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ABSTRACT

The evidence on international capital immobility is extensive, ranging from the correlations between domestic savings and investment pointed out by Feldstein-Horioka (1980), to real interest differentials across countries, to the lack of international portfolio diversification. To what degree does capital immobility modify past results forecasting that small open economies should not tax savings or investment? The answer depends on the cause of this immobility. We argue that asymmetric information between countries provides the most plausible explanation for the above observations. When we examine optimal tax policy in an open economy allowing for asymmetric information, rather than simply finding that savings and investment should not be taxed, we now forecast government subsidies to foreign acquisitions of domestic firms. Some omitted factors that would argue against subsidizing foreign acquisitions are explored briefly.

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Why is Capital so Immobile Internationally?: Possible Explanations and Implications for Capital Income Taxation

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Feldstein–Horioka (1980), in a highly influential paper, report empirical evidence suggesting that capital is quite immobile internationally. Many other papers since then demonstrate the robustness of this result.[1] In general, these papers find that additional savings in a country lead almost dollar for dollar to extra investment in the country. If an economy were small and open, these funds should instead have been invested throughout the world, leading to only minor changes in domestic investment. In addition, there is strong evidence of real interest rate differentials across countries,[2] again suggesting important barriers to capital mobility.

In a related body of literature, Adler–Dumas (1983) and French–Poterba (1991), among others, have provided convincing documentation that individual portfolios are heavily specialized in domestic securities, in spite of the forecast from the theory that there are large gains from international diversification. Tax effects only deepen this puzzle. Investors should be able, with only moderate effort, to evade domestic taxes on the income they earn from portfolio investments abroad, while they should find it relatively difficult to evade taxes on income from domestic investments. Hence, tax considerations reenforce the gains from international diversification.

In spite of this strong empirical evidence on the propensity of savers to invest at home, most theoretical papers studying capital income taxation in an open economy[3] have assumed that capital is fully mobile internationally. These studies conclude that we should not expect to observe any taxation of income from either investment or savings in a small

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[1] See, for example, Penati–Dooley (1984), Dooley, Frankel, and Mathieson (1987), and Bayoumi (1990).

[2] See, for example, Mishkin (1984), Cumby–Obstfeld (1984), and Cumby–Mishkin (1986).

[3] Among other references would be Gordon (1986) and Razin and Sadka (1991).

open economy. The arguments go as follows. If capital is fully mobile internationally, any tax on income from investment in the domestic economy cannot lower the return earned by capital owners, since they can simply move their funds abroad. For production to remain competitive in the country, in spite of the capital income tax, the cost of other factors (e.g. labor and land) must drop by enough to compensate. Since the tax is thus borne by these immobile factors anyway, it would dominate to tax these factors directly and thereby avoid discouraging investment in the country. A government might still want to tax the income from savings accruing to domestic residents. However, if individuals can easily evade these taxes on their holdings of foreign securities,[4] no tax on income from savings is feasible — such a tax would simply induce individuals to shift all their savings abroad. Accordingly, no such tax should be observed.

In spite of these forecasts, corporate income taxes and personal income taxes on portfolio income do exist, and tax rates are often quite high. Is the explanation simply that capital is immobile internationally, thereby weakening the pressures described by the theory to cut rates?

The answer undoubtedly depends on the underlying reasons why capital is so immobile. In section 1, we discuss a variety of possible explanations for the immobility of capital that have appeared in the literature, and discuss their consistency with the empirical evidence. The explanation that we find most convincing, and one that has been inadequately explored to date, is asymmetric information between investors in different countries. In particular, foreign investors are at a handicap relative to domestic investors due to their poorer knowledge of domestic markets. As a result, they are likely to be less successful when setting up new firms, and they are vulnerable to being overcharged if they acquire existing domestic firms. In section 2, we lay out the particular form of asymmetric information we assume and describe the resulting equilibrium pattern of capital allocation and ownership. Section 3 argues that the empirical observations can readily be rationalized if

[4] Enforcement of income taxes occurs mainly through forcing domestic firms and financial intermediaries to report to the government the income earned by each domestic resident. But if individuals use foreign financial intermediaries when investing abroad, then the domestic government has no means to obtain independent information about this income, and so cannot easily enforce the tax. In principle, individuals can buy even domestic securities through a foreign intermediary, and so escape monitoring by the domestic government.

asymmetric information is important by comparing the forecasts of our model with the observed evidence on savings–investment correlations, real interest rate differentials, and the observed specialization of portfolios.

Section 4 considers the optimal taxation of savings and investment in the presence of asymmetric information. Perhaps the most surprising result is that a capital–importing country should subsidize foreign acquisitions by enough so that the domestic rate of return to capital is driven down to the rate prevailing on the world market. Intuitively, domestic owners of firms are able to overcharge when they sell existing firms to foreigners. As a result, if a country is small relative to the world capital market, it gains from marginal foreign acquisitions. Hence, it should subsidize these acquisitions until it is indifferent to any further marginal acquisitions. While our model forecasts that domestic savings should be taxed, the net rate of return on domestic savings should still equal the marginal product of domestic capital. Hence, by standard criteria, savings decisions are not distorted. The tax simply removes the excess incentive to save, due to the ability to overcharge foreigners for the firms they acquire. In capital–exporting countries, the model continues to forecast no taxes on investment or savings, in spite of asymmetric information.

Rather than explaining the continuing presence of corporate income taxes, the model instead deepens the puzzle by prescribing subsidies to foreign acquisitions in capital–importing countries. Yet, it seems hard to come up with examples of subsidies to foreign acquisitions, at least in developed economies. If anything, political pressures seem to restrict foreign acquisitions. In section 5, we discuss some costs of foreign acquisitions not considered in the model. In particular, foreign purchasers may acquire proprietary technological information when they purchase a firm. Any future investment based on this information will occur mainly abroad, where the new owner possesses better knowledge about investment opportunities. If the acquisition had not taken place, future investment based on this information would instead have occurred primarily in the domestic economy, where the domestic owner is better informed. The implicit sale of this information to foreigners therefore can reduce the country's competitive advantage in world markets, an advantage tied in part to the proprietary knowledge it has. In future work, we hope to model more carefully these costs of foreign acquisitions.

1. Possible Explanations for Observed Capital Immobility

What factors might explain the immobility of capital, and how successful are they at explaining the empirical evidence? A variety of possible explanations have been discussed in the literature.

One possible response to the Feldstein–Horioka observations, seen for example in Finn (1990) and Tesar (1988), is simply to argue that capital is in fact fully mobile, but that productivity or other shocks in a country affect both desired savings and desired investment in the country in the same way, leading to a positive correlation between the two series in the data. Productivity shocks would not, however, explain the observed lack of diversification in individual portfolios, nor the real interest rate differentials across countries, suggesting some different underlying cause.

