



**PGIM**  
India Mutual Fund

**MEGATRENDS**

# RESHAPING SERVICES

The investment implications of technological disruption



WINTER 2021

For professional investors only.  
All investments involve risk,  
including possible loss of capital.





## About PGIM

PGIM, the investment management business of Prudential Financial, Inc. (PFI), has a history that dates back over 145 years and through more than 30 market cycles.\* Built on a foundation of strength, stability and disciplined risk management, PGIM's more than 1,300 investment professionals are located in key financial centers around the world. Our firm is comprised of seven autonomous asset management businesses, each specializing in a particular asset class with a focused investment approach. This gives our clients diversified solutions from a top-10 asset manager,\*\* with global depth and scale across public and private asset classes, including fixed income, equities, real estate, and alternatives. For more information, visit [www.pgim.com](http://www.pgim.com).

\* "30 market cycles" represents PFI's asset management expertise through PGIM, its affiliates and its predecessors.

\*\* PGIM is the investment management business of Prudential Financial, Inc. (PFI); PFI is the 10th largest investment manager (out of 477 firms surveyed) in terms of global assets under management based on Pensions & Investments' Top Money Managers list published on May 31, 2021. This ranking represents global assets under management by PFI as of December 30, 2020.

# FOREWORD

Over the past century, the global economy has transitioned from being dominated by agriculture and manufacturing to being powered primarily by services. Services now represent three-quarters of the workforce in developed markets and two-thirds of global GDP.<sup>1</sup>

Since World War II, services have been transformed by shifting consumer and corporate preferences, technological change, and globalization. But after a 20-year period of relative stability, services are now once again at the cusp of a major disruption.

Advances in technologies such as cloud computing, artificial intelligence and machine learning are radically reshaping winners and losers across the service sector in both developed and emerging markets – and at an even faster pace after the COVID-19 pandemic.

This technology transformation will allow new entrants to disrupt key components of the services value chain. At the same time – and to a greater extent than in manufacturing and retail – a select group of technology-forward incumbents will benefit from some unique features of the services sector (such as client acquisition costs and regulatory complexity) to survive, and even thrive, during the process of creative destruction ahead of us.

To understand the investment implications of this next revolution in services, we have drawn on the insights of more than 70 investment professionals across PGIM's fixed income, equity, real estate, private credit, and alternatives managers – as well as leading academics, technologists, industry analysts and venture investors. We focus our investment lens on the three sectors that represent the vast majority of the services sector and 35% of the MSCI ACWI: financial services, healthcare, and transportation and logistics.<sup>2</sup> Our analysis reveals the hidden risks and emerging investment opportunities in services across public and private asset classes in both developed and emerging markets.

At PGIM, we believe investors who fully recognize the multiple pathways through which technology is transforming the global services sector will be best positioned to navigate the rapidly shifting investment landscape.



**David Hunt**  
President and Chief Executive Officer  
PGIM



**Taimur Hyat**  
Chief Operating Officer  
PGIM

An aerial photograph of a road winding through a lush green forest. A white car is driving on the road. A blue grid overlay is visible on the road surface, and a blue circular highlight is around the car. The text 'CHAPTER 4' is in the top left corner.

## CHAPTER 4

# TRANSPORTATION & LOGISTICS

---

“

*While logistics firms like DHL and Amazon employ cutting-edge technology and automation in their operations, overall, the sector is at an early stage of disruption.”*

## CHAPTER 4

# TRANSPORTATION & LOGISTICS: THE FUTURE WILL BE GREENER AND MORE AUTONOMOUS

Transportation and logistics broadly refers to the movement of people and goods and includes passenger transport, trucking, freight, supply chains, distribution and warehousing. While logistics firms like DHL and Amazon employ cutting-edge technology and automation in their operations, overall, the sector is at an early stage of disruption. While highly transformative innovations like autonomous vehicles (AV) are on the horizon for transportation and promise to be a major part of the future, they are having little impact today as AV technology is in a trial phase.

In logistics, optimization and efficiency are the current focus and those firms that are quick to digitize their processes, leverage telematics devices and embrace renewable energy sources and cloud-enabled data analysis will gain an advantage and position themselves for enduring success.

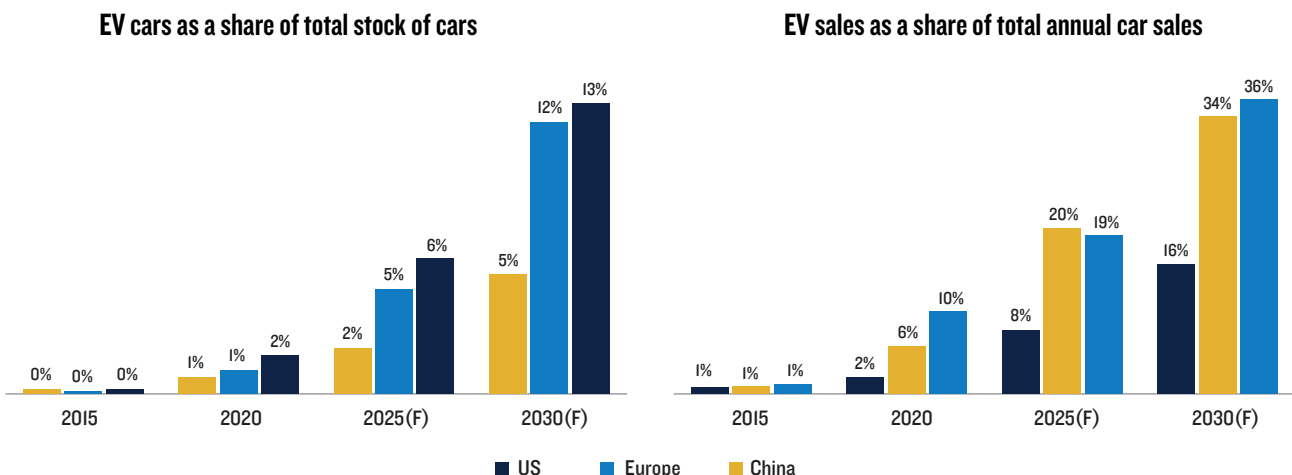
*Adoption of EV and AV will not evolve in the same way or at the same pace in all parts of the world.*

## The Future State of Transportation and Logistics

### Automobiles will be greener – and ultimately autonomous

The technology for electric vehicles (EV) exists today and will certainly be a growing part of the automotive landscape going forward. Indeed, EV sales in many parts of the world are growing rapidly. For example, nearly a million EVs were sold in China in the first half of 2021 – more than doubling in size from a

