Assessing the Social Impact of Corporations: Evidence from Management Control Interventions in the Supply Chain to Increase Worker Wages

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Abstract

This study examines an initiative by a large multinational garment retailer (H&M Group) to increase wages at its supplier factories by intervening in their wage-related management practices. Difference-in-differences estimates based on eight years of data from over 1,800 factories show that the interventions were associated with an average wage increase of approximately 5 percent by the third year of implementation. Our estimates suggest that the intervention-associated wage increase was many times greater than if the retailer's cost for the program was instead paid directly to affected workers. We find that the wage effects were driven by factories with relatively poorer supplier ratings and do not find significantly different wage effects depending on the presence of trade unions. We also examine several non-wage outcomes such as factory orders, supplier price competitiveness, overtime pay, and total employment to probe the mechanisms underlying the wage increases. Overall, these findings have implications for assessing corporate social impact in global supply chains.

JEL Codes: F14, F16, J50, J80, L67, M14, M16, M40, M54

1. INTRODUCTION

Evaluating corporate social responsibility (CSR) practice requires in-depth knowledge about firms' supply chain management. Yet, current reporting standards fail to adequately capture firms' sustainability-related activities along the entire supply chain, an issue which regulators have tried to address with enhanced disclosure requirements.[1] Considering these reporting and regulatory limitations, some activists have directly targeted prominent buyers by highlighting their adverse impact on environmental and social outcomes and demanding supply chain reforms.[2] This study addresses the economic and social impacts of implementing supply chain reforms that respond to activist concerns. Specifically, we examine the effects of new remuneration practices seeking to raise wages for factory workers in global supply chains. The objectives of this study are threefold. First, we document *how* a large multinational buyer sought to make social impact by intervening in the management practices of their supplier firms to raise factory worker wages. Second, we provide empirical estimates of the effectiveness of such interventions. Finally, we discuss potential mechanisms that may explain the effects of these supply chain interventions.

Our data come from H&M Group, a multinational clothing retailer that implemented wage-related programs in its global supply chain beginning in 2013 with the stated objective of achieving "fair living wages" at its supplier factories.[3] The interventions centered around two elements: (1) a

[1] An increasing number of countries have adopted supply chain laws which mandate corporations to report on their due diligence process to ensure that labor rights abuses do not occur in their supply chains and business activities. Examples include the California Transparency in Supply Chains Act which was passed in 2010. Since then, similar laws have passed in Europe, including the UK Modern Slavery Act, the German Supply Chain Due Diligence Act and Norway's Transparency Act.

[2] Examples of activists pressuring buyers on social and labor-related issues include the Worker Rights Consortium and Clean Clothes Campaign. On the environmental side, the Natural Resources Defense Council and Greenpeace have engaged in similar campaigns.

[3] A "living wage" is a wage that is sufficient to afford a decent standard of living for a worker and their family which must include enough to pay for food, water, housing, education, health care, transportation, clothing and some discretionary earnings, including savings for unexpected events (https://labourbehindthelabel.org/). The notion of a "fair" living wage implies that it involves considerations regarding how the wages are paid – i.e., based on mature management/pay structures considering different parameters such as skills, experience, insurance, pensions, etc.

Workplace Dialogue Program (WDP) that promoted awareness of worker rights and formal venues for worker-management communication, and (2) a Wage Management System (WMS) that promoted systems of transparent remuneration of workers according to skill and experience levels (e.g., via the establishment of "Wage Grids"). These wage-related interventions arose in the context of longstanding social activism surrounding poor working conditions in global supply chains targeting both H&M specifically and the global garment industry more broadly (Bartley and Child [2011], Locke [2013]).

Whereas the power imbalance between large corporate buyers and smaller supplier factories, typical for the garment industry, suggests that suppliers are likely to comply with interventions imposed by the buyer, there are several reasons to believe that the interventions seeking to raise worker wages may not succeed. The interventions encouraged supplier factories to create *systems* that allowed workers to raise their wages. These interventions did not promise direct payments to factory workers. Thus, considering the prior existing research that documents persistent noncompliance of minimum labor standards among suppliers (e.g., Locke [2013], Pohler [2020], Kuruvilla [2021]), there is considerable uncertainty around the effectiveness of the wage interventions. Supplier firms are under no legal obligation to adhere to the buyer-imposed systems when the interventions could result in operational disruptions or reduced profit margins. The influence of the interventions could also be mitigated because the ultimate "targets" are front-line workers subject to intermediate layers of management at the supplier firms. Finally, there is the question on the economic magnitude of the effects. It is unclear whether such inventions would have effects beyond their immediate financial costs invested by the buyer.

We estimate the effects of these interventions using the staggered timing of the two wage-related management control interventions at supplier firms. Overall, we estimate that the wage

interventions were associated with an average increase in factory wages of 2.7 percent, reaching approximately 5 percent by the third year following their implementation. We show that the estimated effects are robust to a number of estimation methods including two-way panel fixed effects models, event study analyses, estimations that balance on pre-treatment outcomes, and newly-developed methods addressing various biases in staggered difference-in-differences research designs (i.e., Callaway and Sant'Anna [2021]; Cengiz et al. [2019]; De Chaisemartin and d'Haultfoeuille [2020, 2022]). Our most conservative estimate implies that the wage interventions yielded an average increase in the annual base wage per affected worker of $44 in 2019 constant USD – an approximately 5.6% increase relative to the $1.90 per day defined by the World Bank poverty line.[4] The intervention-associated base wage increase of $44 per worker-year greatly exceeded the buyer's expenditures on these wage interventions, which was $1.62 per worker-year.

In further analyses, we examine the correlates of these interventions' effectiveness. First, we use H&M's supplier performance ratings to examine heterogeneous treatment effects, but do not find statistically significant evidence for differences between higher- and lower-rated suppliers. Second, motivated by research on the effect of labor unions on organizational outcomes, we examine whether labor union presence at factories moderated the effect of the wage-related interventions on factory worker wages. Labor unions are of particular interest in our context as they represent workers, the direct beneficiaries of the interventions. However, empirical results provide only limited support for the hypothesis that labor unions amplify the effect of the interventions. These results are consistent with prior findings that labor unions in many developing countries have only limited influence on worker wages (e.g., Freeman [2010]). Finally, despite the

[4] Information on the poverty line is obtained from https://pip.worldbank.org/home. To allow for comparison, we first adjust the poverty line defined in USD per day, 2011 PPP to an *annual* poverty line in 2019 USD. To adjust for inflation, we use the CPI inflation calculator from the US Bureau of Labor Statistics. This yields a poverty line of approximately USD $792 in annual income.

complementarity of the two wage programs and their sequential implementation in a large majority of factories, we conduct exploratory analyses to isolate the effects of the WDP and the WMS. These analyses point to the effectiveness of the WMS, which targeted systems of remuneration and employee advancement.

In a final set of analyses, we address mechanisms that might explain the wage increases by examining several non-wage outcome variables. First, we find that the wage interventions were associated with a significant increase in business volume for participating suppliers. This finding suggests that the wage-related programs involved some notion of a cooperative "exchange" between H&M and its suppliers with benefits accruing to both parties: H&M benefitting from modest increases in worker wages and a reduction of reputational risk in its supply chain, and suppliers benefitting from business growth. The increase in business volume is consistent with commitments made by H&M when trying to recruit suppliers to adopt the wage-related programs. Second, we do not find that participation in the wage programs was associated with reduced price competitiveness for suppliers. This suggests that the wage increases were not passed on to the buyer in the form of higher prices quoted on their orders. Third, whereas our main analyses focus on base wages, we also examine overtime pay and find no significant effect. This result mitigates concerns that base wage increases were offset by reductions in other forms of remuneration. Finally, we do not find that the higher wages are associated with reductions in overall employment which suggests that supplier firms did not offset the wage increases by reducing their labor force.

None of the analyses of non-wage outcomes revealed costs borne by the buyer (other than its direct spending on the programs) nor by the workers. This suggests either that the suppliers bore the cost of higher wages—while also receiving larger order volumes from the buyer — or that the suppliers were able to identify opportunities to improve productivity to offset the higher

wages. Prior research on how firms in developing countries respond to wage hikes suggests they find opportunities to enhance productivity to offset higher unit labor costs (Mayneris et al. [2018]). While empirical analysis of the wage interventions and labor productivity was not feasible in this research, anecdotal evidence from program implementers suggested the possibility of productivity improvements at factories resulting from enhanced transparency and communication around wage practices. However, even if suppliers subject to the wage interventions were unable to improve labor productivity, because participating suppliers saw their business volumes grow, their total profits can still increase even if profits-per-unit fall.

