

ANALYSIS

February 2020

Prepared by

Mark Zandi
Mark.Zandi@moodys.com
Chief Economist

Steven G. Cochrane
Steve.Cochrane@moodys.com
Chief APAC Economist

Xiao Chun Xu
XiaoChun.Xu@moodys.com
Economist

Contact Us

Email
help@economy.com

U.S./Canada
+1.866.275.3266

EMEA
+44.20.7772.5454 (London)
+420.224.222.929 (Prague)

Asia/Pacific
+852.3551.3077

All Others
+1.610.235.5299

Web
www.economy.com
www.moodysanalytics.com

COVID-19 Alternative Scenarios

Introduction

The COVID-19 virus continues to spread, and the economic damage is mounting. As of mid-February, well over 70,000 people have been infected by this strain of coronavirus and more than 1,700 have died. The virus has been largely contained to China, although people with the virus have shown up in approximately 25 other countries. COVID-19 is not especially easy to transmit compared with other illnesses, according to early estimates, nor is the mortality rate particularly high. Nonetheless, the spread of the virus has surpassed expectations and effectively shut down large parts of the Chinese economy. Given China's central role in the global economy—it is the second largest economy in the world, accounting for 16% of GDP—the economic fallout is spreading quickly around the globe.

COVID-19 Alternative Scenarios

BY MARK ZANDI, STEVEN G. COCHRANE AND XIAO CHUN XU

The COVID-19 virus continues to spread, and the economic damage is mounting. As of mid-February, well over 70,000 people have been infected by this strain of coronavirus and more than 1,700 have died. The virus has been largely contained to China, although people with the virus have shown up in approximately 25 other countries. COVID-19 is not especially easy to transmit compared with other illnesses, according to early estimates, nor is the mortality rate particularly high (see Chart 1). Nonetheless, the spread of the virus has surpassed expectations and effectively shut down large parts of the Chinese economy. Given China's central role in the global economy—it is the second largest economy in the world, accounting for 16% of GDP—the economic fallout is spreading quickly around the globe.

The trajectory of COVID-19 is highly uncertain. Variables include how long it will take for the virus to play out, how many people will be infected, how many will die, and whether the virus will spread in a significant way outside of China. We assess the global macroeconomic impact of two scenarios, although many others, each darker than the next, cannot be ruled out. This assessment is based on simulations of our global macroeconomic model, which captures linkages via international trade, immigration, foreign direct investment, and financial markets for more than 100 countries.

The first scenario is our current *Baseline* scenario, which we judge to be the most likely scenario and assumes:

- » 100,000 to 150,000 people will ultimately be infected;
- » The virus will be effectively contained to China;
- » Infections will abate by mid-2020; and
- » There will be a 2% to 3% mortality rate.

The second, alternative *Wider Contagion* scenario assumes:

- » 250,000 to 300,000 people will ultimately be infected;
- » The virus will be largely contained to China and parts of Southeast Asia, including Hong Kong, Singapore and Taiwan;

- » Infections will abate by year-end 2020; and
- » There will be a 3% to 4% mortality rate.

Baseline scenario (80% probability)

Under the *Baseline* scenario, China suffers an economic body blow, with real GDP falling in the first quarter, but growth rebounds strongly in the second half of the year, and the country's economy fully recovers by mid-2021. Real GDP for all of 2020 is now expected to grow by 5.4%, down from a forecast of 6.2% prior to when the virus struck.

The economic hit to China has already been substantial. Based on an assessment of how badly the economy has been disrupted by the virus in 33 of China's largest prefectures and independent municipalities, output equal to approximately 1% of Chinese GDP has already been lost (see Chart 2). Under the *Baseline* scenario, we expect the Chinese economy to slowly ramp back up

