an asset. An important aspect of foreign investment in land is its effect on the value of this asset and the quantity available to national investors. These magnitudes in turn have implications for the amount of capital supplied nationally.

The analysis addresses three issues. The first is the effect of an exogenous increase in the amount of land owned by foreigners on the domestic economy. The effects on the price of land, on factor prices and on welfare are considered. There is, in fact, no presumption that the price of land rises in response to more foreign investment. The effect depends upon the relative labor shares in the two sectors. Increased foreign ownership does cause the real wage to rise and the interest rate and rent on land to fall, but the effect on welfare in steady state is ambiguous, depending upon the initial interest rate, relative labor shares, and the initial amount of foreign investment.²

A second concern of this paper is the behavior of the economy under free trade in claims on land. The paper considers the effects of changes in the terms of trade, the world interest rate, and the relative amounts of domestic factors in fixed supply on foreign investment and welfare.³ One result is that an increase in the relative price of the agricultural good may raise or lower the amount of land that foreigners own, but regardless of its effect on land ownership or trade patterns, an increase in the price of this good always lowers steady-state welfare. The effects of changes in the world interest rate and in relative factor supplies on welfare and land ownership are ambiguous, depending upon factor shares in the two sectors and the initial foreign investment position. In particular, a country with a low population

density does not necessarily end up with more of its land foreign-owned, and a drop in the world interest rate may reduce foreigners' land holdings.⁴

The third issue that the paper addresses is the effect of a land tax on foreign ownership and on national welfare. This analysis extends to an open economy work by Martin Feldstein (1977), Guillermo Calvo, Lawrence Kotlikoff and Carlos Rodriguez (1979) and Christophe Chamley and Brian Wright (1983) who show, in a closed economy, that taxing land raises steady-state welfare. The reason is that such a tax diverts savings into capital accumulation. The interest rate consequently falls. Since land serves both as a factor of production and as a non-depreciating asset, the rate of return in the economy necessarily exceeds the growth rate. A permanent reduction in the interest rate consequently raises steady-state welfare, since the economy is brought closer to the Golden Rule steady state. With free trade in claims on land, factor prices are unchanged as a consequence of a land tax. Nevertheless, a tax on land raises steady-state welfare as long as the value of land remains positive.⁵

The outline of the paper is as follows: Section I presents the basic assumptions of the analysis. The effect of an exogenous increase in foreign-owned land is examined in Section II. Section III analyzes the economy under free trade in claims on land, while the issue of the land tax is addressed in Section IV. Section V provides some concluding remarks.

I. The Model

In each period t the economy is identical to the three-factor, two-commodity model of Jones (1971). The manufactured good employs capital and

labor in its production. Its output, given factor inputs K of capital and L of labor is $F(K,L)$. The agricultural good is produced by land and labor. Amounts T of land and L of labor produce an output $G(T,L)$. The functions F and G are continuous, twice-differentiable and linear homogeneous.

At each period t the economy is endowed with supplies of each factor in amounts K_t , L_t and T_t . The stock of land is fixed at 1 and the labor force at L each period. Labor is mobile between sectors, and earns the same wage w_t in either activity. Competition in factor markets determines the wage rate, the interest rate r_t , the land rent π_t and an allocation of L_{Mt} units of labor to the manufacturing sector. In the absence of a corner solution, equilibrium is thus described by the equations

$$(1) \quad w_t = F_L(K_t, L_{Mt})$$

$$(2) \quad w_t = p_t G_L(L - L_{Mt})$$

$$(3) \quad r_t = F_K(K_t, L_{Mt})$$

$$(4) \quad \pi_t = p_t G(L - L_{Mt}) - w_t(L - L_{Mt})$$

which determine w_t , r_t , π_t and L_{Mt} as functions of the factor supplies and the relative price of the agricultural good in period t , p_t . The manufactured good serves as numeraire.

New investment in capital takes the form of currently produced units of the manufactured good that are not consumed. National savings is determined

by a simple life-cycle optimization. Individuals live two periods. In the first period of life they provide a unit of labor services to earn a wage w . An amount c^y is spent on current consumption with the remainder invested in land and capital. In the second period the individual consumes the value of his assets and the income that they have earned. This amount is denoted c^o . Lifetime utility as a function of c^y , c^o , and the relative prices of the agricultural good each period, p^y and p^o , is given by $V^y(c^y, p^y) + V^o(c^o, p^o)$.

The price of land is denoted q_t . Denoting the individual's investment in capital as k_t and in land as l_t , budget constraints imply that

$$(5) \quad c_t^y = w_t - k_{t+1} - q_t l_{t+1} .$$

$$(6) \quad c_{t+1}^o = (1 + r_{t+1})k_{t+1} + (q_{t+1} + \pi_{t+1})l_{t+1}$$

With perfect foresight, for both land and capital to be held in positive amounts requires that

$$(7) \quad \frac{q_{t+1} + \pi_{t+1}}{q_t} = 1 + r_{t+1}$$

which implies, with (6), that

$$(8) \quad c_{t+1}^o = (1 + r_{t+1})(w_t - c_t^y) .$$

In the working period the individual's problem is to choose c_t^y to maximize utility, given w_t, r_{t+1}, p_t and p_{t+1} . The utility-maximizing level is

denoted by the function $c^Y(w_t, r_{t+1}, p_t, p_{t+1})$.

