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A PORTFOLIO APPROACH TO A CROSS-SECTORAL AND CROSS-NATIONAL INVESTMENT STRATEGY IN TRANSITION ECONOMIES

Willem H. Buiter
Ricardo Lago
Hélène Rey

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ABSTRACT

This paper takes a systematic look at the portfolio choice problem faced by Investment Banks or Funds investing in transition economies. We relate the performance of projects in the transition economies to the broader macroeconomic and international environment, which affect the project through its input-output structure and its financial balance sheet. Among the macroeconomic determinants of enterprise behavior we consider are productivity growth, real wage growth, movements in the international terms of trade, shocks to the relative price of traded and non-traded goods, domestic and foreign interest rates, currency depreciation and the rate of inflation. We evaluate the attractiveness of alternative investment strategies and provisioning rules from the perspective of portfolio theory.

Willem H. Buiter
Faculty of Economics & Politics
University of Cambridge
Austin Robinson Building
Sidgwick Avenue
Cambridge CB3 9DD
UNITED KINGDOM
and NBER
willem.buiter@econ.cam.ac.uk

Ricardo Lago
European Bank for Reconstruction
and Development
One Exchange Square
London EC2A 2AE
UNITED KINGDOM

Hélène Rey
Centre for Economic Performance
London School of Economics
Houghton Street
London WC2A 2AE
UNITED KINGDOM

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1. Introduction.

This paper investigates how the portfolio choice problem faced by an Investment Bank or *Fund* contemplating investing in transition economies is conditioned by the broader macroeconomic and international environment. The basic approach is first to relate the pecuniary returns on the Fund's lending operations and equity investments to the broader economic developments that the Fund takes as given when making its portfolio choices, and second to evaluate the attractiveness of alternative investment strategies from the perspective of portfolio theory. The outline of the paper is as follows. Section 2 restates very briefly, two basic portfolio theory issues relevant to the management of the Fund's balance sheet. These are (1) the relevant notion of risk as a property of portfolios rather than of individual investments or projects and (2) the distinction between risk-return trade-offs in efficient portfolios and Pareto-improving diversification through the expansion of the available asset menu. Section 3 develops a simple model of industrial or sectoral returns (a simple accounting framework incorporating some assumptions about the technologies and capital structures of enterprises) that can explain the returns on equity investments in and loans to these industries in terms of macroeconomic developments and industry-specific factors. Within a given country, three industries or sectors are distinguished: the traded sector, divided into an exporting and an import-competing sector and the non-traded sector. Section 4 contains an analytical characterization of the constrained mean-variance efficient portfolios of equities, home and foreign currency loans. Section 5 analyzes the risk and return properties of some numerically calibrated portfolios of loans and equity participations. Identical projects in the three sectors are "put through" the different historical macroeconomic environments of a number of transition economies. We consider portfolios diversified across industries and financial instruments but restricted to a single country as well as portfolios diversified across industries, instruments and countries. Section 6 elaborates on four issues. The first three of these can be related immediately to our earlier model and analysis. They are (1) the relative riskiness of loans versus equity participations and the implications of this for provisioning; (2) the currency composition of lending to the various sectors and (3) investing in financial intermediaries. The fourth one concerns the important topic of the implications of capital structure for enterprise governance. It is no more than a warning that our model is not designed to address this issue. Section 7 concludes.

2. Portfolio theory: diversification and efficient asset markets.

The key insight of portfolio theory is that the risk that matters to the portfolio holder is a property of the returns on the entire portfolio of assets and liabilities (or projects), and not of the returns on individual assets and liabilities (or projects). Another way of stating the same insight is that the riskiness of an individual investment (be it a loan, a guarantee or an equity participation) cannot be assessed by considering the properties of the distribution of returns on that investment in isolation; the joint distribution of returns on the entire portfolio of investments is required to price the risk of an individual investment. This obvious (but often forgotten) central point deserves to be stated as a proposition.

Proposition 2.1. *The risk and return that matter are the risk and return on the portfolio as a whole, not the performance of individual investments (projects) in isolation. The riskiness of an individual investment or project can only be assessed by considering its contribution to the uncertainty of the return on the entire portfolio.*

To appreciate what can be achieved in terms of portfolio performance by spreading one's wealth over a larger number of investments, it is essential to distinguish between (1) diversification within the set of efficient portfolios and (2) extending the domain over which portfolio choice can be exercised.

When dealing with efficient portfolios, one inevitably runs into some version of the "there is no such thing as a free lunch" folk theorem. In the remainder of this paper, we consider risk and return in a mean-variance framework, where all that needs to be known about portfolios is contained in the first two moments of the return distribution. A fundamental proposition of financial economics is that for mean-variance efficient equilibrium portfolios the expected rate of return is an increasing affine function of the standard deviation of the rate of return (see e.g. Markovitz [1959], Sharpe [1964], Lintner [1965] and Mossin [1966]). The intercept of this relationship is the riskless rate and its slope (the market price of risk) is the ratio of the excess of the expected rate of return on the market portfolio over the riskless rate, to the standard deviation of the rate of return on the market portfolio. This relationship, often called the *capital market line*, expresses the current terms of trade between risk and return *for efficient portfolios* (or asset combinations).

For a Fund contemplating investing in transition economies, this characterization of the relationship between risk and return in equilibrium for efficient portfolios is irrelevant. We therefore do not constrain the Fund's portfolio choice by imposing the restrictions of efficient asset market equilibrium. Instead, until the transition in Eastern Europe and the FSU is complete, we can restrict ourselves to the "demand side" of portfolio theory; for our purposes, all that matters is the portfolio of projects (equity investments and loans) that the Fund can choose among, regardless of whether the joint returns on these investments are equilibrium returns in the sense required by such equilibrium theories as the Capital Asset Pricing Model (CAPM). The part of portfolio theory that does remain relevant for the Fund is the notion that the risk (as measured, say, by the variance) of a portfolio depends primarily on the covariances among the returns on the investments contained in it.

When the Fund considers whether or not to extend the scope of its portfolio by adding industries to the list of possible investments (for a given set of candidate countries and financial instruments), by adding countries (for a given set of candidate industries and financial instruments) or by adding new types of financial instruments (for a given set of candidate industries and countries), there is scope for improving both the risk and the return on its portfolio. Such a potential Pareto-improvement is possible because the initial asset menu was restricted, that is, inefficient, and because these restrictions are being relaxed. We are not considering moving towards a higher risk but higher return portfolio within the constraints set by some given, constant asset menu. Instead we are increasing the size of the choice set, thus permitting, potentially, a higher expected return for a given risk, a lower risk for a given expected return or indeed a lower risk and a higher expected return. In a very different context, that of global (North-South) financial integration and diversification, this same point has been made very elegantly by Obstfeld [1994].

We summarize this discussion in the following proposition.

Proposition 2.2. *Propositions about risk-return trade-offs in efficient financial markets are not relevant to the Fund when considering its portfolio of projects in Eastern Europe and the FSU. When considering whether or not to extend its portfolio by adding industries, countries or classes of financial instruments, neither the joint returns on the original restricted nor those on the new extended portfolio are subject to the constraints imposed by efficient financial markets. Higher expected return may therefore be obtainable without an increase in risk. The converse is that, if projects are selected badly, higher risk may go together with lower expected return.*

3. The model.

The returns earned by an investor in an industry [1] are the sum of the operating profits of the industry and net returns on the industry's portfolio of financial assets and liabilities (its capital structure). In principle this characterization permits us to use the same framework for financial and non-financial firms, with the former engaged in very limited productive activity relative to the cash flows and capital revaluations associated with their portfolio of financial claims. What follows is an elaboration of the framework developed in Fries and Lago [1994].

3.1. Sectoral returns.

We model the typical national economy as having three productive sectors, the export sector, denoted x, producing exportable goods that are either actually exported or absorbed domestically, the import-competing sector, denoted m, and the non-traded good sector, denoted n. The export sector and the import-competing sector will be referred to collectively as the traded goods sector. For the numerical simulations the three sectoral technologies and capital structures are calibrated on three actual EBRD projects. The exportable project is a chocolate factory, the import-competing project is a bottle manufacturer and the non-traded project is a domestic transportation firm.

Each sector uses the output of the other sectors as inputs, in addition to employing labour and capital. The production technology is of the fixed coefficient or Leontieff variety. Firms own the capital stock they operate. Capital services are priced according to the neoclassical user cost of capital [2]. For simplicity we further assume that the expected rate of inflation of capital goods prices in the three sectors are the same as the overall rate of inflation. The capital structures of the three industries may include domestic- and foreign currency-denominated debt. We assume limited liability.[3] The following notation is used:

p_{K_j}, $j = x, m, n$, is the price of a unit of capital in sector j in terms of the exportable good. π_j , $j = x, m, n$, is the net output per unit of capital in sector j. α_{ij} , $i = x, m, n, \ell$; $j = x, m, n$; $i \neq j$, is the amount of input i used per unit of capital in the production of good j. p_m is the relative price of imports to exports, p_n is the relative price of non-traded goods to exports and w is the wage in terms of exportables. i is the one-period domestic nominal rate of interest; r is the one-period domestic real rate of interest; i^* is the one-period foreign (ECU) rate of interest; δ_j, $j = x, m, n$, is the proportional rate of depreciation of capital in sector j; γ_e is the proportional rate of depreciation of the nominal exchange rate; τ_j, $j = x, m, n$, is the sector-specific tax per unit of capital in sector j; d_j is the ratio of domestic currency debt to capital in sector j and d_j^* the ratio of foreign currency debt to capital in sector j, $j = x, m, n$.

Let z_j denote the resources available per ECU worth of capital, first for servicing debt and then for paying out to shareholders in sector j[4].