A second hypothesis is that the countries being studied are large relative to the world capital market. As Murphy (1984) argues, if savings increase in a large country then a nontrivial fraction of these savings will end up in the home country, leading to a positive correlation between savings and investment. When countries are large, they would also no longer be price takers in the world capital market. Capital exporters would face an incentive to restrict their capital exports, and capital importers their capital imports, in each case so as to induce a favorable movement in the world interest rate. A number of writers (e.g. Caprio–Howard (1984), Summers (1988), and Bayoumi (1990)), report empirical evidence that countries do appear to change their overall budget deficit over time in order to decrease their net current account deficit or surplus, presumably in order to avoid adverse changes in market interest rates. The observed correlation between savings and investment does in fact seem to be higher for large countries than for small countries, as seen in Obstfeld (1986). However, the correlation remains high even among countries that should have very little market power in world capital markets, suggesting that the main explanation for capital immobility is elsewhere. In addition, if market power were important, we should expect to see countries manipulating their tax policy to reduce net capital flows. Capital importing countries should tax investment and subsidize savings to reduce capital imports, while capital exporting countries should subsidize investment

and tax savings. Such a pattern of tax rates is not apparent in either cross–section or time–series data, further undermining this explanation.

Reasons have also been proposed why countries may want to limit gross rather than net outflows of capital. Savings invested abroad, for example, are more likely to escape domestic taxation. A number of OECD countries, e.g. France and Italy until 1986, had capital controls discouraging such evasion by preventing domestic residents from shifting their savings abroad. Even when overall controls do not exist, regulations often require financial institutions to invest only in domestic assets — this was true, for example, of Japanese pension funds until 1987. These restrictions were always partial, however. Foreign direct investment by multinationals remained unrestricted. Hence, if there were profit opportunities available that individual investors or pension funds could not take advantage of, firms could have done so instead. In any case, the correlation between savings and investment has been high as well in countries such as the U.S. that have very limited regulatory restrictions, and has not declined much over time as a number of countries have eliminated such restrictions.

A fourth hypothesis argues that investors face high transactions costs when purchasing foreign securities, discouraging investments abroad. French and Poterba (1991) explored this hypothesis and concluded that the size of transactions costs needed to rationalize observed portfolios would be far too large to be plausible. In addition, Tesar and Werner (1994) report that turnover rates on domestic holdings of foreign securities are if anything higher than on holdings of domestic securities, undermining any argument for high transactions costs on purchases of foreign securities.

Capital flows to certain countries may have been limited because of the fear that these countries may at some point expropriate the holdings of foreign owners. Whereas fear of expropriation may explain the lack of capital flows to some developing countries, most of the data on capital immobility deals with OECD countries where expropriations have been rare.

Exchange rate risk is often cited as an important factor discouraging international capital flows. Bhandari–Mayer (1990), for example, note that savings–investment correlations have been moderately lower within the EMS countries, where exchange rate movements

are not an issue. In principle, however, investors can hedge at least against short–term exchange rate movements in the currency market, allowing them to take advantage of differences in real rates of return on equity without being exposed to exchange rate risk. In any case, the evidence in Adler–Dumas (1983) and French–Poterba (1991) does take exchange rate movements into account, and argues that in spite of these movements the theory forecasts far more international diversification in equity than we in fact observe.

The explanation for the observed capital immobility that we find most plausible, and whose implications we explore in this paper, is asymmetric information across countries. Investors, by living and working in a particular country, know much more about the economic prospects of that country than they do about those in other countries.[5] If they consider setting up a new firm abroad, they would be at a distinct handicap relative to local owners. Only gradually, for example, would they learn how to deal with local banks, the local distribution system, or the local supply network. They will inevitably have to learn many idiosyncratic aspects of the domestic contract law, the local tax system, and local customs regarding labor/management relations. In principle, foreigners can hire local experts to help them through these hurdles. However, how are they to judge which experts to trust? Local experts would have many opportunities to take advantage of the ignorance of the foreign principal, e.g. colluding with local dealers in the sale of overpriced goods and securities to the foreigner. The substantial asymmetric information between the agent and the principal would make it difficult for the principal to give too much authority to such an agent.

Foreigners will also be at an informational disadvantage when buying shares abroad rather than in their own country. If they are buying securities in their own country, they have easier access not only to firm–specific information but also to better forecasts about future government policies affecting the firm. As a result, when buying securities abroad in

[5] Ben–Porath (1980) argues that when individuals enjoy long–term relationships their repeated interchange encourages the development of cooperative behavior and trust between them. For example, merchants may deal very differently with local customers than with other customers. This cooperation implicitly provides some pooling of information. Domestic investors have considerable opportunities to develop long–term relationships with each other, perhaps only in part dealing with securities transactions. Foreign investors, in contrast, would find it much more difficult to establish such cooperative relationships with domestic investors, putting them at an informational disadvantage. We would like to thank Peter Diamond for pointing out this article to us.

existing firms, they can easily end up being overcharged by more knowledgeable domestic owners, and end up buying only the "lemons."

In fact, Grubert, Goodspeed, and Swenson (1993) find that foreign subsidiaries in the U.S. report dramatically lower rates of return than do domestic U.S. firms, even after controlling for industry, age, and other such factors. While transfer pricing might explain an unusually low reported rate of return for subsidiaries owned by parent firms based in countries with low tax rates, Grubert *et al* find virtually the same low reported rate of return regardless of the parent's home country.

The Grubert *et al* data includes both greenfield investments in the U.S. as well as foreign acquisitions, and these acquisitions include takeovers of both closely held and publicly traded firms. It would be plausible that foreign firms would face much less of an informational disadvantage when taking over publicly traded firms. As argued by Grossman (1976), the share price of these firms should under certain assumptions reveal the information available to domestic investors. However, a growing body of literature argues that observed share prices are at best only a very noisy measure of the true values of firms. This is commonly explained by the assumption that an unobserved number of investors enter and leave the market for reasons unrelated to news events affecting the true value of a firm. Given this noise in market prices, foreign investors will remain imperfectly informed about the value even of publicly traded firms. In fact, Harris and Ravenscraft (1991) find that foreign acquirers of publicly traded firms pay a much higher premium for firms than do domestic acquirers, even after controlling for industry, year, and the extent of competition among acquirers, supporting our presumption that they are at an informational disadvantage.

Another way that foreign investors might be able to avoid the efficiency losses arising from asymmetric information about the value of individual firms would be to invest in a diversified portfolio of publicly-traded domestic firms.[6] One problem with doing this is that the set of firms that list their shares on the public exchanges may not be representative of all domestic firms — everything else equal, the "lemons" would be more likely to list

[6] Including shares in a representative sample of closely-held firms in such a portfolio would not likely be feasible.

their shares in the hope that the market will overvalue them. In most countries, only a small fraction of domestic equity is traded on the public exchanges, so that this selection bias can be important. In addition, there can still be asymmetric information between domestic and foreign investors regarding the value of a diversified portfolio of publicly-traded shares, information not fully conveyed through market prices due to the noise in these prices. In the face of this asymmetric information, it may well be advantageous for foreign investors to rely on the information their firms have available about the value of specific target firms when investing abroad.

