# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Executive Summary</td>
<td>3</td>
</tr>
<tr>
<td>Investing in the Underinvested</td>
<td>5</td>
</tr>
<tr>
<td>Entrepreneurship and Economic Equality</td>
<td>6</td>
</tr>
<tr>
<td>Capital Access Gap</td>
<td>7</td>
</tr>
<tr>
<td>Personal Finance Gap</td>
<td>12</td>
</tr>
<tr>
<td>Financial Information Gaps Contribute to the Financial Wellness Gap</td>
<td>13</td>
</tr>
<tr>
<td>Black Owned Businesses Have Worse Outcomes</td>
<td>16</td>
</tr>
<tr>
<td>Black Entrepreneurs Experience Bias and Discrimination</td>
<td>18</td>
</tr>
<tr>
<td>Investing in Black Women Entrepreneurs</td>
<td>20</td>
</tr>
<tr>
<td>Good for Growth</td>
<td>21</td>
</tr>
<tr>
<td>Fairer and Richer Society</td>
<td>21</td>
</tr>
<tr>
<td>Disclosure Appendix</td>
<td>22</td>
</tr>
</tbody>
</table>

*The Bigger Picture* is a publication series from Goldman Sachs Global Investment Research devoted to longer-term economic and policy issues, which complements our more market-focused analysis. For other important disclosures, see the Disclosure Appendix.
Executive Summary

1. **Black women are underrepresented in business ownership.** In *Black Womenomics: Investing in the Underinvested*, we highlighted the fundamental role of earnings in explaining the wealth gap. Black women, make less in the labor market and face job-related economic disadvantages driven by systemic and individual discrimination that are compounded by the intersectionality of gender. Private business ownership contributes significantly to earnings and wealth inequality. Yet, Black women are underrepresented in business ownership. This study focuses on the entrepreneurship gap of Black women, some of the core broader economic and social factors driving it and implications for earnings, wealth and economic mobility.

2. **Black women own less.** Black women own less. Black women make up roughly 6% of the US population but own just 2% of employer businesses. The imbalance is particularly stark for single Black women, just 0.5% of whom own a business—a rate that is 24 times lower than for single white men. Disparities in education and income drive some of the Black-white business ownership gap, but differences in capital access, personal finance, and financial information gaps also play a significant role.

3. **Black women have less access to capital.** Black women continue to face credit market challenges that create barriers to business ownership. Across all industries, a larger share of Black-owned businesses have inadequate initial capital. Similarly, Black entrepreneurs are 20% less likely to fund their startups with bank business loans and depend heavily on personal credit cards as the primary sources of startup capital. Moreover, Black entrepreneurs are more likely to report unmet credit needs and non-participation in seeking financing primarily due to expectations that their requests will be denied. More than half the Black business owners who seek credit report receiving less than the amount they requested from financial institutions versus a quarter of white business owners. Black women entrepreneurs cite limited access to funds as the largest barrier to success.

4. **Personal finances gap.** Historical systemic discriminatory policies and practices were foundational in creating Black Americans unequal access to financial services. Liquidity constraints and low levels of wealth create substantial barriers to entry for Black entrepreneurs. Moreover, weaker personal finances make Black women more vulnerable to negative income or spending shocks which can lead to borrowing on unfavorable terms. Black women’s wealth is not only held down by a lower access to high-return assets, but also by a higher exposure to high-cost liabilities. Black women are, for instance, 5 times more likely than white men to rely on expensive payday loans.

5. **Financial information gap contributes to the financial wellness gap.** There is a significant relationship between better financial education and the financial health of Black Americans. Yet, Black Americans, and especially Black women, lag white Americans on financial knowledge. Research results show that Black Americans score significantly lower on questions related to insuring, comprehending risk, investing and go-to information sources and suggest that higher levels of financial education would lead to better financial wellness.
6. Insufficient funding leads to worse outcomes for Black-owned businesses. Undercapitalization impacts the growth of Black-owned businesses. This is partly due to lower levels of personal wealth to borrow against and lack of access to equity financing, but may also be due to lending discrimination. Black businesses are nearly three times more likely than white businesses to report that access to financial capital and the cost of financial capital negatively impact profits. Black women’s ability to sustain their businesses also tends to fall much more sharply during a recession.