In the export sector,

$$z_x \equiv \frac{1}{p_{K_x}}\left[\pi_x - p_m\alpha_{mx} - p_n\alpha_{nx} - w\alpha_{\ell x}\right] - \left[r + \delta_x + \tau_x - \left(\frac{1+i}{1+\gamma^e}\right)\right] \quad (3.1)$$

in the import-competing sector,

$$z_m = \frac{1}{p_{K_m}}\left[-\alpha_{xm} + p_m\pi_m - p_n\alpha_{nm} - w\alpha_{\ell m}\right] - \left[r + \delta_m + \tau_m - \left(\frac{1+i}{1+\gamma_e}\right)\right] \quad (3.2)$$

and in the non-traded sector,

$$z_n = \frac{1}{p_{K_n}}\left[-\alpha_{xn} - p_m\alpha_{mn} + p_n\pi_n - w\alpha_{\ell n}\right] - \left[r + \delta_n + \tau_n - \left(\frac{1+i}{1+\gamma_e}\right)\right] \quad (3.3)$$

Consider how the payoffs to taking an equity participation in a project or to making a loan to that project depend on the risky gross earnings stream z_j generated by the project. We assume that the interest rate charged on a loan is independent of the probability of default on the individual project, but with country-specific spreads over Libor. This is an institutional constraint the Fund is assumed to be subject to. We also assume that there will be no further borrowing or equity issues that could be used to pay current dividends or service debt. Effectively, we consider the simple special case where the firm is wound up at the end of the current period of operation.

The gross rate of return in ECU on an ECU invested in equity, θ_j, is equal to

$$\begin{aligned} \theta_j &= \left(\frac{1}{1-d_j-d_j^*}\right)\left[z_j - \left(\left(\frac{1+i}{1+\gamma_e}\right)d_j + (1+i^*)d_j^*\right)\right] \text{ if } z_j \geq \left(\frac{1+i}{1+\gamma_e}\right)d_j + (1+i^*)d_j^* \\ &= 0 \text{ if } z_j < \left(\frac{1+i}{1+\gamma_e}\right)d_j + (1+i^*)d_j^* \end{aligned} \quad (3.4)$$

Loans are risky when there are states of the world in which z_j is less that the value of its debt obligations (interest plus principal), $\left(\frac{1+i}{1+\gamma_e}\right)d_j + (1+i^*)d_j^*$, or, equivalently, when its net worth $v_j \equiv z_j - \left(\left(\frac{1+i}{1+\gamma_e}\right)d_j + (1+i^*)d_j^*\right)$ is negative. Assume domestic currency debt and ECU debt are of equal seniority. The (gross) rate of return on a domestic currency-denominated loan, $1+\tilde{i}_j$, is given by

$$\begin{aligned} 1+\tilde{i}_j &= 1+i \text{ if } z_j \geq \left(\frac{1+i}{1+\gamma_e}\right)d_j + (1+i^*)d_j^* \quad (3.5) \\ &= (1+i)\left(\frac{z_j}{\left(\frac{1+i}{1+\gamma_e}\right)d_j + (1+i^*)d_j^*}\right) \text{ if } 0 \leq z_j \leq \left(\frac{1+i}{1+\gamma_e}\right)d_j + (1+i^*)d_j^* \\ &= 0 \text{ if } z_j \leq 0 \end{aligned}$$

The (gross) rate of return on an ECU loan, $1+\tilde{i}^*$, is given by

$$\begin{aligned} 1+\tilde{i}_j^* &= 1+i^* \text{ if } z_j \geq \left(\frac{1+i}{1+\gamma_e}\right) d_j + (1+i^*)d_j^* \\ &= (1+i^*)\left(\frac{z_j}{\left(\frac{1+i}{1+\gamma_e}\right) d_j + (1+i^*)d_j^*}\right) \text{ if } 0 \leq z_j \leq \left(\frac{1+i}{1+\gamma_e}\right) d_j + (1+i^*)d_j^* \\ &= 0 \text{ if } z_j \leq 0 \end{aligned} \tag{3.6}$$

Figure 1 shows how the rate of return on equity and the rate of return on an ECU loan [5] vary with the gross earnings of the firm, z_j.

Two things should be noted. First, when the earnings of the firm are uncertain, both the rate of return on equity and the rate of return on loans will be uncertain. Whenever there is some probability that gross earnings will fall below $\left(\frac{1+i}{1+\gamma_e}\right) d_j + (1+i^*)d_j^*$, loans are risky. Second, the rate of return on equity exceeds the rate of return on loans for high earnings realizations (to the right of Ω in Figure 1), that is, for $z_j > \left(\frac{1+i}{1+\gamma_e}\right) d_j + (1+i^*)d_j^* + 1 + i^*$. It is below the rate of return on loans for intermediate realizations of firm earnings (for $0 < z_j < \left(\frac{1+i}{1+\gamma_e}\right) d_j + (1+i^*)d_j^* + 1 + i^*$). The gross rate of return on equity and the gross rate of return on loans are both equal to zero for sufficiently low earnings (when $z_j < 0$).

If the earnings distribution function of the firm is centered on the intermediate range, with rather little weight in the upper tail, then a single loan, taken in isolation, will tend to be less risky than an equity participation in the same firm. If, however, there is a "serious risk of success", that is, considerable weight in the upper tail, the risk-return characteristics of an equity participation will be superior to those of a loan.

Several observers of the transition economies have noted that the nature of the distribution of returns to industrial investment may well be more favourable to equity investment in transition economies than would be the case in mature developed economies. The reason is that the distribution of returns in transition economies tends to be *leptokurtic*, that is, it has "fat tails": there is a lot of weight (relative to what we observe in the OECD countries) attached both to very bad and to very good outcomes and relatively little weight to moderately bad or good outcomes. Figure 2 illustrates this with a moderate example (Figure 2a) and an extreme (bimodal) example (in Figure 2b).

3.2. Correlated industry returns even with independent shocks to fundamentals.

Consider for simplicity a single national economy. Key to the Fund's ability to diversify the risk in its portfolio are the correlations between the three industrial returns, θ_x, θ_m and θ_n. These three returns (or their joint distribution function) are not, however, the fundamentals (or exogenous variables) of this portfolio allocation problem. They are themselves functions of the following list of fundamentals:

Fundamentals characterizing technology and productive efficiency:

- The three sectoral productivity levels: π_j, $j = x, m, n$
- The nine sectoral input-output coefficients: α_{ij}, $i = x, m, n, \ell$; $j = x, m, n$; $i \neq j$
- The three sectoral depreciation rates: δ_j, $j = x, m, n$

Fundamentals characterizing the financial structure of the industries:

- The six domestic currency and ECU sector gearing ratios, d_j and d_j^*, $j = x, m, n$
- The three sector-specific taxes, τ_j, $j = x, m, n$

Key static and intertemporal relative prices:

- The three static relative prices: p_m, p_n and w
- The expected proportional rate of depreciation of the currency: γ_e
- The domestic and ECU nominal interest rates: i and i^* and the domestic real rate of interest, r
- The prices of the capital assets in the three sectors, p_{K_j} , $j = x, m, n$.

Thus, even this very stylized model of investment in three industries in a single country has 34 parameters. The six domestic and ECU sectoral gearing ratios are *predetermined* and known and the three (initial) capital prices are known to the investor, but for the remaining 25 one would, in principle, have to provide a vector of means and a variance-covariance matrix. Adding to the number of countries would raise the number of parameters *pari-passu*. To reduce the problem to manageable size, the sectoral input-output coefficients, the sectoral depreciation rates, the sectoral tax rates and the domestic and ECU nominal interest rates will be treated as non-stochastic. This leaves as fundamental sources of uncertainty the three sector productivity levels π_x, π_m and π_n, the relative price of imports and exports (the reciprocal of the terms of trade) p_m, the relative price of non-traded good and exports, p_n, the real product wage in the exportable sector, w, the domestic real interest rate, r and the expected rate of depreciation of the currency, γ_e.

For expository purposes, these eight random variables will be taken to be independent in what follows. The methods of this paper can, however, be applied without any modification to the case where the variance-covariance matrix of these eight random variables has a non-diagonal structure.

A few comments are appropriate about five of these random variables.

Productivity shocks.

A sectoral productivity shock will, if it is uncorrelated with productivity shocks in other sectors *and with the other fundamentals determining returns* (that is, p_m, p_n, w, r and γ_e), only raise the return in the sector in which they occur. The assumption that all other fundamentals are independent of the sectoral productivity shocks is, however, quite unlikely for the non-traded goods sector. Since p_n is determined by national demand for and supply of non-traded goods, the relative price of non-traded goods is likely to decline, *cet. par.*, when there is a positive productivity shock in the non-traded goods sector, that is, π_n and p_n may well be negatively correlated.

When the government is engaged in economy-wide economic reforms, all the main sectors of the economy may (following any temporary dislocation) benefit in the form of higher efficiency and increased total factor productivity. This would represent a case of positively correlated shocks to the three sectoral productivity levels.

Real wage shocks.

An increase in w, the real wage in terms of exports, will, *cet. par.*, reduce returns in all three sectors, with the magnitude of the decline depending on the labour-intensity of the sectoral production technologies (the $\alpha_{\ell j}$, $j = x, m, n$). Thus real wage shocks will cause returns in the three sectors to be positively correlated: it will not be possibly to eliminate this risk by holding a portfolio diversified across industries.

Terms of trade shocks.

An increase in p_m, the price of imports relative to exports will, *cet. par.*, obviously improve returns in the import-competing sector. It will hurt returns in the other two sectors to the extent that these use imported intermediate inputs (that is, depending on the magnitude of α_{mx} and α_{mn}). Thus, terms of trade shocks will cause the returns in the three sectors to be either uncorrelated ($\alpha_{mx} = \alpha_{mn} = 0$) or negatively correlated ($\alpha_{mx} > 0$ and $\alpha_{mn} > 0$). If imported intermediate inputs are significant in production, there may well be a diversification argument for holding a mixed portfolio of industries.

Shocks to the relative price of non-traded goods.

An increase in the relative price of non-traded goods to exports will, *cet. par.*, improve returns in the non-traded goods sector. It will hurt returns in the other two sectors to the extent that these use non-traded intermediate inputs (that is, depending on the magnitude of α_{nx} and α_{nm}). Thus, real exchange rate shocks will cause the returns in the three sectors to be either uncorrelated ($\alpha_{nx} = \alpha_{nm} = 0$) or negatively correlated ($\alpha_{nx} > 0$ and $\alpha_{nm} > 0$).

Domestic nominal interest rate shocks and shocks to the rate of depreciation of the currency.

It is clear from equations 3.1 to 3.3 that an increase in the domestic nominal rate of interest, i, of , say, n basis points has the same effect on enterprise financial performance as an n point reduction in the proportional rate of depreciation (increase in the proportional rate of appreciation) of the currency, γ_e. The higher the internal gearing ratio, d_j, $j = x, m, n$, the more adverse the effect of a higher domestic interest rate or a higher rate of appreciation of the currency on the financial performance of an industry.

