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Membership Heterogeneity and Workplace democracy

Andrés Dean *

Resumen

La heterogeneidad de quienes integran una Empresa Autogestionada (EA), a través de los costos de las decisiones colectivas, ha sido señalada como una de las principales razones que pueden explicar la baja presencia de empresas dirigidas por sus trabajadores en las economías capitalistas contemporáneas. Según esta hipótesis, en comparación con los miembros de una EA, los propietarios de Empresas Capitalistas (EC) tienen preferencias más homogéneas. Mientras, las preferencias de los trabajadores de EA divergirían en diferentes temas (salarios, amenidades, condiciones laborales, proyecto de inversión, etc.) dependiendo de las características personales (edad, sexo, riqueza, educación, etc.). El proceso de agregación de esas preferencias puede ser complejo y la resolución de estos conflictos de intereses puede ser costosa. Estos costos crecen con la heterogeneidad de los miembros. El aumento de la homogeneidad entre los socios-trabajadores podría estar entre las medidas endógenas implementadas por las EA para reducir los costos de las decisiones colectivas. En esta investigación se utilizan un conjunto de datos vinculados de empresas y trabajadores de los registros de la seguridad social uruguaya durante el período 1996-2013 para analizar este tema de dos maneras. En primer lugar, utilizando estimaciones de ecuaciones salariales, considero cómo la heterogeneidad entre los miembros de las EA en diferentes dimensiones (edad, sexo y educación) afecta los ingresos de los trabajadores. Además, utilizando técnicas de análisis de duración, analizo si la desviación de las características de los trabajadores de las que prevalecen entre los miembros de las EA afecta sus posibilidades de dejar la empresa en el caso de los miembros o convertirse en miembro en el caso de los trabajadores asalariados de las EA.

Palabras clave: Empresas autogestionadas, heterogeneidad, modelos de duración, diferenciales de ingresos.

Código JEL: D23, J52, J54, P13

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Abstract

Membership heterogeneity, via collective decision costs, is considered one of the primary factors explaining the limited presence of Worker-managed firms (WMFs) in contemporary economies. According to this hypothesis, compared to WMF members, capitalist owners generally exhibit more uniform preferences. In contrast, the preferences of WMF workers may vary on a range of issues, such as wages, amenities, labor conditions, investment projects, and more, depending on individual characteristics like age, gender, wealth, and education. The process of aggregating these diverse preferences can be complex and resolving conflicts of interest can be costly, with these costs increasing as member heterogeneity grows. Promoting greater homogeneity among worker-members might be one of the endogenous measures that WMFs implement to reduce the costs associated with collective decision-making. To examine this subject, I employ a linked employee-employer dataset from Uruguayan social security records spanning the years 1996 to 2013. I approach the analysis in two ways. First, I use Mincer equation estimates to assess how heterogeneity among WMF members across different dimensions, such as age, gender, and education, impacts the earnings of WMF workers. Additionally, I employ duration analysis techniques to investigate whether deviations in the characteristics of workers from those prevailing among WMF members affect their likelihood of leaving the firm in the case of members or becoming a member in the case of WMF's employees.

Keywords: labor-managed firms, heterogeneity, duration models, earnings differentials

JEL Classification: D23, J52, J54, P13

1. Introduction

Worker-Managed Firms (WMFs) have caught attention for their normative virtues since the 19th century (Mill 1909).[1] Depending on the emphases of different schools of thought, various advantages of WMFs have been highlighted in comparison to Conventional Firms (CFs). It has been suggested that in cooperatives, workers would not be exploited, would experience less alienation, be more motivated, achieve higher levels of self-realization, or enable greater access to capital and a more equitable wealth distribution (Dow 2003). These advantages stem from the fact that in WMFs, the conflict of interest between employer and employee disappears. The surpluses generated in the firm are appropriated by the worker members, the worker possesses greater knowledge and involvement in the productive process of the enterprise, and also participates collectively in decision-making on matters that directly affect them.

One of the normative advantages highlighted in WMFs is their democratic nature (Dow 2003). On one hand, some authors have pointed out that WMFs create positive externalities for society as a whole by fostering democratic culture spillovers (Pateman 1970; Mason 1982). On the other hand, it has also been noted that since businesses are hierarchical social organizations where decisions affecting those involved are made, individuals have an inalienable right to participate democratically in the determination of these decisions (Dahl 1985). The only type of enterprise where this right would be exercised is in WMFs.

Despite the mentioned normative advantages, the presence of WMFs in contemporary market economies is notably low. The explanation for this limited presence has been a central theme throughout the theoretical and empirical literature on WMFs (Pencavel 2013).

Some explanations have focused on intrinsic characteristics of these firms, such as employment and wage determination (Ward 1958; Domar 1966; Vanek 1970; Steinherr

[1] Within the economic literature on WMFs, the terms Self-Managed Enterprise and Workers' Cooperative are also used. In this study, these terms will be considered equivalent.

and Thisse 1979; Brewer and Browning 1982), investment decisions and capital accumulation (Furubotn and Pejovich 1973; Vanek 1977; Pejovich 1992), the possibility of cooperatives degenerating into conventional enterprises (Ben-Ner 1984; Miyazaki 1984) or issues related to incentives and the presence of opportunistic behavior within work teams (Alchian and Demsetz 1972). Other explanations emphasize factors external to the enterprise, such as the potential negative discrimination by the financial system (Bowles and Gintis 1994).

Among the intrinsic characteristics of WMFs that may explain their limited presence, some hypotheses have focused on the costs of collective decision-making in democratically managed firms, with one of the key determinants of these costs being the heterogeneity of their members (Hansmann 1996; Kremer 1997). Therefore, the democratic structure of WMFs, which has been identified as one of their normative advantages, could potentially be costly for these firms.

However, there are also arguments to consider that greater member heterogeneity in WMFs could enhance their performance. In these firms, those carrying out productive tasks are simultaneously the individuals comprising the group that controls the firm. From this perspective, more diverse decision-makers may make better choices when confronted with complex problems (Pencavel 2013). On the other hand, team diversity can improve productivity (Hamilton, Nickerson, and Owan 2003). However, the existence of such improvements may depend on the type of task being performed (Ben-Ner, Licht, and Park 2017), the presence of homophilic preferences, or the emergence of increased coordination costs (Kaiser and Müller 2015).

In this article, the topic will be analyzed through a comparative study of Uruguayan Worker-Managed Firms and Capitalist Firms. I will employ Mincer equations to assess the impact of heterogeneity among WMF members on earnings differentials observed within WMFs compared to salaried employees of CFs. Additionally, I will use duration analysis techniques to examine the trajectories and characteristics of WMF members and employees. In doing so, I aim to determine whether deviations in their characteristics from the prevailing ones among firms' members affect their probabilities of entering or leaving this group. In other words, I will investigate whether the processes of exiting the

firm or the transition of WMF employees to member status contribute to making the firm more or less heterogeneous.

Empirical studies on WMFs are relatively scarce, and even fewer of them seek to estimate the effect of member heterogeneity on the behavior of WMFs. This article represents a significant contribution to this literature.

More broadly, this article contributes to the analysis of the effects of member heterogeneity in various collectives or work teams on their performance. From a finance and public economics perspective, it's interesting to observe how the heterogeneity of a group impacts its performance when the group relies on individual contributions from its members (Chan et al. 1999; Cherry, Kroll, and Shogren 2005; Otten et al. 2020) and maintains a democratic structure. The performance and heterogeneity of workgroups are also relevant in discussions about human resources (Joshi, Liao, and Roh 2011) and labor economics (Niebuhr and Peters 2020; Dale-Olsen and Finseraas 2020; Ozgen 2021).

The general objective of this study is to contribute to the analysis of the explanations for the limited presence of WMFs in contemporary economies. To achieve this goal, I aim to address the following questions:

1. Do worker members of WMFs have a higher likelihood of leaving the firm if they share the prevalent characteristics among its members?

2. Do salaried workers in WMFs have a greater chance of becoming members if they share the prevalent characteristics among the members?

3. Does member heterogeneity within a WMF negatively affect its performance (considering the earnings of its members)?

2. Literature review

In the WMF model developed by Ward (1958) , it was considered that the objective function of these firms is the net income per worker, while CFs maximize their profits. This model, along with others developed subsequently, assumes that WMF workers are homogeneous. This assumption eliminates any preference aggregation issues for decision-making since there are no conflicts of interest among workers (Kremer 1997).

However, as soon as the assumption that all workers are identical is relaxed, the problem of preference aggregation emerges. Hansmann (1996) assigns a central role to the costs of collective decisions in explaining the limited presence of WMFs. According to Hansmann, control of a firm's ownership will depend on minimizing transaction costs between the firm and its owners. The activities conducted within the firm will be determined by the ownership and contracting costs in the market for each activity. Furthermore, the minimization of these costs will dictate whether the owners of the firm are the capital providers, non-labor input suppliers, consumers, or the workers.

Among the ownership costs, Hansmann emphasizes, in addition to the costs arising from the need to control managers and assume risks, the costs of collective decisions. According to the author, these latter costs are the main disadvantage of WMFs compared to CFs. This disadvantage would be such that it cannot be compensated for by certain comparative advantages of WMFs, which would result from higher motivation and the elimination of strategic behavior between workers and employers. The reason why WMFs would have higher decision-making costs is the heterogeneity in the preferences of their owners based on their personal characteristics (age, tenure, education, wealth, etc.). These differences could arise on key issues such as defining a wage scale or selecting investment projects. In the latter case, as Pejovich (1992) suggests, older members may have a lower preference for reinvesting surpluses. In comparison, capital owners have more homogeneous interests, as they essentially seek to maximize the return on their investments.

The level of decision-making costs depends on the chosen decision mechanism, whether negotiation or direct voting. In both cases, preference heterogeneity poses a problem.

In the case of negotiation, all members must determine how to distribute the surpluses generated by the project in which they are involved. During these discussions, differences may arise regarding what each member considers a fair outcome (Bowles 2004). Likewise, conflicts could emerge when there is asymmetric information (Kennan and Wilson 1993). As a result of these conflicts, inefficiencies may arise, delaying or even canceling the negotiation, even if there is room to achieve mutually beneficial gains. Resources could also be diverted toward non-productive activities or rent-seeking activities.