Equilibrium in the markets for land and capital implies that

$$(9) \quad K_{t+1} = Lk_{t+1} + K_{t+1}^*$$

$$(10) \quad 1 = Ll_{t+1} + T_{t+1}^*$$

where K_{t+1}^* and T_{t+1}^* denote net foreign investment in capital and land, respectively. Negative values of these variables imply net ownership of these assets abroad by nationals.

The supply of nationally-owned capital K_t^n and the price of land q_t evolve according to the two dynamic equations

$$(11) \quad K_{t+1}^n = L[w_t - c^Y(w_t, r_{t+1}, p_t, p_{t+1})] - \lambda_{t+1}q_t$$

$$(12) \quad q_t = \frac{\pi_{t+1} + q_{t+1}}{1 + r_{t+1}}$$

where $\lambda_{t+1} \equiv Ll_{t+1}$, the share of land owned by nationals.

Since q_t does not appear in equations (1) through (4), w_t , r_t , π_t and $L_M t$ can be expressed as functions of K_t and p_t alone. As Jones (1971), for example, has demonstrated $w_K > 0$, $r_K < 0$, $\pi_K < 0$, $L_{MK} > 0$, $w_p > 0$, $r_p < 0$, $\pi_p > 0$, $L_{Mp} < 0$, where $x_K = \partial x / \partial K_t$ and $x_p = \partial x / \partial p_t$ for $x \equiv w, r, \pi, L_M$.

In the subsequent analysis foreign investment in capital, K_t^* , is assumed to equal zero. Trade in claims on land constitutes the only form of international investment.

II. Foreign Investment in Land

This section treats the amount of land owned by foreigners as exogenous, and considers the effect of changes in this amount on the capital stock, the price of land and national welfare, both on steady-state configurations and in the transition from the initial situation to the new steady state.

The economy is in steady state when the relative price of the agricultural commodity is constant over time, at a level denoted \bar{p} , and the capital stock and price of land are constant values, \bar{K} and \bar{q} , respectively, that satisfy

$$(13) \quad \bar{K} = \chi(\bar{K}, \bar{p}) - \lambda \bar{q}$$

$$(14) \quad \bar{q} = \bar{\pi} / \bar{r}$$

where

$$\chi(\bar{K}, \bar{p}) \equiv L[\bar{w} - c^y(\bar{w}, \bar{r}, \bar{p}, \bar{p})]$$

and

$$\bar{w} \equiv w(\bar{K}, \bar{p})$$

$$\bar{r} \equiv r(\bar{K}, \bar{p})$$

$$\bar{\pi} \equiv \pi(\bar{K}, \bar{p}) .$$

$\bar{x}(K, \bar{p})$ is the total savings of workers in steady state.⁶

An increase in foreign ownership of domestic land is indicated by an increase in $1-\lambda$. The effects, in steady state, on \bar{K} and \bar{q} are given by

$$(15) \quad \frac{d\bar{K}}{d(1-\lambda)} = \frac{\bar{q}}{\Delta}$$

$$(16) \quad \frac{d\bar{q}}{d(1-\lambda)} = V_K \frac{\bar{q}}{\Delta}$$

where

$$(17) \quad \Delta \equiv 1 - L(1 - c_w^y)w_K + c_r^y r_K + \lambda V_K$$

$$(18) \quad V_K \equiv \frac{\pi_K}{r} - \frac{\pi}{r^2} r_K .$$

As shown in the appendix, as long as $1 + c_r^y r_K \geq 0$, the condition $\Delta \geq 0$ is necessary and sufficient for the existence of a unique, stable, non-oscillating convergence path to steady state. This condition states that in the neighborhood of steady state an increase in the capital stock by a particular amount raises investment in capital by a lesser amount. If this stability condition is imposed Proposition 1 follows from equation (15):

Proposition 1: An increase in the amount of domestic land owned by foreigners raises the steady-state capital stock, thereby raising the real wage and lowering the interest rate and rent on land in steady state.

When more land is owned by foreigners, less is available to national investors as a store of value. More savings is diverted into capital

formation. The capital stock rises with the consequent implications for factor rewards.

Imposing the stability condition on equation (16) implies that an increase in the amount of land owned by foreigners raises or lowers the price of land depending upon whether V_K is positive or negative.

The term V_K indicates the effect of an increase in the steady-state capital stock on the price of land. Its sign is ambiguous since an increase in the capital stock has two conflicting effects. One is to raise the real wage, which reduces the profit earned by land, π . This acts to lower the land price. The other is to lower the interest rate which, given π , raises the price of land. The first, negative effect dominates if labor's share in agriculture is larger than its share in manufacturing, and conversely.⁷ From this relationship follows:

Proposition 2: An increase in foreign ownership of domestic land raises or lowers the price of land depending upon whether the manufacturing sector has a larger or smaller labor share than the agricultural sector.

Thus there is no presumption that a permanent increase in the amount of land owned by foreigners raises the price of land. If agriculture is labor-intensive relative to manufacturing, the price falls.