Exhibit 9: Despite growth in annual sales, EVs will likely represent a small share of total cars in 2030



Source: Global EV Data Explorer, International Energy Agency, 2021.

similar period in 2019.<sup>43</sup> In Europe the total market share of EV is increasing sharply – albeit from a modest base. EV market share in Germany has grown from under 4% in June 2020 to nearly 11% in September 2021. The UK has also shown a significant rise in the share of EV over the same period, up from 4.7% to over 8%.<sup>44</sup>

However, growth of EV will be uneven across different countries. Because of this, EV will not be displacing the global stock of internal combustion engines (ICE) for several decades. The global aggregate data make this point clear: In 2020, more than 95% of total new cars sold globally were powered by ICE (Exhibit 9). Even across the EU where carbon emission goals and other policies have boosted demand, only 1 in 10 new cars sold in 2020 were powered by electricity.

Despite the sharp growth of EV in some countries, the tremendous stock of ICE vehicles already in place will have a long sunset. Even under the International Energy Agency’s (IEA) optimistic scenario, two out of three new cars sold in 2030 will still be ICE vehicles. In 2050, when EVs are projected to make up 60% of annual new car sales, the majority of vehicles on the road will still be fueled by gasoline.<sup>45</sup>

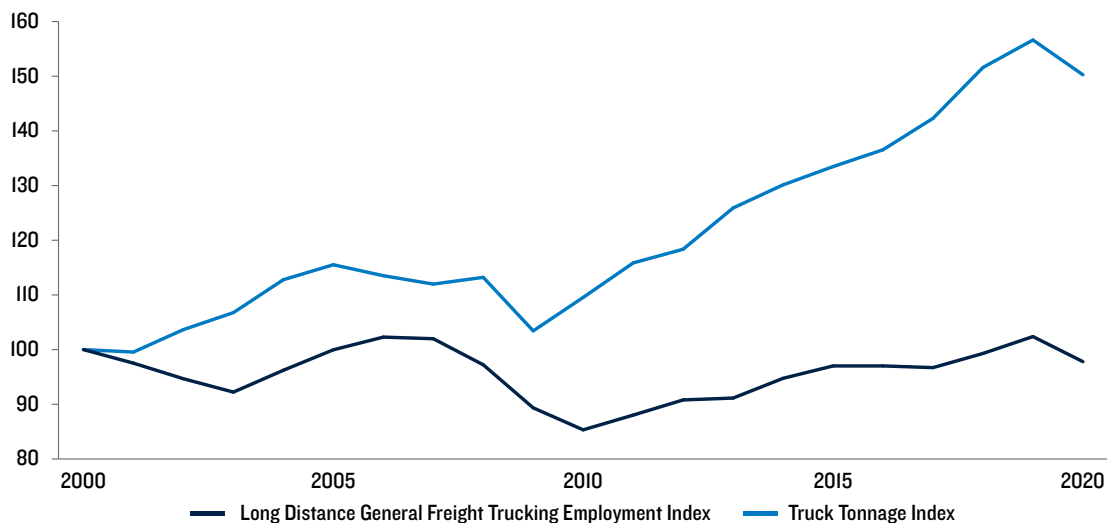
With the proliferation of AV, individuals will find it less cost-effective to own their own car and the ride-sharing model currently disrupting taxis will be

ubiquitous. Corporate business models focused solely on manufacturing autos or ride-sharing platforms will be challenged in an AV-dominant world. The future business model for automotive transport will likely revolve around providing fleets of autonomous ride-sharing vehicles. Auto manufacturers and ride-sharing platforms will need to team up to achieve this – and promising partnerships are already forming.

Of course, the utility and cost-efficiency of AV or EV will not replace personal ownership of an ICE vehicle for all people in all places for several reasons. First, outside of major population centers ride-sharing is often not in great supply and may require a lengthy wait. Consumers in rural areas may opt for the convenience of owning their own car. Second, it will be hard to replace the primal appeal of owning and driving your own car. Automobiles have a prominent place in US culture, for example. Owning and driving the newest, fastest model of sports car or truck and feeling the rumbling of an ICE engine brings an irreplaceable joy to many Americans.

Importantly, adoption of EV and AV will not evolve in the same way or at the same pace in all parts of the world. Autonomous trucking is likely to emerge first in the US, which depends on long-haul trucking for distribution and transport of goods and where drivers make up roughly 40% of trucking costs.<sup>46</sup>

**Exhibit 10: Freight tonnage has increased faster than employment in the US**



Source: FRED, data accessed July 2021.

Labor shortages also loom large for the industry and autonomous trucking could help freight trucking keep pace with the tremendous demand (Exhibit 10).<sup>47</sup>

But other parts of the world are much more likely to lead the way when it comes to both electric and autonomous cars. European governments are increasingly taking measures to push EV adoption and their environmental commitments are reducing reliance on gasoline-powered cars and vans.<sup>48</sup>

Meanwhile, in China, there are a growing number of urban roads designated for AV testing and fleets of autonomous robo-taxis are already roaming the streets of Beijing. These are poised to disrupt local taxi and minivan transport.<sup>49</sup>

*The new and ongoing demand for online deliveries has spawned interest in logistics and warehouses in places where online penetration had been exceptionally low.*

## Global shift to online shopping yields greener logistics

The pandemic has driven a surge in online shopping that is not likely to fully recede. Importantly, it surged in regions that had been previously resistant. Central and Eastern Europe, for example, saw retail e-commerce grow by almost 30% in 2020, China by 28% and Western Europe by 26%.<sup>50</sup> Even as the limitations of the pandemic ease, this tech adoption by consumers will remain. The new and ongoing demand for online deliveries has spawned interest in logistics and warehouses in places where online penetration had been exceptionally low – like Spain and Greece.

The logistics industry will continue to leverage AI, ML and other technologies to be even more efficient – and also more green. Technology to move goods along from sprawling distribution centers located far from

city centers to smaller last-mile warehouses near cities is rapidly evolving and altering location dynamics of warehouses. Additionally, operations of these warehouses are increasingly integrating solar, hydrogen and other green energy sources.<sup>51</sup> Solar panels on roofs provide power for the highly automated distribution centers where hydrogen fuel-cell powered forklifts and electric trucks operate through the night to replenish stock in last-mile warehouses for tomorrow's same-day delivery.