In the case of the voting mechanism, the costs are related to the time and effort that members must invest in understanding the firm and getting to know other members. This also includes the time required to negotiate agreements and participate in meetings (Hansmann 1996). Additionally, in the case of voting, the majority rule is vulnerable to cyclic problems (known as the Condorcet Paradox). Proposals approved in the first round may lose in subsequent rounds. The problem of the voting cycle occurs when the aggregation of member preferences does not satisfy the transitivity property. This framework of instability could negatively impact the organization's long-term growth prospects if the definitions of firm policies were repeatedly modified. Moreover, there could be additional costs if the members responsible for controlling the voting agenda allocate resources to manipulate the votes (Hansmann 1996).

Unlike Hansmann, Kremer (1997) emphasizes that the main disadvantage of using the voting mechanism in WMFs is not due to issues of cyclicality but rather inefficiencies in defining the wage structure. In addition to the costs associated with the decision-making process itself, workers may not only take longer to make decisions but could also make 'bad' decisions. Kremer (1997) argues that if the median voter is less qualified than the average, the WMF will have a relatively egalitarian wage structure, which would be inadequate from an incentive perspective, making it difficult to recruit qualified workers. However, the potential exit of more qualified workers itself would act as a limitation on the degree of internal redistribution chosen by the WMF.

A different perspective is presented by Moene and Wallerstein (1996), who argue that the use of democratic decision mechanisms would favor proposals that prioritize the common interest over more individualistic measures.

According to Hansmann (1996), the weight of the cost of collective decisions in WMFs leads them to adopt rules and practices that increase the homogeneity of their members. Examples of these measures might include reducing the division of labor, minimizing wage differences, limiting the scope of democratic practices (replacing direct democracy with representative democracy), constraining the agenda, incorporating salaried workers without voting rights, or delegating significant decisions to hired managers.

Benham and Keefe (1991) also argue that WMFs often resort to the mentioned measures to reduce the costs of collective decisions. In addition to these measures, they include other actions that WMFs might take, such as selecting new members based on ethnicity, religion, or geographical location. One of the measures they emphasize is limiting the size of the firm as another way to preserve homogeneity.

The size of the WMF is also highlighted by Jones & Kalmi (2012) who consider the potential trade-off between maintaining democratic structures in the firm and seeking greater efficiency, especially when this increased efficiency is achieved through economies of scale or scope. Expanding the size of the firm would entail changes in the cooperative's governance structure that would increase heterogeneity among the members of these enterprises. The broader use of hierarchical and representative structures would impact the decision-making process, heightening tensions between members and managers or executives. With the increase in the number of categories of workers within the organization, this process would lead to the formation of groups of workers with varying capacities to influence the cooperative's decisions. On the other hand, in larger and more heterogeneous cooperatives, members might be more likely to perceive a weak common bond.

However, the effects would be different depending on whether we are talking about plant or firm economies of scale. Only the former type would produce the problems mentioned. In the case of economies of firm scale, the increase in size could occur through the

formation of conglomerates of WMFs (as is the case with Mondragón in Spain), each of which could maintain lower levels of heterogeneity.

However, there are several arguments suggesting that heterogeneity among the members of a WMF could also have positive effects. Pencavel (2013) argues that diverse decision-makers might make better choices when confronted with complex problems. According to Grandori (2016) and Young-Hyman et al (2022), this heterogeneity would not only be positive for WMFs but this type of firm might be better equipped than CFs to manage such diversity, particularly in knowledge-intensive industries. In these contexts, the tasks typically require the collaborative work of individuals with heterogeneous expertise. Furthermore, the tasks are often difficult to define in advance, and if the objectives are not adequately aligned, costs can arise due to task interdependence, and particularly valuable products (such as knowledge) may not be easily appropriable. For this type of activity, an organization in which its members share a set of norms and guidelines, like WMFs, may be better equipped to tackle this kind of challenge. The tasks may have a lower degree of prior definition, and the fact that the results are not easily appropriable would not be an obstacle to encouraging appropriate behavior, as long as workers are motivated by general norms and values that provide guidance for these tasks.

Additionally, a portion of the literature on labor economics and human resource management has focused on analyzing the effects of team heterogeneity on performance. However, the results are far from uniform. Some studies highlight the positive role of having workers with different characteristics, as they bring diverse perspectives to tackle daily tasks in firms (Hamilton, Nickerson, and Owan 2012; 2003). However, there could also be negative effects if coordination problems increase (Kaiser and Müller 2015). Cultural diversity has unclear effects, although most studies find a positive impact on wages and workplace productivity (Niebuhr and Peters 2020; Dale-Olsen and Finseraas 2020; Ozgen 2021).

On the other hand, homophily (McPherson, Smith-Lovin, and Cook 2001) and a preference for discrimination (Becker 1971) could lead workers in a WMF to prefer a more homogeneous firm, even if diversity does not negatively affect firm productivity. In this regard, Leonard & Levine (2006) and Hirsch et al (2020) find that workers in

conventional firms are more likely to quit jobs where there are fewer people with similar characteristics in terms of age, gender, education level, and nationality.

Whether the effects of team heterogeneity on productivity are positive seems to largely depend on the specific characteristic being considered (Joshi, Liao, and Roh 2011) and the type of task (Ben-Ner, Licht, and Park 2017).

In a systematic review of the effects of team diversity on productivity, Joshi & Roh (2009) find that diversity in demographic attributes (gender, age, race/ethnicity) is negatively correlated with team productivity, while diversity in task-oriented characteristics (tenure, education, occupation) is positively correlated. Additionally, Joshi et al (2011) specifically consider the effect of diversity in firm management teams on firm performance, and they find that greater educational diversity among managers is associated with higher levels of innovation.

The literature reviewed mostly analyzes the effects of group heterogeneity, team diversity, and managerial team diversity separately. However, in WMFs, these three spaces overlap. While not everyone working in the firm is part of the decision-making group, the majority usually is, and those who are part of the decision-making group work within the firm as a whole. Additionally, the managerial and political structure often overlap (Milnitsky 1992), with many times the firm's managers also being members of the cooperative. They have the same political rights in the firm's assemblies to define strategic decisions.

Empirical evidence on this topic for WMFs is limited. Schoening (2010) recounts the case of Burley Design Cooperative in Oregon, established in the 1970s with an egalitarian wage structure, where all workers were members. To prevent a potential tendency towards degeneration, they established a rule that offered all salaried workers in the firm the opportunity to become members after working 1,500 hours. This rule meant that the WMF adopted a mechanism for admitting new members that did not take into account the differences between incoming members and existing ones. According to the author, over the years, the firm's participatory culture deteriorated, as did the decision-making

process. In 2006, the firm was sold, and the new owner reduced the number of workers by half.

The composition of WMF members has also been identified as a factor that can explain the processes of hiring wage labor and their potential degeneration (Russell 1984). Russell emphasizes the role that ethnic or cultural heterogeneity can play in the processes of persistence or degeneration of WMFs. Analyzing the cases of cooperatives in San Francisco and Los Angeles in the United States, he claims that the existence of cultural or ethnic similarities between current members and incoming members will facilitate the organization's continued existence as a cooperative.

Kalmi (2004) specifically analyzes the role that collective decision costs can play as determinants of the number of members, based on a case study of five firms in Estonia with data from 1999. Kalmi examines the evolution of different firms during Estonia's transition from a centrally planned economy to a capitalist market economy. The sample includes firms with different legal forms but a common characteristic of involving various degrees and forms of worker participation in the ownership and management of the firms. From this analysis, evidence is found of a decrease in the number of members, concentration of firm ownership in fewer individuals, and the negative influence of collective decision costs on the likelihood of an increase in the number of members.

Several empirical studies have found that WMFs tend to apply more egalitarian wage structures, both in the Mondragon group cooperatives, as well as in the timber cooperatives in the northwest United States, the Italian Lega, Uruguayan WMFs, or the Kibbutzim in Israel (Dow 2003; Abramitzky 2008; Burdín 2016). Additionally, for Uruguay, it has been found that WMF workers tend to have more homogeneous characteristics compared to their counterparts in conventional firms, both in terms of their members' age and educational level (Dean 2014). It is also noted that they have fewer people dedicated to supervisory activities and engage in a greater rotation of tasks and functional integration (Alves et al. 2012; Burdín 2016).

More recently, a set of articles have analyzed the impact of more egalitarian internal wage structures in WMFs on their ability to recruit and retain the most qualified workers. Both

Abramitzky (2008), for the case of Kibbutzim in Israel, and Burdín (2016), for Uruguayan WMFs, find evidence that more egalitarian wage structures resulted in significant difficulties in retaining and recruiting this type of worker. Additionally, Abramitzky (2011) points out that the Kibbutzim applied strict selection processes to recruit members with more homogeneous expected productivities.

Hiring wage labor may be a mechanism used by WMFs if they need to increase the firm's size without changing the size and composition of the decision-making group. However, Dean (2019) analyses the determinants of hiring wage labor in Uruguayan WMFs and no significant relationship is found between the heterogeneity of education, gender, and age among members and the process of substituting members with employees.

Finally, Young-Hyman, Magne & Kruse (2022), using a panel of administrative records from French firms, find a positive differential in the performance of WMFs when comparing their productivity with that of capitalist enterprises in knowledge-intensive sectors. They do not find significant differences in other sectors.

3. Data and Methodology

I use the records of the Uruguayan Social Security Institute (Banco de Previsión Social [BPS]). These records include an unbalanced panel of the universe of workers from registered Uruguayan cooperatives. It comprises over 1.2 million monthly observations for 30,743 workers and 526 Producer Cooperatives (PCs). The data provides monthly information on workers, including earnings (for members, these also include dividend distributions), gender, age, tenure, and their relationship with the firm (whether they are owners or employees). It also includes information about the firm where the worker is employed, such as the number of employees, legal form, and industry classification (ISIC, Rev. 4, 5 digits). The data covers the period from April 1996 to December 2013.

A corresponding comparison group is also available for the same period, which consists of a random sample of 200,000 workers registered with the BPS (more than 20 million observations). This sample is representative of all formal workers in Uruguay, encompassing all industries and legal forms of the organizations they worked for.

Finally, the BPS records for the same period also include a 20% sample of firms registered in social security (over 50 million observations from 205,000 firms), incorporating data for all their employees. The inclusion of this third dataset is due to the fact that the sample of 200,000 workers, while containing information about the firms where they work, is not representative of Uruguayan firms, as it is biased towards larger firms. The key advantage of this data is the ability to match worker information with corresponding firm information, making it a linked employer-employee panel data structure.

The database allows for distinguishing voluntary resignations from separations due to other reasons (such as layoffs, retirements, or deaths).