Consider now the effect of a permanent increase in foreign ownership of land on the level of welfare that is attained in steady state. Differentiating utility, U , evaluated at steady state, with respect to $(1-\lambda)$, gives, using the first-order condition for utility maximization,

$$(19) \quad \frac{dU}{d(1-\lambda)} = V_c^0 \frac{(-pG''F_{KK})\bar{q}}{(pG'' + F_{LL})\Delta} \left[\frac{(1+\bar{r})\bar{K}}{\bar{L}_M} - \frac{\bar{K} + \lambda\bar{q}}{L} \right].$$

The term outside the square brackets is positive. In the steady state of an economy in which land serves both as a productive factor and as a store of value, the interest rate is positive. Therefore expression (19) is nonnegative as long as

$$(20) \quad \frac{K}{L_M} \geq \frac{K + \lambda \frac{\pi}{r}}{L} .$$

Expression (19) consequently implies the following sufficient condition for welfare to rise when foreign land ownership rises:

Proposition 3: A permanent increase in the amount of land owned by foreigners necessarily raises steady-state welfare if the share of capital in national wealth exceeds the fraction of the labor force engaged by the manufacturing sector.

An increase in foreign investment raises the wage and lowers the interest rate. The positive effect of the first on welfare is greater when the capital-labor ratio in manufacturing is high. The negative effect of the second is greater the greater steady-state wealth per worker.

Expression (19) indicates another sufficient condition for increased foreign investment in land to raise welfare:

Proposition 4: A permanent increase in the amount of land owned by foreigners necessarily raises steady-state welfare if the labor share in agriculture is larger than the labor share in manufacturing and net foreign land holdings are initially nonnegative.

Propositions 2 and 4 together imply a third sufficient condition for increased foreign ownership of land to raise steady-state welfare: that

initial foreign land holdings are nonnegative and that the price of land not rise when foreign investment in land rises.

Increased foreign ownership of land can reduce steady-state welfare if agriculture is highly land-intensive relative to the capital intensity of manufacturing. Two extreme cases in which an increase in foreign investment lowers welfare are those in which agriculture employs no labor, and in which manufacturing employs no capital. The second case lowers the steady-state interest rate without raising the wage.

The discussion so far has compared the effect of different levels of foreign investment in land across steady states. The dynamics of a transition from one steady state to another can be analyzed by manipulation of equations (A3) and (A4) in the appendix. Once the change in foreign investment has occurred, the capital stock and price of land, and consequently factor prices, begin to move monotonically toward their new steady-state values.

If the change is anticipated, the land price begins to move toward its new steady-state value prior to the actual increase in foreign ownership. If the steady-state price of land falls, then the capital stock begins to rise before the increased foreign investment occurs. As the price begins to fall in anticipation, more national savings is diverted toward capital investment. If the steady-state land price rises, however, there is a period of capital decumulation before the increase in foreign-ownership. Once the investment takes place, this process is reversed as the capital stock moves to exceed its initial steady-state level.

The older generation at the time that the increase in foreign investment is first anticipated experiences a capital gain or loss on its land holdings depending upon whether the ultimate effect of the foreign investment is to raise or lower the steady-state land price. An implication of Proposition 4

is consequently that an increase in the amount of land that is foreign-owned is never Pareto-worsening. Either steady-state welfare rises or the older generation at the time that the increase is initially anticipated experiences a capital gain, with no other change in income. An increase in foreign investment can bring about a Pareto-improvement, however, if the price of land rises and condition (20) is nevertheless satisfied. This can occur when the interest rate is large or when the amount of land owned nationally is already small.

III. Free Trade in Land

The previous section considered the effect of an increase in the amount of land owned by foreigners, treating this amount as exogenous. This section extends the model to endogenize foreign investment in land when claims on domestic land are freely traded internationally.

Foreign investors are assumed to have available to them investments elsewhere in the world that earn a constant real rate of return r^* . The country considered here is small in the sense that it does not affect this rate. Free trade in claims on land will insure that the rate of return on domestic land equals r^* , or that

$$(21) \quad \frac{\pi_{t+1} + q_{t+1}}{q_t} = 1 + r^* .$$

If nationals continue to invest in domestic land, then condition (7) must continue to apply as well. Together, equations (7) and (21) imply

$$(22) \quad r_t = r^*$$

from which follows:

Proposition 5: Free trade in land will yield a domestic interest rate equal to the world interest rate unless all land is foreign-owned. The domestic interest rate will then exceed the world rate.

Even though, by assumption, foreigners do not invest directly in capital, investment in land has the same effect on the capital stock as if they did. In the rest of this section it is assumed that some domestic land remains nationally-owned, so that the domestic and world interest rates are in fact equal.⁸

The five equations (1) through (4) and (22) determine perfect foresight equilibrium values of w_t , r_t , π_t , L_{Mt} and K_t as functions of the domestic supplies of labor and land, the relative price of the agricultural good, and the world interest rate. If these amounts are constant, then factor returns, the allocation of labor and the supply of domestic capital will be constant as well. Denoting these magnitudes as \bar{w} , \bar{r} , $\bar{\pi}$, \bar{L}_M and \bar{K} , the land price is then also a constant, given by

$$(23) \quad \bar{q} = \frac{\bar{\pi}}{r^*} .$$

From the savings relationship (11), with $K_t^n = \bar{K}$, the share of land that is nationally-owned is:

$$(24) \quad \lambda_t = \frac{\bar{K} - L[w_{t-1} - c^y(w_{t-1}, \bar{r}, \bar{p}, \bar{p})]}{\bar{q}} .$$