These problems faced by foreign investors due to asymmetric information when buying a diversified portfolio may seem minor when investing in a country such as the U.S. where most firms are publicly traded and where mutual funds are readily available. Even for investments in U.S. equity, however, a relatively small fraction of purchases by foreigners appear to consist of such diversified investments in publicly traded firms. For example, during the 1980's virtually 80% of the holdings by Japanese investors of equity in U.S. based firms consisted of direct investment;[7] the equivalent figure for holdings by English investors is 50%. Of the remaining holdings, an unknown fraction consists of investments in equal-weighted portfolios.[8] Whether the above explanations for this dominant role of direct investment are correct or not, since most foreign investments in domestic equity take the form of direct investment, the model we develop focuses on foreign purchases of individual firms rather than of diversified portfolios.

Given foreigners' informational disadvantage when buying domestic equity, one might expect that capital flows instead take the form of purchases of domestic government bonds. Asymmetric information about future interest rates, inflation rates, and tax policy would still put foreign investors at somewhat of a disadvantage but perhaps less so than with domestic equity. However, portfolio models without asymmetric information, such as in

[7] To be classified as direct investment, each investor must hold at least 10% of the shares in any given firm. For equivalent figures for a few other countries, see Gordon-Jun (1993). Figures on the composition of U.S. holdings abroad are quite similar.

[8] In spite of its relatively small share of world GNP, the U.K. is the largest source of portfolio investment in the U.S., and the most important location for U.S. portfolio investment abroad. This suggests the importance of asymmetric information between countries.

Adler–Dumas (1983), forecast that foreigners should hold negative amounts of domestic bonds, to hedge against exchange rate movements when buying domestic equity. The relative penalty on equity due to asymmetric information would need to be severe to reverse this forecast of negative holdings of domestic bonds. We thus focus on the equity market.

2. Set–Up of the Model

Our model focuses on a small open economy that consists of one representative individual who survives for two periods. In the first period, this individual starts with real assets of A, which can either be invested or used for first–period consumption.

Savings can be invested at home or abroad. If they are invested abroad, they earn some real return r^*; we assume the economy is small relative to world capital markets, so take r^* as given. If savings are invested at home, they earn a rate of return denoted by r, which in equilibrium will be a function of r^*. For purposes of discussion, assume for now that r exceeds r^*. If this condition is satisfied, all domestic savings would be invested at home; our focus will therefore be on the extent and form of capital imports.

There are a fixed number of domestic firms, which we denote by N, all initially owned by the representative domestic individual.[9] Ex ante all domestic firms are identical. If firm i raises K_i from its shareholder and invests these funds in real capital, output in the second period will be $f(K_i)(1+\tilde{\epsilon}_i)$,[10] where $f(K_i)$ is a positive concave function, with $f(0)=0$, and where $\tilde{\epsilon}_i$ is independent across firms and identically distributed. To avoid issues of bankruptcy, we assume that $1+\epsilon_i > 0$. At the time investment decisions are made, $\tilde{\epsilon}_i$ is not known; ex ante, its expectation is zero, and we assume for simplicity that its probability distribution has no mass points. Also, N is large so that by the law of large

[9] This assumption of a fixed number of firms is the device we use to limit the scale of investment in the economy. In an earlier version of the model, production required two factors, labor and capital, where labor supply was elastic but individuals were immobile across countries. In this two–factor model, the wage rate could adjust to limit the amount invested. Since the analysis of the two–factor model was significantly messier, yet the conclusions were basically the same as in the one–factor model presented here, we focus on the simpler case.

[10] The capital itself fully depreciates during production.

numbers there is effectively no aggregate uncertainty, given that $\tilde{\epsilon}_i$ is independent across firms.

If the economy were closed, investment would occur until $f'(K_i) = 1 + r$ for each firm, where $f'(K_i) = \partial f(K_i)/\partial K_i$. During the first period, the individual's consumption, C_1, would simply equal his residual assets, $A - \sum_i K_i$. His consumption in the second period, denoted by C_2, would then equal

$$C_2 = \sum_i f(K_i)(1 + \tilde{\epsilon}_i). \tag{1}$$

How does this story change if foreigners can also invest in the country? This investment can take the form either of acquisitions of existing domestic firms or of greenfield investments. The sequence of possible investments is as follows. First, foreign investors can offer to buy ownership of some of the N domestic firms before any investment has occurred in them, paying some amount E per firm. Since there has not yet been any domestic investment in these firms, these purchases will be called greenfield investments. Assume that the first J firms are purchased by foreigners in this manner.

Foreign owners are assumed to be at a handicap relative to domestic owners in setting up and operating such a firm, due to their lack of knowledge about the domestic economy. As a result, we assume that if they invest K_j in firm j, the resulting income in the second period will equal $f(K_j)(1 - \gamma)$, where γ captures the costs they face due to asymmetric information. If foreigners do choose to set up a new firm, investment in the firm would continue until $f'(1 - \gamma) = 1 + r^*$.

Once these greenfield investments have occurred, domestic investors can invest in the $N - J$ remaining domestic firms. After these investment decisions have been made, the values of the $\tilde{\epsilon}_i$ are revealed to domestic but not to foreign investors. At this point, foreign investors can bid for shares in the firms set up by domestic investors, knowing only the amount of capital, K_i, invested in each firm.[11] Domestic owners decide which shares to sell, given the amount bid by the foreign investors. Denote by I the amount the foreign

[11] Since K_i is chosen before ϵ_i is known, its value reveals no information about ϵ_i.

investors spend acquiring shares in firms set up by domestic investors. The representative domestic individual then consumes[12]

$$C_1 = A - \sum_{i>J} K_i + I + JE \equiv A - S \tag{2}$$

in the first period. For later use, we denote net domestic savings by S. In the second period, foreign investors receive the output produced by the firms they purchased through both greenfield investments and acquisitions. Domestic residents receive the income from the remaining firms.

In order to characterize the equilibrium amount and pattern of foreign investment in the economy, we start by analyzing the acquisitions process. We then work backwards to discuss the choice of the K_i. Given the resulting value to domestic owners of setting up a firm themselves, which they either keep or sell to foreigners, we can then analyze the decision by the domestic shareholder whether to sell a firm to foreigners before it has been set up. Finally, we discuss how r is determined in general equilibrium.

How many firms will foreigners succeed in acquiring? If foreign investors had full information when bidding for shares, the value of the i'th firm's shares from their perspective would equal $f(K_i)(1+\tilde{\epsilon}_i)/(1+r^*)$, given that the rate of return available on the world market equals r^*. But since they do not know the value of $\tilde{\epsilon}_i$, all they can do is bid some amount $v_i f(K_i)/(1+r^*)$ for shares in the i'th firm, where their choice variable is v_i.