This study contributes to research that examines how to enhance firms' CSR performance by implementing sustainable management practices in their supply chains. Work in the financial accounting literature primarily focuses on the role of regulatory measures impacting CSR-related information and investments (e.g., Christensen et al. [2021]). This study addresses the idea that corporations can act as "private regulators" by implementing sustainable management practices in their supply chains (Bartley [2018]). While prior research suggests that corporate buyers can diffuse socially responsible behaviors to their suppliers (e.g., Dai et al. [2021]; Schiller [2018]), there is little evidence on whether firms actually institute such supply chain reforms and if so, how. Most empirical studies rely on measures of CSR performance via firm disclosures in public filings and third-party CSR ratings or focus on environment-related sustainability performance due to the availability of relatively well-defined sustainability performance metrics such as pollutant emissions. By leveraging proprietary field data, we contribute by studying supply chain interventions to increase factory worker wages and, thereby, address firms' *social* performance.

Our work also contributes to the management accounting literature by studying supply chain practices to integrate CSR-related performance goals into existing management control

systems. Prior research in this area primarily relies on qualitative case studies and surveys (e.g., Kim and Matsumura [2017], Soderstrom et al. [2017]). Our work provides insights not only on specific interventions implemented at the organizational level to improve CSR performance, but also on the economic magnitude of these effects and the buyer's organizational costs incurred to generate them.

2. PRIOR LITERATURE AND HYPOTHESES

2.1. Ethical Sourcing in the Garment Industry

Violations of international labor standards in the supply chains of multinational corporations have been a contentious issue, especially in the global garment industry. For decades, the typical supply chain configuration of many multinational retailers was to outsource production to low-cost manufacturers mostly located in developing countries. The garment industry is broadly characterized by an entrenched power imbalance whereby a number of large multinational retailers derive most of the value from a product relative to their suppliers, and supplier firms produce clothing for multiple buyers. The trend towards fast fashion has exacerbated the "race to the bottom" on price, intensifying the pressure on suppliers who are already vulnerable to low profit margins, and thus, constraining their ability to pay living wages to their factory workers.[5] Activist campaigns and media exposés have drawn attention to poor working conditions in the global garment industry for many years (Bartley and Child [2011]).[6]

[5] For a comparison between the legal minimum wage and the living wage in some major Asian countries with high representation of supplier factories for multinational corporations in the garment and apparel industry, see https://archive.cleanclothes.org/livingwage/living-wage-versus-minimum-wage.

[6] See, for example, how the activist organization Worker Rights Consortium describes the key problems with the global garment industry: https://www.workersrights.org/issues/

Responding to these pressures from external stakeholders, leading retailers adopted systems of "private regulation" to shape the working conditions in their supplier factories (e.g., Bartley [2018], Locke [2013], Kuruvilla [2022]). This private regulation of labor standards typically focuses on enforcing minimum compliance with globally accepted standards of responsible production. Many retailers also responded by increasing transparency in their supply chains in relation to international standards (Reid and Toffel [2009]). In recent years, regulators have also started to address the issue by introducing enhanced disclosure requirements around firms' supply chain practices. A notable example is the California Transparency in Supply Chains Act – a law that required certain retail sellers and manufacturers doing business in the state of California to disclose information regarding their efforts to eradicate human trafficking and slavery.

2.2. Interventions for Fair Labor Practices in Global Supply Chains

Addressing the issue of unfair labor practices in global supply chains involves inter-firm relationships that are beyond the control of a single organization. Effective management controls, thus, require interventions in inter-firm relationships that transcend the legal organizational boundaries of the firm (Caglio and Ditillo [2008]) incorporating broader sets of information on financial, ecological, and social impacts on various stakeholders (Ditillo and Lisi [2016]). To enforce fair labor practices in global supply chains, leading retailers have been mostly reliant on compliance monitoring and enforcement systems. These revolved around the introduction of codes of conduct that set minimum work standards at supplier firms. Short et al. [2016, 2020] examine various elements for effective supplier monitoring programs. Research also shows that compliance by suppliers is rewarded with greater purchasing from buyers (Distelhorst and Locke [2018]). Other research examines how different types of buyer firm interventions can shape supplier firm compliance with labor standards. Boudreau [2022] examines the introduction of safety committees

in Bangladesh and documents their effects on compliance with labor laws and other outcomes, whereas Anner [2018] examines CSR participation committees in factories in Vietnam and finds no impact on the likelihood of worker strikes. Distelhorst et al. [2017] study the introduction of "lean" manufacturing systems in apparel factories and show improved compliance with labor standards. However, research repeatedly shows that these systems fail to achieve 100% compliance with basic labor standards (e.g., Bartley [2018], Kuruvilla [2021], Locke [2013], Short et al. [2016]).

Locke [2013] highlights the need to shift attention *beyond* compliance-based systems and argues that large multinational retailers can make an impact on wages through other interventions with their suppliers. Existing empirical research provides some evidence on factors that impact supply chain wages. For example, Harrison and Scorse [2010] show that Indonesian export industries exposed to anti-sweatshop campaigns in the 1990s saw faster wage gains. Locke and Romis [2010] compare work systems and wages in two Nike suppliers in Mexico and find that the firm with more sophisticated work organization also paid higher wages. Lollo and O'Rourke [2020] find that redesigned compensation systems in a single Thai garment factory raised productivity, wages, and total profits. In contrast, He and Perloff [2013] find that Chinese factories subject to social audits by their buyers had no higher wages than those that were not audited. Moreover, Bartley [2018] surveys exporters in China and finds that those adopting the SA8000 social responsibility certification paid similar wages to those without the certification.

The present study examines whether inducing pressures via the supply chain by implementing systems for fair remuneration practices affects worker wages. To do so, we use the data from the implementation of wage-related management control interventions by H&M, a multinational clothing retail company, to increase worker wages at its supplier factories.

2.3. Management Control Interventions to Raise Worker Wages at Supplier Firms

Organizations are embedded in multiple relationships transcending different units of analyses such as markets, firms, and individuals. It is, thus, important to understand how organizational activities are formed and coordinated in light of the social relations structured by various organizing principles (Kogut and Zander [1992]). Uzzi [1996] argues that organizational "embeddedness" is a logic of exchange among various individual and/or collective actors that shapes incentives and expectations to promote long-term cooperative relationships. Thus, close contractual relations between corporate buyers and suppliers could enable alignment in the CSR objectives of both parties. In our empirical setting, supplier firms may have already developed significant relationship-specific investments with H&M (e.g., Costello [2013]), leading to an alignment of CSR goals between both parties. Moreover, H&M is one of the world's largest clothing retailers. Its size means that its business volumes could be difficult to replace in the event of buyer exit. H&M's size also presents an opportunity for suppliers; becoming a preferred supplier could lead to significant sales growth.

However, other factors suggest that H&M's wage-related interventions may be ineffective. Despite the power imbalance in the supply chain configuration, H&M's wage programs encouraged supplier factories to create *systems* that might allow workers to raise their wages; the interventions did not set new wage levels or mandate direct payments to workers. In fact, existing empirical research on the effects of supply chain programs targeting working conditions documents persistent noncompliance among suppliers asked to meet major buyers' labor-related demands (see Chapter 7 of Pohler [2020] for an overview of existing research – including Anner [2012], Barrientos and Smith [2007], Bird et al. [2019], Frenkel [2001], Locke et al. [2007], Toffel et al. [2015]).

Considering the prior research on the less-contentious issue of compliance with minimum labor standards, uncertainty around the implementation and impact of H&M's wage programs is considerable. First, suppliers are under no legal obligation to comply with the wage-related demands imposed by a single business partner (beyond compliance to the local minimum wage). Second, opacity around firms' supply chain practices could allow for H&M's competitors to prioritize cost reduction in their supplier selection criteria. If so, H&M's suppliers could seek alternative business relationships that do not impose these additional wage-related demands. Third, suppliers comprise distinct legal entities with intermediate layers of management. Accordingly, management control interventions directed at the subordinates of external entities may be mitigated by the influence of their immediate superiors (Guth and MacMillan [1986]). In our case, supplier managers in charge of the relationship to H&M may agree to terms that production and human resource managers resist and decline to fully implement. These challenges raise the possibility that suppliers could evade or ignore the demands of H&M's wage-related management control interventions.

3. RESEARCH SETTING AND DATA

H&M outsources production to factories mostly located in developing countries. Prior to the interventions we study, although pressures for ethical sourcing practices escalated from socially-responsible investors and consumers, little visible action had been taken by most apparel retailers on the issue of improving garment workers' wages. In 2013, H&M announced a long-term plan focused on raising worker wages by promoting the implementation of well-functioning

pay structures at their supplier factories.[7] The plan included efforts to regularly collect factory wage data and to implement new wage-related management systems at suppliers. This research represents, to our knowledge, the first econometric evaluation of the impact of one component of this supply chain wage strategy.