4. Constrained efficient portfolio allocations.

In what follows we focus on the computation and characterization of the *mean-variance efficient frontier,* the set of portfolios with the lowest variance of returns for any given mean return. We do not take the final step of specifying a Fund objective function allowing us to choose among the set of mean-variance efficient portfolios.[6] We now proceed to look at the implications for risk and return on the Fund's portfolio of extending progressively the domain over which portfolio choice can be exercised. We consider in some detail the case where the Fund can invest in equity, domestic currency loans and foreign currency (ECU) loans in a single country. The only other use of resources is investment in safe ECU-denominated loans at a rate i^*. For reasons of space we omit the algebra for the case where diversification across countries is permitted as well, as the extension is straightforward.

4.1. A portfolio of loans and industry equity participations within a country.

Consider portfolio selection among equity participations, domestic currency loans and ECU loans across industries within a single country, as well as safe ECU lending at the rate of interest i^*. Let s_{i_j} be the share of initial wealth allocated to equity in industry i of country j. Let $\tilde{s}_{k_j}$, $k_j = x_j, m_j, n_j$ be the amount lent to sector k of country j in domestic currency loans (with associated rates of return (possibly risky) $\tilde{i}_{k_j}$, expressed as a fraction of initial paid-in capital). Let $\tilde{s}^*_{k_j}$, $k_j = x_j, m_j, n_j$, be the amount lent to sector k of country j in ECU loans (with associated rates of return $i^*_{k_j}$ (possibly risky), also expressed as a fraction of initial paid-in capital[7]). The Fund can also borrow (risklessly) in home country currency, at the riskless rate i_j. The amount borrowed by the Fund in home currency j, expressed as a fraction of initial paid-in capital, is denoted $-\hat{s}_j$.

We assume that short sales of equity are not permitted to the Fund, that is,

$$0 \leq s_{i_j} \qquad i = x, m, n \tag{4.1}$$

We also impose the constraint on the Fund's portfolio choice that total equity investments not exceed the paid-in capital [8], that is

$$0 \leq 1 - s_{x_j} - s_{m_j} - s_{n_j} \tag{4.2}$$

Two further constraints on the Fund's portfolio mix have to be incorporated, in addition to the constraint in equation 4.2 restricting total equity investments not to exceed the Fund's paid-in capital. A constraint like the first one is often written into the constitution or Articles of Agreement of Investment Banks or Funds like the one whose behavior we are modelling here. The second constraint is a quite common operating rule-of-thumb.

It is important to distinguish between the paid-in capital of the Fund A_0^{P*} and its callable capital A_0^{C*}. The total authorized capital of the Fund A_0^* is the sum of these two.

$$A_0^* \equiv A_0^{P*} + A_0^{C*} \tag{4.3}$$

As the Fund itself is assumed not to be subject to default risk, we impose the following constraints

$$\tilde{s}_{k_j} \geq 0; \; \tilde{s}^*_{k_j} \geq 0; \; \hat{s}_j \leq 0 \tag{4.4}$$

We also assume that the Fund is subject to a 'constitutional' constraint restricting the total amount of outstanding loans, equity investments and guarantees not to exceed its ordinary capital resources [9]

. This paper does not consider guarantees and, because of its one–period perspective, does not consider retained earnings. For our purposes this constraint can therefore be expressed as follows: the total amount of outstanding loans and equity investments cannot exceed the total authorized capital. Formally,

$$s_{x_j} + s_{m_j} + s_{n_j} + \tilde{s}_{x_j} + \tilde{s}_{m_j} + \tilde{s}_{n_j} + \tilde{s}^*_{x_j} + \tilde{s}^*_{m_j} + \tilde{s}^*_{n_j} \leq 1 + \rho \tag{4.5}$$

Here ρ is the ratio of callable capital to paid-in capital, that is,

$$\rho \equiv \frac{A_0^{C*}}{A_0^{P*}} \tag{4.6}$$

For example, in the case of the EBRD, paid-in capital is three billion ECU and callable capital seven billion ECU. The value of ρ in this case is therefore equal to $\frac{7}{3} \approx 2.3333....$

The "conventional practice" constraint concerns a rule against home-country currency exposure in the loan portfolio. This means that lending in domestic currency (at the risky rate $\tilde{i}_{k_j}$ for loans to industry k in country j) must be financed by the Fund borrowing in domestic currency, at the riskless rate i_j in country j. Let $-\hat{s}_j$ be the amount of borrowing by the Fund in domestic currency j , expressed as a fraction of initial paid-in capital. Formally, the "no domestic currency exposure in the loan portfolio" constraint is represented by equation 4.7

$$\tilde{s}_{x_j} + \tilde{s}_{m_j} + \tilde{s}_{n_j} + \hat{s}_j = 0 \tag{4.7}$$

End-of-period wealth is now given by equation 4.8.

$$A^* = \tag{4.8}$$

$$A_0^{P*}\left[\begin{array}{c} s_{x_j}\left(\theta_{x_j} - (1+i^*)\right) + s_{m_j}\left(\theta_{m_j} - (1+i^*)\right) + s_{n_j}\left(\theta_{n_j} - (1+i^*)\right) \\ +\tilde{s}_{x_j}\left(\frac{1+\tilde{i}_{x_j}}{1+\gamma_{e_j}} - (1+i^*)\right) + \tilde{s}_{m_j}\left(\frac{1+\tilde{i}_{m_j}}{1+\gamma_{e_j}} - (1+i^*)\right) + \tilde{s}_{n_j}\left(\frac{1+\tilde{i}_{n_j}}{1+\gamma_{e_j}} - (1+i^*)\right) \\ +\hat{s}_j\left(\frac{1+i_j}{1+\gamma_{e_j}} - (1+i^*)\right) + \tilde{s}^*_{x_j}(\tilde{i}^*_{x_j} - i^*) + \tilde{s}^*_{m_j}(\tilde{i}^*_{m_j} - i^*) + \tilde{s}^*_{n_j}(\tilde{i}^*_{n_j} - i^*) \\ +1 + i^* \end{array}\right]$$

Note that the return to the Fund from lending in domestic currencies, net of the cost of borrowing the amount of the loan in domestic currencies is given by $\tilde{s}_{x_j}\left(\frac{\tilde{i}_{x_j}-i_j}{1+\gamma_{e_j}}\right) + \tilde{s}_{m_j}\left(\frac{\tilde{i}_{m_j}-i_j}{1+\gamma_{e_j}}\right) + \tilde{s}_{n_j}\left(\frac{\tilde{i}_{n_j}-i_j}{1+\gamma_{e_j}}\right)$, so it is apparent that, while the currency risk associated with domestic-currency-denominated loans has been eliminated by borrowing in domestic currency to fund these loans, default risk may still be present.

Let s_j denote the 10×1 column vector of risky portfolio shares allocated to equity investments in or loans to industries in country j, $j = 1, 2, ..., J$. Similarly let θ_j be the corresponding 10×1 column vector of returns of country j.

$$s_j \equiv \begin{bmatrix} s_{x_j} \\ s_{m_j} \\ s_{n_j} \\ \tilde{s}_{x_j} \\ \tilde{s}_{m_j} \\ \tilde{s}_{n_j} \\ \hat{s}_j \\ \tilde{s}^*_{x_j} \\ \tilde{s}^*_{m_j} \\ \tilde{s}^*_{n_j} \end{bmatrix} \qquad \theta_j \equiv \begin{bmatrix} \theta_{x_j} - (1+i^*) \\ \theta_{m_j} - (1+i^*) \\ \theta_{n_j} - (1+i^*) \\ \frac{1+\tilde{i}_{x_j}}{1+\gamma_{e_j}} - (1+i^*) \\ \frac{1+\tilde{i}_{m_j}}{1+\gamma_{e_j}} - (1+i^*) \\ \frac{1+\tilde{i}_{n_j}}{1+\gamma_{e_j}} - (1+i^*) \\ \frac{1+i_j}{1+\gamma_{e_j}} - (1+i^*) \\ i^*_{x_j} - i^* \\ \tilde{i}^*_{m_j} - i^* \\ \tilde{i}^*_{n_j} - i^* \end{bmatrix} \tag{4.9}$$

Equation 4.8 can be rewritten more compactly as equation 4.10:

$$A^* = A_0^{P*}\left[s_j'\theta_j + 1 + i^*\right] \tag{4.10}$$

where a prime denotes transposition.

The 10x1 vector of mean returns for country j, denoted μ_j and the 10x10 variance-covariance matrix of returns for country j, denoted Ω_j are given by:

$$\mu_j \equiv \mathcal{E}(\theta_j) \tag{4.11}$$

and

$$\Omega_j \equiv \mathcal{E}\left[\left(\theta_j - \mathcal{E}(\theta_j)\right)\left(\theta_j - \mathcal{E}(\theta_j)\right)'\right] \tag{4.12}$$

Note that if loans are riskless (there is no default risk on at least one of the loans), then Ω_j is singular. In what follows, loans are treated as risky.

The mean and variance of A^*, the return on the entire portfolio, are given by

$$\mathcal{E}(A^*) = A_0^{P*}\left[s_j'\mu_j + 1 + i^*\right] \tag{4.13}$$

and

$$\sigma^2(A^*) = \left(A_0^{P*}\right)^2 s_j'\Omega_j s_j \tag{4.14}$$

The mean-variance efficient frontier is calculated by choosing the vector of portfolio shares s_j so as to minimize $\sigma^2(A^*)$ subject to $\mathcal{E}(A^*) = \overline{\mathcal{E}(A^*)}$ for all feasible values of $\overline{\mathcal{E}(A^*)}$, and subject to the equality and inequality constraints on portfolio shares discussed earlier in this subsection:

(1) No short sales of equity

$$s_{i_j} \geq 0$$

(2) Total equity investment not to exceed paid-in capital

$$s_{x_j} + s_{m_j} + s_{n_j} \leq 1$$

(3) Only Fund borrowing is automatically free of default risk

$$\begin{aligned} \tilde{s}_{k_j} &\geq 0 \\ \tilde{s}^*_{k_j} &\geq 0 \\ \hat{s}_j &\leq 0 \end{aligned}$$

(4) Total equity investments and loans not to exceed total capital

$$s_{x_j} + s_{m_j} + s_{n_j} + \tilde{s}_{x_j} + \tilde{s}_{m_j} + \tilde{s}_{n_j} + \tilde{s}^*_{x_j} + \tilde{s}^*_{m_j} + \tilde{s}^*_{n_j} \leq 1 + \rho$$

(5) No home currency risk exposure in the loan portfolio

$$\tilde{s}_{x_j} + \tilde{s}_{m_j} + \tilde{s}_{n_j} + \hat{s}_j = 0$$

When the first four of these constraints can be ignored, the vector of optimal risky portfolio shares, $\breve{s}_j$, minimizing $\sigma^2(A^*)$ for a given value, $\overline{\mathcal{E}(A^*)}$, of the expected return can be obtained analytically, and is given by

$$\breve{s}_j = \left(\frac{\overline{\mathcal{E}(A^*)} - A_0^{P*}(1+i^*)}{A_0^{P*} \mu_j' \Omega_j^{-1} \mu_j} \right) \Omega_j^{-1} \mu_j$$

When any of the first four constraints are binding, numerical methods have to be resorted to.

