Networks and Manager Pay
Evidence from Time-Varying Exogenous Metrics

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Motivation

- High executive pay has gained increasing salience in the media and in academia.
- Scholars and media have attributed the abnormally high levels of pay of top managers to their equally high power.
  - Market-based theories: increasing demand for good management and scarce managerial talent.
  - Rent extraction: personal power and lack of scrutiny.
- Managerial power depends on different factors and is not directly observable.
- We focus on a specific indicator of managerial power: the manager's professional network.
- A manager's network is defined as the number of all past professional interactions, within the same firm and year, with co-workers who later become top managers.

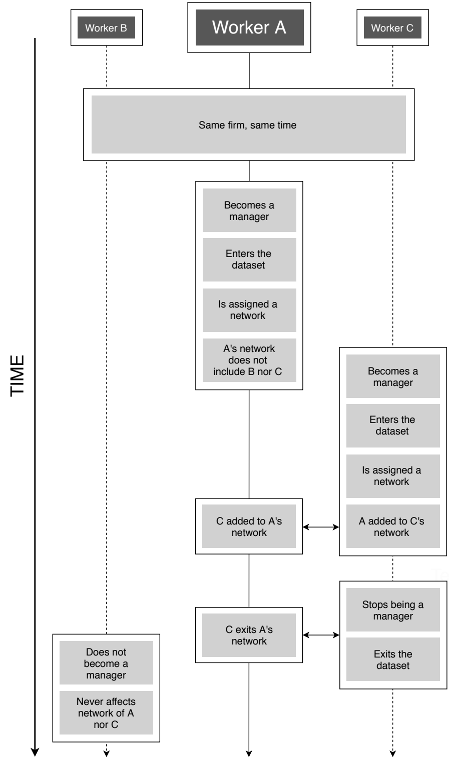
Do networks matter?

- A top manager's network influences their wage if it accrues value to the firm (Engelberg et al. 2013)
- Or at least the firm has to believe it does.
- Three types of benefits from networks that add objective or subjective value to the manager:
  1. Information on business opportunities: bridge between the firm and valuable connections.
  2. Firms may infer competence from the size of the manager's network (Renneboog and Zhao, 2011).
  3. Stronger bargaining power: more outside options (Liu, 2014).
- Regardless of the specific mechanism, we predict a wage-premium for managers who are able to leverage their connections to potentially benefit the firm.

Related Literature

- Formal business settings:
  - CEO pay increases when a board contains interlocking directors (Hallock 1997, Core et al. 1999)
  - Conventionally and socially independent boards award a lower level of compensation than boards that are only conventionally independent(Hwang et al., 2009).
- Informal business settings:
  - Connections through a common background, including attendance of educational institutions(Engelberg et al. 2013), region of origin (Hwang and Kim 2009), experience in civil service (Kramarz and Thesmar 2013).
- Social networks:
  - Connections through social activities have a positive impact on CEO compensation (Brown et al. 2009, Larcker et al. 2006)

Network definition



Contribution to literature

- Identification strategy: our network indicator evolves over time for reasons exogenous to the manager, his ability and choices.
- We address additional endogeneity concerns thoroughly:
  - 2 high-dimensional fixed effects
  - IV approach
- Unique micro-level dataset that allows to define the network such that:
  - It is neither restricted to within-the-firm ties nor to the present (problems of reverse causality).
  - It is not restricted to strong ties (ex: family, board interlocks). Weak ties are a better source for new information (Granovetter, 1973).
- Weighted networks: we assess the impact of connections with potentially distinct value to the manager.

Data

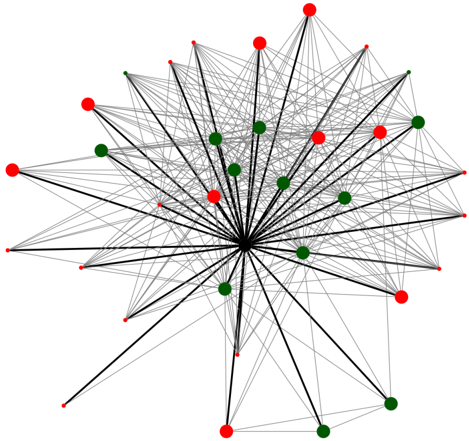
- Quadros de Pessoal
- Final sample:
  - Firms where at least one top manager could be identified
    - Top managers: combine two ranking systems - National Classification of Occupations and grade level (top executive)
  - Firm owners are part of the networks, but not of the final sample
  - Sample: 1 077 233 observations, 135 424 firms, 277 644 top managers and 13 years (1995-2017).
- Network construction:
  1. Identify for each top manager i all the firms they have worked for (since 1986);
  2. List all the employees who worked at the firms from step 1), at the same time as manager i;
  3. Construct network measures for each manager i in year t, considering the connections from step 2), who are also managers in year t (excluding managers from the same firm).

