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Income Taxes as Reciprocal Tariffs
W. Michael Cox, David M. Gould, and Roy J. Ruffin

Seigniorage Revenue and Monetary Policy: Some Preliminary Evidence
Joseph H. Haslag

The Economics of the Private Equity Market
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Contents

Income Taxes as Reciprocal Tariffs

W. Michael Cox, David M. Gould, and Roy J. Ruffin

Page 2

This article shows the equivalence between tariffs on international trade and income taxation. Traditionally, income taxes have been seen as lowering society's output through the household's labor–leisure trade-off. Income taxes also reduce the degree to which individuals specialize in market activity, which is similar to the way countries respond to tariffs in international trade. Income taxes discourage individuals from specializing in activities that reflect their comparative advantage. In so doing, income taxes may have their most distorting effects, not by encouraging individuals to work less but by causing them to spend more time working at endeavors for which their talent is limited.

Using a general model of interpersonal exchange, the authors demonstrate parallels between income taxes and tariffs. Over a range of income taxes, raising taxes can benefit large groups of similarly skilled individuals and hurt small groups. As in tariff theory, the costs of income taxes are small only if they succeed in raising revenue. Thus, it is very costly for an economy to be on the downward portion of its tax revenue (Laffer) curve. The more heterogeneous the society, the higher the income tax rate that will maximize tax revenues. By overlooking the effects of heterogeneity in the workforce and the potential for workers to flee to home production, policymakers may under- or overestimate the effects of income taxes on various sectors of the economy and tax with unintended consequences.

Seigniorage Revenue and Monetary Policy: Some Preliminary Evidence

Joseph H. Haslag

Page 10

Producing new money is inexpensive, making seigniorage—the revenues earned from creating new money—attractive. However, the social costs of faster money creation most likely are greater than the production costs. These marginal social costs may put limits on how much real seigniorage revenue the government can earn. In this article, Joseph Haslag looks across countries to assess the typical reliance on seigniorage revenue. In addition, Haslag determines whether countries with combinations of high rates of money growth and high reserve requirements tend to rely especially heavily on seigniorage revenue.

The Economics of the Private Equity Market

Stephen D. Prowse

Page 21

The private equity market is an important source of funds for start-ups, private middle-market companies, firms in financial distress, and public firms seeking buyout financing. Over the past fifteen years, it has been the fastest growing corporate finance market, far surpassing the public equity and public and private bond markets. In this article, Stephen Prowse examines the economic foundations of the private equity market and describes its institutional structure. He also explores reasons for the market's explosive growth and highlights the main characteristics of that growth, including data on returns to private equity investors. He describes the important investors, intermediaries, and issuers in the market and their interactions with each other. In particular, he investigates how the major intermediary in the market—the limited partnership—addresses the severe information problems associated with investing in small private firms.

Income Taxes as Reciprocal Tariffs

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This article explores the parallel between the standard theory of income taxation and the theory of tariffs in international trade. Insights from the theory of tariffs help us understand how income taxes undercut the very basis on which people gain from trade—specialization.

Public finance experts have long explored the issue of income taxes making the cost of market transactions higher than nonmarket ones. A 50 percent income tax, for example, requires $20,000 in income to purchase $10,000 of market goods. The tax can be avoided, however, if the same goods can be produced at home. The upshot is that income taxes encourage the home production of goods and services that would otherwise be produced and traded in the market. By restricting trade between individuals, income taxes reduce what Adam Smith considered one of the primary benefits of the marketplace—the gains to specialization.

Given that income taxes reduce specialization within an economy, it is easy to see the similarities between the taxing of income within a country and tariff barriers between countries: income taxes encourage individuals to trade less in the marketplace and produce more goods at home; tariffs cause countries to trade less internationally and produce more domestically. Moreover, just as tariffs can redistribute income across countries, flat income tax rates can redistribute income across skill groups. Over a range of positive flat income taxes (tit-for-tat tariffs), raising taxes may actually benefit large groups of similarly skilled individuals (large countries) and hurt the small groups (small countries). Other insights into the effects of income taxation can also be elucidated from tariff theory. As in tariff theory, the costs of income taxes are small only if they succeed in raising revenue; thus, it seriously harms an economy to be on the downward portion of the tax revenue (Laffer) curve. The larger the value of market income (trade) compared with total production (gross domestic product)—that is, the more heterogeneous the society—the higher the income tax rate that maximizes revenue.

This article explores the parallel between the standard theory of income taxation and the theory of tariffs in international trade. Indeed, there is no formal difference in economic theory between a tariff war among countries and a flat-rate personal income tax within an economy. But although analysts generally consider tariff wars extremely costly to economic activity, they often look on income taxes with complacency.[1] One possible reason for these different reactions is that tariff wars are explicitly used to inflict damage on another country, whereas income taxes are used primarily to finance public spending. This article looks at how insights from the theory of tariffs can help us understand the effects of income taxation.

HOME PRODUCTION AND INTERNATIONAL TRADE

As noted above, income taxes shift production from market work to home production. Eisner (1989) estimates that the total value of U.S. home production ranges from 20 percent to 50 percent of measured output (GDP). In Sweden, a country with one of the highest marginal income tax rates in the world, home production accounts for an even larger part of domestic output. Swedish men, for example, averaged more than four hours per week on home improvement activities in 1984. In contrast, U.S. men averaged 2.8 hours and Japanese men less than one hour a week (Juster and Stafford 1991).[2] Trade theorist Ivor Pearce succinctly sums up the effect of taxes on the division of labor:

> The striking growth of do-it-yourself activity in recent years is neither an accident nor a change in basic preferences. Tax is avoided on work for self. Work for an employer is heavily taxed. The cheapest way to get something done is to do it yourself, contrary to the principle of the division of labor on which our high present standards of living depend. The whole structure of industry is deeply affected (Pearce 1977, 105–6).

The effect of income taxes on home production and market specialization has not gone unnoticed in economics. Boskin (1975) combines the household sector with a market sector to examine taxes in a general equilibrium framework. His two-sector model includes capital and labor as factors of production, but labor is untaxed in the household sector. Apps (1981, 1982) uses the analogy of trade theory to examine inequality issues that arise when certain groups of individuals are excluded from the market sector. Sandmo (1990) explicitly shows the similarities between income taxes and tariffs in his examination of optimum tax structures in a Becker-style model (Becker 1965) of household production. Sandmo notes that when household production is included, production efficiency is no longer feasible because "taxes on households are in fact tariffs on their trade with the rest of the economy" (Sandmo 1990, 89). In his framework, however, it is assumed that households must make market purchases, so the household equivalent of international autarky is ruled out. Extensive work on household production and taxation can be found in the literature on real-business-cycle theory. In McGrattan, Rogerson, and Wright (1997), for example, private consumption goods come from market and nonmarket production. Nonmarket goods are produced from domestic capital and labor allocated to home production. Because real-business-cycle models typically assume a representative agent, they cannot analyze how taxes affect individuals with different skills, which this article examines.

In international trade theory, home production is not tied to any good or sector; it is simply anything produced domestically. In tax models, however, a separate household sector typically produces only household goods distinct from those produced in the market sector. Consequently, in representative agent tax models, putting high income taxes on market transactions may reduce the market sector's size and change relative prices, but it will not generate the contrasting experiences of different individuals and the autarkic tendencies of tariff theory.

In the real world, nearly all households produce cleaning, cooking, entertainment, transportation, repair, and many other services. While relatively few goods may be produced at home, households' purchase of durable goods (refrigerators, computers, stoves, lawnmowers, and so on) enables the production of many services. Because of the tremendous diversity in skills and behavior, households cannot be treated as a single representative agent. Households will respond differently to income taxes, just as countries respond differently to tariffs. Thus, departing from the approach of Sandmo (1990) and McGrattan, Rogerson, and Wright (1997), we do not set out a separate household sector or identify a unique household good. All production can be consumed at home or "exported" to the market.

The results of this approach show effects normally not associated with income taxes. Over some range of positive flat income taxes, raising tax rates may benefit a relatively large sector of an economy at the expense of a smaller sector. For example, if manufacturing is the largest sector in an economy, it may benefit from a flat income tax at the expense of agriculture. In a two-person economy, the high-income individual may benefit at the expense of the low-income individual. This is similar to tariff theory, in which large countries may gain from tariffs at the expense of small countries. Flat income taxes, in essence, can boost some economic sectors at the expense of others and dramatically reduce specialization within an

economy. Representative agent models overlook this aspect because they treat everyone as identical. In the real world, each household activity competes with its counterpart in the market economy. Taxes that shift activity away from the market will have redistributional effects outside the purview of representative agent models.

As in tariff theory, the costs of income taxes are small only if they succeed in raising revenue; thus, it is very costly for an economy to be on the downward side of the tax revenue (Laffer) curve.

We also examine the effects of income taxes on general welfare. Here we find that the impact of income taxes depends in a complex way on the heterogeneity of the society.

INCOME TAX THEORY

To consider the theory of income taxation in a heterogeneous agent economy, suppose there are two agents, households 1 and 2, producing two goods, 1 and 2. Each household can produce and consume both goods, one of which is "imported" and the other "exported." Comparative advantage determines which good the household exports (sells) and which it imports (buys). Household i produces and consumes amounts x_j^i and c_j^i of each good j. Household i's utility function is

$$u^i(c_1^i, c_2^i), \tag{1}$$

and its production transformation function is

$$T^i(x_1^i, x_2^i) = k^i. \tag{2}$$

This implicit function shows the maximum output of one good given the output of the other. The function is set equal to the constant k^i, reflecting household i's fixed endowments of capital and labor. The subscript j on a function denotes the partial derivative. Thus, u_j^i denotes household i's marginal utility of good j. Applying the implicit function rule to Equations 1 and 2, we let $MRS^i = u_2^i/u_1^i$ and $MRT^i = -T_2^i/T_1^i$ denote the marginal rates of substitution in consumption and transformation in production, with T_j^i denoting household i's marginal resource cost of good j. Since only relative prices matter, we let p denote the market price of good 2 in terms of good 1. As a convention, we suppose agent 1 (agent 2) always sells good 1 (good 2) and buys good 2 (good 1).

Because taxing household production or consumption is not feasible (imagine trying to tax home cooking or parents' caring for their children), we assume the government imposes taxes only on market transactions. These taxes are essentially income (or, equivalently, sales) taxes. We examine the effects of an income tax, τ, levied ad valorem on each household as a proportion of its net dollar sales, or market income. As a benchmark for the analysis, we assume all income tax receipts, R^i, are directly rebated to each household in the amount paid to the government, but each household treats this as a lump-sum amount independent of any decision the household might make. This device allows us to investigate the distortionary effects of taxation per se, exclusive of the effect of resources absorbed by government.

Each household converts domestic production into domestic consumption through market transactions. Each household's lump-sum tax receipts plus net income (after taxes) must equal market expenditures. Thus, the budget constraints of households are

$$R^1 + (x_1^1 - c_1^1)(1 - \tau) = p(c_2^1 - x_2^1), \tag{3}$$

(tax receipts for household 1 + income from selling good 1 = purchases of good 2)

and

$$R^2 + (x_2^2 - c_2^2)p(1 - \tau) = (c_1^2 - x_1^2). \tag{4}$$

(tax receipts for household 2 + income from selling good 2 = purchases of good 1)

Household 1 chooses (x_j^1, c_j^1) to maximize the Lagrangian

$$\mathcal{L}^1 = u^1(\bullet) + \lambda T^1(\bullet) + \mu[R^1 + (x_1^1 - c_1^1)(1 - \tau) - p(c_2^1 - x_2^1)],$$

which yields the first-order conditions

$$MRS^1 = MRT^1 = p/(1 - \tau). \tag{5}$$

Household 2 chooses production and consumption to maximize

$$\mathcal{L}^2 = u^2(\bullet) + \lambda T^2(\bullet) + \lambda[R^2 + (x_2^2 - c_2^2)p(1 - \tau) - (c_1^2 - x_1^2)],$$

yielding

$$MRS^2 = MRT^2 = p(1 - \tau). \tag{6}$$

The remaining equations are the transformation function (Equation 2) and market clearing:

$$\Sigma_i c_2^i = \Sigma_i x_2^i. \tag{7}$$

We rebate to each household the exact revenue collected by the government. That is,

$$R^1 = \tau(x_1^1 - c_1^1); \tag{8}$$

$$R^2 = \tau p(x_2^2 - c_2^2). \tag{9}$$

Substituting Equations 8 and 9 into Equations 3

and 4, respectively, yields the tax-free budget constraints

$$x_1^i + px_2^i = c_1^i + pc_2^i. \quad (10)$$

Equations 2, 5, 6, 7, and 10 consist of nine equations and nine variables for determining the levels of household production, consumption, and p.

Table 1
Tariff Theory Versus Income Tax Theory

Tariff theory	Income tax theory
$MRS^1 = MRT^1 = p(1 + t^1)$	$MRS^1 = MRT^1 = p/(1 - \tau)$
$MRS^2 = MRT^2 = p/(1 + t^2)$	$MRS^2 = MRT^2 = p(1 - \tau)$
$\Sigma_i c_2^i = \Sigma_i x_2^i$	$\Sigma_i c_2^i = \Sigma_i x_2^i$
$x_1^i + px_2^i = c_1^i + pc_2^i$	$x_1^i + px_2^i = c_1^i + pc_2^i$
$T^i(x_1^i, x_2^i) = 0$	$T^i(x_1^i, x_2^i) = 0$

TARIFF THEORY

This section summarizes the traditional theory of tariffs (see Jones 1969; Ruffin 1979) in a form that is useful for comparison with income tax theory and in a way that parallels our development of the theory of income taxation.

Countries 1 and 2 produce goods 1 and 2, respectively. Country i exports good i. The world price of good 2 in terms of good 1 is p. The domestic relative price of good 2 is p^i. Country i imposes the ad valorem tariff rate t^i on the point-of-origin price (Lerner 1936). Since country 1 imports good 2, the domestic price of good 2 is higher than the foreign price:

$$p^1 = p(1 + t^1). \quad (11)$$

Since country 2 exports good 2, the domestic relative price is lower than the world price:

$$p^2 = p/(1 + t^2). \quad (12)$$

Substituting households for countries, we can use the same notation as before for describing utility in country i and production possibilities.