3.1. Measuring Factory Worker Wages

To support its interventions to raise wages at its supplier firms, H&M developed systems to measure worker wages in its supply chain. These systems established definitions of base and overtime wages and standards for when to consider benefit contributions as part of remuneration packages, an issue that differed according to labor market context. In 2012, H&M began collecting annual wage data at its supplier factories based on in-person audits of factory records. Average factory wages were computed based on "all workers who are directly associated with the production output, e.g., cutting workers, sewers, QC [quality control] inspectors, packaging, sample room and warehouse workers, and line leaders who are engaged in the production process, except the line leaders who handle production management work full time." The wage data collection system was revised in 2016 (leading to a one-year gap in monitoring) allowing for monthly wage tracking in supplier factories beginning in 2017. Collection and validation of the wage data follows a protocol that involves desktop and onsite validation procedures. The revised collection system begins with the submission of the information by supplier firms through H&M's web-based platform. During the desktop validation process, qualified Human Resources and Finance staff review the collected data for inconsistencies, accuracy, and completeness, which involves cross-validation with data from different assessments. Onsite validation, often done in

[7] H&M says it will pay factory workers a 'fair living wage.' It doesn't say what that means. *The Washington Post*. November 26, 2013. URL: https://www.washingtonpost.com/news/wonk/wp/2013/11/26/hm-says-it-will-pay-factory-workers-a-fair-living-wage-it-doesnt-say-what-that-means/

combination with findings from a desktop validation, is generally announced in advance but can also be unannounced, depending on need.

We obtain the wage data that was collected and validated by H&M from 2012 to 2019 spanning factories in their global supply chain across nine countries.[8] In Figure 1, each line represents an individual factory's average monthly wage in inflation-adjusted US dollars, and the black dots show the within-country average monthly wage of all factories in that year. The figures illustrate increases in the real average wage among factories in Bangladesh, Cambodia, China, Indonesia, Myanmar, Pakistan, and Vietnam, whereas wage trends in India and Turkey have been flatter. These heterogeneous wage trends across different markets illustrate the importance of controlling for country-specific economic trends in our empirical analyses. For example, Turkey experienced currency and debt crises in 2018, followed by a 26% increase in the minimum wage in 2019, macroeconomic shocks that are visible in Figure 1. Divergent macroeconomic trends across countries necessitate an empirical approach that models labor-market-specific temporal shocks.

[Insert Figure 1 here]

3.2. Wage-related Interventions in the Supply Chain

With a supplier wage measurement and validation system in place, H&M intervened in the wage-related management practices at its supplier factories via two complementary programs: the Workplace Dialogue Program (WDP) and the Wage Management System (WMS).

3.2.1. The Workplace Dialogue Program (WDP)

The WDP sought to improve dialogue between the employer and worker representatives (e.g., trade unions and/or other representative bodies at the enterprise level). A functional

[8] The data were accessed under a research agreement that defined the key research question and provided the researchers with full control over the research outputs.

workplace dialogue system is defined by (1) employer and worker *awareness* about workers' rights and responsibilities, which is reflected in transparent policies and other guiding documents at the workplace; and (2) *structures* for the dialogue between employers and workers through registered trade unions and/or democratically elected worker representatives. The desired outcomes of a functional workplace dialogue system are (1) peaceful conflict resolution, which refers to negotiations and consultations in good faith between the relevant social parties that should be respected by all parties; and (2) collective bargaining and agreements on working conditions, terms of employment, and regulating relations between the employer and workers.

H&M's responsibility in WDP implementation was to ensure that factories followed an execution plan that encompassed the deployment of a Workplace Dialogue evaluation tool, and standard operating procedures for the formation of worker participation committees. H&M was also involved in providing training on the improvement plans and administering activities for suppliers and workers in the production countries. To enhance accountability and feedback loops of the WDP implementation, H&M assigned sustainability project managers and leaders who would be held responsible for the WDP implementation process. Overall, the WDP sought to increase the influence and voice of the workers on wage-related issues, providing a foundation for the implementation of their second program, WMS, which more directly targeted supplier factories' remuneration systems.

3.2.2. Wage Management System (WMS)

The WMS refers to a set of policies, processes, and practices with the objective of providing all workers in a supplier factory fair compensation for the work they do and opportunities to increase their wages. A functional WMS consists of a minimum of four mechanisms: (1) proper and correct payment of wages according to contracts, legal regulations,

and existing collective bargaining agreements; (2) internal development of human resources polices and processes to ensure competitiveness, high motivation, and sustainable social climate in the factories; (3) a progressive and coherent pay system that rewards workers according to their skills, education, performance, and experience; and (4) proper mechanisms of workers' involvement in factory decisions that generate a process of communication and possible negotiations on the content of wages and payment structures.

Similar to WDP implementation, WMS implementation entailed executing a plan which focused on the establishment of transparent systems for remunerating skill and experience in the manufacturing workforce. Accordingly, latter stages of the WMS included the introduction of Wage Grids that communicated wage and advancement information to all workers in the factory. In theory, by the time when Wage Grids would be established, WMS implementation would have progressed to the adoption of other changes to human resource management practices, such as reform of pay systems and compensation structures and better management of excessive working hours agreed upon by both management and worker representatives.

3.2.3. Program Implementation Sequence

H&M designed the two programs as complements to one another rather than alternatives. The typical implementation sequence began with the implementation of WDP and subsequently continued with the implementation of WMS (including Wage Grid implementation at latter stages of the WMS). H&M believed that beginning with the WDP ensured the presence of worker representatives who could be consulted in the development of new remuneration systems to be implemented at the factories, as envisioned by the WMS intervention. In our data, however, we also observe some factories with atypical implementation sequences, most of which comprise factories where WMS implementation occurred without the WDP. Although H&M typically

sought to implement the WDP first, some factories already had functional worker representative systems in place. Empirically, our data allows us to track the timing of implementation of WDP, WMS, and Wage Grids at each participating factory. In addition to these individual program variables, we also create *Any Wage Program* which is a factory-year indicator defined as one for the earliest year of implementation of any program intervention, and zero otherwise. We consider a factory "treated" in its first year of enrollment in a program, even if it was only for part of the year. If a factory began its program implementation process mid-year, that year's wages count as a post-implementation observation.

Restricting the sample to factories that have annual wage data for at least two years (for use in longitudinal analyses), we obtain a sample of 6,169 factory-year observations of 1,803 unique factories. There are 768 (694) unique factories at which WDP (WMS) was implemented during our study period. Patterns of WDP and WMS program implementation over time are summarized in Panel A of Table 1 and Figure 2. The figures illustrate large quantities of pre-treatment (light blue, "under control") and post-treatment wage data (dark blue, "under treatment") for comparison with one another. They also illustrate sparser pre-2017 wage data before the introduction of monthly wage tracking. Consistent with the progressive implementation described above, the figures show that the WDP generally preceded the WMS in implementation, with the earliest group starting in 2014, and a larger share of participating factories in 2017. The average time between implementing the programs at a factory was approximately 6 months. By 2019, WMS implementation had nearly caught up to WDP implementation.

[Insert Table 1 here]

[Insert Figure 2 here]

Descriptive statistics of all available variables at the factory-year level are provided in Panel B of Table 1. In addition to the data on wages and wage-related programs, we also have data on the presence of trade unions (*Union Presence*), supplier performance scores assigned through H&M's supplier performance evaluation system (*Supplier Score*), and units shipped to H&M (*Pieces*).

3.3. Selection into Wage Programs

Which factories were more likely to adopt the wage programs? H&M indicated that their strategic partners were the first priority for its wage initiatives. Since our empirical identification strategy relies on the staggered implementation in the timing of these two interventions, we compare how treatment and control factories differ in their characteristics over time. For causal identification treatment timing needs to be exogenous and not tied to factors that are correlated with wage effects. In Table 2, we report the mean statistics in each year by summarizing the values in the prior year (i.e., pre-treatment) separately for treated and control factories. Panel A reports the means of wages after adjusting for the average wage in each country-year and units shipped. Note that wage data for 2016 are missing so that summary wage statistics of the pre-treatment period is missing for the year 2017. Panel B reports the means of the supplier score and trade union presence.