When we wish to calculate mean-variance-efficient portfolios of risky investments only, the following additional constraint is imposed[10]

$$s_{x_j} + s_{m_j} + s_{n_j} + \tilde{s}_{x_j} + \tilde{s}_{m_j} + \tilde{s}_{n_j} + \hat{s}_j + \tilde{s}^*_{x_j} + \tilde{s}^*_{m_j} + \tilde{s}^*_{n_j} = 1 \qquad (4.15)$$

5. Macroeconomic determinants of enterprise performance and portfolio choice in transition economies.

In this section we provide a numerical illustration of the framework outlined in the previous two sections, using data for 6 transition economies (group 1 consisting of the Czech Republic, Hungary and Poland, group 2 consisting of Romania, group 3 consisting of the Ukraine and group 4 consisting of Russia)[11]. We simulate the behaviour of three sector-specific investment projects in the historical economic environments of these transition countries between 1992 and 1994, interpreting the sample moments as estimates of the (conditional) means, variances and covariances of the previous section. The differences in investment returns are determined mainly by the different movement in relative prices, productivity levels and interest rates and by the input-output structure. We first focus on "greenfield investments" so that the price of capital is identical across sectors and countries: if i is the country index, $p_{K_{xi}} = p_{K_{m_i}} = p_{K_{n_i}} = 1$. For some of our calculations, we assume that during the first period productivity levels are the same in all the countries. Relaxing this assumption strengthens our main conclusions. Productivity levels for countries and sectors in subsequent periods are then derived endogenously for the remaining periods using both directly available and indirectly derived productivity growth data. We then discuss the case of investment in existing assets, that can trade at a discount or premium.

A brief discussion follows of some of the intermediate steps in computing the return distributions.

5.1. Sectoral price indices.

Data from balance of payments and customs make it possible to compute export and import price indices. These are given in Appendix 1. We can calculate a price index for traded goods (the weights used are the shares of imports, respectively exports, in the sum of imports and exports). Using the CPI, which is a weighted average of both traded and non-traded goods prices, we then calculate a price index for non-traded goods. Price indices are in dollars. Their functional form is Cobb Douglas. The magnitude of the weights has been set at their average value in the period.

5.2. Productivity levels.

Data on productivity growth in the three sectors separately are not available. We have data on industrial or manufacturing productivity growth (taken from the Transition Report 1995 and 1996) and data on GDP per person employed for the whole economy. The only practical option is therefore to interpret the industrial or manufacturing productivity growth figures as the common productivity growth in the two tradable sectors, that is, to assume that productivity growth in the export sector is the same as in the import-competing sector[12].

As regards differential productivity growth between the non-traded sector and the traded sectors as a whole, it makes no sense to assume, in the spirit of Balassa and Samuelson, that differences among the proportional rates of change of sectoral price indices can be interpreted as differentials of productivity growth between these two sectors. The reason is that as real exchange rate movements tend to reflect financial asset market developments and demand effects in general, in addition to or rather than differential productivity growth among sectors. Hyperinflationary episodes in particular push the dollar price of non-traded goods to extremely low levels which should obviously not be interpreted as being due to massive productivity improvements in the non-traded sector. Therefore, we first estimate economy-wide aggregate productivity growth, defined as the growth in the PPP measure of GDP per employed person. Since we know the productivity growth rates in the export and import competing sectors, we can extract an estimate of productivity growth in the non-traded good sector.

The actual level of productivity is calibrated with investment reports of the EBRD (one for each sector): the assumption we make is that the financial rate of return of the investment reports coincides with the expected rate of return on equity in our 1-period model. The financial rates of returns of the projects considered were 37% in the export sector, 9% in the import sector, 14% in the non-traded sector. For *greenfield* investments only, we also make the assumption that the initial level of productivity (in 1991) is the same in all the countries for any given sector, but can differ across sectors.

The resulting productivity levels are given in Appendix 2.

5.3. Input-output coefficients and other data.

Input-output coefficients (measured as inputs per unit of capital) have been extracted from the balance sheet of enterprises of the three sectors as presented in EBRD investment reports[13]. They have no claim to generality but are the only data available. Nevertheless they are consistent with the findings of Lankes and Venables [1996] who state that in their sample export supply projects are "import intensive" and "skilled labour intensive", the labour bill accounting for 24% of the costs. These coefficients are assumed constant over the period of time considered (1992-1994).

Gearing ratios of approximately 18% for both domestic and foreign currency loans, tax rates of 10% and depreciation rates of 6% have also been found in the balance sheets.

Input\Output	Export	Import	Non-traded
Export		0	0
Import	62.48		0.1
Non-traded	2.56	11.18	
Labour	17.15	3.81	10.4

5.4. Returns on investments.

5.4.1. Greenfield investments.

We now estimate returns on greenfield investments. These do not allow for possible discounts on the price of capital for different +countries or sectors.

The returns are computed with historical data between 1992 and 1994 only since we could not get data for earlier years for some of the countries. All averages are GDP-weighted. The returns are gross returns. The interest rates on foreign currency loans are Libor + 150 for group 1, Libor + 300 for groups 2 and 4, Libor + 450 for group 3. Interest rates on domestic currency loans are domestic bank loan rates as provided by IFS data. Gearing ratios, taxes, input output coefficients, initial productivity levels are the same for all sectors and all countries. Returns differ because of different relative prices and wages, different productivity levels, interest rates, inflation rates and exchange rate movements. They are thus determined by the interaction of the same microstructure and different macroeconomic conditions.

Group 1		
	Expected Return	Standard Deviation
θ_x	1.37	0.21
θ_m	1.09	0.11
θ_n	1.14	0.11
$\frac{1+i_x}{1+\gamma^e}$	1.18	0.11
$\frac{1+i_m}{1+\gamma^e}$	1.18	0.11
$\frac{1+i_n}{1+\gamma^e}$	1.18	0.11
$1+\tilde{i}_x^*$	1.06	0.01
$1+\tilde{i}_m^*$	1.06	0.01
$1+\tilde{i}_n^*$	1.06	0.01

Note that in group 1 there is no default on any of the loans.

Group 2		
	Expected Return	Standard Deviation
θ_x	1.26	0.34
θ_m	1.05	0.28
θ_n	1.11	0.37
$\frac{1+\bar{i}_x}{1+\gamma^e}$	0.63	0.32
$\frac{1+\bar{i}_m}{1+\gamma^e}$	0.63	0.32
$\frac{1+\bar{i}_n}{1+\gamma^e}$	0.63	0.32
$1+\bar{i}_x^*$	1.07	0.01
$1+\bar{i}_m^*$	1.07	0.01
$1+\bar{i}_n^*$	1.07	0.01

In group 2 there is no default on loans (although the ECU returns on home currency loans are very poor due to very strong exchange rate depreciation).

Group 3		
	Expected Return	Standard Deviation
θ_x	0.57	0.55
θ_m	0.85	0.73
θ_n	0.67	0.58
$\frac{1+\bar{i}_x}{1+\gamma^e}$	0.36	0.49
$\frac{1+\bar{i}_m}{1+\gamma^e}$	0.36	0.49
$\frac{1+\bar{i}_n}{1+\gamma^e}$	0.36	0.49
$1+\bar{i}_x^*$	0.73	0.63
$1+\bar{i}_m^*$	0.73	0.63
$1+\bar{i}_n^*$	0.73	0.63

There are defaults -on loans and equity[14]- in the import-competing and non-traded good sector.

Group 4		
	Expected Return	Standard Deviation
θ_x	0.54	0.48
θ_m	0.85	0.82
θ_n	0.69	0.74
$\frac{1+i_x}{1+\gamma^e}$	0.42	0.69
$\frac{1+i_m}{1+\gamma^e}$	0.42	0.69
$\frac{1+i_n}{1+\gamma^e}$	0.42	0.69
$1+i_x^*$	0.72	0.62
$1+i_m^*$	0.72	0.62
$1+i_n^*$	0.72	0.62

In group 4, there are some defaults -on loans and equity- in the three sectors.

The data we have on domestic interest rates are obviously not excessively reliable. When we look for the optimal portfolio, we will therefore limit ourselves to equity and foreign currency loans. But it is true that the "bad" quality of our data on interest rates also affects -more indirectly- our returns on foreign currency loans and equity. Very shaky macroeconomic conditions in groups 3 and 4 for example lead to extreme values of the real interest rate and trigger default for some periods and some sectors. Although the actual figures may not be terribly accurate, the macroeconomic instability they reflect does seem to be genuine. In this respect, our results are quite suggestive. Furthermore, in the Pissarides, Singer and Svejnar [1996] survey, managers tend to rank high interest rates as one of the most serious constraints they face.

From these results, we can see that greenfield investments are generally dominated in groups 2, 3, 4 by investments in groups 1 and 2: greenfield investments have higher returns for countries which are in a more advanced stage of transition. Nevertheless, returns differ widely by sector: equity investment in the export sector in group 2 has a higher expected return than in group 1, and also a higher risk. It is the only exception. Loans can obviously be risky, either because of default risk (in countries of groups 3 and 4) or because of currency risk.

Lankes and Venables [1996] link greenfield investments to the control mode. Fully-owned firms are more likely to be greenfield investments and therefore greenfield investments are more likely to occur when foreign investors want complete control of the whole production process of the company. This motive is especially powerful when there is strong emphasis on the quality of the product. Joint ventures are more attractive as means of providing information about and access to the local market and to mitigate risk.[15] Here we provide an alternative view -based on the influence of macro conditions on micro performance- where greenfield investments tend to be optimal in the countries which are more advanced on the transition path.

