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Moody's Analytics Country Risk Service

INTRODUCTION

A critical component to a multinational firm's investment and development is the risks associated with operating in a foreign country. Moody's Analytics has created a Country Risk Service that will allow clients the ability to assess the risks across several dimensions using a suite of indicators. Risks for some businesses may tilt more heavily toward exchange rate or transfer risk or sovereign debt risk, and we provide a solution that gives clients the flexibility to leverage our data and analysis to assess their risk profile.

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The core of our risk service is the Moody's Analytics Country Risk Index, which assesses risk of 188 countries along six risk dimensions. The index incorporates more than 100 metrics, as well as country-expert opinions. In addition, users have the option of adjusting weights across the six dimensions to produce scores that more accurately match their risk preferences. As the broadest measure of risk, the MACRI sets the relative levels of long-run risk across the globe.

To complement the MACRI's broad view of risk, Moody's Analytics has developed risk measures of specific short-run events. While Venezuela might be riskier than Chile in the MACRI due to systemic differences, at a given point in time Chile might be closer to a recession or a currency depreciation than Venezuela. Our risk service provides four different elements focused on short-run risk.

A recession can easily disrupt operations and transform revenue projections. Therefore, we developed a risk of recession metric that estimates the probability of a recession occurring over the subsequent 12 months. This product covers the 105 countries that Moody's Analytics forecasts. Every month new estimates are calculated using the most recent high-frequency data series possible for each country.

While recessions can sometimes cause depreciation of a currency, depreciation events can happen more quickly and be just as disruptive to a firm's operations. Our Currency Depreciation Index provides users a view as to where depreciation events are most likely to occur across 108 different countries. This indicator is updated monthly and estimates the risk over both the short and medium term.

Government debt crises can interact with currency valuations and disrupt credit markets. To measure risks associated with government debt, we have developed a measure of fiscal space for 77 of the countries that we forecast. We define fiscal space as the amount of additional borrowing, above current debt (as measured as the percent of GDP), that a country is capable of without endangering debt sustainability.

Data and forecasts serve as the foundation for all our country risk metrics. Our final risk measure uses that data in a slightly different way to measure the short-run economic performance of a country. The economic surprise and clarity indexes inform users about how the most recent data stack up against our forecast and a country's historical performance. Has the country overperformed our forecasts? Or has it underperformed relative to its history? This is a broader view than the other short-run risk measures and is more focused on the economy and a shorter time frame than the MACRI.

Moody's Analytics Country Risk Service provides clients with the ability to assess risk in many ways and provides flexibility for users to focus on the risks that are most critical to their operations. Our risk service views several dimensions of risk as well as multiple time horizons to generate as complete a picture as possible. Further risk measures will be added, and as with all Moody's products, the underlying data and models will continue to be monitored, maintained and improved.

MACRI – Moody's Analytics Country Risk Index

The MACRI aggregates threats faced along multiple dimensions of risk and uncertainty into a single country risk score, ranging from 0 to 100. This score is computed from a weighted average of numeric scores assigned to six specific categories of risk. Each of these risk scores is calculated by transforming, weighting and aggregating across a vector of quantitative and qualitative risk metrics, together with subjective risk ratings produced by Moody's Analytics country analysts.

The value of a risk indicator depends on its ability to condense data of high dimensionality into a specific ranking. But it must do so in a way that preserves definitional clarity, by not conflating too many different types of risk into a single, vaguely defined category. To strike a balance between too little and too much data aggregation, the MACRI provides risk assessments for six distinct dimensions of economic or sociopolitical risk. As a result, rather than simply stating a single overall risk ranking for a country, or a ranking of a vague concept such as "political risk,"

it allows users to create their own risk assessments by choosing their own weighting across specific, well-defined categories of risk. The six categories are as follows:

- » **Macroeconomic risk**, related to the natural cyclical nature of the economy and the quality of monetary and fiscal policy;
- » **Microeconomic (or business) risk**, reflecting operational uncertainty from local conditions that businesses face on a daily basis;
- » **Financial (or balance sheet) risk**, related to the possibility of shifts in asset and liability valuations due to interest-rate and exchange-rate shocks;
- » **Social risk**, related to the probability of either large-scale social upheaval or individual-level risks such as crime and disease that affect human resources;
- » **Political risk**, reflecting policy uncertainty and/or the possibility of large shifts in political conditions; and
- » **Security risk**, reflecting the risk to human life and property from war, terrorism, geopolitical instability, natural disasters and climate change.