[Insert Table 2 here]

Overall, we find no clear pattern of selection on wage until the final period in our data. Treatment factories exhibited slightly lower wages, but these differences are statistically indistinguishable from zero from 2013–2017. In 2018, treatment factories exhibited lower pre-treatment average wages ($p = 0.001$). Consistent with H&M's explanation of its priorities, treated factories consistently exhibited higher volumes of units shipped to H&M in the year prior to

treatment. In the early years, this gap was quite large with treated factories shipping on average roughly seven times the units of control factories, but this gap diminished over time. The average treatment factory shipped (pre-treatment) 4.3 million units in 2013 compared to 0.87 million in 2018. Supplier performance scores exhibit no clear pattern of selection. In 2013-2015, control factories had higher or very similar supplier scores whereas treatment factories exhibited higher supplier scores in 2016-2017. In 2018, the difference returned to being statistically indistinguishable. Treated factories generally had higher levels of trade union presence than control factories, but we can only reject the null hypothesis of no difference in two years: 2015 and 2018. In summary, the wage programs targeted suppliers with high volumes of products shipped to H&M. However, these factories neither received consistently better supplier ratings nor exhibited higher wages than the non-adopters.

4. EMPIRICAL RESEARCH DESIGN

We employ a difference-in-differences specification that compares the change in average supplier factory wages between treated and control factories. We begin by estimating the following two-way panel fixed effects model using OLS:

$$\ln(\textit{Base Wage})_{it} = \textit{Program}_{it} + \eta_i + \gamma_{tj} + \varepsilon_{it} \quad (1)$$

where η_i is the fixed-effect for factory i, and γ_{tj} is the fixed-effect for country j in year t, which controls for country-specific macroeconomic fluctuations. The dependent variable is the natural logarithm of the factory's average monthly base wage. Base wages (i.e. wages earned during normal work hours) are the focal outcome in this study because the interventions sought to increase worker wages before the inclusion of overtime earnings. We standardize wages over countries and

time using St Louis Fed GDP price deflators to convert nominal wages to 2019 real constant USD.[9] The coefficient of interest is that on $Program_{it}$ which estimates the approximate percentage change in average supplier factory base wage associated with program implementation at supplier factories.[10] Factory fixed-effects control for factory-level differences in average wage levels prior to the interventions. For example, treated factories may be concentrated in particular countries or product types, leading to either higher or lower wages prior to program implementation. The inclusion of country-specific year fixed effects allows us to account for within-country wage shocks in all factories that are unrelated to program participation. We adopt this approach out of concern about varying macroeconomic events across countries, such as economic crises and changes in minimum wage legislation. Robust standard errors are clustered at the factory-level.

One challenge in interpreting the analysis of each program intervention is the consecutive implementation sequence of the programs. The wage-related interventions were designed such that implementing the WMS generally occurred after implementing the WDP. Moreover, factories that only implemented WMS in our sample were considered to already have attained the WDP objectives such that no dialogue-based intervention was needed. Thus, we caution about attributing any empirical estimates to each program in isolation, even though they can be modeled separately in our specifications. Instead, for our main interpretations, we rely on the program indicator *Any Wage Program* which is a factory-year indicator defined as one for the earliest year of implementation of any wage-related program, and zero otherwise.[11]

[9] Results remain qualitatively similar if we use the natural logarithm of inflation-unadjusted wages in the corresponding local currencies. The results of the estimations are reported in the Online Appendix.
[10] Note that the precise percentage change requires raising *e* to the power of the OLS coefficient and subtracting one; where we report results scaled in percent (%) we have computed the precise percentage change in this way.
[11] To provide further insights on the relative effectiveness of the two different programs in raising wages, we conduct additional analyses that try to isolate the effects of the individual elements in Section 5.4.

In addition to the two-way panel fixed effects estimation described above, we also estimate an event study model of the effects of the wage interventions. Rather than *Any Wage Program*, this model introduces a series of binary indicators ES_{kit} where k represents the number of years until (negative) or since (positive) factory i received treatment, relative to year t. This enables estimations of the effect on wages relative to treatment timing, including an empirical probe of whether differences between the treated and untreated factories pre-date the introduction of the wage program. If differences emerge prior to treatment, the coefficient on ES_{kit} will be non-zero when $k < 0$.

Despite a research design that controls for factory-specific and time-specific factors, there remain concerns about the *timing* of selection into treatment. The WDP and WMS were not randomly assigned to supplier factories. While participation in the wage-related programs was encouraged at all supplier firms, implementation was prioritized at key suppliers with larger volumes (see Table 2) with the promise of maintaining a long-term business relationship with H&M.[12] We note that the descriptive statistics in Table 2 do not exhibit any specific patterns that warrants concerns about endogeneity in the timing of implementation with regard to wage levels. In addition, reported differences between treated and control factories for any factory-associated variables are neither monotonically increasing nor decreasing. Nevertheless, to address any potential endogeneity concerns, we conduct analyses using a number of recent, alternative estimation methods which are discussed and presented in Section 7.

[12] Other than concerns that the timing of program adoption may be endogenous, there is also a concern that supplier firms consenting to the wage-related interventions do so because they already pay workers well. In this case only minimal effects associated with the wage-related program implementations would be expected. However, Table 2 shows that adopters did not have significantly higher wages prior to program implementation. There may also be concerns related to selection into different program implementation sequences. However, due to the distinct objectives of the two wage-related programs along with the sequential implementation strategy that began with the WDP and then proceeded with WMS, we believe that this type of selection bias is of less concern. We note that our main inferences are based on the *Any Wage Program* indicator that encompasses any wage-related intervention which further mitigates this concern.

5. DISCUSSION OF MAIN RESULTS

5.1. Effect of Wage Interventions on Base Wages

Panel A of Table 3 presents the results from estimating equation (1) where each column differs with respect to the inclusion of the *Program* adoption indicators. Columns 1 through 3 report models of individual management control interventions in isolation. Column 4 includes all three *Program* variables in one specification. Column 5 uses the indicator variable *Any Wage Program.* Overall, the estimated coefficients suggest that the programs were associated with an increase of the average worker wages at H&M's supplier factories. Results in columns 1 through 3 show a 2–3 percent increase in average supplier factory base wages, depending on program type. Whereas the estimated coefficients for all individual programs are statistically significant at the 1 or 5 percent level, the effect on WDP loses statistical significance when all programs appear together in Column 4 and falls to 0.5 percent in magnitude. The magnitudes of the estimated coefficients on WMS and Wage Grid suggest an approximately 2 percent improvement in average supplier factory base wages and are comparable to the estimates in the previous columns. The bottom of column 4 reports point estimates for linear combinations of the program coefficients, estimating the cumulative impact of multiple, overlapping interventions. WMS implementation layered onto WDP is associated with a 2.7 percent increase in average supplier factory base wages. The added implementation of a wage grid is associated with a 5.0 percent ($e^{0.049} = 1.050$) increase in average base wages, relative to control factories at which no programs were implemented over the same time period. Finally, the results in column 5 suggest that the pooled implementation of any wage program was associated with a 2.7 percent increase in base wages.

[Insert Table 3 here]

The results from estimating the event study model of the wage-intervention effects using the *Any Wage Program* indicator are reported in Figure 3.[13] We first begin by estimating the baseline model that only includes the fixed effects as in equation (1) (top left), and progressively introduce controls for lagged values of wages (top right), lagged values for pieces ordered by the buyer (bottom left), and lagged values for both (bottom right). The figures plot the coefficients on the binary indicators ES_{kit} on the y-axis with the corresponding 95% confidence intervals. These results provide corroborating evidence for the absence of pre-trends as shown by the statistically insignificant wage differentials prior to treatment. The baseline model shows a suggestive pre-treatment trend in wages; however, the inclusion of lagged controls for wages and pieces significantly improves this, yielding no pre-treatment trend but estimating highly similar post-treatment effects. Across all event study specifications, we estimate that base wages of treated factories are approximately 5% higher by the third year of program implementation. Their wages continue to grow in future years, although our confidence intervals are wide in later periods due to data sparsity.

[Insert Figure 3 here]

Based on cost data obtained from H&M for implementing the WDP and WMS programs, we compared the intervention-associated base wage effects relative to an alternative scenario in which the invested financial resources were instead directly paid out to the affected workers (Panel B of Table 3).[14] We first quantify the effect on wages in total dollar amounts based on country-

[13] The corresponding estimation results are reported in the Online Appendix. One concern in estimating the event study models was the dramatic decrease in the number of observations due to the inclusion of lagged wages. To mitigate concerns, we also estimate the regressions by imputing missing 2016 wages in two ways: 1) using the same wages as in 2015 for 2016, and 2) using the average of 2015 and 2017 wages for 2016. Results are robust to imputing 2016 wages.

