Assessment of Corporate Sector Value and Vulnerability

Links to Exchange Rate and Financial Crises

Dale F. Gray
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Dale F. Gray

The World Bank
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FOREWORD

The relationship between the corporate sector and a country’s macroeconomy is receiving increased attention from policymakers and investors, especially those affected by the Asian crisis. Recent crises have pointed out the importance of improving our understanding of the links between the corporate sector, the financial sector and the macroeconomy in a world of volatile capital flows. Assessing the vulnerability of the corporate sector and its links to financial and exchange rate crisis is important for both improved surveillance and in the design of policies in crisis countries. However, the analytical and operations tools available to policy makers and investors to analyze this problem have been limited. This Technical paper was prepared as part of an initiative in the Corporate Restructuring Group of the Private Sector Development Department to develop new frameworks which can integrate state-of-the art corporate finance principles, macroeconomic, and financial sector analysis. An innovative yet practical framework is developed in this paper which has numerous applications for assessing corporate sector vulnerability, design of corporate restructuring strategies, as well as financial sector and macroeconomic policies.

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ABSTRACT

This paper presents an innovative yet practical framework to assess corporate sector vulnerability and the links to exchange rates and financial crises that bridges the gap between corporate finance and macroeconomic analysis. This framework provides a “missing link” describing how changes in aggregate value of the corporate sector are interrelated with exchange rate crises, financial crises and associated fiscal costs of bank recapitalization. The factors that can make the corporate sector particularly vulnerable include both sector-specific characteristics (leverage, composition of debt, maturity of debt, hard currency profits, etc.) and characteristics of the current account adjustment process that feed back on corporate balance sheets. The framework has multiple applications. It can help policy makers and investors understand past crises and assess risks of future crises. It can also help improve surveillance as well as improve policy design at the macroeconomic, financial and corporate sector levels.
ACKNOWLEDGMENTS

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SUMMARY

This paper presents an innovative yet practical framework to assess corporate sector vulnerability and the links to exchange rates and financial crises. The framework can help understand past crises and assess risks of future crises, as well as help improve surveillance and both macroeconomic and sector-level policy design. This new framework is an genuine effort to bridge the gap between corporate finance and macroeconomic analysis. This framework provides a “missing link” describing how changes in aggregate value of the corporate sector are interrelated with exchange rate crises, financial crises and associated fiscal costs of bank recapitalization. Fundamental corporate finance principles based on economic value added, which is tied to the creation of shareholder wealth, are applied to aggregated corporate sector financial data in a way to be amenable to analysis of short-term capital flows and default risk. The risk-adjusted discount rates used to estimate the present value of assets and equity in the corporate sector are derived from estimates of the cost of equity and debt, which include variation in sovereign spreads, asset price volatility, and interest rates (based on a new methodology to calculate discount rates developed by Goldman Sachs).

Vulnerability in the corporate sector means there is a risk that the financial condition can deteriorate and decline to a threshold that triggers widespread default. The risk of widespread default is higher if: (i) the aggregate equity value is highly sensitive to changes in exchange rates, interest rates, investment, etc.; (ii) the initial level of equity is low; and/or, (iii) shocks are large enough to cause default of even prudently managed firms. The factors that can make the corporate sector particularly vulnerable include both sector-specific characteristics (leverage, composition of debt, maturity of debt, hard currency profits, etc.) and characteristics of the current account adjustment process that feed back on corporate balance sheets. It illuminates the path through which companies get into financial difficulties due to nonlinear changes in their balance sheets, particularly from the direct and indirect effects of unexpected exchange rate changes. Country examples are given to illustrate the differential impact of higher exchange rates, higher interest rates, lower investment, and lower profits on corporate equity. A possible dynamic process is described whereby even small shocks can destabilize a corporate sector when vulnerability factors are high, the insolvency system is weak, and there is strong feedback from lower asset prices to reduced investment.

The framework has multiple applications. Used for retroactive analysis, it can help us understand past crises: the degree of insolvency and vulnerability before a crisis takes hold and how to disaggregate the relative importance of past changes in exchange rates, interest rates, recession, and other factors on corporate sector equity value. At the same time the framework is useful for forward-looking analysis, through simulations of the impact of different shocks (including exchange rates, interest rates, recessions, and investment plans) and policy options. These different scenarios can be used to simulate changes in equity and estimated economic value (EVE) in aggregate for the corporate sector as a whole or by key sectors (such as export industries, real estate/construction, utilities, services/domestic industries). Useful insights can be obtained from analysis of
changes in equity or EVE even if data availability is limited; calculations of absolute levels require more detailed and comprehensive data.

Rating the vulnerability of the corporate sector across countries can help investors and policymakers understand the links to financial sector stability and sovereign risk, as well as the riskiness of the environments in which individual corporations operate. A preliminary worldwide survey identifies countries with potentially vulnerable corporate sectors. The corporate vulnerability indicators show an alarming vulnerability in the four Asian crisis countries in 1996 and 1997, which demonstrates the potential predictive power of this framework.

The framework is extended so that corporate sector vulnerability can be integrated with analysis of banking sector stability. First, the changes in corporate sector equity are linked to the level of non-performing loans (NPLs) and to arrears to foreign creditors. Second, the level of NPLs is linked to the level of equity in the banking system. Thus, the conditions which cause default in the corporate sector can contribute to negative equity in the banking system, which requires bank recapitalization. The present value of the fiscal cost associated with this component of bank recapitalization is called ADAM, or alternative deficit analysis methodology. Together ADAM and EVE can be used to evaluate the impact of shocks and the combinations of policy options that maximize the economic value of the corporate sector and minimize the present value of associated fiscal costs.

The framework has important applications for policy design and risk analysis at the macroeconomic level and at the sector level (both financial and corporate). At the macro level it can be used as part of an early warning system for high vulnerability. It can be used to evaluate the potential impact of alternative exchange-rate regimes and instruments to control capital flows. Exchange rate crises can have an extremely detrimental impact even on prudently managed corporate sectors, if the exchange rate and/or interest rates shocks are large enough. As a tool for credit risk analysis it is can be used to improve surveillance of financial sector stability, and thus has implications for regulation and supervision of banks. It can be used to help devise policies that reduce corporate sector vulnerability and in the design of corporate restructuring strategies. By evaluating how combinations of policy options and various shocks affect the present value of corporate sector equity, the value of EVE, and the present value of fiscal costs of bank recapitalization, the trade-offs between different policy options can be quantified and ranked. Similarly, investors can use this framework for a quantitative analysis of trade-offs between different investment options or for risk analysis.
INTRODUCTION

This paper develops a framework of analysis that bridges the gap between corporate finance and macroeconomics. Fundamental corporate finance principles, based on economic value added using risk-adjusted discount rates, are integrated with macroeconomic analysis. This paper provides a “missing link,” describing how changes in the value of the corporate sector are interrelated with exchange rate crises, financial sector crises, and the associated fiscal costs of bank recapitalization.

Inattention to the interrelationship of corporate balance sheets and the macroeconomy has been costly to corporations, countries, creditors, and the international community. It is now clear that highly leveraged corporate balance sheets were a significant contributor to the onset and depth of the Asian crisis. A new framework is therefore needed to understand and anticipate crises as well as compare reform options.

Part I develops the Economic Value Estimate (EVE), a methodology that estimates changes in the economic value of the corporate sector in response to external shocks, changes in macroeconomic variables, and alternative policy choices. The estimated economic value is equal to equity, measured on a cash-flow basis, plus foreign and domestic debt.

Part II uses the EVE framework to analyze corporate sector vulnerability and illiquidity and insolvency. It identifies characteristics of a country’s corporate sector and in the economy that can lead to large drops in the equity value of the corporate sector due to changes in the nominal exchange rate, investment, and domestic interest rates. It shows the links of corporate vulnerability to the current account adjustment process. This framework provides insights into the contribution of corporate insolvency and weakness that existed well before the Asian crisis. It describes conditions under which a vulnerable corporate sector can become destabilized, causing EVE to decline -- and only recover over a long period of time.

Part III describes how a decline in the equity value of a significant part of the corporate sector can fall to a threshold that triggers widespread default. When this occurs it can result in negative equity in the banking system, which requires fiscal resources for recapitalization. A second framework, the Alternative Deficit Analysis Methodology (ADAM), estimates the present value of the fiscal cost, and the contribution to the fiscal deficit, associated with alternative recapitalization options and restructuring strategies. Together ADAM and EVE can be used to evaluate those combinations of policy options that maximize corporate sector economic value and minimize present value of fiscal costs associated with bank restructuring.
Part IV provides some applications. This new framework is useful for:

- Understanding past crises, as retroactive analysis can help explain the degree of insolvency and vulnerability before a crisis takes hold;
- Forward-looking analysis, through simulations of the impact of different shocks (including exchange rates, interest rates, recessions, and investment plans) and policy options;
- Rating the vulnerability of the corporate sector across countries can then help investors and policy makers understand the links to financial sector stability and sovereign risk, as well as the riskiness of the environments in which individual corporations are operate;
- Policy analysis at the macroeconomic level as well as at the financial sector and corporate sector levels. At the macro level it can be used as part of an early warning system for high vulnerability;
- Evaluating the potential impact of alternative exchange rate regimes and instruments to control capital flows;
- Financial sector vulnerability analysis, and thus has implications for regulation and supervision of banks; and
- Policy design to reduce vulnerability at the corporate level and for the formulation of corporate restructuring strategies.
I - ECONOMIC VALUE OF THE CORPORATE SECTOR

The Economic Value Estimate (EVE) Framework

The economic value estimate (EVE) is the aggregate estimated economic value of the corporate sector. It is a new practical tool developed and used in this paper. The EVE of segments of the corporate sector, or the corporate sector as a whole, is equal to equity, measured on a cash flow basis, plus short-term assets, plus liabilities (i.e., short-term and long-term foreign and domestic debt). A significant advantage of this tool is that it can estimate changes in present value of assets and equity, providing a useful measure of value and solvency. It can simultaneously evaluate changes in short-term assets and liabilities of the sector, and thus useful for analysis of liquidity changes and the interaction with short-term capital flows.