We make the usual assumption in tariff theory that all tax revenues are redistributed in lump-sum form to consumers. We could proceed as before, but note that this assumption is automatically captured if the rates of substitution and transformation are set equal to the domestic price ratio and the value of exports equals the value of imports at world prices, or, equivalently, the value of production equals the value of consumption at world prices. Thus, the fundamental equations of tariff theory are:

$$x_1^i + px_2^i = c_1^i + pc_2^i; \quad (13)$$

$$MRS^1 = MRT^1 = p(1 + t^1); \quad (14)$$

$$MRS^2 = MRT^2 = p/(1 + t^2); \quad (15)$$

$$\Sigma_i c_2^i = \Sigma_i x_2^i; \quad (16)$$

$$T^i(\bullet) = 0. \quad (17)$$

Equation 13 describes the spending constraints, Equations 14 and 15 set out the private optimization conditions, Equation 16 gives the market-clearing conditions, and Equation 17 relates the supply constraints. There are nine independent equations (two each for Equations 13, 14, 15, and 17) to solve for the nine variables. Table 1 compares the theory of income taxation with the theory of tariffs. It is obvious that they are formally equivalent provided

$$(1 + t^i) = 1/(1 - \tau). \quad (18)$$

The theory of tariffs can thus be interpreted as the theory of sales taxation if countries are seen as households.[3]

Income taxes work heavily against market production because they act like reciprocal tariffs, which impose the same tariff rate on each country. Table 2 uses Equation 18 to show the reciprocal tariff equivalents for different income tax rates. While a 10 percent income tax is the same as an 11 percent reciprocal tariff (each country imposes the same tariff), an income tax of 33.33 percent is like a reciprocal tariff of 50 percent. A 50 percent income tax is equivalent to a 100 percent tariff. In the parlance of tariff theory, income taxation has potentially large antispecialization effects. Income taxes are, in effect, a government-sponsored tit-for-tat tariff war between individuals.

Table 2
Reciprocal-Tariff Equivalents to Income Taxes

Income tax rate (Percent)	Reciprocal-tariff equivalent (Percent)
10	11
20	25
25	33
33	50
50	100

WELFARE

In this section we analyze the welfare implications of income taxes in the same way economists examine tariff theory (see Jones 1969). As a benchmark for the analysis, we continue to assume all income tax receipts are directly rebated to each household in the amount paid to the government. $E_j^i = c_j^i - x_j^i$ is household i's excess demand for good j. In market equilibrium, one household's excess demand will just offset another household's excess supply. Use $p^i = MRS^i = MRT^i$ to denote household i's opportunity cost in terms of good 2. Household i's change in real income is defined as

$$dy^i = dc_1^i + p^i dc_2^i. \tag{19}$$

Equation 19 is derived from the utility function itself and is the total differential of utility measured in terms of the numeraire good, good 1. We can convert the change in utility to market variables by differentiating the budget constraint (Equation 10) and using Equation 19, noting that along the production transformation curve $dx_1^i + p^i dx_2^i = 0$. Thus,

$$dy^i = (p^i - p)dE_2^i - E_2^i dp. \tag{20}$$

This well-known equation in trade theory also applies to households. If household i is a net buyer of good 2 (that is, imports good 2 because $p^i > p$), the change in welfare is the household's personal profit, $(p^i - p)dE_2^i$, on additional purchases minus the increase in the cost of previous purchases, $E_2^i dp$.

We first use Equation 20 to show that sufficiently high taxes always reduce welfare. Suppose taxes are so high that each household is driven to autarky ($E_2^i = 0$). Working backward from autarky, we see that welfare increases as taxes are reduced:

$$dy^i \big|_{E_2^i = 0} = (p^i - p)dE_2^i > 0.$$

This inequality follows from Equation 20 because initially $E_2^i = 0$ and $dE_2^i > 0$ when taxes are reduced. In other words, welfare falls as we increase taxes and approach autarky.

Another result is that increases in income taxes are the most costly when the economy is on the downward side of the tax revenue (Laffer) curve. Without loss of generality, we can look at household 2, where $(p^2 - p) = -p\tau$. Taxes paid (and rebated) to this household are $R^2 = (p^2 - p)E_2^2$. The change in revenue is

$$dR^2 = (p^2 - p)dE_2^2 + (dp^2 - dp)E_2^2. \tag{21}$$

Substituting Equation 20 into Equation 21 yields

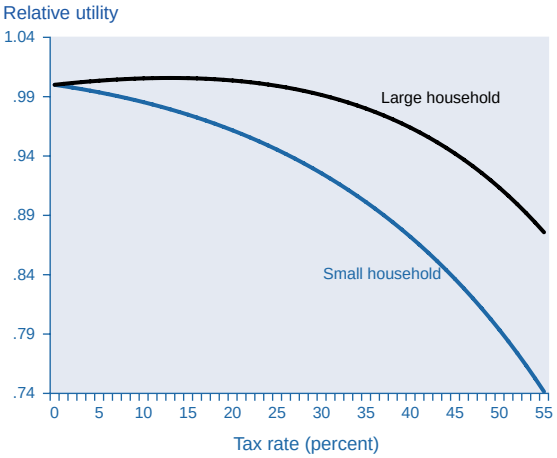
$$dy^2 = dR^2 - dp^2 E_2^2. \tag{22}$$

Any increase in τ will reduce the net price of good 2 to household 2 when it sells the good in the market, so $dp^2 < 0$. Because household 2 is a net seller of good 2, its excess demand for the good is negative, so the second term in Equation 22 is negative (the product of three negatives). This shows that when there is any change in income taxes and tax payments are rebated in a lump sum, welfare can only increase if the lump-sum payment increases. In other words, increments in the income tax hurt the most when the economy is on the downward side of the tax revenue function. If tax revenues are maximized at, say, $\tau = 0.2$, doubling τ from 0.05 to 0.1 will have a smaller impact on welfare than increasing τ from 0.2 to 0.25.

The most interesting implication of Equation 20 is that an equal change in income taxes across all households will not necessarily affect everyone in the same manner. In our model, taxation causes each individual to produce less of the good he or she sells. But taxation can also change the relative price of goods, which benefits one household and hurts the other. This differential impact arises from the ambiguous effect a change in the income tax rate, τ, can have on the terms of trade, p. As income taxes are raised, the terms-of-trade effects are ambiguous because the offer curves of both households shift inward. If households are asymmetrical in terms of their production possibilities and preferences, the terms of trade will change as the offer curves shift inward at different rates, and the relative price of one good will most likely increase. For example, an income tax may lower a plumber's demand for doctors' services proportionately more or less than it lowers a doctor's demand for plumbers' services.

Thus, when households are not symmetrically different, some will experience an improvement in their terms of trade and find their welfare increasing over a range of income taxes. Just as a large country can gain at the expense of a small one by imposing an optimal tariff to improve its terms of trade, some households may gain at the expense of others when income taxes are imposed. The proof of this proposition is straightforward. Starting from zero income taxes, $(p^i - p) = 0$, Equation 20 shows that a household experiencing an improvement in the terms of trade from income taxes ($dp < 0$ and $E_2^i > 0$, or, $dp > 0$ and $E_2^i < 0$) will find its welfare enhanced:

Figure 1
Unequal Household Incomes



$$dy^i \Big|_{\tau = 0} = -E_2^i dp > 0. \tag{23}$$

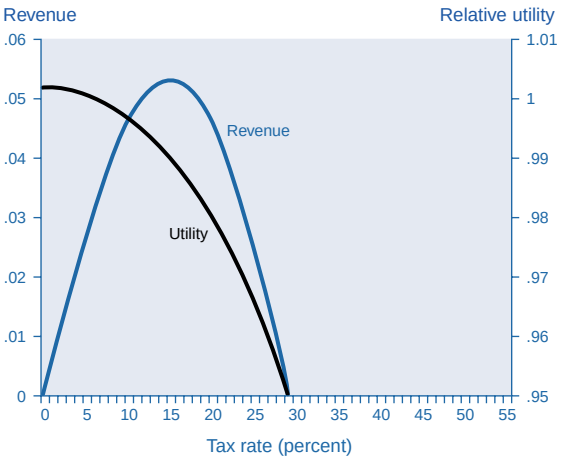
Likewise, the household that experiences a deterioration in its terms of trade will find its welfare declines: $dy^i \Big|_{\tau = 0} < 0$. Equation 23 shows that a small tax improves the welfare of the party whose terms of trade improve. This is because $E_2^1 + E_2^2 = 0$, so that facing the same change in market price, dp, one household is better off and the other worse off.[4]

Thus, we see that a sufficiently small income tax of the sort being considered (tax rebated in a lump sum) will usually help some groups. Which groups will benefit? The answer can be found by looking at income taxes as tit-for-tat tariff wars. It is easy to see that large countries will win a matching tariff war: they can improve their terms of trade because they have a larger impact on world prices. A similar result obtains here. In the case of flat income taxes, the consumer with the higher income will benefit from higher taxes over a certain range. Say the high-income person sells financial services to a low-income person in return for painting. Starting from a zero flat income tax rate, increasing tax rates will raise the market price of both financial services and painting. The high-income person will demand less painting, and the low-income person will demand fewer financial services. However, because the high-income person consumes relatively more painting than the low-income person consumes financial services, the relative demand for painting will fall more than that of financial services. The high-income person's demand falls by more because a higher income essentially means that demand curves are flatter (all else equal). Therefore, the price of painting should fall relative to financial services. At the margin, starting from no taxes, this benefits the high-income person and hurts the low-income one. This result of our model should not be interpreted as meaning that in the real world income taxes hurt low-income people more than high-income people. This result applies to larger similarly skilled *groups* versus smaller ones. Thus, if high-income individuals in the real world represent a small share of total production and if their comparative advantage overlaps little with that of low-income individuals, flat income taxes would affect them more adversely.

Figures 1, 2, and 3 show some illustrative calculations for several hypothetical economies (see the box entitled "Model Description" for a characterization of the hypothetical economies). It is assumed that the utility and product transformation functions display a constant elasticity of substitution. Figure 1 shows a typical case in which household 2's income is roughly twice that of household 1. As income taxes are increased, household 2's utility rises while that of household 1 falls. Indeed, household 2's real income is maximized when the tax rate is approximately 13 percent, and its real income does not fall below that associated with no taxes until the tax rate is 25 percent. Thus, the redistribution effects can be significant.

Figures 2 and 3 consider the case of equal-income households. In Figure 2 the households are largely homogenous, with small differences in their comparative advantages. In Figure 3 the households are distinctly heterogeneous. In the symmetrical cases the utility of each household behaves in the same way. As the income tax increases, nothing happens to the market price because the increase in demand from one party

Figure 2
Small Differences in Comparative Advantage, Equal Household Income



Model Description

The model underlying the simulations in Figures 1–3 is as follows:

$$U_1 = (c_{11}^{\rho} + c_{12}^{\rho})^{1/\rho}$$

$$U_2 = (c_{21}^{\rho} + c_{22}^{\rho})^{1/\rho}$$

$$x_{11}^{\alpha} + Bx_{12}^{\alpha} = k_1$$

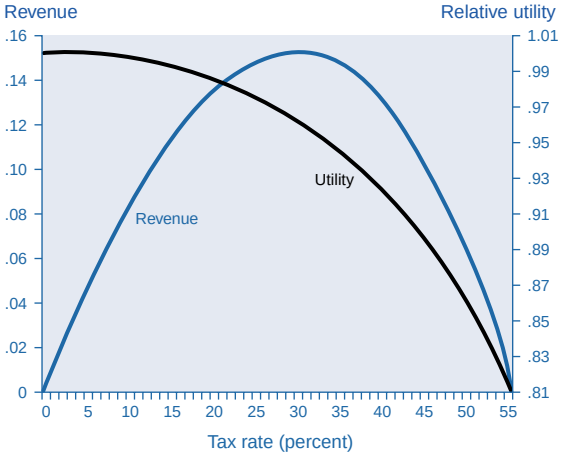
$$Bx_{21}^{\alpha} + x_{22}^{\alpha} = k_2,$$

where $\rho = 0.5$, $\alpha = 1.5$.

In Figure 1, $B = 2$ and $k_1 = 1$ and $k_2 = 2$.
In Figure 2, $B = 2$ and $k_1 = k_2 = 1$.
In Figure 3, $B = 5$ and $k_1 = k_2 = 1$.

equals the reduction in demand from the other. Real income falls from the outset; the optimal income tax for both households is zero, as could be expected. The revenue, or Laffer, curve is also shown. In Figure 2 the revenue function reaches its maximum at an income tax of 15 percent and revenue falls to zero when both parties are reduced to autarky (no exchange) with an income tax rate of 29 percent. In the autarky case, both parties lose about 5 percent of their welfare relative to the zero income tax position. In Figure 3, with large differences in comparative advantage (greater heterogeneity), maximum revenue is achieved at a tax rate of 30 percent, and autarky is reached at a tax rate of 55 percent. In this case, with taxes that choke off all trade, both parties lose about 20 percent of the welfare they would have with no income taxes.

Figure 3
Large Differences in Comparative Advantage, Equal Household Income



CONCLUSION

Traditionally, income taxes have been seen as lowering society's output through the household's labor–leisure trade-off. Income taxes lower the after-tax wage rate and thus encourage people to work less and enjoy more leisure. However, income taxes also reduce the degree to which individuals specialize in market activity, which is similar to the way countries respond to tariffs in international trade. Income taxes discourage individuals from specializing in activities that reflect their comparative advantage. Instead, they encourage everyone to become a jack-of-all-trades. In so doing, income taxes may have their most distorting effects not by encouraging individuals to work less but by causing them to spend more time working at endeavors in which their talents do not lie.

As long as it is necessary to raise revenue, the autarkic tendencies of income taxes, sales taxes, and value-added taxes are unavoidable. The only solution would be to minimize them by imposing lump-sum supplements to these antispecialization taxes. But, as the experience of the Thatcher government in Britain illustrates, even small poll taxes are highly unpopular. Income taxes are thus likely to remain the primary source of government revenue.

Nevertheless, the ways in which income taxes affect society's welfare must be recognized. By focusing mostly on the labor–leisure trade-off and ignoring heterogeneity in the workforce and the potential for workers to flee to home production, policymakers may under- or overestimate the effect income taxes have on various sectors of the economy and thereby tax with unintended consequences. Just as in trade among nations, where equal tariffs can wreak more economic destruction in some nations than in others, in the day-to-day commerce within a nation even flat income taxes can have differing deleterious effects. They affect the very basis on which people gain from trade—the ability to specialize.

NOTES

We thank Avinash Dixit, Joseph Haslag, Peter Mieszkowski, and Jason Saving for helpful comments and suggestions.

[1] Indeed, the protectionist trade war triggered by the Smoot–Hawley tariff may have contributed significantly

to the Great Depression. See, for example, Wanniski (1978), Chapter 7, "The Stock Market and the Wedge," for a discussion of this topic.