[14] Only direct implementation costs incurred by H&M are included in this analysis. The analysis does not capture more subtle (potential) costs such as opportunity cost associated with H&M continuing relationships with participating suppliers and forgoing the opportunity to form buyer-supplier relationships with other factories. Our analysis also cannot capture the costs incurred by supplier firms.

specific effect estimates from equation (1). This analysis computed a counterfactual total wage bill for each factory-year. We subtracted this from the actual wage bill to quantify the total increase in annual wages at each treated plant. To obtain an estimate for the increase in wages per worker, we divided the difference by the total number of worker-years in our sample. Based on this method, we estimate an average increase in the base wage per worker-year of $44 in 2019 USD. The total cost to H&M of implementing the wage-related programs was USD $4.57 million—USD $0.96 million for the WDP and USD $3.61 million for the WMS.[15] Dividing the total cost by the total number of worker-years in our sample yields an estimated cost of $1.62 per worker-year. Taken together, these estimates suggest that the wage-related interventions generated wage effects far greater than the direct implementation costs. To achieve comparable effects through direct transfers to supply chain workers, H&M would have had to pay roughly 27 times ($44 / $1.62) its investment in the wage intervention programs.

5.2. Heterogeneous Effects by Supplier Rating

To understand whether the wage effects were driven by certain subgroups of suppliers, we examine heterogenous treatment effects using performance ratings from H&M's supplier performance evaluation system.[16] Supplier performance evaluation categories include product quality, logistics, price (evaluated against two benchmarks: the market average and best in market), production lead-time, on-time delivery, and sustainability (including both labor and environmental components).[17] H&M aggregates performance across these categories to classify its suppliers into

[15] Since the total cost data include factories beyond those analyzed by the research project (i.e., factories for which we lacked sufficient wage data), we use the average cost per enrolled factory to estimate the total cost for the factories analyzed in this study.

[16] Suppliers as defined by H&M's performance evaluation system are not directly equivalent to factories. Suppliers are often groups comprised of multiple factories. The unit of analysis in all our empirical tests remains the factory (where individuals are employed and wages are measured), and not the supplier.

[17] We note that collected wage data were available to H&M in evaluating supplier performance. However, they influenced the determination of the ratings to the extent they influenced the overall sustainability rating of the seven

four major tiers. Higher-ranked suppliers are considered strategic partners that share compatible goals. To examine whether and how program effects differ across suppliers of differing strategic importance to H&M, we conduct subsample analyses of estimations in Panel A of Table 3 for factories belonging to higher- and lower-rated suppliers. Higher-rated suppliers are those that have been classified in the two top tiers in the system. Table 4 reports the results from the lower- and higher-rated subsamples. Whereas the results in columns 2 and 4 show that the estimated effect magnitude on *Any Wage Program* is greater among the lower-rated suppliers, a test of differences in the coefficients yields a Z-statistic of 1.03, meaning we fail to reject the null hypothesis of no difference in effects across the two groups.

[Insert Table 4 here]

5.3. Moderating Effect of Labor Union Presence

H&M's efforts to increase wages at their supplier firms included mechanisms to enhance the bargaining power of factory workers. This raises the possibility that the effects of H&M's wage-related management control interventions may vary according to institutional factors at the factory level.[18] If H&M's wage-related effects depend on the quality of worker representation institutions in the factory, we expect that factories at which labor unions were present when the wage-related programs were implemented to experience greater wage increases than those at which no labor unions were present. To examine this possibility, Table 5 models the interaction between labor union presence (*Union Presence*) and the wage interventions. The coefficient of interest is the interaction term between *Any Wage Program* and *Union Presence.* A positive

different performance categories. Other than worker-related considerations, sustainability performance also considered various other dimension on various social and environment-related standards.

[18] Prior research suggests that the presence of labor unions can significantly influence many organizational outcomes such as firms' capital investment structure (e.g., Bronars and Deere [1991], Klasa et al. [2009]) and financial reporting practices (e.g., Bova [2013], DeAngelo and DeAngelo [1991], Hamm et al. [2018], Liberty and Zimmerman [1986]).

coefficient would indicate that the effects of the wage interventions were greater in the presence of labor unions. The estimated coefficient on the interaction is statistically insignificant, but the magnitude is sizeable – almost half the treatment effect. The bottom panel shows that the interventions were associated with a 3.7 percent increase when labor unions were present and a 2.5 percent increase without labor unions.

[Insert Table 5 here]

5.4. Isolating Effects of Individual Program Elements

Isolating the impacts of the separate programs (WDP and WMS) is an empirical challenge due to their sequential implementation in practice. H&M designed these two initiatives to work together, with the WDP generally preceding the WMS. Most factories that implemented the WMS therefore had already implemented the WDP. Keeping this caveat in mind, Panel A of Table 6 analyzes the limited number of factories that implemented just one of the two programs, relative to never-treated factories. Column 1 compares factories that have adopted WDP, but not yet adopted WMS, relative to factories that have adopted neither. Column 2 compares factories that adopted WMS, but not yet adopted WDP relative to factories that have adopted neither. Although both estimated wage effects are positive (+1.9% for WDP and +5.5% for WMS), these analyses reject the null hypothesis for WMS-only adopters, but not for WDP-only adopters. Panel B of Table 6 presents analyses that only consider treatment factories following the typical implementation sequence: WDP then WMS then a Wage Grid. Binary indicators correspond to each additive program in the sequence. The effect remains insignificant when only WDP was in place and exhibits statistical significance beginning with the implementation of WMS. Overall, these findings suggest that WMS implementation focusing on changing remuneration structures was more effective in raising factory worker wages than WDP implementation focusing on

worker-management dialogue around wage issues. However, we again caution that the possibility that effects of dialogue-enhancing programs unfold over time combined with the sequential implementation of the interventions prevents a conclusive analysis.

[Insert Table 6 here]

6. DISCUSSION OF OTHER EFFECTS

Our findings so far show that H&M's management control interventions raised base wages at their supplier factories. In addition to the direct program implementation costs analyzed in Table 3, costs associated with the worker wage increases could be passed on to various stakeholders indirectly. In the following subsections, we address alternative scenarios for the absorption of increased wages resulting from the wage-related interventions.

6.1. Supplier Business Volume

When H&M solicited supplier participation in the wage programs, it told suppliers that one outcome of participation would be to "secure long term business" from H&M. Implementing the wage-related programs was framed as a form of cooperative exchange between H&M and its suppliers. This suggests that implementing the wage programs might lead business volumes to grow. If we assume that suppliers simply take higher wage costs out of their profit margins, volume growth could allow them maintain or increase total profits. Conversely, if business volumes remained the same, the reduced margin would mechanically reduce total profits.[19] Finally, we note that increased wages need not reduce profit margin at all, due to managers' strategic response to changes in input costs. Mayneris et al. [2018] studied how firms in China responded to minimum

[19] Whereas reduced profit margins could be offset with the larger business volume from H&M, suppliers may also fulfill orders for other buyers such that raising worker wages may have spillover effects on the profit margins for other customers too. This study did not have access to supplier financial records, leaving us unable to assess impact on supplier margins.

wage hikes and found no impact on their profitability. Instead, affected firms invested in capital goods and new management techniques to improve productivity, thereby offsetting the cost of higher wages.

We begin by investigating whether the wage-related program implementations were associated with changes in the number of units ordered by H&M. We estimate equation (1) replacing the dependent variable with the natural logarithm of *Pieces* instead of *Base Wage.* Results are tabulated in Table 7. The estimated coefficients on the programs are positive, large, and statistically significant across all model specifications at the 1 or 5 percent level. Column 5 reports the result with the *Any Wage Program* indicator and estimates an approximately 29 percent increase in units ordered.[20]

[Insert Table 7 here]

The Online Appendix additionally reports the event study model as reported in Figure 3 with the natural logarithm of *Pieces* as the dependent variable. However, these results yield divergent pre-treatment trends between the treated and control factories. We therefore employ two recently developed methods to address this issue: trajectory balancing (Hazlett and Xu 2018) and panel matching (Imai, Kim, and Wang 2019). The former method re-weights the control units to balance on pre-treatment trajectories in the dependent variable. The latter method constitutes a nonparametric generalization of the difference-in-differences estimator that includes standard matching methods based on propensity score and Mahalanobis distance, as well as weighting

[20] We conduct back-of-the-envelope calculations for the approximate increase in additional units ordered for suppliers to maintain the same level of profits given the estimated increase in labor costs of about 3%. We use estimates of garment factory cost structures from Rumbens [2017] in the clothing supply chain. The study shows that cost structures vary depending on factory location. On average, assuming a labor cost share of 14%, and a profit margin of 6%, our estimated approximate increase in labor costs by 3% would imply that units ordered would need to increase roughly 8% to maintain the same total profits. It is important to note that these calculations also do not assume any change in factory labor productivity, nor in the prices paid by H&M. Data on factory labor productivity and unit prices are not available to us in this study.

methods. Both methods yield a lack of pre-trend after balancing the control to the treated factories. After making this adjustment to correct for pre-trends, we continue to estimate large positive program effects on units ordered. These results support the case that the implementation of wage programs at suppliers was met with a corresponding increase in business from H&M.