What value for v_i will they choose? To answer this question, consider the response of the domestic owner to any given value of v_i. If he keeps the shares, he receives an amount in present value equal to $f(K_i)(1+\tilde{\epsilon}_i)/(1+r)$, given that the opportunity cost of funds he faces is r. If instead he sells the shares to foreign bidders, he receives $v_i f(K_i)/(1+r^*)$. Hence, he gains by selling if and only if

$$\frac{v_i f(K_i)}{1+r^*} \geq \frac{f(K_i)(1+\tilde{\epsilon}_i)}{1+r}. \tag{3}$$

In equilibrium, shares will be sold as long as $\tilde{\epsilon}_i$ is less than or equal to some value ϵ^*, where ϵ^* is defined implicitly by $1+\epsilon^* = v_i(1+r)/(1+r^*)$. The fraction of firms acquired by foreigners equals $\Phi(\epsilon^*)$, where $\Phi(.)$ is the cumulative distribution function for $\tilde{\epsilon}$.

[12] Recall that investment in greenfield firms is paid for by the foreign owner.

Foreign bidders therefore systematically overpay for the firms they acquire from the perspective of the domestic owner. But since the foreign bidders face a lower opportunity cost of funds than the domestic shareholder does, foreign bidders may still gain from the acquisitions. In particular, the expected value to the foreign bidders of the shares they acquire equals $f(K_i)(1+e^-)/(1+r^*)$, where $e^- = \mathrm{E}(\tilde{\epsilon}_i|\tilde{\epsilon}_i \leq \epsilon^*)$. Since the country is small relative to the world capital market, foreigners will bid for shares until they just break even on the shares they acquire. They break even if

$$\frac{f(K_i)(1+e^-)}{1+r^*} = \frac{v_i f(K_i)}{1+r^*}, \tag{4}$$

or if $v_i = 1+e^-$. Note that $v_i < 1$ since foreigners acquire the "lemons" among domestic firms. Given the definition of ϵ^*, we find that in equilibrium

$$\frac{1+\epsilon^*}{1+e^-} = \frac{1+r}{1+r^*}. \tag{5}$$

Since e^- is a function of only ϵ^*, the left-hand side of equation (5) depends only on ϵ^*. As a function of ϵ^*, its value must lie in the range $[1,\infty)$. In particular, since $\epsilon_i > -1$, as ϵ^* decreases, the left-hand side must eventually approach one; in contrast as ϵ^* increases without bound, so does the value of the left-hand side. In general, though, the value of the left-hand side need not be a monotonic function of ϵ^*. For example, if the distribution of ϵ_i had a mass point, then the value of the left-hand side would drop discretely at this mass point. For purposes of discussion, we will assume that the distribution function for ϵ_i is such that the left-hand side of equation (5) is a monotonically increasing function of ϵ^*,[13] implying that as r increases the fraction of firms acquired by foreigners increases.[14] Where results depend on this assumption of a monotonic relationship, we will make note of it.

In equilibrium, the size of foreign acquisitions, I, equals

$$I = \Phi(\epsilon^*)\left(\frac{\sum_{i>J} f(K_i)(1+\epsilon^*)}{1+r}\right) = \Phi(\epsilon^*)\left(\frac{\sum_{i>J} f(K_i)(1+e^-)}{1+r^*}\right). \tag{6}$$

[13] A sufficient condition for this to be true is that ϵ_i has a uniform distribution.

[14] As asymmetric information becomes less important, so that the distribution of ϵ_i becomes less disperse, the fraction of firms acquired by foreigners becomes more responsive to changes in r.

Second period consumption by the representative individual equals

$$C_2 = (1 - \Phi(\epsilon^*)) \sum_{i>J} f(K_i)(1 + \epsilon^+), \tag{7}$$

where $\epsilon^+ = E(\tilde{\epsilon}_i | \tilde{\epsilon}_i > \epsilon^*)$. Given that $(1 - \Phi(\epsilon^*))(1 + e^+) + \Phi(\epsilon^*)(1 + e^-) = 1$, equations (6) and (7) imply that

$$C_2 = \sum_{i>J} f(K_i) - (1 + r^*)I. \tag{7a}$$

Since the country is small relative to the world capital market, foreigners break even on their investments, so receive only $I(1 + r^*)$ in the second period on their initial investment of I.

We next show that $1 + r > f' > 1 + r^*$ if capital imports occur — the marginal product of capital is not driven down to the cost of funds on the world market, and the return to savings exceeds f' since investors can overcharge foreigners for the "lemons". To derive the first inequality, note that the return to savings, $1 + r$, equals $-(\partial C_2/\partial K_i)/(\partial C_1/\partial K_i)$. By using equation (6) to substitute for I in equations (2) and (7a), we can calculate this ratio and, using equation (5) to eliminate r^*, find that

$$1 + r = f'[1 + \Phi(\epsilon^*)(\epsilon^* - e^-)] > f'. \tag{8}$$

To derive the second inequality, note first, using equations (5) and (6), that equation (8) can be reexpressed as[15]

$$1 + r = f' \left[1 + \frac{(r - r^*)I}{\sum_{i>J} f(K_i)} \right]. \tag{8a}$$

It immediately follows that

$$f' - (1 + r^*) = (r - r^*) \left(1 - \frac{f'I}{\sum_{i>J} f(K_i)} \right) > 0, \tag{8b}$$

where the inequality follows because of the concavity of the production function and the fact that $I < K$.

[15] The intuition behind this expression is as follows: Given the difference in the interest rates prevailing at home vs. abroad, there are potential gains from trade. Since the country is small, foreigners earn the rate of return, r^*, prevailing on the world market, so that all the gains from trade go to the domestic shareholder. By investing more, the individual has more capital to sell to foreigners. Given asymmetric information, the fraction of his assets that he does sell to foreigners is $I/\sum_{i>J} f(K_i)$.

We now derive the equilibrium amount of greenfield investment. There are only N possible domestic firms, all initially owned by the representative domestic shareholder. If this individual sets up a firm himself, selling some shares later to foreign acquirers, then the present value of the income produced by this investment, net of the initial capital expenditures, equals

$$\frac{f(K_i)[1+\Phi(\epsilon^*)(\epsilon^*-e^-)]}{1+r} - K_i = \frac{f(K_i)-K_i f'(K_i)}{f'(K_i)}, \tag{9}$$

where the equality follows from equation (8). This value simply equals the rents arising from the concavity of the production function. If a foreign investor purchases the firm and sets it up himself as a greenfield investment, the present value of the resulting income to the foreign owner is

$$\frac{f(K_j)(1-\gamma)}{(1+r^*)} - K_j = \frac{f(K_j)-K_j f'(K_j)}{f'(K_j)} = E, \tag{9a}$$

where the first equality follows from the fact that the foreign owner would set K_j so that $f'(1-\gamma) = 1+r^*$. Again the value simply equals the rents arising from the concavity of the production function. Since the country is small, foreigners would bid up the price, E, until they are just indifferent to buying these firms. Sales take place if and only if E is greater than the value to domestic owners of keeping the firms, as expressed in equation (9). Given that $f(K_i)$ is a concave function of K_i, the value in equation (9a) is larger than that in equation (9) if and only if $K_j > K_i$. The value of K_i depends, however, on the amount of greenfield investment — additional greenfield investment leaves the representative domestic resident with fewer firms to invest in when trying to save to finance second period consumption, leading to a rise in K_i in each of the remaining firms. If the optimal value of K_j would be smaller than K_i even when all firms are owned by the domestic resident, then no foreign greenfield investment will in fact occur. Otherwise, there will be at least some greenfield investment. In equilibrium, greenfield investment continues until K_i has risen by enough so that $K_j = K_i$, implicitly determining the size of J.