In steady state, $w_{t-1} = \bar{w}$. The amount of land owned by foreigners in steady state, $\bar{\lambda}$, is thus given by expression (24) with $w_{t-1} = \bar{w}$.⁹

The remainder of this section considers the effects of permanent changes in the relative commodity price, \bar{p} , the world interest rate, r^* , and domestic supplies of fixed factors on foreign investment in land and on national welfare.¹⁰

A. An Increase in the Relative Price of the Agricultural Good

1. Steady-State Foreign Investment

As long as land ownership remains diversified a change in the relative price of the agricultural commodity has no effect on the steady-state rate of interest or wage. These are tied to r^* by equations (1) through (4) and (22). Foreign investment is affected through the effect of \bar{p} (i) on the value of land, which rises when \bar{p} rises, (ii) on the equilibrium capital stock, which falls when \bar{p} rises, and (iii) on worker's consumption, which can either rise or fall. The first acts to attract foreign investment by diverting more national savings toward investment in land rather than capital. The second has the opposite effect.

The total effect on the amount of foreign-owned land of a rise in the price of the agricultural commodity is, from equation (24), given by

$$(25) \quad \frac{d(1-\bar{\lambda})}{d\bar{p}} = \frac{c_p^y L - \frac{\bar{w}G'}{r^*\bar{p}G''} \left[\frac{\bar{\lambda}\sigma\pi}{\bar{w}(L-\bar{L}_M)} - \frac{r^*\bar{K}}{\bar{w}\bar{L}_M} \right]}{\bar{q}}$$

where

$$c_p^Y \equiv \partial c^Y / \partial p^Y + \partial c^Y / \partial p^0$$

the effect of a permanent change in p on a worker's consumption,¹¹ and

$$\sigma \equiv - \frac{GG''(L-L_M)}{\pi G'}$$

the elasticity of substitution between land and labor in the agricultural sector.

If tastes are homothetic and identical across periods then $c_p^Y = 0$. More generally there is no presumption as to its sign. The sign of the remaining term of expression (25) depends upon the sign of the term in square brackets, from which follows:

Proposition 6: A permanent increase in the price of the agricultural good is more likely to raise foreign investment in land when (i) the labor share in agriculture is smaller than its share in manufacturing, (ii) the elasticity of substitution between land and labor in agriculture is large, and (iii) the initial amount of foreign-owned land is small.

If either $\sigma = 0$ or $\bar{\lambda} = 0$, and $c_p^Y \leq 0$, foreign ownership of land necessarily falls when \bar{p} rises. A high elasticity of substitution in agriculture and a high labor share in agriculture relative to manufacturing imply that the capital stock that equates the domestic to the world interest rate does not fall very far when \bar{p} rises.¹² Consequently the main effect of a rise in \bar{p} is to raise the value of a given amount of land, diverting national savings away from capital. To obtain the required investment in capital more foreign investment in land must be attracted. If little land is held by

nationals initially, however, an increase in the price of land, given λ , affects investment in capital very little.

Since the price of land rises when \bar{p} rises, the value of foreign investment in land may rise even when the amount of land that is foreign-owned falls. The effect of a permanent increase in \bar{p} on the value of foreign-owned land is given by

$$(26) \quad \frac{d[(1-\bar{\lambda})\bar{q}]}{d\bar{p}} = c_{pL}^y - \frac{wG'}{r^*pG''} \left[\frac{\sigma\pi}{w(L-L_M)} - \frac{r^*K}{wL^M} \right].$$

There is still no presumption that an increase in \bar{p} raises the value of foreign investment. It is more likely to do so when the labor share in manufacturing is larger than in agriculture and when the elasticity of substitution between land and labor in agriculture is large.

2. Steady-State Welfare

Since the steady-state wage and interest rate in terms of the manufactured good are unaffected by a change in \bar{p} , an increase in the relative price of the agricultural good unambiguously lowers welfare in steady state. It does so by reducing the purchasing power of the wage and of interest income. This result emerges regardless of the trade pattern or the pattern of land ownership.

3. Transitional Effects

If the increase in \bar{p} is unanticipated, the retirees at the time the change occurs will experience an unanticipated capital gain on their land but earn a lower than expected return on capital. The net effect is ambiguous.

If the increase in \bar{p} is anticipated, the price of land will begin to rise before the commodity price increase. During this period more national savings will be diverted toward land unless λ falls. To maintain the domestic interest rate at the world level thus requires more foreign investment between the announcement of the change and the change itself. When the rise in \bar{p} actually occurs, foreign investment will fall, possibly to below its initial steady-state level.

When the increase in \bar{p} is anticipated the retired generation at the time of the announced change experiences an unambiguous welfare gain: The value of their land rises above its previous steady-state level, but the rate of return on their capital is unaffected. The welfare of generations between the announcement and the change itself is unaffected, but when \bar{p} does actually rise current and all subsequent generations experience a reduction in welfare.