6.2. Supplier Price Competitiveness

If the wage interventions threatened supplier profit margins, one way they could respond would be by rising prices quoted to H&M. To explore this possibility, we analyze data from the supplier performance evaluation system on suppliers' price competitiveness and production-related performance. The results of these analyses are reported in the Online Appendix Table A9.[21] First, we find no evidence of a change in the total supplier score associated with the factory (column 1). The estimated effect of *Any Wage Program* is 0.2 on a 100-point scale and not statistically different from zero.[22] Second, we find no evidence that program adopters became less competitive in price. In both price-related performance evaluation metrics, benchmarked against the average price of competitors (column 2) and best-in-market price (column 3), we fail to reject the null of no effect. The magnitudes of both are small relative to the high variability of the price scores.[23] Third, we find mixed results for non-price performance metrics. We observe a significant positive effect on lead-time (i.e., treatment factories seem to turn-around orders more rapidly), and a significant negative effect on product quality in the wage program adopters. However, these effect sizes are again small compared to the variability of the outcome; both are approximately 0.1 standard deviations. Taken together, we find no evidence that the wage interventions were

[21] In analyses using supplier scores as the outcome variable, we use the same approach to balance pre-treatment means in supplier scores and pieces shipped as for the entropy balancing method illustrated in Section 7.2. Supplier scores can range from 0-100.
[22] The standard deviation for *Total Score* is 8.
[23] The standard deviation for the score on price relative to the average price of competitors is 35. The standard deviation for the score on price relative to best-in-market is 36.

associated with significant declines in suppliers' overall competitiveness. It does not appear that modest wage increases associated with the wage programs led to any significant change in the prices quoted to H&M. The estimated effects on all supplier performance metrics tracked by H&M are modest in magnitude.

6.3. Worker Overtime Pay

One major criticism of low-wage industries like garment manufacturing is that workers must work excessive overtime hours to meet their basic needs. The wage interventions focused on base wages during normal work hours in part to address this criticism. If the wage interventions stimulated supplier firms to reorganize work to induce higher labor productivity, factories may meet their production targets with less need for overtime hours. If so, we expect overtime wage to fall after introduction of wage programs. On the other hand, if labor productivity during normal work hours remained the same, we might instead see stability in the level of overtime work.

We only have records of overtime wages in a subsample of factories, mostly from 2017-2019. Within this subsample, we see suggestive evidence that factories were able to decrease their reliance on overtime wages, possibly through greater labor productivity during normal work hours. In the Online Appendix, we estimate equation (1) replacing the dependent variable with the natural logarithm of *Overtime Pay* instead of *Base Wage.* The results show an (insignificant) 1.9% decline in the overtime wage associated with the introduction of any wage program. The average overtime pay is USD 116 and represents 26% of total earnings in this subsample. That is, the reduction in average total earnings from the reduction in overtime wage is (26%)(–1.9%) = –0.5%, which is more than offset by the estimated increases in base wage during normal work hours.

6.4. Total Employment

One concern about raising wages is that higher wages may lead to lower overall employment. Although our empirical setting differs from the more typical context in which wages and employment have been studied (the imposition of minimum wage laws on entire labor markets), it remains possible that participating factories reduced their employment as wages rose. For example, the skill-upgrading incentivized by the WMS could lead to a reliance on fewer, more highly-skilled operators. To examine this possibility, we analyze whether the wage interventions were associated in lower employment at participating factories. We only have limited data on the number of employed factory workers available from 2017 to 2019. Within this subsample, we estimate equation (1) replacing the dependent variable with the natural logarithm of *Total Workers* instead of *Base Wage.* Results reported in the Online Appendix suggest that the wage programs were associated with an increase rather than a decrease in total employment. Participating factories show an increase in the number of employed workers of approximately 4%. This increase in employment suggests that suppliers required a larger workforce to complete the larger orders they received from H&M as a consequence of participating in the wage programs.

6.5. Discussion of Findings

H&M's wage programs encouraged supplier factories to create systems that allowed workers to raise their wages by accomplishing the milestones defined by the wage programs. These interventions did not impose a new minimum wage, and, thus, differ from the traditional setting for economic analysis of wages and prices: the statutory minimum wage (Clemens [2021]). If labor productivity is assumed to be completely static, then supplier firms that increase wages face a trade-off between reducing their profits or increasing their prices. However, in a more realistic model where labor productivity is dynamic, suppliers could also respond to increased labor costs

by increasing the productivity of labor they employ to offset higher hourly costs (Mayneris et al. [2018]). Higher labor productivity may be achieved by changing the organization of work, the technology deployed at work, or the skill mix of employees. Prior research (e.g., Lazear [2000], Lollo and O'Rourke [2020]) finds that improvements in remuneration systems can be associated with increased worker productivity that offsets the costs of higher wages. Bloom and Van Reenen [2010] present survey evidence that management practices among many firms in the developing world remain quite far from the productivity frontier, suggesting that the implementation of new management practices could unlock productivity improvements.

Overall, our empirical findings show (a) that wage program participants received higher business volumes from H&M and (b) that there is no evidence the costs of higher wages were passed along to H&M in the form of higher prices. This suggests that the costs were absorbed by some combination of reduced supplier profit margins (but not necessarily total profits, due to the increase in volume) and productivity improvements to offset the wage costs. Interviews with H&M managers yielded anecdotes about how the wage-related programs resulted in mechanisms to increase labor productivity; intra-factory discussions around wage levels improved communication and transparency around human resource management practices, which resulted in improved workers' ability to bargain for other workplace amenities and enhanced worker morale and productivity. Our findings on the small decline in overtime pay also suggest greater labor productivity during normal work hours. That said, a comprehensive empirical analysis of the wage interventions and labor productivity was not possible in this research. We note that for our average base wage effect of a few percentage points, relatively modest productivity gains could offset this increase in wages. In addition to the mechanisms described above to increase labor productivity from the implementation of remuneration systems, the increase in order volumes associated with

the wage programs may have yielded increased opportunities for economies of scale that suppliers could exploit to achieve higher labor productivity.

7. ADDITIONAL ROBUSTNESS TESTS

7.1. Controlling for Factory-Specific Wage Trends

A major potential source of bias may arise through selection on wage trends. If the average wage trend in adopters differed from non-adopters, the panel fixed effects model in equation (1) will yield biased estimates of the effect of the wage programs, even after accounting for different wage levels across factories and country-specific macroeconomic shocks. In analyses reported in the Online Appendix, we estimate the panel fixed effects model and the event study model as in Panel A of Table 3 augmented with factory-specific linear time trends. This specification absorbs linear trends in unobserved confounders that vary from factory to factory (e.g., Hainmueller and Hangartner [2013]). The estimation yields a statistically significant coefficient of 0.031 on the *Any Wage Program* indicator which is slightly larger than the estimated effect of 0.027 in Table 3. We also conduct the same analyses with units ordered as the dependent variable. Although both analyses conclude that units ordered increased, the magnitude declines markedly after introducing factory-specific trends. This coefficient instability suggests that the effects on pieces estimated from simple two-way fixed effects models are distorted by omitted variable bias (Oster [2017]; Altonji et al. [2005]). This leads us to prefer estimates that directly address the possibility of divergent trends across treated and control groups, such as the trajectory-balancing and panel-matching methods described in section 6.1, as well as the analysis reported here modeling factory-specific time trends. All these analyses converge on a large, statistically significant positive effect on pieces ordered.

7.2. Entropy Balancing

To address potential bias due to selection into treatment based on other non-wage characteristics, we use entropy balancing to better match treatment factories to comparable control factories (Hainmueller [2012]). Specifically, we use information from the supplier performance evaluation system to create a new estimation sample in which control factories have identical pre-treatment means and variances in their supplier ratings to the factories that received treatment. In addition to these supplier performance scores, we include two production-based measures in the balancing process. The first is the share of production for H&M's primary brand. The second is the average annual number of units shipped to H&M in the pre-treatment period. For all pre-treatment covariates, we take the average *prior* to treatment. For example, if a factory receives treatment in 2015, we take its average supplier score for 2012–2014. For a factory that never gets treated, we take its average supplier score over 2012–2019. Comparisons of the pre- and post-entropy-balancing moments reported in the Online Appendix show that treated suppliers scored higher on sustainability but lower on other features like price and quality prior to balancing. Treated factories also shipped more units to H&M prior to treatment. Post-entropy balancing summary statistics confirm that, within the newly balanced sample, treated and never-treated suppliers exhibit highly comparable characteristics. In results reported in the Online Appendix, we replicate our analyses in the balanced subsample and demonstrate the robustness of our results from the panel fixed effects model within this balanced sample.