[2] Moreover, according to the same article, Swedish men averaged 39.8 hours of market work and 18.1 of housework (including home improvements) per week, whereas U.S. men averaged 44 hours of market work and 13.8 hours of housework.

[3] Furthermore, we have shown that sales taxes are equivalent to income taxes even in the presence of household production. See Mieszkowski (1967, 251) for a lucid statement of the equivalence of income taxes and sales taxes in a world without home production.

[4] Of course, the country as a whole is made worse off because the terms-of-trade improvement for some households is more than offset by the terms-of-trade loss to the households that experience a fall in their terms of trade. This can be demonstrated by Equation 20. Welfare is maximized when $dy^1 + dy^2 = 0$, which implies that tax rates are zero.

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Seigniorage Revenue and Monetary Policy

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The resource costs to the U.S. Treasury [to print a $100 bill] are more than offset by the value of the goods that could be purchased with the $100 bill.

Money creation is one potential source of revenue for a government. Seigniorage—government revenue received through creating money—is a relatively inexpensive means of raising funds. Take the United States as an example. It costs just a few pennies to print a $100 bill. The resource costs to the U.S. Treasury are more than offset by the value of the goods that could be purchased with the $100 bill. It is even less expensive for the Federal Reserve to electronically purchase large quantities of Treasury bonds, notes, and bills from traders in New York. It is important to note that the Federal Reserve returns the interest payments on its security holdings (less its expenses) to the U.S. Treasury. Consequently, when the Federal Reserve increases its bond holdings, for example, the U.S. Treasury realizes an effective reduction to its debt expenses.[1] The present value of the reduction in Treasury expenses is equal to the amount of money injected by the Federal Reserve's open market purchase.

The problem is that although money may be cheap to produce, the social costs of money creation are almost certainly greater than what the Federal Reserve pays to create it. Indeed, a large body of empirical evidence suggests that the rate of money creation is closely correlated with inflation. Thus, faster money creation costs society by eroding the purchasing power of money already in circulation, which is the inflation tax. Though tempted by low production costs, governments must balance the benefits with social costs when deciding how much to rely on seigniorage.

The article addresses two questions. First, how much do countries rely on money creation as a source of revenue? The answer to this question gives some idea of the size of the seigniorage revenue "problem." For most of the countries, money creation accounts for less than 2 percent of real GDP. The evidence indicates that seigniorage revenue is not the primary source of revenue for a government, but neither is it quantitatively insignificant.

Second, are monetary policy settings systematically related to a government's reliance on real seigniorage revenue, and, if so, what is the relationship? Such evidence should be a useful guide for economic theories—that is, a good theory should be able to account for a government's reliance on seigniorage revenue versus, say, its reliance on income taxes.

Sargent (1986) presents some evidence that very rapid money growth does not translate into greater reliance on real seigniorage revenue. He studies monetary policy during four

hyperinflation episodes that occurred immediately following World War I. For two countries, Austria and Hungary, Sargent reports data on money growth and the fraction of government spending earned through seigniorage revenue. Austria raised about 67 percent of government expenditures through money creation in the first half of 1919. However, the ratio of money creation to government expenditures fell to about 40 percent of government expenditures by 1922. Between 1919 and 1922, Austrian crowns in circulation went from roughly 4.7 billion to nearly 4.1 *trillion*. For Hungary, money creation accounted for more than 45 percent of its government expenditures in 1921–22, falling to about 33 percent in 1924–25. Between February 1921 and April 1925, Hungary saw its notes in circulation rise from 15 billion kronen to 4.5 trillion kronen.[2] For these two case studies, the evidence suggests that reliance on money creation decreases as the rate of money growth increases. Hyperinflations are rare and probably not good laboratories for studying the relationship between monetary policy and seigniorage revenue. Still, the Austrian and Hungarian data show that dramatic increases in the rate of money growth do not necessarily translate into a government's increased reliance on seigniorage revenue.

In this article, I use data from different countries to identify whether a systematic relationship exists between monetary policy and a country's reliance on seigniorage revenue. Rather than focus on year-to-year realizations, the approach taken in this article is to study the correlation between monetary policy and seigniorage over a longer horizon; specifically, the sample mean is computed from a 30-year period. Both economic theory and problems with statistical inference point to using a sufficient statistic to measure monetary policy. (A sufficient statistic captures changes in the variable that the researcher is studying.) Here, the monetary policy measure is a combination of the money growth rate and the reserve ratio. As such, the evidence bears on whether countries with a high money growth rate–reserve ratio combination also tend, on average, to rely more heavily on seigniorage revenue over these longer horizons than countries with a low money growth rate–reserve ratio combination.

The cross-country evidence indicates a positive association between the monetary policy measure and a country's reliance on seigniorage revenue. Thus, countries with high monetary policy settings tend to rely more on seigniorage revenue than countries with low monetary policy settings. An additional implication follows from the way in which the measure of monetary policy is constructed; specifically, one can infer that the relationship between the reserve ratio, which holds the money growth rate constant, and a country's reliance on seigniorage revenue is concave. The concave relationship also holds between the money growth rate and seigniorage reliance when the reserve ratio is constant. The implied concavity complements Sargent's findings for Austria and Hungary.

It is useful to begin with a brief overview of seigniorage revenue that shows how it fits into a broader picture of government finance.

SEIGNIORAGE REVENUE—AN OVERVIEW

Suppose the government prints new pieces of currency and uses these newly created bills to buy goods and services, such as missiles or computers, or pay workers' salaries.[3] For simplicity, I assume that the economy has a composite commodity (hereafter, the consumption good). The government can buy units of this consumption good with the newly printed money, which is

$$(M_t - M_{t-1})v_t, \tag{1}$$

where M denotes the total quantity of high-powered money in the economy (t denotes time), and v denotes the money's value in terms of the units of the consumption good that can be acquired with one unit of money (that is, the inverse of the price level). Thus, Equation 1 represents the units of the consumption good that can be purchased with newly printed money—in other words, real seigniorage revenue.

Seigniorage revenue is just one part of a larger picture. To see the complete picture, it is necessary to give the government's income statement, or budget constraint. To keep things simple, assume that the government issues only one-period, fully indexed bonds.[4] For this simple economy, the government's budget constraint can be written as

$$g_t + r_t b_{t-1} = \tau_t y_t + b_t + (M_t - M_{t-1})v_t. \tag{2}$$

In Equation 2, g is the total quantity of goods purchased by the government; the product, rb, is the principal and interest payments, measured in units of the good, that the government owes for one-period bonds issued at date $t - 1$; r is the real gross return (principal plus net interest) on government securities worth b goods. Thus, the left-hand side of Equation 2 represents

the total expenditures by the government. The right-hand side characterizes the government's total receipts. The product, τy, represents the income tax revenue earned by the government at rate τ, and y is the aggregate level of real income.

Note that in Equation 2 the government has access to an income tax. Representing tax revenue this way is not necessary. However, there is a useful analogy between seigniorage revenue and income tax revenue. The relationship between the income tax rate and tax revenue has been popularized in the Laffer curve. Suppose that income, y, is negatively related to the tax rate. With an increase in the tax rate, for example, people would report less income.[5] The basic supply-side question, therefore, is whether higher tax rates are offset by a lower tax base. Since tax revenues are the product of these two factors, it is impossible to say, *a priori*, whether income tax revenues rise or fall in response to an increase in tax rates.

Seigniorage Revenue and Money Growth

An increase in the money growth rate has an effect on seigniorage that is analogous to the effect that an increase in the tax rate has on income tax revenue. To illustrate this point, I modify the expression for seigniorage revenue to identify a tax rate and tax base. The date t quantity of money in circulation is equal to the product of a growth rate and date $t - 1$ stock. Thus,

$$M_t = \theta_t M_{t-1}, \tag{3}$$

where θ is the gross rate of money supply expansion. With $\theta > 0$, the percentage change in the money supply is $\theta - 1$. Use Equation 3 to substitute for M_{t-1} in Equation 1. The resulting government budget constraint is given by

$$g_t + r_t b_{t-1} = \tau_t y_t + b_t + v_t M_t (1 - 1/\theta_t). \tag{2'}$$

The analog to income tax revenue is now more accessible. In Equation 2′, the total revenue from money creation is now the product of a tax base, $v_t M_t$, and a tax rate, $(1 - 1/\theta)$, that is positively related to the rate of money growth.

To complete the analogy to the tax revenue setting, linking the seigniorage tax base to the seigniorage tax rate is necessary. One way to do this is to assume that the real quantity of money—which for seigniorage revenue is the tax base—is a function of its real rate of return. More specifically, let real money balances be positively related to the real return on money. It is straightforward to show that the real rate of return on money is the inverse of the inflation rate; that is, $1/\pi$, where $\pi = p_t/p_{t-1}$.[6] Other things being equal, the rate of inflation is positively related to the rate of money growth. Hence, faster money growth means that the real return on money falls. It follows that faster money growth results in a smaller tax base for real seigniorage revenue.

Overall, faster money growth can lead to either more or less real seigniorage revenue, depending on whether the change in the tax rate or the change in the tax base is quantitatively larger.

Reserve Requirements and the Tax Base

There is another monetary policy tool that could potentially influence real seigniorage revenue. The reserve requirement stipulates that money balances cannot be less than γ percent of bank deposits, where γ denotes the reserve requirement ratio. Consequently, for a given level of deposits, a higher reserve requirement implies that the quantity of real money balances increases; that is, a larger tax base. However, holding the level of deposits constant is unlikely. An increase in the reserve requirement ratio may induce people to decrease their total savings and hence their bank deposits. As a result, people may avoid the inflation tax by reducing their bank deposits.

To illustrate this point, people have two means of saving: government bonds and money. For simplicity, I assume that the real return on the government bonds, r, is constant and that these bonds dominate money in terms of offering a higher rate of return—that is, $1/\pi < r$.

In this economy, banks serve a very simple function. I assume that government bonds are issued in denominations that are too large for any one saver to acquire. The bank costlessly pools the funds to acquire these government bonds. Because the bank maximizes profits in a perfectly competitive market, the rate of return on deposits will also be r. Each person takes the rate of return on deposits as given. The reserve requirement stipulates that the person hold a fraction of these deposits as money balances.[7] Because money is rate of return dominated by government bonds, the person will not hold any fiat money in excess of this reserve requirement. The equilibrium return on a person's savings is

$$q = \frac{\gamma}{1+\gamma} \cdot \frac{1}{\pi} + \frac{r}{1+\gamma}, \tag{4}$$

where q is the gross real return on savings. Note that q is a weighted average of the rate of return on real money balances and on government

bonds. With $1/\pi < r$, Equation 4 implies that $q < r$. In other words, the reserve requirement ratio drives a wedge between the return on bonds and the return to savings.

Suppose there is an increase in the reserve requirement ratio. The quantity of real money balances held by people is γd, where d is the quantity of goods deposited with banks. For a given level of deposits, people will hold more money and the tax base rises. Equation 4, however, implies that the real return on savings falls as the reserve requirement ratio increases. It seems reasonable to assume that people's savings are positively related to the real return on savings. Therefore, it follows that a higher reserve requirement ratio will result in a decline in a person's savings. A decline in savings implies a decline in the quantity of bank deposits. As such, γ is increasing and d is falling so that the product—the seigniorage tax base—could either increase or decrease.

The thrust of this section is twofold. First, real seigniorage revenue is formally defined. Second, economic theory offers an ambiguous picture regarding the effects that monetary policy settings have on the size of this revenue. The gist of the economic argument is that people try to avoid taxes, so with higher tax rates, whether it be inflation or income, they have an incentive to reduce the quantity of the good being taxed. The remainder of this article seeks to establish some preliminary observations on the correlation between a country's reliance on seigniorage revenue and its monetary policy settings.

THE DATA

I obtain the data in this article from International Financial Statistics. I use annual observations, spanning the period 1965–94. For each of the variables I examine over this 30-year period, I use the sample mean to measure each country's central tendency. Unfortunately, observations are not available for each country for each year. Each country in the sample has at least fifteen annual observations. The result is a sample of sixty-seven countries.[8]

Following Fischer (1982), I compute the ratio of seigniorage revenue to output, hereafter S/Y, for each country.[9] Here, I use high-powered money as the measure of the money stock (M). One alternative to computing ratios is to convert each country's seigniorage to a dollar-equivalent value. The chief advantage to using ratios is that no assumptions are required regarding the exchange rate and purchasing power parity.

Before reporting any statistics, it is important to note that the reserve requirement ratio presents a measurement issue. In principal, the average marginal reserve requirement ratio—the ratio that applies to the next dollar deposited—would be measured.[10] In practice, however, measuring this is not so simple. There is a dizzying array of reserve requirements; U.S. banks are currently required to hold reserves equal to 3 percent of the first $49.3 million of checkable deposits and 10 percent of all deposits above the low-reserve tranche. Therefore, it matters whether the deposits are going into small banks or large banks. In other countries, the reserve requirement structures are even more convoluted.[11]

Equations 1 through 4 are built on the notion that there is one reserve requirement ratio that is the marginal reserve requirement. To compute the marginal reserve requirement ratio, one could use the distribution of deposits across the different categories corresponding to the reserve requirement structure. For example, 20 percent of the deposits are in small U.S. banks (with less than $49.3 million in checkable deposits) and 80 percent are in large banks. The average marginal reserve requirement ratio would be $(0.2 \cdot 0.03) + (0.8 \cdot 0.1) = 0.086$. Unfortunately, neither the United States nor any other countries report the distribution across deposit categories, which is necessary to construct such a measure. Consequently, I use the reserve-to-deposit ratio, denoted R/D, (hereafter reserve ratio) as a proxy for the reserve requirement ratio. Historically, reserve requirements have been applied against deposits included in what is the U.S. counterpart to M2. Accordingly, I use M2 less currency outside the bank as my measure of bank deposits. As it is measured, the reserve ratio ignores any extra information contained in the distribution of deposits across the alternative categories. Instead, different deposit categories are treated as if there is only one type.

Table 1 reports summary statistics for the seigniorage ratio, S/Y; as well as a monetary policy measure, g; a tax rate measure, TAX; and the growth rate of output, y'. On average, seigniorage revenue accounts for a fairly small fraction of total output—about 2 percent.[12] Tax receipts are, on average, about 22 percent of aggregate output. As one would probably expect, seigniorage revenue is not the primary source of government revenue.