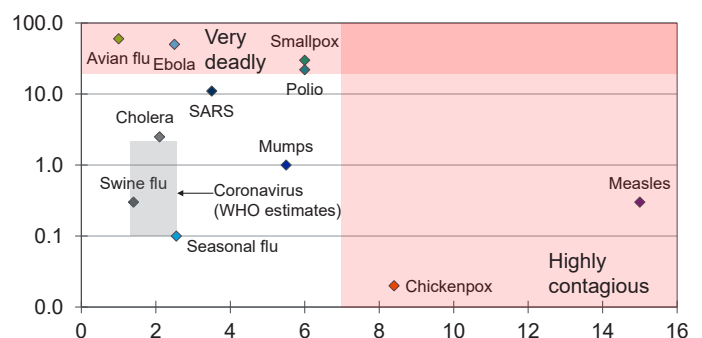
beginning in the next week or two, and to be back to more-or-less full strength by the end of April.

Cushioning the fallout on the Chinese economy is the expectation of a substantial increase in monetary and fiscal stimulus. Chinese authorities have significant room to lower interest rates and stimulate credit growth, particularly via state-owned enterprises. They also have plenty of fiscal space to cut taxes and increase government spending. They are expected to do all of the above.

The global economy will feel the ill effects from China's economic problems

Chart 1: How Widespread, How Virulent?

X-axis: Contagiousness (R0), Y-axis: Mortality rate (% , log scale)



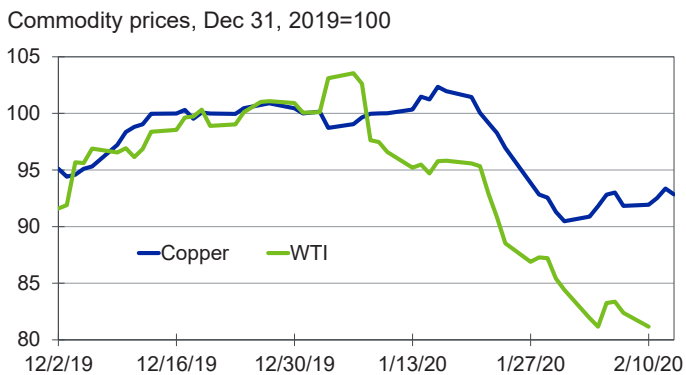
Sources: CDC, WHO, Various studies, Moody's Analytics

Chart 2: Body Blow to China



Source: Moody's Analytics

Chart 3: Prices Take It on the Chin



Sources: EIA, LME, Moody's Analytics

through three principal channels. Chinese tourism and business travel to the rest of the world have already stopped. Major tourism destinations across the globe are feeling the effects, although they are most pronounced throughout Asia. Second, the global manufacturing supply chain is disrupted, as China is at the end of many of those chains. Southeast Asia is especially vulnerable to this disruption, although manufacturers throughout the world, including in the U.S. and Europe, will be affected. Shortages of some goods will likely result this spring. Finally, emerging markets, particularly in Latin America and Africa, will also soon feel the ill effects of the slump in commodity markets since China will purchase less oil, copper, soybeans and other commodities (see Chart 3). Global real GDP growth is expected to throttle back to 2.4% in 2020, down from a forecast of over 2.6%—the global economy's estimated growth potential—prior to the virus.

The U.S. economy is more insulated from the impact of the virus, but it is not immune. Some 3 million Chinese tourists travel to the U.S. each year, and each spends nearly 50% more than the typical foreign visitor. Most U.S. multinationals (such as Apple, General Motors and Starbucks) have big operations in China, either as a place to produce their goods or as a large market for sale of their products. COVID-19 is expected to cut 0.3 percentage point annualized from first-quarter real GDP growth, and reduce growth in 2020 to 1.7%, not quite 0.2 percentage point less

than previously projected and just below the economy's potential.

Wider Contagion scenario (20% probability)

Under the *Wider Contagion* scenario, the Chinese economy effectively stalls out in 2020. Real GDP growth for the year comes in at 1.7% but is close to zero on a fourth-quarter to fourth-quarter basis (see Chart 4). This would be China's worst economic performance in 30 years.