7.3. Alternative Estimation Methods

Recent research in accounting (e.g., Barrios [2021]) highlights issues inherent in the staggered differences-in-differences research design in estimating treatment effects. Potential bias arises due to different forms of treatment effect heterogeneity. In a standard two-way fixed effects

model, already-treated units may serve as effective control units for units treated in later periods such that their outcome changes may already reflect treatment effects from earlier periods. Whereas existing research suggests several alternative estimators to address these problems, it has not settled on an established standard yet. In this section, we show that our estimated wage effects are robust to several alternative estimation methods that have been proposed in recent literatures. Results based on the stacked cohort design suggest an effect size of roughly 15% (Cengiz et al. [2019]), while the De Chaisemartin and d'Haultfoeuille [2020] method estimates an effect size that is roughly 16% higher in treated factories by the third year of program implementation. Given our unbalanced panel data structure and the importance of controlling for macroeconomic shocks present in each of the different labor markets, we believe that the estimation method developed by Callaway and Sant'Anna [2021] is most suitable for our research design. To allow macroeconomic conditions to vary by country as in our main analyses, we first use the Callaway and Sant'Anna [2021] method to compute nine country-specific average treatment effects on the treated (ATT). Then, we aggregate these into an overall ATT, with the weight of each country-specific effect proportional to the country's share of treated factories (reported in the final column). The estimated effect on wages using the Callaway and Sant'Anna method is 3.0%, which is extremely close to our prior estimates.[24] These results are reported in the Online Appendix.

8. CONCLUSION

This study examined the impact of inter-firm management control interventions to increase factory worker wages at supplier firms by H&M, a large multinational clothing retailer. Our difference-in-differences estimates suggest that the wage-related managerial interventions were

[24] The corresponding effect on units ordered based on the Callaway and Sant'Anna [2021] estimator is 17.9%.

associated with an average wage increase of approximately 3 percent relative to factories at which no wage-related interventions were implemented. Event study analyses estimate this effect grows to 5 percent in by the third year of implementation. We do not find conclusive evidence that labor union presence increases the wage effects of the programs. The wage programs were also associated with an increase in units ordered from participating factories, suggesting a deepening of the commercial relationship in exchange for factories' embrace of H&M's wage-related goals.

These findings offer new evidence on the role of inter-firm management control interventions for generating social impact in global supply chains. These interventions require significant resource investments that include the establishment of formal management control systems such as wage grids that establish clear guidelines for employers to remunerate their workers according to skill level and experience. Our analyses suggest that these investments have a significant impact on increasing worker wages compared to their cost to the buyer; the estimated wage impacts were many times greater than H&M's investment in the interventions. This study therefore has implications for how corporations can exert positive social impact by promoting remuneration practices that can result in fair and ethical treatment of factory workers employed at globally dispersed supplier firms. We encourage future research to examine different contextual factors that influence the effectiveness of inter-firm management control interventions and speak to boundary conditions of such interventions.

Although we are cautious in generalizing the estimated magnitude of the impact to other settings, we believe that our results provide supporting evidence of the impact that multinational corporations can have in diffusing sustainable management practices in the developing world. Research in the strategy literature points to performance differences among seemingly similar enterprises that persist despite comparable organizational capabilities (e.g., Gibbons and

Henderson [2012]). One possible reason for such persistent differences is that practices underlying key organizational capabilities are difficult to diffuse as they involve tacit knowledge and complementarities (e.g., Levinthal [1997], Rivkin [2000]). Our findings provide further evidence that multinational corporations can have a significant impact in diffusing organizational practices via inter-firm management control interventions in their supply chain (e.g., Bloom et al. [2013]), and thereby can have a positive influence on worker earnings.

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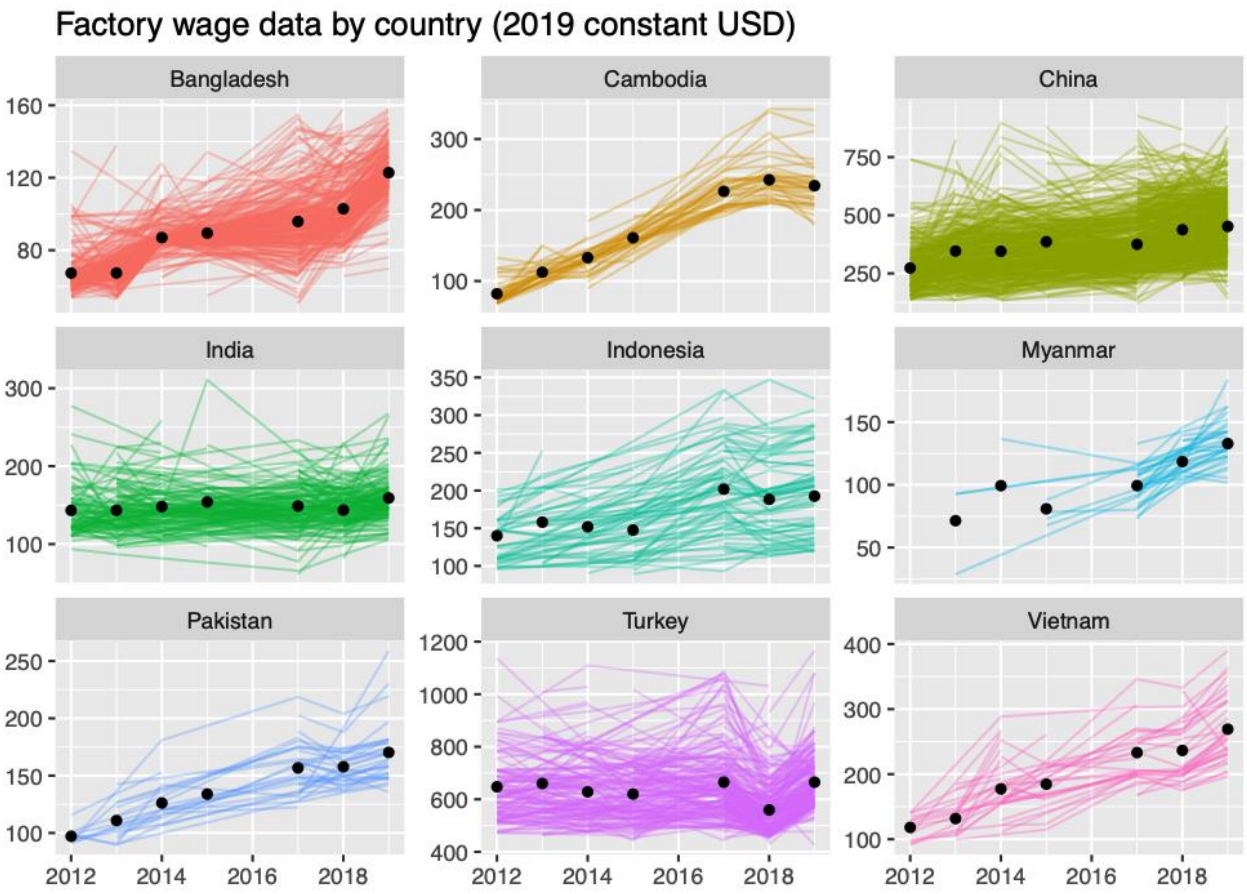
Figure 1:
Factory Base Monthly Wages



This figure shows average monthly wages of all factories for which wage data was collected, divided into the nine countries represented in this study. Wages are given in inflation-adjusted US dollars. Each line represents a factory, and black dots show the within-country average base wage. Factories cycle in and out of the supply chain. Thus, mean wages are not calculated from the same set of factories over time.