B. An Increase in the Labor Force

As long as nationals continue to own land, a permanent change in the size of the labor force has no effect on the wage and the interest rate. The profit on land, and consequently the value of land, are also unaffected. What does change is the amount of national savings, which rises in proportion to the labor force, and the capital stock required to employ the larger labor force at the world interest rate and implied wage. The first acts to reduce foreign investment and the second to attract it.

Differentiating $1-\bar{\lambda}$ with respect to L gives

$$(27) \quad \frac{d(1-\bar{\lambda})}{dL} = \frac{\bar{K} + \lambda\bar{q}}{L_M\bar{q}} \left[\frac{L_M}{L} - \frac{K}{K + \lambda\bar{q}} \right]$$

which implies

Proposition 7: A permanent increase in the total labor force will lead to a rise or fall in the amount of land that is foreign-owned depending upon whether the proportion of the labor force engaged in manufacturing is larger or smaller than the proportion of national wealth that consists of capital.

Since factor prices are unaffected by a change in the size of the labor force, welfare is also unaffected. Since there is no change in the price of land, the amount and the value of foreign investment in land change in the same proportion.

C. An Increase in the World Interest Rate

The world interest rate affects all domestic factor prices, the price of land and the equilibrium domestic capital stock. A rise in r^* causes the wage and the capital stock to fall and the return on land to rise. The effect on the price of land is given by:

$$(29) \quad \frac{d\bar{q}}{dr^*} = \frac{w(L-L_M)}{(r^*)^2} \left(\frac{r^*K}{wL_M} - \frac{\pi}{w(L-L_M)} \right)$$

which is positive or negative as the labor share in agriculture is larger or smaller than in manufacturing.

1. Foreign-Owned Land

Both the amount and the value of foreign investment in land may rise or fall as a consequence of an increase in the world interest rate. Unless the interest elasticity of savings is highly positive, national savings falls when r^* rises. This acts to raise foreign investment. The decline in the

equilibrium capital stock acts to reduce foreign investment, however. Finally, the wealth effect associated with the change in \bar{q} acts to attract foreign investment if the land price rises but to repel it if it falls. No simple condition summarizes the net impact of these three effects on foreign land ownership, but foreign investment does not necessarily fall as a consequence of a higher world interest rate. The opposite result will emerge, for example, if agriculture is very labor-intensive relative to manufacturing.

2. Welfare

To determine the effect of an increase in the interest rate on welfare in steady-state is more straightforward. Differentiating the utility function with respect to r^* given

$$(29) \quad \frac{dV}{dr^*} = V_c^0 \left[\frac{\bar{K} + \bar{\lambda}\bar{q}}{L} - \frac{(1+r^*)\bar{K}}{L_M} \right].$$

This expression is opposite in sign to the expression that indicates the effect of an exogenous increase in foreign investment on welfare: A rise in the world interest rate with free trade in land affects steady-state welfare in the same way as a fall in foreign investment when foreign-owned land is exogenous. Welfare is more likely to rise when the interest rate is initially low and manufacturing labor-intensive relative to agriculture. There is thus no presumption that a net recipient of foreign investment experiences a reduction in its steady-state welfare when the world interest rate rises.¹³

IV. The Consequence of a Tax on Land with International Capital Mobility

In contrast to what is implied by a static model of tax incidence, that a tax on land is neutral in its effects on resource allocation, in a closed economy, overlapping-generations context such a tax increases the steady-state supply of capital, thereby reducing the interest rate and raising the real wage. As long as the initial interest rate exceeds the population growth rate, which it will when land serves both as an asset and as a factor of production, steady-state welfare rises.¹⁴ A land tax raises the capital stock by reducing the price of land. More savings is then available for capital investment.¹⁵

With capital mobility, in the form of either foreign borrowing or direct foreign investment in land, a tax on land has no effect on factor prices and the domestic stock of capital. These are governed by the world interest rate. Nevertheless, the tax does have real effects. It lowers the value of foreign investment and, as in the closed economy case, it raises steady-state welfare.¹⁶

A. The Land Tax and Foreign Investment

Consider a lump-sum tax in amount τ that is collected on all domestic land each period. If nationals continue to invest in land, free trade in claims on land continues to equate the domestic interest rate to the world rate. Equation (22), along with equations (1) through (4), imply a particular value for the capital stock. Since the tax affects none of these four relationships, it has no effect on the stock of domestic capital, factor

rewards, or the allocation of labor, with π_t defined now as the pre-tax return on land.

The tax does affect the price of land, however. To incorporate its effect equation (7) must be changed to

$$(30) \quad \frac{q_{t+1} + \pi_{t+1} - \tau}{q_t} = 1 + r_{t+1} .$$

If the tax revenue is distributed to the working generation, an individual worker's wage income is augmented by τ/L . The relevant savings relation becomes

$$(31) \quad K_{t+1}^n = L[w_t + \tau/L - c^y(w_t + \tau/L, r_{t+1}, p_t, p_{t+1})] - \lambda_{t+1} q_t .$$

If, instead, the government gives the tax revenue to the retired generation, the relevant equation is

$$(31') \quad K_{t+1} = L[w_t - c^y(w_t + \frac{\tau}{L(1+r_{t+1})}, r_{t+1}, p_t, p_{t+1})] - \lambda_{t+1} q_t .$$