Network measures: degree

Degree: number of direct connections

$$D(i) = \sum_{j \neq i} x_{ij}, \qquad (1)$$

where x_{ij} is 1 for the presence of a link between *i* and *j*.



Note: Lines correspond to direct connections. Green/red nodes are managers who earn more/less than the black node in 2017. Large/small nodes have a higher/lower level of degree.

The network effect

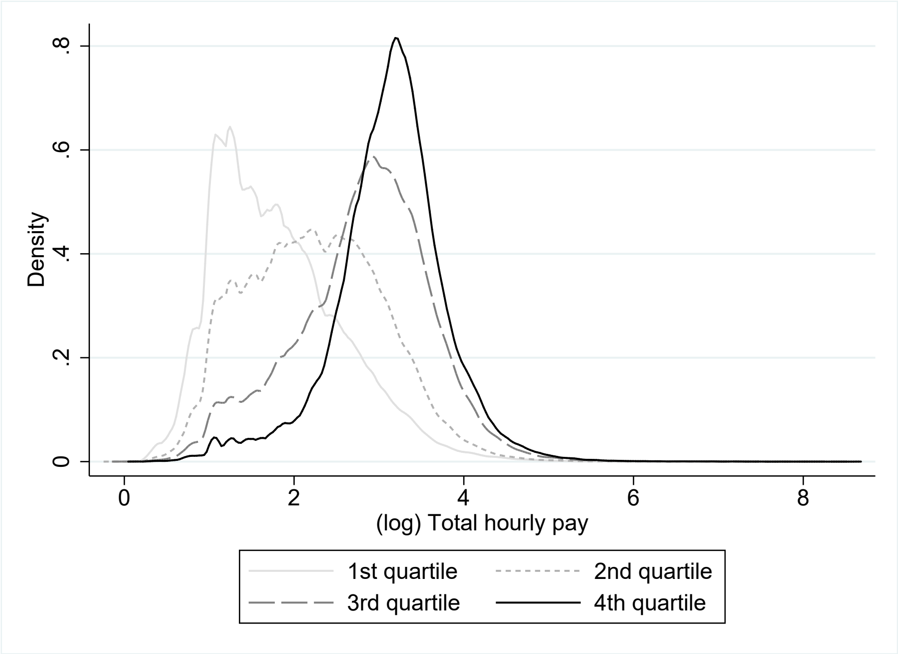


Figure: Distribution of (log) wages by Degree quartile

Empirical framework

$$Ln(w)_{ijt} = \beta_1 Network\ Measures_{ijt} + \beta_2 Manager\ Characteristics_{ijt} \\ + \beta_3 Firm\ Characteristics_{jt} + \eta_t + \gamma_j + \alpha_i + e_{ijt} \quad (2)$$

- Ln(w)$_{ijt}$ represents the natural logarithm of the real hourly wage (base, bonus or total) of manager i, in firm j, at year t.
- $ManagerCharacteristics_{ijt}$ include age squared, tenure, tenure squared and education level.
- $FirmCharacteristics_{ijt}$ include the number of workers and establishments.
- η_t are year dummies.
- $gamma_j$ are firm fixed effects.
- $alpha_i$ are manager fixed effects.
- e_{ijt} is the error term, assumed to follow the conventional assumptions.