The operational tools that have typically been used in policy design to gauge the interplay between a country’s corporate balance sheets and the macroeconomy have been fairly limited. Simple financial ratios such as the ratio of corporate debt to equity and of debt to assets are the most common measures to attempt to assess the vulnerability of corporations to macroeconomic shocks. The next most popular tool is current cash-flow simulation of a corporation based on its profit statement. The impact on current profits of changes in domestic and foreign interest rates and the exchange rate and debt restructuring can be calculated. The limitations on cash flow simulations are that they account only for the impact of policies for the current period, even though their effectiveness depends on their impact in future periods as well (Gray and Stone, 1999). The EVE approach, however, accounts for the changes in cash flows and present value for multiple future periods. EVE is a new analytical tool that can improve policy design and help investors to better understand liquidity and solvency risks.

The EVE approach is similar to the methodology used by investment banks and investors to analyze shareholder value for individual corporations but extends this concept and measures the present economic value of groups of corporations or the corporate sector as a whole. Economic Value Added, EVA®, (developed by Stewart, 1991, and used by the firm Stern & Stewart) is a very important and useful valuation methodology applied at the firm level. A similar valuation methodology is used by McKinsey & Co. at the firm level. These approaches are being increasingly used since a revolution in thinking about value began in the 1980s that changed the way firms are valued and provided steps for managers to take to maximize shareholder value. EVA is the financial performance measure that captures the true economic profit of an enterprise and the performance measure most closely linked to creation of shareholder wealth over time. The present value of EVA is called MVA, or market value added of a firm. EVE can be considered close to aggregate MVA for groups of companies or the corporate sector as a whole.
In the most simplified form, the value of an enterprise, or group of enterprises, is:

\[ \text{Economic Value Estimate (EVE)} = \text{Value of Debt} + \text{Value of Equity} \]
\[ = \text{PV of return to creditors} + \text{PV of return to shareholders} \]
\[ = \text{PV of current operations} + \text{PV of future investment} \]

This shows how EVE is generated from current operations and future investment and split between creditors and shareholders. An increase in EVE can be considered as an increase in the present value of economic wealth and to increase GDP over time.

The economic value of a group of corporations could be aggregated in a number of ways. In this paper a simplified version of the Miller-Modigliani (MM) formula is used which is simple but captures the key elements. In this formulation the EVE is given by:

\[
D + E = D_d + D_F e_N + E = \sum_{t=1}^{\infty} \text{NOPAT}_t/(1+WACC_t)^t + \sum_{t=1}^{\infty} (\text{ROIC} - WACC_t) I_t / WACC_t
\]

where,

\[ D = \text{total debt, } D_d = \text{domestic debt, } D_F = \text{foreign currency denominated debt, } \]
\[ E = \text{cash flow based estimate of equity, } e_N = \text{nominal exchange rate, } \]
\[ \text{NOPAT}_t = \text{net operating profits after tax, } \text{ROIC} = \text{return on invested capital, } \]
\[ I_t = \text{annual investment, } WACC_t = \text{weighted average cost of capital} \]

The value of foreign currency debt in local currency terms is \[ D_F \] times the nominal exchange rate \( e_N \). \( E \) is the (cash flow based) estimate of equity. These after-tax cash flows are discounted at the weighted average cost of capital \( WACC_t \) in each period, which is the after-tax cost of domestic debt, after-tax cost of foreign debt, and cost of equity, weighted by the shares of debt and equity. The EVE is the positive present value added above the \( WACC_t \). (See Annex 1 for a description of valuation methodologies which focus on value enhancement and the collection and aggregation of corporate financial data.)

Note that in this framework \( WACC \) varies with time. The changes in \( WACC_t \) capture changes in domestic interest rates and domestic bank spreads, as well as the country risk premium, which affects the cost of domestic borrowing, foreign borrowing, and cost of equity. The EVE of the corporate sector falls (rises) as the \( WACC \) increases (decreases) in response to higher (lower) country borrowing spreads. The \( WACC \) can vary significantly due to large changes in the sovereign spread, volatility of the equity market, and other factors. A new methodology from Goldman Sachs shows that the cost of equity rose from 11 percent in 1997 to between 20 and 35 percent for Asian crisis countries for most of 1998. (See Annex 2 for a detailed discussion on calculation of
WACC, for a specific country using CAPM and the Goldman Sachs approach, including graphic representation of changes in cost of borrowing and equity.

**Aggregate Corporate Sector Equity**

One useful application of this conceptual framework is the evaluation of how various external factors, or firm level factors or policies can increase or decrease the value of equity of the corporate sector. By rearranging the terms in equation [1], the aggregate equity value (E) equals the sum of the changes in the present value of current operations and the present value created by new investment, minus the changes in domestic debt and foreign debt obligations. Figure 1 shows how equity value is qualitatively affected by macroeconomic factors, corporate changes in operations to improve value, and the policy environment.

Macroeconomic factors, such as a rise in the country borrowing spread or a rise in domestic interest rates, increase WACC, and thus lower EVE and lower equity value. Depreciation of the exchange rate increases the cost of servicing unhedged foreign debt in local currency terms and can lower equity. While some foreign exchange exposure can be hedged through markets, it is not possible, or prohibitively costly, to hedge most or all of it in emerging markets. Depreciation of the exchange rate and can affect EVE indirectly through affects on profits and other channels (discussed later and in Box 1).

Changes in corporate-level factors such as NOPAT, ROIC, and I also affect equity and EVE. Its important to note that when investments are very unproductive, or funds are stolen or wasted, the present economic value of future operations can be negative if RIOC < WACC.5

One of the many advantages of this framework is that it can be used to assess changes in EVE and in equity value of the corporate sector, given different assumptions about external variables and policy choices. If equation [1] is rearranged, equity equals:

\[
E = \sum_{t=1}^{\infty} \frac{NOPAT_t}{(1+WACC_t)^t} + \sum_{t=1}^{\infty} \frac{(ROIC - WACC_t) I_t}{WACC_t} - \frac{D_O}{D_F} \epsilon_N
\]

Figure 1 shows how corporate restructuring, corporate governance, financial sector policies, and other reforms can affect EVE and corporate equity. Corporate restructuring that results in real operational restructuring and debt reduction increases EVE and increases equity. Figure 1 also shows how various banking policies can affect the present value of new investment and domestic debt.
### Figure 1 - Impact of External Factors, Corporate Factors, and Policy and Reform Measures on the Value of Corporate Equity

<table>
<thead>
<tr>
<th>Corporate Equity =</th>
<th>PV of Current Operations</th>
<th>+ PV of New Investment</th>
<th>(- Debt Domestic)</th>
<th>(- Debt Foreign)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EVE (Estimated Economic Value)</td>
<td>Total Debt</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Macroeconomic Factors</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rise in WACC due to increase in country borrowing spread, increase in dom. int. rate</td>
<td>↓</td>
<td>↓</td>
<td></td>
<td></td>
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<tr>
<td>Depreciation of the exchange rate</td>
<td>↓ ↑</td>
<td>↓</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Corporate/Firm Level Factors</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decrease in NOPAT</td>
<td>↓</td>
<td>↓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increase in I if ROIC &gt; WACC</td>
<td>↑</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increase in I if RIOC &lt; WACC</td>
<td>↓</td>
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<tr>
<td><strong>Policy and Reform Measures</strong></td>
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<tr>
<td>Corporate restructuring framework</td>
<td>↑</td>
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<tr>
<td>Working capital / trade facilities</td>
<td>↑</td>
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<tr>
<td>Corporate governance framework</td>
<td>↑</td>
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<tr>
<td>Effective ownership change</td>
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<td>↑</td>
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<tr>
<td>Bank resolution (mandate/capacity)</td>
<td>↑</td>
<td>↑</td>
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<td>Rapid achievement of 8% CAR</td>
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<td>Competitive banking system</td>
<td>↑</td>
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<tr>
<td>Write-off of foreign debt</td>
<td></td>
<td>↑</td>
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</tbody>
</table>

Upward arrows indicate an increase in equity value. EVE equals PV (present value) of current operations plus PV of new investment. Total debt equals domestic plus foreign debt.
An illustration of how estimated equity value of the corporate sector changes (as percent of GDP) in response to external, macroeconomic, or policy choices for the Republic of Korea and Indonesia is shown in Table 1. For example, either a rise in the world rate of interest or a rise in the country risk premium raises the cost of capital and lowers the present value of the equity of corporate sector (measured, as mentioned before, on a cash flow basis). This lowers the EVE of the corporate sector as well. A devaluation (specifically the impact of a depreciation on unhedged foreign debt) lowers the value of equity. The structure of domestic and foreign debt, as well as other factors, shows that equity value in Korea is less sensitive to potential changes in the exchange rate than in Indonesia. In Korea, equity value is more sensitive to interest rate changes than in Indonesia.

Table 1 - Example of Change in Estimated Present Value of Corporate Sector Equity (percent of 1998 GDP)

<table>
<thead>
<tr>
<th></th>
<th>Korea, Rep. of</th>
<th>Indonesia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rise in country risk premium by 8 % for one year</td>
<td>- 7</td>
<td>- 2</td>
</tr>
<tr>
<td>Exchange rate depreciation of 50%</td>
<td>- 9</td>
<td>- 21</td>
</tr>
<tr>
<td>A 30 % temporary rise in domestic interest rates in one year</td>
<td>- 2.5</td>
<td>- 1</td>
</tr>
</tbody>
</table>

In 1998, the value of corporate equity in Korea was about a fifth of GDP, while in Indonesia equity was negative.