Finally, we characterize the equilibrium value of r. Without capital imports, the equilibrium investment condition $f'(K_i) = 1+r$ implies a negative relation between r and K_i,

whereas the equilibrium savings relation $U_2/U_1 = 1+r$ would be presumed to imply a positive relation between r and total savings, $S = NK_i$. Together these conditions determine r and K_i. When foreign acquisitions are allowed for, each of these relationships between r and K_i changes. The investment condition is now equation (8), which for any given value of r implies a larger value of K_i than in the closed economy.[16] Similarly, for any given r, the sum of domestic savings and foreign acquisitions implies a larger supply of capital than in a closed economy. Together these relationships again determine the equilibrium values of K_i and r — due to foreign acquisitions, the equilibrium K_i must be larger than in a closed economy.[17] If the resulting equilibrium value of K_i is less than K_j, then greenfield investment will occur until the equilibrium value of K_i is driven up to K_j.

3. Consistency of These Forecasts with the Stylized Facts

Feldstein and Horioka (1980) argue that the close observed link between savings and investment in a country is dramatically inconsistent with a model that assumes costless international capital mobility; the inequality of real interest rates across countries provides further support for this conclusion. Similarly, French and Poterba (1991) maintain that the observed specialization of individual portfolios violates standard models of optimal portfolio choice, which assume that the joint distribution of returns on securities is common knowledge.

To what degree does the incorporation of asymmetric information into the model help resolve these inconsistencies between theory and evidence? To begin with, as seen from equation (5), the model implies that real interest rates must differ across countries in equilibrium if there are international capital flows. In particular, interest rates should be higher in capital importing countries, a forecast broadly consistent with past experience. In fact, the greater the degree of asymmetric information the higher r must be for any

[16] Equation (5) can be used to specify ϵ^* as a function of r.

[17] The equilibrium may not be unique, however. In particular, equation (8) no longer necessarily implies a uniformly negative relationship between K_i and r once the effects of r on ϵ^* are taken into account. Similarly, when the relationship between ϵ^* and r is not monotonic, domestic savings plus foreign acquisitions together need not be a uniformly increasing function of r.

given size of capital imports.[18]

In addition, the model forecasts an extreme form of portfolio specialization. If a country is a capital importer, as is the case in the country we focus on, any domestic shareholder will not want to invest abroad, where the available return r^* is less than the return available in the domestic market. Similarly, a capital exporting country will not import capital — if residents in this country are indifferent between investing at home vs. abroad, in spite of their superior knowledge about domestic investment opportunities, then foreign investors would not invest there. Therefore, residents in a capital–exporting country would in equilibrium own the entire domestic capital stock and invest any further savings abroad, while residents of capital–importing countries would rather invest all their savings at home and import any further capital from abroad. While observed portfolio diversification is much less than would be forecast ignoring asymmetric information, these forecasts suggest far more specialization than in fact occurs. Note, however, that our model has no market risk, so no incentive for portfolio diversification. If we added market risk, the model would forecast only a limited amount of portfolio diversification. Expected rates of return would continue to differ between domestic and foreign securities due to asymmetric information — investors would diversify to the extent that gains from diversification outweigh these differences in rates of return.

What about the conclusion in Feldstein–Horioka (1980) that increases in domestic savings lead almost dollar for dollar to increases in domestic investment? To examine the implications of the model for this relationship, assume first that there is no greenfield investment, so that domestic savings, S, is given by $K - I$. Note that we can implicitly define aggregate output as a function of the aggregate capital stock, $K \equiv \sum_i K_i$ — since all firms are identical ex ante, $K_i = K/N$. We can then rewrite equation (6) as

$$K - S = \Phi(\epsilon^*)\left(\frac{Nf(K/N)(1+\epsilon^-)}{1+r^*}\right). \qquad (6a)$$

[18] To see this, consider a proportional expansion in the distribution of ϵ_i, so that each value of ϵ_i is replaced by $a\epsilon_i$ for $a > 1$. Holding ϵ^* fixed, as a grows the value of r satisfying equation (5) increases, while the value of I satisfying equation (6) shrinks. Since I is an increasing function of r, to achieve the same size of I as before r must therefore increase further.

Differentiating this equation with respect to S, solving for $\partial K/\partial S$, and using equation (6), we find that

$$\frac{\partial K}{\partial S} = \left(\frac{Nf(K_i)}{Nf(K_i) - If'}\right)\left[1 + \left(\frac{Nf(K_i)}{1+r^*}\right)\left(\frac{\partial[\Phi(\epsilon^*)(1+\epsilon^-)]}{\partial r}\right)\left(\frac{\partial r}{\partial S}\right)\right]. \qquad (10)$$

In interpreting this equation, assume first that r remains unchanged, i.e. that ϵ^* does not change as K rises. Then, we find that $\partial K/\partial S > 1$! Not only does domestic savings lead to additional domestic investment, even though the economy is small and open, but domestic investment goes up by more than dollar for dollar as savings rises. The intuition behind this surprising result is straightforward. As more domestic savings occurs, each firm is larger. If r does not change, however, then the same fraction of firms will be purchased by foreign investors as before, implying that capital imports expand as well. Since the rise in S leads to a rise in I, $\partial K/\partial S > 1$.

In general, of course, the value of r will change, and this change can easily rationalize the less dramatic values of $\partial K/\partial S$ reported by Feldstein–Horioka (1980). In particular, the rise in K will cause f' to decline due to the diminishing returns to capital, and by equation (8) r would normally fall as well. The drop in r would normally lead to a fall in ϵ^*, by equation (5), reducing the fraction of firms acquired by foreigners. This drop in ϵ^* can well be large enough that on net capital imports decrease due to the rise in S, resulting in a value of $\partial K/\partial S < 1$ as found in the empirical work.