While the most relevant characteristics of WMFs are defined by law, these firms choose their operating rules on a wide range of issues. WMFs must have a general assembly that elects the board of directors. The board, in turn, selects the managers and supervises day-to-day operations. Each worker has a single vote, regardless of their capital contribution. The assets of the firms can be individually or collectively owned by WMF members. In the case of individual ownership, members can sell their stake in the market. Under the collective ownership structure, members do not possess tradable stakes. However, in Uruguay, less than 10% of WMFs operate under an individual ownership scheme (Alves et al. 2012). The Uruguayan tax regime treats worker-members of WMFs and salaried employees of CFs in the same manner.

The distinction between a WMF and a capitalist firm seems obvious. Intuitively, the former is a firm where workers are the owners of the means of production, participate in the management of the firm, and have control over economic decisions. Following Ben-Ner et al. (1993) and Dow (2003), a worker-managed firm can be defined as a type of economic organization where workers ultimately have control over decisions. In contrast, in a capitalist firm, control rights are in the hands of those who provide the capital. The controlling group determines the operating rules of the organization, designs its structure, and may delegate functions to other agents.

Among the legal forms adopted by Uruguayan firms, the one that clearly aligns most closely with the chosen conceptual definition is the 'Producer Cooperative' (PC). However, adherence to this legal form does not fully satisfy the scope of the study. In particular, it is a common practice for cooperatives to hire employees, which deviates from the theoretical definition of a pure WMF. In this regard, it was observed that in the year 2005, on average, 43% of those employed by PCs were hired employees.

To distinguish these cases, Uruguayan legislation defines WMFs as those PCs in which the hired employees does not account for more than 20% of the total worker-members. WMFs are allowed to temporarily exceed this threshold due to seasonal changes in demand but must respect this maximum in order to qualify for the exemption of some payroll taxes. Furthermore, the law prohibits PCs from having fewer than 6 members.[2]

Unlike countries like France or Italy, Uruguayan legislation does not impose additional restrictions on PCs in relation to the hiring of salaried workers, except for those that apply to CFs. Employees of PCs can receive different compensation from that of the members and typically do not earn income other than their wage (even if the firm distributes surpluses among the members). Using this definition, approximately 50% of PCs are classified as WMFs.

Econometric estimations will be conducted for the entire WMF dataset, while in most of the descriptive statistics that will be presented, WMFs will be distinguished.

To determine the impact of the heterogeneity of WMF members on the performance of these firms, the following Mincer wage equation is estimated:

$$w_{it} = \alpha_0 + \alpha_1 C_{it} + \alpha_2 C_{it} \boldsymbol{H}_{jt} + \boldsymbol{\beta X}_{it} + \boldsymbol{\gamma Z}_{jt} + \delta Y_t + \mu_i + u_{it} \qquad (1)$$

[2] The Law 13,481 of June 23, 1966 established that the number of employees should not exceed 25% of the members in the first 5 years of activity and 20% in the subsequent years.

Where w_{it} is the natural logarithm of worker i's wage in month t. The coefficient of interest is α_2. C_{it} is a dummy variable that takes the value 1 if worker i works in a WMF in month t and 0 otherwise, and $\boldsymbol{H}_{jt}$ is a vector of variables that measure the heterogeneity of the members of WMF j where worker i works in month t; $\boldsymbol{X}$ is a vector with characteristics of worker i at time t (gender, age, tenure); $\boldsymbol{Z}$ is a vector with characteristics of firm j (industry, size) where worker i works in month t; Y_t is a vector of yearly and monthly dummy variables; μ_i is unobservable heterogeneity (capturing time-fixed variables for each individual); and u_{it} is the error term.

The vector $\boldsymbol{H}_{jt}$ includes all or some of the following variables: Firstly, the Gini Index of workers' income in the firm. This indicator reflects the heterogeneity of the productivities of the firm's workers. However, WMFs tend to have flatter income distributions than CFs, not necessarily reflecting the productivities of their workers (at least not as they are remunerated in the labor market). Furthermore, WMFs simultaneously determine the earnings of all their workers. Therefore, using an indicator of heterogeneity based on the current earning of the firm's workers will have evident endogeneity problems. This is why we also use the Gini Index of the prediction of each worker's earnings in a Mincer equation. This equation was estimated using only periods when workers are employed in a CF, and the prediction is made for periods when they work in a WMF.

Secondly, the Gini Index of the Fixed Effect estimated when calculating the same Mincer equation mentioned earlier for periods when workers are employed in CFs is included. Given that this estimation was done considering only observations of workers over 25 years of age, this estimated Fixed Effect serves as a proxy for the educational level of each worker.

Thirdly, both the standard deviation of the age of the firm's workers and the proportion of women in the firm are included.

The performance of WMFs will be approximated by the observed earnings differentials among their workers. The identification of these differentials relies on the fact that workers switch firms over the course of their work history, and the data used include all their employment episodes, both prior and subsequent to their employment in a WMF.

Additionally, semi-parametric duration analysis techniques (Cox proportional hazards model) and non-parametric methods will be used to assess the probability of a member leaving the firm, depending on whether their characteristics deviate from the median member.

Furthermore, the trajectory of each salaried worker in WMFs will be analyzed to study if their characteristics affect their likelihood of becoming a member of the WMF. Ideally, we would like to conduct a similar duration analysis as for firm exits to consider the previous trajectory of members and determine what characteristics make it more likely for any worker to join a WMF. However, for this, our database should include all the workers in the economy who are potential candidates to join a WMF. Nevertheless, even though we can observe the previous history of those who join WMFs, we cannot observe that of those who did not want or could not join a WMF. Nonetheless, we can observe the trajectory of those who joined a WMF not as members but as salaried workers. Some of them have subsequently become members of the WMF. This way, we can determine what characteristics make it more likely for one of these workers to become a member of the firm.

The data provided by the BPS allow to observe the work history of each worker. This way, I can identify the moment when workers enter the firm and leave it, as well as their relationship with it (when they become members and when they are employees in the firm).

I estimate stratified Cox models where each worker has their own flexible baseline hazard function. Estimation of Cox models allows for controlling all time-invariant characteristics at the worker level (Giuliano, Levine, and Leonard 2011).

In the duration analysis for member workers, the variable of interest is the time that elapses between the moment when the member joins the firm (entry) and when they leave (exit). In the duration analysis for salaried workers, the variable of interest is the time that elapses between the moment when the worker joins the firm (entry) and when

they become a member (exit). The observed trajectory of workers in the database can be complete or right-censored. The latter occurs when the entry date is known, but an exit event has not occurred at the end of the observed period. The duration of the observed trajectory for a worker $t>0$ is an occurrence of a random variable T with a cumulative distribution function $F(t)$ and probability distribution function $f(t)$. The survival function is defined as $S(t) = 1 - F(t)$ and represents the probability that the worker survives at time t. $f(t)$ is the slope of $F(t)$ such as $f(t) = lim_{\Delta t \to 0} P(t \leq T \leq t + \Delta t) / \Delta t = \partial F(t) / \partial t = - \partial S(t) / \partial t$.

Both $S(t)$ and $F(t)$ satisfy the properties of probabilities. $S(t)$ is bounded between zero and one and is strictly decreasing in t, equal to one at the beginning of the observed trajectory and zero at infinity. The hazard rate $h(t)$ is defined as the instantaneous probability of failure (exit) at time t. It is the probability that the worker leaves the firm at time t, given that the worker has survived until t, such that $h(t) = f(t) / 1 - F(t) = f(t) / S(t)$. Finally, the cumulative hazard function $H(t)$ is defined as the integral of the hazard rate in (0, t), such that $H(t)=\int_0^t h(u)du$ (Jenkins 2005).

The choice to use a Cox (1972) proportional hazards model is made because the functional form of the hazard function is unknown. This modeling approach is advantageous as it allows for the estimation of the relationship between the hazard rate and explanatory variables without making specific assumptions about the functional form of the baseline hazard function.

The Cox model used to analyze whether the similarity in characteristics between a member worker and the other members of the WMF increases the chances that the former remains in the firm as a member is as follows:

$$h(t|.) = h_0(t)exp\left(\phi_1 HCh_i + \phi_2 HCl_i + \phi_3 HAh_i + \phi_4 HAl_i + \phi_5 HS_i + \phi_6 X_i\right) \qquad (2)$$

$h_o(t)$ is the baseline hazard function. This model will be estimated for the entire set of members in WMF, and the event of interest is when the member leaves the firm. The

coefficients of interest are ϕ_1, ϕ_2,, ϕ_3, ϕ_4 and ϕ_5. HCh_i is a dummy variable that takes the value 1 if worker i belongs to the top third most qualified in the WMF, while HCl_i is a dummy variable that takes the value 1 if worker i belongs to the bottom third least qualified in the WMF (the omitted group consists of workers close to the qualification levels of the median worker); HAh_i is a dummy variable that takes the value 1 if worker belongs to the top third in terms of age in the firm, while HAl_i is a dummy variable that takes the value 1 if worker belongs to the bottom third in terms of age. Finally, HS_i is a dummy variable that takes the value 1 if the worker is male in a WMF with a predominantly female membership or female in a WMF with a predominantly male membership. X is a vector containing control variables, including the worker's cohort, the size of the firm, and industry.

HCh_i and HCl_i are proxies for the similarity in the level of qualifications of the worker and the WMF members. To construct them, two indicators are used. On one hand, workers are classified into thirds based on their earning level. On the other hand, the thirds are constructed using the fixed effect estimated for each worker in a Mincer equation, using only employment episodes as salaried workers in capitalist firms. Since the wage equation is calculated only for workers aged between 25 and 55, it is reasonable to assume that the fixed effect captures their educational levels. These two proxies, along with HAh_i, HAl_i and HS_i aim to measure whether the likelihood of the worker leaving the firm increases as their characteristics deviate from the characteristics of member workers close to the median.

To analyze whether the similarity in the characteristics of salaried workers and WMF members increases the likelihood of the former being incorporated as members, the same Cox model will be used.

In the estimation of workers, those with the highest and lowest wages (percentile 100 and 1, respectively) are excluded. Left-censoring cases are eliminated, meaning cases where the worker was already in the firm in April 1996. Right-censoring issues are addressed by using duration analysis techniques. Additionally, workers over 55 years old are excluded (as they are likely considering retirement). Separations of members due to firm closures are not considered. Separations due to other causes different from dismissal or resignation (retirements, deaths) are treated as censored.

In the case of analyzing the trajectories of workers, the explanatory variables are constructed for each employment spell. Therefore, the averages vary both between and within each firm, but only vary between individuals and not for each one of them. This allows for the estimation of the Cox model stratified by firm.

