Gender and Ethnic pay inequality in academia: a formal system dynamics model

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Abstract

Intersectional pay gaps, meaning pay gaps based on gender and ethnic background, continue to exist in academia. White upper class men earn higher wages in the same positions than women and people with an ethnic minority background. This papers builds a formal system dynamics based upon a literature review of papers on intersectional inequality in organizations. The basis structure of the formal model consists of the average wages of white upper class men and the outgroup and on the human capital of these groups. Feedback processes explain how present pay gaps normalize acceptance of higher wage claims of the ingroup over the outgroup. Calibration of the formal model based upon anonymized pay gap data of a Dutch university, shows that higher claims of the ingroup of white upper class men and small differences in acceptance of wage claims of the ingroups over the outgroups explain persistent pay gaps. Despite larger investments in the human capital of the outgroup, intersectional pay gaps continue to exist for the higher academic positions.

Introduction

Considerable intersectional pay gaps continue to exist in academia throughout the European Union (Croxford, 2018; Dubois-Shaik & Fusulier, 2016). For example, ethnic minority academics at top universities in the UK have 26% lower wages than white colleagues (Trump, 2018); similarly, white women on average receive 15% lower wages than white men, while

Asian women receive 22% lower wages, and black women 39% lower wages (Croxford, 2018). The most severe pay gaps exists between white men and ethnic minority women in the same academic positions, which indicates co-occurrence of gender and ethnic pay inequalities. We need to further explore the interlinkage between multiple inequalities in organizations to understand their co-occurrence and persistence (Bapuji, Ertug & Shaw, 2020) and this paper does do so pay using a system dynamics perspective on intersectional pay inequalities.

This paper aims to improve the understanding of the feedback of intersectional pay gaps by presenting and calibrating a formal system dynamics model of pay inequality. Using the concept of feedback, derived from system dynamics (SD) theory (Forrester, 1987, 1992; Sterman, 2000) to analyse the phenomenon of intersecting inequalities in organizations (Amis et al., 2020), increases the theoretical understanding of the perseverance and complexity of inequalities. There is increasing recognition that inequalities in organizations are explained by structural mechanisms rather than individual causes and that we need new theories to understand the complex and multifarious relationships between intersecting inequalities and organizations (Bapuji et. al., 2020). The theoretical challenge is understanding how these structural mechanisms actually work: we need to conceptualize systems that create, sustain and change organizational inequalities (Amis et al., 2020). First a formal system dynamics model of the intersectional pay gaps is build, based on a literature review on wage inequality in organization studies. Second this formal model is calibrated against the reference mode of behaviour of pay inequality in a Dutch university.

