September 25, 2023

Economic Network Strength

Race, Gender, and Community Gaps in the US

Key Takeaways

- **Measuring the strength of an economic network should consider multiple facets of to whom and how individuals are connected.** Networks are stronger when they increase the likelihood that career-enhancing information is shared. That strength thus depends on the size of a person's network, the work statuses of the people connected with, how likely that information is to be communicated, and the likelihood that information is not already available through other connections (weak ties). These features can be combined into an aggregate network strength measure.

- **Men have higher average aggregate network strength than women.** Men's average percentile is 52.8, while women's is 46.8. In other words, if you selected 100 people and ranked them from weakest to strongest economic network, on average woman would be 6 people lower in the line than the average for men.

- **Members in higher income ZIP Codes have higher network strength scores than members in lower income ZIP Codes.** The top quartile ZIP Codes' members score in the 56.6th percentile, and those in the bottom quartile are in the 43.8th percentile.

- **On average, Latino and Black members have the weakest network strength, while Asian and White members have the strongest.** Latino and Black members average in the 46.5th and 48.4th percentile respectively, while Asian and White members average 56.4th and 49.8th percentile in terms of network strength.

- **Men and individuals in higher income communities have larger networks with higher information value and more communication.** Higher information value is measured by being connected to more senior workers in related industries and occupations, among other inputs. Gender and ZIP Code Median income are strongly predictive of these features. The relationships by race are less consistent, with Asian members having more connections and communication (messaging on

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the platform) but with lower information value connections, while White members' connections have the highest average information value, measured by being connected to senior workers in related occupations and industries.

- **Women, Black and Latino members, and members in lower income communities tend to have less redundant connections in their networks.** Although these groups have on average weaker aggregate network strength, driven by smaller networks with lower information value and less communication, their networks tend to have more "weak ties" which provide more opportunity for information. Their connections are more likely to bridge them to other groups of individuals outside of their immediate network.

Introduction

Economic networks are important for advancing careers of works. These networks encompass professional connections who may share information about job opportunities, work trends, new people to connect with, and skills which could help the worker. The century-old saying, "It's not what you know, but who you know," remains pertinent today. Though the value of networks for career success predates professional platforms like LinkedIn, these platforms offer new opportunities to remove traditional barriers to networking faced by historically and systematically marginalized groups, as well as, to evaluate such gaps. In this report, we analyze data from LinkedIn to discern disparities across race, gender, and community income groups. We build a new model for gauging economic network strength, considering various aspects of one's network, and evaluate differences in network strength among individuals in the United States (US).

A few caveats are important to address before proceeding. First, racial, gender, and community income gaps in economic conditions are pervasive and well-known in the US. Disparities in network strength exist outside of LinkedIn and the impact LinkedIn has on these gaps requires further study. In particular, we are unable to measure and observe the alternative of what economic networks look like or would look like without LinkedIn; however, we speculate that gaps in network strength would be even worse without LinkedIn as workers try to navigate historical networking structures that benefit privileged members of society. Additionally, the race/ethnicity analysis is based on self-identification of US LinkedIn members, and may not be representative of the overall US LinkedIn membership or the US economy.

Modeling Economic Strength

We conceptualize economic network strength in terms of the information that a person's connections can share with them that would help the person advance in their career. This could happen through such mechanisms as sharing job opportunities, skills in demand, helping make new connections, and

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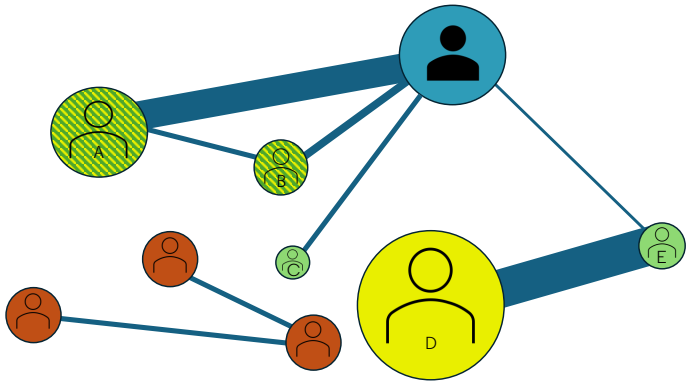
general mentoring. Our new working paper[1] contains the details of the network strength model we use in this research note, but in summary we can conceptualize there being four elements of network strength which can be captured in the following figure.