7. Black entrepreneurs experience bias and discrimination. Exacerbating the credit market challenges, Black women may face discrimination in the lending market which also limits their ability to invest in their businesses. Field experiments find that Black businesses are scrutinized at a much higher level than white-owned businesses, are prodded for more personal information and receive less customer service. Multiple studies document that high levels of discrimination persists in the labor and credit markets.

8. Solutions to close the entrepreneurship gap. This study identifies public and private investment opportunities to help close the entrepreneurship gap that focus on intentional structural adjustments to reduce systemic barriers. We reiterate that it is critical that the public sector robustly address racial inequity and mandate changes to laws and policies that may also influence social behavior and close the gaps over time. Proposed actions for the private sector include reducing barriers to entry, enabling growth and increasing financial education.

9. Good for growth. Our framework takes into account the broad economic disadvantages that Black women experience. Overcoming these adverse economic trends would make for not only a fairer but also a richer society. We estimate that reducing the earnings gap for Black women, which includes increasing business ownership to drive economic mobility, could raise the level of annual US GDP by 1.4-2.1% each year, or $350-525bn in current dollars.¹

¹ We would like to thank Jan Hatzius our Chief Economist and Head of Global Investment Research Division for his guidance throughout the project and our colleagues Joseph Briggs and Daan Struyven for their helpful suggestions and comments.
Investing in the Underinvested

In *Black Womenomics: Investing in the Underinvested*, we highlighted the fundamental role of earnings in explaining the wealth gap. Black women make less in the labor market and face job-related economic disadvantages driven by systemic and individual discrimination that are compounded by the intersectionality of gender. Black earnings account for about two-thirds of the average wealth gap (Exhibit 1) and an even larger share among lower-wealth households. The remainder is explained by other factors, including racial gaps in access to capital and investment opportunities including inheritances and home ownership, personal finances and financial information.

Access to better-paying occupations and industries drove a substantial narrowing in the wage gap of Black women relative to white men in the 80s and 90s, but that progress has stalled in the past two decades, while the wage gap with white women has increased. Exhibit 2 shows that while differences in education and occupations contribute to the widening gap, a significant and growing portion is not explained by measurable factors in the model (red bars). This implies that factors that are harder to measure quantitatively—such as bias and discrimination and differences in career opportunities or social networks—are likely playing a role in the persistence and widening of the wage gap versus white women.

Source: Panel Study of Income Dynamics, Goldman Sachs Global Investment Research
Entrepreneurship and Economic Equality

Academic research suggests that private businesses are an important component of wealth.² While the median Black household owns nearly 90% less wealth than the median white household, among both Black and white families, wealth is disproportionately distributed toward entrepreneurs versus wage or salary workers.³ Moreover, Black and white entrepreneurs are found to have more upward mobility and less downward mobility in the wealth distribution than wage/salary workers.⁴ Yet, Black women are underrepresented in business ownership. They make up roughly 6% of the US population, but own only 2% of employer businesses.

The most striking statistic is that only 0.5% of single Black women own their own business, a rate that is 24 times lower than for single white men; consistent with a large entrepreneurship gap (Exhibit 3).

For instance, although the lack of gender equality in funding startups is a broad issue, Black women have especially low representation. While there has been some progress over the past decade, Black women still account for a very low share of venture capital funding. Project Diane finds that Black women-founded companies raised over $700mn in funding from 2018-2019 which accounts for 0.27% of funds for that period, a notable

---

Disparities in income and education drive some of the Black-white private business ownership gap, but differences in capital access, personal finance, and financial information gaps play a significant role.

**Capital Access Gap**

Black women continue to face credit market challenges that create barriers to business ownership. While all business owners depend on personal finance, business loans from banks and personal credit cards as the primary sources of startup capital, Black business owners depend most heavily on personal credit cards.\(^6\)

Data from the Annual Survey of Entrepreneurs corroborates that Black entrepreneurs are 20% less likely to fund their startups with bank business loans, but are instead more likely to rely on more expensive personal credit card debt and personal and family savings (Exhibit 4, left panel). This greater reliance on internal finance and expensive forms of external finance suggests credit constraints are more severe. More than three quarters of Black and Hispanic women business founders cite limited access to funds or investment as a barrier to success (Exhibit 4, right panel).

---


A larger share of Black-owned businesses had low amounts of initial capital across all major industries. Exhibit 5 shows the top five industries for Black business owners.

