

Decentralised Autonomous Organisations: A New Research Agenda for Labour Economics

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Abstract

Decentralised autonomous organisations (DAOs) are a new type of organisational structure and a new type of labour market. We review several theories from industrial and labour economics about contemporary post-industrial labour markets and assesses their applicability in emerging DAO labour markets. The review suggests a need for new theoretical frameworks to analyse the new forms of DAO employment, as well as a need for empirical research and new data collection methodologies fit for DAO digital labour economics.

Keywords: *decentralised autonomous organisation, labour market, labour economics, industrial economics, cryptoeconomics*

JEL Classifications: J21, J22, J23, J24, J46, J49, E24, L00

1. Introduction

Decentralised autonomous organisation (DAOs) is a new form of organisational structure offering an alternative to corporations [1–5]. A DAO is a digitally-native organisation that allows their members to govern themselves through smart contracts set on a public blockchain [6–10]. For workers, the critical difference is the horizontal structure, where there is little formal hierarchy and no bosses. Every member of a DAO is at the same time a co-owner, co-manager, and potential co-worker. The membership community governs a DAO as a mini democracy where everyone's vote counts. Members collectively decide on every matter and rules are executed according to the nexus of smart contracts that constitute the DAO.

DAOs offer a revolutionary new type of employment: a hybrid of ownership, traditional employment, freelancing, and volunteering. Every member is a boss and a worker (both paid and unpaid) and is free to contribute when and where they see fit. Members might contribute to a managerial or executive function (boss) by submitting and deciding on proposals for DAO activities, or act as employees or contractors (worker) by completing approved tasks themselves. Each member is free to choose how much time they want to spend working, voting, and participating in discussions. Members decide how much labour they are willing to supply to a DAO and under what conditions – from freelancing micro-work to a standard full-time working week, and beyond – provided there is DAO demand for their preferred employment contract. Moreover, one can be a member of multiple DAOs and choose how much time and effort they devote to each. According to DeepDAO, numerous top DAO contributors are members of dozens of DAOs at once, with the largest contributor currently part of over a hundred [11]. Employment in a DAO is flexible, discretionary, overlapping, and deregulated.

Labour economics is a branch of economics that has studied employment relations in conventional firms and markets [12] and industrial organisation is a field of institutional economics building on the theory of the firm by examining the structure and boundaries of firms and markets [13–16]. We review several theories from industrial and labour economics about contemporary post-industrial labour markets and assesses their applicability

for the new emerging DAO labour market relationship.

2. What is DAO labour?

The DAO has emerged as both a new type of organisational structure and a new type of labour market. DAOs blur the lines between traditional institutions of economic organisation (firm and market) and employment relations (owner and worker), offering new institutional innovations for studying theories of the firm, governance, management, and labour economics [5, 17].

DAO employment offers considerable worker flexibility – in terms of their overall supply of labour, working hours, and variety of tasks – due to the digital, remote, and asynchronous nature of DAO operations [18, 19]. Even today it is possible to earn a living working for a DAO or across multiple DAOs, with some earning an income as much as \$US 300,000 in 2021 [20]. A survey of 422 DAO members conducted by Gitcoin and Bankless showed that half of the respondent were able to earn a living from working in one or more DAOs [21]. However, the remuneration rarely comes as a traditional salary and is commonly paid in tokens. Furthermore, the moment one starts working for a DAO and gets paid can be two entirely different points in time.

How does this work? The moment one joins a DAO (usually by purchasing a token), they can start contributing by participating in a community forum (e.g., on Discord) and voting (e.g., on Snapshot). At this point, however, there is a slim chance of getting paid. As one's reputation grows, the DAO community may reward them based on discussion and participation KPIs (usually via airdrops). Once a member has familiarised themselves with the DAO and proved their reputation, they might start contributing to the core DAO project. At this stage, this usually happens in the form of completing a bounty – a small, disconnected task. Bounties are paid and lead to further accumulation of reputation and DAO specific skills [17–21].

The next step is to secure a part-time or full-time position within a DAO. While relatively rare and hard to get, these jobs are often well-paid. Longer-term or ongoing position such as these are usually associated with the core

operations of the DAO project: for example, a software developer role in a protocol DAO; or a graphic designer role in an NFT art production DAO. If one does not want to have a fixed arrangement, they can continue contributing when convenient, and the peer review process will decide how to remunerate the value they add to the DAO [17–21].