Consider the strength of blue's network. First, blue's network is stronger with each additional connection made, as each new connection offers an opportunity for information sharing, as discussed in our prior white paper.[2] Green circles represent first-degree connections (these are people with whom blue is directly connected). Yellow circles represent second-degree connections (friends of blue's friends). Red represents individuals who are neither first- nor second-degree connections. If blue connected to the red circles, their network would become larger and thus stronger, with more opportunities for information sharing.

Second, not all potential connections possess the same ability to help blue's career. People who are more senior and working in related occupations and industries have on average a higher potential to help blue's career; they have a higher information value. This is represented by the sizes of the circle in the diagram. Connection A has more information value for blue than connection B.

However, just because a connection has more potential information value does not mean that this information is shared. The third element of network strength we evaluate is information bandwidth. This is related to the probability that blue and their connections exchange information and is based on the platform messaging behavior between connections. In the figure, it is represented by the thickness of the lines connecting the individuals. The connection between blue and A has higher information bandwidth than the connection between blue and B.

Fourth, our model considers both network strength from first- and second-degree connections. This relates to the concept of weak ties. Weak ties refer to connections between people that are not as close or strong as, say, close friends or family members. Instead, weak ties are more like acquaintances or people not interacted with often. These weak ties are valuable because they connect different social circles or groups of people. They serve as bridges, allowing information, ideas, or opportunities to flow between these different groups. In other words, they offer less redundant information. A person who has

[1] Baird, M., D. Kavanagh-Smith, O. Osoba, and Y. Wu (2023). "Measuring Gender Gaps in Economic Network Strength in the U.S." Economic Graph Working Paper No. 3. https://economicgraph.linkedin.com/content/dam/me/economicgraph/en-us/PDF/measuring-gender-gaps-in-economic-network-strength-us.pdf

[2] Baird, M., D. Kavanagh-Smith, O. Osoba, and Y. Wu (2023). "Disparities in U.S. Economic Network Formation: Gender, Race, and Community Income". Economic Graph White Paper. https://economicgraph.linkedin.com/content/dam/me/economicgraph/en-us/PDF/disparities-in-us-economic-network-formation.pdf

a higher share of weak ties has a network with less redundant information.[3] In the figure, connection D is a second-degree connection with high information value, and thus indirectly provides some information value through connection E to blue. If blue was already connected to D, then the value of D would already be accounted for in the first-degree connections, and thus would not impact second degree. While A is a friend of B, and thus a second-degree connection to blue, blue is already connected to A directly, and is thus a first degree connection (hence the yellow/green shading). A network is stronger the more non-redundant its connections are, that is the higher the fraction of second-degree connections that are not already first-degree connections, or as shown in the figure, the higher the fraction of green circles out of all green plus yellow/green.

In summary, we characterize an economic network's strength based on four features:

1. **Network size**: the number of connections (number of lines in the figure above), given by the total network size, or total connections, of the member.
2. **Information value**: the potential information each connection has to help a person's career (size of circles). As discussed later, this is based on five different characteristics of the people a member is connected to, all of which aim to capture how helpful that person might be in having information that would advance the member's career.
3. **Information bandwidth**: how likely a connection is to share information of value (width of lines). This is captured by how frequently a connectee messages a member.
4. **Information non-redundancy**: the fraction of second-degree connections who are not already first-degree connections.

Before exploring the disparities, we make note of how we interpret the results. We examine the average percentile value of each information value component by gender, by ZIP Code median income, and by race/ethnicity. We use average percentile ranking to put each measure on a common scale, as it provides a useful, interpretable benchmark at the 50th percentile.

For instance, if there is a 4 percentile point gap between group A and group B, it means that group A, on average, ranks in the 48th percentile while group B ranks in the 52nd percentile. One way to interpret this gap is as follows: if we lined up 100 people based on their percentile score on any of the measures (say, aggregate network strength score), then moving from group A (in the 48th percentile, or having a network stronger than 48% of the population) to group B (52nd percentile, or stronger than 52% of the population) would, on average, move a person ahead by 4 positions out of those 100 people lined up.