Generally, the government budget constraint links the variables in Table 1 together. As such, the statistics describe the central tenden-

Table 1
Summary Statistics

Variables	Sample mean	Standard deviation	Minimum	Maximum
S/Y	.0211	.0201	.0025	.0998
R/D	.1712	.1303	.0068	.6402
g	.2085	.1667	.0332	.8981
TAX	.2254	.1008	.0537	.5586
y'	.0407	.0181	–.0018	.0904

S/Y Real seigniorage/real GDP
R/D Bank reserves/deposits (M2 less currency)
g Percentage change in high-powered money
TAX Tax revenue/GDP
y' Percentage change in real GDP

cies and average dispersion of monetary policy, fiscal policy, and some aggregate measure of economic activity. The money growth rate, *g*, is $(M_t/M_{t-1}) - 1$. *TAX* is the ratio of tax revenue to GNP. Lastly, $y' = (Y_t/Y_{t-1}) - 1$ is the growth rate of output.

One rather interesting finding is how the reliance on seigniorage revenue is distributed. Approximately three-fourths of the countries collect, on average, less than 2 percent of GNP through money creation. Most of the variation, therefore, occurs among those countries in the top quartile of the distribution. In this sample, Ghana relies most heavily on seigniorage, collecting revenues equal to 10 percent of output, on average, through money creation. Overall, the distribution of *S/Y* ratios is quite skewed toward the low-seigniorage-reliance tail of the distribution.

Table 1 also reports the range of reserve ratios and average money growth rates. The difference between the minimum and maximum values is substantial. Reserve ratios range from a low of 0.6 percent to 64 percent. Money growth rates range from 3.3 percent to nearly 90 percent. This evidence shows that banks hold a substantial fraction of money against deposits in some countries. It also shows that some countries create money at a rapid pace.

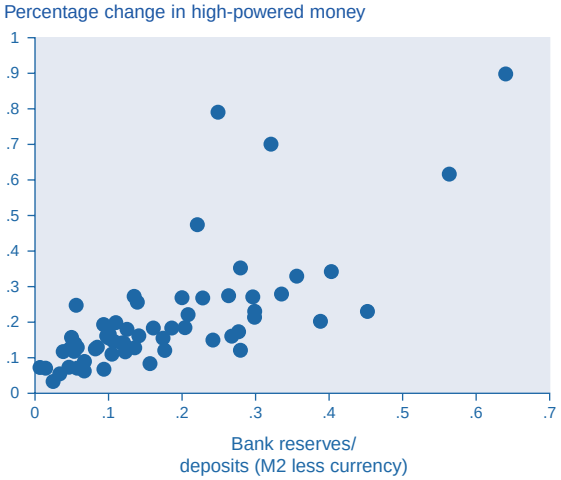
Do countries that rely heavily on seigniorage revenue also exhibit large year-to-year volatility in their earnings from money creation? The answer indicates whether countries tend to rely on seigniorage revenue consistently or if there are periods of heavy reliance on seigniorage interspersed with periods in which countries rely less on it. A positive correlation between the seigniorage ratio and volatility would show that countries with large values of *S/Y*, for example, also tend to experience greater year-over-year variability in the *S/Y* ratio. Conversely, if the correlation coefficient is negative, then countries that have relatively high *S/Y* ratios tend to experience less variability in the year-to-year reliance on seigniorage.

The correlation coefficient between a country's average reliance on seigniorage revenue and its sample standard deviation is 0.8462. Thus, the high correlation coefficient suggests that countries with high seigniorage rates have the greatest volatility in year-over-year realizations. In other words, countries that rely, on average, more heavily on money creation as a source of revenue also tend to exhibit the largest variability in reliance from year to year. In contrast, countries that rely relatively little on seigniorage revenue tend to receive about the same fraction of GNP from year to year.[13]

Figure 1 focuses on the two monetary policy variables. Specifically, it plots combinations of the average reserve ratio and the average money growth rate for each country in this sample. The plot suggests that a country with a high average reserve ratio has a high average money growth rate. Formal statistics support the notion that the reserve ratio and money growth are positively related; the correlation coefficient between the reserve ratio and the money growth rate is 0.72.

Thus, three facts emerge from this preliminary review of the data. These facts serve to answer the primary question of how much countries rely on seigniorage revenue. First, for most countries, seigniorage revenue accounts for less than 2 percent of output. Second, countries with the highest average reliance on seigniorage revenue also tend to have the greater year-to-year volatility in the *S/Y* ratio. Third, the evidence suggests that monetary policy settings are not independent of one

Figure 1
Cross-Country Plots of Reserve Requirements Versus Money Growth



another; countries with high money growth rates also tend to have high reserve ratios.

MONETARY POLICY AND SEIGNIORAGE

To determine whether a relationship exists between a country's monetary policy settings and its reliance on seigniorage revenue, I present results from a simple regression. Because of this potentially nonlinear relationship, I use a sufficient statistic, z, to measure monetary policy settings. Specifically, let $z = [R/D/(1 + R/D)][g/(1 + g)]$. The economics motivating this decision is sketched out in the box entitled "A Case for Combining the Money Growth Rate with the Reserve Ratio." Statistical issues also arise, in part, because of the evidence presented in Figure 1. Recall from Figure 1 (and the correlation coefficient) that countries with high average reserve ratios tend to have high average money growth rates. By studying the contribution of each of the monetary policy measures, multicollinearity is a potential problem; that is, if two independent variables are highly correlated, the standard errors of the coefficients are inflated, creating inference problems. In measuring monetary policy settings with a single variable, I am assuming that z is a sufficient statistic for monetary policy. As a sufficient statistic, z is useful because changes in it capture changes in each of the monetary policy variables being studied. As such, z is serving as a measure of the overall thrust of monetary policy as it relates to seigniorage revenue.

One additional property of z is noteworthy. It is straightforward to show that the definition of z implies a concave relationship between it and each of the two monetary policy variables. To illustrate this, consider the effect of a change in the reserve ratio, holding the money growth rate constant. As the reserve ratio increases, z increases also, but the change in z will be smaller as the reserve ratio increases. In other words, for a given increase in the reserve ratio, z will increase at a diminishing rate. The same holds if, for example, the money growth rate increases, holding the reserve ratio constant. With a positive coefficient on z, the relationship between the seigniorage rate and each of the monetary policy variables is concave.[14]

In the benchmark regression, I include the squared value of z and a constant term as additional explanatory variables. In doing so, it is possible to assess whether there are any additional nonlinearities that characterize the relationship between a country's monetary policy settings and its reliance on seigniorage revenue. If the additional quadratic term in the regression is significant, this relationship will vary as z varies. For instance, if the coefficient on z^2 is significantly less than zero, the evidence suggests that the relationship is concave. Conversely, if the coefficient on the squared term is significantly greater than zero, the evidence indicates that the relationship is convex.[15]

The results from the benchmark regression are reported in column 1 of Table 2.[16] The coefficient on z is significantly greater than zero, while the coefficient on z^2 is not significantly different from zero. Thus, the evidence is consistent with the notion that countries with high monetary policy settings (high z values) tend to rely more heavily on seigniorage revenue than do countries with lower monetary policy settings (low z values). As discussed above, the evidence suggests a positive, concave relationship between a country's reserve ratio and money growth rate and its reliance on seigniorage revenue. Further, the adjusted R^2—a measure of the variation in seigniorage that is accounted for by the regression variables—indicates the monetary policy measure accounts for more than 40 percent of the variation in the S/Y ratio, which is a reasonably good fit for a cross-country sample.

Table 2
Regression Results for Seigniorage Ratios and Monetary Policy Variable

Dependent variable: S/Y

Variable	Benchmark model	Financial sophistication I	Financial sophistication II
constant	.011* (.0032)	.0094* (.0034)	.0113* (.0032)
z	.3982† (.1788)	.4273† (.1722)	.3835† (.1808)
z^2	–.0915 (1.157)	–.1554 (1.1854)	–.0072 (1.1545)
y 65‡	—	–.338E-06 (.416E-06)	—
OECD	—	—	–.006§ (.0033)
OECD•z	—	—	–1.144* (.3909)
OECD•z^2	—	—	165.817* (37.035)
adjusted R^2	.448	.504	.437
Standard error of the estimate	.0148	.0135	.0149

NOTE: Standard errors in parentheses.

* Significant at the 1 percent level.
† Significant at the 5 percent level.
‡ Per capita real GDP in 1965.
§ Significant at the 10 percent level.

A Case for Combining the Money Growth Rate with the Reserve Ratio

In this box, I show that the *S/Y* ratio, in equilibrium, is a nonlinear function of the reserve requirement and money growth rate. This application is a modified version of the economy developed in Champ and Freeman (1994). The chief feature of the model is that a person engages in market activity for two consecutive periods. In other words, *N* people enter market activity at each date *t*, stay for two periods, and then exit. It is equivalent to interpret this setup as one in which people are alive for two periods. In this context for a particular date *t*, those entering the market for the first time are "the young," and those entering the second period of market activity are "the old." Each person receives labor income when young, but nothing when old. Time is discrete and is indexed by $t = 1, 2, 3$, and so on. I assume there are *N* people at date $t = 1$ who have only one period in the economy; members of this generation are the "initial old." Preferences are identical for all people born at date *t* and after.

For simplicity, I focus exclusively on a stationary version of the following economy. All people born at date $t = 1$ and later have identical preferences. Thus, without loss of generality, one can focus on the problem of the representative person, which is characterized by the following equations:

$$\max_{c1,c2} \ln(c_{1t}) + \beta \ln(c_{2t+1}) \tag{B.1}$$

$$y \geq c_{1t} + a_t \tag{B.2}$$

$$c_{2t+1} \leq q_{t+1} a_t \tag{B.3}$$

$$a_t = v_t m_t + d_t \tag{B.4}$$

$$v_t m_t \geq \gamma d_t, \tag{B.5}$$

where c_{1t} is the young person's consumption at date *t*; c_{2t+1} is old-age consumption by the person born at date *t*; β is the person's discount factor; *y* is the person's labor income; *a* is the total quantity of goods saved by the young person; *q* is the gross return on savings carried from date *t* to date $t + 1$; and *d* is the quantity of goods stored as bank deposits by the young person. A person can also choose fiat money, which is *m*. Here, *v* stands for the value of fiat money—that is, the quantity of the consumption good that can be purchased with one unit of money. The consumption good is perishable.

Equation B.1 is a function that describes the welfare a representative person receives during a market-active period. The person seeks to maximize welfare by consuming as much of the consumption good as possible. Equation B.2 represents the two options—to save or to consume—that the typical young person faces when young, while Equation B.3 indicates that the typical old person can consume up to the value of principal and interest earned on savings. Equation B.4 shows that savings are in the form of either real money balances or bank deposits. Lastly, Equation B.5 is the reserve requirement, dictating that real money balances cannot be less than γ percent of bank deposits.

I assume that deposits offer a greater return than fiat money. Consequently, the typical person will hold the minimum quantity of fiat money balances. Equations B.4 and B.5, therefore, imply that $a_t = (1 + \gamma) d_t$. Substitute for *a* in Equations B.2 and B.3, and solve Equation B.3 for $(1 + \gamma) d_t$, substituting the result into Equation B.2. After the algebra, the expression is

$$y \geq c_{1t} + c_{2t+1}/q_{t+1}, \tag{B.6}$$

which is the person's lifetime budget.

To maximize lifetime utility, the typical person will choose first- and second-period consumption so that

$$\frac{1}{c_{1t}} = \frac{\beta q}{c_{2t+1}}. \tag{B.7}$$

Equation B.7 is an efficiency condition. It says that labor income will be allocated between first- and second-period consumption so that the benefits received from the last good consumed when young (measured by $1/c_{1t}$) are equal to the benefits received from the last good consumed when old (measured by $\beta q/c_{2t+1}$). In this economy, the optimizing conditions imply that the typical person will spend all of the labor income. Hence, Equation B.6 holds with equality.

In a stationary equilibrium, $c_{1t} = c_{1t+1}$ and $c_{2t+1} = c_{2t+2}$ at any date *t*, so that one can drop the time subscripts. For a stationary equilibrium, Equations B.6 and B.7 imply that $c_1 = y/(1 + \beta)$. With $0 < \beta < 1$, the typical person will spend a fixed fraction of labor income on consumption when young.

One might ask why the equilibrium expression for c_1 does not contain *q*. The answer is that a change in the gross return on assets has two opposing effects on consumption when young: substitution and wealth. With the substitution effect, an increase in *q*, for example, makes consumption when young more expensive relative to consumption when old. (Note that in the lifetime budget constraint [Equation B.6], $1/q$ can be interpreted as the price of consumption when old.) Thus, an increase in the gross return to assets would induce people to consume less when young and more when old. With the wealth effect, when c_2 becomes less expensive, consuming more of both c_1 and c_2 is possible. As such, an increase in *q*, for instance, will induce people to consume more when young. Clearly, the substitution and wealth effects have opposing impacts on consumption when young. With log utility, these effects exactly offset each other. Consequently, in a stationary equilibrium the value of c_1 is independent of movements in the gross return on assets.

A Case for Combining the Money Growth Rate with the Reserve Ratio (*continued*)

With $c_1 = y/(1 + \beta)$, the level of bank deposits can be represented as

$$d = \frac{\gamma}{1+\gamma}\left(\frac{\beta}{1+\beta}\right). \tag{B.8}$$

Next, substituting Equation B.8 into Equation B.5 yields the expression for the equilibrium value of real money balances; formally,

$$v_t m_t = \frac{\beta}{1+\beta} \cdot \frac{\gamma}{1+\gamma} y. \tag{B.9}$$

Here one can see the importance of the equilibrium expression for consumption when young. Because of the substitution and wealth effects, neither the quantity of deposits nor the quantity of real money balances is affected by changes in the gross return on assets. The implication is that the tax base for real seigniorage revenue is not affected by changes in real return on assets.

Expressing the equilibrium value of real seigniorage revenue is now possible. Substituting Equation B.9 into the expression for real seigniorage revenue yields $v_t m_t (1 - 1/\theta)$. With $g = \theta - 1$, I divide the expression by y so that the equilibrium reliance on seigniorage revenue per young person is

$$\frac{s}{y} = \frac{\beta}{1+\beta} \cdot \frac{\gamma}{1+\gamma} \cdot \frac{g}{1+g}. \tag{B.10}$$

Equation B.10 indicates that the equilibrium s/y ratio is a nonlinear function of the reserve ratio and the money growth rate.[1] Indeed, it is straightforward to show that the equilibrium value of s/y is a concave function of both the reserve requirement ratio and the money growth rate (see note 12).

To see how a change in monetary policy affects the equilibrium seigniorage ratio, consider a permanent, unanticipated increase in the reserve requirement ratio. In this model economy, Equation B.5 indicates that the holdings of real money balances will increase. Remember that the equilibrium level of deposits is not affected even though q will decline. Thus, the model economy predicts that the equilibrium seigniorage ratio will rise in response to an increase in the reserve requirement.