Strikingly, Black business owners are three times more likely than white business owners to have their business in the healthcare and social assistance industry, a large outlier that makes up 30% of Black-owned businesses, possibly due to the lower capital requirements to start businesses in this sector. Consistent with this explanation, Exhibit 6 shows that Black businesses are overrepresented in sectors with low capital intensity, like health care and social assistance and underrepresented in sectors with high capital intensity like real estate and construction.
Access to credit is necessary to grow businesses and is a key determinant of a firm’s sustainability. Black entrepreneurs are more likely to report unmet credit needs. Exhibit 7 shows that Black business owners do not receive funding requested at the same rate as white business owners. More than half of Black business owners report receiving less than the amount they requested from financial institutions versus a quarter of white business owners.

**Exhibit 6: Black-owned Businesses Are Overrepresented in Low-Margin Industries**

Source: Annual Survey of Entrepreneurs, Goldman Sachs Global Investment Research

The 2021 Small Business Credit Survey, a national survey of small businesses conducted by the 12 Federal Reserve Banks, found that significantly fewer Black-owned firms receive all the funding they requested. Exhibit 8 shows that 13% of Black-owned
firms received all the financing they requested in the 12 months prior to the survey, versus 40% of white-owned firms. Forty-six percent of Black-owned firms that applied for financing received none of the financing they requested, the largest share of any group.

Exhibit 8: Significantly Fewer Black Owned Firms Receive All the Funding They Request

A striking number of Black business owners never apply for additional financing even when there is an established business need for it. Exhibit 9 shows that nearly three times more Black business owners report that they avoid applying for financing, primarily due to expectations that it would be denied, versus white entrepreneurs.

Exhibit 9: Black Business Owners Are Three Times More Likely to Avoid Applying for Financing

The pandemic has further highlighted the consequences of the racial gap between Black and white-owned businesses’ ability to access funds. According to researchers at the
Federal Reserve Bank of New York, while the number of active business owners saw a record decline nationally from February to April 2020 (22%), Black businesses had the largest drop (41%). This is partially attributable to the weaker financial positions of many Black businesses going into the pandemic which may have consequently impacted their decisions to apply for funding.

Exhibit 10 further illustrates this pattern. Results from the 2021 Small Business Credit Survey find that Black business owners applied for and received less Paycheck Protection Program (PPP) funding, even after controlling for credit risk. Researchers at the Federal Reserve Bank of Boston suggest this is partly driven by historical and systemic exclusion of Black Americans from the housing market which stymied their ability to build equity and impaired their trust in financial institutions. This is compounded by the limited presence of traditional banks in Black communities which adversely impacts banking relationships and access.

Exhibit 10: Only 61% of Black-Owned Businesses Applied for PPP Funding; Only 43% Received it

The survey finds that only 61% of Black-owned firms applied for Payment Protection Program (PPP) funding, and of those, only 43% received all the funding they sought, versus 82% and 79% for white-owned businesses, respectively. Even among firms with good credit, businesses owned by Black Americans were half as likely as businesses owned by white Americans to receive all the financing they required (24% versus 48%). Black-owned applicant firms were five times as likely to receive none of the PPP funding they requested, versus white-owned businesses (20% vs 4% respectively).

Academic research suggests that persistent structural social and economic inequality have contributed to discouragement and disillusionment among minority business owners and that this has fundamentally impacted Black Americans entrepreneurial behavior. In turn, the derived entrepreneurial decisions negatively impacts potential

---

Personal Finance Gap

Historical systemic discriminatory policies and practices are foundational in Black Americans unequal access to financial services. Black entrepreneurs use personal and family savings as the main source of startup capital and investors frequently require a significant investment of owners’ capital as an incentive or as collateral. The finding that personal wealth decreases the probability that an existing firm is denied a loan is consistent with racial disparities in wealth contributing to racial differences in startup capital. Moreover, low levels of wealth and liquidity constraints may create a substantial barrier to entry for black entrepreneurs.

In Black Womenomics: Investing in the Underinvested, we highlighted that Black women’s wealth is not only held down by a lower access to high-return assets, but also by a higher exposure to high-cost liabilities. Personal finances make Black women more vulnerable to negative income or spending shocks which can lead to borrowing on unfavorable terms.