Source: World Bank staff estimates.
II. CORPORATE SECTOR VULNERABILITY

What is corporate sector vulnerability? The definition used in this paper is the risk of sharp decline in equity of the corporate sector as a result of exchange rate, interest rate, and other shocks, below a threshold that triggers widespread default for a significant part of the corporate sector. Certain characteristics increase the sensitivity of corporate equity to changes, including corporate sector characteristics such as the degree of leverage, composition of debt, profits from hard currency, and the way in which the current account adjusts. If the initial level of equity is low due to very poor return on past investments, there is a higher risk that it will fall to the point where payments are suspended.

Illiquidity and Insolvency

In the wake of the recent Asian crisis, debate is ongoing about how much of the reaction of investors was panic causing illiquidity as opposed to realization of insolvency of corporations and banks. Krugman (1999[a]) argues that the severity of the crisis was heavily influenced by “self-fulfilling behavior” as a loss of confidence by investors and lenders led to negative developments that further reduced confidence eventually resulting in an unexpectedly severe crisis. Some observers imply that initially the companies were basically sound (Krugman, 1999[b], Radelet and Sachs, 1998). Others (Garber, 1999) argue that companies were insolvent before the crisis and once this was realized outflows started and a liquidity crisis followed. The framework in this paper can help decompose the roots of the crisis and help determine whether it was primarily a liquidity crisis, or insolvency that then triggered a liquidity crisis, or a vulnerable corporate sector “pushed over the edge” by various shocks (i.e., exchange rates or interest rates) into illiquidity, and in some cases, insolvency.

Analysis of liquidity shocks can be improved by explicitly separating out short-term liabilities and assets. Liabilities can be separated into short-term and long-term debt, both foreign currency denominated, $A_{ST}$, and local currency denominated assets, $A_{SLT}$. Short-term assets minus short-term liabilities highlight the maturity mismatch and risk of changes in short-term flows and a liquidity crisis. If short-term and long-term debt and assets are included in equation [2] the result is:

$$
E = \sum_{t=1}^{\infty} \frac{N_aP_{a_t} c_{e_t}}{(1 + WACC_t)^t} + \sum_{t=1}^{\infty} (ROIC_t - WACC_t) I_t / WACC_t - D_{DST} - D_{DLT} - D_{FST} c_{e_t} - D_{FLT} c_{e_t} + A_{ST} c_{e_t} + A_{SLT}$$

where:

- $D_{DST}$ = short-term domestic debt, $D_{DLT}$ = long-term domestic debt,
- $D_{FST}$ = short-term foreign debt, $D_{FLT}$ = long-term foreign debt,
- $A_{ST}$ = foreign liquid assets, $A_{SLT}$ = domestic liquid assets
Illiquidity occurs when interest and principal payments on short-term debt and interest payments on long-term debt are greater than profits plus liquid assets (NOPAT\textsubscript{t} + AST\textsubscript{tr} + AST\textsubscript{LC}). In this case companies only pay their loans if cash flow is sufficient to make payments. Insolvency occurs when \( E < 0 \). In another situation corporations are not technically illiquid or technically insolvent, but suspend debt payments because they are forced to finance themselves when financial markets break down. If they do not expect to have access to future sources of working capital, they stop servicing the debt at the point where their operating cash flow equals their wage and minimal investment needs. The quality and effectiveness of bank regulation and the insolvency system is an important determinant of the point at which payments are suspended. One would expect nonpayment to domestic banks and arrears to foreign creditors to be higher, other factors being equal, if insolvency systems are inadequate and enforcement of creditors' rights is weak.

Once equity has fallen below a certain threshold for a significant period of time, it triggers a suspension of debt payments and distorts incentives for equity holders and managers. But what is a significant period of time? You or I could pay a $10 million annual mortgage payment for a day or two but not two or three months. Similarly, owners and managers can withstand short periods of illiquidity or negative equity but not longer ones. At some point in time, the inability to meet obligations and perception of continued difficulties creates a system-wide breakdown in debt payments. The following sections will describe the factors that influence the sensitivity of equity to shocks as well as some analysis of the depth and duration of shocks that may trigger illiquidity and insolvency.

**Sensitivity of Corporate Equity to Domestic Interest Rates and Exchange Rate Changes**

A more accurate understanding of the potential variability of equity needs to incorporate domestic interest rates and short-term assets, along with exchange rates. If there is a large and/or persistent domestic interest rate shock, then the domestic interest bill could be large and have a very detrimental impact on corporate finances. In the previous analysis domestic interest rates entered only via their affect on WACC\textsubscript{t}. Higher interest rates are likely to raise the cost of rolling over short-term debt and may result in shortening the maturity of domestic debt. The high interest rates associated with an exchange rate crisis can have a very negative impact on firms that have only domestic debt.

One way to explicitly bring in the impact of higher interest rates is to separate domestic debt into periodic amortization payments and interest payments and then link the level of domestic debt to changes in the interest rate. The exact way in which this process could occur depends on the structure of short-term debt and is specific to the sector and country.

A distinction can be made between sectors. The choice of sectors depends on the availability of data and key issues to be investigated. It is useful for analysis to have at
least four sectors: export/tradable, domestic sale, utilities, and real estate. For simple illustration, however, it is useful to disaggregate by grouping corporations into the export/tradable sector and domestic sale/nontradable sector. Corporations that are primarily exporters, and thus have a natural hedge as profits from export earnings in foreign currency can be used to service foreign debt, are different from those corporations that sell primarily into the domestic market. NOPATₜ will stand for the net operating profits coming from exports and NOPAT₂ₜ for those coming from the domestic market. NOPATₜ is clearly affected by the level of the real exchange rate and other factors. NOPAT₂ₜ is affected by domestic GDP. The recession following a crisis or loss of confidence can lower spending thus substantially lowering profits.

Including these factors and the domestic interest rate “i” in equation [3] results in:

\[
E = \sum_{t=1}^{\infty} \frac{\text{NOPAT}_{LC_{t}}}{(1 + \text{WACC}_{t})^t} + \sum_{t=1}^{\infty} \frac{\text{NOPAT}_{S_{t}}}{(1 + \text{WACC}_{t})^t} + \sum_{t=1}^{\infty} \frac{(\text{ROIC} - \text{WACC}_{t}) \ I_{/ \text{WACC}_{t}}}{(1 + \text{WACC}_{t})^t} - D_{ST} \ (i) - D_{DLT} - D_{FST} \ e_{N} - D_{FLT} \ e_{N} + A_{STS} \ e_{N} + A_{STLC} \]  

[4]

Taking the derivative of E with respect to \( e_{N} \) and derivative with respect to i, the result is:

\[
\frac{dE}{dWACC} = \frac{\text{NOPAT}_{S_{t}} - D_{FST} - D_{FLT}}{\text{WACC}} \ d e_{N} + \frac{-D_{ST}}{d \text{WACC}} \ d \text{i} \]  

[5]

This formula includes the basic factors that determine the sensitivity of corporate equity to changes in the nominal exchange rate and the domestic interest rate. Higher vulnerability results when the factors in brackets are large, either separately or in aggregate, and combine to produce a sharp drop in E for “reasonable” changes in \( e_{N} \) or i. There is a level of change in either \( e_{N} \) or i, however, that would destroy even those firms with reasonable factors between the brackets.

Exchange Rate Changes, Current Account Adjustment, and Corporate Balance Sheets

The dynamics of adjustment of the current account and capital inflows and outflows of a country is complex and changes can take years to work through the economy. In a series of papers Calvo, and Reinhart (1993 and 1995) argue that capital inflows induce a real exchange rate appreciation, are not likely to be spent efficiently and reversals may lead to a crisis. There has, however, been little work on how this complex process affects corporate sector balance sheets, value, or profitability of investment. Three important current account and exchange rate processes have linkages to corporate sector vulnerability.
First, small increases in foreigners' net demand for a country's liabilities (debt and non-debt) can lead to an "overshooting" of the current account deficit, as compared to its long-run sustainable level, and is associated with a temporary real exchange rate appreciation (Edwards, 1999 and Ades & Kaune, 1997). Similarly, decreases in allocation of foreigners' portfolio to a particular country leads to an "undershooting" of the current account deficit and a real exchange rate depreciation. This process normally takes years but depends on the rate of change in flows.

Second, in the short-run, the nominal exchange rate can "overshoot" when it depreciates. In the Asian crisis countries the nominal exchange rate overshooting lasted between 9 to 15 months, finally settling at about 20 to 45 percent below the peak. This period of time and the magnitude of change have an important impact on corporate illiquidity and insolvency. Commonly, the rate of change in the real exchange rate $\frac{de}{dt}$ is modeled as a function of the lagged difference of the nominal exchange rate and real exchange rate, where real exchange rate is $e$.

$$\frac{de}{dt} = \lambda (e_N - e), \text{ where } \frac{1}{\lambda} = \text{mean lag}$$

[6]

The magnitude of the real exchange rate appreciation and depreciation will depend on a number of variables, including marginal propensity to spend on imports and labor intensity of the non-tradables sector. In other words, in some countries the exchange rates will change more than others, given a certain capital inflow or outflow.

Third, the reduction or reversal of flows to the corporate sector necessitates an adjustment of the current account via depreciation of the exchange rate and contraction in output. If the corporate sector has a high share of debt, especially foreign debt, it weakens corporate balance sheets and accelerates outflows creating a vicious cycle that eventually pushes many companies into insolvency (Krugman, 1999[a]).