## Investment Implications

### Fragmented landscape for autonomous vehicles provides equity opportunities

The autonomous vehicle space provides a wealth of opportunities for global equity investors. The industry is in the very early stages of developing and testing the technology. Consequently, many partnerships between auto manufacturers and tech firms have been formed and there are likely to be some first-mover advantages. The landscape is evolving quickly, and it remains unclear which partnerships may produce a mass marketable autonomous platform first.

Despite the uncertainty, there are some characteristics of autonomous platforms and partnerships that equity investors should look out for. First, on the auto manufacturer side, there needs to be sufficient capital and commitment to support the lengthy processes of testing, regulatory approvals and production capability to mass produce successful models. On this front, the larger automakers can leverage their size and regulatory experience.

Second, rigorous and thorough testing under all kinds of circumstances is required. Countries like China that are supportive of AV testing on their roads and smart infrastructure will have an advantage.<sup>52</sup> In fact, testing of robo-taxis and other vehicles is already underway in multiple densely trafficked cities like Beijing, Guangzhou and Wuhan.<sup>53</sup>

Third, when it comes to the hardware associated with AV – all the cameras as well as the myriad of sensors – reducing size and weight is critical. Furthermore, integrating these inputs seamlessly with the operations

of the car are vital to make the best real-time decisions and ensure the safest rides.

Fourth, the algorithm that interprets all the input from cameras and sensors needs to be able to process all this data quickly and efficiently. For example, the first-generation AV algorithm used between 500 and 800 watts of power and required considerable ventilation and cooling. The most advanced AV algorithms today run much more efficiently, using less than 50 watts of power, and requiring far less cooling.<sup>54</sup>

Based on these criteria, in the autonomous car and robo-taxi space, Chinese AV firms DeepRoute (partnered with Dong Feng), Pony (partnered with Toyota) and WeRide (partnered with Nissan) are examples of potential front-runners and are in the midst of testing autonomous platforms.

In the autonomous trucking space, Aurora's partnership with Volvo is currently testing in North America. Meanwhile, Daimler's partnership with Waymo and Navistar's partnership with TuSimple appear to be promising as well. Investors should also be aware that developments in autonomous trucking will have implications for logistics and warehouses.

## **Digital platforms to optimize supply chains, logistics and transport**

While some parts of the logistics and delivery ecosystem like UPS, DHL and FedEx are very tech-savvy, adoption of technology has been inconsistent. The less tech-forward portions of the logistics and supply chain sector provide a growth opportunity for software firms and investors alike. Cloud-based platforms to digitize supply chains provide many possibilities for freight forwarders, customs brokers, and other logistics players to increase efficiency. For public equity investors, leading players like Canada's Descartes Systems Group can be attractive growth opportunities. Descartes offers a supply chain management platform that optimizes logistics, operations and shipping routes as well as connects the different parts of the chain using real-time messaging and data.

In private equity, British tech firm Connexin specializes in the Internet-of-Things and offers an integrated transport and logistics platform for trucking and warehouses. They provide both the hardware –

telematics devices and sensors – used to generate data as well as the software to integrate and analyze it for optimization of fleets, routes and warehouses.

Software platforms can offer attractive opportunities for debt investors as well. Their subscription models and essential function in businesses make for steady and reliable cash flows during all phases of the economic cycle. Software platforms for transportation and logistics offer some of the best examples. Spanish software maker Amadeus provides an operational platform for managing both airports and airlines. It can optimize runway and gate usage for airport operations as well as flight schedules, re-bookings and upgrades for airlines. The Convoy shipper platform is another example in logistics. It offers a digital freight network where tens of thousands of independent freight haulers in the US can find partial or full loads for their trucks.

## **Europe offers new opportunities and challenges in logistics real estate**

With relatively low e-commerce penetration compared to other regions, Europe has lagged in online shopping. However, the pandemic has allowed it to catch up quickly. The surge in online shopping due to COVID-19 restrictions created tremendous growth in demand for distribution and logistics facilities. This has directly led to an increase in demand for remote distribution centers outside major cities like Berlin, Madrid, Paris, and Brussels, as well as smaller last-mile warehouses closer to population centers.<sup>55</sup>

Aside from rising rental prices on existing facilities, there is considerable room for new development as well. In the UK, land outside big cities like London and Manchester that is close to major motorway junctions has become especially coveted as demand for same-day delivery soars.

However, European regulation and infrastructure also present some unique challenges for investors. European motorways and urban streets are generally narrower than other parts of the world and may not be able to easily support the volume of electric scooters, vans and trucks needed to sustain more e-commerce deliveries.

Also, policy initiatives that are designed to make societies greener and more socially responsible may have some unintended consequences for e-commerce



and the logistics space broadly. For example, local efforts across the EU to reduce city traffic – like congestion pricing and low emission zones – are growing.<sup>56</sup> This poses a risk to delivery vehicles. Additionally, efforts in Germany to support sustainable supply chains will take effect in 2023 and its rippling impact up and down value chains remains very unclear.<sup>57</sup> With more scrutiny of global sourcing, closer-to-home sourcing of goods and materials will gain prominence and may shift demand for logistics and warehouses from import facilities to local manufacturing hubs.

*Policy initiatives that are designed to make societies greener and more socially responsible may have unintended consequences for e-commerce and the logistics space broadly.*

## **Green technology alters the locational analysis for warehouses in the US**

In mature markets like the US, technology is altering the locational analysis for distribution centers. These are the sprawling, more remotely located facilities that replenish the stock of smaller last-mile warehouses closer to major cities. For example, autonomous trucking with an efficient transfer hub model or multiple trucks linked together to reduce drag may make it economically and logistically feasible to locate distribution centers further from last-mile facilities.<sup>58</sup>

Other dynamics are also nudging distribution centers further away from urban centers. In the past, distribution centers needed access to major metropolitan areas and large electricity grids to meet their demand for ample labor and power. The proliferation of automation within the facilities augments labor and may diminish the need for access to large labor pools. Furthermore, renewable energy from solar panels on their expansive roofs and hydrogen fuel cells in major machinery play a growing role in powering distribution centers today. As a result

of distribution centers becoming greener, proximity to a major power grid is less critical, though many choose to remain close to sell excess power to the grid and repurchase power as needs change.