4. Results

4.1 Descriptives

The database used has between 153 and 183 WMFs in each observed month, with 50 times more CFs in the year 2012. Considering that for WMFs, the database includes the universe of registered firms, while for CFs, it represents a 20% sample, this implies that WMFs account for less than 0.5% of the registered firms. WMFs are on average smaller than other PCs (although with a higher absolute number of members), but they have a much smaller fraction of salaried employees. In turn, CFs are much smaller, averaging between 4 and 6 employees between 1997 and 2012. This is not the only difference between WMFs, other PCs, and CFs. Among the former, there is a higher participation of firms in transport, especially at the beginning of the period. WMFs that operate in the service industry have a lower share, although this increases during the period, becoming greater among WMFs than among CFs.

Among the workers of PCs, especially those in WMFs, on average, different characteristics can be observed compared to those working in CFs. As shown in Table 1, it can be noted that, on average, WMFs workers are older, with slightly longer tenure and a lower female participation, although the latter increases during the period, reaching levels very similar to those in CFs. Also, among WMFs workers, earnings were higher at the beginning of the period compared to what was observed in CFs, but as they grew more slowly, they reached lower levels by the year 2012. Comparing WMFs with other PCs, it is evident that the average earnings of all workers and exclusively their members show greater differences for all PCs than for WMFs.

For WMFs and PCs, the information is also presented separately for their members, as it is the decision-making group in the firm, their heterogeneity affects the costs of collective decisions.

Finally, among the workers of WMFs (especially among their members), there is a lower average dispersion in the three variables described (earnings, age, and seniority) compared to CFs. This data would indicate a lower heterogeneity in the characteristics of WMF members, consistent with some of the hypotheses mentioned earlier. This result is also in line with previous evidence found in Dean (2014), which reports high levels of homogeneity in Uruguayan WMFs based on data from a survey of firms in the year 2010. The study notes that in approximately 50% of WMFs, no member under the age of 35 coexists with another member over the age of 50, while in only about 10% do members with completed university coexist with members who have not completed high school.

Table 1. Descriptive Statistics: Panel Data with Worker-Firm Linked Data. Firm-Level Information

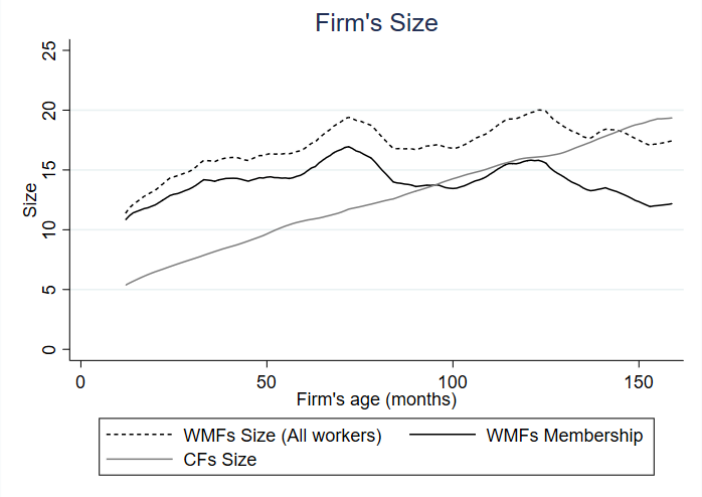
	1997		2002		2007		2012	
	Members	All	Members	All	Members	All	Members	All
All PCs								
Number of firms	267		272		381		376	
Average size (number of workers)	15.3	36.1	14.1	30.7	12.2	25.3	13.7	32.3
Fraction of women	0.25	0.31	0.30	0.36	0.39	0.43	0.45	0.49
Earnings (mean)	20.5	17.8	11.8	11.3	13.8	13.0	18.6	17.2
Average earnings dispersion (SD)	3.9	5.0	2.3	3.4	3.9	4.7	5.3	6.6
Age (mean)	43.8	42.1	45.5	43.9	46.0	44.5	46.0	43.7
Average age dispersion (SD)	8.9	9.8	8.7	9.5	9.0	9.9	9.3	10.2
Tenure (mean)	5.6	4.6	6.5	6.0	6.8	5.3	6.8	5.6
Average tenure dispersion (SD)	1.9	2.5	2.7	3.3	2.9	3.6	3.3	3.9
Fraction in manufacturing	0.16		0.16		0.16		0.16	
Fraction in transport	0.43		0.40		0.24		0.23	
Fraction in services	0.29		0.37		0.40		0.51	
WMFs								
Number of firms	153		171		172		183	
Average size (number of workers)	22.7	24.1	19.9	21.1	22.2	23.7	23.7	25.3
Fraction of women	0.24	0.25	0.26	0.27	0.35	0.36	0.40	0.40
Earnings (mean)	16.0	15.7	11.4	11.2	12.4	12.4	16.7	16.7
Average earnings dispersion (SD)	2.2	2.6	2.1	2.5	3.1	3.4	5.0	5.2
Age (mean)	43.7	43.5	45.3	45.2	44.2	43.9	44.5	44.3
Average age dispersion (SD)	9.1	9.4	9.1	9.3	9.2	9.4	9.6	9.7
Tenure (mean)	4.6	4.5	6.1	6.0	5.1	4.9	5.4	5.2
Average tenure dispersion (SD)	1.9	2.1	3.0	3.1	2.8	2.9	3.1	3.1
Fraction in manufacturing	0.19		0.19		0.20		0.18	
Fraction in transport	0.61		0.52		0.33		0.30	
Fraction in services	0.14		0.22		0.31		0.42	
CFs								
Number of firms	9435		7690		10745		9089	
Average size (number of workers)	4.1		4.1		4.4		5.9	
Fraction of women	0.39		0.40		0.40		0.42	
Earnings (mean)	14.8		11.5		13.6		19.1	
Average earnings dispersion (SD)	7.3		5.6		6.2		8.6	
Age (mean)	36.6		38.5		38.4		38.2	
Average age dispersion (SD)	10.3		10.0		10.2		10.3	
Tenure (mean)	4.6		5.3		4.3		4.0	
Average tenure dispersion (SD)	3.6		3.5		3.5		3.6	
Fraction in manufacturing	0.25		0.21		0.19		0.17	
Fraction in transport	0.10		0.11		0.13		0.13	
Fraction in services	0.27		0.30		0.31		0.33	

Table 1 Notes: The summary statistics correspond to October of each year. Tenure is measured in years. Earnings are measured in thousands of Uruguayan pesos, adjusted for inflation using the Consumer Price Index (IPC) as of December 2015. SD = standard deviation. The figures by industry exclude sectors with low but increasing presence of CPs, such as agriculture, construction, sanitation, and retail trade.

As previously noted in the literature review, the pursuit of greater homogeneity among members in WMFs may influence the type of salaried worker accepted as a member. The existence of common elements among the members in some dimension (age, education, ethnicity, ideology, culture, etc.) could serve as a screening criterion.

The available data only allow us to evaluate the presence of some of these characteristics. Subsequently, information on the evolution of the degree of heterogeneity among the members of WMFs in terms of age, gender, and proxies for educational levels is presented. But first, the evolution of the average size of CFs and WMFs is shown according to the age of each type of firm, as heterogeneity within each type of firm is expected to increase as its size grows. Both graphs exclude agricultural firms, as well as those with fewer than 3 workers.

Figure 1. Evolution of average firm size by type and age (in months)

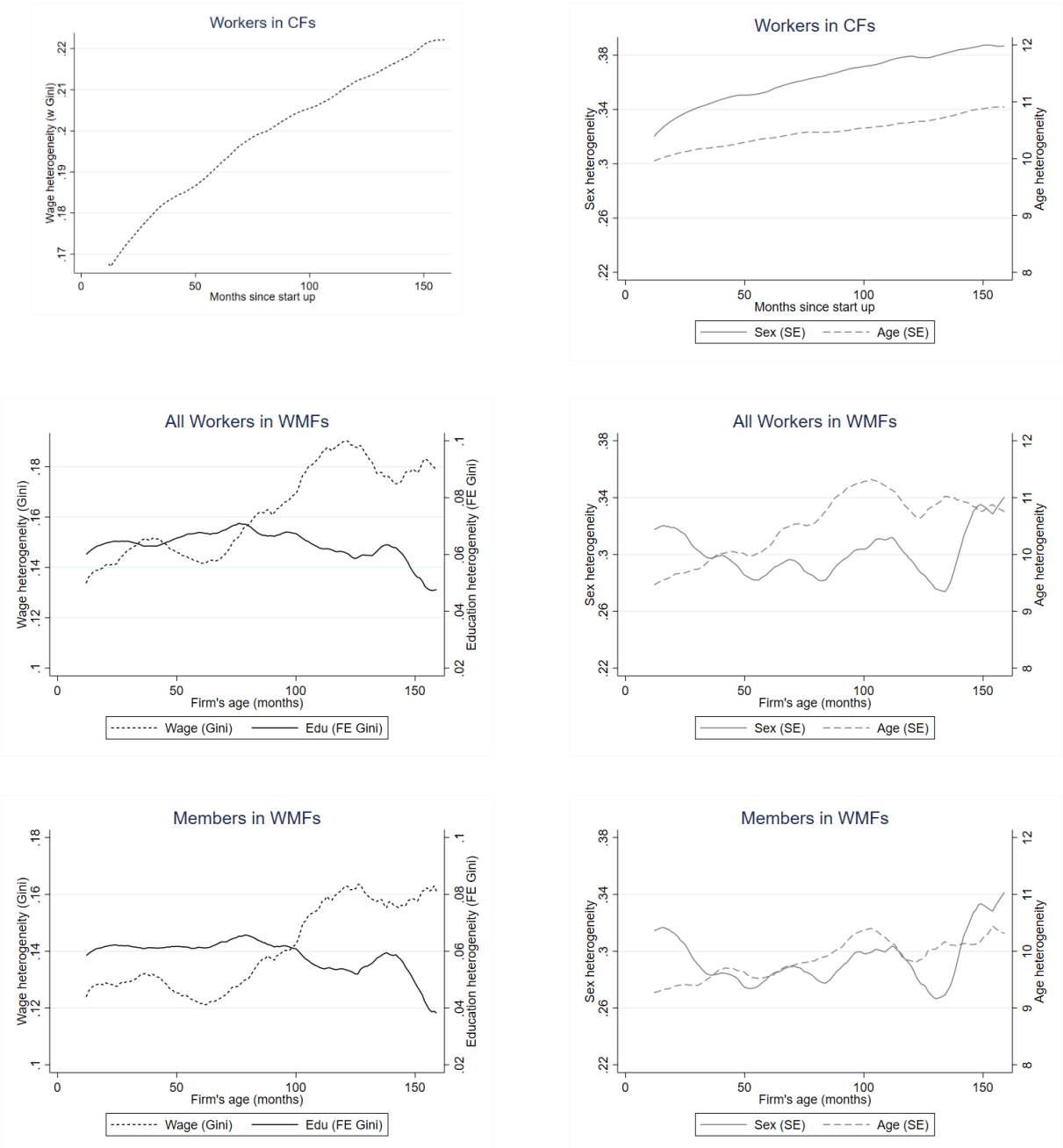


Source: Author's own elaboration based on data from BPS.
Note Figure 1: The graphs display the average values for the last 12 months.

