Workers positional power
An input-output relations study.

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1 Introduction: from posicionality to centrality

This paper analyzes the structure of inter-sectoral relations of Argentina's economy, via network analysis tools. The research question focuses on the notion of positionality and how it can explain the power relations between capital and labor. From our point of view, the position held by the different sectors in the economic system reflects the structural advantages of the actors involved in them.

The concept of posicionality has been addressed by different theoretical approaches from disciplines such as sociology, political economy and network theory. In this literature, position is used to highlight the multidimensionality of power relations and the structural importance of actors operating in a system. These contributions show that the strategic position of workers in an economic system gives them a "disruptive potential" to affect the normal functioning of the production process of key industries (Wright, 2000; Perrone et al., 1984). They also highlight the importance of divergent trajectories in sectoral profit rates (Marx, 1980; Botwinick, 2017) and the different levels of union organization and action (Barrera Insua and Marshall, 2019) as determinants of sectoral wages. Finally, actors position in an interconnected system as been widely approached through the analysis of its structural properties. In particular, the concept of centrality in network theory allows capturing the structural importance of actors in a system (Barabási, 2016). Therefore, centrality measures can be used as indicators of the structural power of actors through their position in the economic system.

In short, economic sectors hold a specific position in the production network, which give rise to a particular structure whose topological characteristics express the positional dimension of union bargaining power. The complex network theory concept that captures different aspects of a node's position is centrality (reflecting the actors structural importance); so we can operationalize the concept of structural power using these measures.

The aim of this work is: (1) to operationalize the concept of workers' positional/structural power through the analysis of the propierties of the production network in Argentina; and (2) to explore its link with the sectoral wages distribution.

2 Data and methodology

Wage negotiations take place at a sectoral level, so we are concerned with this scope of application: the degree of influence of workers actions in the negotiation with employers' organizations that represent firms belonging with different economic sectors (Barrera Insua and Marshall, 2019). Therefore, workers position will be determined by the network position held by the economic sector to which the firm where they work belongs. This information is provided by the Input-Output Table (IOT), obtained from the OECD database, which contains data for 45 sectors, according to the International Standard Industrial Classification system ISIC Rev.4[1], detailing the relationships between each of them at a national level. The data is annual, for the period 1998-2018 and for the Argentine case.

The IOT can be described as a network $G(V, E)$ directed and weighted, defined by te set of nodes V and the set of edges E. It is directed because IO systems represent bidirectional flows between economic sectors, *i.e.* each pair of nodes is connected by two links, one for each of the directions in which transactions may take place. It is also weighted because the links do not only represent the presence of a connection, but such connection has a specific magnitude.[2]

We propose the Weighted PageRank Index (WPR) (Brin and Page, 1998; Zhang et al., 2022) to approximate the structural power of workers. A node WPR score depends on: (1) it receives a large number of incoming edges, (2)

This is a global centrality measure that takes into account: (1) the neighbors position in the production network, (2) the number and weight of the incoming edges, (3) some node-specific quantifiable information attached to sector i and (4) a tuning parameter (θ) adjusting the relative importance of weights in the definition.

Formally, it is defined as:

$$\mathbf{wrank_i} = \alpha \sum_{j \in V}(\theta \frac{w_{ij}}{s_j^{out}} + (1-\theta)\frac{a_{ij}}{d_j^{out}})\mathbf{wrank_j} + \frac{(1-\alpha)u_i}{\sum_{i \in V} u_i}$$

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[1] The sectors can be consulted at the following link: https://www.oecd.org/sti/ind/input-outputtables.htm.

[2] Given the nature of IOT, the weighted adjacency matrix $W = (w_{ij})$ is a non-negative square matrix, where each element w_{ij} represents the volume of transactions directed from the node i to node j. The associated binary adjacency matrix $A = (a_{ij})$ is such that each element a_{ij} is equal to 1 when there is a link connecting node i with node j, and is equal to 0, otherwise.