Risk scores are constructed for each country along each of these risk categories by aggregating across a vector of country characteristics associated with, or otherwise predictive of, that specific risk concept. The MACRI also incorporates the subjective risk assessments of country analysts to complement the objective risk assessments generated by the data. This helps to overcome the principal shortcoming of risk metrics constructed from historical data, which is that they are backward-looking, depending upon frequency of events in the past rather than their likelihood in the future. For example, the standard deviation of growth and inflation rates over the last few decades is a useful measure of past macroeconomic volatility but may be an imperfect measure of current conditions or future performance.

By contrast, the use of these objective data-driven risk measures helps to ground subjective risk assessments and reduce any bias toward overweighting recent events or simply reproducing an assessment of what might be considered common knowledge. Combining both approaches—objective and subjective—allows for a more accurate and reliable estimate of country risk.

The MACRI is updated quarterly. While most of the data underpinning the country risk score are published annually, macroeconomic and financial measures are often updated at a much higher frequency. In addition, subjective measures determined by Moody's Analytics country analysts can be updated quarterly in order to factor in their most recent qualitative judgments that may not yet be reflected in the quantitative measures.

Even so, because many of the metrics used—such as averages and standard deviations—evolve slowly with each new datapoint, the set of objective risk metrics typically changes gradually from year to year. This is as it should be, for risk—as compared with a forecast—reflects the distribution of all possibilities rather than a single expected outcome.

CDI – Currency Depreciation Index

Moody's Analytics has developed a model to assess the vulnerability of a country's real effective exchange rate. Research on the determinants of foreign exchange posit many plausible variables that influence exchange rates, and we use that rich literature to inform the basis of our model. As a result, our Currency Depreciation Index provides clients with a data-driven indicator covering 105 countries.

Our methodology relies on a regression model with known currency crisis explanatory variables to generate monthly forecasts of the probability of a future currency depreciation event. We then construct an indicator based on predicted probabilities generated by our model.

In our model a depreciation event is defined by two alternative criteria: 1) a 3% decrease in the real effective exchange rate over one month, or 2) no change in a three-month period when there is a greater than 5% decrease in foreign reserves. The second criterion reflects when a currency might have depreciation but for the intervention of the central bank. Many central banks either target an exchange rate or seek to minimize exchange rate volatility. Without including these "nonevents" one would underestimate the importance of currency depreciation predictors.

We regress our event variable on known currency crisis variables such as exchange rate volatility, exchange rate overvaluation, trade balances, and import cover using panel regression techniques. While a panel regression typically leads one to consider fixed effects to capture the time-insensitive probability that one country's currency might have a higher or lower likelihood of depreciating, we choose to use a random effects model over fixed effects.

Fixed effects have two downsides that we would like to avoid. First, fixed effects eliminate our ability to include dummy variables that group countries together because of perfect multicollinearity. For example, we might expect that currencies under a currency peg regime would have a lower probability of experiencing a depreciation. Second, fixed effects limit our ability to cluster errors. We prefer clustering errors because we have an unbalanced panel and those countries with the smallest panels are also candidates for exchange rate fluctuations. In addition, the concept of clustering errors fits in line with the idea of risk; those countries that have larger errors are riskier.

In addition, we forecast over multiple horizons and average across horizons to utilize all available information. A one-month-ahead forecasting model can project out one year, but errors compound and therefore are quite large. In contrast, a one-year-ahead forecast-

ing model has smaller errors on the 12-month horizon but does not use the most recent data when forecasting the coming month. By averaging across the suite of forecasting models, we make the most of recent data while still maintaining narrow forecast errors over longer horizons.

We use the predicted probability of a currency depreciation to construct an indicator that incorporates both the global percentile and the country-specific percentile. The global percentile is the percentile of the predicted probability in the whole dataset (>31,000 observations), whereas the country-specific percentile is the percentile within the country's history. Thus, a country receives a high rank when its predicted probability is high relative to the rest of the world and to its own historical experience.