In Figure 1, we can observe how the size of the two types of firms increases with their age. However, they do so at a very different pace. On average, WMFs start with around 11 workers, and 13 years later, their size has increased to approximately 17 workers. In contrast, CFs begin with a much smaller average size, but from the eleventh year of existence, their size surpasses that of WMFs. After 160 months since their creation, CFs reach an average size of 19 workers.

Figure 2 illustrates the evolution of heterogeneity in CFs and WMFs based on their age, considering the four indicators to be used in the earnings differential estimation equation. In the case of WMFs, information is also presented only for their members, and for both types of firms, workers under the age of 25 are excluded.

Figure 2. Evolution of various average intrafirm heterogeneity indicators by firm type and age (in months)



Source: Author's own elaboration based on BPS data.
Note Figure 2: The graphs display the average values for the last 12 months

As can be observed, the heterogeneity of CF workers increases with the firm‘s age, both in terms of earnings and the gender and age of the workers. Figure 2 also illustrates the evolution of these indicators for WMFs.[3] In addition to displaying less clear trends due

[3] Figure 2 displays a much less smooth evolution of WMF indicators when compared to the evolution of CF indicators. This is due to the significantly smaller number of WMFs created after 1996 (around 290 WMFs). This means that abrupt changes in one or a few firms can have a strong impact on the overall average of the WMFs. Additionally, this issue becomes more pronounced as the age of the firms increases because the trajectory of WMFs is censored, and as some WMFs

to a significantly smaller number of observations, we can observe that the trends are somewhat different. While the heterogeneity of worker age tends to increase, this is not the case for gender heterogeneity. However, earnings heterogeneity does exhibit a similar trend to CFs. It also increases but starts at much lower levels. While the earning Gini coefficient for CFs increases from less than 0.17 to just over 0.22 in the first 13 years of the firm's life, in the case of WMFs, it increases from just under 0.14 to 0.18. Now, when we focus on WMF members, the wage Gini coefficient goes from an average of 0.13 to 0.16. Lastly, educational heterogeneity (measured through the estimation of the fixed effect in a Mincer equation) shows a slight tendency to decrease.[4]

The trend of decreasing educational heterogeneity among WMF members with the age of the firm can be explained by the hypothesis of Hansmann (1996). As WMFs need to increase in size as they get older, WMF members may prefer greater homogeneity to keep collective decision-making costs low, which tend to increase with the number of members. This preference for homogeneity can lead to a reduction in educational heterogeneity among members over time.

However, it is necessary to consider other hypotheses if we want to explore possible explanations for the increase in wage dispersion in WMFs when the indicators of heterogeneity used do not increase or decrease. This phenomenon could be explained, in addition to the effect of unobserved variables, by the existence of a knowledge-based hierarchy, as proposed by Garicano & Rossi-Hansberg (2015). According to this hypothesis, the emergence of a hierarchical structure within a firm as it grows in size allows more highly qualified individuals to delegate tasks for which they are

close, the composition of firms used to calculate the averages changes. As previously mentioned, for the average of the first year of an WMF's life, information from nearly 290 firms is used. However, for the average of the thirteenth year of an WMF's life, data from fewer than 10 firms were used (the evolution of the number of firms used can be seen in Appendix Figure A1). This is because, for that year, only data from firms created in 1996 and that survived for 13 years can be used.

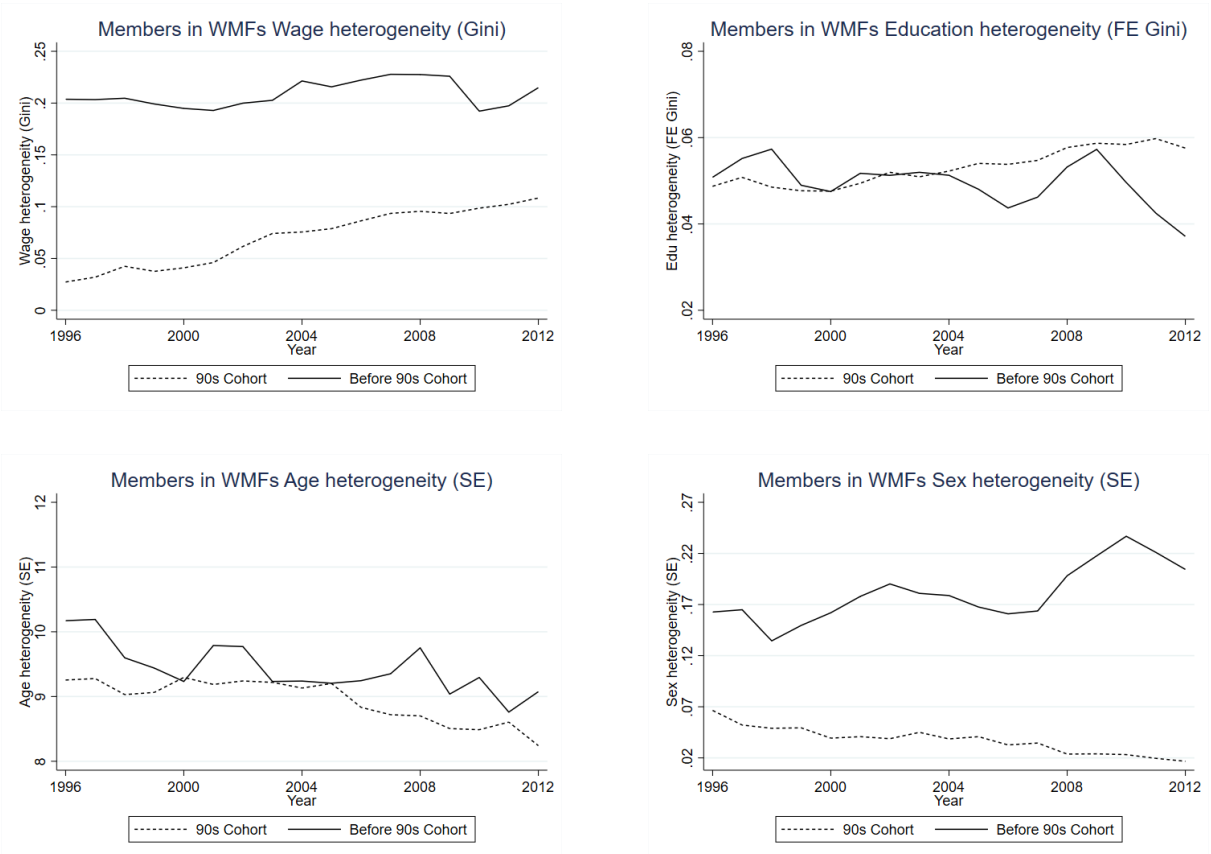
[4] The evolution of this indicator is not presented for CFs because the database only contains information about their workers while they remain in the sampled firms. Since there are no observations of their previous or subsequent jobs in non-sampled firms, it is not possible to estimate the fixed effect for them. Another database available is a sample of workers containing information about their entire work history, making it possible to estimate the fixed effect for each worker as long as they change jobs. However, being a sample of workers, it is not representative of firms. Estimating such an effect using this second database would yield biased results, overrepresenting larger firms.

overqualified, thus increasing their own productivity. But in the case of WMFs, an additional element needs to be considered.

One of the factors often cited as motivation for workers to join a WMF is ideological considerations (Abramitzky 2008; Burdín 2016). Those who join a WMF may desire a firm with a more egalitarian salary structure than what is observed in CFs. This ideological motivation may be particularly present among the founding members of WMFs, who face higher costs in establishing the firm (Burdín 2016). Furthermore, as mentioned earlier, more egalitarian WMFs may face a brain drain problem. These factors can lead to a change in the average preferences of WMFs for less internal equality as the composition of their members changes, and founding members start to work alongside new members. On the other hand, the difficulty of retaining and recruiting qualified workers may lead to an acceptance of greater wage dispersion over time, given a certain level of worker education.

The information presented in Figure 2 only includes firms created after April 1996 (the first month for which data is available in the database). WMFs created before this date could not be considered. However, for these firms, I do have data on their creation date. This allows to observe the average evolution for these firms by cohort. This information is presented in Figure 3. In this figure, you can see the evolution of the four heterogeneity indicators used by year and WMF cohort. Only two cohorts are used: those created before the 1990s and those created during the 1990s (but before April 1996).

Figure 3. Evolution of various average member heterogeneity indicators by year of WMF creation



Source: Author's own elaboration based on BPS data.
Note Figure 3: The graphs display annual averages.

As shown in Figure 3, the evolution of heterogeneity does not coincide for the three groups of WMFs: those created before 1990, those created between 1990 and 1996 (both in Figure 3), and those created after 1996 (Figure 2). Wage heterogeneity clearly increased for the WMFs created post-1996 and also for those created between 1990 and 1996. However, the situation is different for the WMFs created before 1990, where a relatively stable evolution is observed. This could be because wage dispersion had already increased in the past, and once it reached a certain level, it remained stable.

Another noteworthy aspect is the low level of wage Gini coefficient among WMFs created between 1990 and 1996 (ranging between 0.03 and 0.1). This result is strongly influenced by the fact that most WMFs created during this period were taxi firms. These are small firms with approximately 10 members, where almost all of them perform the same tasks (they are drivers) and receive very similar earnings.

When observing the evolution of educational heterogeneity among WMF members, it tends to increase for the 1990-96 cohort while decreasing for the pre-1990 cohort. A similar trend was also observed among post-1996 WMFs as they aged. However, when considering heterogeneity in the age of members, it decreases for both cohorts of WMFs created before 1996, while for those created after 1996, it tends to increase with the age of the firm (see Figure 2).