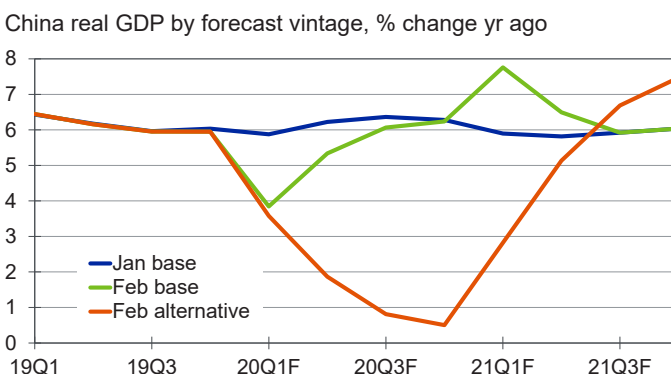
In this scenario, much of China remains locked down through April and slowly ramps up, getting back to full strength only by year's end. Complicating any start-up of the economy is that many Chinese were never able to return home after the Lunar New Year, and even when they are able to return home, they will be under quarantine for some time longer. Many schools are also closed, and it will be difficult for workers to get back on the job until those schools reopen, which will take time. Also, Chinese officials will most certainly prefer to err on the side of caution when reopening schools and other facilities rather than risk reigniting the outbreak. This will further delay the recovery of global supply chains

(especially for autos and tech products) and the resumption of pre-virus trade flows. As of mid-February, the quarantines were getting tighter rather than looser. For example, a ban on traffic in Wuhan prefecture was expanded to include the entire Hubei province in which it is located.

This is a severe downside scenario, but it could easily be even more severe if the economic downturn results in a significant increase in business loan and bond defaults. Corporate leverage is high and has grown rapidly in recent years, and bankruptcies and defaults have been on the rise. There will be greater credit problems in this scenario, but we are assuming that Chinese regulators and banking authorities will show significant forbearance and forestall a serious credit crisis.

The global economy also suffers significantly in this *Wider Contagion* scenario, with real GDP growth in 2020 cut in half to

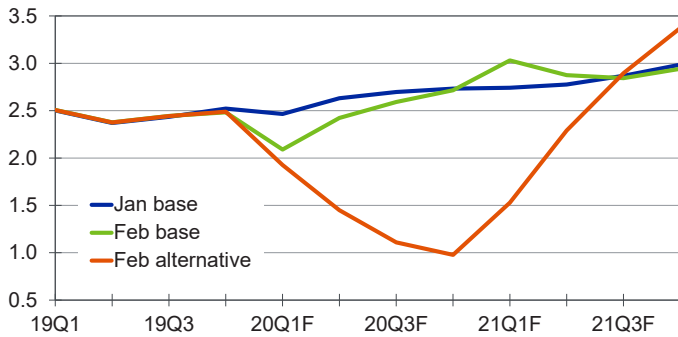
Chart 4: China's Economic Outlook



Sources: Government of China, Moody's Analytics

Chart 5: Global Economic Outlook

Global real GDP by forecast vintage, % change yr ago



Source: Moody's Analytics

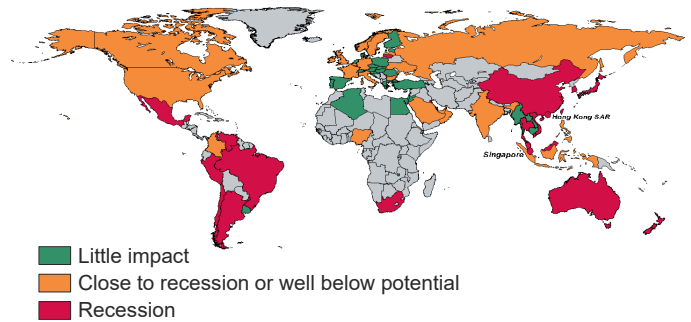
1.1% (see Chart 5). This is the weakest performance since the financial crisis, although the economy is able to avoid an outright recession. Southeast Asia and other emerging economies are hit hardest in the risk-off environment as their currencies come under pressure (see Chart 6). Even weaker commodity prices—the price of West Texas Intermediate falls to below \$40 per barrel—inflict a severe blow.