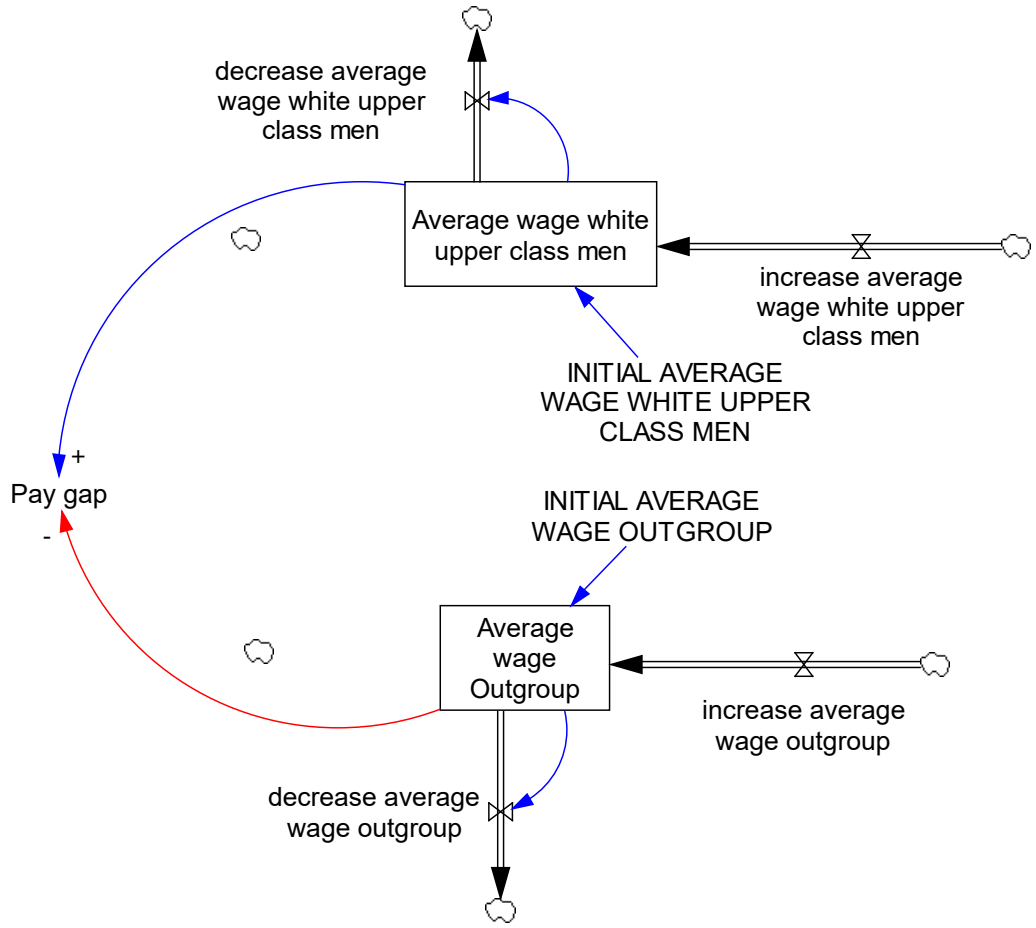
Theory and formal model

Intersecting inequalities in remuneration

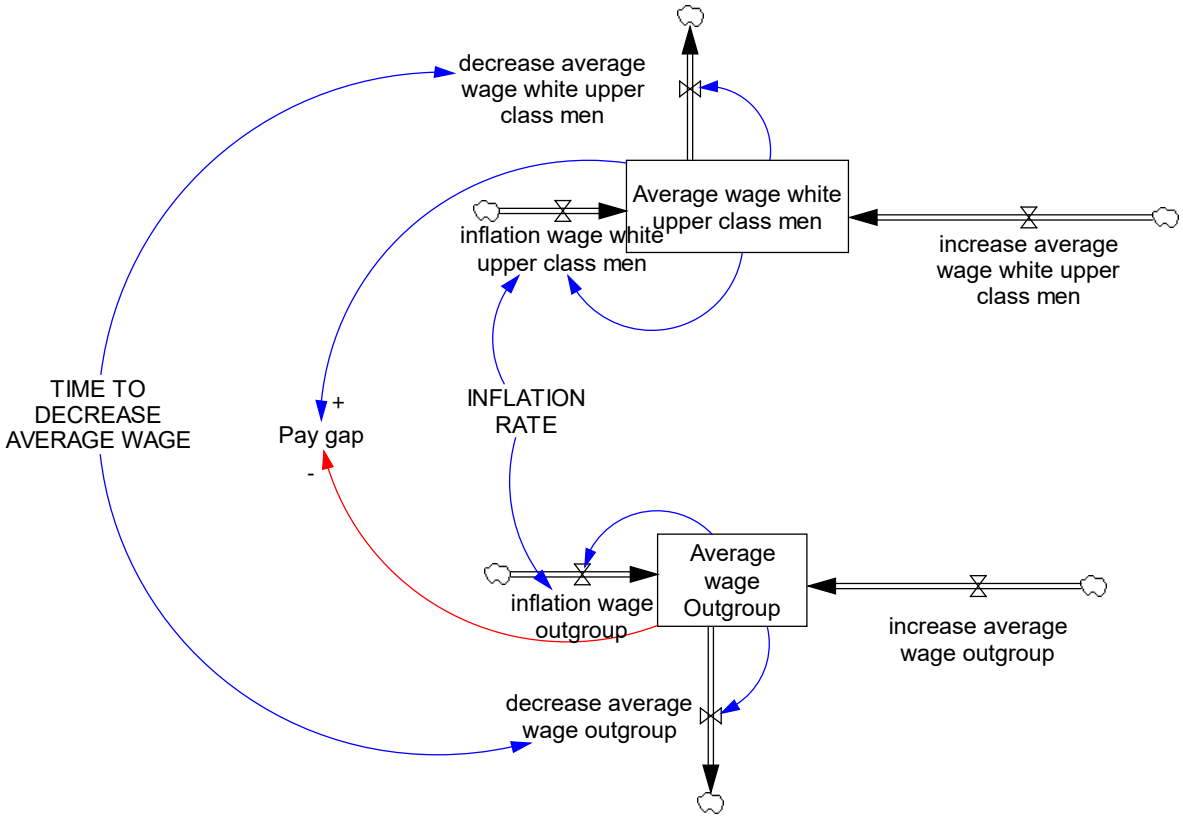
The concept of intersectional pay-gap refers to the unequal distribution of wage across different demographical groups. The term *intersectionality* was coined by Kimberly Crenshaw (1989) to explain how labour market disadvantages based on gender intersect with disadvanteges based on race in explaining discrimination of black women. Crenshaw's work marked a theoretical jump forward in conceptualizing privilege and disadvantage as based on complex intersections of categories rather than as based on mutually exclusive social categories. In the last two decades, the term intersectionality has been used in organisation studies to understand inequalities in organisation based upon the intersection of gender and race with social categories such as class, age, sexual idenity, ability and religion (Bendl et al., 2015; Holvino, 2010). A literature review on intersectional inequalities in organizations (Bleijenbergh and Ambaum, 2020), suggests the attribution of wage is connected to privilege of the ingroup and the disadvantege of the outgroup. Empirical research shows that white upper class men as a demographic category receive more wage for the same jobs than individuals from different social categories (Avent-Holt and Tomaskovic-Devey, 2014). In the following paragraph I will explain how this can be translated into a formal model.

White upper class men and outgroups

A formal model of intersectional pay-gaps start with dividing between the averages wages of the ingroup, white upper class men, and the outgroup, consisting of women, lower classes and people of color. As intersectional pay gaps have been persistent over time (Bapuji et al., 2020), we assume that the initial average wage of the ingroup, white upper class men, has a higher value than that of the outgroup. This structure of two stocks forms the basis of the formal model.