[3] For example, imagine a worker has a close friend (a strong tie) with whom they share many mutual connections (there are very few second-degree connections to whom the worker is not already connected) and a coworker they only see occasionally (a weak tie). The close friend with shared connections knows many of the same people you do, but the coworker knows a whole different set of people. Through the coworker, the worker might hear about job opportunities, events, or ideas that they would not have come across otherwise. See Rajkumar, K., Saint-Jacques, G., Bojinov, I., Brynjolfsson, E., & Aral, S. (2022). A causal test of the strength of weak ties. Science, 377(6612), 1304-1310.

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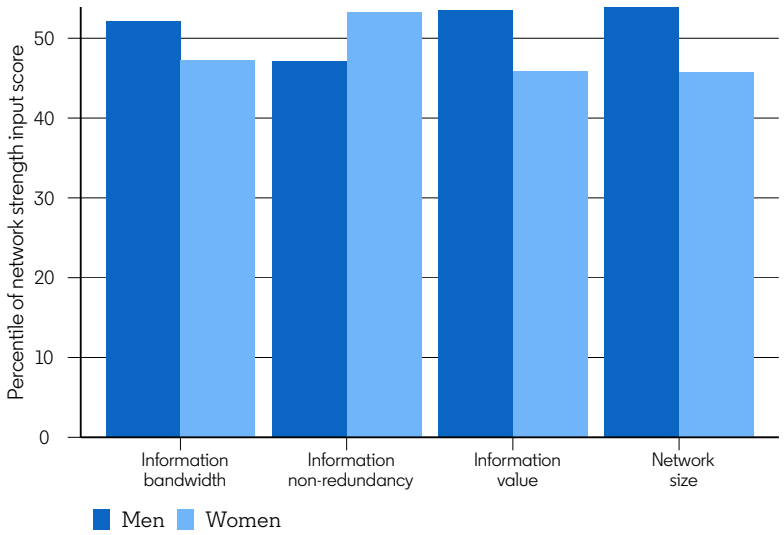
Estimated Disparities in Network Strength Features

We examine the average percentiles of the four network strength features discussed above.

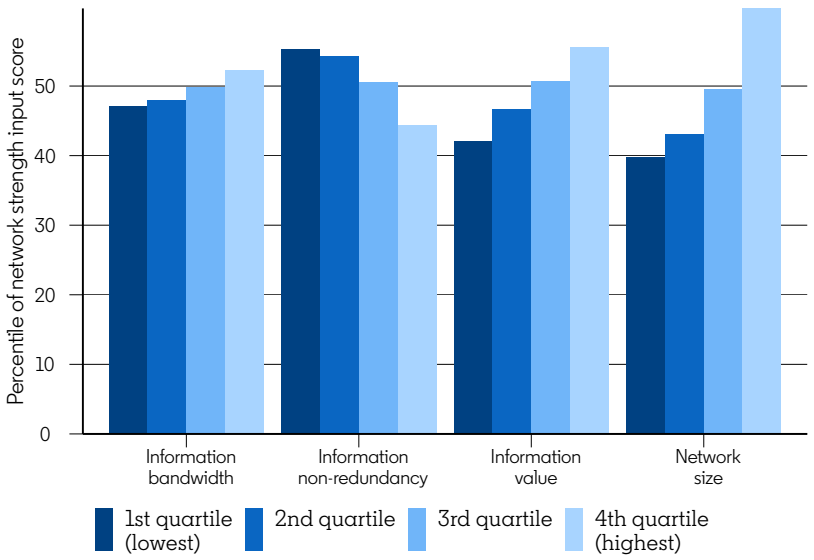
Gender: On average, men hold an edge over women for three of the four inputs to aggregate network strength.

- Men rank 5.5 percentile points higher in network size than women.
- Men rank 4.5 percentile points higher in information value than women—how likely their connections are to have valuable information.
- Men rank 2.5 percentile points higher in information bandwidth than women—how often they communicate with their connections.
- Meanwhile, women rank 3.9 percentile points higher on average for information non-redundancy—they have more weak ties which increases their access to distinctive career information.