The global economy would likely suffer a recession in this scenario if not for substantial monetary and fiscal stimulus, but the ability of some emerging market economies to release further monetary stimulus is limited by the threat of igniting capital outflows in the risk averse environment. As an aside, within the global model the stimulus is endogenously determined and thus may underestimate the amount of overall stimulus (including discretionary stimulus) that would be provided in such a scenario. However, it is important to remember that central banks and governments in much of the developed world are hamstrung by negative interest rates and little fiscal space.

The U.S. economy also barely skirts recession in this scenario, with real GDP growth in 2020 of 1.1% (see Chart 7). Adding to the economy's woes are the hit to stock prices and the widening in credit spreads that occur. Financial market reaction to the virus has been relatively muted so far, and in the *Baseline* scenario there is only a modest impact on markets as investors largely look through the temporary disruption to economic activity. However, under the *Wider Contagion* scenario investors are unable to ignore the impact on corporate profitability, and there is a significant correction in stock prices. Growth is weak enough in this scenario that unemployment begins to rise, recession risks become uncomfortably high, and if anything else goes awry, recession will be unavoidable.

Chart 6: Wider Contagion Scenario

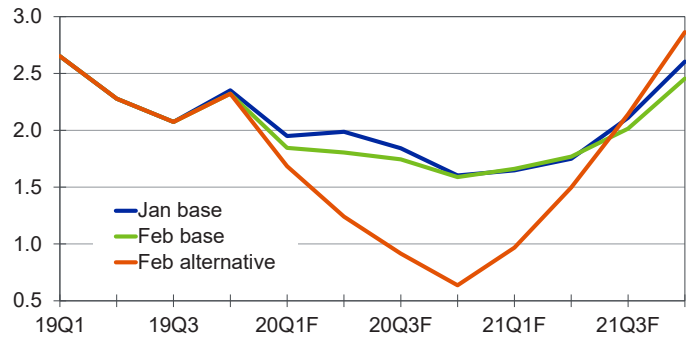
Feb 2020



Source: Moody's Analytics

Chart 7: U.S. Economic Outlook

U.S. real GDP by forecast vintage, % change yr ago



Sources: BEA, Moody's Analytics

Conclusion

COVID-19 poses a significant threat to the global economy. Much depends on how severe a pandemic ultimately ensues. Under the most likely, *Baseline* scenario, the contagion causes only a temporary hit to the global economy, which navigates through reasonably gracefully. However, alternative, darker scenarios are not difficult to envisage. The *Wider Contagion* scenario is only one of those many others. We will continue to monitor events and update our scenarios accordingly.

About the Authors

Mark Zandi is chief economist of Moody's Analytics, where he directs economic research. Moody's Analytics, a subsidiary of Moody's Corp., is a leading provider of economic research, data and analytical tools. Dr. Zandi is a cofounder of Economy.com, which Moody's purchased in 2005.

Dr. Zandi's broad research interests encompass macroeconomics, financial markets and public policy. His recent research has focused on mortgage finance reform and the determinants of mortgage foreclosure and personal bankruptcy. He has analyzed the economic impact of various tax and government spending policies and assessed the appropriate monetary policy response to bubbles in asset markets.

A trusted adviser to policymakers and an influential source of economic analysis for businesses, journalists and the public, Dr. Zandi frequently testifies before Congress on topics including the economic outlook, the nation's daunting fiscal challenges, the merits of fiscal stimulus, financial regulatory reform, and foreclosure mitigation.

Dr. Zandi conducts regular briefings on the economy for corporate boards, trade associations and policymakers at all levels. He is on the board of directors of MGIC, the nation's largest private mortgage insurance company, and The Reinvestment Fund, a large CDFI that makes investments in disadvantaged neighborhoods. He is often quoted in national and global publications and interviewed by major news media outlets, and is a frequent guest on CNBC, NPR, Meet the Press, CNN, and various other national networks and news programs.