While displaying some characteristics of traditional employment (e.g., volunteering, gig economy, contracting), the distinguishing characteristics of DAOs require fundamentally new approaches to economic analysis and employment practices. For example, DAOs provide a new and different context to owner-worker labour dynamics by distributing ownership and control benefits to workers with their employment [21]. Employment itself is a dynamic concept in DAOs, where employment status is not a binary variable but a spectrum of arrangements (both within a DAO or across multiple DAOs or sub-DAOs) depending on development cycle timelines, investments in DAO-specific human capital and reputation, and labour market forces of competition for talent between DAOs. Moreover, in practice DAO employment is currently largely unregulated (i.e., due to DAO legal uncertainty), and could in principle become unregulatable (i.e., only governed by DAO member decisions and smart contracts) [8, 22].

3. Human capital investment in two-period schooling model

Traditional labour market models start with human capital theories. Consider a two-period model of schooling investment [24]. In the first period, the individual invests in education. In the second period, they get returns from employment. The longer the schooling investment period one, the greater the expenses and the greater the return in the second period, also referred to as the skill-wage premium. The model suggests that a greater skill-wage premium will encourage more years of education, and a higher interest rate will discourage studying for longer. The total present value of the skill-wage premium over the lifetime should be larger or equal to the expenditures on the education for a person choose to study. This model can be applied to a DAO labour market by assuming that period one (the cost) corresponds to the period of learning about the DAO, entering the community, and building trust and confidence. Period two (the benefits of the skill-wage premium) then corresponds to the access and ability to make proposals to the DAO for work. While there is often no formal education required to join the DAO, skills will be necessary later when completing bounties, especially when working on the core DAO projects, for example, as a software developer. Along with token costs, these opportunity costs associated with DAO apprenticeship are still upfront costs. An individual needs to spend considerable time and effort contributing to the DAO community by participating in discussions to get a reputation within each specific DAO.

4. Firm-specific human capital and bargaining power

The process of gaining reputation and skills within the DAO resembles another labour market model – firm-specific human capital. Becker's [24] model of human capital accumulation provides a detailed theoretical background to general and firm-specific training. Both will increase workers' marginal product of labour [25]. General training will increase the marginal productivity in a range of jobs, while firm-specific only at the current workplace. As a result, the general investment in human capital will increase the worker's wage across the industry. The same is not the case with firm-specific human capital. While the worker's productivity is higher, the firm has no incentive to increase the wage since the worker cannot get a better offer elsewhere.

Firm-specific capital accumulation process in a DAO is different. Firstly, a member of a DAO starts accumulating their DAO-specific capital after they join the DAO but before they get any paid work done, unlike in the traditional company, where paid work is the only source of specific capital accumulation. Moreover, DAO-specific capital is a prerequisite to getting paid tasks in a DAO. Even though firm-specific capital plays a more

significant role in hiring and maintaining paid work in a DAO, there is less room for withholding a skill-wage premium. Individuals can be active members of multiple DAOs simultaneously, hence accumulating the firm-specific capital at more than one DAO, unlike traditional firms where each worker is typically an employee of one firm. Members choose how many DAOs they want to be part of and how they allocate their time and effort between the DAOs. Therefore, DAO membership allows for more outside options.

Workers are imperfect substitutes within each experience group, even in the conventional labour market [26]. This stylised empirical observation is especially prominent in the DAO labour market as each DAO is uniquely designed, and the size of the DAO labour market is relatively small. Therefore, although individuals first accumulate firm-specific capital before completing paid tasks in the DAO, they still retain their bargaining power.

5. Asymmetric information and monitoring

The principal-agent problem in the labour market is concerned with how the principal (employer) can design a remuneration scheme to motivate the agent (employee) to act in their interests [27–31]. The problem stems from the fact that employer and employee interests are different. The employer wants to maximise their profits, and the employee maximises their utility by minimising their effort (moral hazard problem). The problem persists due to information asymmetry, where an employer cannot fully observe the employee's effort into their work [32].