Optimal portfolios of greenfield investments. We consider optimal portfolios consisting of risky investments only, that is, safe ECU lending at the rate of interest i^* is excluded[16]. The available assets are foreign currency loans and equities[17]. We show only the non dominated part of the mean-variance efficient frontier. Columns 1 and 2 give the expected return and the standard deviation of the investment. In column 3, we show the proportion of the optimal portfolio held in equity and in the other columns we have put the respective contributions of the 4 groups of countries to the optimal portfolio.

mean returns	st. dev.	% equity	gr 1	gr2	gr3	gr4
1.075	0.000	39.02	56,28	32.60	0.00	1.02
1.10	0.000	88.32	79.77	17.01	2.53	0.69
1.125	0.000	90.23	78.12	19.72	1.46	0.70
1.15	0.006	100.00	78.45	21.55	0.00	0.00
1.20	0.022	100.00	71.38	19.27	0.00	0.00
1.25	0.070	100.00	80.73	6.44	0.00	0.00
1.30	0.116	100.00	93.56	2.50	0.00	0.00
1.37	0.210	100.00	100.00	0.00	0.00	0.00

Along the mean-variance efficient frontier, the proportion of equity increases with the expected return on the portfolio and with its risk. The share of equity is equal to 100% for returns higher than 12.5%. For the lowest expected returns (7.5%) and the lowest risk, investing mainly in loans to groups 1 and 2 is optimal. For expected returns between 10 and 12,5%, it is optimal to invest mostly in groups 1 and 2 and to diversify risk by small investments in groups 3 and 4. For a broad range of expected returns (between 15% and 37%), investing primarily in equities of group 1 is optimal, with some significant participation in group 2. For the highest returns, only investments in equity of group 1 should be considered. Without any further assumptions such as debt guarantees for example, significant greenfield investments in groups 3 and 4 are never optimal and investment in debt in "risky countries" is usually dominated .

These results would be strengthened if we had taken into account differences in productivity levels across countries for the initial period, as productivity in group 1 might be taken to be higher than that in the other groups, even in the case of Greenfield investments. We only allow for such initial productivity differences in the case of investments in existing assets, considered below.

5.4.2. Investments in existing assets.

We now try to allow for the fact that existing assets can sell at a discount in countries with unfavorable (macro)economic conditions, that is, we allow the p_{K_j} to differ across countries. Our estimate of the magnitude of the existing asset price discount is based on the deviation of the country's exchange rate from the OECD's estimate of its PPP exchange rate for 1993. No intra-industry differences in the discounts on these assets can therefore be allowed for. These estimates of the prevailing asset price discount are likely to be subject to wide margins of error. The computations of the optimal portfolios that follow are conditional on these estimates and should therefore be treated with caution. If a the projects of a country or group of countries do not succeed in pricing themselves into the optimal portfolio with the asset price discounts we attribute to them, there will always exist (higher) discounts for which these projects will become viable. That indeed is a central message of this paper: if a country has a highly unfavorable macroeconomic environment, it will pay for it through high discounts on the prices of its existing immobile factors.

Discount prices with respect to group 1.

Group	Comparative price level (%)
2	64.78
3	37.37
4	54.82

The least advanced countries on the transition path have the highest discounts on the price of their sunk capital. Therefore, the less advanced on the transition path, the bigger the incentive for investing in existing assets *ceteris paribus*. But here *ceteris paribus* truly does mean holding a lot of other things constant. The existing capital the Fund can invest in is often obsolete, depending on the countries and the sectors. In the Pissarides, Singer and Svejnar [1996] survey: managers in Bulgaria and Russia complain that "capital is old" and claim that this obsolescence is one of the most binding constraints they face. Therefore, while the assumption made thus far that productivity levels are the same across countries in the initial period may be suitable for greenfield investments, it is highly questionable when we turn to investments in existing assets. We therefore must make a correction for the relative levels of productivity across countries for the initial period. We take average Economy-wide $PPP GDP per employee to estimate the relative productivity levels at the beginning of the period. We make the assumption that initial productivity differences between countries are the same in the three sectors. Relatively to group1, we find that group 2 has a relative initial level of productivity of 0.42, group 3 of 0.64 and group 4 of 0.72.

Returns on investments in existing assets. The means and standard deviations of returns on equity investments and loans in the 3 industries for each of the 4 groups are given below.

Group 1		
	Expected Return	Standard Deviation
θ_x	1.37	0.21
θ_m	1.09	0.11
θ_n	1.14	0.11
$\frac{1+i_x}{1+\gamma^e}$	1.18	0.11
$\frac{1+i_m}{1+\gamma^e}$	1.18	0.11
$\frac{1+i_n}{1+\gamma^e}$	1.18	0.11
$1+i_x^*$	1.06	0.01
$1+i_m^*$	1.06	0.01
$1+i_n^*$	1.06	0.01

Group 1 being our benchmark, returns are the same as for greenfield investments.

Group 2		
	Expected Return	Standard Deviation
θ_x	0.72	0.43
θ_m	1.36	0.41
θ_n	1.48	0.50
$\frac{1+i_x}{1+\gamma^e}$	0.63	0.32
$\frac{1+i_m}{1+\gamma^e}$	0.63	0.32
$\frac{1+i_n}{1+\gamma^e}$	0.63	0.32
$1+i_x^*$	1.07	0.01
$1+i_m^*$	1.07	0.01
$1+i_n^*$	1.07	0.01

Investing in existing assets has an impact on the relative profitability ranking of the investments: the high expected return on equity in the export sector for greenfield investments in group 2 was linked to the assumed high initial productivity level. With lower initial levels of productivity in the export sector of group 2, investments in the import-competing and non-traded sectors become relatively more profitable. For group 2, returns on loans are the same as for greenfield investments.

Group 3		
	Expected Return	Standard Deviation
θ_x	0.88	0.97
θ_m	2.09	1.81
θ_n	1.79	1.56
$\frac{1+i_x}{1+\gamma^e}$	0.36	0.49
$\frac{1+i_m}{1+\gamma^e}$	0.36	0.49
$\frac{1+i_n}{1+\gamma^e}$	0.36	0.49
$1+i_x^*$	0.73	0.63
$1+i_m^*$	0.73	0.63
$1+i_n^*$	0.73	0.63

Group 4		
	Expected Return	Standard Deviation
θ_x	0.95	0.84
θ_m	1.54	1.49
θ_n	1.26	1.34
$\frac{1+i_x}{1+\gamma^e}$	0.42	0.69
$\frac{1+i_m}{1+\gamma^e}$	0.42	0.69
$\frac{1+i_n}{1+\gamma^e}$	0.42	0.69
$1+i_x^*$	0.72	0.62
$1+i_m^*$	0.72	0.62
$1+i_n^*$	0.72	0.62

Investing in equities in groups 3 and 4 by purchasing pre-existing assets becomes much more profitable and also much riskier than in the case of greenfield investments.

Optimal portfolios of existing assets. We again consider portfolios consisting of risky investments only. Mean-variance efficient frontiers of portfolios of investments across sectors and across countries have been computed taking into account all the institutional constraints. The assets considered are again foreign currency loans and equities. The results for the mean-variance efficient frontier of portfolios are as follows:

returns	st. dev	% equity	gr 1	gr 2	gr 3	gr 4
1.075	0.000	55.30	66.28	26.69	3.83	3.20
1.10	0.000	58.54	62.82	30.47	2.72	3.99
1.125	0.000	66.65	61.94	31.28	1.97	4.81
1.15	0.000	73.88	64.63	29.26	1.62	4.48
1.20	0.007	100.00	71.22	24.01	0.00	4.77
1.25	0.031	100.00	82.53	17.47	0.00	0.00
1.30	0.080	100.00	78.12	21.88	0.00	0.00
1.35	0.128	100.00	73.71	26.29	0.00	0.00
1.40	0.175	100.00	0.00	84.97	0.00	15.03
1.45	0.220	100.00	0.00	85.20	0.00	14.80
1.50	0.282	100.00	0.00	82.39	1.79	15.83
1.55	0.402	100.00	0.00	72.62	9.79	17.58
1.60	0.522	100.00	0.00	62.86	17.80	19.34
1.70	0.761	100.00	0.00	43.33	33.82	22.85
1.80	1.001	100.00	0.00	23.81	49.83	26.36
1.90	1.241	100.00	0.00	4.28	65.85	29.87
2.00	1.509	100.00	0.00	0.00	83.57	16.43
2.09	1.810	100.00	0.00	0.00	100.00	0.00

The basic results of risk diversification across countries (and across sectors, although this information does not appear in this table) are as follows:

As with greenfield investments, the share of equity in the optimal portfolio increases with the expected return and with risk. For the lowest expected returns (between 7.5% and 20% roughly), it is optimal to invest mainly in loans and equities of groups 1 and 2 with some minor diversification in groups 3 and 4. When the expected rate of return exceeds 20% (and is below 35%), it becomes optimal to invest only in equities and primarily in group 1 but also in group 2. For expected returns above 35% but below 50%, it is optimal to invest mainly in equity in group 2 and -to some extent- in group 4. For expected returns between 50% and 90%, a mixed portfolio of groups 2, 4 and 3 is optimal, with the importance of equity investments in group 3 increasing. For the highest expected returns and riskiest investments it is optimal to invest in equities in groups 3 and 4 only and then, for the highest possible risk in group 3 only. We note that, as in the case of greenfield investments, investments in groups 3 and 4 are dominated for a broad range of expected returns, although they do kick in significantly for the very highest expected returns.

The specific numerical inputs and outputs of this section are to be viewed as illustrative only. The data we used are highly unreliable; we had to make a number of heroic simplifying assumptions to get estimates of some of the variables we needed to apply our approach; and we could perform historical simulations only for a far too restricted number of periods. Nevertheless the framework we use seems to be useful to link the microeconomic performance of firms to their macroeconomic environment and can be expected to give very interesting results when more and better data become available. We also believe that the simulations support the view that the fundamental tools of portfolio theory are applicable to the problem of optimal investment in transition economies.