Dr. Zandi is the author of *Paying the Price: Ending the Great Recession and Beginning a New American Century*, which provides an assessment of the monetary and fiscal policy response to the Great Recession. His other book, *Financial Shock: A 360° Look at the Subprime Mortgage Implosion, and How to Avoid the Next Financial Crisis*, is described by the New York Times as the "clearest guide" to the financial crisis.

Dr. Zandi earned his BS from the Wharton School at the University of Pennsylvania and his PhD at the University of Pennsylvania. He lives with his wife and three children in the suburbs of Philadelphia.

Steven G. Cochrane is chief APAC economist with Moody's Analytics. He leads the Asia economic analysis and forecasting activities of the Moody's Analytics Research team, as well as the continual expansion of the company's international, national and subnational forecast models. In addition, Steve directs consulting projects for clients to help them understand the effects of regional economic developments on their business under baseline forecasts and alternative scenarios. Steve's expertise lies in providing clear insights into an area's or region's strengths, weaknesses and comparative advantages relative to macro or global economic trends. A highly regarded speaker, Steve has provided economic insights at hundreds of engagements during the past 20 years and has been featured on CNBC, ChannelNewsAsia, Bloomberg TV and Wall Street Radio. Through his research and presentations, Steve dissects how various components of the macro and regional economies shape patterns of growth. Steve holds a PhD from the University of Pennsylvania and is a Penn Institute for Urban Research Scholar. He also holds a master's degree from the University of Colorado at Denver and a bachelor's degree from the University of California at Davis. Dr. Cochrane is based out of the Moody's Analytics Singapore office.

Xiao Chun Xu is an economist at Moody's Analytics. Xiao is responsible for covering national and metropolitan economies across the Asia-Pacific region. His expertise lies in applied macroeconomics, computational methods, and time series analysis. He holds a PhD in economics from the University of New South Wales and previously worked in policy analysis at the Australian Treasury.

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.

Moody's Analytics is a subsidiary of Moody's Corporation (NYSE: MCO). Further information is available at www.moodyanalytics.com.

DISCLAIMER: Moody's Analytics, a unit of Moody's Corporation, provides economic analysis, credit risk data and insight, as well as risk management solutions. Research authored by Moody's Analytics does not reflect the opinions of Moody's Investors Service, the credit rating agency. To avoid confusion, please use the full company name "Moody's Analytics", when citing views from Moody's Analytics.

About Moody's Corporation

Moody's Analytics is a subsidiary of Moody's Corporation (NYSE: MCO). MCO reported revenue of \$4.4 billion in 2018, employs approximately 13,100 people worldwide and maintains a presence in 42 countries. Further information about Moody's Analytics is available at www.moodyanalytics.com.

© 2020 Moody's Corporation, Moody's Investors Service, Inc., Moody's Analytics, Inc. and/or their licensors and affiliates (collectively, "MOODY'S"). All rights reserved.