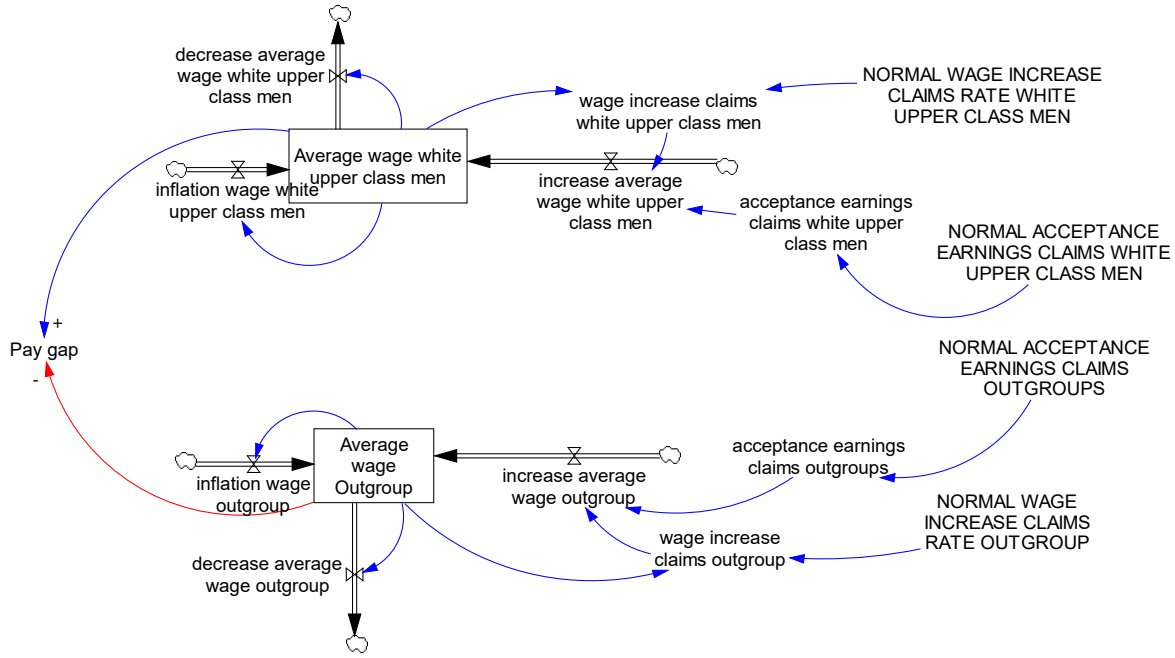
We assume that wages are influenced by inflation as well. Therefor we add an inflation rate of 5% on a yearly base and we put the time to decrease the average wage on 0, assuming a neutral influence of time on average wages except for inflation.



Earnings claims and acceptance of earnings claims

For extending the model, we move to the set of variables that influence the increase of average wages. According to Avent-Holt and Tomaskovic-Devey (2014) the attribution of wages is based upon the question whether employees claim certain earning and whether organizational decision maker accept such claim. Therefore, we added wage increase claims of white upper class men and wage increase claims of outgroups as variables. We also added acceptance of earnings claims of white upper class men and acceptance of earnings claims of outgroups. According to literature (Avent-Holt and Tomaskovic-Devey, 2014**;** Trump, 2018; Shin, 2009), employees can initiate earnings claims at various moments during employment, like during the hiring process, at the moment of a promotion or based on perceived job performance. Whether organizational decision-makers accept earnings claims is based, among others, on human

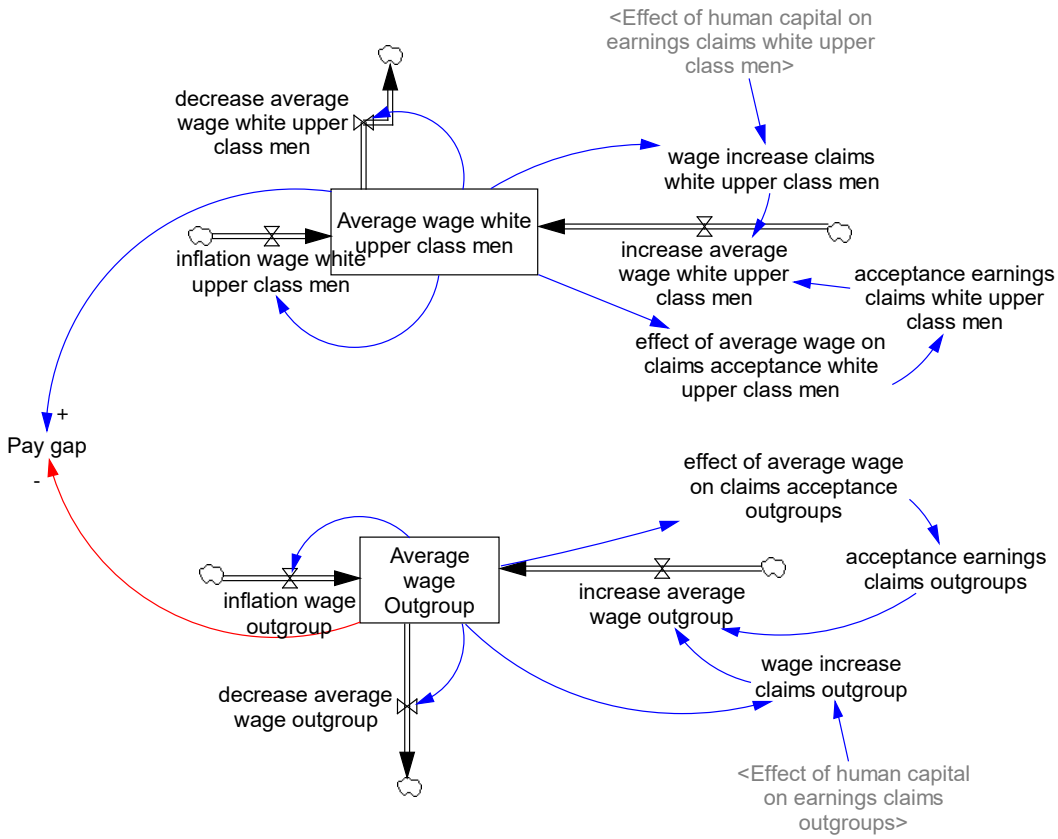
capital and on the norm regarding wage distribution and income regulations (Avent-Holt and Tomaskovic-Devey, 2014**;** Trump, 2018; Shin, 2009). We will discuss human capital in the next two paragraphs. The norms regarding wage distribution are translate in four variables that indicate the normal wage increase claims of white upper class men and the normal wage increase claims of outgroups and the normal acceptance of earnings claims of white upper class men and the normal acceptance of earnings claims of outgroups.