6. Four further issues.

6.1. Provisioning for loans and for equity.

Many banks and other financial institutions have provisioning rules that require them to provision for equity participations at twice the rate required for loans. Presumably, this is rationalized with the view that equity involves greater default risk than loans. The practice of provisioning for losses on loans, equity participations or any other kind of investment is a reflection of the severe penalties incurred by any enterprise that defaults on its own contractual financial obligations (loans, debt, guarantees etc.). There is a sharp discontinuity in the firm's effective valuation of its net worth at zero net worth.

There does not appear to be much of an analytical or formal literature looking into the rationale for various provisioning rules. One that, from a casual perusal of some of the practical literature, appears to be popular is that an enterprise should provision an amount, P say, at least equal to its expected loss, conditional on that loss being positive, that is, its expected loss in those states of the world in which losses are incurred. Formally, letting $\mathcal{E}$ denote the mathematical expectation operator

$$P \geq \mathcal{E}(v_x \mid v_x < 0) \qquad (6.1)$$

According to 6.1, the amount provisioned should be no less than the mean of the truncated distribution of the net worth of the enterprise below zero. There is nothing about the rule in 6.1 that makes it uniquely appropriate. It is unclear, for instance, what features of the firm's objective function (such as risk aversion) and of its environment would make the expected loss (conditional on there being losses) the optimal lower bound on the amount provisioned.

The approach of this implies that our Fund should provision against the possibility of its entire portfolio being in default. Defaults on individual loan contracts or debt instruments held as investments by the Fund or the risk of individual equity stakes held by the Fund becoming worthless are of interest only to the extent that they affect the probability and magnitude of default of the Fund's entire portfolio. Provisioning for individual projects would create a bias towards overprovisioning.

In addition to creating a general overprovisioning bias, a focus on individual projects is also likely to lead to a relative overprovisioning for equity participations compared to loans or debt. It is clearly true, since loans and debt are senior to equity, that the risk of making a loss on one ECU worth of loans to a given borrower must be lower than the risk of making a loss on one ECU's worth of equity in the borrowing firm. Likewise the expected loss, conditional on a loss occurring, on one ECU worth of loans (to a given borrower) will be less than the expected loss, conditional on a loss occurring, on one ECU worth of equity in the borrowing firm. However, adding one ECU's worth of equity in a different firm to an existing portfolio (for instance – but not necessarily – one consisting entirely of loans) may increase the expected loss on the portfolio, conditional on a loss occurring, by less than would be the case if instead one ECU worth of loans were to be extended to the new firm. It is even possible that the expected loss on the portfolio, conditional on a loss occurring, would be reduced through the new equity investment.

It may be the case that for certain loans, there is an (implicit or explicit, direct or indirect) sovereign guarantee, which is absent for equity participations. Clearly, if the sovereign, or some other third party, assumes the default risk, then loans are safe and the relationship between z_x and $1 + \tilde{i}_x^*$ in Figure 1 becomes the horizontal line over the entire range of z_x with intercept $1 + i^*$. To what extent sovereign guarantees extended by the government of the host country are credible is of course another issue. To view loans as riskless assets rather than as equity with a cap would seem to be a dangerous practice.

Having considered the returns to individual risky loans and equity participations in some detail, it should be clear that equity participations are likely to be the only effective way of hedging the risk involved in making loans that are subject to default risk. To hedge the default risk associated with a loan, there must be another investment that, on average, pays off well in precisely those circumstances under which default occurs on the loan, that is, an investment whose return is negatively correlated with the return on the risky loan. Another risky loan -one that does not default when the original loan goes into default- could provide some hedging opportunities, especially if the perceived default risk on the new loan has been translated into a risk premium in the loan rate of interest. However, no loan contract can offer a shot at the very large positive payoffs that can be earned on an equity participation whenever the firm that one has the equity stake in really hits the jackpot. Default risk can only be hedged effectively by marshalling the diversification potential of equity participations with their potentially unbounded upside potential.

This suggests the following proposition.

Proposition 6.1. *The Fund should provision against the risk of it defaulting on its obligations. Provisioning rules for individual investments made by the Fund should be guided by the contribution of each particular investment to the loss made on the Fund's entire portfolio, in those states of the world where there is such a loss. Consider for instance a Fund that follows the rule of provisioning an amount equal to its expected loss, conditional on that loss being positive. In this case the addition of an individual project to the Fund's portfolio should change the amount provisioned for by the change in the expected loss (conditional on that loss being positive) on the portfolio as a whole, brought about by the addition of that project to the portfolio. There appears to be no evidence that the application of this principle to provisioning against loans and equity participations would routinely and automatically require the Fund to provision at a higher rate against equity participations than against loans.*

6.2. The currency composition of lending.

Lending in domestic currency by the Fund is restricted by the requirement that domestic currency loans (loans denominated in the currency of the borrowing country) be financed by Fund borrowing in domestic currency. This means there is never any *currency risk* or *exchange risk* [18]. The only risk attached to these loans is therefore *default risk*.

What are the implications of restrictions on home currency risk exposure for risk and return of the portfolio as a whole?

The answer is that any restriction of this kind on average worsens portfolio performance. It also has the undesirable property of focusing attention on "foreign exchange risk", which is not an intrinsically important category rather than on the risk attached to the returns on the entire portfolio. Even if one were interested in foreign exchange rate *per se*, the sensitivity of the gross rate of return to exchange rate fluctuations should be considered at the level of the entire portfolio of Fund projects, and not on a project-by-project basis. Foreign exchange risk can be hedged across projects as well as within projects.

6.3. Investing in financial intermediaries.

Investing in financial intermediaries poses two kinds of special problems for our Fund, especially if, in addition to caring for the pecuniary returns on its portfolio, it is interested in the general transition impact of its activities. The first is that there are possible *economy-wide externalities* (or significant *transition effects or* *impacts*) associated with improvements in the institutions and processes of financial intermediation. This is especially likely in economies in which the (private financial sector) has to take over many of the coordinating functions previously performed by the central planning authorities. We recognized the central importance of the issue, but as our setup is not the proper one for addressing it, we cannot go beyond that here.

The second problem can be called the problem of leverage (broadly defined) and indirect exposure. Our discussion expands on Fries and Lago [1994]. One of the constraints to which the Fund's portfolio is subject is (in the simplified setting of this paper) that the sum of equity participations and loans cannot exceed the total capital of the Fund. If the Fund takes, say, an equity stake in a financial institution in transition economy j, and if this financial institution is highly leveraged, (say it has issued debt or borrowed in order to invest in country j industrial equities), then the Fund indirectly becomes more leveraged. Going behind the "veil" of the financial institution, the Fund's equity participation in the financial institutions can be viewed as claim to the earnings from a prorated share of its gross assets and liabilities. Even if the Fund's direct equity participations and loans do not exceed its total capital, its direct plus indirect equity participations and loans could easily exceed it.

In fact, the framework developed for Section 3 of this paper, already allows for most of this, because it is recognized throughout that industrial firms may have financial liabilities (domestic currency debt and ECU debt) on their balance sheets. The extension allowing the firms to hold financial assets (including equity participations) as well is formally trivial. When the Fund takes an $x\%$ equity stake in a financial enterprise (henceforth a bank) in one of its countries of operations, it acquires an $x\%$ share in the profit-generating capacity of this bank or, equivalently, an $x\%$ share in its entire balance sheet. When the Fund makes a loan to a bank, and this loan is neither subject to sovereign guarantee [19] nor secured against specific collateral, it is the general earnings generating capacity of the borrowing bank that determines the extent to which the loan commitments will be honoured, that is, the degree to which that loan will be serviced and repaid. The same applies if the Fund provides guarantees of various kinds to a bank that are not secured against collateral that can be attached and realized.

One implication of this argument for the portfolio selection strategies of the Fund is that when the Fund invests in enterprises that are themselves highly geared (carry significant domestic and foreign currency debt in their balance sheet), the proportion of loans in the optimal portfolio of the Fund will increase. This is most easily seen in the ideal "Modigliani-Miller" case where portfolio selection is totally unconstrained (that is, the *'no short sales of equity', 'total equity investment not to exceed paid-in capital', 'total equity investments and loans not to* *exceed total capital' and 'no home currency risk exposure in the loan portfolio'* constraints are absent), there are no distortionary taxes, lending and borrowing rates reflect default risk premia and there is no limited liability. Consider the mean-variance efficient frontier with given leverage ratios d_j and d_j^*, $j = x, m, n$ for the enterprises. An increase in these enterprise leverage ratios would leave the mean-variance efficient frontier faced by the Fund completely unaffected. However, the optimal portfolios of loans and equity participation corresponding to any given point on the mean-variance efficient frontier would contain a smaller share of equity and a correspondingly larger share of loans. Home-made leverage of the Fund would be reduced in order to offset the increased leverage acquired indirectly through equity participations in the more heavily geared enterprises. In the case of our *constrained* mean-variance efficient frontier, a change in the enterprise gearing ratios would affect the position and shape of the frontier. Nevertheless, numerical simulations involving a doubling and halving of the gearing ratios of the enterprises suggest that the proposition that, other things being equal, an efficient portfolio will contain a larger share of loans and a lower share of equity when the enterprises are more highly geared, remains valid.

The substantive issue is whether the Fund should allow for the equity, loans and other financial claims it acquires, indirectly, when it invests in a financial intermediary, in calculating its total exposure for the purposes of meeting the various constraints imposed on its capital structure, such as *"total equity investment not to exceed paid-in capital", "total equity investments and loans not to exceed total capital" and "no home currency risk exposure in the loan portfolio* [20] *"*. Whatever the merits of these constraints, the spirit and quite possibly the letter of the Fund's constitution would seem to require that it consider both its direct and indirect portfolio holdings when determining whether the constraints are satisfied.

6.4. Capital structure and corporate governance.

Throughout this paper we have assumed that the gross earnings of the firm, that is, the total amount of resources available first for servicing debt and then for paying out to shareholders (z_j in our earlier notation) is independent of the firm's capital structure. If enterprise performance is independent of financial structure, corporate governance issues effectively vanish. While the earlier parts of this paper establish that even in such a highly simplified universe there remain important economic issues to be resolved, this subsection serves to remind the reader of the incompleteness of our approach and of its possible consequences.