Local ZIP Code Income: For three of the four features of network strength, there is a consistent trend with members in higher income communities having stronger networks.

- Individuals in the highest income communities (lightest blue bars) have higher bandwidth, information value and network size, but smaller information non-redundancy.
- The largest gap is for network size, a 14.4 percentile point gap between the top to bottom quartiles, with people in the top quartile having a median 57.6 percentile point score.
- Just as for gender, this reverses for non-redundancy. Top income quartile members are more likely to have fewer weak ties and thus have more information redundancy, with each connection not having as much unique information on average given the member is more likely to already be connected to the second-degree connections.



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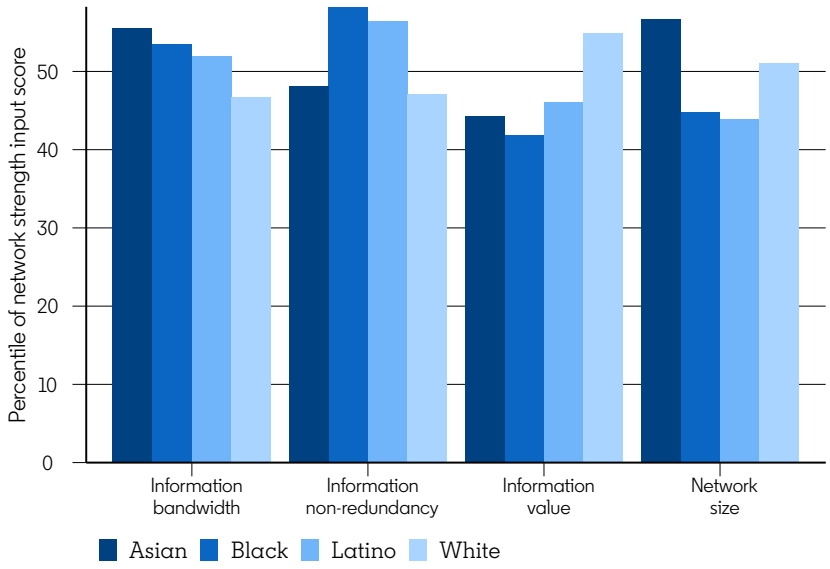
Race/ethnicity: We do not see as consistent a dynamic across the network strength features by race/ethnicity as we see by gender and by ZIP Code median income.

- White members have the lowest information bandwidth (46.8th percentile) and among the lowest information non-redundancy, but the highest information value by far (54.9 percentile), and second highest network size.
- Asian members have the largest network sizes and highest information bandwidth.
- Black members have the least redundant network connections.



Components of Information Value

We next examine the components of information value. As discussed above, information value is the potentially career-advancing information that each connection can provide to an individual based on their employment and skills. We explore five features of information value that together are aggregated into overall information value.

1. **Not having open to work status on**[4]: openness to work signals the desire for new employment, which can signify unemployment or underemployment. Having more connections who are not actively job seeking increases information value and contributes to a stronger network.
2. **Endorsed skills:** being connected to members who have more endorsed skills implies that they possess more valuable career information to offer.
3. **Industry similarity:** how "similar" a connectee's industry is to a person's own industry. We measure similarity based on the observed frequency of transitions from the person's industry to the connectee's industry, as explained in the working paper.[5]
4. **Occupation similarity**: how "similar" a connectee's industry is to a person's own industry. We measure similarity based on the observed frequency of transitions from the person's occupation to the connectee's occupation, as explained in the working paper.[5]

[4] Members on LinkedIn have the ability to publicly or privately opt into "Open to Work" status, which flags their interest in looking for new work opportunities.