The effect of average wage on claims acceptance

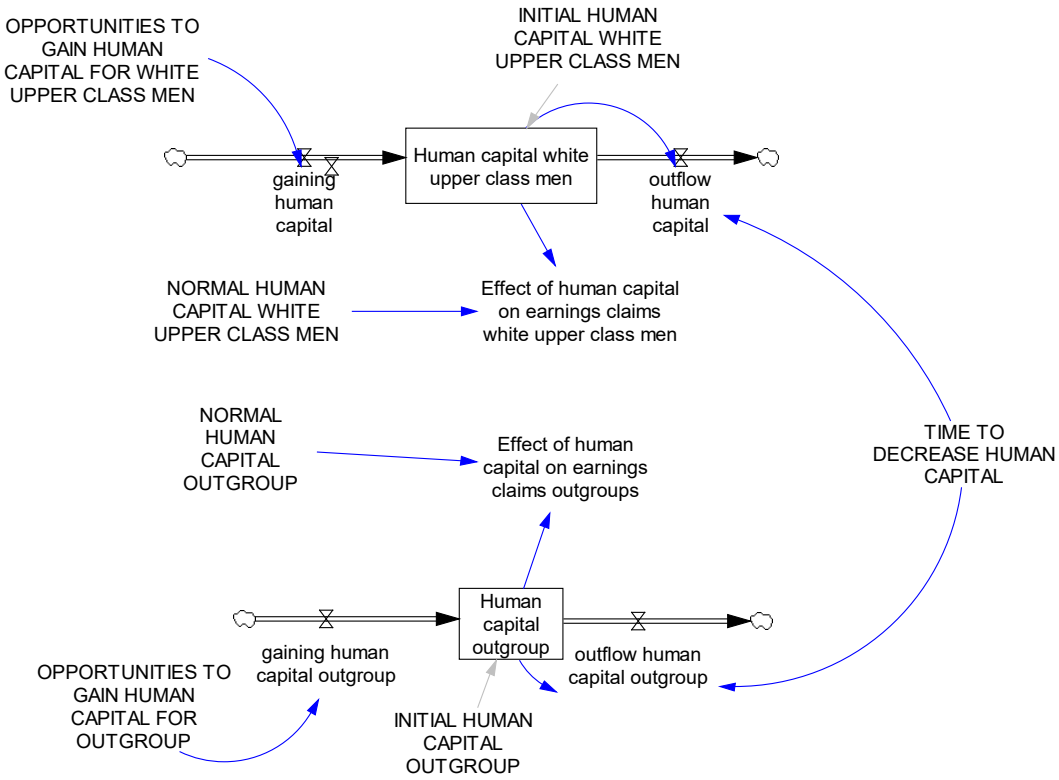
In understanding the acceptance of earnings claims of the different groups, a reinforcing feedback loop is introduced. At the moment, white upper class men earn relatively more wage for the same job (Laurison & Friedman, 2016; Trump, 2018). This increases belief that wage inequality is legitimate establishes it as a norm (Gray & Kish-Gephart, 2013). Literature shows that society is more acceptant towards pay-gaps in general as the pay-gap becomes bigger (Trump, 2018). Moreover, decisionmakers are more likely to accept wage claims from white, upper class men as they fit the image of deserving a high reward for their job. This is a

reinforcing loop. The pay gap is reinforced at the organisational level. White upper class men are the primary decision makers in attributing wage, which leads to a biased judgement of the ingroup's performance and how it is valued (Markus, 2017**;** Ridgeway and Correll, 2004). The wage claims of white upper class men wage are more easily accepted than the claims of the ougroup. Both feedback loops represents how decision makers' bias is fuelled by existing average wages and eventually fuels the paygap itself. This also works the other way around. Once intersectional pay gaps become smaller, the outgroup will be viewed as more or equally compentent and performance is more likely to be valued based on merits instead of categories (Sliwa and Johansson, 2014; Markus, 2017).



The effect of human capital on wage acceptance

The acceptance of earnings claims is not only influenced by the average wage of different groups, but also by their human capital (Avent-Holt and Tomaskovic-Devey, 2014). In this model, human capital refers to the skills, education and experience of the employee. The more human capital people have, the more likely that decision makers accept earnings claims of these groups. White upper class men have more access to sources of human capital as a higher wage increases this access (Laurison and Friedman, 2016). To illustrate, in general white upper class men have enjoyed highly regarded education (Castro and Holvino, 2016). In this model, two feedback loops indicate that the wages of white upper class men and of the outgroup reinforce the access to sources of human capital that justify earnings claims, which may reinforce the pay gap between these groups. This may lead to the outgroup having less opportunities to gain human capital, which ultimately results in this group having less human capital to make decision makers accept their wage claims.



Calibrating the model

This formal system dynamics model was calibrated based on data from an anonymous Dutch university (see Annex 2). The initial assumptions were the wage differences between male lecturers (representing the white, male upper class men) and the female lecturers (representing the outgroup). Initial human capital was set at 99 for white upper class men and at 101 for the outgroup, assuming more human capital was needed for the outgroup to qualify for this position. The normal human capital was set at 100 for both groups and the acceptance claims were set at 0,0017% for both groups. The normal acceptance of earnings claims of white upper class men was set at 0,51, while the normal acceptance of earnings claims of the outgroup was set at 0,49, representing small differences in acceptance rates based upon the present overrepresentation of white upper class men in decision-making positions. We assume human capital decreases very slowly, over a thirty years' time period, setting it at 360 months. We set time to decrease average wage at zero and inflation rate at 5%. The presence of schooling opportunities for underrepresented groups, made us put the opportunities to gain human capital at 1,0 for white upper class men and at 1,2 for the outgroup.

Calibration was done through the solver function in excel, putting the square of the gap between the wages of the white upper class men and of the outgroup as the target variable and the variables above as the variables that can be optimized to predict the actual changes in the values. Optimization was done for the different function levels researcher, lecturer, assistant professor, associate professor and full professor. The results are to be found in the Annex 3. The results show that the intersectional pay gaps show goal seeking decline in the function levels of lecturer (Table 1) and goal seeking increase in the function levels of researcher, assistant professor and full professor (Table 2, 4 and 5). Only the associate professor function leave shows a more linear decline (Table 3). The differences between the function of lecturer and the research oriented function levels of researcher, assistant and full professor may be

explained by outgroup candidates dominating the education oriented functions and so becoming the norm employees. The decline in the associate professor pay gaps maybe explained by the overrepresentation of highly qualified members of outgroups in this function level.