How is EVE of the corporate sector affected by the first stage of this process, i.e., capital inflow and appreciation? What vulnerabilities might be set up that may lead to a serious crisis in the corporate sector in the second stage, i.e., capital outflow and depreciation? In the first stage, capital is flowing in and real appreciation makes the exports sector less profitable so a disproportionate share may be invested in the non-traded sector. Investments are likely to be based on the expectation that the prevailing (overvalued) exchange rate and rapid growth in GDP will continue. This implies that there is likely to be an expectation of high ROIC. Large inflows, as we know, can be wasted, allocated to unprofitable investment, or lead to bubbles in real estate or other sectors. The counterpart to these investments frequently is a high level of short-term debt. Stock prices are likely to be high. Thus the EVE of the export sector may be low, due to lower profits from a high real exchange rate, and EVE of the non-traded sector may also be low, due to inefficient investment. In other words, stage one conditions may very well encourage vulnerability in the corporate sector.
During the second stage when capital outflows occur, the overshooting of the current account from the first process and possible associated overshooting of the exchange rate from the second process, as well as the vicious cycle described in the third process, may all combine to make a significant part of the corporate sector illiquid and insolvent. Thus the first stage may encourage a buildup of vulnerabilities, producing a "triple shock" to the corporate sector when the outflows occur in the second stage. There is a potential asymmetry in investment in the traded vs. non-traded sector. Exports become more profitable in the second phase just at the time that resources for investment are severely constrained, thus possibly lowering long-run growth.

Micro data from the Asian crisis on corporate financial ratios does warn of the decline in corporate profitability in the years leading up to the crisis (Pomerleano, 1998). Internal Deutsche Bank memos document that an estimated 80 percent of investments in Asia did not cover the cost of debt and equity used to finance them from 1994 through 1996.

Refinement in Vulnerability Factors that Includes Investment and Feedback Effects from Exchange Rate Adjustments

A refinement of the model includes how changes in investment affect the value of corporate equity including the feedback effects from exchange rate changes. Following Krugman (1999), the real exchange rate (e) can be expressed as:

\[
e = \frac{y \left[ 1-(1-a)(1-u) \right] - (1-u)I_1}{X}
\]  

where,

- \( e \) = the real exchange rate
- \( y \) = output
- \( 1-a \) = share of domestic income accruing to workers, which by assumption must be spent in one period
- \( 1-u \) = share of consumption and investment spending on domestic goods
- \( u \) = share of consumption and investment spending on imports
- \( X \) = the value of domestic goods in terms of foreign goods (fixed), foreign elasticity of substitution is 1
- \( I_1 \) = the corporate investment in period 1 (to be fully correct public investment should be added as well, but is not included here as the analysis will focus on changes to corporate investment).

The ratio of the nominal exchange rate (Local Currency/$) to the real exchange rate is defined as \( v_t \), where \( v_t e_t = e_N \) (the nominal exchange rate). Substituting equation [7] in equation [2] and differentiating with respect to \( I \) (corporate investment), we get:

\[
dE = \left[ \frac{v_t (1-u) D_E}{X} \right] dI
\]  

[8]
If the factor in brackets is significantly positive, it magnifies an increase in dl creating an even larger increase in equity, dE. But this works in reverse, causing a sharp fall in equity if dl becomes negative. Thus, higher vulnerability occurs when the factor on brackets is high. This occurs when the share of corporate debt to exports is high and when the marginal propensity to import is low. However, a sharp rise in the term v can significantly increase the factor in brackets in equation [8]. The value of v is very high when the nominal rate depreciates sharply, but before the higher costs of imports have a chance to feed through to increase inflation, raising the domestic price level and bringing v back closer to its pre-crisis value.10 This temporary, increase in v is likely to happen in a crisis just at the same time that dl is negative.

Including all these factors in equation [4] results in:

$$E = \sum_{t=1}^{\infty} \frac{\text{NOPAT}_{L(t)} / (1 + \text{WACC}_t)^t}{(1 + \text{WACC}_t)} + \sum_{t=1}^{\infty} \frac{\text{NOPAT}_{St} \cdot \text{v}_t \cdot \text{e}_t / (1 + \text{WACC}_t)^t + \sum \text{(ROIC} - \text{WACC}_t) \cdot \text{i}_t / \text{WACC}_t}{X}$$

\[- \text{D}_{\text{DST}(t)} - \text{D}_{\text{DLT}} - \text{D}_{\text{FST}} \cdot \text{v}_t \cdot \text{e}_t - \text{D}_{\text{FLT}} \cdot \text{v}_t \cdot \text{e}_t + \text{A}_{\text{STS}} \cdot \text{v}_t \cdot \text{e}_t + \text{A}_{\text{STLC}} \]  

[9]

Inserting equation [7] and taking the total differential, i.e., the derivative with respect to l, as before, plus derivative with respect to eN (= \text{v}_t \text{e}_t), and derivative with respect to \text{i} the result is:

$$dE = \left( \frac{\text{v}_t \cdot (1 - \text{u}) \cdot (\text{D}_{\text{DST}} + \text{D}_{\text{FLT}}) - \text{NOPAT}_{\text{St}} \cdot (1 - \text{u}) \cdot \text{v}_t \cdot \text{e}_t - \text{A}_{\text{STS}} \cdot (1 - \text{u}) \cdot \text{v}_t}{X} \right) \cdot d\text{l}$$

$$+ \left[ \frac{\text{A}_{\text{STS}} + \text{NOPAT}_{\text{St}}}{X} \cdot \text{D}_{\text{DST}} - \text{D}_{\text{FLT}} \right] \cdot d\text{eN}$$

$$+ \left[ - \text{D}_{\text{DST}} \right] \cdot d\text{i}$$

[10]

This is a very powerful formula with the key factors that determine the sensitivity of corporate equity to changes in investment, the nominal exchange rate, and the domestic interest rate. Higher vulnerability results when the factors in brackets are large, either separately or in aggregate, and combine to produce a sharp drop in E for “reasonable” changes in l, eN, or i. From this formula we can see that if NOPAT is large then this offsets the effect of the first term, making the whole term in the first brackets smaller. Thus, as would be expected a large share of export earnings reduces vulnerability corporate sector. (This could be expanded to include commodity price links to profits or recession risks, but this will not be developed further at this point.)
Summary of Vulnerability Factors

The corporate sector is thus highly vulnerable if there is:

- high leverage in the corporate sector and low level of equity;
- high foreign debt in the corporate sector and a high ratio of corporate foreign debt to exports \((D_F/X)\);
- high level of short-term domestic debt and/or short-term foreign debt;
- the potential for the nominal exchange rate to overshoot significantly during a depreciation for a significant period of time (6 months or longer) and ratio of the nominal exchange rate to the real rate to rise sharply;
- a low marginal propensity to import (the ratio of imports to GDP, \(u\), is low) and other factors that may encourage sharp exchange rate adjustments;
- the potential for investment to drop by a large amount. A high share of short-term debt could create the potential for investment to turn negative in a short period of time by creating a short-term financing constraint;
- net hard currency operating profits after tax, NOPAT, are low, and there is the potential for NOPAT and NOPAT to fall sharply in a crisis;
- low level of liquid assets held by corporations;
- an overvaluation of the exchange rate and high investment in the corporate sector for significant period of time; and
- there is a high level of short-term debt and a high concentration of a few lenders, either domestic and foreign, to the corporate sector which could stop financing or rolling-over a short-term debt (Rodrik & Velasco, 1999, and Reinhart & Kaminsky, 1999).

Corporate Sector Destabilization

Once the equity in a corporate sector drops sharply can a corporate sector get destabilized? Destabilization means that protracted restructuring, lower investment, and higher WACC lead to a drop in EVE that takes years to recover to its pre-crisis level. A very important question is whether the corporate sector can get destabilized by initially small exchange rate, and interest rate, or other shocks. A complete answer is beyond the scope of this paper. However, a possible dynamic process is described in Box 1, which indicates that small changes in exchange rates and interest rates and investment may destabilize the sector if: (i) the initial level of equity is low; (ii) vulnerability indicators are high (as described in section above); and (iii) the feedback mechanism from lower equity, and lower asset prices, to lower investment is particularly strong.

The corporate sector can also be destabilized if the shocks are large enough, even if the sensitivity to changes in exchange rate and interest rates is not unusually high and the firms initially had reasonably sound financial positions. The feedback mechanism from lower equity and lower asset prices to lower investment is influenced by expectations. A shock large enough can change expectations, reducing profits and investment thus destabilizing the sector and lowering EVE and growth.
Box 1 – Possible Dynamic Process of Corporate Sector Destabilization

A dynamic model is developed in this section which indicates that the corporate sector may become destabilized from initially small changes in exchange rates and interest rates if vulnerability characteristics and feedback mechanisms exist.

An important feedback whereby the decline in equity value, however, in turn reduces investment. Drawing on the work by Tobin, “Tobin’s Q” is the ratio of the value of existing capital goods to their current “reproductions” cost. In other words a sharp drop in equity means that assets can be purchased for a cheaper price that investing in new capital that means the drop in equity will reduce investment. One way to think of this relationship is that for a given change in E of the corporate sector in aggregate, “I” drops by \((1/\eta)E\), where \(\eta\) is derived from the Tobin’s Q relationship for individual firms or groups of firms.

A drop in “I” and a change in \(v\), if the sector is vulnerable, leads to a drop in E which feeds back further reducing “I” creating a vicious cycle. If a large portion of firms have equity that has suddenly dropped to near zero (or negative) then widespread suspension of payments to creditors is likely to occur, resulting in a systemic crisis. In other words, there is a “point of no return” where a systemic crisis occurs. The uncertainties and expectation of future protracted negotiations with creditors causes a further reduction in expected future investment.