[5] Baird, M., D. Kavanagh-Smith, O. Osoba, and Y. Wu (2023). "Measuring Gender Gaps in Economic Network Strength in the U.S." Economic Graph Working Paper No. 3. https://economicgraph.linkedin.com/content/dam/me/economicgraph/en-us/PDF/measuring-gender-gaps-in-economic-network-strength-us.pdf

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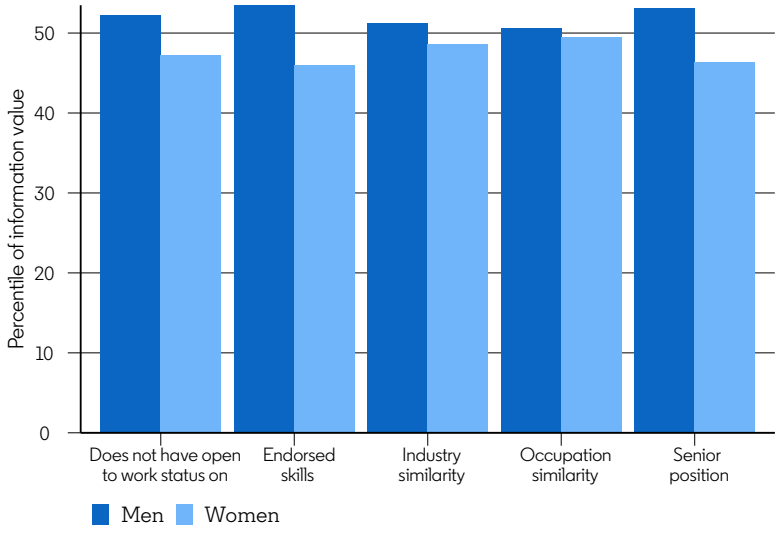
5. **Job seniority:** The fraction of a person's network who are working in senior positions. People in senior positions may be more informed or more able to assist a person's career in terms of job opportunities and skills.[6]

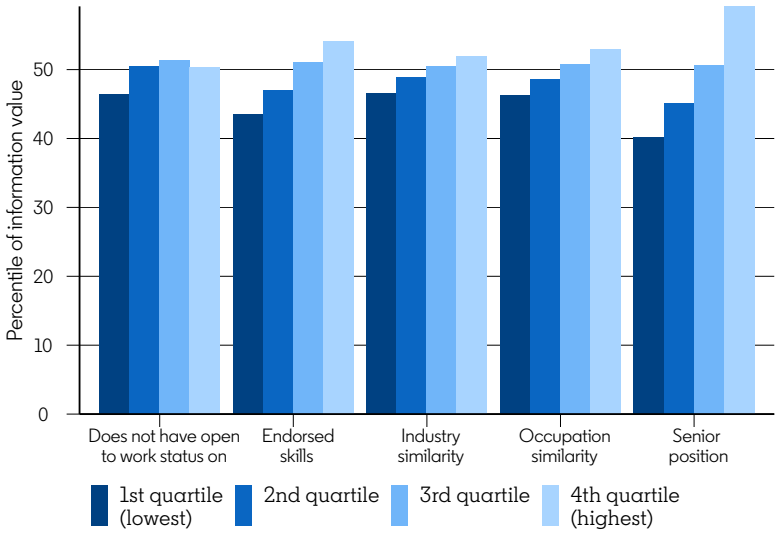
Gender: Men on average are connected to individuals who are more likely to have more valuable information across all five inputs. Compared to women, men rank:

- 4.8 percentile points higher ranked in the number of endorsed skills their connections have.
- 4.2 percentile points higher in the fraction of their connections in senior positions.
- 2.8 percentile points higher in the fraction of their connections without an open to work status.
- 1.5 percentile points higher in how similar their connections' industries are.
- 0.8 percentile points higher in their connections' average occupational similarity score.



ZIP Code Median Income: Members in higher income communities are consistently connected to individuals who are more likely to have valuable career information.

- Across inputs, information value consistently increases across ZIP Code median income quartiles. In other words, the higher the income community, the higher the information value of connections. The weakest relationship is that of open to work status, which is relatively flat.
- The largest divergence is for the seniority of connections: highest income community members have on average a 5 percentile point higher rank in senior connections over the second highest. This gap of 5 percentile points is larger than the gender gap



[6] Based on the LinkedIn taxonomy of position seniority, we define a person as being in a senior position if their position is classified as manager, director, VP, CXO, or owner; they are defined as non-senior if their position is intern, entry, or senior (which is a non-leadership position).