Risk of recession

To assess what financial markets and the economic data are telling us about the odds of a recession, we create separate economic and financial market probit models. Our application uses the normal distribution to convert the two results into a probability of recession over the coming 12 months. These models were first developed and tested by Moody's Analytics to develop a model of the odds of recession in the U.S. This model has been extended for use across 105 countries.

For the current exercise, we extend the time horizon to 12 months and focus entirely on national economic and financial variables provided at a monthly frequency for all 105 countries forecast in the Moody's Analytics Global Macroeconomic Model. We focus simply on the ability of the economic and financial variables to separately signal a recession rather than on their success in forecasting economic activity. We acknowledge that the best predictor of recessions is likely a combination of financial and economic indicators.

Our approach uses a broader definition of recession, involving measures of consumption, employment, asset prices and industrial output rather than what many are taught in principles of macroeconomics: that a recession is two consecutive quarters of declining GDP. Because recessions are discrete events, the recession status is denoted using 0 or 1 in the probit model. If the economy is in recession, a 1 is assigned to each month of the downturn. If the economy is not in recession, the dependent variable equals zero. The probability of a recession in 12 months is determined using information in the current period.

In constructing the models, we face a trade-off between more observations capturing more recessions, and sacrificing potentially significant indicators that offer more explanatory power. For more data-rich economies, a variety of statistically significant variables providing strong explanatory power can be included in the model without sacrificing a substantial number of observations. For example, Australia's model provides 485 monthly observations dating back to 1980 with terms for a number of commodities, industries and consumer variables, achieving an adjusted R^2 of 0.39. In other instances, such as Brazil, the most statistically significant data series only begin in the early 2000s.

Fiscal space

Fiscal space measures the additional debt-financed spending, expressed as a percent of GDP, that a national government can do without putting debt sustainability or market access at risk. Arithmetically, fiscal space is computed as the difference between an estimate of each country's maximum sustainable debt ratio and its current debt ratio. The estimated maximum sustainable debt ratio primarily depends on three key factors:

- » A projection of the maximum sustainable primary balance.¹ This is estimated from each nation's current and historical budget surpluses and deficits.
- » The government's current long-term borrowing rate. This is an indicator of current and future interest costs and incorporates current investor perceptions of risk and the effects of currency and monetary regimes on interest rates.
- » Projected nominal output growth. Faster economic growth expands available budget resources to service debt.

A higher sustainable debt-to-GDP ratio and, hence, greater fiscal space will result from a higher primary balance, lower borrowing rate, and higher GDP growth rate. However, high volatility of these factors will lead to lower estimated sustainable debt and fiscal space because the government needs to maintain a precautionary buffer against the risk of experiencing a large enough shock to trigger a runaway debt spiral or a spike in borrowing costs. The estimates account for crowding out effects, which reduce fiscal space because a larger government debt crowds out investment, leading to a smaller capital stock, higher interest rates, and lower growth rates. They also account for the additional risks posed by debt denominated in foreign currencies and the term structure of debt, with countries that have a lot of short-term debt generally facing larger risks of being unable to roll over their debt.

To produce the monthly updated estimates for more than 70 countries, we maintain a time series database of budget, national output and price level statistics compiled from data published by national statistical agencies, the International Monetary Fund, and World Bank. We select budget line items to ensure consistency of the concepts for making debt sustainability calculations and make adjustments as needed to increase comparability. We augment the database with market yields on long-term sovereign debt for each country, using a proxy for countries where this information is unavailable, as an indicator of long-term government borrowing costs and market access.

¹ Primary balance is defined as government revenues less noninterest expenditures expressed as a percent of GDP.

We validate the estimates by computing time series estimates of fiscal space for each country and comparing the projections through time and across countries with other indicators of debt sustainability and market access such as credit default swaps, ratings, and simple debt ratios. Our fiscal space estimates have predictive value for assessing risks of sovereign default or projecting which countries will be constrained in their fiscal policies when responding to recessions and crises.

Economic clarity and surprise indexes

Uncertainty about economic conditions can present a risk to firms. That uncertainty comes from multiple sources: data quality, data volume, and the signal-to-noise ratio. To assist clients in assessing current economic conditions, we have created two indexes that measure the degree to which an economy is over- or underperforming. Our metrics give clients the ability to quickly assess what the most recent data have to say about all of the countries that Moody's Analytics forecasts.