Figure 1. Workers structural power, operationalized through WPR. Argentina, 1998,2008 y 2018
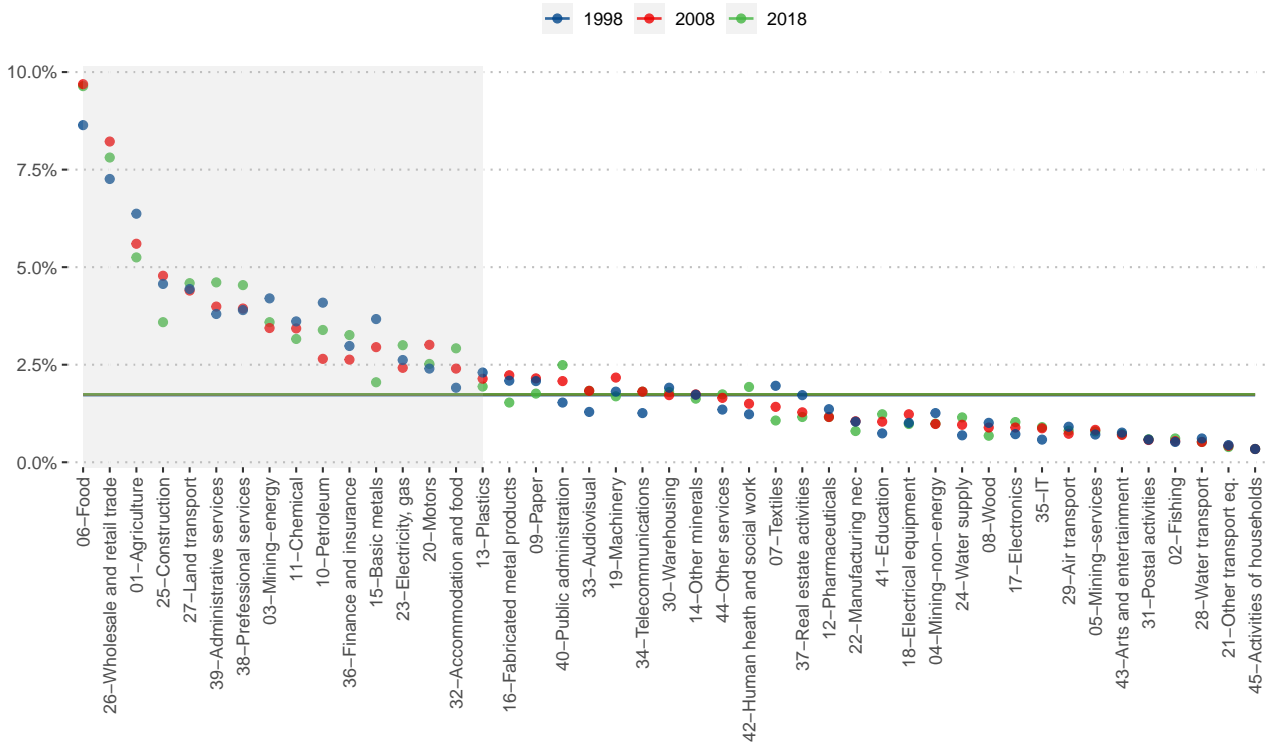
where $\theta \in [0,1]$[3]; d_j^{out}, s_j^{out} and $wrank_j$ are the out-degree, the out-strength and the WPR of node j, respectively; and u_i takes the non-uniform relative importance of the nodes into account. we include the share of each sector in formal employment in Argentina as relevant node-information to calculate its centrality[4].

3 Positional power and wage sectoral inequality

Interactions between sectors have remained relatively stable over time. However, we observe a slight growth in the last two decades, linked to the growing phenomenon of supply chain fragmentation that takes place on both global and local scale. However, regarding the top positions in the sectoral ranking, practically the same activities remain there, with some minor changes.

Figure 1 shows the ranking of structural power operationalized through the WPR. The ranking is led by the food industry, retail and wholesale trade, and the agricultural sector. Although it is a heterogeneous group, the three sectors are associated with global valorization processes, which is reflected in the fact that they are export-oriented industries.

We explore the link between structural power operationalized through the selected centrality measure and sectoral wages. When comparing WPR results and each sector position compared to the rest in terms of wages, we initially observe a positive correlation between both variables. Given the characteristics of employment and of the firms involved in the different sectors –among other factors affecting wage determination–, wage results of union intervention, reflected in sectoral wages, vary according to the more or less strategic position that each sector occupies in the economic structure and the consequent disruptive potential of union action.