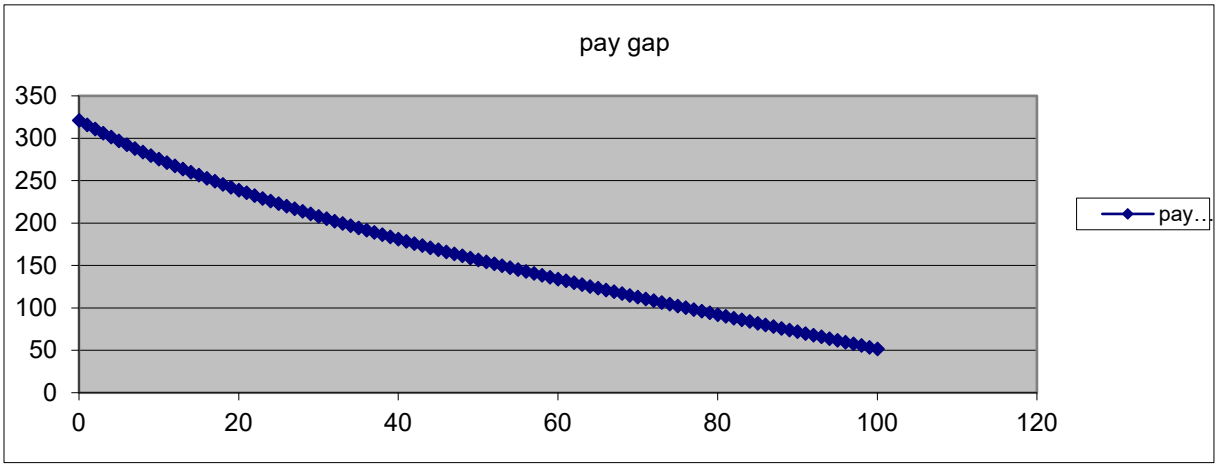


Table 1: intersectional pay gap of lecturers over time

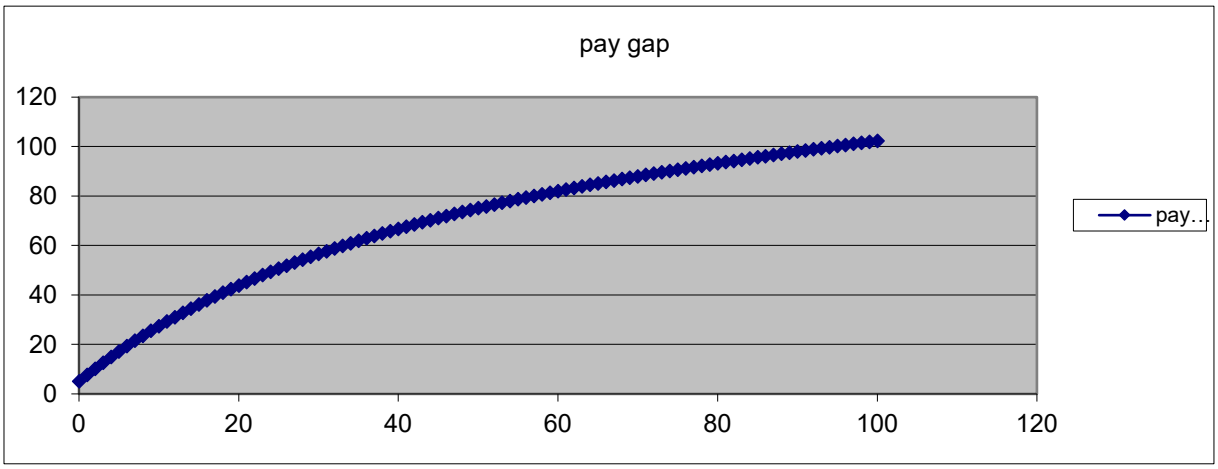


Table 2: intersectional pay gaps of researchers over time

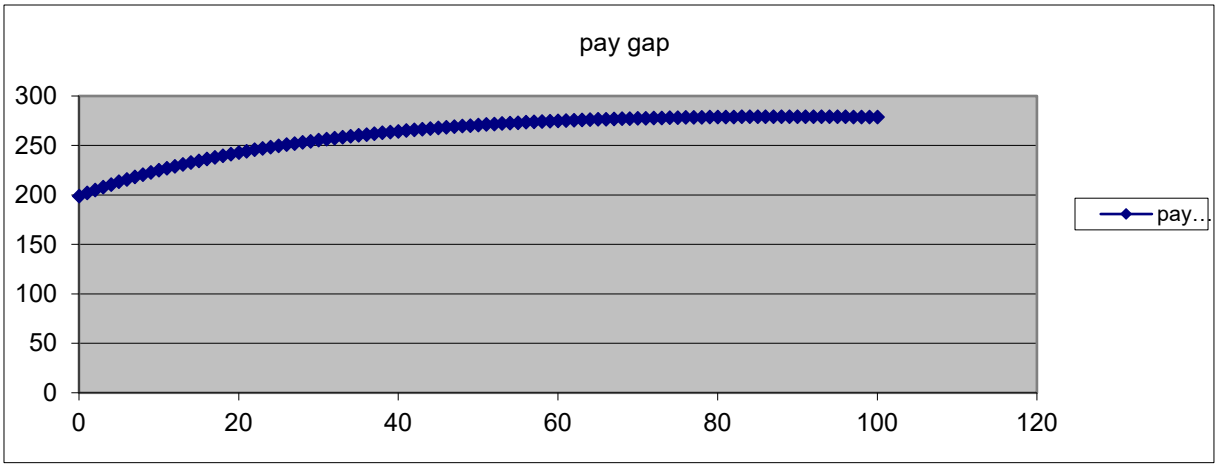


Table 3: intersectional pay gaps of assistant professors over time

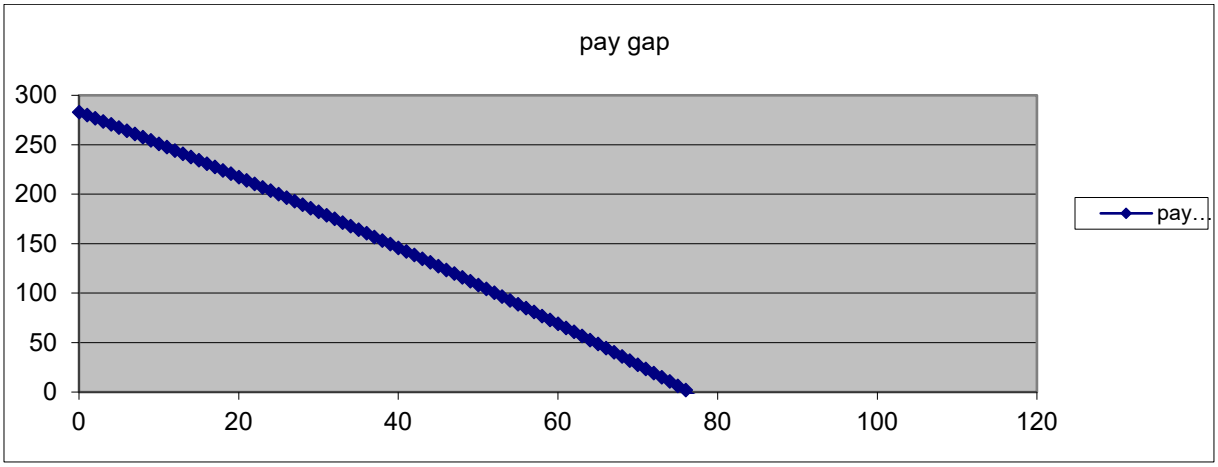


Table 4: intersectional pay gaps of associate professors over time

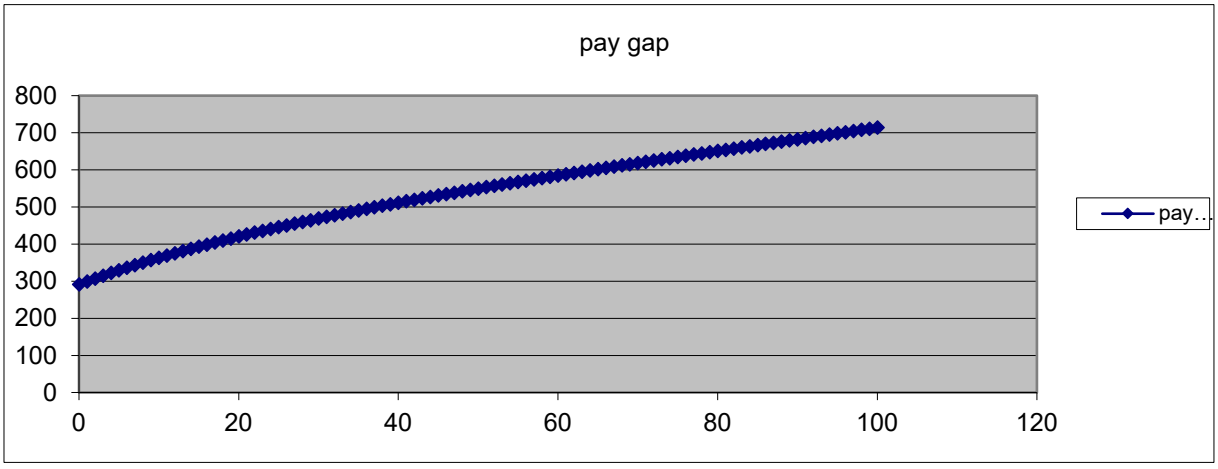


Table 5; intersectional pay gaps of full professors over time

Discussion

This exploration of the dynamic structures underneath intersectional pay gaps in organizations helps to understand how and why gender and ethnic pay gaps co-occur and contributes a new method to conceptualize the complexity of understanding social categories of inequality (Mc Call, 2005). This gives a more specific insight in how economic inequalities in organizations reinforce each other (see also Riaz, 2015). Moreover, understanding the dynamic structures underneath intersecting inequalities allow to further explore leverage points to address inequalities in organizations. The calibrated model suggest that the differences between the initial human capital of white upper class men and outgroups are smaller than initially assumed, just like the normal human capital of both groups are very close. However, the wage claims in all function levels are larger for white upper class men than for the outgroups, except for