CREDIT RATINGS ISSUED BY MOODY'S INVESTORS SERVICE, INC. AND ITS RATINGS AFFILIATES ("MIS") ARE MOODY'S CURRENT OPINIONS OF THE RELATIVE FUTURE CREDIT RISK OF ENTITIES, CREDIT COMMITMENTS, OR DEBT OR DEBT-LIKE SECURITIES, AND MOODY'S PUBLICATIONS MAY INCLUDE MOODY'S CURRENT OPINIONS OF THE RELATIVE FUTURE CREDIT RISK OF ENTITIES, CREDIT COMMITMENTS, OR DEBT OR DEBT-LIKE SECURITIES. MOODY'S DEFINES CREDIT RISK AS THE RISK THAT AN ENTITY MAY NOT MEET ITS CONTRACTUAL, FINANCIAL OBLIGATIONS AS THEY COME DUE AND ANY ESTIMATED FINANCIAL LOSS IN THE EVENT OF DEFAULT. CREDIT RATINGS DO NOT ADDRESS ANY OTHER RISK, INCLUDING BUT NOT LIMITED TO: LIQUIDITY RISK, MARKET VALUE RISK, OR PRICE VOLATILITY. CREDIT RATINGS AND MOODY'S OPINIONS INCLUDED IN MOODY'S PUBLICATIONS ARE NOT STATEMENTS OF CURRENT OR HISTORICAL FACT. MOODY'S PUBLICATIONS MAY ALSO INCLUDE QUANTITATIVE MODEL-BASED ESTIMATES OF CREDIT RISK AND RELATED OPINIONS OR COMMENTARY PUBLISHED BY MOODY'S ANALYTICS, INC. CREDIT RATINGS AND MOODY'S PUBLICATIONS DO NOT CONSTITUTE OR PROVIDE INVESTMENT OR FINANCIAL ADVICE, AND CREDIT RATINGS AND MOODY'S PUBLICATIONS ARE NOT AND DO NOT PROVIDE RECOMMENDATIONS TO PURCHASE, SELL, OR HOLD PARTICULAR SECURITIES. NEITHER CREDIT RATINGS NOR MOODY'S PUBLICATIONS COMMENT ON THE SUITABILITY OF AN INVESTMENT FOR ANY PARTICULAR INVESTOR. MOODY'S ISSUES ITS CREDIT RATINGS AND PUBLISHES MOODY'S PUBLICATIONS WITH THE EXPECTATION AND UNDERSTANDING THAT EACH INVESTOR WILL, WITH DUE CARE, MAKE ITS OWN STUDY AND EVALUATION OF EACH SECURITY THAT IS UNDER CONSIDERATION FOR PURCHASE, HOLDING, OR SALE.

MOODY'S CREDIT RATINGS AND MOODY'S PUBLICATIONS ARE NOT INTENDED FOR USE BY RETAIL INVESTORS AND IT WOULD BE RECKLESS AND INAPPROPRIATE FOR RETAIL INVESTORS TO USE MOODY'S CREDIT RATINGS OR MOODY'S PUBLICATIONS WHEN MAKING AN INVESTMENT DECISION. IF IN DOUBT YOU SHOULD CONTACT YOUR FINANCIAL OR OTHER PROFESSIONAL ADVISER.

ALL INFORMATION CONTAINED HEREIN IS PROTECTED BY LAW, INCLUDING BUT NOT LIMITED TO, COPYRIGHT LAW, AND NONE OF SUCH INFORMATION MAY BE COPIED OR OTHERWISE REPRODUCED, REPACKAGED, FURTHER TRANSMITTED, TRANSFERRED, DISSEMINATED, REDISTRIBUTED OR RESOLD, OR STORED FOR SUBSEQUENT USE FOR ANY SUCH PURPOSE, IN WHOLE OR IN PART, IN ANY FORM OR MANNER OR BY ANY MEANS WHATSOEVER, BY ANY PERSON WITHOUT MOODY'S PRIOR WRITTEN CONSENT.

All information contained herein is obtained by MOODY'S from sources believed by it to be accurate and reliable. Because of the possibility of human or mechanical error as well as other factors, however, all information contained herein is provided "AS IS" without warranty of any kind. MOODY'S adopts all necessary measures so that the information it uses in assigning a credit rating is of sufficient quality and from sources MOODY'S considers to be reliable including, when appropriate, independent third-party sources. However, MOODY'S is not an auditor and cannot in every instance independently verify or validate information received in the rating process or in preparing the Moody's publications.

To the extent permitted by law, MOODY'S and its directors, officers, employees, agents, representatives, licensors and suppliers disclaim liability to any person or entity for any indirect, special, consequential, or incidental losses or damages whatsoever arising from or in connection with the information contained herein or the use of or inability to use any such information, even if MOODY'S or any of its directors, officers, employees, agents, representatives, licensors or suppliers is advised in advance of the possibility of such losses or damages, including but not limited to: (a) any loss of present or prospective profits or (b) any loss or damage arising where the relevant financial instrument is not the subject of a particular credit rating assigned by MOODY'S.