Relying on a single data series such as industrial production to assess the strength or weakness of an economy has many pitfalls. Some series are more correlated with economic activity in one country than in another, making cross-country comparison challenging. Other series are not updated very frequently or with significant lag and therefore provide only a weak signal.

To address these concerns, we aggregate and sort series into sectors such as labor markets or trade. The weights used in aggregations are determined by the frequency and time lag of each series. Then we calculate the correlation of that sector with economic activity, which is defined as GDP growth, to sort each sector into tiers so that highly correlated sectors receive more weight in the final index score.

In order to normalize, we consider whether the economy is underperforming or overperforming expectations and/or history. Both benchmarks are important; having both can give users a nuanced view of current performance. An economy that is underperforming history but overperforming forecasting could indicate a strong bounce after a recession. An economy that is underperforming both history and forecast is heading for a deep recession. This is why we have an economic surprise index that is related to forecast and an economic clarity index that is related to history.

Summary of Moody's Analytics Country Risk Methodology

The Moody's Analytics Country Risk Indicator is constructed as a weighted sum of six sub-indexes, each capturing some dimension of economic or socio-political risk. Each subindex is, in turn, constructed using an aggregation of standardized values for a range of indicators. These indicators are listed in the table below. The standardized values of each variable were averaged, and then converted into a percentile under the assumption of a normal distribution. Thus, each subindex is a value from 0 to 100, which can be interpreted as a percentile. A country with a risk score of 54 for "economic stability" can be thought of as being positioned at the 54th percentile in the distribution of all countries with respect to that risk factor. (This is in terms of all hypothetically possible countries, not the actual sample of countries: thus several countries could be scored at the 54th percentile, and none at the 56th percentile).

Variables Used in the Construction of the Country Risk Indicators

	Source
Dimensions of Economic Risk	
Macroeconomic Risk	
<i>Economic Stability (risks associated with the cyclical activity of real activity)</i>	
Gross National Income, (log, PPP international \$)	World Bank, IMF
Growth risk, (std. deviation of the growth rate minus average)	IMF, Moody's Analytics
Index of recession risk, over next 12 months	Various Sources, Moody's Analytics
Economic structure and performance: gross investment, (% of GDP)	Moody's Investors Service
Openness, (sum of exports plus imports as % of GDP)	Moody's Investors Service
CPIA macroeconomic management rating	World Bank
Macroeconomic contagion	Moody's Analytics
<i>Monetary Stability (risk of shocks to the price and quantity of credit)</i>	
Inflation risk, (log of rolling std. deviation of monthly inflation rate)	IMF, Moody's Analytics
Liquidity risk, (log of rolling std. deviation of annual growth in credit as % of GDP)	Moody's Investors Service, Moody's Analytics
Policy risk, (rolling std. deviation of real monetary policy rate)	Moody's Investors Service, Moody's Analytics
Current inflation rate, (end of period, annual % chg)	IMF, Moody's Analytics
Real interest rate, (rolling std. deviation)	World Bank, Moody's Analytics
<i>Fiscal Stability (risks related to tax rates and sovereign default)</i>	
General government gross debt, (% of GDP)	IMF
General government net lending/borrowing, (% of GDP)	IMF
Government interest payments, (% of GDP)	IMF
Government effectiveness index, (standardized aggregation of primary surveys)	World Bank
Fiscal policy uncertainty, (std. deviation of structural balance as % of GDP)	IMF, Moody's Analytics
CPIA fiscal policy rating, (index)	World Bank
CPIA debt policy rating, (index)	World Bank
Moody's Implied Sovereign Risk Rating	Moody's Investor Services
Business Risk	
<i>Risks related to operations</i>	
Access to finance, (% of firms identifying as a major obstacle)	World Bank
Electricity, (% of firms identifying as a major obstacle)	World Bank
Power outages in a typical month, (log number)	World Bank, Moody's Analytics
Duration of a typical electrical outage, (log number of hours)	World Bank, Moody's Analytics
Average number of incidents of water insufficiency in a typical month, (log number)	World Bank, Moody's Analytics
Firms paying for security, (% of firms surveyed)	World Bank
Losses due to theft and vandalism against the, (% of annual sales)	World Bank
Security costs, (% of annual sales)	World Bank
Products shipped to supply domestic markets lost due to theft, (% of product value)	World Bank
Crime, theft and disorder, (% of firms identifying as a major constraint)	World Bank
<i>Risks related to uncertainty of regulatory and market environment</i>	
Licenses and permits, (% of firms identifying as a major obstacle)	World Bank
Customs & trade regulations, (% of firms identifying as a major obstacle)	World Bank
Average time to clear imports from customs, (days)	World Bank
Government or state ownership, (% of firms)	World Bank

Summary of Moody's Analytics Country Risk Methodology (Cont.)