Next, consider a permanent, unanticipated increase in the money growth rate. With faster money growth, Equation B.10 indicates that an economy's reliance on real seigniorage revenue will increase. With an increase in g, the tax rate on real seigniorage revenue will rise and the gross return on assets will decline. Because of the utility function, the equilibrium quantity of real money balances is not affected by the decline in the gross real return on assets. Thus, faster money growth translates into an increase in the seigniorage ratio.

For this model economy, the s/y ratio increases with respect to an increase in either the reserve requirement ratio or money growth rate, but at a declining rate. For different utility specifications, substitution and wealth effects would not necessarily cancel each other out. Hence, the typical person could respond to an increase in q by increasing consumption when young, thereby saving less. Accordingly, a young person could reduce holdings of real money balances by enough to see a decline in the s/y ratio for a given increase in either the reserve requirement or the money growth rate. The purpose of this box is to illustrate the basic economic trade-offs. Hence, arguing the appropriate utility specification is outside the scope of this article.

Overall, Equation B.10 suggests a particular sufficient statistic for assessing the relationship between monetary policy and a country's reliance on seigniorage revenue. Throughout the statistical analysis, I use the product $z = [\gamma/(1 + \gamma)][g/(1 + g)]$ as the measure of monetary policy.

Note

[1] Here, the s/y ratio pertains to the ratio of per capita levels, which accounts for the use of lowercase letters.

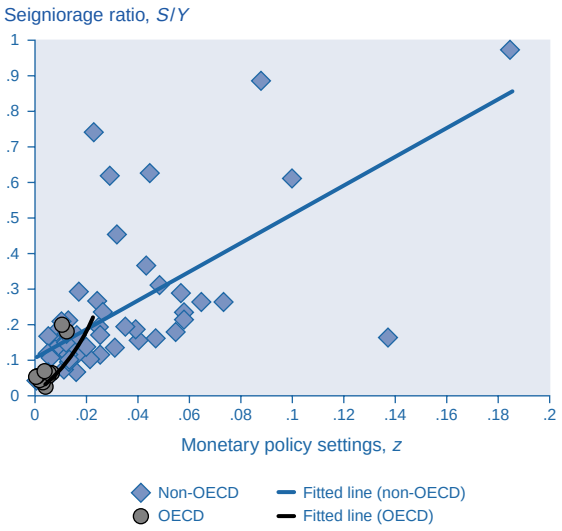
Important differences across countries could alter the relationship between monetary policy and the reliance on seigniorage revenue. For example, with only z as an explanatory variable, the regression's constant term captures any differences between countries. Insofar as differences across countries can be measured, additional insight may be gained into the relationship between monetary policy and reliance on seigniorage. Such measurements indicate whether the results obtained in this analysis are robust.

A particular concern is the ability of people to avoid the inflation tax. Such avoidance depends, in part, on a country's financial sophistication. Citizens in countries with more sophisticated financial structure, for instance, can avoid taxation by shifting to nonreservable deposits. They can also dodge the tax by shifting from currency to, say, credit cards as the means of payment. It would seem prudent, therefore, to measure a country's financial sophistication to assess whether this omitted variable affects the relationship between a country's monetary policy settings and its reliance on seigniorage.

The measure of financial sophistication should not depend on the monetary policy set-

Figure 2

Seigniorage–Income Ratio and Monetary Policy Settings



tings to get an accurate estimate of the coefficient between monetary policy and seigniorage reliance. In other words, movements in the measure should not reflect behaviors related to monetary policy settings, and yet the variable should be reasonably well correlated with a country's level of financial sophistication. In reality, finding such a measure is quite difficult. Two variables are offered as proxies for financial sophistication: the level of real per capita GDP in 1965 and a dummy variable indicating whether the country is a member of the Organization for Economic Cooperation and Development (OECD).[17] Certainly OECD membership and monetary policy settings are conceivably linked as part of a country's policy package. The more modest claim is that OECD membership and per capita real GDP are less likely to respond to movements in the monetary policy settings than are financial-sophistication measures such as bank deposits.

Figure 2 plots the combination of z and S/Y as well as separate fitted lines for non-OECD and OECD countries. Each line is fitted to a regression of the form $(S/Y)_I = c_0 + \alpha z_i + \beta z_i^2$. These two fitted lines appear quite different. Based on this preliminary look at the data, the evidence suggests that the relationship between a country's monetary policy statistic and its reliance on seigniorage revenue is different for developed countries than it is for less developed countries. Indeed, the fitted line for the non-OECD countries is upward sloping, whereas the one for the OECD countries appears to have some curvature.

I report regression results in columns 2 and 3 of Table 2. Here, I use two proxies to measure financial sophistication; one is the OECD membership, and the other is per capita real income in 1965. Two different sets of results emerge. Specifically, with per capita real income as the measure of financial sophistication, the evidence suggests a linear relationship between seigniorage reliance and z. As such, the evidence suggests, as it did when no financial sophistication measures were included, that countries that rely the most heavily on seigniorage revenue have higher monetary policy settings.

Consider, however, the results for a case in which OECD membership is used as a proxy for financial sophistication. These regression results correspond to the evidence presented in Figure 2. The formal statistical analysis supports the eyeball difference presented in the figure; that is, the z–S/Y relationship is significantly different for OECD countries than for non-OECD countries. The coefficient on $OECD \bullet z$ is negative and significant, and the coefficient on $OECD \bullet z^2$ is positive and significant. Thus, the evidence suggests that the relationship between seigniorage rates and monetary policy settings is convex. Indeed, the evidence indicates that an OECD country reaches a minimum reliance on seigniorage revenue at a value of $z = 0.0023$.

To illustrate this result, suppose one is looking at two OECD countries—country A and country B. Each has a different monetary policy setting, with country A always associated with the lower value of z. According to the regression statistics, if $z < 0.0023$ for both countries, then country B would rely less on seigniorage revenue than would country A. In contrast, for $z > 0.0023$, the regression predicts that country B would rely more on seigniorage revenue than would country A.[18]

The convex relationship exhibited by OECD countries is puzzling. In the model economy described in the box, financial sophistication would seem to permit a country's citizens to avoid the inflation tax. Given an increase in z, the equilibrium outcome for the S/Y ratio would either decline or increase, but at a decreasing rate as people avoid the inflation tax. In other words, it is reasonable to expect that increased tax-avoidance capabilities would result in a more concave relationship between a country's monetary policy settings and its reliance on seigniorage revenue, not a more convex one.

Overall, the evidence suggests that there is a systematic, positive relationship between a

country's monetary policy settings and its reliance on seigniorage revenue. Thus, countries with higher monetary policy settings tend to rely more heavily on seigniorage. But compared with less financially sophisticated countries, the more financially sophisticated countries tend to rely on seigniorage revenue at an increasing rate. The findings with respect to financial sophistication are difficult to explain and deserve more attention.

CONCLUDING REMARKS

I present evidence in this article on the importance of seigniorage revenue and its relationship to monetary policy. I use cross-country observations to examine whether the average money growth rate and average reserve ratio are systematically related to a country's reliance on seigniorage revenue. Both economic and statistical considerations suggest that some combination of the money growth rate and the reserve ratio should be used in the empirical analysis. Consequently, a country's monetary policy setting is measured using a combination variable as opposed to investigating two separate relationships—one between seigniorage reliance and the reserve ratio and the other between seigniorage reliance and the money growth rate.

The main finding in this article is that there is a systematic, positive relationship between a country's monetary policy settings and its reliance on seigniorage revenue. Thus, countries that rely most heavily on seigniorage revenue tend to have the highest values of the monetary policy measure. There is some additional evidence that the relationship between the monetary policy variable and the seigniorage rate is nonlinear for OECD countries. Here, OECD membership is used as a proxy for financial sophistication. The evidence suggests that OECD countries rely on seigniorage revenue at an increasing rate for given changes in the monetary policy variable.

The findings in this article constitute a very preliminary investigation of the relationship between seigniorage revenue and monetary policy. There is always a risk of excluding a key variable in a regression, and that risk certainly holds here. One approach would be to control for a host of other environmental factors—for example, a more complete analysis of the depth and structure of financial markets.

The most surprising and, in some ways, the most interesting results are those differentiating between financially developed and less financially developed countries. If these results were to stand up to further scrutiny, economic theory would need to address the puzzle. One possible line of research would be to consider a simple open economy in which two countries differ in terms of financial sophistication and monetary policy rules.

Another avenue for future research would be to recognize that monetary policy variables and seigniorage revenue are jointly determined. While I have tried to describe the correlations without referring to any monetary policy as "causing" movements in seigniorage revenue, the estimated regressions could be interpreted as treating monetary policy as exogenous to the determination of such revenue. Edwards and Tabellini (1991) examine seigniorage revenue as the outcome of various political forces that influence, among other things, monetary policy settings. Thus, future research could attempt to disentangle the relative importance of political factors, controlling for monetary policy explicitly.

NOTES

[1] See Cox (1992) for an excellent discussion of the practical relationship between the Federal Reserve and the U.S. Treasury. For an interesting description of seigniorage in medieval times, see Rolnick, Velde, and Weber (1994).

[2] For reference, the United States raises, on average, about 2 percent of federal government expenditures through money creation.

[3] After all the accounting is consolidated for the government and the central bank, the net change in the government's income state is that money creation amounts to a revenue source to cover various expenses.

[4] Bryant and Wallace (1984) offer an explanation for the coexistence of government bonds and money. They argue that the two types of government paper effectively price discriminate between "rich" and "poor" households.

As far as my assumption about one-period bonds is concerned, I could examine a more complicated maturity structure for government debt. Such generality would not alter the conclusions that I reach about seigniorage revenue, but it would mean that I would have to keep tabs on the entire distribution of government bonds and when each one matures.

[5] The reduction in reported income can come either from effective avoidance or from people working less or acquiring less capital. Of course, the discussion describes what happens to the steady-state level of income.

[6] There is no explicit interest on money. Consequently, its one-period rate of return is calculated as the ratio of the date t price (the potential selling price) to the

date $t-1$ price (the purchase price). Formally, this is the ratio of v_t/v_{t-1}. With $v_t = 1/p_t$, then simple substitution yields the expression for the gross real return on money.

[7] Here, the reserve requirement pins down the fraction of a person's portfolio held in the form of money balances. This approach is qualitatively the same as one in which the reserve requirement pins down the bank's portfolio.

[8] The data set is available from the author upon request.

[9] Fischer is primarily interested in describing why countries maintain national currencies. Computing the seigniorage-to-GNP ratio demonstrates how important seigniorage is. The ratio represents the command over resources that a government obtains by creating money.

[10] The income tax analog is the average marginal tax rate. See, for example, Seater (1985).

[11] Historically, the U.S. reserve requirement structure was more convoluted. In the past, for example, it mattered whether the commercial bank was located in a Reserve Bank city or outside.

[12] Interestingly, Fischer (1982) presents evidence that several governments have made substantial use of seigniorage. In Fischer's sample, which generally covers the period between 1960 and 1978, Argentina collected, on average, 6.2 percent of GNP through money creation.

[13] This result does not bear directly on the relative importance of seigniorage revenue. Rather, it bears on the issue of variability within a country across time. In short, the reader gains a sense of how the countries in the sample rely on seigniorage over time.

[14] The effect of a change in the reserve ratio, holding money growth constant, is given by the following derivative: $\partial z/\partial(R/D) = W/(1 + R/D)^2$, where $W = g/(1 + g)$. With $W > 0$, the expression says z is increasing the reserve ratio. In addition, $\partial^2 z/\partial(R/D)^2 = (-2 \bullet W)/(1 + R/D)^3$, which is negative for $W > 0$.

[15] To see this relationship, suppose the estimated regression is given by

$$S/Y = c_0 + \alpha z + \beta z^2.$$

For a country with a 1-percentage-point higher average z, an estimate of the change in S/Y is $\alpha + 2\beta z$. Thus, a 1-percentage-point change in z depends on the value of z.

[16] In all regressions, the Newey–West procedure is applied to correct any potential bias in standard errors. In this particular application, heteroskedasticity is the chief worry.

[17] Per capita real GDP comes from the Summers–Heston Penn World Tables. In addition, regressions are run using per capita real GDP for 1980 and 1994 as alternative measures of financial sophistication in case the 1965 GDP value suffers from some time-specific factors. The regressions are qualitatively the same as those reported in Table 2.

[18] Three OECD countries in this sample — France, the Netherlands, and Norway — have z values less than 0.0023. Using the method outlined in Fomby, Hill, and Johnson (1984, 58), one can compute the standard errors for the value of z at which seigniorage reliance is minimized. With 90 percent confidence, the seigniorage-reliance minimizing value of z is between 0.0022 and 0.0024.

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The Economics of the Private Equity Market

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This article examines the economic foundations of the private equity market and describes its institutional structure.

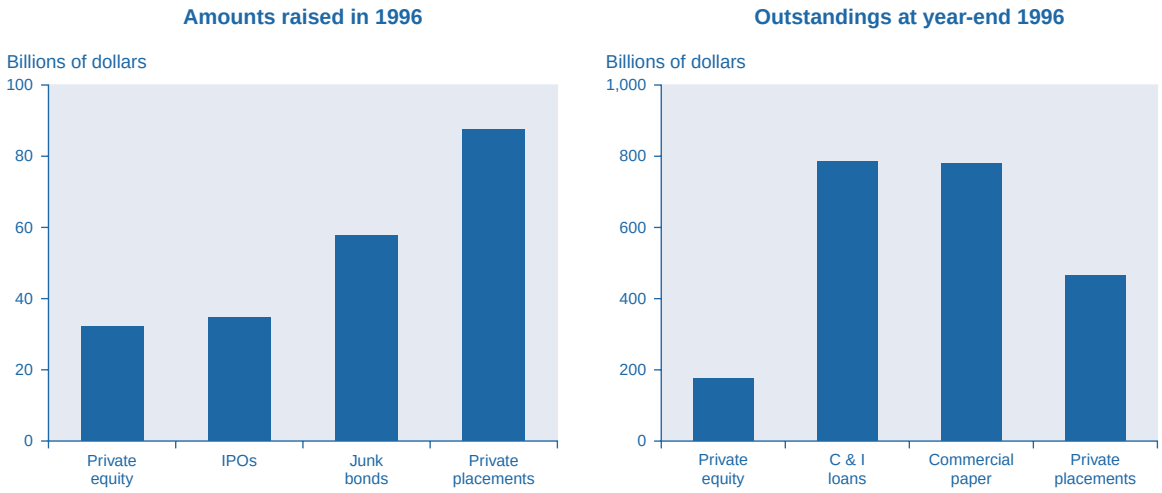
The private equity market is an important source of funds for start-ups, private middle-market companies, firms in financial distress, and public firms seeking buyout financing.[1] Over the past fifteen years, it has been the fastest growing market for corporate finance, far surpassing others such as the public equity and bond markets and the market for private placement debt. Today the private equity market is roughly one-quarter the size of both the market for commercial and industrial bank loans and the market for commercial paper in terms of outstandings (*Figure 1*). In recent years, private equity capital raised by partnerships has matched, and sometimes exceeded, funds raised through initial public offerings and gross issuance of public high-yield corporate bonds. Probably the most celebrated aspect of the private equity market is the investment in small, often high-tech, start-up firms. These investments often fuel explosive growth in such firms. For example, Microsoft, Dell Computer, and Genentech all received private equity backing in their early stages. In addition, the private equity market supplied equity funds in the huge leveraged buyouts of such large public companies as Safeway, RJR Nabisco, and Beatrice in the 1980s.