In steady state these become:

$$(32) \quad \bar{K} = L[\bar{w} + \tau/L - c^y(\bar{w} + \tau/L, r^*, \bar{p}, \bar{p})] - \bar{\lambda} \left(\frac{\bar{\pi} - \tau}{r^*} \right)$$

and

$$(32') \quad \bar{K} = L[\bar{w} - c^y(\bar{w} + \frac{\tau}{L(1+r^*)}, r^*, \bar{p}, \bar{p})] - \bar{\lambda} \left(\frac{\bar{\pi} - \tau}{r^*} \right)$$

respectively.¹⁷ Differentiating equation (32) with respect to τ gives:

$$(33) \quad \frac{d\bar{\lambda}}{d\tau} = \frac{1 - c_w^y + \lambda/r^*}{\bar{q}}$$

which is positive as long as future consumption is non-inferior. Taxing land raises the amount of domestic land owned nationally, if the tax revenue is distributed to the working generation. It does so for two reasons. First, by increasing working period income, the tax revenue raises savings. Second, by lowering the price of land it increases the amount of savings available for investment. Since the capital stock cannot rise, the amount of land owned by nationals rises.

The equivalent derivative for equation (32') is

$$(33') \quad \frac{d\bar{\lambda}}{d\tau} = \frac{-c_w^y/(1+r^*) + \bar{\lambda}/r^*}{\bar{q}} .$$

If $\bar{\lambda}$ is close to one, this expression is positive: as before, the land tax raises the amount of land owned by nationals. If $\bar{\lambda}$ is very small, however, the expression is negative. The reason is that, in this case, the net effect of the tax is to raise retirement income. Savings in the form of land acquisitions is consequently lower. These results may be summarized as follows:

Proposition 8: Taxing land reduces the amount of foreign-owned land in steady state unless (i) the tax revenue is distributed to the retired generation and (ii) foreigners already own most land.

Regardless of how the tax revenue is distributed or the pattern of land ownership, unless first-period consumption is highly inferior the land tax reduces the steady-state value of foreign investment in land. If tax revenue is distributed to workers then, using expression (32),

$$(34) \quad \frac{d(1-\bar{\lambda})\bar{q}}{d\tau} = c_w^y - \frac{1+r^*}{r^*}$$

which is negative as long as $c_w^y < 1$. If the tax revenue is distributed to retirees, the expression is

$$(34') \quad \frac{d(1-\bar{\lambda})\bar{q}}{d\tau} = \frac{1}{1+r^*} \left(c_w^y - \frac{1+r^*}{r^*} \right)$$

which has the same sign as (35') but is smaller in absolute magnitude.¹⁸

B. The Effect of a Land Tax on Welfare

However the tax revenue is distributed, the land tax does not affect the steady-state wage rate or rate of return on savings. If tax revenue is distributed to workers then each worker receives, in addition to his wage income, an amount τ/L in redistributed tax proceeds. If the revenue is distributed to retirees then each retiree receives an additional τ/L , which is equivalent to a wage supplement of $\tau/L(1+r^*)$. In either case the tax provides a net addition to income, leaving the steady-state return on savings unaffected. Proposition 9 immediately follows:

Proposition 9: A tax on land raises steady-state welfare regardless of how the revenue is distributed between generations.

Steady-state welfare rises as τ rises. The potential welfare gain is not, of course, unlimited. If land can remain unowned then when $\tau > \bar{\pi}$ no land is owned and no tax is collected; $\bar{\pi}$ consequently imposes an upper bound on τ .¹⁹

While Feldstein (1977) and Chamley and Wright (1983) demonstrate that a land tax raises steady-state welfare in a closed economy, they also show that such a tax does not constitute a Pareto improvement. This is likely to be the case when land is traded, as well. If the tax is announced in advance of its imposition, or if the tax revenue is distributed to workers at the time the tax is announced, retirees owning land experience a capital loss for which they receive no compensation. Their welfare drops because of the tax. If, however, the tax is imposed immediately upon its announcement and retirees are given the tax revenue, the potential for a Pareto-improving land tax, from a national perspective, emerges.

The tax creates an immediate capital loss for retirees in total amount $\bar{\lambda}_0 \tau / r^*$, where $\bar{\lambda}_0$ is the initial amount of land owned nationally. If $\bar{\lambda}_0 > r^*$, of course, this magnitude exceeds tax revenue, τ . Even if retired land owners are given the tax revenue, it does not compensate them for their capital loss. They are net losers. If $\bar{\lambda}_0 < r^*$, however, tax receipts exceed the capital loss to nationals, and retirees are net beneficiaries of a land tax. Since steady-state welfare rises as a consequence of the tax, and the new steady state is achieved in one period, the tax yields, from a national perspective, a Pareto improvement. The capital loss on the part of foreign land-owners is, of course, the source of the gain to the initial retirees.

In summary, while a land tax raises steady state welfare, it typically harms the retired generation at the time it is announced. For a national Pareto improvement to emerge requires that (i) the tax is not anticipated, (ii) tax revenue is distributed to retirees, and (iii) the share of nationally-owned domestic land is less than the world interest rate.