The dynamic process by which the corporate sector might be destabilized is as follows:

**Stage 1** - Small or large outflows result in \(e_N\) up, \(i\) up, \(I\) down;

**Stage 2** - Initial efforts to repay short-term foreign debt reduces reserves. Outflows raise \(e_N\), and \(e_N\) may overshoot;

**Stage 3** - As \(e_N\) increases, \(v\) increases. The exchange rate \(e_N\) may initially overshoot but adjust to a new higher equilibrium level with a lag, as per \(de/dt = \lambda [e_N - e]\). As it takes several months for prices to increase following the devaluation, \(v\) remains high during this period and change in \(I\) is negative. In an attempt to defend the exchange rate, \(i\) is raised;

**Stage 4** - Equity value, \(E\), drops sharply via the parameters in equation [10] given the changes in \(e_N\), \(v\), \(i\), and \(I\). If \(i\) is raised significantly and short-term domestic debt levels are high, \(E\) declines (even if there is little or no change in \(e_N\) in say an unsuccessful speculative attack);

**Stage 5** - \(I\) down driven by \(dI_{t+1} = (1/\eta) dE_t\);

**Stage 6** - Feedback from stages 5 to stages 3 and 4, etc. thus creating vicious cycle until \(E\) has dropped significantly. Negative expectations and other effects reduce sales and profits reducing \(E\). If \(E\) drops to near 0 or \(E < 0\) for a large portion of companies for a significant period of time (1 to 3 months), a systemic crisis occurs;

**Stage 7** - A protracted period of restructuring, lower investment, high cost of borrowing from domestic banks, higher country risk premium, and higher overall WACC result in a lower present value of equity and lower EVE for the corporate sector, as shown in Figure 2. This lowers economic growth. It may take years to recover to pre-crisis levels.
Figure 2 – Diagram of Moderate vs. Severe Crisis

A) Moderate Crisis

![Graph of Moderate Crisis]

B) Severe Crisis

![Graph of Severe Crisis]
III - CORPORATE SECTOR VULNERABILITY AND LINK TO BANKING CRISES AND RECAPITALIZATION COSTS

Since lower, or negative equity in the corporate sector are frequently linked to an increase in non-performing loans, this framework can also be used in evaluation of the linkage of corporate sector vulnerability to banking sector vulnerability.

The timing and level of non-performing loans (NPLs) is a complex phenomena. The increase in NPLs, and arrears to foreign creditors, depends on many legal, regulatory, and behavioral factors. Many are country and situation specific. A full discussion of the point at which NPLs and arrears to foreign creditors occur and their magnitude is beyond the scope of this paper, but certain aspects were discussed in Part II. However, for the purposes of this paper, it will be assumed that NPLs and arrears to foreign creditors occur when a large part of the corporate sector suspends debt payments (for simplicity nonpayment is defined to occur when E drops below a threshold level defined as \( \alpha \)). This nonpayment can be triggered by illiquidity, insolvency, or because payments can be stopped. NPLs are booked commonly after three months of nonpayment.

**Equity of the Banking System**

The cash-flow-based estimate of the equity in the banking system includes present value of earnings and franchise value, less NPLs and payments on foreign debt. While this type of analysis can be very sophisticated and is explained in numerous writings, a simplified formula of the equity of the banking system developed by Flemings can be used here to capture the key relationships. This method to calculate the value of equity in the banking system is the EBPATA method (earnings before provisions after taxes adjusted) includes both book value and premium, even though the recapitalization costs would be based only on the book value.

\[
\text{Value of equity of a banking system} = \frac{E_B}{WACC} - NPLs \times (1 - \text{tax rate})
\]

\( E_B \) is the value of the banking system or groups of banks aggregated in a practical manner. EBPATA is the cash flow of a “clean” banks without the losses of the NPLs (i.e., EBPATA = net income + provisions + [NPLs - balance sheet reserves) x interest rate\( (1-t) \)]. The value of the equity in a “dirty” bank system is simply the market value of the clean bank (EBPATA discounted to PV) less the cash flow expected to be lost from its NPLs after taxes (NPLs - balance sheet reserves) x interest rate x \( (1-t) \) discounted to PV. Banks and finance companies may have liabilities in foreign currency. Note that the payments on foreign liabilities could be separated out from EBPATA if unhedged foreign debt is high (i.e., short-term foreign debt of the banking system is \( D_{bst} \) times the nominal exchange rate \( e_N \) and the long-term foreign debt of the banking system is \( D_{bst} \) times the nominal exchange rate \( e_N \)). A high level of foreign debt in the banking system can sharply reduce the equity in the banking system when the exchange rate depreciates.
sharply or overshoots. This will occur at the same time corporate sector equity also declines in response to the depreciation.

The amount that equity in the corporate sector falls below \( \alpha \) is equivalent to the size of NPLs plus arrears to foreign creditors in hard currency (AFC). In other words, if \( E < \alpha \), then \( \alpha - E = \text{NPLs} + \text{AFC e}_\text{N} \), or equivalently \( \text{NPLs} = \alpha - E - \text{AFC e}_\text{N} \). If this is inserted in the equation for the equity value of the banking system [11], then, other factors equal, this results in the following:

\[
E_B = \frac{\text{EBPATA}}{\text{WACC}} - [\alpha - E - \text{AFC e}_\text{N}] (1-\text{tax rate}) \tag{12}
\]

This relationship can demonstrate the trade-off between negative equity in the banking system, exchange rate, and arrears to foreign creditors. Of course the sensitivity to interest rates could also be calculated, but this is quite complex because EBPATA is a function of the interest spread and is affected by the behaviour of distressed borrowers. This sensitivity of market value is called the modified duration (i.e., duration times \( 1/(1+r) \), where duration of the asset is the weighted average maturity of future flows discounted at \( r \)).

**Banking Sector Recapitalization Costs and the Fiscal Deficit**

An increase in NPLs (driven by the drop in equity in the corporate sector) and reduction in bank equity (from higher costs of meeting foreign liabilities) and result in negative equity in the banking system. If negative equity in the banking system persists for a significant period of time (this varies by country but 6 to 18 months is a guide) then recapitalization is undertaken. The negative equity levels plus the required capital adequacy ratio (CAR) times the remaining earning assets determine recapitalization costs. See Box 2 below.

---

**Box 2 – Calculating Banking Recapitalization Costs**

Once banking equity is estimated, one way of estimating recapitalization costs is the *adjusted book value method*. Recapitalization costs (A) are equal to negative equity in the banking sector plus the required capital adequacy ratio (CAR) times post write-off (W/O) risk weighted assets (RWA). The negative equity in the banking sector is equal to the pre-crisis equity (Eb) less the write-offs (W/O) of peak NPLs. The write-offs (W/O) of peak NPLs are equal to the total value of peak NPLs less accumulated provisions (PROV) and less expected recovery (\( r \times \text{NPLs} \)), where \( r \) is the recovery ratio of collateral value recovered to the total value of the NPL.

\[
A = \text{negative equity + positive equity to meet CAR requirement}
A = [Eb - (W/O)] + [\text{CARx(RWA - W/O)}]
A = [Eb - (\text{NPLs} - \text{PROV} - r \times \text{NPLs})] + [\text{CARx(RWA - (NPLs - PROV - r \times \text{NPLs})]}]
\]

To use these equations, we can plug in the value of Eb, the required CAR percentage, and the RWA.
Using the recapitalization cost methodology described above, or similar approaches, a matrix can be constructed to estimate the present value of the net funding cost for a given level of negative equity in the banking system, factoring in the effects of banking sector foreign debt and of the decline in the corporate sector equity below the threshold $\alpha$. The funding cost can be calculated for various levels of NPLs and various levels of recovery rates. The table below gives an example of fiscal cost that needs to be funded, both the gross funding required and expected net funding for a given recovery rate.

**Table 2 - Example Bank Recapitalization Costs (As a Percent of 1998 GDP)**

<table>
<thead>
<tr>
<th>Peak Non-Performing Loans</th>
<th>Gross Funding Required</th>
<th>Net Funding Required After Recovery If the Recovery Rate Is:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>20%</td>
</tr>
<tr>
<td>30</td>
<td>17</td>
<td>12</td>
</tr>
<tr>
<td>40</td>
<td>26</td>
<td>19</td>
</tr>
<tr>
<td>45</td>
<td>30</td>
<td>22</td>
</tr>
<tr>
<td>55</td>
<td>39</td>
<td>29</td>
</tr>
</tbody>
</table>

Assumes recapitalization to 8% Capital Adequacy Ratio (CAR).

Source: World Bank staff estimates.

The timing of the recovery of the loans will affect the present value of the fiscal cost because the carrying cost will be higher. Equity increases as debts are written down, NOPAT, ROIC and I go up, or WACC drops. This should be factored into fiscal cost estimates and funding requirements.

The concept of present value of fiscal costs associated with recapitalization costs from negative equity in the banking system is called ADAM, or Alternative Deficit Analysis Methodology. This useful concept factors in all the costs associated with the fiscal costs on a present value basis, and thus is comparable to EVE. The impact of external circumstances and of various policy options on both EVE and ADAM can be estimated. This gives a quantitative basis for comparison of policy options. Figure 3 is a diagram of key relationships between the corporate sector, macroeconomy, and financial sector.
Figure 3 – Relationship of Corporate Sector, Macroeconomics, and the Financial Sector

CORPORATE SECTOR

Bank Equity

Financial Sector

NPLs

Domestic Debt

Foreign Debt

Equity

EVE

Interest Rates

WACC

Fiscal Policy

(PV of bank recapitalization costs or ADAM - Alternate Deficit Analysis Methodology)

MACROECONOMICS
IV - POTENTIAL APPLICATIONS

The framework has multiple applications. It can help us understand past crises. Using it for retroactive analysis can help us understand the degree of insolvency and vulnerability present before a crisis takes hold, as well as disaggregate the relative importance of past changes in exchange rates, interest rates, recession, and other factors on corporate sector equity value. The framework also allows forward-looking analysis, through simulations of the impact of different shocks (including exchange rates, interest rates, recessions, and investment plans) and policy options. These different scenarios can be used to simulate changes in equity and EVE in aggregate or by sector. Rating the vulnerability of the corporate sector across countries can then help investors and policymakers understand the links to financial sector stability and sovereign risk, as well as the riskiness of the environments in which individual corporations are operate. It can help banks do better credit risk analysis and improve surveillance of financial sector stability.