Lastly, gender heterogeneity among WMF members tends to increase for the pre-1990 cohort and decrease for the 1990-96 cohort. However, there was no clear trend based on the age of post-1996 WMFs.

These differences observed in the evolution of member heterogeneity among WMFs by their cohorts show that there is no global trend for the entire set of these firms. As seen in Table 1, the composition of WMFs by industry changed significantly during the study period. This suggests that the differing evolution by cohort is likely due to the different industry compositions of each cohort. In this case, the evolution of heterogeneity would likely depend on factors such as the technology or organizational structure that firms adopt in each industry.

If this is the case, none of the theoretical explanations outlined in the previous paragraphs to explain the results in Figure 2 would be the best explanation for the entire set of Uruguayan WMFs. In the best-case scenario, some hypotheses might be more suitable for explaining the behavior of one subgroup of WMFs, while others would be better suited to explain the results of another group of WMFs.

4.2. Earnings Differential Estimates

Following I present the results of the within-group estimation of the Mincer equation to study the impact of different levels of worker heterogeneity in WMFs on their earnings. The dependent variable is the logarithm of earnings, and a dummy variable identifying WMFs is included. This dummy variable is interacted with various indicators of worker or member heterogeneity within WMFs. Initially, in column 1 of Table 2, the earnings

differential experienced by workers in relation to those working in CFs is estimated. On average, workers experience a positive wage differential of 5.1% for being employed in a WMF.[5]

Next, in column 2, the Gini index of earnings for the workers in the firm where worker *i* is employed in month *t* is included as a measure of heterogeneity. However, the coefficient for this indicator is not statistically significant. Nevertheless, this estimation likely faces endogeneity issues since this indicator and the dependent variable are determined simultaneously. WMFs simultaneously determine the incomes their workers will receive. That's why, in column 3, the average Gini index during the first observed year of the firm for workers' earnings is used. This indicator has a positive effect on the earnings of WMF workers.

In column 4, the average standard deviation of worker ages within the firm and the proportion of women during the first observed year of the firm are also included. These effects are estimated for CF workers as well. In this case, it can be seen that intra-firm wage inequality does not have a significant effect on the wages of its workers, unlike WMFs. Regarding gender heterogeneity, the effect is negative for both types of firms, while age heterogeneity has a negative effect for CFs and a positive effect for WMFs.

From column 5 onwards, heterogeneity indicators are constructed using only the members of the WMF. In particular, the estimation in column 5 differs from column 3 only in this respect. This restriction is incorporated because the heterogeneity that is most relevant to consider is that of the decision-making group. In column 6, the Gini index of the first year for WMF members was constructed using a prediction of their earnings instead of current earnings. This prediction was made based on OLS estimates of their earnings in the periods they worked in CFs. The reason for using a prediction instead of current earnings is explained by the more equal earnings structure often found in WMFs, which means that their earnings dispersion does not adequately capture heterogeneity in worker productivities. The estimate in column 7 is the same as column 6, except that the earnings prediction was made using fixed effects. In column 8, the Gini index is constructed using fixed effects estimated in an earnings equation for workers

[5] This estimate is similar, albeit slightly higher than the one found in Burdín (2016).

over 25 years old during the periods they worked in CFs. It is considered that this is the best approximation that can be made for the heterogeneity in educational levels of WMF members. In column 9, only workers aged between 25 and 55 years are considered to reduce the chances that the effect of education in the estimation of equation 2 is not captured by the fixed effect. Equation 10 adds an interaction with the number of members the WMF had in its first year to consider the combined effect of heterogeneity and size. Column 11 additionally includes heterogeneity in age and gender.

In all the estimates conducted, the effect on the earnings differentials of WMFs or greater heterogeneity in qualifications or educational levels is positive. This effect also increases with the size of the firm, as shown in columns 10 and 11. Lastly, when heterogeneity indicators are constructed only for WMF members, the effect of greater diversity in age is positive, while the effect of greater gender diversity is negative.

The results shown in Table 2 display the average effects on wage differentials for workers. However, considering that WMF members make decisions democratically, it might be more relevant to understand the effects of heterogeneity indicators on the median worker. In cases where significant income inequality exists within WMFs, a positive effect of heterogeneity on the average could coexist with a negative effect for most members. This potential issue was ruled out, as all estimations from columns (1) to (11) in Table 2 were repeated using quantile estimations at the median, and qualitatively similar results were obtained as those shown in Table 2.[6]

[6] In order to perform quantile regressions with panel data, the method proposed by Canay (2011) was applied.

Table 2. WMFs' workers wage differentials

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
WMF	0.051	0.040	-0.106	-0.108	-0.089	-0.575	-0.234	-0.106	-0.073	-0.097	-0.269	
	(0.011)***	(0.020)**	(0.021)***	(0.054)**	(0.020)***	(0.028)***	(0.038)***	(0.037)***	(0.053)	(0.053)*	(0.080)***	
Wage Gini * WMF		0.056										
		(0.073)										
Initial Wage Gini				0.055								
				(0.047)								
Initial Wage Gini * WMF			0.952	1.078								
			(0.091)***	(0.118)***								
Initial Sex SD				-0.056								
				(0.013)***								
Initial Sex SD * WMF				-0.755								
				(0.064)***								
Initial Age SD				-0.007								
				(0.001)***								
Initial Age SD * WMF				0.017								
				(0.005)***								
WMF Members Initial Wage Gini					0.893							
					(0.090)***							
WMF Members Initial OLS Wage Estimate Gini						15.193						
						(0.622)***						
WMF Members Initial FE Wage Estimate Gini							3.165					
							(0.385)***					
WMF Members Initial FE Estimate Gini								1.877	1.697	1.035	-0.600	
								(0.433)***	(0.628)***	(0.619)*	(0.732)	
WMF Members FE Estimate Gini												2.515
												(1.05)**

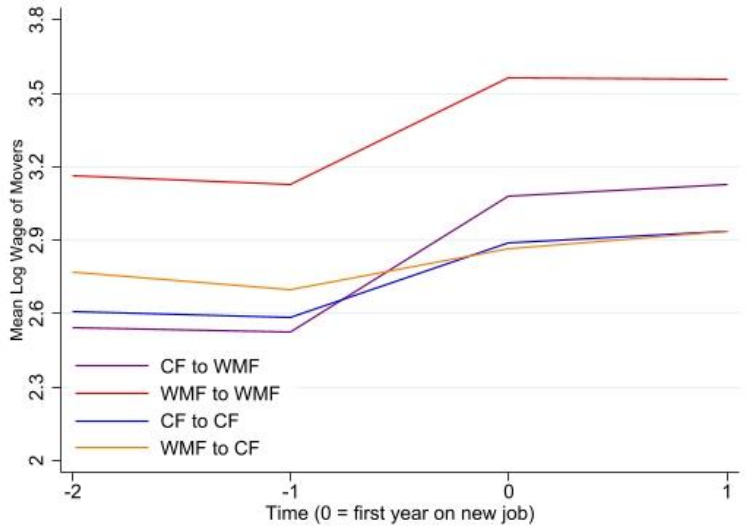
WMF Members Initial FE Estimate Gini * Initial Membership Size										0.006 (0.001)***	0.006 (0.001)***	
WMF Members Initial Sex SD											-0.141 (0.084)*	
WMF Members Sex SD												-0.915 (0.186)***
WMF Members Initial Age SD											0.036 (0.008)***	
WMF Members Age SD												0.034 (0.019)*
Observations	7,101,160	7,101,160	7,101,160	6,723,532	7,099,862	7,101,160	7,101,160	7,087,254	3,181,179	3,181,179	3,181,179	3,168,068
R-squared	0.193	0.193	0.194	0.192	0.194	0.196	0.194	0.193	0.185	0.186	0.187	0.163
Individuals	202,995	202,995	202,995	191,479	202,964	202,995	202,995	202,718	83,502	83,502	83,502	75,819
Age, Sex, Tenure and firms size controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Worker Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	No	No	No	No	No	No	No	No	No	No	No	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No

Note Table 2: The dependent variable is the natural logarithm of monthly earnings. The estimations in columns (9)-(11) exclude workers under 25 years of age and those over 55. All estimations include a set of 17 year dummies, 11 month dummies, and 9 industry dummies. Standard errors (in parentheses) are clustered at the individual level. *Significant at 10%; **Significant at 5%; ***Significant at 1%

The identification strategy for earnings differentials among WMF workers faces a potential endogeneity problem in the case that there might be some systematic difference between workers who switch from one type of firm to another and those who do not. In this case, the results could be biased. To address this potential problem, the strategy suggested by Card et al. (2013) was followed. First, a simple event study was conducted to analyze the effect of transitioning from one type of firm to another on workers' earnings. The results can be seen in Figure 4. For this estimation, only workers with at least 24 months of employment in the job they leave and at least another 24 months in the new job were considered. In Figure 4, it can be observed that, on average, all four groups of workers experienced an increase in earnings when switching jobs. This phenomenon is largely explained by the fact that 70% of transitions from CFs and 77% of transitions from WMFs were voluntary departures. Therefore, it is expected that these transitions occurred mostly with the anticipation of an increase in income.

The graph suggests that the different groups already had different salaries before the transition. For example, the average earnings of those who, while in a WMF, moved to an CF, are lower compared to those who moved to another WMF. Among those starting in CFs, there are differences as well, albeit smaller, with those moving to a WMF having lower earnings before the transition. In both cases, workers who move not only from one firm but also change the type of firm are those who had lower income before the transition, with those moving from a CF to a WMF experiencing the greatest increase. Taking into account that all groups, on average, experience an increase in income when changing firms, it is the intersection of the curves of those moving from a CF to a WMF and those moving from a WMF to a CF that would explain the presence of an earnings differential in favor of WMFs, as observed in the estimations in Table 2.

Figure 4. Switchers average earnings by movement, 1997-2013



Source: Own elaboration based on BPS data

Note Figure 4: The graph displays the average salary (in logarithms) observed from 1997 to 2013 for those who changed jobs and held both the previous and the subsequent job for at least 24 consecutive months. Employment refers to the worker-employer relationships that represent the majority of the worker's income.