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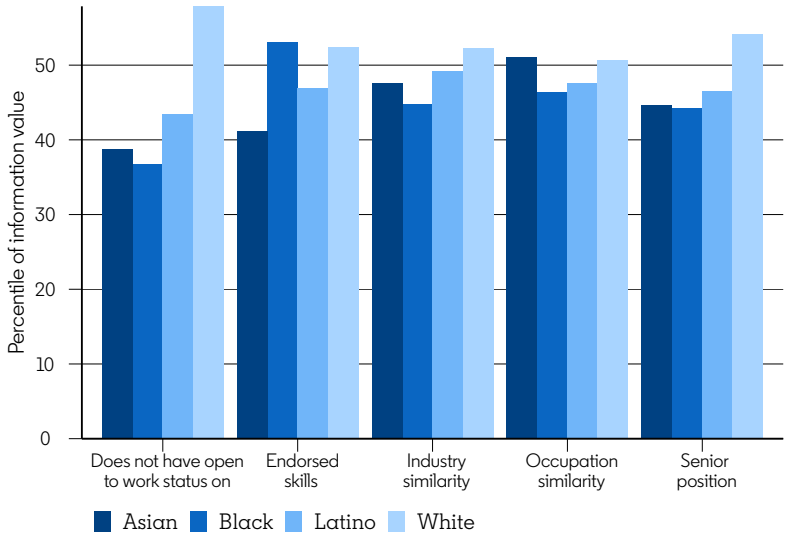
between men and women. When compared with the lowest income quartile, the highest income members see a 11.7 percentile point advantage.

- The next largest gap is for endorsed skills, with a gap of 6.5 percentile points between the top to bottom income quartiles.



Race/Ethnicity: White members tend to have the highest average percentiles of information value across the components. Latino members tend to have the lowest values.

- The largest gaps in information value are for having a higher fraction of connections who do not have the open to work flag turned on, with White members having the largest fraction of connections who do not have open to work status on (14.4 percentile point higher for White vs Latino).
- White members also have the highest degree of occupational similarity with their connectees as well as the highest fraction of connections who are senior members.
- Black members' networks have the highest endorsed skills rates; Asian members' networks have highest occupation similarity; Latino members' networks have second highest rates for senior positions and for industry similarity.
- Aside from White members' advantage here, there are no consistent patterns across race like we saw for gender and local income.

Aggregate Network Strength

We next take the four features of network strength and aggregate them as described in our working paper. We show the first-degree network strength which is based on a member's first-degree connections (who they are directly connected with), their second-degree connections (who their connections are connected to), and the aggregation of both yielding aggregate network strength.

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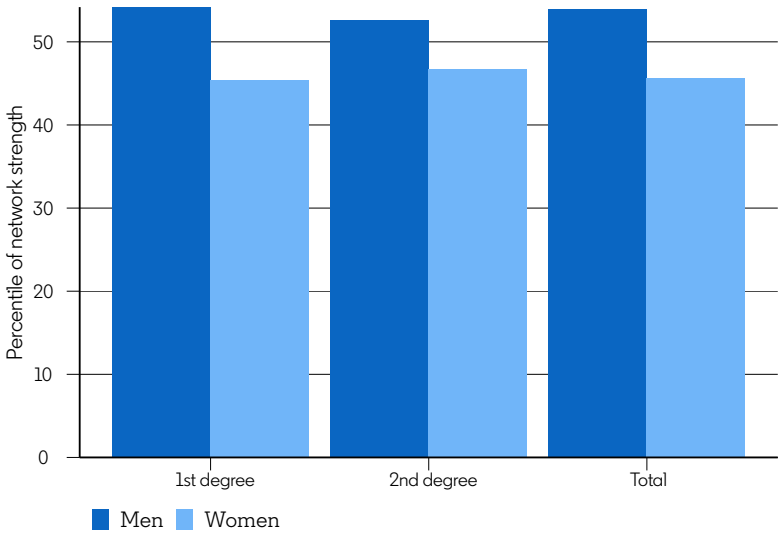
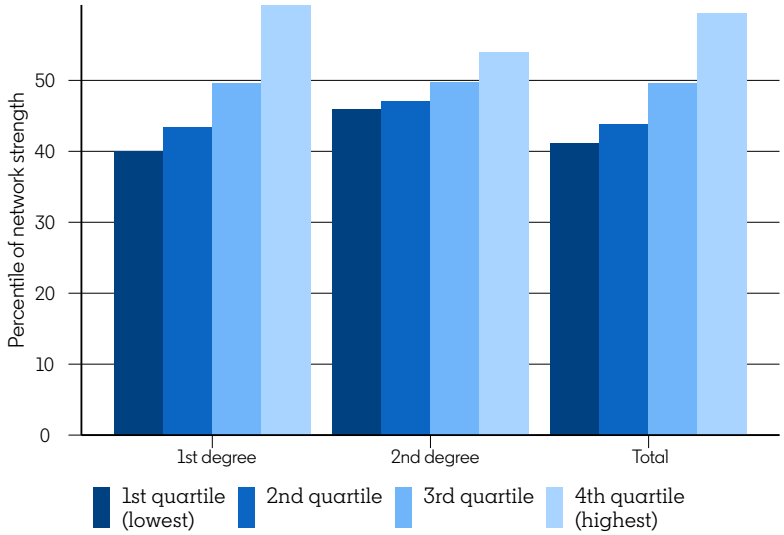
Gender: Men have stronger networks than women. We find:

- The average male aggregate network strength is in the 52.8th percentile, while the average female network strength is in the 46.8th percentile, for a gap of 6 percentile points.
- The gap is primarily driven by large gaps in network size and the value of information connections have, with men being more likely to be connected to more senior workers who do not have open to work status enabled and have more endorsed skills.



ZIP Code median income: individuals in lower income communities have weaker networks than individuals living in higher income communities:

- The median individual in the highest income community is in the 56.6th percentile of aggregate network strength. The median member in the lowest income community is in the 43.8th percentile, for a relatively large gap of 12.8 percentile points.
- If you randomly selected 100 people and ordered them from weakest to strongest economic network, the typical member in the lowest income community would be 13 people lower in the line than the typical person in the highest income community.
- The gap is primarily driven by large gaps in network size and the value of information connections have (more senior, higher skill-endorsed workers in more similar occupations and industries).



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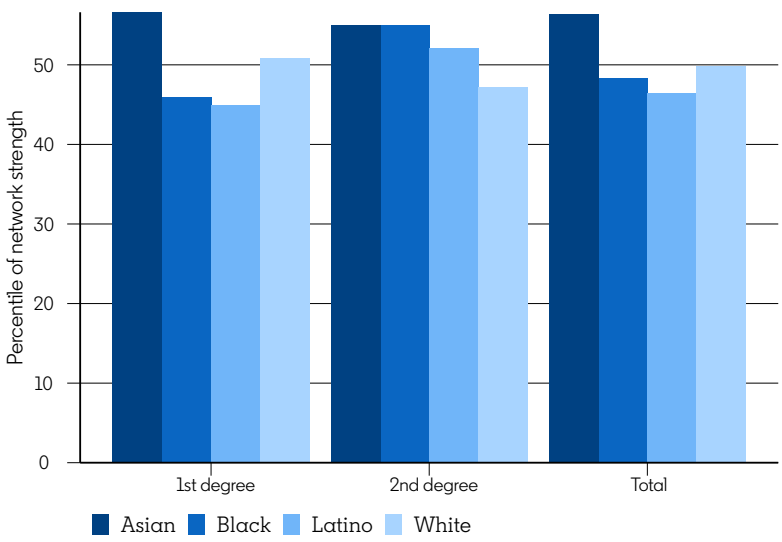
Race/ethnicity:

- Aggregated together, Asian members have the strongest networks (56.4th percentile), followed by White members, despite the large information value advantage for White members.
- Asian members' highest rating arises from having moderately strong information value and the highest rankings for network size and bandwidth.
- White members have the lowest second-degree networks value (47.2th percentile).
- Overall, Latino and Black members have the lowest aggregate network strength, at 46.5th percentile for Latino members and 48.4th percentile for Black members.



Policy Suggestions

In this report, we demonstrated that there are many existing disparities in U.S. members' network strength along gender, race/ethnicity, and ZIP Code median income. This has important implications for career success of these groups, and efforts to narrow gaps in employment outcomes. Further research is necessary to determine the reasons underlying these disparities, and their implications on economic outcomes. However, in a working paper examining gender disparities in network strength, we found that the largest determinant of that gap was which occupations each person worked in. Additional research can explore this more thoroughly.