Policy analysis is another important application of the framework that can help policymakers at the macroeconomic level or at the financial sector and corporate sector level. At the macro level it can be part of an early warning system for high vulnerability. It can be used to evaluate the potential impact of alternative exchange rate regimes and instruments to control capital flows. As a tool for credit risk analysis it can be used to examine financial sector vulnerability, and thus has implications for regulation and supervision of banks. It can help determine policy to reduce vulnerability at the corporate level and in the design of corporate restructuring strategies.

Improving Understanding of Past Crises

This framework can be useful in diagnosing past crises in several ways. Pre-crisis data can be used to estimate the formulas for value of equity and EVE (by key sectors). Using data during and after the crisis, the factors contributing to the decline in equity and EVE can be estimated. Destabilization of parts of the corporate sector can be analyzed.

Indonesia is used as an example to apply part of the framework to help understand the recent crisis. Annex 3 gives details on the negative impact of the exchange rate depreciation in 1998, by sector. Firm data shows how equity declined and the standard deviation of equity of groups of firms increased, particularly in the industrial sector. The present value of aggregate corporate sector equity, as proposed in this paper, was estimated for firms comprising three-quarters of the corporate sector (stock exchange data plus estimates for some others). A forward-looking analysis was undertaken to compare the aggregate equity value with and without a crisis, from the viewpoint of 1997. The estimated equity value is lower by 55 percent of 1998 GDP. The effects of various factors can be disaggregated. Equity dropped an estimated 29 percent of GDP due to the exchange rate depreciating from the 1997 level (Rp 2,500/$) to the post-overshooting level (Rp 8,500/$). Equity fell 10 percent of GDP due to the interest rate increases and another 8 percent of GDP due to the WACC increasing sharply in 1998 and declining over time to the pre-crisis level (the WACC went up due to the increase in
sovereign spreads and higher domestic interest rates; the higher cost of equity was estimated using Goldman Sachs figures given in Annex 2). Equity fell an estimated 6 percent of GDP due to lower profits (lower NOPAT for 3 years; note NOPAT does not include debt service payments). Equity fell 2 percent of GDP due to lower investment. It was assumed that investment would be low for about 4 years and then return to pre-crisis levels and pre-crisis returns (i.e., high investment but low returns, which may be similar to lower investment and higher returns). Different scenarios, such as scenarios for profits and investment, could be made for future years, but these figures illustrate the usefulness of this framework in disaggregating the impact of various factors on value of corporate equity.

Macroeconomic Policy Analysis

The framework can be applied to forward-looking analysis through simulations of the impact of different possible shocks (including exchange rates, interest rates, recessions, and investment plans) and policy options. These different scenarios can be used to simulate changes in equity and EVE, in aggregate or by sector. This can help in early-warning models that measure financial sector vulnerability. Three potential applications to macroeconomic policy are discussed here. First, stress testing and early warning are useful applications of the potential impact of combinations of policy options (exchange rate, monetary, and other) on corporate sector equity. A second important application is the evaluation of alternative exchange rate regimes. For example, how do a fixed peg, floating rates, or dollarization compare as to their potential impact on EVE and equity in different scenarios? With dollarization many of the risks of destabilizing the corporate sector disappear (i.e., exchange rate shocks, high interest rate shocks, and high sovereign risk due to currency changes). As pointed out by Hinds (1999), there are large benefits to the business sector of dollarization. The analysis of floating rates plus much more hedging is another alternative. This framework can be used to bring in country-specific characteristics, of the current account adjustment process or of the corporate sector, to help design optimal exchange rate and interest rate policies during a potential crisis.

Value at Risk models, like the capital at risk models, measure the expected loss of exceptional losses beyond a certain probability (usually 5%). If there are probability distributions on the risk of exchange rate changes and for other variables, an Economic Value at Risk (EVAR) might be estimated for the present economic value at risk (i.e., lost EVE). The EVAR for different exchange rate regimes could also be estimated. Similarly, the portion of the capital at risk for the banking system that is contributed by the corporate sector could be estimated.

A third application is to help design instruments for control of short-term capital flows, such as taxes on short-term capital inflows. These instruments may help reduce vulnerability of the corporate sector and reduce the magnitude of outflows during a panic.
Surveillance – Cross Country Comparisons of Vulnerability

Rough calculations of corporate sector vulnerability (called the V score), using readily available public data, were used to estimate the sensitivity of equity to changes in a combination of exchange rate, interest rate, and investment shocks. The vulnerability score measures the sensitivity of equity using estimates for equation [10]. The level of equity and its relationship to the threshold of nonpayment are not included due to limited resources available for this study. However, it is significant that the key Asian crisis countries top the list, followed by other countries with recent difficulties. The scores are highest for the four Asian crisis countries, as well as, South Africa, Colombia, Chile, and Argentina. Chile and Argentina have capital controls or a currency board, which reduces the vulnerability to exchange rate shocks. South Africa and Colombia have had, or are currently having, serious difficulties. The results are shown in Table 3 below.

Table 3 - Improving Surveillance of Corporate Sector Vulnerability

<table>
<thead>
<tr>
<th>Country</th>
<th>V Score for Corporate Sector –1996/7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thailand</td>
<td>10</td>
</tr>
<tr>
<td>Indonesia</td>
<td>8</td>
</tr>
<tr>
<td>Korea, Rep. of</td>
<td>7</td>
</tr>
<tr>
<td>Malaysia</td>
<td>6</td>
</tr>
<tr>
<td>South Africa</td>
<td>6</td>
</tr>
<tr>
<td>Colombia</td>
<td>6</td>
</tr>
<tr>
<td>Chile</td>
<td>6</td>
</tr>
<tr>
<td>Argentina</td>
<td>5</td>
</tr>
<tr>
<td>Peru</td>
<td>4</td>
</tr>
<tr>
<td>China</td>
<td>3</td>
</tr>
<tr>
<td>Brazil</td>
<td>3</td>
</tr>
<tr>
<td>Philippines</td>
<td>3</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>3</td>
</tr>
<tr>
<td>Pakistan</td>
<td>2</td>
</tr>
<tr>
<td>Egypt</td>
<td>2</td>
</tr>
<tr>
<td>Turkey</td>
<td>2</td>
</tr>
<tr>
<td>India</td>
<td>2</td>
</tr>
</tbody>
</table>

Source: Author's estimates.

The higher the V score the higher the vulnerability. These vulnerability scores are preliminary, based on available data; and more detailed, more accurate analysis is being undertaken.
Corporate Restructuring - Evaluating Alternative Policy Options and Burden-Sharing Arrangements

Since sound corporations are necessary if an economy is to have good banks, corporate restructuring must be linked to bank restructuring, which, in turn, must be linked to the settlement of external debt problems. Integrated restructuring of both corporate assets and liabilities is required if competitive enterprise and financial sectors are to be developed, the risk of crises recurring is to be reduced, and the cost to taxpayers is to be minimized.

This framework can be used to calculate the value of corporate equity and present value of associated fiscal deficit costs associated with bank recapitalization. Examples of corporate restructuring scenarios that show different sizes of debt writedown, different speeds of restructuring, and different burden-sharing arrangements are shown in Table 4. This is a useful tool to evaluate combinations of policy options so as to maximize the EVE of the corporate sector and minimize the fiscal costs. In order to bring debt-to-equity ratios of the corporate sector in Korea back to near two, about one fifth of all debt needs to be converted into equity or written off, while for Indonesia this figure is over one half of all debt. In both countries, acceleration of corporate restructuring by 2 years is estimated to increase the present value of equity by a sizeable amount, from 7 to 9 percent of GDP.

Table 4 – Example of Change in Value of Corporate Sector Equity and Present Value of Net Fiscal Deficit Cost (ADAM) (percent of 1998 GDP)

<table>
<thead>
<tr>
<th>Korea, Rep. of</th>
<th>Indonesia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value of Corporate Equity</td>
<td>PV of Fiscal Costs</td>
</tr>
<tr>
<td>Debt writedown of 20%</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>31</td>
</tr>
<tr>
<td>40%</td>
<td></td>
</tr>
<tr>
<td>66%</td>
<td>(Both foreign and dom. debt)</td>
</tr>
<tr>
<td>Reducing corporate debt to equity ratios to 200% in 2 years rather than 4 years</td>
<td>7</td>
</tr>
<tr>
<td>No foreign debt writedown with full adjustment by writedown of domestic debt to reach debt to equity ratios of 200% in 2 years</td>
<td>17</td>
</tr>
</tbody>
</table>

In 1998, the value of corporate equity in Korea was about a fifth of GDP, while in Indonesia equity was negative.

Source: Author’s estimates.
Other Possible Applications

The framework for valuation developed in this paper could help assess potential loan recovery value under different conditions. This is relevant to the secondary market value for debt from distressed corporations, which can create liquidity for banks and enhance recovery of bad loans for an asset management unit (AMU).

This framework might be used to evaluate the potential impact of alternative insolvency regimes. Insolvency frameworks, or corporate rescue frameworks as they are sometimes called, can help reduce vulnerability by weeding out non-viable firms and by allowing restructuring to take place quickly in the event of a crisis. An effective bankruptcy system, out of court procedures, and elimination of obstacles to restructuring are an important part of the insolvency framework. Obstacles to debt-to-equity conversions, mergers, other distortions, as well as an out-of-court workout system, should be in place before a crisis to help reduce vulnerability.

This framework is also applicable to issues related to the adjustment of the balance sheet of underleveraged companies prior to privatization. It was common in the U.K. and other privatizations to inject debt on balance sheets. By injecting debt or converting debt to equity, prior to privatization the government, as owner of the debt, can increase the present value of fiscal resources and reduce the agency free cash flow problem within the enterprise (thus improving EVE).
Annex 1 - EVA® and Valuation Approaches Using Corporate Financial Data at the
Firm and Sector Level

The traditional measures of valuation, below, are increasing being replaced by
measures which rely on economic value added, to capture the true economic profit of the
enterprise or groups of enterprises.