V. Conclusion

Capital and land serve both as factors of production and as stores of value. The primary distinction between capital and land is that the supply of the first is determined by household saving and foreign investment. Nature determines the supply of land. Models of international trade and investment have typically incorporated land and capital only in their roles as factors of production, not as competing assets in household portfolios. Once a role for land as an asset is recognized, standard results on the implications of international investment can change significantly. This paper has examined the effects of international investment when land is both a factor of production and an asset in fixed supply. International investment raises the wage, but lowers the return on land and capital. The first effect is more pronounced when the share of labor in agriculture, the land-using sector, is large relative to the labor share in manufacturing, which uses capital. When this effect dominates foreign investment is more likely to raise welfare, and increases in the labor force and the price of the land-using commodity are more likely to reduce the amount of foreign investment. At the same time foreign investment in land is more likely to reduce the steady-state price of land when agriculture has a larger labor share than manufacturing. Taxing land raises steady-state welfare and is likely to reduce foreign investment.

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APPENDIX

Equations (11) and (12) in the text may be linearized around \bar{K} and \bar{q} as follows:

$$(A1) \quad x_{t+1} = L(1 - c_w^y)w_K x_t - Lc_r^y r_K x_{t+1} - \lambda y_t$$

$$(A2) \quad y_t = \left[\frac{\pi_K}{1+r} - \frac{\pi}{(1+r)^2} r_K \right] x_{t+1} + \frac{1}{1+r} y_{t+1}$$

where $x_t \equiv K_t - \bar{K}$ and $y_t \equiv q_t - \bar{q}$.

These equations constitute a second-order system of linear homogeneous difference equations. Their solution has the form:

$$(A3) \quad x_t = A_1(\rho_1)^t + A_2(\rho_2)^t$$

$$(A4) \quad y_t = \frac{\rho_1 - \Gamma_{11}}{\Gamma_{12}} A_1(\rho_1)^t + \frac{\rho_2 - \Gamma_{11}}{\Gamma_{12}} A_2(\rho_2)^t$$

where ρ_1 and ρ_2 are the roots of the equation.

$$\rho^2 - (\Gamma_{11} + \Gamma_{22})\rho + \Gamma_{11}(1+r) = 0$$

where

$$\Gamma_{11} \equiv \frac{L(1-c_w^y)w_K}{1 + Lc_r^y r_K}$$

$$\Gamma_{12} \equiv \frac{-\lambda}{1 + Lc_r^y r_K}$$

$$\Gamma_{21} \equiv -(\pi_K - \frac{\pi}{r} r_K) \Gamma_{11}$$

$$\Gamma_{22} \equiv 1 + r + \Gamma_{12} \Gamma_{21} / \Gamma_{11}$$

and with ρ_1 and ρ_2 defined so that $\rho_1 \leq \rho_2$. The scalars A_1 and A_2 are determined by boundary conditions.

At any period t the capital stock K_t , and hence x_t , are predetermined. The price of land q_t , and hence y_t , are determined by asset-market equilibrium each period. At period $t = 0$ A_1 must therefore satisfy the condition

$$A_1 = x_0 - A_2.$$

A necessary and sufficient condition for the existence of a unique stable non-oscillating convergence path to steady state is that $0 \leq \rho_1 < 1 \leq \rho_2$.

If $\rho_1 < 0$ the system oscillates. The condition $\Gamma_{11} > 0$ is necessary and sufficient to preclude oscillation. This condition in turn is guaranteed by the two conditions

$$(A5) \quad 1 \geq c_w^y$$

which states that the marginal propensity to save is nonnegative, and

$$(A6) \quad 1 + c_r^y r_K > 0$$

which requires that an increase in the interest rate not have a highly negative effect on savings.

If $\rho_1 \geq 0$ and $\rho_2 < 1$ then for any value of A_2 equations (A3) and (A4) converge to steady state while if $\rho_1 \geq 1$ no path converges unless $A_2 = 0$. A

unique convergence path therefore requires that $0 \leq \rho_1 < 1 \leq \rho_2$ and $A_2 = 0$.

If (A5) and (A6) are satisfied a necessary and sufficient condition for a unique stable non-oscillating convergence path is that $\Delta \geq 0$ where Δ is defined in equation (17).

To verify that $\Delta \geq 0$ is necessary and sufficient define the function

$$\Lambda(\rho) \equiv \rho^2 - (\Gamma_{11} + \Gamma_{22})\rho + \Gamma_{11}(1+r) .$$

Since $\Lambda(\rho) = 0$ defines ρ_1 and ρ_2 , for $\rho \in (\rho_1, \rho_2)$, $\Lambda(\rho) < 0$. If $\rho_1 < 1 \leq \rho_2$ then $\Lambda(1) \leq 0$. Since

$$\Lambda(1) = \frac{\Delta}{-(1 + Lc_r^y r_K)} .$$

Along with (A6), $\Delta \geq 0$ implies and is implied by $\Lambda(1) \leq 0$.

FOOTNOTES

1. The amount of land in the United States that is owned by foreigners apparently grew substantially during the 1970s. Concern over increased ownership of U.S. land by foreigners has led to closer monitoring of land-ownership patterns by the U.S. Department of Commerce. Legislation restricting the sale of agricultural land to foreigners has been considered in California. The state of Oklahoma has tried to enforce a clause in its state constitution prohibiting non-resident foreigners from owning land in that state. A number of countries currently restrict foreign ownership of land, particularly land used in agriculture. See articles in Business Week (1979a, 1979b, 1982) for a discussion.