The network premium

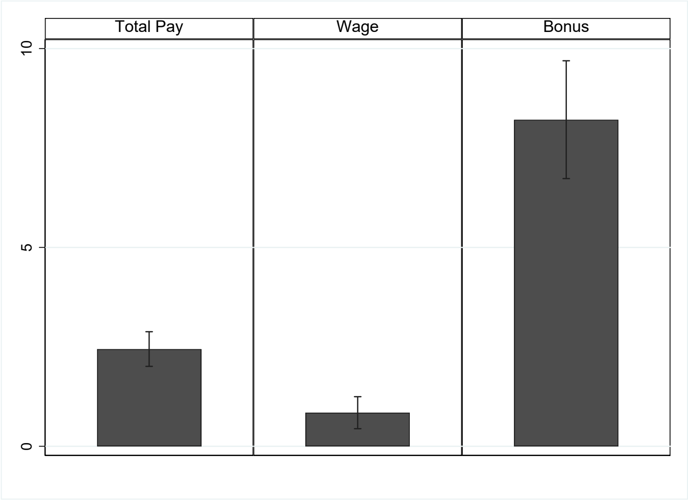


Figure: The network premium: degree

Note: The columns stand for the estimated coefficients for a one standard deviation change in the variable and the lines represent the 95 per cent confidence interval.

Permanent firm heterogeneity

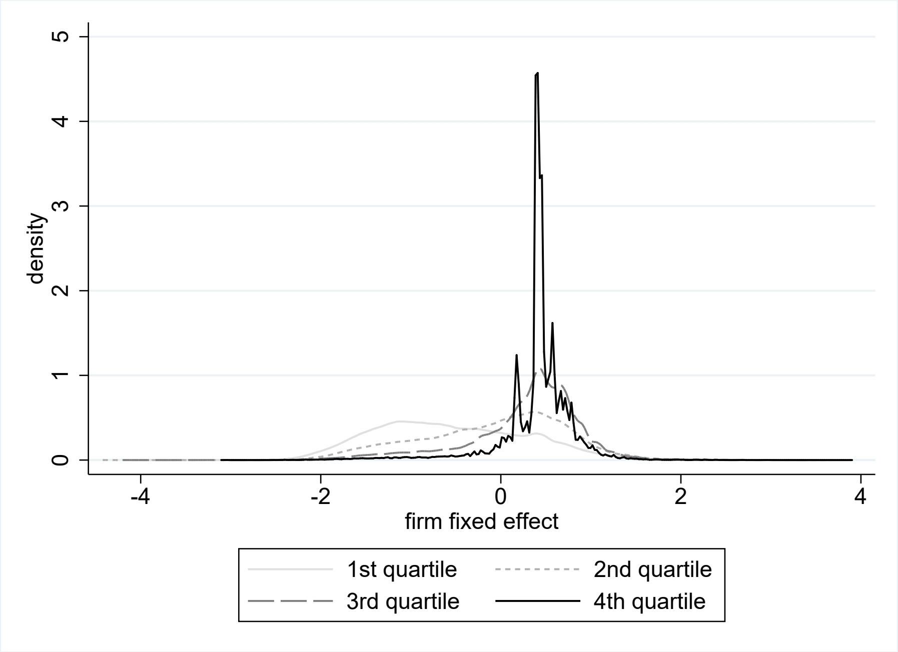


Figure: Distribution of firm fixed effects by Degree quartile

Network measures: Depth and Power

Depth and Power: sum of weights on all direct connections

$$S(\mathrm{i}) = \sum_{j \neq i} w_{ij} x_{ij}, \tag{3}$$

where w_{ij} is greater than 0 for the presence of a link between i and j and the value represents the weight of the tie defined as:

$$w_{ij} = \frac{Years_{ij}}{FirmSize_{ij}}, \qquad or \qquad w_{ij} = \frac{\sum_j FirmSize_j}{\sum_j NumberManagers_j}, \tag{4}$$

where $Years_{ij}$ corresponds to the years worked together and $FirmSize_{ij}$ to the firm where the connection was formed. $FirmSize_j$ and $NumberManagers_j$ refer to all firms managed by j.

Power or depth: is it who you know or how well you know them?