Taken altogether, the roughly flat profiles before and after changing jobs suggest that the incomes of those who change firms can be adequately approximated by a combination of a permanent component per worker, a component per firm, and a residual component that varies over time and is uncorrelated with mobility. Therefore, secondly, we proceeded to use a specification of equation (1) that includes worker and firm fixed effects, which would provide an unbiased estimation of the earnings differential of WMFs. This estimation is presented in column (12) of Table 2. As can be observed, the results are not qualitatively different from the previous ones. A disadvantage of applying this method is that by including firm fixed effects, it is not possible to include in the model variables that are fixed over time for each firm. This is the case for the industry dummy variables, which identify WMFs, or the heterogeneity indicators used in the previous estimations. In the estimations in columns (3) to (11), the value of the average of the heterogeneity indicator for the first observed year of the WMF was used. Therefore, to incorporate firm fixed effects, the current values of these indicators had to be used in the estimation in column (12), increasing the potential problems of endogeneity arising from the simultaneous determination of income for WMF workers and their internal composition.

The results in Table 2 indicate that, on average, greater educational or age heterogeneity among the members of WMFs is associated with higher incomes. Conversely, the opposite appears to be true for gender heterogeneity. However, the average evolution of internal heterogeneity within WMFs observed in Figures 2 and 3 suggests that these results may differ depending on the industry in which these firms are located. To consider this possibility, the Mincer equation was estimated three times, similar to the one used in column 11 of Table 2. However, in this case, a different heterogeneity indicator was interacted each time with industry dummy variables. This allowed us to calculate the effect of member heterogeneity within WMFs on earnings differentials for their workers in each of the 9 industries considered. The results are shown in Table 3.

Table 3. Estimation of the Effect of Member Heterogeneity in WMFs on Wage Differentials by Industry

	(1) WMF Members Initial Gini of Estimated FE	(2) WMF Members Initial Age SD	(3) WMF Members Initial Sex SD
Manufacturing	-5.611 (0.822)***	-0.018 (0.010)*	-0.924 (0.094)***
Sanitation	0.836 (0.775)	0.034 (0.008)***	0.374 (0.111)***
Construction	-2.424 (3.662)	0.007 (0.022)	0.000 (0.000)
Retail Trade	-1.511 (1.660)	-0.015 (0.022)	-0.656 (0.599)
Transport	1.539 (0.768)**	0.043 (0.010)***	0.528 (0.226)**
Low qualified work services	-0.780 (0.842)	0.019 (0.008)**	-0.054 (0.107)
Education	1.333 (1.423)	0.024 (0.011)**	0.168 (0.223)
Health	-2.602 (1.508)*	0.010 (0.023)	-0.252 (0.306)
High qualified work services	-6.946 (1.557)***	-0.028 (0.014)*	-0.562 (0.217)***
Individuals	83,502	83,502	83,502
Observations	3,181,179	3,181,179	3,181,179

Notes for Table 3: The dependent variable is the natural logarithm of monthly wage. The table displays estimates of the coefficients of industry dummy variables interacted with the heterogeneity indicators in each column. The estimates exclude workers under 25 years old and over 55 years old. All estimates include the following covariates: WMF dummy, age and age squared, and their interaction with the gender dummy; seniority and seniority squared; firm size; and a set of 17 year dummies, 11 month dummies, and 9 industry dummies. Standard errors (in parentheses) are clustered at the individual level. *Significant at 10%; **Significant at 5%; ***Significant at 1%.

For each of the heterogeneity indicators used (education, age, and gender), their impacts on wage differentials vary by industry. Educational heterogeneity appears to have a negative effect on earnings in WMFs in Manufacturing, Health, and Other High Qualified Services, while it would have a positive effect on wages in Transport WMFs. For other industries, the coefficients were not significantly different from zero. A similar diversity is observed when considering age heterogeneity. Its effect is negative for two of the industries considered, while it is positive for four others. Lastly, when considering gender heterogeneity, its effect is, on average, negative for WMFs in two industries, while it is positive for two others.

According to these results, it would be hasty to claim that higher or lower heterogeneity among WMF members will have a positive or negative impact on their earnings as a whole. The fact that this impact depends on the industry suggests that the type of technology used in each sector, which, in turn, conditions the organizational structure of the firm, leads to varying impacts of member heterogeneity for WMFs.

4.3. Semiparametric duration analysis

Next, a duration analysis is conducted to assess whether the distance in characteristics of each worker from the predominant characteristics in the WMF makes it more likely for them to leave the firm. For this purpose, workers are divided into terciles or thirds of the variables that represent heterogeneity (education and age). Workers in the first and third terciles are those who deviate the most from the median characteristics. If the process of workers leaving a WMF contributes to greater internal homogeneity, workers in the second tercile should have a lower probability of leaving the firm. The opposite would occur if the exit process favored greater heterogeneity.

As mentioned earlier, one of the disadvantages of conducting duration analysis using only survival functions is that control variables cannot be included. To address this limitation, this section presents semi-parametric Cox (1972) proportional hazard estimates. The primary advantage of this method is that it allows for estimating the relationship between the hazard rate and the explanatory variables without making any assumptions about the functional form of the baseline hazard function.

Survival functions or semi-parametric Cox estimations for all workers in the WMF could be estimated. However, the evidence of diverse behavior by the WMF depending on the industry leads to the conclusion that a combined study of this type would be of lesser utility. Therefore, a duration analysis was conducted for two selected industries: Manufacturing and Transport. In these two industries, significant impacts of heterogeneity (whether in education, age, or gender) on the earnings of their members were observed. Additionally, the impacts were of opposite signs. While the estimated coefficients for the Manufacturing industry in Table 3 show negative signs, the opposite is true for the WMF in Transport. Another crucial characteristic of these two industries is that they are the only ones that accumulate an acceptable number of failure events in the database enough to perform the analysis.

Table 4 presents the results for WMF workers in Manufacturing. In the estimates shown in columns (1) to (3), the failure event used is the voluntary departure of WMF members. In columns (1) to (6), a coefficient with a positive sign would indicate that the higher relative departure of that group of workers would favor the firm becoming more homogeneous. The opposite would occur if the coefficients have a negative sign. Column (1) includes only variables that capture differences in education level. As can be seen, the estimation of these coefficients is only significant for less educated workers, who would have a lower probability of leaving the firm than the other two groups, thus helping the firm become more heterogeneous. In columns (2) and (3), the same estimation is performed, but includes variables that capture the different ages of the members. Additionally, to study the behavior of WMFs regarding gender heterogeneity, separate estimations are performed for WMFs with a majority of women (column 2) and with a majority of men (column 3). In both cases, a dummy variable is included, which takes the value 1 when the member is not of the predominant gender in the WMF.

For WMFs whose members are predominantly women (column 2), both younger and older workers would have a higher probability of leaving the firm, making the WMF relatively more homogeneous. In these firms, male members would also have a higher probability of quitting, contributing to greater homogeneity. However, these results are not replicated for WMFs with a majority of male members (column 3). For these firms, only less educated workers would have a higher probability of leaving the WMF. The process of voluntary departures in this case would also help these WMFs become more

heterogeneous. The fact that different results are observed in WMFs depending on whether they are mostly composed of men or women suggests once again that the results vary depending on the industries in which these firms are producing. Since, in the Manufacturing industry, as well as in other sectors of the economy, workers' job placement by industry has a strong gender bias. In the case of the data used for these estimates, it turns out that WMFs in the Manufacturing industry were placed in 36 sectors using the 5-digit ISIC classification. Of these, in 11 sectors, all WMFs are predominantly female, in 21, all WMFs are predominantly male, and only in 4 sectors do predominantly male and predominantly female WMFs coexist.

In the cases of the voluntary departures just discussed, the decision of who leaves the firm is not in the hands of the WMF. That's why, to get a better approximation of the members' preferences regarding the heterogeneity of their firm, it is more relevant to observe non-voluntary departures. In Uruguay, the expulsion of a member must be approved by the majority of the general assembly of the WMF. Therefore, this type of departure better reflects the preferences of its members. The semi-parametric Cox estimations for non-voluntary exits in Manufacturing WMFs are shown in columns (4) to (6) of Table 4.

As with voluntary exits, when considering all Manufacturing WMFs, the process of involuntary exits does not seem to be affected by the educational level of its members (column 4). However, when estimating this separately for WMFs based on whether the majority of the members are male or female, it is observed that in WMFs with a majority of male members, less educated workers are more likely to be expelled, making these firms more homogeneous.

Table 4. Semiparametric Cox estimate for manufacturing WMF workers.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Voluntarily exits			Non-voluntarily exits			Status change		
Low Education ($\widehat{FE}$)	-0.285	-0.264	-0.538	0.665	0.653	2.247	0.569	-0.0463	1.404
	(0.168)*	(0.194)	(0.395)	(0.565)	(0.918)	(0.750)***	(0.333)*	(0.464)	(0.483)***
High Education ($\widehat{FE}$)	0.0495	0.0469	-0.162	-0.115	0.0134	-0.664	0.392	-0.181	-0.159
	(0.131)	(0.156)	(0.274)	(0.380)	(0.436)	(1.339)	(0.232)*	(0.185)	(0.400)
Young		0.352	0.330		0.176	0.372		1.037	2.149
		(0.124)***	(0.204)		(0.272)	(0.340)		(0.270)***	(0.371)***
Old		0.334	0.582		0.549	0.0127		0.858	1.308
		(0.151)**	(0.267)**		(0.366)	(0.556)		(0.327)***	(0.490)***
Man in a Female WMF		0.331			0.190			-0.345	
		(0.174)*			(0.268)			(0.224)	
Woman in a Male WMF			0.114			0.388			0.122
			(0.247)			(0.476)			(0.452)
Controls by Industry, Cohort and Size	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Subjects	868	533	335	868	533	335	556	320	236
Failures	460	339	121	108	79	29	136	84	52
Observations	27,080	13,907	13,173	27,080	13,907	13,173	9,602	4,999	4,603

Notes Table 4: Cox proportional hazard models stratified by firm. "Low Education ($\widehat{FE}$)" is a dummy variable that equals one when the worker belongs to the lower third of educational attainment within the firm. "High Education ($\widehat{FE}$)" is a dummy variable that equals one when the worker belongs to the top third of educational attainment within the firm. "Young" is a dummy variable that equals one when the worker belongs to the youngest third of employees within the firm. "Old" is a dummy variable that equals one when the worker belongs to the oldest third of employees within the firm. "Man in a Female WMF" is a dummy variable that equals one when the worker is male. This variable is only used in the estimations of columns 2, 5, and 8, where only WMFs with a female majority are considered. "Woman in a Male WMF" is a dummy variable that equals one when the worker is female. This variable is only used in the estimations of columns 3, 6, and 9, where only WMFs with a male majority are considered. Standard errors, adjusted for clustering at the worker level, are shown in parentheses. *Significant at 10%; **Significant at 5%; ***Significant at 1%.