Exhibit 11 illustrates these patterns using data from the Federal Reserve’s Survey of Household Economics and Decisionmaking (SHED). The left panel shows that less than 40% of Black women have the liquidity to cover three months of expenses vs. more than 60% of white men. The right panel shows that Black women are also nearly 5 times more likely not to have a bank account than white women, consistent with structural issues such as more limited access to banking and banking products. More generally, SHED data show that 14% of Black adults are unbanked and 32% are underbanked, versus 3% and 11% of white adults, respectively. Smaller liquidity buffers and more limited access to formal credit might also help explain why Black women are 5 times more likely than white men to use expensive payday loans (right panel), which typically feature annualized percentage interest rates of over 400%.

---


12 The Federal Reserve defines fully banked individuals as individuals with a bank or credit union account and who have not used an alternative financial service in the past year such as non-bank money orders, payday loans, pawn shops or auto title loans, and tax refund advances. Underbanked is defined as having a bank account but using an alternative financial product like a payday loan while unbanked is not having a bank account.
Financial Information Gaps Contribute to the Financial Wellness Gap

Financial capabilities — the understanding of financial concepts and the ability to leverage that knowledge to make informed financial decisions — are essential in addressing the personal finance gap and consequently, impacts economic progress. A study from Annamaria Lusardi and co-authors estimates that financial knowledge accounts for more than 30% of retirement wealth inequality.\(^\text{13}\)

The TIAA Institute documents the financial knowledge gap between Black Americans and white Americans. The report uses a Personal Finance Index based on twenty-eight questions to assess financial capabilities across eight areas of personal finance: earning, consuming, saving, investing, borrowing and managing debt, insuring, comprehending risk and uncertainty and go-to information sources. The research highlights that higher levels of financial education lead to better financial competence and finds a significant relationship between better financial education and the financial wellness of Black Americans.\(^\text{14}\)

A joint research project by the Global Financial Literacy Excellence Center and TIAA Institute corroborates these results. Researchers review the financial capabilities of Black Americans and find that while there is a gap between the finance education of Black Americans and white Americans, within the Black community, there is also a meaningful financial information gap between Black women and Black men — characteristic of the patterns identified more broadly across the US population (Exhibit 12). On average, Black men answered 42% of the Personal Finance Index questions.

---


correctly; Black women answered 35% correctly.\textsuperscript{15}

**Exhibit 12: There Are Significant Financial Information Gaps Between Black Americans vs. white Americans and Between Black Men and Black Women**

![Bar chart showing financial literacy gaps between Black women, Black men, and white individuals.](chart)

Source: TIAA Institute-GFLEC Personal Finance Index, Goldman Sachs Global Investment Research

Black Americans scored significantly lower on questions related to insuring, comprehending risk, investing and identifying go-to information sources (Exhibit 13). The lack of financial capabilities to assess risk is salient as risk management is intrinsic in navigating financial decisions and the subsequent outcomes.\textsuperscript{16} Interestingly, Black Americans who had participated in financial education programs scored 11 percent higher on the Personal Finance Index questions vs. those who had no exposure to related content.\textsuperscript{17} This suggests that financial education programming increases financial capabilities.


The evidence suggests that financial information gaps also contribute to expensive borrowing and frictions on the investment side. Sumit Agarwal and co-authors find that most payday borrowers who also have a credit card have substantial credit card liquidity. Consistent with personal finance information gaps, SHED survey data summarized in the left panel of Exhibit 14 shows that Black women are significantly less likely to correctly answer a survey question on the compounding of interest rates than white men.

Similarly, the right panel shows that Black women are less likely to correctly answer a survey question on stock market risk diversification.

A study by Sherman Hanna and Yoonkyung Yuh suggests that financial education familiarizing Black households with investment risk and risk tolerance would increase their likelihood of owning high-return assets.

Source: TIAA Institute-GFLEC Personal Finance Index, Goldman Sachs Global Investment Research
Black Owned Businesses Have Worse Outcomes

Undercapitalization impacts the growth of Black-owned businesses. Previous research indicates that the level of startup capital, which can be impacted by lower levels of personal wealth, is a strong predictor of business success.\(^{18}\) Black businesses are more likely to report their profits negatively impacted by access to and the cost of financial capital. Exhibit 15 shows that Black business owners are nearly three times more likely than white entrepreneurs to report that access to financial capital and the cost of financial capital negatively impact the profitability of their businesses.

On average, business sales are much lower for Black-owned businesses than white-owned businesses and especially lower, for Black-women-owned businesses (Exhibit 16).