## **Opportunities in the transition to greener and smarter infrastructure**

Given new government-funded infrastructure plans in the US and Europe, it is important to recognize the investment opportunities around the transition to smart, green infrastructure. Rest stops and gas stations along major roadways have long been attractive infrastructure investments, for example. Going forward, investors will need to be mindful of the transition to EV. There will be a lengthy transition period where motorists will have a need for both EV charging as well as gasoline at highway rest stops. Investors can look at debt of highway service providers, like Autobahn Tank & Rast in Germany, who are tuned into the needs of local motorists and can switch the balance between refueling and recharging as local demand warrants.

Other examples lie in municipal infrastructure. As technology is increasingly being employed to make cities smarter, investors can find attractive opportunities in both the manufacturers of these systems as well as the public-private partnerships that enable smart cities. Chicago Parking Meters, for example, is a public-private partnership that operates street parking in parts of the city. Their user app has a predictive parking feature that leverages proprietary data and AI to help users find empty parking spaces today or in the future. They also use camera-enabled AI to determine whether cars are in compliance with local parking regulations and can issue tickets based on that information.<sup>59</sup>

## **A very long road for EV presents ICE opportunities for debt investors**

Electric vehicles are clearly part of the future, but it is also clear internal combustion engines will have a very long sunset. While auto manufacturers are being pushed by government emissions regulations to develop EV, not all consumers will opt for them given they are often more expensive than comparable

ICE vehicles. The unpleasant reality is global auto manufacturers will be selling at least as many ICE as EV vehicles for the next 10 years – or more. It is clear gasoline-fueled autos will play a prominent role in the global landscape for decades to come – and perhaps even longer in places like the US. It is also clear the businesses and infrastructure that support it (e.g., parts makers, gas stations, etc.) will still be relevant and sources of reliable cash flows, even if their revenue growth slows. For debt investors, there is a compelling investment case to be made for auto parts distributors and retailers like NAPA in the US, which may be priced for more imminent obsolescence.

### Logistics incumbents embracing cloud technology will thrive

While US trucking is likely to be disrupted by autonomous trucks and consolidate significantly, trucking companies that embrace new technologies and leverage the efficiency gains from it will most likely be part of the future. This type of tech-forward firm can offer resilient cash flows to debt investors.

US trucking company Old Dominion provides a good example. It is investing heavily in technology to modernize its operations and reduce risk. The company utilizes telematics devices on its entire fleet to track and record basic data about each and every truck in the field, including speed, acceleration, and braking. The firm leverages this proprietary data using cloud-based analytic tools to optimize operations of vehicles, drivers, and routes.

Chapters 2-4 examined the significant investment opportunities and risks for specific asset classes (Table 4). CIOs also need to consider some of the hidden risks and implications of disruption across asset classes. The next chapter provides actionable recommendations to help CIOs navigate the tumultuous aspects of technology disruption in services across their entire portfolio.

**Table 4: Investment Implications Summary**

	Public Equity	Public and Private Debt	Real Estate and Infrastructure	Venture Capital	Private Equity
<b>Financial Services</b>					
Global opportunities in the expanding fintech ecosystem (e.g., neobanks, payment and other platforms)	●			●	●
Insurance firms that integrate advanced data analytics will succeed	●	●			
Focus on targeted blockchain applications that solve specific problems today				●	●
Incumbent banks leveraging new technology will thrive and widen their moats		●			
Next generation payment systems allow tech-forward incumbents and select new entrants to thrive	●	●		●	●

	Public Equity	Public and Private Debt	Real Estate and Infrastructure	Venture Capital	Private Equity
<b>Healthcare</b>					
Emerging markets offer new opportunities and risks for biotech and pharmaceuticals	●			●	●
Investing in small-cap US biotech firms requires an active approach	●				
Care outside of the doctor's office, from an app				●	
Specialized healthcare platforms				●	●
Medical devices as a service offer stable cash flows for debt investors		●			
Lab testing and diagnostics offer steady cash flows for debt investors		●	●		
Senior housing remains attractive for real estate investors			●		
<b>Transportation and Logistics</b>					
Participating in fragmented AV landscape	●			●	●
Digital platforms to optimize supply chains and logistics	●	●			●
Europe offers new opportunities and challenges in logistics real estate			●		
Green technology alters the locational analysis for warehouses in the US			●		●
Opportunities in the transition to greener and smarter infrastructure		●	●		
A very long road for EV presents ICE opportunities for debt investors		●			
Logistics incumbents embracing cloud technology will thrive		●			

## Acknowledgments

*PGIM gratefully acknowledges the contributions by the following individuals:*

Alex Blostein, Managing Director, Equity Research – Capital Markets: Asset Managers, Brokers, Exchanges, Trust Banks, Goldman Sachs

Dr. Mercedes Delgado, Associate Professor, Copenhagen Business School

Seth Ginns, Managing Partner and Head of Liquid Investments, CoinFund

Chris Hallam, Executive Director, Global Equity Research – European Aerospace & Defence, Goldman Sachs

Dr. Chang-Tai Hsieh, Phyllis and Irwin Winkelried Professor of Economics and PCL Faculty Scholar, Chicago Booth School of Business