If greenfield investment occurs, however, conclusions change dramatically. Given that there is greenfield investment, we know that $K_i = K_j$, which defines the equilibrium value of r. As domestic savings go up, given r, foreign acquisitions go up proportionately, since the fraction of firms acquired by foreigners remains unchanged. But if K_i and K_j are both to remain constant, this process can occur only by having the extra domestic savings and foreign acquisitions together crowd out foreign greenfield investments. Therefore, the extra domestic savings lead to a growth in foreign acquisitions, a fall in foreign greenfield investments, and no change in the domestic capital stock. If there is greenfield investment, therefore, the theory does not help rationalize the Feldstein–Horioka observations, but it does have strong testable implications.

The above model is therefore consistent with the empirical results on the observed immobility of capital only if there is no greenfield investment in equilibrium. How important

in fact is greenfield investment relative to foreign acquisitions? According to the data reported in Auerbach–Hassett (1993), greenfield investments have been under 10% of capital imports to the U.S. in recent years. Some certainly did occur, however. But our model ignores any of the synergy gains from common operations emphasized as explanations for foreign investment by Dunning (1985). If differences in available rates of return among countries are not sufficient in themselves to explain the observed greenfield investments, ignoring the synergy gains, then our model would forecast that K should respond to additional savings, as described by equation (10). In that case, the model is in principle consistent with the Feldstein–Horioka observations.

4. Optimal Domestic Tax Policy

Past models of taxation of income from investment in small open economies, which ignored asymmetric information, concluded that domestic investment should not be taxed even if the government has revenue needs — direct taxes on immobile factors dominate. In addition, taxes on savings by domestic residents would be infeasible if earnings abroad cannot be monitored, an assumption we continue to adopt here. How do these conclusions change once we introduce asymmetric information into the model?

Rather than introducing explicit tax instruments from the beginning, we start by assuming that the government has direct control over the number of firms J sold initially to foreigners, the amount of foreign acquisitions I, and the individual's net savings, S. Given the differences between the resulting optimal allocation and the market equilibrium, we then discuss what types of tax interventions would produce the optimal allocation. To begin with, we ignore any revenue needs of the government, and simply assume that policy is set so as to maximize the individual's utility, $U(C_1, C_2)$, where (from equation (2)) $C_1 = A - S$ and (from equation (7a))

$$C_2 = (N - J)f\left(\frac{S + I + JE}{N - J}\right) - (1 + r^*)I.$$

Given these expressions for C_1 and C_2, what do the first–order conditions for optimal policy imply?

Differentiating utility with respect to J, we find that firms should be sold if and only if

$$E \geq \frac{f - K_i f'(K_i)}{f'(K_i)}.$$

As seen in equation (9), this is just what happens in the market equilibrium — firms should be sold only if the price foreigners pay exceeds the rents earned from keeping them.

The amount of foreign acquisitions that occurs in the market equilibrium is not optimal, however. Since the funds provided by the foreign investor earn an expected return of f' but cost only $1 + r^*$, capital imports should continue until

$$f' = 1 + r^*, \tag{11}$$

as can be seen by differentiating utility with respect to I. In the market equilibrium, in contrast, $f' > 1 + r^*$ (see equation (8b)). As in Akerlof (1970), too little trade occurs from an efficiency point of view in the market equilibrium as a result of asymmetric information. Denote the size of K in this optimal allocation by K^*.

In combination, these results imply that no greenfield investment occurs under the optimal allocation. Under the optimal policies, $f'(K_i) = 1 + r^*$, whereas the equilibrium condition for K_j is $f'(K_j)(1-\gamma) = 1+r^*$. As a result $K_j < K_i$, so no greenfield investment occurs. Capital in greenfield firms is invested inefficiently since $\gamma > 0$, whereas capital in firms that end up being sold to foreigners is invested efficiently, at least ex ante. Since foreign investors in either case simply earn the world rate of return, $1 + r^*$, the domestic resident prefers attracting funds in the form of foreign acquisitions rather than greenfield investments.

If we differentiate utility with respect to S, we find a condition characterizing optimal savings:

$$\frac{U_1}{U_2} = f'. \tag{12}$$

Since $f' = 1 + r^*$ under the optimal policies and $U_1/U_2 = 1 + r$ given decentralized savings decisions, we conclude that the rate of return to savings, $1 + r$, should equal the rate of return available on the world market, $1 + r^*$. If investments can be financed with foreign funds at a cost of $1 + r^*$, there is no point in financing them instead with domestic savings that cost $1 + r$ if $r > r^*$.

These first-order conditions are the same as would prevail in a small open economy that did not face any problems with asymmetric information. The role of policy is therefore to overcome the misallocations that result from the presence of asymmetric information.

What types of tax policies can the government use so that equations (11) and (12) hold in the market equilibrium? One possible approach would be to impose an income tax at rate τ on all firms, but add a subsidy at rate σ on firms acquired by foreigners. With these policies, the representative shareholder would receive second-period income of $f(K_i)(1+\tilde{\epsilon}_i)(1-\tau)$ if he keeps firm i, whereas a foreign owner would instead receive $f(K_i)(1+\tilde{\epsilon}_i)(1-\tau)(1+\sigma)$. We assume that the net tax revenue will be returned to the individual in a lump-sum form in the second-period.[19]

What tax rates would be needed to sustain the optimal allocation? To begin with, the subsidy rate has to be large enough to increase K to K^*. According to the tax-inclusive version of equation (6), since $r = r^*$ this implies that ϵ^* must satisfy

$$K^* - S = \Phi(\epsilon^*)\left(\frac{Nf(K^*/N)(1+\epsilon^*)(1-\tau)}{1+r^*}\right). \tag{6b}$$

Deriving equation (5) in the presence of taxes, we find that σ must be set so that $1+\epsilon^* = (1+\sigma)(1+e^-)$ at this required value of ϵ^*. When taxes are incorporated into equation (8), we find that the after-tax rate of return to savings now satisfies

$$1 + r = f'(1-\tau)[1 + \Phi(\epsilon^*)(\epsilon^* - e^-)]. \tag{8c}$$

For any given value of τ, the increase in ϵ^* needed to bring K up to K^* results in a rise in r — since foreigners continue to earn $1+r^*$ on their savings, the subsidy used to raise ϵ^* simply accrues to the domestic resident in the form of an increased rate of return to savings. If tax rates are to be set so that $r = r^*$, then τ must be set so that

$$(1-\tau)[1 + \Phi(\epsilon^*)(\epsilon^* - e^-)] = 1. \tag{13}$$

How would these results change if the government has revenue needs? Individuals are receiving pure profits in this model, due to the concavity of the production function. Hence

[19] In fact, net tax revenue will be zero under the optimal policies, since each group of investors is paid the average gross return generated on their investments.

the government could collect revenue without distorting any decisions by taxing these pure profits. Would it choose to deviate in any other ways from the above policies, which were chosen ignoring any revenue needs?