the function levels of lecturers where outgroups dominate and the function level of associate professor where outgroups on average stay longer and so are more highly qualified. Slight small advantages in the normal acceptance of earnings claims of white upper class men compared to outgroups explain for pay gaps to persist. The calibrated model shows much larger opportunities for outgroups to gain human capital than for white upper class men, but they do not compensate sufficiently for the pay gaps based on small differences in acceptance rates.

This modelling effort has its limitations. Due the legal restrictions, pay gap data in the Netherlands can only be linked to gender and not to ethnic background. More complex data sets would allow insight in how gender and ethnic pay gaps develop empirically. The data set is based upon two time series. More data points would be needed to provide for more sophisticated calibration of the model.

References

Amis, J.M., Mair, J., & Munir, K.A. (2020) The organizational reproduction of inequality. *Academy of Management Annals*, *14*(1): 195-230.

Andersen, D.L., Luna-Reyes, L.F., Diker, V.G., Black, L., Rich, E. & Andersen, D.F. (2012), The disconfirmatory interview as a strategy for the assessment of system dynamics models. *System Dynamics Review*, 28: 255-275.

Avent-Holt, D. and Tomaskovic-Devey, D. (2014). A relational theory of earnings inequality. *American Behavioral Scientist, 58*(3), 379-399.