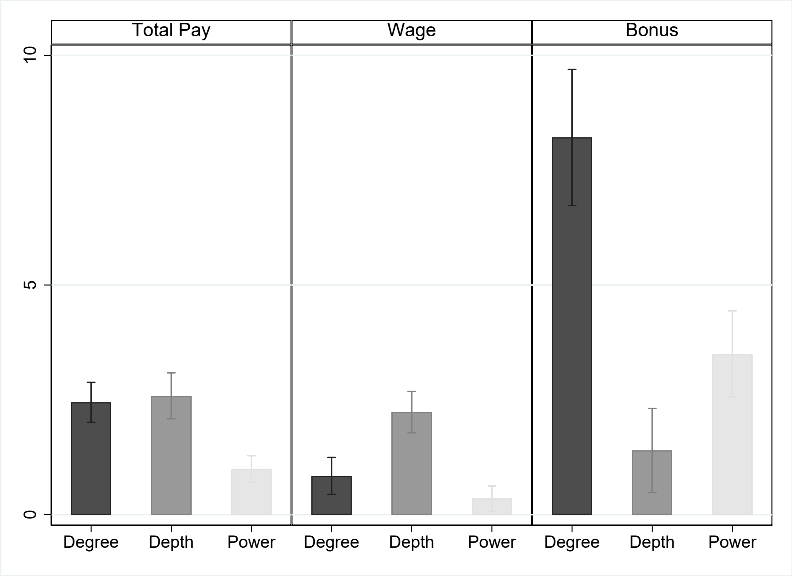


Figure: Network measures

Note: The columns stand for the estimated coefficients for a one standard deviation change in the variable and the lines represent the 95 per cent confidence interval.

Network measures: Betweenness and Page Rank

- Betweenness: number of geodesic paths between any two nodes passing through manager i, divided by the total number of geodesic paths between them.

$$B_i = \sum_{j \neq i \neq k} \frac{g_{jik}}{g_{jk}}, \tag{5}$$

where g_{jik} are the number of geodesic paths between j and k that pass through i.

- Page Rank centrality:

$$PR_i = \alpha \sum_j \frac{x_{ji}}{D_j} PR_j + (1-\alpha), \tag{6}$$

where α is a constant (the damping factor), x_{ij} is 1 for the presence of a link between i and j, D_j is the degree of node j if such degree is positive, or $D_j = 1$ if the degree of j is null.

The value of indirect ties

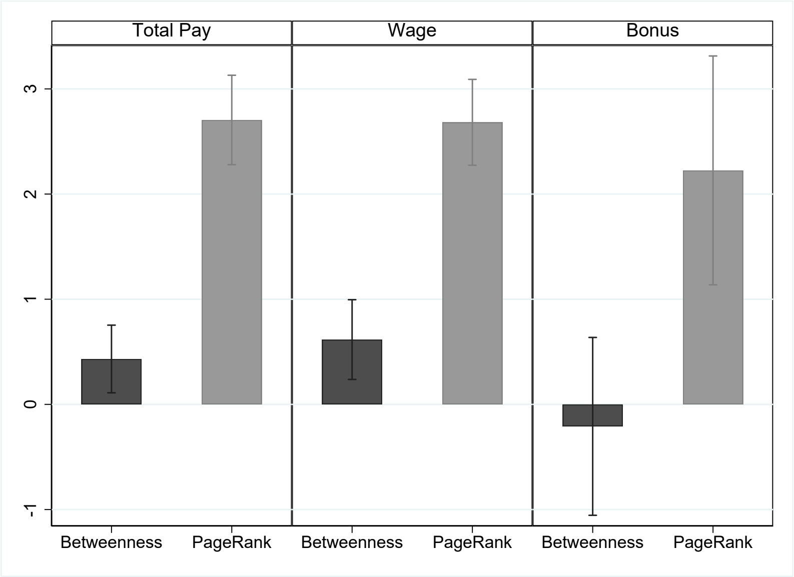


Figure: Indirect network measures: Betweenness and Page Rank

The columns stand for the estimated coefficients for a one standard deviation change in the variable and the lines represent the 95 per cent confidence interval.

Additional results

- Principal component analysis: reduce our 5 metrics to a single network indicator
  - Results are quantitatively and qualitatively robust
- IV approach: use as instrument network metrics of initial peers
  - All results, except for betweenness, are confirmed
- Firm type: results are (qualitatively) homogeneous across firms
- 5 year rolling window: results persist, but evidence does not support that recent connections are more valuable
- Productivity-wage gap: preliminary analysis suggests that networks are not overpaid.

Some final remarks

- Networks matter! Both for base wage and bonus pay.
- Deeper connections are more valuable.
- It is not only who managers know, but also what they know through them that matters.
- A preliminary analysis unveils that networks are not overpaid and effectively translate into firm value.
- Future research should explore further the channels through which networks create value for firms.