Traditional measures

_Earnings per share or return on equity_

Short-term, requires information about cash flow only the next few years at the
best. Earnings tends to focus mainly on managing the income statement and places low
weight on the actual amount and timing of the cash flows. Traditional measures are less
comprehensive in measuring value of companies.

New measures (EVA® or McKinsey's Cash-Flow Based Valuation Approach)

Measuring corporate values must use a long-term point of view, taking into
account all cash flows on both the income statement and the balance sheet, and cash
flows from different time periods on a risk-adjusted basis. EVA is Economic Value
Added, a term coined by Stern and Stewart, which is a measure of the true profits of a
corporation. EVA is defined as Net Operating Profits after Tax minus cost of capital
times total capital. The present value of EVA is MVA, or Market Value Added of a firm.

For a group of firms the value, using risk adjusted discount rates, is EV which is
similar to aggregate MVA of many firms added together. Economic Value Estimate
(EVE) = Value of Debt + Value of Equity = PV of return to creditors + PV of return to
shareholders =PV of current operations + PV of Future Investment

PV of Current Operations = NOPAT/WACC
PV of Future Investment = (ROIC-WACC)I /WACC

Net operating profit after tax (NOPAT)

NOPAT represents the after-tax operating profits of the company after adjusting
the taxes to a cash basis. It represents the value that is available to all the company’s
capital providers, both debt and equity.

Calculation of NOPAT

NOPAT = EBIT – Income Taxes
EBIT = Earnings before interests and taxes
   = Sales Revenue – Costs of goods sold
     – Selling and admin. Costs
     – Depreciation expense
Rate of return on invested capital (ROIC)

ROIC is a better analytical tool for understanding the company’s performance than other measures such as return on equity or return on assets, because it focuses on the true operating performance of the company. Return on equity mixes operating performance with financial structure. Return on assets are not adequate because non-interest bearing assets are not deducted from the total assets.

\[
\text{ROIC} = \frac{\text{NOPAT}}{\text{Invested Capital}}
\]

Invested capital = Operating Capital + Net Fixed Assets + Other Assets = All Equity + Interest bearing Debt

\[
\text{ROIC} = \frac{\text{EBIT} \times (1-\text{Tax rate})}{\text{Invested Capital}} = \frac{\text{EBIT}}{\text{Sales Revenues}} \times \frac{\text{Sales Revenue}}{\text{Invested Capital}} \times (1-\text{Tax rate}) = \frac{\text{Operating Margin}}{\text{Capital Turnover Ratio}} \times (1-\text{Tax rate})
\]

Interest coverage

Interest coverage, the amount of earnings available to pay interest expense, measures the company’s financial cushion. It provides a sense of how far operating profits could fall before the company would have difficulty serving its debt.

\[
\text{Interest Coverage} = \frac{\text{EBIT}}{\text{Interest Expense}}
\]

Capital structure

Debt/Total Investment Funds measure the company’s reliance on debt capital. While debt has tax advantages, it reduces a company’s flexibility, because debtholders expect to be paid on a pre-set schedule, while the company has greater flexibility in paying dividends to shareholders.

Investment rate

The investment rate is the ratio of investment to available funds. This measure can tell you whether the company is consuming more funds than it is generating (investment rate greater than one) or generating extra cash flow than can be paid to investors as interest expense, dividends, etc.

\[
\text{Dividend payout ratio}
\]

The dividend payout ratio is total common dividends divided by income available to common shareholders. In conjunction with the investment rate, we can understand the financial situation of the company.
Data to Be Collected

Collection of key corporate data requires both a top down approach and a bottom up approach. The top down data are aggregate data on debt by type of borrower, maturity, duration, etc from government, BIS, IMF, Bank and other sources. The data for a bottom up assessment of large corporates should include the following: (i) trends in profitability (e.g., net profit), and operating cash flow (EBITDA) relative to interest expense; (ii) trends in investment return (e.g., ROA, ROI, ROE); (iii) trends in the maturity of corporate debt; (iv) trends in leverage (e.g., liabilities/equity); (v) aggregate hedge and FX positions; and (vi) sectoral cost trends. The information may already have been collected and be available from local stock exchanges, the central bank, BIS, IMF, WB or investment banks. Approximate estimates of aggregate equity by key sectors can be made with available data and this can give useful insights. However, detailed information is desirable and if the information has not been compiled, extra effort will be necessary to collect it or hire accounting firms to collect specific corporate disaggregated and aggregated data. Detailed company data can be aggregated through a bottom up approach or shortcuts can be used to estimate the parameters for groups of companies.
Annex 2 – Weighted Average Cost of Capital (WACC) and Capital Asset Pricing Model in Emerging Markets

To estimate the value of companies or value of the whole corporate sector, the appropriate risk-adjusted discount rates for equity, domestic debt and foreign debt need to be estimated. These are weighted by the shares of debt and equity to get the weighted average cost of capital. The weights used to calculate value can be the weights in the actual capital structure or the target capital structure. The choice depends on the goals of the exercise. Existing shares of debt and equity can be used for countries pre-crisis and target shares for in crisis and post-crisis countries.

The capital asset pricing model, commonly used in developed economies, can be simplified and used to estimate the cost of debt and equity in an emerging market. In developed markets, the CAPM calculates the cost of equity using:

\[ R = R_f + R_{EQ} = R_f + \beta (R_M - R_f) \]

where \( R_{EQ} \) is the equity risk premium, and \( \beta = \frac{\text{cov} (R_M, R_f)}{\text{var} (R_M)} \), \( R_M \) = the return on the market, \( R_f \) = risk free rate, \( \text{cov} \) is covariance and \( \text{var} \) is variance.

** Modifications needed when adapting this model in emerging markets **

First, a country risk premium, estimated by the spread on emerging market debt, needs to be included. The country risk premium (\( R_{CRP} \)) can be thought of as the extra cost to all borrowers reflecting the deadweight loss of defaults and losses from a few borrowers. It raises the cost of borrowing and shifts up the market risk-return line in the emerging market country. The \( R_{CRP} \) rises with the overall debt level in the country and rises when there is a contagion effect in emerging markets that increases the emerging market spread. This raises the cost of capital for public and private borrowers alike.

Second, the cost of domestic borrowing by a private entity within an emerging market country should build the higher cost, \( R_B \), associated with inefficiency and high costs that might be associated with the domestic banking system (e.g., high lending spreads due to the need to cover bad loans and/or high costs).

Third, an estimate of the equity risk premium, \( R_{EQ} \), in the emerging market is needed. One way to possibly estimate it is to break out the term which make up the \( \beta \) can be rearranged as follows:

\[ R_{EQ} = \beta (R_M - R_f) = \frac{\text{cov} (R_M, R_f)}{\text{var} (R_M)} (R_M - R_f) = \rho \sigma \ (R_M - R_f)/ \sigma \]

The last term, \( (R_M - R_f)/ \sigma \), is the “market price of risk” measured to be 0.5 in stock markets around the world (Eiteman and Stonehill, 1979). It is, in a sense, the measure of risk aversion for an average investor. If the market price of risk is constant and if \( \rho \) and \( \sigma \) can be estimated, then a value can be obtained for \( R_{EQ} \). However, in practice it is not
clear if the risk premium changes or not and the other factors are difficult to estimate. The suggested way of estimating the equity risk premium is relative to the US risk premium and relative market volatility, as developed by Goldman Sachs and described in the next section of this Annex.

Combining these adjustments, we can have a simplified formulas for the cost of debt and cost of equity in emerging markets. $R_{CRP}$ is the country risk premium measure by the spread on the country's emerging market sovereign debt. $R_f$ is the T-bill rate or overnight intrabank rate in the country, which of course varies with monetary policy and interest rate changes to defend the exchange rate. $R_B$ is the bank spread which increases with inefficiency and non-performing loans in the banking system, and is reduced if bank efficiency improves or with recapitalization. $R_{PRP}$ is the corporate lending spread.

Cost of domestic debt: $$R_{DD} = R_f + R_{CRP} + R_B$$

Cost of foreign debt to domestic private sector: $$R_{FDP} = R_f + R_{CRP} + R_{PRP}$$

Cost of equity for private sector: $$R_{EP} = R_f + R_{CRP} + R_B + R_{EQ}$$

Cost of foreign debt for sovereign: $$R_{FDS} = R_f + R_{CRP}$$

During periods of excessive liquidity in the international market, emerging market spreads can be unusually low (as in 1996 and early 1997). This makes the cost of foreign borrowing and the $R_{CRP}$ quite low. However, during an exchange rate crisis, $R_{CRP}$ can be very high for a period of time. During a banking crisis, which frequently coincides with an exchange rate crisis, the $R_B$ can increase. Below are illustrative figures for the real cost of debt and equity, with and without a crisis.

<table>
<thead>
<tr>
<th></th>
<th>No Crisis</th>
<th>With Crisis</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_f$</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>$R_{CRP}$</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>$R_B$</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>$\rho_{MK} \sigma_k$ 0.5</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>$\rho_{NLK} \sigma_k$ 0.5</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Cost of Domestic Debt: $R_{DD}$</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>Cost of Foreign Debt: $R_{FD}$</td>
<td>8</td>
<td>14</td>
</tr>
<tr>
<td>Cost of Equity $R_{EP}$</td>
<td>15</td>
<td>26</td>
</tr>
</tbody>
</table>

These are used with target weights for capital structure of each firm or approximations using aggregate data for groups of firms. The calculations of EVE are in local currency. It is easiest to estimate real rates to discount real flows in local currency.
Goldman Sachs Methodology for Estimating the Equity Risk Premium

Goldman Sachs has developed a very interesting and practical methodology for estimating the cost of equity in emerging markets, which has gotten good reviews. See attached sections excerpted from a Goldman Sachs publication “Emerging Market Discount Rates” by Mariscal and Hargis (1999).