Dr. Jeremy D. Lack, Partner, Athyrium

Grace Liu, Managing Director & Global Partner, Fosun RZ Capital

Ioana Niculcea, Head of FinTech Advisory, Citi

Otto Pohl, Founder and Principal, Core Communications LLC

Jay Wang, Director, Fosun RZ Capital

## PGIM Contributors

Cheryl Akawie, PGIM Fixed Income

Lauren Alpeyrie, PGIM Real Estate

Naveen Argarwal, PFI

Alexander Babulevich, PGIM Fixed Income

Henry Balbirer, PGIM Fixed Income

Mark Baribeau, Jennison Associates

Keith Bexell, PFI

Steve Blazejewski, PGIM Real Estate

Al Caesar, PFI

Ed Campbell, PGIM Quantitative Solutions

Michael Cardi, PGIM Fixed Income

Yanru Chen, PGIM Fixed Income

Victoria Cheng, PruVen Capital

Brannon Cook, Jennison Associates

Charles Crowe, PGIM Real Estate

John Di Paolo, PGIM Fixed Income

Roben Dunkin, PGIM

Ian Ellis, PFI

Edward Farley, PGIM Fixed Income

Sebastiano Ferrante, PGIM Real Estate

Manoj Govindan, PFI

Billy Greer, PGIM Private Capital

Katy Griffin, PGIM Fixed Income

Ramneek Gupta, PruVen Capital

Elizabeth Halpin, PGIM Fixed Income

Dr. Peter Hayes, PGIM Real Estate

Alex Herbert, PGIM Fixed Income

Daniel Hermansson, PFI

Gary Horbacz, PGIM Fixed Income

David Hunt, PGIM

Robert Huntsman, PFI

Dr. Taimur Hyat, PGIM

James Hyde, PGIM Fixed Income  
Nikola Ivanov, PGIM Fixed Income  
David Jiang, PGIM Fixed Income  
Wilhelm Johannis, PGIM Fixed Income  
Josh Jordan, PGIM Fixed Income  
Jake Kemeny, PGIM Fixed Income  
Ed Keon, PGIM Quantitative Solutions  
Christina Kim, PGIM Private Capital  
Owuraka Koney, Jennison Associates  
Albert Kwok, Jennison Associates  
Alexander Latter, PGIM Fixed Income  
Morgan Laughlin, PGIM Real Estate  
Allyson Laurence, PFI  
Tim Lyons, PFI  
John Maxwell, PGIM Fixed Income  
Lee Menifee, PGIM Real Estate  
Sara Moreno, Jennison Associates  
Naveed Mukhtar, PGIM Fixed Income  
Patrick Myers, PGIM Fixed Income  
Debra Netschert, Jennison Associates  
Cuong Nguyen, PGIM Real Estate  
Steve Oliveira, PGIM Real Estate  
Juan Otero, PGIM Fixed Income  
Bill Pappas, PGIM Private Capital  
Dr. Harsh Parikh, PGIM IAS  
Greg Peters, PGIM Fixed Income  
Abe Pothireddy, PGIM  
Dave Power, PGIM Real Estate  
Dave Quackenbush, PGIM Private Capital  
Indy Reddy, PGIM Investments  
John Sarokhan, PGIM Real Estate  
Anindya Sengupta, PFI  
Sara Shank, PGIM Real Estate  
Dr. Nathan Sheets, PGIM Fixed Income  
Todd Shriber, PFI  
Travis Skelly, PruVen Capital  
Daryl Skinner, PGIM Private Capital  
Dr. Gavin Smith, PGIM Quantitative Solutions  
Robin Snyder, PGIM Fixed Income  
Tatiana Spineanu, PGIM Fixed Income  
Pinto Suri, PGIM Fixed Income  
Steven Tanz, PGIM Fixed Income  
Amol Tembe, PFI  
Mark Thurgood, PGIM Fixed Income  
Andrew Tucker, Jennison Associates  
Mark Vande Hey, PGIM Real Estate  
Jocelyn de Verdelon, PGIM Real Estate  
John Vibert, PGIM Fixed Income  
Henri Vuong, PGIM Real Estate  
Dr. Noah Weisberger, PGIM IAS  
Kelly Whitman, PGIM Real Estate

## Principal Authors

Shehriyar Antia, PGIM Thematic Research

David Klausner, PGIM Thematic Research

## Endnotes

1. World Bank Databank, accessed July 13, 2021.
2. PGIM analysis based on data from MSCI, as of 6/28/2021.
3. Lund, Susan and Manyika, James, “Five lessons from history on AI, automation, and employment,” McKinsey & Company, November 28, 2017, <<https://www.mckinsey.com/featured-insights/future-of-work/five-lessons-from-history-on-ai-automation-and-employment>>; Bank of England, data accessed July 14, 2021, <<https://www.bankofengland.co.uk/statistics/research-datasets>>.
4. Rodrick, Dani, “Premature deindustrialization,” *Journal of Economic Growth*, vol 21(1), pages 1-33, 2016, <<https://www.nber.org/papers/w20935>>
5. Liping, Zhang and Evenett, Simon J., “The Growth of China’s Services Sector and Associated Trade: Complementarities between Structural Change and Sustainability,” International Institute for Sustainable Development, July 2010, <[https://www.iisd.org/system/files/publications/sts\\_4\\_growth\\_china\\_services\\_sector.pdf](https://www.iisd.org/system/files/publications/sts_4_growth_china_services_sector.pdf)>; “Distribution of the workforce across economic sectors in China from 2010 to 2020,” Statista, accessed September 7, 2021, <<https://www.statista.com/statistics/270327/distribution-of-the-workforce-across-economic-sectors-in-china/>>
6. World Bank Databank, accessed June 8, 2021. For this paper, services are defined as including wholesale and retail trade and restaurants and hotels; transport, storage, and communications; financing, insurance, real estate, and business services; and community, social, and personal services. Unless otherwise stated, service-oriented jobs embedded in manufacturing firms are included in the manufacturing sector.
7. Autor, David, “Why Are There Still So Many Jobs? The History and Future of Workplace Automation,” *Journal of Economic Perspectives* – Volume 29, Number 3 – Summer 2015 – Pages 3-30, <<https://economics.mit.edu/files/11563>>
8. United Nations Statistics Division, data accessed July 7, 2021, <<http://data.un.org/Data.aspx>>
9. Autor, David, “Why Are There Still So Many Jobs? The History and Future of Workplace Automation,” *Journal of Economic Perspectives* – Volume 29, Number 3 – Summer 2015 – Pages 3-30, <<https://economics.mit.edu/files/11563>>
10. Lodefalk, Magnus, “Tear down the trade-policy silos! Or how the servicification of manufacturing makes divides in trade policymaking irrelevant,” Vox EU, January 16, 2015, <<https://voxeu.org/article/servicification-manufacturing-and-trade-policy>>
11. Delgado, Mercedes, Kim, J. Daniel and Mills, Karen, “The Servicification of the U.S. Economy: The Role of Startups versus Incumbent Firms,” National Bureau of Economic Research, January 26, 2021, <<https://www.nber.org/system/files/chapters/c14379/c14379.pdf>>
12. Ibid.
13. Bank of England, data accessed June 28, 2021, <<https://www.bankofengland.co.uk/statistics/research-datasets>>
14. World Bank Databank, accessed June 15, 2021.
15. PGIM analysis based on 6/30/2021 portfolios of Calpers, NGPF and CIC. Services share of a typical institutional investor portfolio is lower than services share of GDP because portfolios also include real estate, infrastructure and sovereign bonds.
16. PGIM analysis based on OECD data on value added and its components by activity, ISIC rev4. Countries used in the analysis include the European Union, United States, Japan, Canada, Australia, Korea, Mexico and Turkey. PGIM analysis based on data from MSCI, as of 6/28/2021.
17. Manyika, James, et al., “Digital America: A Tale of the Haves and Have-Mores,” McKinsey Global Institute, December 2015, <[https://www.mckinsey.com/-/media/mckinsey/industries/technology%20media%20and%20telecommunications/high%20tech/our%20insights/digital%20america%20a%20tale%20of%20the%20haves%20and%20have%20mores/mgi%20digital%20america\\_executive%20summary\\_december%202015.pdf](https://www.mckinsey.com/-/media/mckinsey/industries/technology%20media%20and%20telecommunications/high%20tech/our%20insights/digital%20america%20a%20tale%20of%20the%20haves%20and%20have%20mores/mgi%20digital%20america_executive%20summary_december%202015.pdf)>
18. Hrushka, Anna, “What’s in store for challenger banks in 2021,” Banking Dive, January 25, 2021, <<https://www.bankingdive.com/news/challenger-banks-outlook-2021/593872/>>
19. “The Future Means Business,” PGIM, October 2019, <<https://www.pgim.com/megatrends/future-means-business>>
20. Carson, Brant, et al., “Blockchain beyond the hype: What is the strategic business value?” McKinsey & Company, June 19, 2018, <<https://www.mckinsey.com/business-functions/mckinsey-digital/our-insights/blockchain-beyond-the-hype-what-is-the-strategic-business-value>>
21. World Bank Global Findex 2017, data accessed June 27, 2021, <<https://globalfindex.worldbank.org>>
22. “Walmart files for trademark for fintech unit: 'Hazel by Walmart,’” Bloomberg, April 7, 2021, <<https://www.bloomberg.com/news/articles/2021-04-07/walmart-files-for-trademark-for-fintech-unit-hazel-by-walmart>>
23. “Monzo bank in money laundering rules investigation,” BBC News, July 31, 2021, <<https://www.bbc.com/news/business-58033700>>
24. Siegel Bernard, Tara, “Consumers and Companies Are Buying In on Paying Later,” *The New York Times*, September 3, 2021, <<https://www.nytimes.com/2021/09/03/your-money/buy-now-pay-later-afterpay-affirm-amazon-square.html?auth=login-email&login=email>>