The principal-agent problem between employer and employee in the traditional corporation stems from the asymmetry of information and hierarchical structure of the firm. In the DAO labour market, neither holds. Firstly, the governance structure of the DAO is flat all employees are also members and, hence, owners and decision-makers [6–9, 17, 18]. That eliminates the problem of the conflicting utility maximisation objectives. On the other hand, a DAO's existence on blockchain makes all transactions completely transparent [6–9, 17, 18]. That includes the contribution of the DAO members. Even the participation in forum discussions is tracked and shown as a KPI. The information on the completed tasks and effort is entirely transparent and, in most DAOs, is used as a basis for the distribution of remuneration for the work done. Hence, the design of DAOs works to minimise principal-agent problems.

6. Discrimination and inequality

Economic discrimination in labour markets occurs when two workers are paid different wages despite having the same abilities and therefore, adding the same value to the firm [33]. Gender wage gaps persist even in developed western countries even with substantial regulatory and social effort to eliminate them [34].

DAO membership is pseudonymous, meaning that a person is represented by a pseudonym and an avatar image that does not have to show their identity and hence does not communicate any of the characteristics that traditionally result in labour market discrimination [35]. Remuneration decisions are based only on observed productivity and contribution to the DAO.

Nevertheless, DAO employment could systematically disadvantage some groups of employee-members. DAO labour markets are highly deregulated, with no leave and other job security provisions. Therefore, those who must look after children, for example, can still be at risk of being disadvantaged because they might be taking time off more frequently. This is a possible explanation for gender imbalance within the DAO workforce, reported in the recent GitHub/Bankless survey showing almost seven times more males than females in the DAO member gender mix [21]. Conversely, the flexibility of the DAO working arrangements can attract caregivers to

being DAO contributors.

7. Conclusion

DAOs are an exciting new research area for labour economics, and we have briefly indicated here how some of the main theories that might apply. However, to advance this we need to gather more and better data. Most theories in labour economics are calibrated and tested using real-world data. Presently, the same cannot be done for the DAO labour market theoretical propositions because suitable data does not exist. To date, there is only one small survey conducted by Github and Bankless [21]. While providing valuable initial insight into the market, it has major methodological drawbacks. The sample is largely biased towards the members of the abovementioned DAOs that were funding the survey. Further, it was biased toward highly active members of the DAOs, which is not representative of the average DAO member experience.

The leading example of empirical work on labour relationships related to DAOs is Atherton et al. [36], which provides an interesting insight into blockchain skills demand and shortages using Burning Glass job listings data. However, this work examines all blockchain industry labour skills and did not discuss DAO skills. Existing job market data does not provide the capacity to single out skills needed to work for DAOs from broader blockchain industry related skills, however this could be achieved by applying a similar methodology specifically to DAO job listings. Tagaki [37] presents another interesting methodology for defining DAO-compatible occupations, by constructing an index measuring the suitability of skills for DAO work, using the US Department of Labor O*NET database. However, this work is based on the author's subjective interpretation of suitability for DAO employment and fails to measure the size of the labour markets with DAO-compatible occupations.

The limitations of the works and the need for reliable data justify the need for developing a robust DAO surveying and measurement methodology, as an input to an empirical DAO labour economics. Data on DAO employment is preliminary and not suitable for the academic economic analysis. Existing survey methodologies for labour market surveys cannot be directly applied to DAO surveys as sampling methods cannot be directly transferred to the DAO digital economy without some difficulty; for example, due to the still largely unregulated position of DAOs and the pseudonymous characteristic of DAO employment. Hence, we also suggest that future research should focus on developing survey and other data collection methodologies specific to the DAO economy. There is much work yet to be done here.

Further, to underpin future empirical economics analysis there need to be robust theoretical foundations. Even the brief attempt to apply the few fundamental labour economic theories revealed that they do not fully describe DAO labour market behaviours. We therefore suggest that DAO labour economics should be studied and developed as a new research frontier with potentially novel theoretical foundations – drawing on, testing, and modifying existing frameworks from labour economics. There are also important theoretical connections to be made with formative theories of industrial organisation [38–42], which could further inform practices of ownership, control, and management in DAO digital labour economics.

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