To judge this, consider the government's choice of the rate of return to individual savings, r, and the amount of capital imports, I. It can control these allocations indirectly through taxes on savings and subsidies to capital imports, and for simplicity we treat the allocations rather than the taxes as the instruments. Given the presence of pure profits taxes, the government's objective is to maximize

$$U(C_1, C_2) + \lambda R$$

with respect to r and I, where λ measures the value of additional government revenue, $C_1 = A - S$, $C_2 = S(1 + r)$ since pure profits have been taxed away, and

$$R = Nf\left(\frac{I+S}{N}\right) - (1+r^*)I - (1+r)S.$$

In setting r, the government must take into account the constraint that $r \geq r^*$ — if r were to drop below r^*, all domestic savings would shift abroad. If the government were to raise r and simultaneously adjust I so as to leave K constant, then the resulting change in social welfare equals

$$-(\lambda - U_2)S - \lambda(r - r^*)\frac{\partial S}{\partial r}. \tag{14}$$

As long as savings is an increasing function of the interest rate, this expression is negative for all values of $r \geq r^*$,[20] implying that r will be set at its minimum feasible value of r^*.[21] If we differentiate the government's objective function with respect to I, we find that $f' = 1 + r^*$. As a result, the optimal allocation is identical to the one chosen without revenue

[20] When we assume that the government has revenue needs, we are assuming that government revenue is more valued that private consumption, so that $\lambda > U_2$.

[21] If a tax on foreign-source earnings could be enforced, then equation (14) implies that the optimal value of r will be below r^*.

needs. Again, the marginal product of capital, and the return to individual savings, are both set equal to the rate of return, r^*, prevailing on the world market.[22]

These results prescribing a subsidy to foreign acquisitions and a tax on domestic savings are in sharp contrast to the forecasted tax policy in a large open economy. As noted above, a large capital importer will want to discourage capital imports in order to reduce the rate of return required by foreign investors. Similarly, Gordon and Varian (1989) show that when the distribution of returns on a country's equity has idiosyncratic components, the country has market power over access to this distribution of returns. Hence, it will want to discourage foreign purchases of domestic equity in order to drive up the price of its equity. In contrast, when asymmetric information explains the lack of capital mobility, a capital importer will want to explicitly encourage foreign acquisitions of domestic equity.

So far we have examined optimal tax policy in a small capital–importing country. What about policy in a capital–exporting country? In such a country, investors are indifferent at the margin between investing at home or abroad. The government cannot reduce the net-of-tax return to domestic investment, since investors can always go elsewhere. The analysis of this case in fact would be identical to the previous analysis in Gordon (1986) and Razin–Sadka (1991). In particular, it would continue to show that source–based capital income taxes are dominated by direct taxes on immobile factors, and that residence–based capital income taxes are infeasible.

5. Discussion

This model could be complicated in a variety of directions. For example, we assumed that existing firms had no way to signal information about their actual value of ϵ_i to potential foreign investors, yet would want to signal if they could. The firm's initial capital stock, K_1, can not serve as a signal, since it is chosen before ϵ_i is known. One signal that

[22] These conclusions depend on the availability of explicit taxes on the immobile factor bearing the incidence of this tax. If the government could not impose a 100% profits tax, for example, then the optimal policies would change. Whereas the rate of return to savings would be kept equal to r^*, the subsidies to foreign acquisitions would fall in order to save on revenue, resulting in a fall in K from the value seen above. Similarly, in our original model with two factors, capital and labor, optimal tax policy would set $f' = 1 + r^*$ and $r = r^*$ only so long as the government has available a tax on labor income. Note that $f' = 1 + r = 1 + r^*$ would remain optimal even though labor supply is elastic.

can be effective, however, is an offer to retain some of the shares in the firm in exchange for a somewhat higher price for the remaining shares. Only firms that are doing relatively well would find this option more attractive than selling all of the shares at a somewhat lower price.

To what degree does the equilibrium change when such a signal is used? Such a signalling equilibrium can lead to more firms having foreign owners. In spite of this, however, capital imports need not be larger since fewer shares are sold by each firm. To see this, consider the special case in which ϵ_i is distributed uniformly on the interval $[-a, a]$, and consider the particular signalling equilibrium in which a firm can sell either all or the fraction μ of its shares to the foreign investors. For simplicity we ignore the possibility of greenfield investments. The options open to foreign investors are now to offer to pay some amount $vf(K_i)/(1+r^*)$ for firms that sell all their shares, and another amount $\mu v^* f(K_i)/(1+r^*)$ for the fraction μ of the shares of firms that choose to sell only this amount. What characterizes the equilibrium values of v and v^*?

For any given values of v and v^*, there will be some value of ϵ_i, denoted by ϵ_1^*, such that a domestic firm with this ϵ_i would be just indifferent to selling all its shares or the fraction μ of its shares. Being indifferent implies that

$$\frac{vf(K_i)}{1+r^*} = \mu\frac{v^*f(K_i)}{1+r^*} + (1-\mu)\frac{f(K_i)(1+\epsilon_1^*)}{1+r}. \tag{15}$$

Any firm with $\epsilon_i < \epsilon_1^*$ would strictly prefer to sell all of its shares, and conversely.

Similarly, there will be some other value of $\epsilon_i > \epsilon_1^*$, denoted by ϵ_2^*, such that a domestic firm with this ϵ_i would be just indifferent to selling the fraction μ or selling none of its shares, implying that

$$\frac{v^*f(K_i)}{1+r^*} = \frac{f(K_i)(1+\epsilon_2^*)}{1+r}. \tag{15a}$$

Any firm with $\epsilon_i > \epsilon_2^*$ would strictly prefer not to sell any of its shares, and conversely.

Given this behavior, foreigners break even on their purchases of firms selling all of their shares if $v = 1 + \mathrm{E}(\epsilon_i|\epsilon_i \le \epsilon_1^*) = 1 + .5(\epsilon_1^* - a)$; they break even on their joint ventures if $v^* = 1 + \mathrm{E}(\epsilon_i|\epsilon_1^* < \epsilon_i \le \epsilon_2^*) = 1 + .5(\epsilon_1^* + \epsilon_2^*)$. Substituting these equilibrium conditions into equations (15) and (15a) gives two conditions which together determine the values of ϵ_1^* and ϵ_2^*. If $\mu > 1 - .5(1+r)/(1+r^*)$, then the only feasible solution to these equations sets

$\epsilon_1^* = -a$ and $\epsilon_2^* = \epsilon^*$, where ϵ^* is the solution found in the previous model. As a result, no firms are sold entirely and the same fraction of firms as before have foreign owners. But since only the fraction μ of the shares of these firms are now being sold, total capital imports are now reduced by the fraction $1 - \mu$.