Bapuji, H., Ertug, G., & Shaw, J.D. (2020). Organizations and societal economic inequality: a review and way forward. *Academy of Management Annals*, *14*(1): 60-91.

Barlas, Y. (1996). Formal aspects of model validity and validation in system dynamics. *System Dynamics Review, 12* (3): 183-210.

Bendl, R., Bleijenbergh, I., Henttonen, E. & Mills, A. [ed.] (2015). *Oxford Handbook on diversity in organizations*. Oxford: Oxford University Press.

Bleijenbergh, I. and Ambaum, M. (2020) *A feedback perspective on intersecting inequalities in organizations. Paper presented at the Academy of Management Conference 2021***.**

Castro, M. R., & Holvino, E. (2016). Applying intersectionality in organizations: Inequality markers, cultural scripts and advancement practices in a professional service firm. Gender, Work and Organization, 23(3): 328–347.

Crenshaw, K. (1989). Demarginalizing the Intersection of Race and Sex: A Black Feminist Critique of Antidiscrimination Doctrine, Feminist theory and Antiracist Politics. *University of Chicago Legal Forum, 989*(1): 1390-67.

Croxford, R. (2018, 7 December). Ethnic minority academics earn less than white colleagues. *BBC News*. Retrieved at https://www.bbc.com/news/education-46473269.

Dubois-Shaik, F. & Fusulier, B. (2016). *Academic careers and Gender inequality: Leaky pipeline and interrelated phenomena in Seven European Countries*. GARCIA working papers 11. Retrieved at://eige.europa.eu/sites/default/files/garcia_working_paper_5_academic_careers_gende r_ https inequality.pdf

Forrester, J. W. (1987). Lessons from system dynamics modeling. *System Dynamics Review*, *3*(2): 136-149.

Forrester, J. W. (1992). Policies, decisions and information sources for modeling. *European journal of operational research*, *59*(1): 42-63.

Gray, B., & Kish-Gephart, J. J. (2013). Encountering social class differences at work: How "class work" perpetuates inequality. *Academy of Management Review, 38*: 670–699.

Holvino, E. (2010). Intersections: The simultaneity of race, gender and class in organization studies. *Gender, Work and Organization, 17*(3): 248–277.

Kalev, A., Dobbin, F., & Kelly, E. (2006). Best practices or best guesses? Assessing the efficacy of corporate affirmative action and diversity policies. *American Sociological Review, 71*: 589–617.

Laurison, D., & Friedman, S. (2016). The class pay gap in higher professional and managerial occupations. *American Sociological Review, 81*: 668–695.

Markus, H. R. (2017). In this together: Doing and undoing inequality and social class divides. *Journal of Social Issues, 73*: 211–221.

McCall, L. (2005). The complexity of intersectionality. *Signs*, 30(3): 1771-1800.

Riaz, S. 2015. Bringing inequality back in: The economic inequality footprint of management and organizational practices. *Human Relations, 68*(7): 1085–1097

Ridgeway, C. L., & Correll, S. J. (2004). Unpacking the gender system. *Gender & Society, 18*(4): 510–531

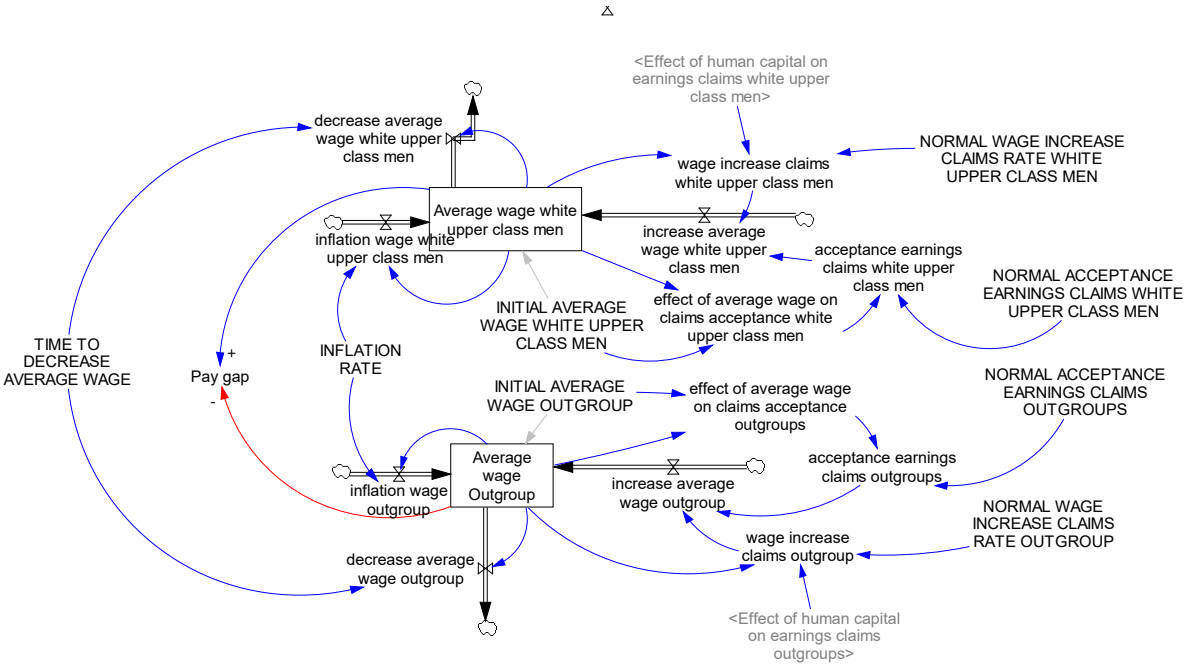
Shin, T. (2009). Earnings inequality within organizations. *Social Science Research, 38*(1): 225–238.