Despite its dramatic growth and increased significance for corporate finance, the private equity market has received little attention in the financial press or the academic literature.[2] The lack of attention is due partly to the nature of the instrument itself. A private equity security is exempt from registration with the Securities and Exchange Commission by virtue of its being issued in transactions "not involving any public offering." Thus, information about private transactions is often limited, and analyzing developments in this market is difficult.

This article examines the economic foundations of the private equity market and describes its institutional structure. First, I briefly discuss the growth of the limited partnership as the major intermediary in the private equity market over the last fifteen years. Next, I explain the overall structure of the market, focusing in turn on the major investors, intermediaries, and issuers. I then look at returns to private equity over the last fifteen years. Finally, I analyze the role of limited partnerships and why they are a particularly effective form of intermediary in the private equity market. This entails a detailed examination of the contracts these partnerships write with their investors and the companies in which the partnerships invest.

Figure 1

Flows and Outstandings in Private Equity and Other Corporate Finance Markets



SOURCES: Federal Reserve Board flow of funds accounts; author's estimates.

THE GROWTH OF LIMITED PARTNERSHIPS IN THE PRIVATE EQUITY MARKET

The private equity market consists of professionally managed equity investments in the unregistered securities of private and public companies.[3] Professional management is provided by specialized intermediaries called limited partnerships, which raise money from institutional investors and invest it in both publicly and privately held corporations. Private equity managers acquire large ownership stakes and take an active role in monitoring and advising companies in which they invest. They often exercise as much or more control than company insiders.

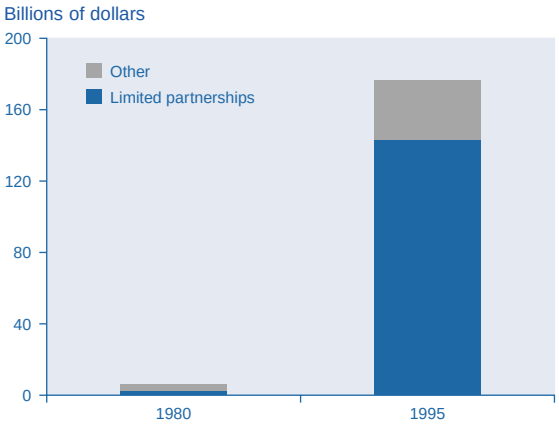
The growth of private equity is a classic example of how organizational innovation, aided by regulatory and tax changes, can ignite activity in a particular market. In this case, the innovation was the widespread adoption of the limited partnership as the means of organizing private equity investments. Until the late 1970s, private equity investments were undertaken mainly by wealthy families, industrial corporations, and financial institutions investing directly in issuing firms. By contrast, most investment since 1980 has been undertaken by intermediaries on behalf of institutional investors. The major intermediary is the limited partnership; institutional investors are the limited partners, and professional investment managers are the general partners.

The emergence of the limited partnership as the dominant form of intermediary is a result of the extreme information asymmetries and incentive problems that arise in the private equity market. The specific advantages of limited partnerships are rooted in the way in which they address these problems. The general partners specialize in finding, structuring, and managing equity investments in closely held private companies. Limited partnerships are among the largest and most active shareholders with significant means of both formal and informal control and thus can direct companies to serve the interests of their shareholders. At the same time, limited partnerships employ organizational and contractual mechanisms that align the interests of the general and limited partners.

Limited partnership growth was also fostered by regulatory changes in the late 1970s that permitted greater private equity investment

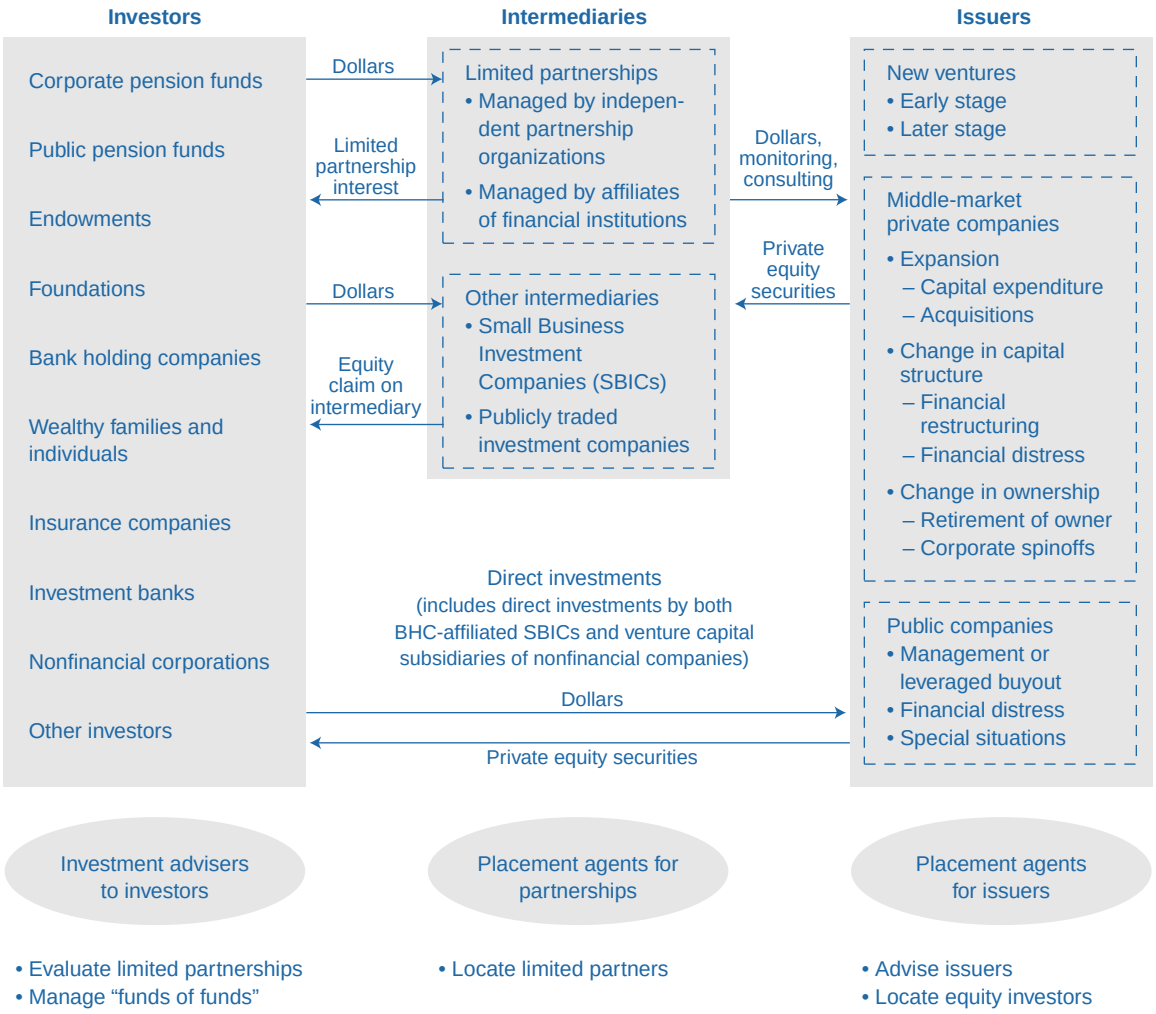
Figure 2

Private Equity Capital Outstanding, by Source of Funds, 1980 and 1995



SOURCES: *Venture Economics*; Fenn, Liang, and Prowse (1997).

Figure 3
Organized Private Equity Market



by pension funds. The results of these changes are telling: from 1980 to 1995, the amount of capital under management in the organized private equity market increased from roughly $4.7 billion to over $175 billion. In addition, limited partnerships went from managing less than 50 percent of private equity investments to managing more than 80 percent (*Figure 2*).[4] Most of the remaining private equity stock is held directly by investors, but even much of this direct investment activity is the result of knowledge that these investors have gained investing in and alongside limited partnerships.

THE STRUCTURE OF THE ORGANIZED PRIVATE EQUITY MARKET

The organized private equity market has three major players and an assortment of minor ones. Figure 3 illustrates how these players interact with each other. The left-hand column lists the major investors, the middle column lists major intermediaries, and the right-hand column lists the major issuers in the private equity market. Arrows pointing from left to right indicate the flow of dollars and other services; arrows pointing from right to left indicate the flow of private equity securities or other claims. The bottom of Figure 3 lists an assortment of agents and investment advisors that help issuers or intermediaries raise money or advise investors on the best intermediaries in which to invest. The role of each of these players in the private equity market is discussed below.

Investors

Figure 4 illustrates the total estimated private equity outstanding at year-end 1996 and the portions held by the various investor groups. Public and corporate pension funds are the largest groups, together holding roughly 40 percent of capital outstanding and currently

supplying close to 50 percent of all new funds raised by partnerships.[5] Public pension funds are the fastest growing investor group and recently overtook private pension funds in terms of the amount of total private equity held. Endowments and foundations, bank holding companies, and wealthy families and individuals each hold about 10 percent of total private equity. Insurance companies, investment banks, and nonfinancial corporations are the remaining major investor groups. Over the 1980s the investor base within each investor group broadened dramatically, but still only a minority of institutions within each group (primarily the larger institutions) hold private equity.

Most institutional investors invest in private equity for strictly financial reasons, specifically because they expect the risk-adjusted returns on private equity to be higher than those on other investments and because of the potential benefits of diversification.[6] Bank holding companies, investment banks, and nonfinancial corporations may also invest in the private equity market to take advantage of economies of scope between private equity investing and their other activities. Commercial banks, for example, are large lenders to small and medium-sized firms. As such, they have contact with many potential candidates for private equity. Conversely, by investing in a private equity partnership, banks may be able to generate lending opportunities to the firms in which the partnership invests. Nonfinancial firms typically invest in early-stage developmental ventures that may fit with their competitive and strategic objectives.

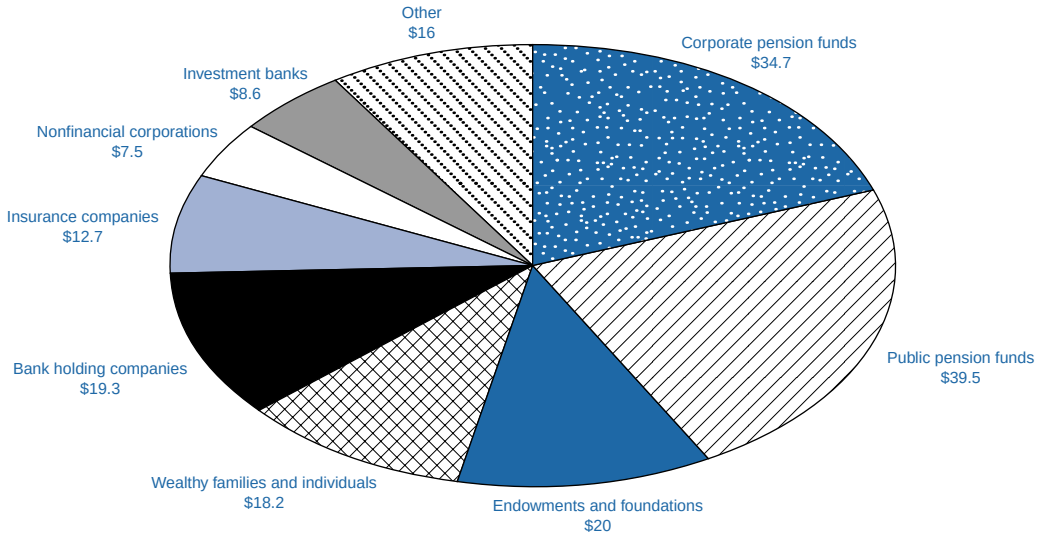
Intermediaries

Intermediaries—mainly limited partnerships—manage an estimated 80 percent of private equity investments. Under the partnership arrangement, institutional investors are the limited partners and a team of professional private equity managers serves as the general partners. Most often the general partners are associated with a partnership management firm (such as the venture capital firm Kleiner Perkins Caufield & Byers or the buyout group Kohlberg Kravis Roberts & Co.). Some management companies are affiliates of a financial institution (an insurance company, bank holding company, or investment bank); the affiliated companies generally are structured and managed no differently than independent partnership management companies.

Investment companies not organized as limited partnerships—Small Business Investment Companies (SBICs), publicly traded investment companies, and other companies—today play only a marginal role as intermediaries in the private equity market.[7] SBICs, established in 1958 to encourage investment in private equity, can leverage their private capital with loans from, or guaranteed by, the Small Business Administration.[8] In the 1970s they accounted for as much as one-third of private equity investment, but today they account for

Figure 4
Investors in the Private Equity Market, by Holdings of Outstandings at Year-End 1996

Billions of dollars



Total Private Equity Outstanding = $176.5 billion

Table 1
Characteristics of Major Issuers in the Private Equity Market

Characteristic	Early-stage new ventures	Later stage new ventures	Middle-market private firms	Public and private firms in financial distress	Public buyouts	Other public firms
Size	Revenues between zero and $15 million	Revenues between $15 million and $50 million	Established, with stable cash flows between $25 million and $500 million	Any size	Any size	Any size
Financial attributes	High growth potential	High growth potential	Growth prospects vary widely	May be over-leveraged or have operating problems	Under-performing High levels of free cash flow	Depend on reasons for seeking private equity
Reason(s) for seeking private equity	To start operations	To expand plant and operations To cash out early-stage investors	To finance a required change in ownership or capital structure To expand by acquiring or purchasing new plant	To effect a turnaround	To finance a change in management or in management incentives	To ensure confidentiality To issue a small offering For convenience Because industry is temporarily out of favor with public equity markets
Major source(s) of private equity	"Angels" Early-stage venture partnerships	Later stage venture partnerships	Later stage venture partnerships Nonventure partnerships	"Turnaround" partnerships	LBO and mezzanine debt partnerships	Nonventure partnerships
Extent of access to other financial markets	For more mature firms with collateral, limited access to bank loans	Access to bank loans to finance working capital	Access to bank loans For more mature, larger firms, access to private place-ment market	Very limited access	Generally, access to all public and private markets	Generally, access to all public and private markets

less than $1 billion of the $176.5 billion market. The reduced role of SBICs has resulted in part from their inability to make long-term equity investments when they themselves are financed with debt. Publicly traded investment companies also played a role in the past, but today fewer than a dozen such companies are active, and together they manage less than $300 million. Apparently the long-term nature of private equity investing is not compatible with the short-term investment horizons of stock analysts and public investors.[9]

The dramatic growth of the limited partnership as the major intermediary in the private equity market is a result of the limited partnership's success in mitigating the severe information problems that exist in the market—both for institutional investors looking for appropriate partnerships in which to invest and for partnerships looking for appropriate portfolio company investments. The mechanisms the limited partnerships use to control these problems are explored in detail in a following section.