While there is a large literature on financial structure in a complete contracts setting (principal-agent models with asymmetric information and costly state verification (see e.g. Gale and Hellwig [1985, 1989])), most of the key issues of corporate governance and control can only be addressed effectively in an incomplete contracts model, in which ownership bestows the right to take the residual decisions, that is, all decisions involving contingencies not explicitly provided for in an enforceable contract. Financial structure matters in such an incomplete contracts model because it affects the resolution of the conflict between outside investors and management by influencing the incentives of the parties on whom these residual decision rights are currently bestowed and by influencing the conditions under which these rights are shifted to other stake-holders in the enterprise. Consider, for instance, the simplest interpretation of a debt contract. A sequence of fixed payments is contracted for. If the payments are not made, the creditors gain control over the debtor's assets (say, an enterprise) and can decide what to do with them (installing new management, selling of the enterprise as a going concern, breaking it up and selling off the separate bits etc.). If the debtors gains rents from his control of the enterprise (if the managers gain control benefits),they will take actions to avoid non-performance on the loan contract. The incomplete contracts literature is large and growing (for an introduction to the field see e.g. the seminal paper by Aghion and Bolton [1992], the non-technical treatise by Hart [1995] and the recent paper by Hart and Moore [1995]). The following three examples give an indication of the potential importance of these governance issues.

Concentrated equity holdings in a public company bestow control rights in addition to a claim to a share in the residual income of the firm. Widely dispersed equity holdings dilute the control rights nominally associated with equity ownership. This gives rise to free-rider problems when the exercise of control rights is costly.

Short-term debt can be of critical strategic importance when it is in the interest of the owners of the firm to shrink the size of the enterprise while management has an incentive to maintain or even expand the size of its empire. Basically, short-term debt can trigger the liquidation of the enterprise in the interest of the outside investors even if it is in the interest of the managers to keep it going (see Myers [1977]).

Long-term debt can (as shown in Hart and Moore [1995]) be used to influence management's ability to finance future investments when enterprise expansion may be in the interest of the outside investors, but self-interested management must be prevented from financing unprofitable investments. In those cases where simple debt and equity contracts are optimal they show that (1) the higher is the average profitability of the enterprise's new investment projects the lower the optimal level of long-term debt and that (2) the higher the average profitability of the enterprise's existing assets, the higher the optimal level of long-term debt.

Note that even if the Fund is not interested in getting directly involved in corporate governance issues, that is, even if it has no wish to influence managerial decision making in the enterprises in which it invests through the strategic use of its powers as an equity holder, lender or bond holder, it is still necessary to pay attention to these issues. Even as a passive "portfolio investor" unable or unwilling to strategically influence the capital structure of the enterprises it invests in, the Fund should pay attention to the dependence of enterprise performance on enterprise capital structure, in order to make informed investment choices.

7. Conclusion.

We briefly recapitulate our main conclusions.

For any financial institution (Fund) which has profitability either as an objective or as a constraint, the risk and return relevant for evaluating its performance are the risk and return on its entire portfolio of assets and liabilities. For example, adding a country to the Fund's list of countries of operation can reduce the risk in the Fund's portfolio even if the variance of the rate of return in that country exceeds that in all existing countries of operation. Independence of country rates of return is sufficient (but not necessary) for this to be true. The low positive covariances and the negative covariances that create the scope for risk diversification can be present even if the exogenous shocks perturbing the economy are independent. The input-output structure of the economy and the capital structure of enterprises will cause independent shocks to be transformed into project returns that offer scope for risk diversification.

Our numerical simulations suggest that greenfield investments should generally take place in the most advanced transition economies. The safest (but low yield) investments tend to be loans. Only if one is ready to face a high risk for a high expected return should one invest primarily in equities in intermediate stage transition economies. Greenfield investments in the least advanced transition economies tend to be dominated.

As regards investment in existing assets, the general picture is that when one seeks low expected returns and safe investments, one should go for loans to advanced and intermediate transition economies. For riskier investments, and higher expected returns, one should first turn to investments in equity in the advanced and intermediate transition economies. For even higher risk and return, one should consider a mixed portfolio of equities diversified across economies in all stages of transition. If one wants to select the highest possible risk-return combination, one should invest only in equity of the least advanced transition economies.

An important practical problem is that there is very little reliable empirical evidence to estimate the expected returns, variances and covariances relevant to investment in the transition economies. The same problem bedevils provisioning, as there is no reliable evidence on the default risk attached to loans to different kinds of borrowers in the transition economies. Rules of thumb based on US or West European historical experience could be off by orders of magnitude.

The importance of diversification extends beyond project selection into such areas as provisioning for loan losses, the choice of financial instruments (equity, loans, guarantees etc.) and the imposition of home currency exposure restrictions.

There is no general presumption that an equity participation in a project is more risky than a loan to that project. Again what matters is the contribution of the equity participation and the loan to the risk and return of the entire portfolio. If the returns on equity, although very volatile, happens to be high in circumstances that the whole portfolio performs poorly, the amount of provisioning required to counter the risk of default on the entire portfolio could increase by less if the equity participation is added to the portfolio than if the loan were added instead.

Adding home currency exposure restrictions unambiguously impairs portfolio performance.

When investing in a financial intermediary, it is essential to realize that one becomes exposed to the risk and return contained in the entire balance sheet (and the off-balance sheet assets and liabilities) of the financial intermediary in question.

Notes

[1]We use "industry", "enterprise" and "project interchangeably as shorthand for "representative firm in the industry".

[2]If R_j is the capital rental rate in sector j, P_{K_j} the domestic currency price of a unit of capital in sector j , $P^e_{K_j}$ the expected price of capital, i the domestic short nominal interest rate and δ_j the physical capital depreciation rate in sector j, the the following arbitrage condition is assumed to hold:

$\frac{R_j}{P_{K_j}} + \frac{P^e_K(+1)(1-\delta_j)}{P_K} = 1 + i.$

We recognize the the risk-neutrality of this equilibrium condition co-habits uneasily with the rest of our mean-variance optimization framework, but there is no other simple way of pinning down the relationship between the current and the expected future price of capital and the rental price of capital services in our partial equilibrium model. As the firm is assumed to be the owner of its capital stock, each firm's capital stock makes a contribution to end-of-period net worth (measured in ECU) equal to $P_{K_j}(+1)(1-\delta_j)\frac{K_j}{e(+1)}$.

[3]For the puposes of this paper, it does not matter very much who absorbs the losses of the firm under limited liability for shareholders when $v_x < 0$. First consider the case where current after-tax operating profits are at least equal to current variable cost. In that case, after the owners of equity lose their entire investment, suppliers of intermediate inputs, the firm's labor force and the tax authorities would absorb the losses. In the worst case scenario, equity holders would receive nothing, workers and suppliers would not get paid, no debt would be serviced and no taxes would be paid.

If revenues do not even cover variable cost and taxes, another means of absording losses will have to be found. We do not consider this issue any further here for reasons of space.

[4]All magnitudes that follow (net worth, provisioning etc.) are divided by the value of the capital stock.

[5]We show only the rate of return on an ECU loan, in order not to clutter the picture.

[6]To take this additional step we could, for instance, assume that the Fund is interested in obtaining the best mix of risk (as measured by variance) and return (as measured by mean or mathematical expectation) for its end-of-period wealth measured in ECU, A^* . Formally, the Fund is assumed to be interested in maximizing

$$U(A^*) = a\mathcal{E}(A^*) - b\sigma^2(A^*) \qquad a, b > 0 \qquad (7.1)$$

where $\mathcal{E}$ is the mathematical expectation and σ^2 is the variance. We could gain some theoretical brownie points by specifying the objective function in terms of the mean and variance of *real* end-of-period wealth and further theoretical brownie points by doing a proper multi-period analysis with the objective functional specified in terms of a stream of current and future utilities from consumption of the Fund's shareholders. We shall resist this temptation, for the sake of simplicity and transparency.

[7]The Fund is assumed only to be able to differentiate to a limited extent between borrowerst subject to differential default risk. The four country groups considered are charged different spreads over libor, but these spreads are taken to be exogenous in our simulations. This is a reflection of the institutional reality faced by institutions like the EBRD.

[8]A constraint like this one can, for instance, be found in the EBRD's Articles of Agreement (Article 12,3).

[9]An example of such a constitutional requirement is Article 12,1 or the EBRD.

[10]Equation 4.15 does not impose the constraint that there be no home-currency risk exposure ($\tilde{s}_{x_j} + \tilde{s}_{m_j} + \tilde{s}_{n_j} + \hat{s}_j = 0$). Note that borrowing by the Fund in home currency is default-risk free, but it is subject to exchange rate risk, so $-\hat{s}_j$ is included in the portfolio of risky investments.

[11]Data sources: Transition Report 1995 and its Update, 1996, EBRD Banking Department Monthly Report February 1996, International Financial Statitics of the IMF, Institute of Intenational Finance, OECD, World Bank Atlas 1996, Wiener Institut für Internationale Wirtschaftsvergleiche handbook of statistics for countries in Transition 95, Russian Economic Trends, Ukrainian Economic Trends.

[12]Another option would be to view the import-competing sector as a partially sheltered or only *quasi-traded* sector, unlike the export sector which is assumed to be a price taker in world markets. If we treat the import-competing sector in this manner, differences among the proportional rates of change of dollar price indices between the export and the import-competing sectors could be interpreted as differentials of productivity growth between these two sectors (this would be exactly correct in a simple Balassa-Samuelson world where the economy-wide wage is equal to the marginal product of labour in each sector). Making this alternative assumption does not have much effect on our numerical calculations.

[13]Recall that the projects considered are a chocolate producer for the export sector, a bottle manufacturer for the import sector and a transportation company for the non-traded sector.

[14]"Default" on equity simply means that the net rate of return is negative, or the gross rate of return θ_i is less than 1.

[15]The Lankes-Venables [1996] survey shows that the proportion of greenfield investments in their group I (Czech Rep., Hungary) is 38 whereas it is only 32 in their group II and 30 in their group III which corroborates our results (their

groups have been ranked using transition indicators).

[16]In order to graph the mean-variance efficient frontier including riskless lending at i^*, the safe rate can be taken to be the ECU Libor rate.

[17]historical period: 92, 93, 94.

[18]This constraint may be hard to implement in practice, especially when the Fund invests in a financial intermediary with a wide range of domestic currency assets and liabilities.

[19]A sovereign guarantee is of course no automatic insurance against default. It all depends on the sovereign.

[20]Note that if the financial intermediary has lent in domestic currency without a matching domestic currency liability, the Fund, by taking an equity stake in the financial intermediary, could violate the rule against home currency exposure, unless offsetting changes in domestic currency lending or borrowing are made elsewhere in the Fund's portfolio.