25. "Figure Announces Merger With Top Mortgage Lender Homebridge Financial Services," Figure, August 3, 2021, <<https://www.figure.com/blog/figure-announces-merger-with-top-mortgage-lender-homebridge-financial-services>>; Chiglinsky, Katherine, "Cagney's Figure Agrees to Merger with Lender Homebridge," Bloomberg, August 3, 2021, <<https://www.bloomberg.com/news/articles/2021-08-03/cagney-s-figure-agrees-to-merge-with-mortgage-lender-homebridge>>
26. "Twenty-five years of digitization: Ten insights into how to play it right," McKinsey Global Institute, Prepared for the Digital Enterprise Show 21-23 May, Madrid, May 2019, <<https://www.mckinsey.com/-/media/mckinsey/business%20functions/mckinsey%20digital/our%20insights/twenty-five%20years%20of%20digitization%20ten%20insights%20into%20how%20to%20play%20it%20right/mgi-briefing-note-twenty-five-years-of-digitization-may-2019.ashx>>
27. Mehrotra A, Bhatia RS, Snoswell CL, "Paying for Telemedicine After the Pandemic," JAMA, 325(5):431–432, 2021, <<https://jamanetwork.com/journals/jama/article-abstract/2775723>>. Note: Canada figures represent Ontario.
28. Dolan, Shelagh, "The technology, devices, and benefits of remote patient monitoring in the healthcare industry," Business Insider, July 28, 2021, <<https://www.businessinsider.com/remote-patient-monitoring-industry-explained>>
29. Boddy, Jessica, "FDA Approves Marketing of Consumer Genetic Tests For Some Conditions," NPR, April 7, 2017, <<https://www.npr.org/sections/health-shots/2017/04/07/522897473/fda-approves-marketing-of-consumer-genetic-tests-for-some-conditions>>
30. "23andMe for Healthcare Professionals," 23andMe, <<https://medical.23andme.com/>>
31. Buhr, Sarah, "For less than \$1,000 you can now pull up your entire genome on your smartphone," Tech Crunch, March 8, 2016, <<https://techcrunch.com/2016/03/08/you-can-now-pull-up-your-entire-genome-for-under-1000-on-your-smartphone/>>
32. Landor, Laura, "How Apps Can Help Manage Chronic Diseases," *The Wall Street Journal* and the American Medical Association, <<https://partners.wsj.com/ama/charting-change/apps-can-help-manage-chronic-diseases/>>
33. Nogrady, Bianca, "How Indian biotech is driving innovation," *Nature*, December 12, 2018, <<https://www.nature.com/articles/d41586-018-07671-9>>
34. "Extracting Growth Alpha in Emerging Markets," Jennison Associates, October 2020, <<https://cdn.pfcdn.com/cms/jennison/sites/default/files/2020-10/Extracting%20Growth%20Alpha%20in%20Emerging%20Markets.pdf>>
35. Moreno, Sara, "Chinese Healthcare: Growth Abounds," Jennison Associates, February 10, 2021, <<https://www.jennison.com/brochure/chinese-healthcare-growth-abounds>>
36. Wang, Xu and Diao, Yuanyuan, "New Drug Approvals in China in 2019," Global Forum, May 2020, <<https://globalforum.diaglobal.org/issue/may-2020/new-drug-approvals-in-china-in-2019/>>
37. Moreno, Sara, "Chinese Healthcare: Growth Abounds," Jennison Associates, February 10, 2021, <<https://www.jennison.com/brochure/chinese-healthcare-growth-abounds>>
38. Xie, Grace and Fern Woo, Li, "How to cope with the Volume-based Procurement policy on high-value medical device?" KPMG, May 2021, <<https://assets.kpmg/content/dam/kpmg/cn/pdf/en/2021/05/how-to-cope-with-the-volume-based-procurement-policy-on-high-value-medical-device.pdf>>
39. Jennings, Katie, "Venture Firm Behind Livongo Launches \$150 Million Consumer Health Fund," *Forbes*, May 18, 2021, <<https://www.forbes.com/sites/katiejennings/2021/05/18/venture-firm-behind-livongo-launches-150-million-consumer-health-fund/?sh=433ad7547bc2>>
40. "Modern care for modern families," Maven, <<https://www.mavenclinic.com/for-employers>>; Cleo, <<https://hicleo.com/for-employers/>>
41. "A Silver Lining: The Investment Implications of an Aging World," PGIM, November 2016, <<https://www.pgim.com/megatrends/longevity>>. World Population Prospects 2019, United Nations. Seniors are defined as those aged 75+.
42. Ibid.
43. "Electric Vehicle Sales Review Q3," Strategy&, Q3 2021, <<https://www.strategyand.pwc.com/nl/en/industries/automotive/electric-vehicle-sales-review-2021-q3.html>>
44. Ibid.
45. Plumer, Brad, Popovich, Nadja, and Miglizzo, Blacki, "Electric Cars are Coming. How Long Until They Rule the Road?" *New York Times*, March 10, 2021, <<https://www.nytimes.com/interactive/2021/03/10/climate/electric-vehicle-fleet-turnover.html>>
46. Based on interview with PGIM investment professional.
47. Williams, Nathan and Murray, Dan, "An Analysis of the Operational Costs of Trucking: 2020 Update," American Transport Research Institute, November 2020, <<https://truckingresearch.org/wp-content/uploads/2020/11/ATRI-Operational-Costs-of-Trucking-2020.pdf>>
48. Ambrose, Jillian, "UK plans to bring forward ban on fossil fuel vehicles to 2030," *The Guardian*, September 21, 2020, <<https://www.theguardian.com/environment/2020/sep/21/uk-plans-to-bring-forward-ban-on-fossil-fuel-vehicles-to-2030>>
49. Pan, Che, "Baidu will offer first paid robotaxi service in China next month, letting people hail rides without drivers," *South China Morning Post*, April 29, 2021, <<https://www.scmp.com/tech/big-tech/article/3131617/baidu-will-offer-first-paid-robotaxi-service-china-next-month-letting>>