Based on the findings we have here, we suggest consideration of the following policy actions:

- Members can increase their networks by sending out more invitations and supporting those with emerging connections. Be intentional on where invitations are sent.
- Start by connecting with people you have started to build a relationship with and who are connected to your career goals.
- Consider expanding your community of second-degree connections.

Firms should encourage mentoring activities of less senior members in ways that allow for network expansion.

Appendix

Acknowledgements

We gratefully acknowledge the support and feedback of many individuals in this report. These include Simone Bell, Gorki De Los Santos, Meg Garlinghouse, Sakshi Jain, Karin Kimbrough, Jen Ramos, Carl Shan, and Amie Wong.

Methodology

For all analysis, we limit attention to non-restricted, active accounts. For the race analysis, we additionally limit to individuals who have self-identified their race and gender. We drew a random sample of one million members to calculate network strength.

Data and Privacy This body of work represents the world seen through LinkedIn data, drawn from the anonymized and aggregated profile information of LinkedIn's 930+ million members around the world. As such, it is influenced by how members choose to use the platform, which can vary based on professional, social, and regional culture, as well as overall site availability and accessibility.

In publishing these insights from LinkedIn's Economic Graph, we want to provide accurate statistics while ensuring our members' privacy. As a result, all data show aggregated information for the corresponding period following strict data quality thresholds that prevent disclosing any information about specific individuals.

Gender Classification Gender identity isn't binary, and we recognize that some LinkedIn members identify beyond the traditional gender constructs of "man" and "woman." If not explicitly self-identified, we have inferred the gender of members included in this analysis either by the pronouns used on their LinkedIn profiles or inferred on the basis of first name. Members whose gender could not be inferred as either man or woman were excluded from this analysis.

Appendix

Table 1. Network Strength Average Percentiles by Gender

	Men	Women
Information value components		
Industry similarity	50.9	49.4
Occupation similarity	51.6	50.8
Not open to work	51.5	48.7
Senior positions	52.1	47.9
Endorsed skills	52.2	47.5
Network strength features		
Information bandwidth	52.4	49.9
Network size	52.8	47.3
Information non-redundancy	48.5	52.4
Information value components	52.1	47.6
Total network strength		
1st degree	52.8	46.8
2nd degree	51.9	47.9
Total network strength	52.8	46.8

Appendix

Table 2. Network Strength Average Percentiles by ZIP Code Median Income Quartile

	1st (lowest)	2nd	3rd	4th (highest)
Information value components				
Industry similarity	48.2	49.5	50.5	51.3
Occupation similarity	48.6	50.1	51.4	53.0
Not open to work	48.2	50.5	51.0	50.4
Senior positions	43.8	47.0	50.5	55.4
Endorsed skills	46.1	48.3	50.9	52.6
Network strength features				
Information bandwidth	50.0	50.3	51.0	52.3
Network size	43.3	45.4	49.8	57.7
Information non-redundancy	53.9	53.0	50.5	46.0
Information value components	45.2	48.1	50.7	53.4
Total network strength				
1st degree	43.0	45.4	49.8	57.2
2nd degree	47.3	48.2	49.9	52.8
Total network strength	43.8	45.8	49.7	56.6

Appendix

Table 3. Network Strength Average Percentiles by Race/Ethnicity

	Asian	Black	Latino	White
Information value components				
Industry similarity	47.5	44.8	49.2	52.3
Occupation similarity	51.0	46.4	47.6	50.7
Not open to work	38.8	36.7	43.5	57.9
Senior positions	44.6	44.3	46.5	54.1
Endorsed skills	41.2	53.1	46.9	52.4
Network strength features				
Information bandwidth	55.5	53.5	51.9	46.8
Network size	56.6	44.7	43.9	51.0
Information non-redundancy	48.1	58.3	56.4	47.2
Information value components	44.3	41.9	46.1	54.9
Total network strength				
1st degree	56.6	45.9	45.0	50.8
2nd degree	55.0	54.9	52.1	47.2
Total network strength	56.4	48.4	46.5	49.8