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APPENDIX 1: SECTORAL PRICE INDICES.

P_x, P_m, and P_n are the dollar price indices in the export, import competing, non-traded good sector respectively[21]. The real effective exchange rate, $REER$, is the IMF's index, from the IFS. x denotes the value of exports, m the value of imports and y GDP.

Poland					
	1990	1991	1992	1993	1994
P_x	87.15	100.00	102.89	113.26	124.47
P_m	115.00	100.00	111.60	114.26	114.88
P_n	50.18	100.00	115.70	117.33	125.36
CPI	63.02	100.00	112.81	116.14	123.43
P_n/P_t	50.13	100.00	107.97	103.14	104.84
w/P_x	78.22	100.00	103.90	98.63	99.17
$REER$	64.98	100.00	99.09	106.63	107.28

$\frac{x}{x+m} = 0.50$; $\frac{x+m}{y} = 0.33$

Hungary					
	1990	1991	1992	1993	1994
P_x	76.51	100.00	109.33	122.34	144.45
P_m	68.54	100.00	109.87	120.29	138.86
P_n	111.14	100.00	126.43	124.51	120.58
CPI	90.34	100.00	118.06	122.94	130.19
P_n/P_t	153.98	100.00	115.34	102.69	85.24
w/P_x	119.77	100.00	109.15	105.19	94.17
$REER$	88.20	100.00	108.07	119.54	118.53

$\frac{x}{x+m} = 0.47$; $\frac{x+m}{y} = 0.48$

Czech Republic					
	1990	1991	1992	1993	1994
P_x		100.00	105.18	104.26	106.43
P_m		100.00	107.05	102.54	103.05
P_n		100.00	134.05	192.50	242.47
CPI	107.81	100.00	117.34	135.06	150.22
P_n/P_t		100.00	126.31	186.21	231.61
w/P_x		100.00	121.40	148.65	175.03
$REER$	108.72	100.00	106.89	129.89	138.57

$\frac{x}{x+m} = 0.49$; $\frac{x+m}{y} = 0.57$

Group 1					
	1990	1991	1992	1993	1994
P_x	83.14	100.00	104.92	113.70	125.50
P_m	97.48	100.00	110.32	113.40	118.17
P_n	73.16	100.00	121.81	134.19	148.68
CPI	81.95	100.00	114.96	121.62	130.65
P_n/P_t	81.67	100.00	113.23	118.20	122.15
w/P_x	92.63	100.00	1.8.55	109.58	111.23
$REER$	82.49	100.00	102.78	114.49	116.51

Romania					
	1990	1991	1992	1993	1994
P_x	75.08	100.00	118.26	119.84	120.03
P_m	65.03	100.00	103.25	109.69	109.79
P_n	127.49	100.00	65.57	109.59	132.25
CPI	105.53	100.00	76.89	110.95	126.36
P_n/P_t	184.03	100.00	59.83	96.09	115.82
w/P_x	186.29	100.00	48.39	55.42	59.86
$REER$	105.05	100	62.24	86.64	93.25

$\frac{x}{x+m} = 0.44$; $\frac{x+m}{y} = 0.31$

Ukraine					
	1990	1991	1992	1993	1994
P_x		100.00	99.3	98.31	130.36
P_m		100.00	99.5	100.59	169.7
P_n		100.00	3.22	6.32	6.85
CPI		100.00	9.01	14.45	17.27
P_n/P_t		100.00	3.24	6.35	4.56
w/P_x		100.00	13.25	6.12	10.61
$REER$	131.23	100.00	38.85	55.25	32.15

$\frac{x}{x+m} = 0.47$; $\frac{x+m}{y} = 0.30$

Russia					
	1990	1991	1992	1993	1994
P_x		100.00	88.4	81.95	79.73
P_m		100.00	97.3	101.19	106.35
P_n		100.00	4.48	15.5	32.99
CPI		100.00	11.13	26.47	44.74
P_n/P_t		100.00	4.83	17.03	35.82
w/P_x		100.00	10.09	25.56	40.86
$REER$	165.29	100.00	12.40	28.93	53.22

$\frac{x}{x+m} = 0.50$ $\frac{x+m}{y} = 0.30$

APPENDIX 2: PRODUCTIVITY LEVELS FOR GREENFIELD INVESTMENTS.

The units are net output per unit of capital. The initial productivity levels were calibrated to equate the gross rate of return to investment in equity in each sector to the financial rate of return of the benchmark projects taken from the EBRD's actual portfolio.

Group 1				
Productivity levels	1991	1992	1993	1994
Export	88.53	98.15	109.81	124.27
Import	20.95	23.23	25.99	29.41
Non-traded	18.16	19.18	19.85	20.84

Group 2				
Productivity levels	1991	1992	1993	1994
Export	88.53	79.68	87.96	98.17
Import	20.95	18.86	20.82	23.23
Non-traded	18.16	17.72	18.83	20.42

Group 3				
Productivity levels	1991	1992	1993	1994
Export	88.53	77.90	69.41	58.65
Import	20.95	18.44	16.43	13.88
Non-traded	18.16	16.57	14.97	13.75

Group 4				
Productivity levels	1991	1992	1993	1994
Export	88.53	77.02	66.08	57.03
Import	20.95	18.23	15.64	13.50
Non-traded	18.16	15.15	14.15	13.15

APPENDIX 3: PRODUCTIVITY LEVELS FOR INVESTMENTS IN EXISTING ASSETS.

Group 1				
Productivity levels	1991	1992	1993	1994
Export	88.53	98.16	109.81	124.27
Import	20.95	23.23	22.19	29.41
Non-traded	18.16	19.18	19.85	20.84

Group 2				
Productivity levels	1991	1992	1993	1994
Export	37.18	33.46	36.94	41.23
Import	8.80	7.92	8.74	9.76
Non-traded	7.63	7.44	7.91	8.58

Group 3				
Productivity levels	1991	1992	1993	1994
Export	56.66	49.86	44.42	37.54
Import	13.41	11.80	10.51	8.88
Non-traded	11.62	10.60	9.58	8.80

Group 4				
Productivity levels	1991	1992	1993	1994
Export	85.39	74.29	63.74	55.01
Import	20.21	17.58	15.09	13.02
Non-traded	16.79	14.00	13.08	12.16

FIGURE 1
RETURNS TO EQUITY AND DEBT AS FUNCTIONS OF TOTAL EARNINGS

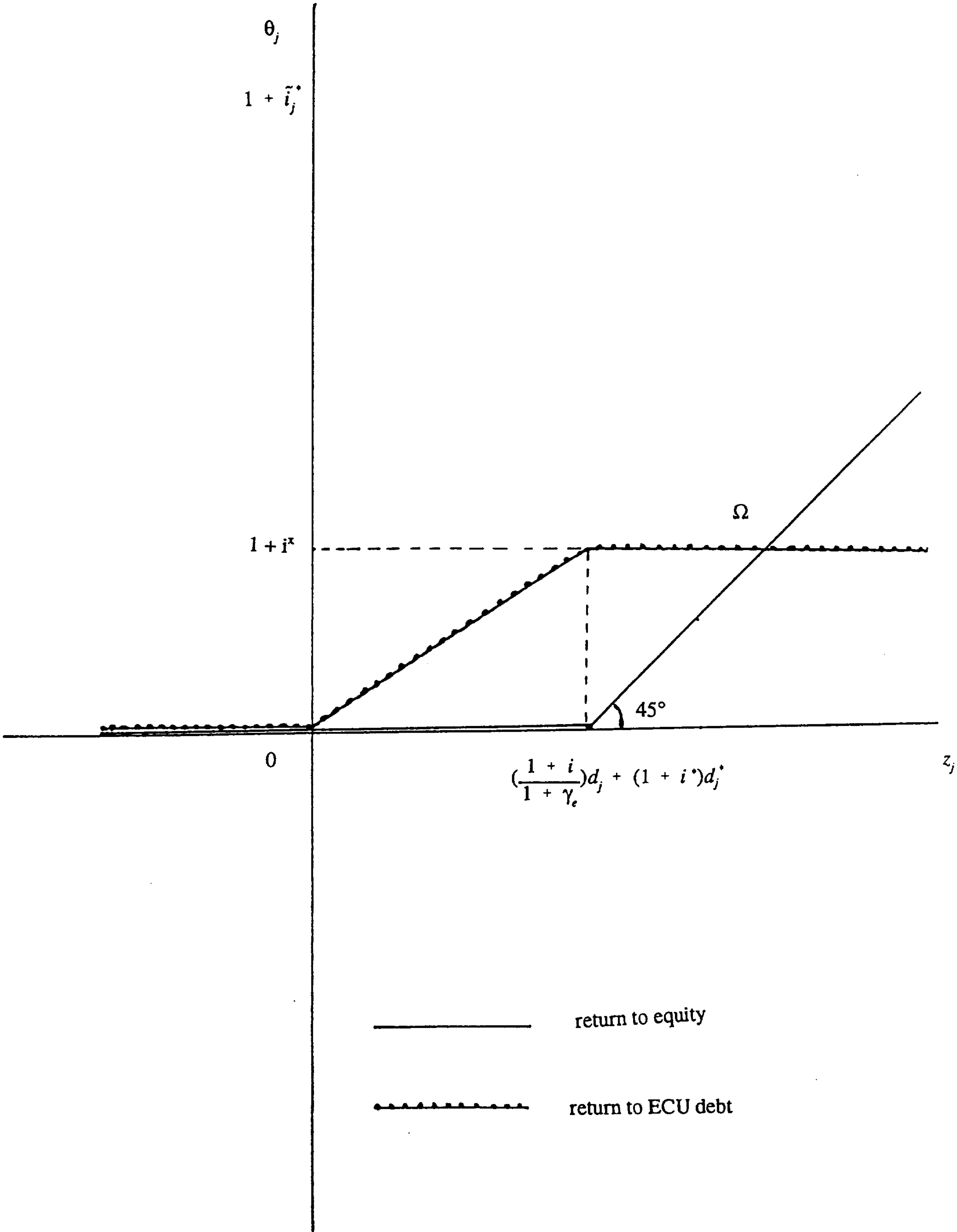

FIGURE 2
RETURN DISTRIBUTIONS AND DEFAULT IN
ADVANCED MARKET ECONOMICS AND TRANSITION ECONOMICS