50. Keenan, Michael, "Global Ecommerce Explained: Stats and Trends to Watch in 2021," Shopify, May 13, 2021, <<https://www.shopify.com/enterprise/global-e-commerce-statistics>>
51. Rulison, Larry, "Plug Power plays huge role helping Amazon and Walmart supply America during COVID-19 crisis," *Times Union*, May 7, 2020, <<https://www.timesunion.com/business/article/Plug-Power-playing-huge-role-in-helping-Amazon-15254512.php>>
52. Tabeta, Shunsuke, "China intends for self-driving cars to propel smart megacity," *Nikkei Asia*, May 20, 2018, <<https://asia.nikkei.com/Economy/China-intends-for-self-driving-cars-to-propel-smart-megacity>>
53. Jian, Yang, "China Opens up to AVs," *Automotive News*, December 20, 2020, <<https://www.autonews.com/shift/china-opens-avs>>
54. Based on interview with Fosun RZ Capital.
55. "After the Great Lockdown: New Business Realities and the Implications for Investors," PGIM, May 2020, <<https://www.pgim.com/megatrends/after-the-great-lockdown>>
56. Tirone, Jonathan, "Congestion Pricing, the Route More Cities Are Taking," *Bloomberg*, October 1, 2020, <<https://www.bloomberg.com/news/articles/2020-10-01/congestion-pricing-the-route-more-cities-are-taking-quicktake?sref=OXBg9m2M>>
57. Howells, Richard, "Germany Raises The Bar For Supply Chain Traceability and Sustainability," *Forbes*, July 1, 2021, <<https://www.forbes.com/sites/sap/2021/07/01/germany-raises-the-bar-for-supply-chain-traceability-and-sustainability/?sh=25eeab654e4e>>
58. Zarif, Rasheq, et al., "Autonomous Trucks Lead the Way," *Deloitte*, February 17, 2021, <<https://www2.deloitte.com/us/en/insights/focus/future-of-mobility/autonomous-trucks-lead-the-way.html>>
59. "Sensen Networks," *Enterprise IOT Insights*, April 2020, <<https://i0.wp.com/enterpriseiotinsights.com/wp-content/uploads/2020/04/Sensen-Networks.jpg?fit=1280%2C720&ssl=1>>
60. "The Technology Frontier: Investment Implications of Disruptive Change," PGIM, Fall 2018, <<https://www.pgim.com/megatrends/technology-frontier>>
61. Smith, Oliver, "Belgium's Aion Bank has acquired London robo-advisor ETFmatic," *AltFi*, March 10, 2021, <[https://www.altfi.com/article/7686\\_belgiums-aion-bank-has-acquired-london-robo-advisor-etfmatic](https://www.altfi.com/article/7686_belgiums-aion-bank-has-acquired-london-robo-advisor-etfmatic)>; Janowski, Davis, "Schwab Acquires Motif Investing Tech, IP," *Wealth Management*, May 8, 2020, <<https://www.wealthmanagement.com/technology/schwab-acquires-motif-investing-tech-ip>>
62. Orchard, Marianne, "Teaming up for instant lending with Kabbage & ING," *Medium*, February 5, 2018, <<https://medium.com/gingertech/teaming-up-for-instant-lending-with-kabbage-ing-91f87718028>>; "Philips completes the acquisition of BioTelemetry, Inc.," *Philips*, February 9, 2021, <<https://www.philips.com/a-w/about/news/archive/standard/news/press/2021/20210209-philips-completes-the-acquisition-of-biotelemetry-inc.html>>
63. "China's Techlash Gains Steam. Again," *The Economist*, July 28, 2021, <<https://www.economist.com/business/2021/07/28/chinas-techlash-gains-steam-again>>
64. McFarland, Matt, "Uber self-driving car operator charged in pedestrian death," *CNN Business*, September 18, 2020, <<https://www.cnn.com/2020/09/18/cars/uber-vasquez-charged/index.html>>



## Important Information

**Professional Investor Use Only. All investments involve risks, including possible loss of principal. Past performance is not indicative of future results.**

The information contained herein is provided by PGIM, Inc., the principal asset management business of Prudential Financial, Inc. (PFI), and an investment adviser registered with the US Securities and Exchange Commission (SEC). Registration with the SEC does not imply a certain level of skill or training.