Issuers

Issuers in the private equity market vary widely in size and their motivation for raising capital, as well as in other ways. They do share a common trait, however: because private equity is one of the most expensive forms of finance, issuers generally are firms that cannot raise financing from the debt or public equity markets.

Table 1 lists six major issuers of private equity and their main characteristics. Issuers of

Table 2
Average Internal Rates of Return for Venture and Nonventure Private Equity Limited Partnerships and for Public Small-Company Stocks

Average annual return (percent)

Partnerships formed in:	Venture capital	Nonventure capital	Public small-company stocks
1969–79	23.3	—	11.5*
1980–84	10.0	24.8	15.3†
1985–89	15.2	15.3	13.4‡
1990–91	24.1	28.9	15.6§

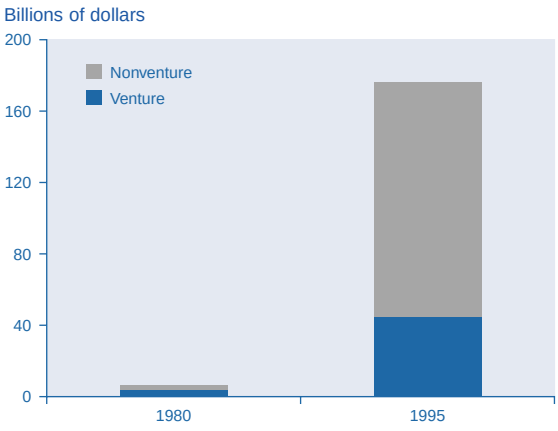
* Over the period 1969 to 1988.
† Over the period 1980 to 1993.
‡ Over the period 1985 to 1996.
§ Over the period 1990 to 1996.

SOURCE: Fenn, Liang, and Prowse (1997).

traditional venture capital are young firms, most often those developing innovative technologies that are predicted to show very high growth rates in the future. They may be early-stage companies, those still in the research and development stage or the earliest stages of commercialization, or later stage companies, those with several years of sales but still trying to grow rapidly.

Since 1980, nonventure private equity investment—comprising investments in established public and private companies—has outpaced venture investment, as illustrated in Figure 5. Nonventure investments include those in middle-market companies (roughly, those with annual sales of $25 million to $500 million), which have become increasingly attractive to private equity investors. Many of these companies are stable, profitable businesses in low-technology manufacturing, distribution, services, and retail industries. They use the private equity market to finance expansion—through new capital expenditures and acquisitions—and to finance changes in capital structure and in ownership (the latter increasingly the result of private business owners reaching retirement age).

Figure 5
Private Equity Capital Outstanding, by Type of Investment, 1980 and 1995



SOURCES: *Venture Economics*; Fenn, Liang, and Prowse (1997).

Public companies also are issuers in the nonventure sector of the private equity market. Such companies often issue a combination of debt and private equity to finance their management or leveraged buyout. Indeed, between the mid- and late 1980s such transactions absorbed most new nonventure private equity capital. Public companies also issue private equity to help them through periods of financial distress, to avoid registration costs and public disclosures, and to raise funds during periods when their industry is out of favor with public market investors.

Agents and Advisors

Also important in the private equity market is a group of "information producers" whose role has increased significantly in recent years. These are the agents and advisors who place private equity, raise funds for private equity partnerships, and evaluate partnerships for potential investors. They exist because they reduce the costs associated with the information problems that arise in private equity investing. Agents facilitate private companies' searches for equity capital and limited partnerships' searches for institutional investors; they also advise on the structure, timing, and pricing of private equity issues and assist in negotiations. Advisors facilitate institutional investors' evaluations of limited partnerships; they may be particularly valuable to financial institutions unfamiliar with the workings of the private equity market.

RETURNS IN THE PRIVATE EQUITY MARKET

A major reason for the explosive growth of the private equity market since 1980 has been the anticipation by institutional investors of returns substantially higher than can be earned in alternative markets. Of course, private equity investments are regarded as considerably more risky and more illiquid than other assets. For those institutional investors that can bear such risk and illiquidity, however, the high expected returns are a major attraction.

Available data indicate that returns to private equity have at times far exceeded returns in the public market. Table 2 shows internal

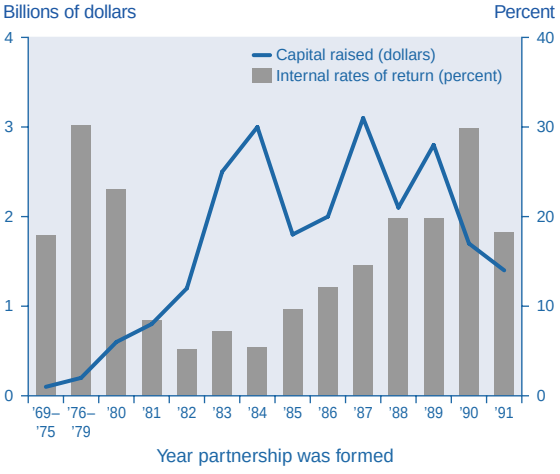
rates of return on venture and nonventure private equity partnerships during the period in which the partnership was formed. These returns are those experienced by the limited partners; they are measured net of management fees and other partnership expenses. Returns to partnerships that have not yet been liquidated reflect the valuation of a residual component comprising investments whose market values are unknown but are often reported at cost. This may bias downward the returns reported for the funds formed from the mid-1980s onward.

Overall, Table 2 suggests that returns to private equity have generally been above those experienced in the public equity market. The fourth column of Table 2 shows the annual average returns on a portfolio of public small-company stocks over various periods. These periods are intended to be roughly comparable with the ones during which the partnerships listed were earning the bulk of their returns.[10] Except for the early 1980s, returns to both venture and nonventure private equity are greater than returns to public small-company stocks, sometimes substantially so. Whether this is enough to compensate investors for the increased risk of such investments is, of course, another matter. However, as mentioned above, returns for more recent partnerships may be biased downward.

Table 2 also suggests that returns have been higher for nonventure than for venture partnerships. This pattern may partly explain the faster growth of the later stage and, particularly, nonventure sectors of the private equity market over the past fifteen years.

To a certain extent, returns are driven by capital availability. For venture investments, for example, returns have been greatest on investments made during periods when relatively small amounts of capital were available (*Figure 6*). Conversely, there is concern, if not a large amount of evidence, that periods of greater capital availability depress future returns.

Figure 6
Capital Raised by Venture Capital Partnerships and Internal Rates of Return as of 1995



SOURCE: Fenn, Liang, and Prowse (1997).

Table 3
Mechanisms Used to Align the Interests of Participants in the Private Equity Market

Limited partners – general partners	Partnership – portfolio companies
Performance incentives	Performance incentives
Reputation	Managerial ownership
General partner compensation	Managerial compensation
Direct means of control	**Direct means of control**
Partnership covenants	**Voting rights**
Advisory boards	**Board seats**
	Access to capital

NOTE: Most important mechanisms are in bold type.

THE ROLE OF LIMITED PARTNERSHIPS IN THE PRIVATE EQUITY MARKET

Accompanying the rapid growth of the private equity market in the 1980s was the rise of professionally managed limited partnerships as intermediaries, as illustrated in Figure 2. In certain respects, the success of limited partnerships is paradoxical. Funds invested in such partnerships are illiquid over the partnership's life, which in some cases runs more than ten years. During this period, investors have little control over the way their funds are managed. Nevertheless, the increasing dominance of limited partnerships suggests that they benefit both investors and issuers.

Table 3 provides an overview of the mechanisms that are used to align the interests of (1) the limited and general partners and (2) the partnerships and the management of the companies in which they invest. These mechanisms can be categorized under the broad headings of performance incentives and direct means of control.

As shown on the left-hand side of Table 3, performance incentives that align the interests of the limited and general partners are twofold. First, the general partners must establish a favorable track record to raise new partnerships. Second, they operate under a pay-for-performance scheme in which most of their expected compensation is a share of the profits earned on

investments. These provisions are the principal means by which the interests of the general and limited partners are harmonized. Of secondary importance are direct control mechanisms such as partnership agreements and advisory boards composed of limited partners. Partnership agreements give limited partners restricted direct control over the general partners' activities. These agreements consist mainly of restrictions on allowable investments and other partnership covenants, which the advisory board can waive by majority vote.

In contrast, the direct means of oversight and control are the principal mechanisms for aligning the interests of the partnership and portfolio company management. The most important of these mechanisms are a partnership's voting rights, its seats on the company board, and its ability to control companies' access to additional capital. Performance incentives for company management, including managerial ownership of stock, are also important but are secondary to direct partnership control.

Information Problems in Private Equity Investing

Two types of problems frequently occur when outsiders finance a firm's investment activity—sorting problems and incentive problems. Sorting (or adverse selection) problems arise in the course of selecting investments. Firm owners and managers typically know much more about the condition of their business than do outsiders, and it is in their interest to accent the positive while downplaying potential difficulties (see Leland and Pyle 1977; Ross 1977). Incentive (or moral hazard) problems arise in the course of the firm's operations. Managers have many opportunities to take actions that benefit themselves at the expense of outside investors.

Private equity is used in financing situations in which the sorting and incentive problems are especially severe.[11] Resolving these problems requires that investors engage in intensive preinvestment due diligence and postinvestment monitoring. These activities are not efficiently performed by large numbers of investors; there can either be too much of both types of activities because investors duplicate each others' work, or too little of each owing to the tendency for investors to free ride on the efforts of others. Thus, delegating these activities to a single intermediary is potentially efficient.

The efficiency of intermediation depends on how effectively the sorting and incentive problems between the ultimate investors and intermediaries can be resolved.[12] In the private equity market, reputation plays a key role in addressing these problems because the market consists of a few actors that repeatedly interact with each other. For example, partnership managers that fail to establish a favorable track record may subsequently be unable to raise funds or participate in investment syndicates with other partnerships.[13]

Overview of Private Equity Partnerships

Private equity partnerships are limited partnerships in which the senior managers of a partnership management firm serve as the general partners and institutional investors are the limited partners. The general partners are responsible for managing the partnership's investments and contributing a very small proportion of the partnership's capital (most often, 1 percent); the limited partners provide the balance and bulk of the investment funds.

Each partnership has a contractually fixed lifetime—generally ten years—with provisions to extend the partnership, usually in one- or two-year increments, up to a maximum of four years. During the first three to five years, the partnership's capital is invested. Thereafter, the investments are managed and gradually liquidated. As the investments are liquidated, distributions are made to the limited partners in the form of cash or securities. The partnership managers typically raise a new partnership fund at about the time the investment phase for an existing partnership has been completed. Thus, the managers are raising new partnership funds approximately every three to five years and at any one time may be managing several funds, each in a different phase of its life. Each partnership is legally separate, however, and is managed independently of the others.

A partnership typically invests in ten to fifty portfolio companies (two to fifteen companies a year) during its three- to five-year investment phase. The number of limited partners is not fixed: most private equity partnerships have ten to thirty, though some have as few as one and others more than fifty.[14] The minimum commitment is typically $1 million, but partnerships that cater to wealthy individuals may have a lower minimum and larger partnerships may have a $10 million to $20 million minimum.

Most partnership management firms have six to twelve senior managers who serve as general partners, although many new firms are started by two or three general partners and a few large firms have twenty or more. Partnership management firms also employ

associates—general partners in training—usually in the ratio of one associate to every one or two general partners. General partners often have backgrounds as entrepreneurs and senior managers in industries in which private equity partnerships invest and, to a lesser extent, in investment and commercial banking.

RELATIONSHIP BETWEEN A PARTNERSHIP AND ITS PORTFOLIO COMPANIES

Partnership managers receive hundreds of investment proposals each year. Of these proposals, only about 1 percent are chosen for investment. The partnership managers' success depends upon their ability to select these proposals efficiently. Efficient selection is properly regarded as more art than science and depends on the acumen of the general partners acquired through experience operating businesses as well as experience in the private equity field.

Investment proposals are first screened to eliminate those that are unpromising or that fail to meet the partnership's investment criteria. Private equity partnerships typically specialize by type of investment and by industry and location of the investment. Specialization reduces the number of investment opportunities considered and reflects the degree of specialized knowledge required to make successful investment decisions.

This initial review consumes only a few hours and results in the rejection of up to 90 percent of the proposals the partnership receives. In many cases, the remaining proposals are subjected to a second review, which may take several days. Critical information included in the investment proposal is verified and the major assumptions of the business plans are scrutinized. As many as half the proposals that survived the initial screening are rejected at this stage.

Proposals that survive these preliminary reviews become the subject of a more comprehensive due-diligence process that can last up to six weeks. It includes visits to the firm; meetings and telephone discussions with key employees, customers, suppliers, and creditors; and the retention of outside lawyers, accountants, and industry consultants. For proposals that involve new ventures, the main concerns are the quality of the firm's management and the economic viability of the firm's product or service (Gladstone 1988). For proposals involving established firms, the general objective is to gain a thorough understanding of the existing business, although the precise focus of the investigation varies with the type of investment. With distressed companies, efforts are focused on discussions with the company's lenders; for buyouts of family-owned businesses, management succession issues will warrant greater attention; and for highly leveraged acquisitions, efforts will focus on developing detailed cash-flow projections.