Black-owned businesses also have lower profits. Exhibit 17 shows that a smaller share of Black-owned businesses had profits and a larger share had losses compared to white owned businesses.
Researchers at the Enterprise Research Center in the UK identified seven dimensions for entrepreneurial motivation: achievement, challenge and learning, independence and autonomy, income security and financial success, recognition and status, family and roles, dissatisfaction with prior work arrangement. These results suggest that displacement in the labor market could be an important motivation for entrepreneurship. One possible reason for Black displacement is discrimination. The subject of race and prejudice and the consequent impact remains complex and, at times, controversial. However, multiple studies document that high levels of discrimination persists in the labor and credit markets.

A groundbreaking field experiment submitted fictitious resumes with names that sounded either white (e.g. Emily Walsh) or Black (e.g. Lakisha Washington) to potential employers, showed that Blacks were routinely and uniformly disadvantaged in the resume selection process, with white names receiving 50% more callbacks than Black names. The study also found that credentials had a statistically insignificant impact on the outcome for Black candidates, whereas white applicants with higher quality resumes received 30% more callbacks than white applicants with lower quality resumes. This suggests that resumes with Black names were systematically removed from consideration.

---


Lincoln Quillian, Devah Pager, Ole Hexel and Arnfinn H. Midtboen. 2017. “Meta-analysis of Field Experiments Shows No Change in Racial Discrimination in Hiring Over Time,” Proceedings of the National Academy of Sciences, 114 (41), 10875. Data was analyzed from 24 field experiments, which included over 54,000 applications and 25,000 recruiting roles.
Similarly, a comprehensive study published in the Proceedings of National Academy of Sciences examined callback rates of job candidates from 1990 to 2015 and found that white applicants received 36% more callbacks than Black applicants. Strikingly, the researchers also find that the level of racial discrimination against Black applicants in the hiring process has not fallen over the past 25 years.\textsuperscript{21} Related studies conducted for the US and other countries—from Germany to India—consistently point to racial or ethnic labor market discrimination.\textsuperscript{22}

A recent study by Sterling Bone and co-authors employing mystery shoppers\textsuperscript{23} provides evidence that structural discrimination impacts the opportunities of Black Americans in the credit market. The research inferred three key themes (Exhibit 18).

\textbf{Exhibit 18: Black Businesses Are Scrutinized More, Black Owners Are Prodded for More Personal Information and Receive Less Customer Service Help}

\begin{figure}
\centering
\includegraphics[width=\textwidth]{exhibit18}
\caption{Share of Loan Applicants: (Bone et al. 2019)}
\end{figure}

*Asking about marital status when determining credit worthiness is a violation of fair lending laws.

First, Black businesses are scrutinized at a much higher level than white-owned businesses. Second, Black business owners are prodded for more personal information than white business owners. In the field experiment, while both Black and white testers were asked about their marital status by loan officers (in violation of the fair lending law), Black American testers were asked almost 6 times more often. Moreover, only the Black American testers were asked about the status of their spouses’ employment, also a violation of the fair lending law. And third, Black business owners receive less customer service help.\textsuperscript{24} These studies underline that structural discrimination remains a material

\textsuperscript{21} Lincoln Quillian, Devah Pager, Ole Hexel and Arnfinn H. Midtboen. 2017. “Meta-analysis of Field Experiments Shows No Change in Racial Discrimination in Hiring Over Time,” Proceedings of the National Academy of Sciences, 114 (41), 10875. Data was analyzed from 24 field experiments, which included over 54,000 applications and 25,000 recruiting roles.


\textsuperscript{23} Mystery shopping research methodology present mystery ”shoppers” as customers to gather feedback or data to assess customer experience.

factor in the disadvantage faced by Black Americans.

Investing in Black Women Entrepreneurs

Business ownership is an important alternative to wage or salary employment and has a large impact on economic progress. Subsequently, it has important implications for inequality.

In Black Womenomics: Investing in the Underinvested, we offered several recommendations to reduce racial economic and social inequities experienced by Black Americans. The caveats are that the issues are complex, that the list is not exhaustive and is presented with the recognition that any efforts to effectively address the issues would require a multidimensional commitment across the public and private sectors which could only be successful if Black women are actively engaged in formulating the strategies and framing the outcomes.

Exacerbating the credit market challenges, Black women may face discrimination in the lending market which also limit their ability to invest in their businesses. It is critical that discrimination is also addressed toward the goal of real and sustainable progress.