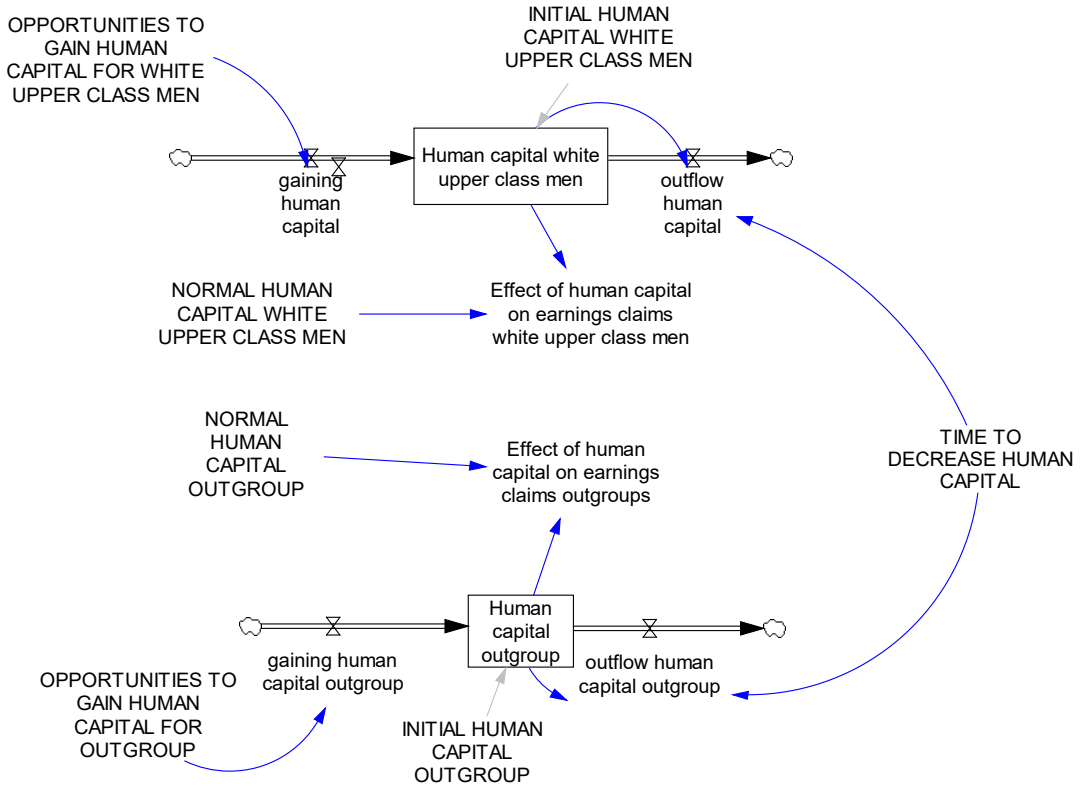
Sliwa, M., & Johansson, M. (2014). The discourse of meritocracy contested/reproduced: Foreign women academics in UK business schools. *Organization, 21*(6): 821–843.

Sterman, J.D. (2000). *Business Dynamics; systems thinking and modeling for a complex world*. McGraw-Hill: Boston.

Trump, K.-S. (2018). Income inequality influences perceptions of legitimate income differences. *British Journal of Political Science, 48*(4): 929–952.

Annex 1: a formal model of intersectional inequalities in two views





Annex 2 Pay gap data of a Dutch University

	Average wage women 2015	Average wage man 2015	Gender pay gap 2015	Average age women	Average age men	Average wage women 2020	Average wage men 2020	Gender pay gap 2020	Average age women	Aerage age men
PhD candidate	n.a.	n.a.	n.a.	28	28	2.807	2.804	-3	28	28
lecturer	3.950	4.271	321	43	47	4.325	4.459	135	44	47
researcher	3.738	3.743	4	42	46	3.985	4.067	82	43	46
Assistant professor	4.572	4.771	199	41	44	4.985	5.260	275	40	43
Associate professor	5.604	5.887	283	47	50	6.387	6.456	70	48	51
Full professor	7.250	7.541	291	52	55	7.853	8.438	585	54	57

Annex 3A: Model parameters for the Calibrated model

	INITIAL AVERAGE WAGE UPPER CLASS MEN	INITIAL AVERAGE WAGE OUTGROUP	INITIAL HUMAN CAPITAL UPPER CLASS MEN	INITIAL HUMAN CAPITAL OUTGROUP	NORMAL HUMAN CAPITAL WHITE UPPER CLASS MEN	NORMAL HUMAN CAPITAL OUTGROUP	WAGE CLAIMS RATE WHITE UPPER CLASS MEN	WAGE CLAIMS RATE OUTGROUP
Basic model	4271	3950	99	101	100	100	0,0017%	0,0017%
Lecturer	4271	3950	100	100	100	100	0,00%	0,27%
Researcher	3743	3738	100	100	100	100	0,25%	0,11%
Assistant professor	4771	4572	100	100	100	100	0,33%	0,22%
Associate professor	5887	5604	100	100	100	100	0,31%	0,43%
Full professor	7541	7250	100	100	100	100	0,22%	0,02%

Annex 3B: Model parameters for the Calibrated model

	NORMAL ACCEPTANCE EARNINGS CLAIMS WHITE UPPER CLASS MEN	NORMAL ACCEPTANCE EARNINGS CLAIMS OUTGROUP	TIME TO DECREASE HUMAN CAPITAL	TIME TO DECREASE AVERAGE WAGE	OPPORTUNITIES TO GAIN HUMAN CAPITAL	OPPORTUNITIES TO GAIN HUMAN CAPITAL FOR THE OUTGROUP
Basic model	0,51	0,49	360	0	1	1,2
Lecturer	0,50	0,49	31,77	0	1	1,1
Researcher	0,50	0,50	31,77	0	1	1,40
Assistant professor	0,50	0,50	31,77	0	1	1,41
Associate professor	0,49	0,50	31,77	0	1	1,41
Full professor	0,50	0,49	31,77	0	1	1,10