Extensive due diligence in the private equity market is needed because little, if any, information about issuers is publicly available and in most cases the partnership has had no relationship with the issuer. Thus, the partnership must rely heavily on information that it can produce *de novo*. Moreover, the management of the issuing firm typically knows more than outsiders do about many aspects of its business. This information asymmetry, combined with the fact that issuing private equity is very expensive, has the potential to create severe adverse selection problems for investors. In the private equity market, this problem is mitigated by the extensive amount of due diligence and by the fact that alternative sources of financing for private equity issuers are limited.

Information asymmetries between investors and managers of the issuing firm give rise to a potential moral hazard problem, whereby management pursues its own interests at the expense of investors. Private equity partnerships rely on various mechanisms to align the interests of managers and investors. These mechanisms can be classified into two main categories. The first category comprises mechanisms that relate to performance incentives, including the level of managerial stock ownership, the type of private equity issued to investors, and the terms of management employment contracts. The second comprises mechanisms that relate to direct means of control of the firm, including board representation, allocation of voting rights, and control of access to additional financing. These mechanisms are examined in turn.

Performance Incentives

Managerial Stock Ownership. Private equity managers usually insist that the portfolio firm's senior managers own a significant share of their company's stock, and stock ownership often accounts for a large part of managers' total compensation. In venture capital, management stock ownership varies widely depending upon the management's financial resources and the company's financing needs and projected future value. It also depends upon the number of rounds of financing, as dilution typically occurs

with each round. Even in later stage companies, however, management ownership of 20 percent is not unusual. For nonventure companies, managerial share ownership usually ranges between 10 percent and 20 percent.

A common provision in both venture and nonventure financing is an equity "earn-out" (Golder 1983). This arrangement allows management to increase its ownership share (at the expense of investors) if certain performance objectives are met.

Type of Private Equity Issued to Investors. Convertible preferred stock is the private equity security most frequently issued to investors. The major difference between convertible preferred stock and common stock is that holders of preferred stock are paid before holders of common stock in the event of liquidation. From the partnership's standpoint, this offers two advantages. First, it reduces the partnership's investment risk. Second, and more important, it provides strong performance incentives to the company's management because management typically holds either common stock or warrants to purchase common stock. If the company is only marginally successful, its common stock will be worth relatively little. Thus, the use of convertible preferred stock mitigates moral hazard problems. Subordinated debt with conversion privileges or warrants is sometimes used as an alternative way of financing the firm: it confers the same liquidation preference to investors as convertible preferred equity and, thus, the same performance incentives to management.

Management Employment Contracts. In principle, management's equity position in the firm could induce excessive risk taking. However, management compensation can also be structured to include provisions that penalize poor performance, thereby offsetting incentives for risk taking. Such provisions often take the form of employment contracts that specify conditions under which management can be replaced and buyback provisions that allow the firm to repurchase a manager's shares in the event that he or she is replaced.

Mechanisms of Direct Control

Although managerial incentives are a very important means of aligning the interests of management and investors, a private equity partnership relies primarily on its ability to exercise control over the firm to protect its interests.

Board Representation. In principle, a firm's board of directors bears the ultimate responsibility for the management of the firm, including hiring and firing the CEO, monitoring and evaluating the firm's performance, and contributing significantly to the firm's business and financial planning process.

General partners can be extremely influential and effective outside directors. As large stakeholders, they have an incentive to incur the expense necessary to monitor the firm. Moreover, they have the resources to be effective monitors—in the form of their own staff members, information acquired during the due-diligence process, and the expertise acquired while monitoring similar companies.

Private equity partnerships in many cases dominate the boards of their portfolio companies. Lerner (1994) reports that general partners hold more than one-third of the seats on the boards of venture-backed biotechnology firms, which is more than the share held by management or other outside directors. Even if it is a minority investor, a private equity partnership usually has at least one board seat and is able to participate actively in a company's management.

Allocation of Voting Rights. For early-stage new ventures, leveraged buyouts, and financially distressed firms, the investment is often large enough to confer majority ownership. In other situations, the partnership may obtain voting control even if it is not a majority shareholder. Even if the partnership lacks voting control, however, it is generally the largest nonmanagement shareholder. Thus, it has a disproportionate degree of influence on matters that come to a shareholder vote.

In general, a partnership's voting rights do not depend on the type of stock issued. For example, holders of convertible preferred stock may be allowed to vote their shares on an "as-converted" basis. Similarly, subordinated debt can be designed so that investors have voting rights should a vote take place. The issue of voting control can also be addressed by creating separate classes of voting and nonvoting stock.

Control of Access to Additional Financing. Partnerships can also exercise control by providing a company with continued access to funds. This is especially the case for new ventures. Venture capital is typically provided to portfolio companies in several rounds at fairly well-defined development stages, generally with the amount provided just enough for the firm to advance to the next stage of development. Even if diversification provisions in the partnership agreement prevent the partnership itself from providing further financing, the general partners have the power, through their extensive contacts, to bring in other investors.

Conversely, if the original partnership is unwilling to arrange for additional financing, it is unlikely that any other partnership will choose to do so; the reluctance of the original partnership is a strong signal that the company is a poor investment.

Nonventure capital is also provided in stages, though to a lesser extent. For example, middle-market firms that embark on a strategy of acquisitions periodically require capital infusions to finance growth; that capital is not provided all at once. Similarly, companies that undergo leveraged buyouts are forced to service debt out of free cash flow and subsequently must justify the need for any new capital (Palepu 1990).

Other Control Mechanisms. Other mechanisms by which partnerships control and monitor the activities of the companies in which they invest include covenants that give the partnership the right to inspect the company's facilities, books, and records and to receive timely financial reports and operating statements. Other covenants require that the company not sell stock or securities, merge or sell the company, or enter into large contracts without the approval of the partnership.

RELATIONSHIP BETWEEN THE LIMITED PARTNERS AND THE GENERAL PARTNERS

By investing through a partnership rather than directly in issuing firms, investors delegate to the general partners the labor-intensive responsibilities of selecting, structuring, managing, and eventually liquidating private equity investments. However, limited partners must be concerned with how effectively the general partners safeguard their interests. Among the more obvious ways in which general partners can further their own interests at the expense of the limited partners are spending too little effort monitoring and advising portfolio firms, charging excessive management fees, taking undue investment risks, and reserving the most attractive investment opportunities for themselves.

Private equity partnerships address these problems in two basic ways: by using mechanisms that relate to performance incentives and mechanisms that relate to direct means of control. Performance incentives are the more important means of aligning general partners' interests with those of the limited partners. These incentives involve the general partners' need to protect their reputations and the terms of the general partners' compensation structure, such as their share of the profits. These incentives can significantly curtail the general partners' inclination to engage in behavior that does not maximize value for investors. Direct control mechanisms in the partnership agreement are relatively less important means of controlling the moral hazard problem between general and limited partners.

Performance Incentives

Reputation. Partnerships have finite lives. To remain in business, private equity managers must regularly raise new funds, and fund raising is less costly for more reputable firms. In fact, to invest in portfolio companies on a continuous basis, managers must raise new partnerships once the funds from the existing partnership are fully invested, or about once every three to five years.

Raising partnership funds is time consuming and costly, involving presentations to institutional investors and their advisors that can take from two months to well over a year, depending on the general partners' reputation and experience. A favorable track record is important because it conveys some information about ability and suggests that general partners will take extra care to protect their reputation. Also, experience itself is regarded as an asset. To minimize their expenses, partnership managers generally turn first to those who invested in their previous partnerships—assuming, of course, that their previous relationships were satisfactory.

Certain features of a partnership enhance the ability of the general partners to establish a reputation. These features essentially make both the partnership's performance and the managers' activities more transparent to investors than might be the case for other financial intermediaries. One such feature is segregated investment pools. By comparing one partnership's investment returns with those of other partnerships raised at the same time, it is easier to account for factors that are beyond the control of the general partners, such as the stage of the business cycle or the condition of the market for initial public offerings, mergers, and acquisitions. By contrast, if private equity intermediaries did not maintain segregated investment pools, earnings would represent a blend of investment returns that occur at different stages of the business cycle or under different market conditions.

Another feature is the separation of management expenses and investment funds. In a limited partnership, management fees are specified in the partnership agreement (described

below). Thus, the amount of investment capital that can be consumed in the form of manager salaries and other perquisites is capped. Moreover, because such expenses are transparent, it is easier to compare expenses across partnerships. Other types of financial intermediaries pay expenses and finance investments out of the same funds raised from investors; although expenses are reported, they are difficult to control before the fact and are not always transparent after the fact.

Compensation Structure. General partners earn a management fee and a share of a partnership's profits, the latter known as carried interest. For a partnership that yields average returns, carried interest may be several times larger than the management fees (Sahlman 1990). This arrangement—providing limited compensation for making and managing investments and significant compensation in the form of profit sharing—lies at the heart of the partnership's incentive structure.

Management fees are frequently set at a fixed percentage of committed capital and remain at that level over the partnership's life. Fee percentages range from 1 percent to 3 percent. Carried interest is most often set at 20 percent of the partnership's net return.

Direct Control Mechanisms

Partnership agreements also protect limited partners' interests through covenants that place restrictions on a partnership's investments and on other activities of the general partners. Restrictions on investments are especially important because a considerable portion of the general partners' compensation is in the form of an option-like claim on the fund's assets. This form of compensation can lead to excessive risk taking. In particular, it may be in the interest of the general partners to maximize the partnership's risk—and hence the expected value of their carried interest—rather than the partnership's risk-adjusted expected rate of return.

To address the problem of excessive risk taking, partnership covenants usually set limits on the percentage of the partnership's capital that may be invested in a single firm. Covenants may also preclude investments in publicly traded and foreign securities, derivatives, other private equity funds, and private equity investments that deviate significantly from the partnership's primary focus. Finally, covenants usually restrict the fund's use of debt and in many cases require that cash from the sale of portfolio assets be distributed to investors immediately.

Partnership covenants also limit deal fees (by requiring that deal fees be offset against management fees), restrict coinvestment with the general partners' earlier or later funds, and restrict the ability of general partners and their associates to coinvest selectively in the partnership's deals.

Finally, partnership agreements allow limited partners some degree of oversight over the partnership. Most partnerships have an advisory board composed of the largest limited partners. These boards help resolve conflicts involving deal fees and conflict-of-interest transactions. They do so by approving exemptions from partnership covenants. Special committees are also created to help determine the value of the partnership's investments. However, these two types of bodies do not provide the kind of management oversight that a board of directors can for a corporation; indeed, their power is limited by the legal nature of the partnership, which prohibits limited partners from taking an active role in management.

CONCLUSION

This article has presented an economic analysis of the private equity market. In particular, it has detailed how the contracts that limited partnerships write with investors and portfolio firms address many of the adverse selection and moral hazard problems that face investors considering investments in small and medium-sized firms.

The private equity market's success in addressing these problems is evidenced by the large number of successful firms that received initial financing in this market. This success has been much admired in the rest of the industrialized world, particularly in Japan and Germany. In these countries, private equity markets of the U.S. kind do not exist, primarily due to the heavily regulated nature of their securities markets, and so firms rely much more on bank financing. While such bank-centered systems may have had advantages in the past, there is an increasing feeling that such systems may not adequately provide funds for small and medium-sized firms that are the engine of future economic growth and innovation. Both Japan and Germany have recently taken steps to deregulate their financial markets. By fostering the growth of U.S. private equity market practices, these countries hope to solve the informational and governance problems of small firms looking for capital.

NOTES

[1] This article draws selectively from a longer, more comprehensive research paper on the private equity market by Fenn, Liang, and Prowse (1997).

[2] Some studies have been made of particular market sectors, such as venture capital and leveraged buyouts (LBOs) of large public companies. On venture capital, see Sahlman (1990) and special issues of *Financial Management* (1994) and *The Financier* (1994). For a summary of the LBO literature, see Jensen (1994).

[3] An equity investment is any form of security that has an equity participation feature. The most common forms are common stock, convertible preferred stock, and subordinated debt with conversion privileges or warrants.

[4] The emergence of limited partnerships is actually more dramatic than these figures indicate. As recently as 1977, limited partnerships managed less than 20 percent of the private equity stock.

[5] These and other figures in this section are my estimates based on information from a variety of sources. See Fenn, Liang, and Prowse (1997) for details on how these estimates are constructed.

[6] Private equity is often included in a portfolio of "alternative assets" that also includes distressed debt, emerging market stocks, real estate, oil and gas, timber and farmland, and economically targeted investments.

[7] Two other types of private equity organizations are SBICs owned by bank holding companies and venture capital subsidiaries of nonfinancial corporations. Both types were extremely important in the 1960s, and they still manage significant amounts of private equity. However, these organizations invest only their corporate parent's capital. In this sense, neither is really an intermediary but rather a conduit for direct investments. I treat the investments by these organizations as direct investments, not as investments by intermediaries.

[8] See the *Venture Capital Journal*, October 1983.

[9] This, of course, raises the question of why private equity investments haven't proven to be ideal for closed-end mutual funds, wherein the fund invests money for the long term but investors can get out in the short term.

[10] For example, partnerships in the first row were formed between the years 1969 and 1979. These funds would have invested and earned returns on their capital between the years 1969 and 1988. The first row/fourth column thus shows the annual average return to public small companies over this 20-year period. Returns for small-company stocks for the other periods are similarly calculated. Returns for small-company stocks are after transactions costs (Ibbotson 1997).

[11] In venture investing, for example, the firm is often a start-up with no track record. In a leveraged buyout, while there may be ample information about the firm, management may have little or no incentive to act in equityholders' best interests.

[12] If, for example, investors must investigate the intermediary to the same extent that they would investigate the investments that the intermediary makes on their behalf, using one may be *less* efficient (Diamond 1984).

[13] Intermediaries are also important because selecting, structuring, and managing private equity investments require considerable expertise. Gaining such expertise requires a critical mass of investment activity that most institutional investors cannot attain on their own. Managers of private equity intermediaries are able to acquire such expertise through exposure to and participation in a large number of investment opportunities. Although institutional investors could also specialize in this way, they would lose the benefits of diversification. Finally, intermediaries play an important role in furnishing business expertise to the firms in which they invest. Reputation, learning, and specialization all enhance an intermediary's ability to provide these services. For example, a reputation for investing in well-managed firms is valuable in obtaining the services of underwriters. Likewise, specialization allows an intermediary to more effectively assist its portfolio companies in hiring personnel, dealing with suppliers, and helping in other operations-related matters.

[14] Many partnerships that have a single limited partner have been initiated and organized by the limited partner rather than by the general partner. Such limited partners are in many cases nonfinancial corporations that want to invest for strategic as well as financial reasons—for example, a corporation that wants exposure to emerging technologies in its field.

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