We also explore the statistical distribution that these two variables follow, –namely, WPR centrality and sectoral wages– in order to assess whether they follow a power law[5], another distribution characterized byheavy-tails or neither. To do so, we follow the technique proposed by Clauset et al. (2009). The results indicate that there is not enough evidence to reject the null hypothesis that the sample comes from a power-law distribution[6].

It is important to notice that greater structural power does not necessarily mean higher wages or

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[3]The value of θ can be chosen according to practical needs and actual interpretations. We are concerned with the volume of transactions, but also with the number of edges because it reflects the scope of the disruptive potential, so both degree and strength matter simultaneously. Therefore, we set $\theta = 0.5$

[4]For further details on the algorithm used, we refer the reader to Zhang et al. (2022).

[5]A power-law is a functional relationship between two quantities, which states that a relative change in one quantity results in a proportional relative change in the other, regardless of the initial size of those quantities. Mathematically, is expressed as $p(x) \propto x^{-\alpha}$, where α is the scaling parameter of the power-law distribution.

[6]As well as for a log-normal relationship. Up to know, we are unable to determine wheter power-law or log-normal better fits to out data. The results of the three stages provided by Clauset et al. (2009) are available upon request.

greater bargaining power overall. This is because: (1) structural power captures only a piece of the overall bargaining power, i.e. even in situations of high structural power, overall bargaining power may be low due to, for example, low associative power; y (2) the relationship between bargaining and wages is not deterministic but stochastic: high bargaining power means a high probability of success in the wage dispute and not directly higher wages.

Therefore, in order to get a more concrete idea regarding the relationship of the two variables, we regressed the logarithms of the two variables, including another relevant variables on sectoral wage determination as controls, based on Barrera Insua and Noguera (2021) analytical framework[7]. So, we estimate the exponent of the relationship

$$\mathbf{w} \sim WPR^{\alpha},$$

by regressing

$$\log(\mathbf{w}) = c + \alpha \log(WPR),$$

wehere $\mathbf{w}$ is the sectoral wage and WPR is the weighted PageRank centrality index. We found a statistically significant relationship with an exponent being on average around 1.9. Given that WPR centrality captures the relative workers structural power at the sectoral level, considering the national structure of production, the power-law between this variable and the sectoral wage implies that a relative change in the quantity of workers structural power may give rise to a proportional relative change in the quantity of sectoral wages, regardless the initial values of each variable.

Table 1. Sectoral wage model, results for WPR as a measure of structural power. Argentina, 2003-2018.

Dependent variable: mean sectoral wage (log)						
(1)	(2)	(3)	(4)	(5)	(6)	(7)
log(PageRank) **1.873**	**1.806**	**1.876**	**1.821**	**1.802**	**1.871**	**1.766**
(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Controls No	A1	A2	B	C	D	B,C,D
Fixed effects Sí	Sí	Sí	Sí	Sí	Sí	Sí
N 945	945	945	945	945	945	945
R2 0.5382	0.5688	0.5409	0.5544	0.6201	0.5481	0.7164
adj. R2 0.538	0.569	0.541	0.554	0.620	0.548	0.716

Notes: p-values between brackets. Controls A=1-Total strength, 2-in/out strength. B=Sectoral profit rate, companies payment capacity. C= Unionization rate, conflict. D=Minimun wage.

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[7]We include the following controls: the sectoral profit rate (Income Generation Account-CGI published by the National Institute of Statistics and Censuses-INDEC); the payment capacity of companies in each sector approximated by their average size (Ministry of Labor, Employment and Social Security-MTEySS); the unionization rate (National Survey of Workers on Conditions of Employment, Work, Health and Safety-ECETSS); the minimum wage (published in the Official Gazette); and the conflict, (variable built based on the information published by the MTEySS). For further details we refer to Barrera Insua and Noguera (2021).

4   Concluding remarks

In this paper we focus on studying the workers structural power and its link with wage inequality at the sectoral level. The main results can be summarized in the following two elements: (1) the distribution of positional power is asymmetric between sectors and that implies an asymmetric distribution of sectoral wages; (2) positional power is relevant to explain distributive conflict dynamics.

We consider that the paper's contribution is twofold. First, we propose an alternative way to measure the workers bargaining power, by operationalizing it through complex networks approach. On the other hand, we provide empirical evidence (at the national level) about the relationship between the workers structural power and the sectoral wage distribution.

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