It is critical that the public sector is robustly addressing racial inequity and mandate changes to laws and policies that may also influence social behavior and close the gaps over time.

To help close the capital access and investment gaps for Black entrepreneurs, policymakers could enforce fair lending laws to address discrimination in the credit market, and especially expanded access to capital for Black women.

In this study, we again highlight the power of private capital. The proposed actions focus on lowering barriers and creating pathways to economic security for Black women, their families, and their communities.

**Provide access to capital for Black women entrepreneurs.** More equitable access to credit and small business loans with reasonable repayment conditions (e.g. lower rates of interests and fees, and access) and to equity investments would reduce dependence

| Exhibit 19: Public Sector and Private Sector Actions to Change the Economic Disadvantages of Black Women Entrepreneurs |
|---|---|
| **Capital Access Gap** | **Financial Information Gap** |
| - Enforce fair lending laws to address discrimination | - Boost financial literacy and entrepreneurship courses in school curricula |
| - Direct public sector action on access to capital for small businesses, e.g. via the Small Business Administration, increase funding and regulatory support for Community Development Financial Institutions | |
| - Increase business loans to Black women | - Increase financial education in the workplace |
| - Increase investment in Black women's businesses | - Invest in efforts that boost financial wellness of Black women |
| - Combine capital access with mentoring ad sponsorship | |
| - Help Black women build their network | |

Source: Goldman Sachs Global Investment Research
on more expensive forms of credit and use of personal savings, factors that often inhibit the success of Black women-owned businesses. This would likely increase the number of Black women entrepreneurs, support existing small businesses, and grow long-term wealth.

**Increase financial education.** Critical to overall financial wellness is the ability to make informed decisions that impact effective management of personal finance including investments in important financial assets that contribute to wealth appreciation. Providing Black women entrepreneurs educational frameworks that will expand their capabilities, combined with mentoring and coaching, will decrease the risks of financial pitfalls and better position them to navigate and recover more quickly from potential crises.

### Good for Growth

In Black Womenomics: Investing in the Underinvested, we highlighted that our recommendations for public policies and private investments would improve the lifetime earnings prospects of Black women, and this will also add to the country’s economic potential over time. We do not quantify harder to measure benefits such as innovation and the impact on the community.

Our framework takes into account the broad economic disadvantages that Black women experience. We estimate that reducing the earnings gap for Black women, which includes increasing business ownership to drive economic mobility, could raise the level of annual US GDP by 1.4% each year or $350bn in current dollars. If the improvements benefit Black women and men alike, we estimate a larger increase in US GDP of 2.1%, which corresponds to $525bn per year.

### Fairer and Richer Society

Private business ownership has significant implications for earnings and wealth inequality, however, Black women are underrepresented in entrepreneurship. Targeted resource allocation is necessary to counter historical and systemic social and economic racial inequality. Black women continue to make their own efforts to overcome the racial and gender barriers. However, absent directed actions that facilitate Black women's efforts to start and succeed at business ownership, sustained economic recovery and mobility would be inaccessible in the short term. One of our key takeaways from Black Womenomics, is that equalizing Black women's positions would make for not only a fairer, but also a richer society.
Disclosure Appendix

Disclosures

The Bigger Picture is a publication series from Goldman Sachs Global Investment Research devoted to longer-term economic and policy issues, which complements our more market-focused analysis.

Prior to publication, this report may have been discussed with or reviewed by persons outside of the Global Investment Research Division. While this report may discuss implications of legislative, regulatory and economic policy developments for industry sectors and the broader economy, it may include strategic corporate advice and may have broad social implications, it does not recommend any individual security or an investment in any individual company and should not be relied upon in making investment decisions with respect to individual companies or securities.