In third place, semi-parametric Cox estimations were carried out, considering only salaried workers within WMFs, and the event of failure was defined as their change in status from salaried worker to member or owner of the firm. These estimations are presented in columns (7) to (9) and follow the same rationale as the previous analyses. The process of changing the status of salaried workers is also of particular interest for understanding the preferences of WMF members regarding the heterogeneity within their firms. Just like non-voluntary exits, the inclusion of a worker as a cooperative member must be approved by the majority of the general assembly. In these cases, as status changes involve the entry of new members, positive coefficients would indicate that a higher relative entry of that group of workers would favor an increase in the heterogeneity of the firm. Conversely, negative coefficients would suggest the opposite.

In this case, it is observed that both the least and most educated workers are more likely to become members (column 7), contributing to making the cooperative more heterogeneous. However, this result seems to be explained primarily by majority-male WMFs. In these WMFs, less-educated workers are 4.1 times more likely to become members compared to workers in the "middle third." These are firms for which we have just seen that it was also more likely that someone from this same group of workers would be expelled. Both results combined suggest that there is no systematic intention among the majority of members in these WMFs to make their firms more or less heterogeneous in terms of education levels.

When considering the age of the workers, it is observed that, for the whole group of cooperatives, both younger and older workers are more likely to become members, contributing to making the WMF more heterogeneous. This result may be surprising, especially considering that age heterogeneity in Manufacturing WMFs as a whole would have a negative impact on the incomes of their members (see Table 3).

Table 5 presents the results of the semiparametric Cox estimation for workers in Transport WMFs. Among these firms, there are none that are predominantly female. Therefore, the overall results correspond entirely to predominantly male cooperatives.

For these firms, it is observed that women are less likely to leave the firm, thereby contributing to greater gender heterogeneity. The same is true for non-voluntary departures, whereas in the case of status changes, the gender coefficient is not significant. This result would indicate that the departure processes in Transport WMFs help make these firms more gender-heterogeneous.

Regarding educational levels, less educated workers are more likely to become members, which would also help make the firm more heterogeneous. However, the process of non-voluntary exits would contribute to making these firms more homogeneous, as workers with higher educational levels are more likely to be expelled. Once again, in this case, there is no systematic behavior observed on the part of the firm to make it more or less heterogeneous.

Lastly, with regard to age heterogeneity, two results in opposite directions are observed. On one hand, both younger and older workers are more likely to be expelled, while they also have a higher chance of becoming members. However, the coefficients in the case of status changes are larger than those estimated for involuntary departures. Moreover, among the transport cooperatives, there were 399 status changes and only 44 involuntary departures. Therefore, the heterogenizing effect of the status change processes seems to dominate the homogenizing effect of non-voluntary departures. Once again, these diverse results do not align with the a priori expectation considering that heterogeneity in the three studied dimensions have positive effects on the earnings of their members (see Table 3).

Table 5. Semiparametric Cox estimate for transport WMF workers.

	(1)	(2)	(3)	(4)	(5)	(6)
	Voluntarily exits		Non-voluntarily exits		Status change	
Low Education ($\widehat{FE}$)	0.00984	-0.0540	0.204	-0.0898	0.612	0.787
	(0.241)	(0.253)	(1.251)	(1.857)	(0.273)**	(0.391)**
High Education ($\widehat{FE}$)	-0.0171	-0.0263	1.620	1.423	-0.753	-0.461
	(0.253)	(0.255)	(0.646)**	(0.680)**	(0.497)	(0.418)
Young		0.196		0.706		3.496
		(0.117)*		(0.410)*		(0.169)***
Old		0.373		1.794		2.298
		(0.222)*		(0.898)**		(0.498)***
Woman in a Male WMF		-0.558		-1.578		-0.156
		(0.259)**		(0.757)**		(0.221)
Controls by Industry, Cohort and Size	Yes	Yes	Yes	Yes	Yes	Yes
Subjects	1,524	1,513	1,524	1,513	1,118	1,111
Failures	406	404	44	44	339	399
Observations	80,189	79,836	80,189	79,836	19,258	19,161

Notes Table 5: Cox proportional hazard models stratified by firm. "Low Education ($\widehat{FE}$)" is a dummy variable that equals one when the worker belongs to the lower third of educational attainment within the firm. "High Education ($\widehat{FE}$)" is a dummy variable that equals one when the worker belongs to the top third of educational attainment within the firm. "Young" is a dummy variable that equals one when the worker belongs to the youngest third of employees within the firm. "Old" is a dummy variable that equals one when the worker belongs to the oldest third of employees within the firm. "Woman in a Male WMF" is a dummy variable that equals one when the worker is female. Standard errors, adjusted for clustering at the worker level, are shown in parentheses. *Significant at 10%; **Significant at 5%; ***Significant at 1%.

The results in Table 5 for transport WMFs, similar to what was observed for Manufacturing coops, also do not seem to show a systematic behavior on the part of firms favoring greater or lesser internal heterogeneity within cooperatives.

Some limitations of the results just presented could arise from potential issues with the data when capturing non-voluntary departures of WMF members. Social security records for WMFs could register as a dismissal something that is actually a voluntary or partially voluntary departure. This could be the case if a worker, dissatisfied with their employment in the WMF, attempts to provoke dismissal by modifying their performance or relationship with others in a way that leads other members to opt for termination. It could also happen that the data captures cases of an agreed departure with the firm but is registered as a dismissal so that the worker can receive unemployment benefits. However, it is expected that this type of practice would have limited scope, as WMFs (like CFs) have to pay the corresponding severance pay every time they record a worker's exit as a dismissal.

Another limitation, as previously noted, is that the consideration of voluntary and non-voluntary exits, as well as changes in status, does not allow us to see the entire picture of entry and exit processes in WMFs. We have not been able to analyze the inclusion of new members who do not go through a previous period as salaried employees (478 cases in the Manufacturing Industry and 1830 cases in Transportation). This limitation prevents us from assessing whether the net effect, when taking into account all entries and exits from the firm, makes it more or less heterogeneous.

5. Final comments

This article examines the extent and effects of heterogeneity in WMFs. The analysis yields three main results. First, on average WMFs display higher levels of homogeneity among their workers compared to what is observed in CFs. This homogeneity is even more pronounced among WMF members. However, there is significant diversity among WMFs, both in terms of internal homogeneity levels and their evolution. While CFs tend to become more heterogeneous as they age, different WMF groups exhibit varying evolutions depending on the cohort and industry.

Second, for the average WMF worker, a positive wage differential is observed concerning the income they would earn in a CF. Heterogeneity in educational levels and ages of WMF members has a positive impact on these differentials (gender heterogeneity did not have significant effects). However, this effect is not consistent across all WMFs. For some industries, such as Manufacturing, the effect of member heterogeneity on income differentials was negative. Conversely, for workers in Transport, the opposite occurred. The evidence found is inconsistent with the hypothesis Hansmann (1996), which suggests that member heterogeneity in WMFs not only would always have negative effects on their performance but that these effects would be of such magnitude that they would become the main reason for the low presence of WMFs in today's economies. The results indicate that member heterogeneity can have negative effects on their earnings in some cases, but not in all cases. If there are WMFs for which heterogeneity has positive effects, Hansmann's catastrophic prediction may not be fulfilled. Reality seems to be more complex. The impacts of member heterogeneity on the performance of WMFs are

diverse and appear to depend on the different technologies and organizational structures that these firms adopt.

Third, there is no evidence that non-voluntary exit processes, as well as changes in status (which require WMF approval), systematically contribute to making cooperatives more or less homogeneous. Even for the transport WMFs, where member heterogeneity on average has positive effects on their incomes, it is not observed that the processes of status changes or non-voluntary exits are used to make the firm more heterogeneous. Either other issues are considered more relevant by the majority of their members when deciding on the composition of the firm, or the estimated averages do not capture the diversity among the firms within these industries.

Once it is concluded that member heterogeneity can have various impacts on the performance of WMFs, it becomes particularly important to understand what determines whether this impact can be positive or negative. Analyzing the determinants of why heterogeneity can be positive for cooperatives is beyond the scope and possibilities of this work. However, it is of paramount importance to know if some of these determinants are under the control of the firms and can therefore be altered by the cooperatives. Or if, on the contrary, they are beyond the control of WMFs and depend on aspects such as the technology used in each industry. On the other hand, it is necessary to assess the impact of heterogeneity using better indicators of firm performance. In this work, the earnings differential experienced by its workers has been used, but it would be more convenient to analyze the impact on the productivity of cooperatives. Evidence from other studies suggests that the performance of WMFs is similar (or even better) than that of CFs (Craig et al. 1995; Fakhfakh, Pérotin, and Gago 2012; Pencavel 2013; Montero 2022).[7] According to Young-Hyman, Magne, and Kruse (2022), these positive differences in favor of WMFs occur mainly in knowledge-intensive industries. However, there are still no studies directly analyzing the impact of member heterogeneity on the productivity of WMFs. New research is needed to understand how technology and the organizational structure of WMFs interact with member heterogeneity and how this affects their performance.

[7] For a review of the differences in productivity between WMFs and CFs, see Dow (2018).

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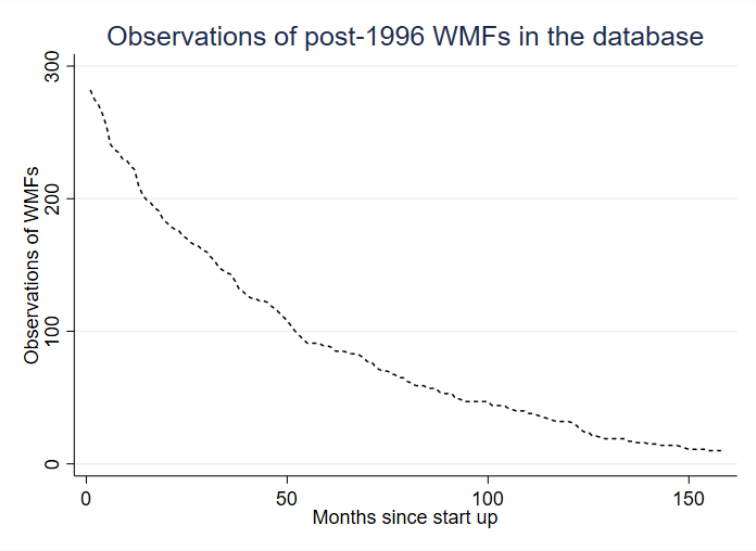
Appendix

Figure A1. Number of observations of WMFs created after 1996 by age (in months)



Source: Own elaboration based on BPS data