To the extent permitted by law, MOODY'S and its directors, officers, employees, agents, representatives, licensors and suppliers disclaim liability for any direct or compensatory losses or damages caused to any person or entity, including but not limited to by any negligence (but excluding fraud, willful misconduct or any other type of liability that, for the avoidance of doubt, by law cannot be excluded) on the part of, or any contingency within or beyond the control of, MOODY'S or any of its directors, officers, employees, agents, representatives, licensors or suppliers, arising from or in connection with the information contained herein or the use of or inability to use any such information.

NO WARRANTY, EXPRESS OR IMPLIED, AS TO THE ACCURACY, TIMELINESS, COMPLETENESS, MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE OF ANY SUCH RATING OR OTHER OPINION OR INFORMATION IS GIVEN OR MADE BY MOODY'S IN ANY FORM OR MANNER WHATSOEVER.

Moody's Investors Service, Inc., a wholly-owned credit rating agency subsidiary of Moody's Corporation ("MCO"), hereby discloses that most issuers of debt securities (including corporate and municipal bonds, debentures, notes and commercial paper) and preferred stock rated by Moody's Investors Service, Inc. have, prior to assignment of any rating, agreed to pay to Moody's Investors Service, Inc. for appraisal and rating services rendered by it fees ranging from \$1,500 to approximately \$2,500,000. MCO and MIS also maintain policies and procedures to address the independence of MIS's ratings and rating processes. Information regarding certain affiliations that may exist between directors of MCO and rated entities, and between entities who hold ratings from MIS and have also publicly reported to the SEC an ownership interest in MCO of more than 5%, is posted annually at www.moody's.com under the heading "Investor Relations — Corporate Governance — Director and Shareholder Affiliation Policy."

Additional terms for Australia only: Any publication into Australia of this document is pursuant to the Australian Financial Services License of MOODY'S affiliate, Moody's Investors Service Pty Limited ABN 61 003 399 657AFSL 336969 and/or Moody's Analytics Australia Pty Ltd ABN 94 105 136 972 AFSL 383569 (as applicable). This document is intended to be provided only to "wholesale clients" within the meaning of section 761G of the Corporations Act 2001. By continuing to access this document from within Australia, you represent to MOODY'S that you are, or are accessing the document as a representative of, a "wholesale client" and that neither you nor the entity you represent will directly or indirectly disseminate this document or its contents to "retail clients" within the meaning of section 761G of the Corporations Act 2001. MOODY'S credit rating is an opinion as to the creditworthiness of a debt obligation of the issuer, not on the equity securities of the issuer or any form of security that is available to retail investors. It would be reckless and inappropriate for retail investors to use MOODY'S credit ratings or publications when making an investment decision. If in doubt you should contact your financial or other professional adviser.

Additional terms for Japan only: Moody's Japan K.K. ("MJKK") is a wholly-owned credit rating agency subsidiary of Moody's Group Japan G.K., which is wholly-owned by Moody's Overseas Holdings Inc., a wholly-owned subsidiary of MCO. Moody's SF Japan K.K. ("MSFJ") is a wholly-owned credit rating agency subsidiary of MJKK. MSFJ is not a Nationally Recognized Statistical Rating Organization ("NRSRO"). Therefore, credit ratings assigned by MSFJ are Non-NRSRO Credit Ratings. Non-NRSRO Credit Ratings are assigned by an entity that is not a NRSRO and, consequently, the rated obligation will not qualify for certain types of treatment under U.S. laws. MJKK and MSFJ are credit rating agencies registered with the Japan Financial Services Agency and their registration numbers are FSA Commissioner (Ratings) No. 2 and 3 respectively.

MJKK or MSFJ (as applicable) hereby disclose that most issuers of debt securities (including corporate and municipal bonds, debentures, notes and commercial paper) and preferred stock rated by MJKK or MSFJ (as applicable) have, prior to assignment of any rating, agreed to pay to MJKK or MSFJ (as applicable) for appraisal and rating services rendered by it fees ranging from JPY200,000 to approximately JPY350,000,000.

MJKK and MSFJ also maintain policies and procedures to address Japanese regulatory requirements.