Global product; distributing entities

The Global Investment Research Division of Goldman Sachs produces and distributes research products for clients of Goldman Sachs on a global basis. Analysts based in Goldman Sachs offices around the world produce research on industries and companies, and research on macroeconomics, currencies, commodities and portfolio strategy. This research is disseminated in Australia by Goldman Sachs Australia Pty Ltd (ABN 21 006 797 897); in Brazil by Goldman Sachs do Brasil Corretora de Títulos e Valores Mobiliários S.A.; Public Communication Channel Goldman Sachs Brazil: 0800 727 5764 and / or contatogoldmanbrasil@gs.com. Available Weekdays (except holidays), from 9am to 6pm. Canal de Comunicación com o Público Goldman Sachs Brasil: 0800 727 5764 e/ou contatogoldmanbrasil@gs.com. Horário de funcionamento: segunda-feira à sexta-feira (exceto feriados), das 9h às 18h; in Canada by either Goldman Sachs Canada Inc. or Goldman Sachs & Co. LLC; in Hong Kong by Goldman Sachs (Asia) L.L.C.; in India by Goldman Sachs (India) Securities Private Ltd.; in Japan by Goldman Sachs Japan Co., Ltd.; in the Republic of Korea by Goldman Sachs (Asia) L.L.C., Seoul Branch; in New Zealand by Goldman Sachs New Zealand Limited; in Russia by OOO Goldman Sachs; in Singapore by Goldman Sachs (Singapore) Pte. (Company Number: 198602165W); and in the United States of America by Goldman Sachs & Co. LLC. Goldman Sachs International has approved this research in connection with its distribution in the United Kingdom.

Effective from the date of the United Kingdom’s departure from the European Union and the European Economic Area ("Brexit Day") the following information with respect to distributing entities will apply:

- Goldman Sachs International ("GSI"), authorised by the Prudential Regulation Authority ("PRA") and regulated by the Financial Conduct Authority ("FCA") and the PRA, has approved this research in connection with its distribution in the United Kingdom.

European Economic Area: GSI, authorised by the PRA and regulated by the FCA and the PRA, disseminates research in the following jurisdictions within the European Economic Area: the Grand Duchy of Luxembourg, Italy, the Kingdom of Belgium, the Kingdom of Denmark, the Kingdom of Norway, the Republic of Finland, Portugal, the Republic of Cyprus and the Republic of Ireland; GS - Succursale de Paris (Paris branch) which, from Brexit Day, will be authorised by the French Autorité de contrôle prudentiel et de resolution ("ACPR") and regulated by the Autorité de contrôle prudentiel et de resolution et la Autorité des marchés financiers ("AMF") disseminates research in France; GSI - Sucursal en España (Madrid branch) authorized in Spain by the Comisión Nacional del Mercado de Valores disseminates research in the Kingdom of Spain; GSI - Sweden Bankfilial (Stockholm branch) is authorized by the SFS as a "third country branch" in accordance with Chapter 4, Section 4 of the Swedish Securities and Market Act (Sw. lag (2007:528) om värdepappersmarknaden) disseminates research in the Kingdom of Sweden; Goldman Sachs Bank Europe SE ("GSBE") is a credit institution incorporated in Germany and, within the Single Supervisory Mechanism, subject to direct prudential supervision by the European Central Bank and in other respects supervised by German Federal Financial Supervisory Authority (Bundesanstalt für Finanzdienstleistungsaufsicht, BaFin) and Deutsche Bundesbank and disseminates research in the Federal Republic of Germany and those jurisdictions within the European Economic Area where GSI is not authorised to disseminate research and additionally, GSBE, Copenhagen Branch filial af GSBE, Tyskland, supervised by the Danish Financial Authority disseminates research in the Kingdom of Denmark; GSBE - Sucursal en España (Madrid branch) subject to a limited extent to local supervision by the Bank of Spain disseminates research in the Kingdom of Spain; GSBE - Succursale Italia (Milan branch) to the relevant applicable extent, subject to local supervision by the Bank of Italy (Banca d’Italia) and the Italian Companies and Exchange Commission (Commissione Nazionale per le Società e la Borsa "Consob") disseminates research in Italy; GSBE - Succursale de Paris (Paris branch), supervised by the AMF and by the ACPR disseminates research in France; and GSBE - Sweden Bankfilial (Stockholm branch), to a limited extent, subject to local supervision by the Swedish Financial Supervisory Authority (Finansinspektionen) disseminates research in the Kingdom of Sweden.

Goldman Sachs conducts a global full-service, integrated investment banking, investment management and brokerage business. It has investment banking and other business relationships with governments and companies around the world, and publishes equity, fixed income, commodities and economic research about, and with implications for, those governments and companies that may be inconsistent with the views expressed in this report. In addition, its trading and investment businesses and asset management operations may take positions and make decisions without regard to the views expressed in this report.

© 2022 Goldman Sachs.

No part of this material may be (i) copied, photocopied or duplicated in any form by any means or (ii) redistributed without the prior written consent of The Goldman Sachs Group, Inc.