2. Foreign investment has been analyzed in two-factor, one-asset OLG models by John Kareken and Neil Wallace (1977) and by Willem Buiter (1981). Kareken and Wallace ignore capital, so that changes in the price of land and the amount that is owned by foreigners have no effect on factor supplies. Buiter's model, in contrast, has no land. Again, there is no asset substitution effect of foreign investment on asset supplies. The effect of foreign investment on steady-state welfare that these authors find is consequently quite different.

3. Elsewhere I have explored the implications of changes in the terms of trade and in factor supplies in a dynamic specific-factors framework with portfolio autarky: i.e., in the absence of trade in claims on land or capital flows (Eaton, 1984).

4. In a series of articles Jagdish Bhagwati and Ernesto Tironi (1980) and Bhagwati and Richard Brecher (1980, 1981) investigate the implications of foreign-owned factors of production for trade and welfare. Their analysis is static, and treats the amount of foreign investment as exogenous. The results are consequently quite different.

5. John Dutton (1982, 1984) derives optimal tax policies toward foreign and domestic capital income in a two-factor OLG model.

6. Conditions for the existence of a \bar{K} and \bar{q} that satisfy (13) and (14) are derived elsewhere (Eaton, 1984). A condition for the stability of the steady state is provided in the Appendix.

7. Since $\pi_K = -w_K(L-L_M)$ and $r_K K + w_K L_M = 0$,

$$V_K = \frac{\pi w_K}{w r} \left[\frac{w L_M}{r K} - \frac{w(L - L_M)}{\pi} \right]$$

which is positive or negative as

$$\frac{w L_M}{r K} > \frac{w(L - L_M)}{\pi} .$$

8. If the amount of land bought by foreigners were less than the amount that equated interest rates, then the domestic capital stock would be lower, since more national savings would be channeled into purchases of domestic land. The domestic interest rate would consequently be higher. Equation (7) would then imply a net rate of return on domestic land above r^* . An incentive for more

foreign investment would emerge. By the same argument, if foreigners bought more than the appropriate amount, the rate of return on land would be less than r^* . Foreign investment would fall.

9. Note that factor prices and the domestic capital stock, and consequently the price of land, assume their new steady-state values immediately upon any anticipated change in exogenous variables. From equation (24) the amount of land owned by foreigners therefore achieves its new steady-state value after one period.

10. The analysis considers the effect of changes in exogenous variables on both the amount of land owned by foreigners and the value of their investment. When the price of land itself changes these two magnitudes can respond in different directions. Free trade in land, when it does not lead to a total divestiture of land holdings by nationals, leads to domestic factor prices that are the same as those that would emerge if capital, rather than land, were internationally mobile. The value of land owned by foreigners then equals the amount of foreign borrowing that would occur if capital were mobile.

11. The sign of c_p^y is the same as that of

$$\frac{\partial x^0}{\partial c^0} - \frac{\partial x^y}{\partial c^y} + \left(\frac{x^y}{c^y}\right)R^y - \left(\frac{x^0}{c^0}\right)R^0,$$

where x^i is the consumption of the agricultural commodity in the i^{th} period of life, $i = y, 0$, and

$$R^i \equiv - \frac{V_{CC}^i C^i}{V_C^i} \quad i = y, 0$$

the elasticity of the marginal utility of consumption expenditure in period i .

12. Differentiating, $\frac{dK}{d\bar{p}} = - \frac{rKG(L - L_M)}{L_M \sigma \pi}$.

13. If the increase in the world interest rate is not anticipated, the retired generation at the time the change occurs benefits if the steady-state land price rises, but the effect on their welfare is ambiguous otherwise. If the increase is anticipated the retired generation when the change occurs necessarily benefits while the retired generation in the period in which the change is first anticipated gains or loses depending upon whether land prices rise or fall.

14. These qualitative effects emerge independently of how the proceeds of the tax are distributed. Feldstein (1977) incorrectly asserted that the traditional results reemerge if the tax revenue is given to the retired generation. Calvo, et al. (1979) correct this error.

15. The effect is similar to the so-called "Tobin effect" of inflation on the capital stock: higher anticipated inflation channels savings out of cash balances into capital investment (James Tobin, 1965). Chamley and Wright (1983) emphasize the quantitatively trivial potential for inflation to affect the capital stock in contrast with the potential effect of a land tax.

16. The effect of the tax on the steady-state value of foreign investment and welfare is the same regardless of whether capital mobility takes the form of borrowing or direct foreign investment in land, barring a corner solution in which all domestic land is foreign-owned.

17. These expressions apply only if $\lambda < 1$, so that there is net foreign investment in domestic land. If $\lambda > 1$ the last term in these equations should become $-\frac{\bar{\pi}-\tau}{r^*} - (\lambda-1)q^*$ where q^* is the price of foreign land. This change does not affect the qualitative conclusions stated here, as the interested reader can readily verify.

18. The reason is that when tax revenue is distributed to retirees its effect on savings is muted; the delay reduces the present value of the payment.

19. If land-owners must sell their land then a negative price of land must be admitted. The upper bound on τ in this case is determined by the wealth of land-owners at the period in which the tax is initially imposed.