Variables Used in the Construction of the Country Risk Indicators

	Source
Market capitalization excluding top 10 companies, (% of total market capitalization)	World Bank
Firms using Email to communicate with clients and suppliers, (%)	World Bank
Practices of competitors in the informal sector, (% of firms identifying as a major constraint)	World Bank
Corruption, (% of firms identifying as a major constraint)	World Bank
Firms with annual financial statement reviewed by external auditor, (%)	World Bank
Senior management time spent in dealing with requirements of government regulation, (%)	World Bank
Firms identifying labor regulations as a major constraint, (%)	World Bank
Ease of doing business index, (1=most business-friendly regulations)	World Bank
Time required to enforce a contract, (days)	World Bank
Firms competing against unregistered or informal firms, (%)	World Bank
Firms formally registered when started operations in the country, (%)	World Bank
Firms using banks to finance investments, (%)	World Bank
Working capital financed by supplier credit, (%)	World Bank
Electronic payments used to make payments - Ages 15 and older, (%)	World Bank
Regulatory quality, (rank)	World Bank
Regulatory quality, (index)	World Bank
<i>Risks related to globalization</i>	
Human flight and brain drain, (index)	The Fund for Peace
Net foreign direct investment inflows, (% of GDP, rolling std. deviation)	World Bank, Moody's Analytics
Financial Risk	
<i>Measures of overall currency & credit market risk</i>	
FX volatility, (rolling std. deviation of log of exchange rate)	IMF
Volatility of real interest rate, (std. deviation of annual averages)	World Bank
Moody's Implied Sovereign Risk Rating	Moody's Investor Services
Financial contagion	Moody's Analytics
<i>Market-derived risk measures</i>	
10-yr spread on U.S. Treasuries, (central government 10-yr yield - U.S. Treasury yield, basis points)	World Bank
Risk premium on lending, (lending rate minus treasury bill rate, %)	World Bank
Interest rate spread, (lending rate minus deposit rate, %)	World Bank
<i>Leading indicators of banking crises</i>	
Bank capital to assets ratio, (%)	World Bank
Bank liquid reserves to assets ratio, (%)	World Bank
Nonperforming loans, (% of total)	World Bank
Domestic credit provided by banking sector, (% of GDP)	World Bank
Domestic credit to private sector, (% of GDP)	World Bank
<i>Leading indicators of currency crises</i>	
Real overvaluation, (log of real exchange rate divided by 100)	IMF, Moody's Analytics
Current account balance, (% of GDP, most recent)	IMF
Ratio of private foreign currency liabilities to total foreign currency assets	Moody's Investor Services
Gross external debt, (% of GDP, most recent)	World Bank, Moody's Analytics
Short-term external debt, (% of total external debt, most recent)	World Bank, Moody's Analytics
Short-term external debt, (% of foreign reserves, most recent)	World Bank
External short-term liabilities, (% of foreign reserves)	Moody's Investor Services
Total debt service ratio, (% of exports and primary income)	World Bank
<i>Quality of financial institutions</i>	
Credit info availability, (index)	World Bank
Legal rights of borrowers and lenders, (index)	World Bank
Strength of investor protection, (index)	World Bank
Insolvency rates, (% of dollar recovered)	World Bank

Summary of Moody's Analytics Country Risk Methodology (Cont.)