“Our methodology starts with the basic assumption of the capital asset pricing model, where the discount rate for a stock is equal to the risk-free rate plus the equity risk premium. 1 As would be the case for the stock of any region, we define the discount rate (R) as the sum of risk-free rate (R_f) plus an equity risk premium (R_EQ) as shown in equation 1.0.

(Eq. 1.0) \[ R = R_f + R_EQ \]

For dollar-denominated investors buying emerging market stocks, we redefine the risk-free rate (R_f) as the sum of the risk-free rate in the U.S. market (R_u), the yield on the 30-year US Treasury bond, plus a country-risk spread (R_s), the yield differential on a sovereign, dollar-denominated emerging market bond of similar maturity. This relationship is summarized in equation 2.0.

(Eq. 2.0) \[ R_f = R_u + R_s \]

Analogously, we define the equity risk premium for a given emerging stock market (R_EQ) as the equity risk premium in the United States (R_EQUS) multiplied by the ratio of daily volatility of the stock market index of the emerging country (S_b) to the volatility of the U.S. market index (S_u). This relationship is shown in equation 3.0, below.

(Eq. 3.0) \[ R_EQ_{Emerging} = \left( \frac{S_b}{S_u} \right) R_EQUS \]

Our decision to use the ratio of standard deviations rather than the beta of the emerging market is due our assumption that local-market volatility plays a greater role than betas in determining risk in a world market portfolio (i.e., as if it were segmented from the U.S. market). Research on emerging market equities has not been able to determine definitively whether markets are currently segmented or integrated. However, measures of volatility can distinguish between high-and low-return markets better than betas do. For this reason, we use local-market volatility rather than betas (we elaborate further on this point below).

The equity risk premium is allowed to vary over time. In this fashion, our formulation is an improvement on the popular method of adjusting the equity risk premium for emerging markets by adding a constant spread over the U.S. equity risk premium. Substituting equations 2.0 and 3.0 into equation 1.0, we obtain our basic discount rate expression as follows:

(Eq. 4.0) \[ R = (R_u + R_s) + \left( \frac{S_b}{S_u} \right) R_EQUS \]
Our formulation allows expressing the equity risk premium as a multiple of the U.S. market premium. (The first term on the right side of the equation represents the redefined risk-free rate, while the second term is the adjusted equity risk premium. To calculate a stock-specific discount rate ($R_p$), the equity risk premium in equation 4.0 could be further adjusted by the beta of the stock ($\beta$) versus the local stock market, as follows:

(Eq. 4.1) \[ R_p = (R_u + R_s) + \beta \left( \frac{S_b}{S_u} \right) R_{EQUUS} \]

The model, as presented above, has at least one significant structural flaw. While in the basic CAPM model, the risk-free rate and the equity risk premium are two different and independent types of risk, the two risks may actually overlap in our formulation, leading to a problem of double counting. One possible reason for double counting is the exchange-rate linkage. For consistency, we measure the discount rate in dollar terms; therefore, foreign exchange volatility affects both the equity risk premium (measured in dollars) as well as the sovereign risk spreads. This double counting would likely result in an exaggeration of risk and an overestimation of the discount rate. To obtain a more realistic assessment of the true discount rate, we adjust the equity risk premium by subtracting the correlation of dollar returns between the stock market and the "risk-free" bond, as follows:

(Eq. 5.0) \[ \text{Adjusted } R_{EO} = R_{EQUUS} \left( \frac{S_b}{S_u} \right) (1 - \text{corr}(T, B)) \]

In equation 5.0, $E_a$ is the adjusted equity risk premium, and $T$ and $B$ are dollar-denominated stock and bond returns, respectively. Substituting expressions (5.0) and (2.0) into (1.0), we obtain our basic discount rate formulation:

(Eq. 6.0) \[ R = (R_u + R_s) + R_{EQUUS} \left( \frac{S_b}{S_u} \right) (1 - \text{corr}(T, B)) \]

We note several advantages to our methodology. First, from a conceptual perspective, our formulation allows for the decomposition of the discount rates into bond market variables (U.S. interest rates and local bond spreads) and stock market variables (local-market volatility). This feature permits us to use the calculated discount rate to simulate stock market sensitivity to changes in sovereign spreads, U.S. interest rates, or stock market volatility assumptions. In addition, the decomposition of the discount rate components enables us to optimize the existing analytical resources at a firm. Forecasts for U.S. interest rates are obtained from our U.S. economists, while forecasts for bond spreads are obtained from our sovereign bond specialists and emerging market economists. Finally, the model uses observable and easy-to-obtain market data, rather than subjective assumptions about risk indicators.” See example calculations in attached graph.
Annex 3 – Graphs on Corporate Sector Data in Indonesia

Four graphs are attached on changes in corporate equity for groups of companies in various sectors, estimates of unhedged liabilities and exchange rate changes in Asian crisis countries. Data from the stock exchange, representing more than half the corporate sector was used. The level of unhedged liabilities in 1997 was very high, above 80% for most sectors, as shown in Graph 1, below. A comparison of the exchange rate depreciations, overshooting followed by stabilization, for the four key Asian crisis countries is Graph 2, below. With June 1997 used for the base year, it can be seen that the exchange rate depreciation was two to three times larger in Indonesia, in percentage terms, than in Thailand, Korea, and Malaysia. The sharp decline in equity by sector can be seen in Graph 3, which shows positive equity for all sectors using 1997 data (exchange rate of Rp2500/$) to a “snapshot” of equity value in June 1998 (exchange rate Rp14,000/$) due to the impact of the exchange rate on unhedged foreign debt. It is useful to look at the distribution equity by firm for four key sectors in December 1997 and June 1998. The equity distribution does not change too much for firms with a natural hedge of exports, mining, and agriculture. The industrial sector shows a much different story. While the equity was positive for all firms in 1997, it is negative for virtually all firms in June 1998; and the standard deviation of the distribution of equity increases substantially. Other sectors--consumer goods, real estate and construction, and trade--show similar trends but the drop in the level of equity and the rise in the standard deviation are smaller than for the industrial sector. The exchange rate of course came down from the peak of Rp14,000/$ to a stabilized level of Rp8,500/$. Thus by 1999 the impact of the exchange rate was reduced, but recession, higher interest rates, credit crunch, and low investment have had a negative impact on corporate sector finances. The sector was clearly destabilized. A period of complex debt and corporate restructuring has begun that will take years to complete.
Distribution of Equity of Listed Indonesian Firms by Sector, December 1997 and June 1998

Source: Jakarta Stock Exchange and World Bank estimates.

Sector
1–Agriculture and Mining, 2–Industry, 3–Consumer Goods, 4–Real Estate, Construction, and Infrastructure, 5–Trade, Services, and Investment
Value of Equity of Listed Firms in Indonesia by Sector, Pre-and-During Crisis

Source: Jakarta Stock Exchange and World Bank estimates.

Sector
AGR-Agriculture; MIN-Mining; INCH-Basic Industry and Chemical, MISC-Misc. Industry; CON-Consumer Goods; REST- Real Estate and Construction; INF-Infrastructure, Utilities and Transportation; TRSER-Trade, Services and Investment
Share of Unhedged Foreign liabilities of Indonesian Listed Firms, End of December 1997

Source: Jakarta Stock Exchange and World Bank estimates.

AGR-Agriculture; MIN-Mining; INCH-Basic Industry and Chemical; MISC-Misc. Industry; CON-Consumer Goods; REST-Real Estate and Construction; INF-Infrastructure, Utilities and Transportation; TRSER-Trade, Services and Investment
East Asia: Exchange Rate Overshooting During the Crisis

Source: Jakarta Stock Exchange and World Bank estimates.
NOTES

1 Profits = Operating revenues - operating costs
   - domestic interest rate x domestic debt
   - foreign interest rate x exchange rate x foreign debt
   - domestic debt principal payments
   - exchange rate x foreign debt principal payments

2 EVA® is described in “Quest for Value” by G. Bennett Stewart III and “EVA” by A. Erhbar.


4 Details on how to estimate the cash flows and to estimate WACC values are explained in detail in several publications and in Annex 1.

5 Note that pure waste or theft of a portion of the “investment” can drag down the overall ROIC.

6 This follows the shorthand used by Modigliani and Miller (from book “Valuation”). In fact NOPAT is discounted by (1+WACC) for each future year, but the second term is incremental units of investment discounted to infinity so a shorthand formula with WACC as divisor is used. This also applies to equation [10].

7 This assumes there is not a very high consistent correlation between i and eN on average in the short-run across countries, a reasonable assumption and supported by analysis by the World Bank (1999).

8 Real rate as measured by the PPP equilibrium rate or an estimated real exchange rate used for a base year.

9 l is in fact l1 in the formula above. d E = [ (ROIC - 1 + v, (1- u) Df ) ] d l
   WACC

   It is assumed that ROIC is close to WACC.

10 Since v = eN/e, if e is nearly equal to the long-run equilibrium real rate, then:

   v = de/dt + 1
   \lambda \ e

   In this case v is a function of the mean lag factor 1/\lambda, which is determined by the characteristics of trade adjustment in the country under study, as well as e and de/dt.

11 The full expression, using a modified EBPATA that separates out payments on foreign debt, is:

   Value of equity of a banking system = E = modified EBPATA / WACC
   - Delt eN - Dfet eN
   - [(\alpha) \cdot (\Sigma) NOPATt / WACCt + \Sigma NOPATt eN / WACCt + \Sigma (ROIC -WACC) l, / WACCt
   - Dst (i) - Dlt - Df eN + Afs eN + Astl - AFC eN] \times (1 - tax rate)

   (The sum \Sigma is from t=1 to large T.)

12 Duration is the weight average maturity of future discounted flows using the ratio of the present value of each flow to the present value of all flows as weight for the different dates. (See Risk Management in Banking by J. Bessis, pages 205 to 214.)

13 A level generally recognized as being reasonably “safe.”
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