If $\mu < 1 - .5(1 + r)/(1 + r^*) < .5$, then there will be a separating equilibrium with $\epsilon_1^* > -a$ and $\epsilon_2^* > \epsilon^*$. Now more firms than before will be selling at least some of their shares to foreigners. But do capital imports go up as a result? Previously, capital imports satisfied equation (6). Now they instead satisfy

$$I^* = \left(\frac{\sum_i f(K_i)}{1 + r^*}\right)[\Phi(\epsilon_1^*)(1 + .5(\epsilon_1^* - a)) + \mu(\Phi(\epsilon_2^*) - \Phi(\epsilon_1^*))(1 + .5(\epsilon_1^* + \epsilon_2^*)]. \qquad (6c)$$

Since I^* is continuous in μ, it is clear that for μ not much below $1-.5(1+r)/(1+r^*)$, I^* will still be smaller than the I satisfying equation (6). A more careful algebraic comparison reveals that I^* is smaller than I for all possible values of μ. Therefore, this particular signalling equilibrium always leads to smaller capital imports, so would imply lower utility for the domestic resident than the equilibrium without signalling. If we allowed additional heterogeneity in the possible fractions sold, leading to greater separation among domestic firms, it may be that an equilibria can be found that will involve increased capital imports. But the basic conclusion would remain that capital imports are limited in spite of the interest rate differentials.

One other more detailed issue that we feel could well be important is that foreigners may be able to observe some forms of capital more easily than others, e.g. tangible assets such as machines may be readily observable, but intangible assets such as goodwill, durability of the capital stock, the quality of market information, etc. may not be. We could capture this by assuming that there are two possible forms of capital: intangible capital, K^n, and tangible capital, K^t. Ex post output might then equal $f(K^n, K^t)(1 + \tilde{\epsilon}_i)$, but foreigners observe only K^t. Private incentives to invest in K^n are reduced because of the possibility of sales to foreigners, who do not observe K^n so do not compensate the firm for any additional investment in K^n. If K^t and K^n are complements in production, then foreign investors would treat a higher observed K^t in part as a signal that K^n is higher as well, adding to the firm's incentive to invest in K^t. Since foreigners recognize that this manipulation is going

on, they will adjust their bid for shares so as to assure that ex post they earn the going rate of return, r^*. The result of this manipulation is an efficiency loss from the country's perspective. Policy should as a result be designed to shift the firm's composition of inputs to the values that would be chosen with common knowledge, leading to a different form of government intervention.

Such complications do not change the basic conclusions. Adding asymmetric information to models of international capital allocation does contribute to explaining past empirical observations on capital immobility. However, it fails to explain the important role of corporate income taxes in developed countries. Not only does the model continue to forecast no taxes on savings or investment in capital–exporting countries, but it also forecasts no distortions to savings incentives[23] and subsidies to foreign acquisitions in capital–importing countries. This latter conclusion is particularly puzzling, given the seemingly strong domestic political opposition to takeovers by foreign firms. What factors might explain the lack of subsidies to foreign acquisitions?

One simple story is that the presence of such a subsidy may induce domestic investors to assume the guise of a foreign investor when buying shares, in order to qualify for the subsidy. If the tax authorities cannot successfully monitor the true residence of the owner of each share, the optimal tax policy certainly changes. However, it would still involve subsidies to domestic investment and taxes on domestic savings, so still seem counterfactual.

One consideration omitted from our model, however, is the possibility that foreign acquisitions can lead to an exchange of information between the new foreign owners and the existing labor force in the firm. Information flows can go in both directions. In the context of developing countries or Eastern European countries during the transition, economists often argue that foreign acquisitions in the country allow domestic residents to see how firms from other countries conduct business, enabling them to learn from these operations how better to run other local businesses. To the extent that this domestic learning spills over to individuals other than those who sold the firm to the foreigners,

[23] While the return to savings would be taxed, the net rate of return would equal the marginal product of domestic capital, implying no distortions to incentives.

there is in principle an additional ground for government intervention to subsidize foreign acquisitions, so as to internalize this spillover, reinforcing the prior results.

Information can flow in the opposite direction as well, however. The domestic firm may own patents, have nonpatented expertise in particular technologies, employ workers skilled at developing new technologies, or simply know better how to organize the internal operations of a firm. When a foreigner acquires ownership of the firm, it will be in a position to acquire this intangible capital, as well as the physical assets of the firm. In making use of this intangible capital, however, it will be constrained by its relatively limited knowledge about the host economy. As a result, future investments based on this intangible capital would occur primarily in the foreign firm's home country. If the domestic firm had not been acquired, however, the domestic owner would have made use of his intangible assets primarily in the domestic economy, where he knows better how to operate. The acquisition therefore not only affects the ownership of capital currently, but also has implications for future investment patterns.

Trying to deal explicitly with future investments, made based on firm–specific intangible capital, would raise a variety of complications that are well beyond the scope of this paper. What directions would such a model likely take? If we were to extend the model to three periods, to allow foreign acquisitions to affect investment patterns in the second period, we would face a situation where firms differed ex ante at the beginning of the second period in their technologies, a complication not faced in the current model. To deal with this, we could allow for takeovers among domestic firms before investment occurs in the second period. As a result, those with more profitable technologies could expand by buying up other domestic firms, so as to spread the use of their superior technology more broadly, leading if there are no other complications to only the most profitable technology being used in the domestic economy. Whether the domestic owner expands further by investing abroad would depend on whether the gain from using a superior technology outweighs the loss from operating at an informational disadvantage abroad. If the intangible capital were developed in a capital importing country, then likely all use of the capital would occur in the domestic economy if the firm remains owned by the domestic resident.

If the firm were acquired by a foreign owner during the first period, however, then the new owner would be able to expand use of this technology throughout his home economy

during the second period, bidding more for firms there than others would who have access to worse technology. Whether the foreign owner expands further in the host country would depend on whether greenfield investments pay off there, given that the foreigner is at an informational disadvantage.[24]

The result is that the market value of firms in the capital-importing country in the second period would be affected by whether domestic intangible assets were acquired by foreigners during the first period.[25] If a particular foreign investor can expand production to a larger pool of firms in the second period than can other investors, then he would find intangible assets relatively more valuable in the first period, introducing an additional consideration into the acquisition process in the first period. As a result, we would expect to find that investors based in larger countries have an advantage when bidding for firms with intangible assets in the first period.

A country's government, in setting policy, would need to take into account that foreign acquisitions in the first period result in a drop in the value of domestic firms in the second period (or a drop in wage rates, if labor were added as a factor). This drop in value would not be taken into account by the owner selling out to the foreign acquirer. As a result, the government would face an additional consideration, in itself creating an incentive to discourage sales of firms to foreigners. In effect, a country's comparative advantage depends on the quality of the technology available to firms owned by domestic residents.

While we believe that asymmetric information between countries provides a promising direction for explaining the empirical evidence on the international immobility of capital, there seem to be many more fruitful directions to pursue before we can feel confident we understand the full implications of asymmetric information for tax policy.

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[24] That foreign acquisitions were profitable in the first period does not imply that greenfield investments would be profitable in the second period.

[25] If we introduced labor as a second factor into the model, then we would conclude that the equilibrium wage in the second period would be affected by foreign acquisitions in the first period.

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