Variables Used in the Construction of the Country Risk Indicators

	Source
Other Dimensions of Country Risk	
Social Risk	
<i>Risks from disenfranchisement: education, poverty and opportunity</i>	
Adult literacy rate, (% of men and women ages 15 and above)	World Bank
Education, (% of age-eligible women in secondary school)	World Bank
Ratio of young literate females to males	World Bank
Poverty headcount ratio at national poverty line, (% of population)	World Bank
Inequality, (Gini Index)	World Bank
Rural population density	World Bank
<i>Risks to health and wellbeing</i>	
Per capita health expenditure, (log)	World Bank, Moody's Analytics
Mortality rate, (per 1,000 men)	World Bank
Incidence of tuberculosis, (per 100,000 people)	World Bank
Prevalence of HIV, (% of population ages 15-49)	World Bank
Prevalence of undernourishment, (% of population)	World Bank
Improved water source, (% of population with access)	World Bank
Malaria cases, (number per 100,000 people)	World Bank
<i>Other factors precipitating social discontent</i>	
Slums, (% of urban population living in)	World Bank
Crime, theft & disorder, (% of firms identifying as a major obstacle)	World Bank
Unemployment rate, (% of laborforce)	World Bank
Ethnolinguistic fractionalization, (index)	Harvard Dataverse
Political Risk	
<i>Stability of the government</i>	
Political stability, (index of standardized score of primary surveys)	World Bank
Political instability, (% of firms identifying as a major obstacle)	World Bank
Perceived risk of political change, (index)	Moody's Analytics
<i>Power of entrenched elites</i>	
Voice and accountability, (index)	World Bank
Natural resource rents, (% of GDP; proxy for elite power)	World Bank
Military, (% of the labor force)	World Bank
<i>Predictability of policy</i>	
Rule of law, (index)	World Bank
Control of corruption, (index)	World Bank
CPIA transparency, accountability, and corruption in the public sector, (index)	World Bank
CPIA quality of public administration, (index)	World Bank

Summary of Moody's Analytics Country Risk Methodology (Cont.)

Variables Used in the Construction of the Country Risk Indicators

	Source
Security Risk	
<i>Risk from terrorism</i>	
Probability of an attack (total number of incidents since 2000 per square km)	START Global Terrorism Database, CIA World Factbook, Moody's Analytics
Intensity of attacks (average of killed + 1/2* number wounded, per attack)	START Global Terrorism Database, Moody's Analytics
Threat level (total killed + 1/2*wounded from terrorism since 2000, as % of population)	START Global Terrorism Database, Census Bureau, Moody's Analytics
<i>State insecurity</i>	
Quality of public services, (index)	The Fund for Peace
Geopolitical insecurity and conflict	
Quality of human rights, (index)	The Fund for Peace
Environmental	
Disaster Risk: human and economic losses due to natural disasters	Harmeling (2011),EM-DAT, Moody's Analytics
Vulnerability to climate change	World Bank, CIA World Factbook, Moody's Analytics

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EM-DAT: The OFDA/CRED International Disaster Database – www.emdat.be, Université Catholique de Louvain, Brussels (Belgium);

Harmeling, Sven. "Global Climate Risk Index 2012: Who Suffers Most from Extreme Weather Events? Weather-related Loss Events in 2010 and 1991 to 2010." Germanwatch Briefing Paper, November 2011.

About Moody's Analytics

Moody's Analytics provides financial intelligence and analytical tools supporting our clients' growth, efficiency and risk management objectives. The combination of our unparalleled expertise in risk, expansive information resources, and innovative application of technology helps today's business leaders confidently navigate an evolving marketplace. We are recognized for our industry-leading solutions, comprising research, data, software and professional services, assembled to deliver a seamless customer experience. Thousands of organizations worldwide have made us their trusted partner because of our uncompromising commitment to quality, client service, and integrity.

Concise and timely economic research by Moody's Analytics supports firms and policymakers in strategic planning, product and sales forecasting, credit risk and sensitivity management, and investment research. Our economic research publications provide in-depth analysis of the global economy, including the U.S. and all of its state and metropolitan areas, all European countries and their subnational areas, Asia, and the Americas. We track and forecast economic growth and cover specialized topics such as labor markets, housing, consumer spending and credit, output and income, mortgage activity, demographics, central bank behavior, and prices. We also provide real-time monitoring of macroeconomic indicators and analysis on timely topics such as monetary policy and sovereign risk. Our clients include multinational corporations, governments at all levels, central banks, financial regulators, retailers, mutual funds, financial institutions, utilities, residential and commercial real estate firms, insurance companies, and professional investors.

Moody's Analytics added the economic forecasting firm Economy.com to its portfolio in 2005. This unit is based in West Chester PA, a suburb of Philadelphia, with offices in London, Prague and Sydney. More information is available at www.economy.com.

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