In the United Kingdom, information is issued by PGIM Limited with registered office: Grand Buildings, 1-3 Strand, Trafalgar Square, London, WC2N 5HR. PGIM Limited is authorised and regulated by the Financial Conduct Authority (“FCA”) of the United Kingdom (Firm Reference Number 193418). In the European Economic Area (“EEA”), information is issued by PGIM Netherlands B.V. with registered office: Gustav Mahlerlaan 1212, 1081 LA Amsterdam, The Netherlands. PGIM Netherlands B.V. is, authorised by the Autoriteit Financiële Markten (“AFM”) in the Netherlands (Registration number 15003620) and operating on the basis of a European passport. In certain EEA countries, information is, where permitted, presented by PGIM Limited in reliance of provisions, exemptions or licenses available to PGIM Limited under temporary permission arrangements following the exit of the United Kingdom from the European Union. These materials are issued by PGIM Limited and/or PGIM Netherlands B.V. to persons who are professional clients as defined under the rules of the FCA and/or to persons who are professional clients as defined in the relevant local implementation of Directive 2014/65/EU (MiFID II). These materials are issued to persons who are professional clients or eligible counterparties as defined in Directive 2014/65/EU (MiFIDII), investing for their own account, for funds of funds or discretionary clients. In Singapore, information is issued by PGIM (Singapore) Pte. Ltd. (PGIM Singapore), a Singapore investment manager that is licensed as a capital markets service license holder by the Monetary Authority of Singapore and an exempt financial adviser (registration number: 199404146N). These materials are issued by PGIM Singapore for the general information of “institutional investors” pursuant to Section 304 of the Securities and Futures Act, Chapter 289 of Singapore (the “SFA”) and “accredited investors” and other relevant persons in accordance with the conditions specified in Section 305 of the SFA. In Hong Kong, information is provided by PGIM (Hong Kong) Limited, a regulated entity with the Securities & Futures Commission in Hong Kong to professional investors as defined in Section 1 of Part 1 of Schedule 1 (paragraph (a) to (i) of the Securities and Futures Ordinance (Cap. 571). PGIM, Inc. is exempt from the requirement to hold an Australian Financial Services License under the Corporations Act 2001 in respect of financial services. PGIM, Inc. is exempt by virtue of its regulation by the Securities and Exchange Commission under the laws of the United States of America, including applicable state laws and the application of ASIC Class Order 03/1100. The laws of the United States of America differ from Australian laws. In Japan, information is presented by PGIM Japan, Co. Ltd. (“PGIM Japan”), a registered Financial Instruments Business Operator with the Financial Services Agency of Japan. In South Korea, information is issued by PGIM, Inc., which is licensed to provide discretionary investment management services directly to South Korean qualified institutional investors on a cross-border basis.

These materials are for informational or educational purposes only. The information is not intended as investment advice and is not a recommendation about managing or investing assets. In providing these materials, PGIM is not acting as your fiduciary.

These materials represent the views, opinions and recommendations of the author(s) regarding the economic conditions, asset classes, securities, issuers or financial instruments referenced herein. Distribution of this information to any person other than the person to whom it was originally delivered and to such person's advisers is unauthorized, and any reproduction of these materials, in whole or in part, or the divulgence of any of the contents hereof, without prior consent of PGIM is prohibited. Certain information contained herein has been obtained from sources that PGIM believes to be reliable as of the date presented; however, PGIM cannot guarantee the accuracy of such information, assure its completeness, or warrant such information will not be changed. The information contained herein is current as of the date of issuance (or such earlier date as referenced herein) and is subject to change without notice. PGIM has no obligation to update any or all of such information; nor do we make any express or implied warranties or representations as to the completeness or accuracy or accept responsibility for errors. These materials are not intended as an offer or solicitation with respect to the purchase or sale of any security or other financial instrument or any investment management services and should not be used as the basis for any investment decision. No risk management technique can guarantee the mitigation or elimination of risk in any market environment. Past performance is not a guarantee or a reliable indicator of future results and an investment could lose value. No liability whatsoever is accepted for any loss (whether direct, indirect, or consequential) that may arise from any use of the information contained in or derived from this report. PGIM and its affiliates may make investment decisions that are inconsistent with the recommendations or views expressed herein, including for proprietary accounts of PGIM or its affiliates. Any projections or forecasts presented herein are as of the date of this presentation and are subject to change without notice. Actual data will vary and may not be reflected here. Projections and forecasts are subject to high levels of uncertainty. Accordingly, any projections or forecasts should be viewed as merely representative of a broad range of possible outcomes. Projections or forecasts are estimated, based on assumptions, and are subject to significant revision and may change materially as economic and market conditions change. PGIM has no obligation to provide updates or changes to any projections or forecasts.

This material may contain examples of the firm's internal ESG research program and is not intended to represent any particular product's or strategy's performance or how any particular product or strategy will be invested or allocated at any particular time. PGIM's ESG processes, rankings and factors may change over time. ESG investing is qualitative and subjective by nature; there is no guarantee that the criteria used or judgment exercised by PGIM will reflect the beliefs or values of any investor. Information regarding ESG practices is obtained through third-party reporting, which may not be accurate or complete, and PGIM depends on this information to evaluate a company's commitment to, or implementation of, ESG practices. ESG norms differ by region. There is no assurance that PGIM's ESG investing techniques will be successful.

The opinions and recommendations herein do not take into account individual client circumstances, objectives, or needs and are not intended as recommendations of particular securities, financial instruments or strategies to particular clients or prospects. No determination has been made regarding the suitability of any securities, financial instruments or strategies for particular clients or prospects. For any securities or financial instruments mentioned herein, the recipient(s) of this report must make its own independent decisions.

Conflicts of Interest: PGIM and its affiliates may have investment advisory or other business relationships with the issuers of securities referenced herein. PGIM and its affiliates, officers, directors and employees may from time to time have long or short positions in and buy or sell securities or financial instruments referenced herein. PGIM and its affiliates may develop and publish research that is independent of, and different than, the recommendations contained herein. PGIM's personnel other than the author(s), such as sales, marketing and trading personnel, may provide oral or written market commentary or ideas to PGIM's clients or prospects or proprietary investment ideas that differ from the views expressed herein.

©2021 PFI and its related entities. PGIM, the PGIM logo, and the Rock symbol are service marks of Prudential Financial, Inc., and its related entities, registered in many jurisdictions worldwide.

**Mutual Fund investments are subject to market risks, read all scheme related documents carefully.**



**PGIM**  
India Mutual Fund

PGIM India Asset Management Pvt. Ltd.  
4-C, Laxmi Towers, Bandra Kurla  
Complex, Bandra East, Mumbai – 400 051

Visit us at [www.pgimindiamf.com](http://www.pgimindiamf.com)

Follow us on    