Figure 2:
Implementation Pattern of Programs

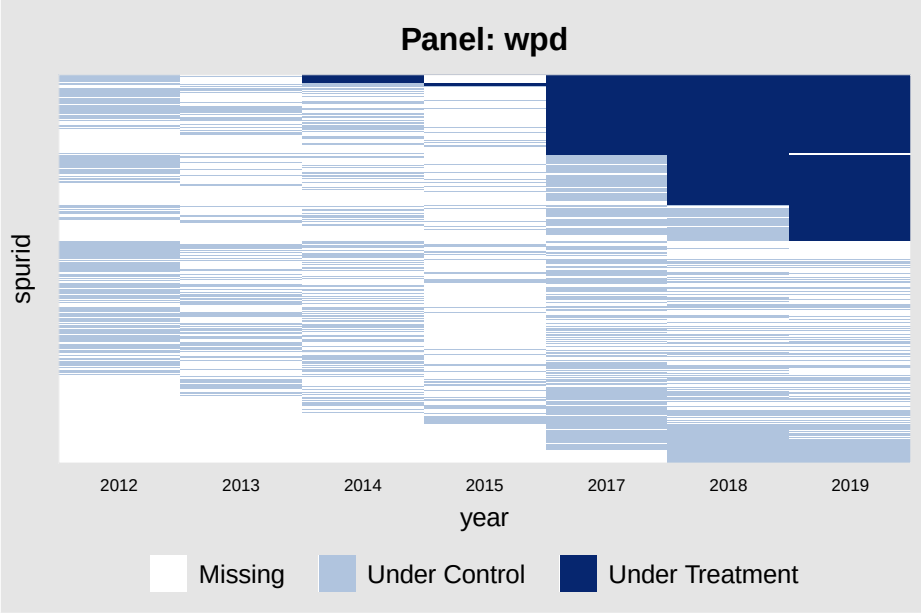


Figure 2a: WPD

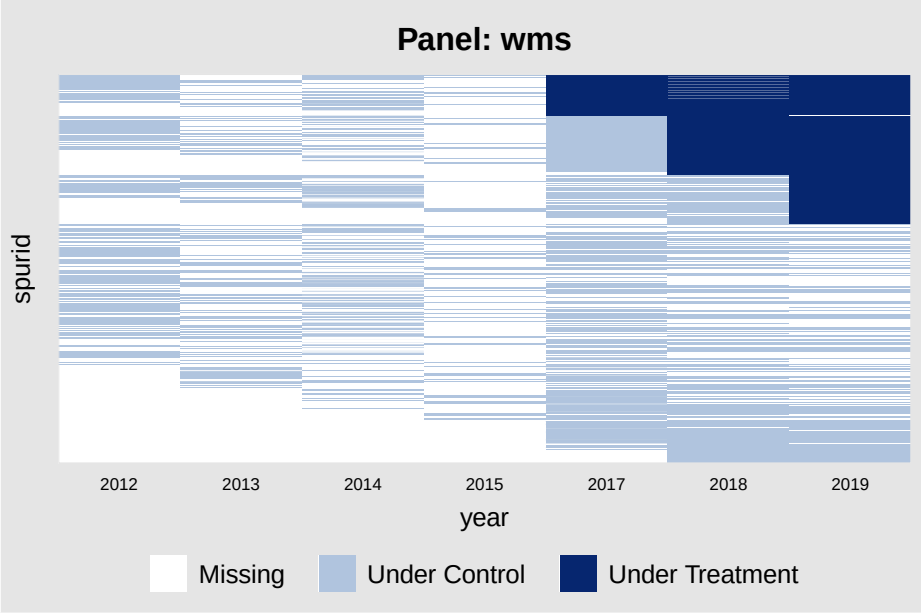
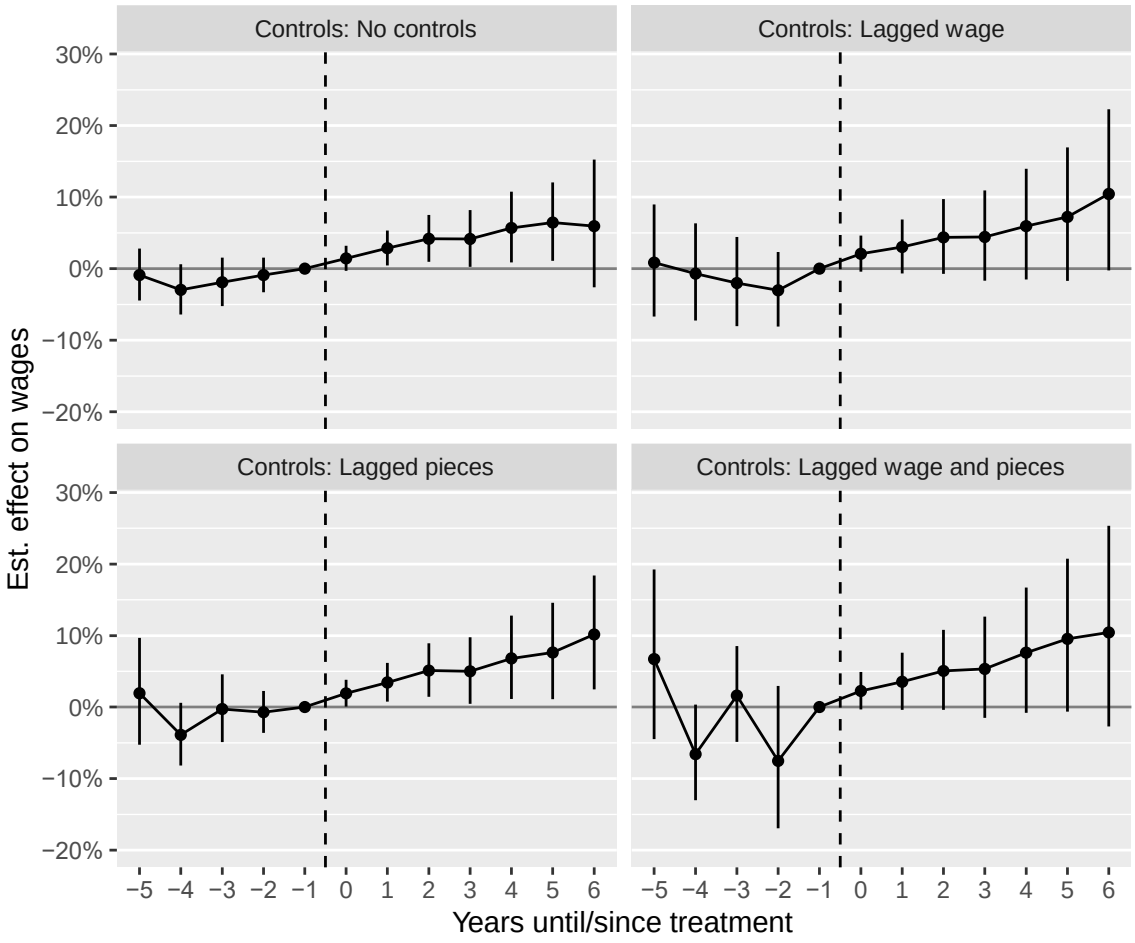


Figure 2b: WMS

Figure 2a illustrates the implementation pattern of WPD and Figure 2b illustrates the implementation pattern of WMS. Each horizontal ribbon represents a factory. Light blue indicates factories with wage data that are not yet enrolled in the program ("under control"). Dark blue indicates factories with wage data that are enrolled in the program ("under treatment").

Figure 3:
Event Studies of Program Effects on Average Base Wage



This figure plots the coefficients from regressing the natural logarithm of average factory wages on a series of binary indicators relative to the treatment year. Treatment is defined based on the *Any Wage Program* indicator. The x-axis represents the year relative to treatment. Lines show 95% confidence intervals. The figure in the top left estimates the baseline model that only includes the fixed effects as in equation (1). The figure in the top right adds lagged wages as a control. The figure in the bottom left adds lagged pieces as a control. The figure in the bottom right includes both lagged wages and lagged pieces as additional controls to the baseline model.

Table 1:
Descriptive Statistics

Panel A reports the number of factories with valid wage data for each implementation pattern of the wage-related program elements in our data. *WDP*, *WMS* and *Wage Grid*, correspond to the individual wage-related program elements. The "typical" implementation sequence begins with the WDP, then followed by the WMS with Wage Grid implementation at latter stages of the WMS. "Atypical" implementation sequence refers to any implementation pattern that deviates from the consecutive adoption of WDP, WMS, and Wage Grid. All values for 2016 are zero because 2016 wage data were not recorded during a revision to H&M's monitoring system. Panel B provides descriptive statistics for our main variables during the sample period 2013-2019. The unit of analysis is the factory-year. *Base wage* is the annual average base wage in 2019 constant USD. *WDP*, *WMS*, and *Wage Grid* are indicator variables corresponding to the wage-related program elements. *Any Wage Program* is an indicator variable equal to one when a factory has been exposed to any of the three wage-related program elements, and zero otherwise. Factories are considered treated in their first year of participation in the program, even if it was only for part of the year. *Union Presence* is an indicator variable equal to one if a trade union was present in a factory-year, and zero otherwise. *Supplier Score* is the supplier performance evaluation system score associated with the factory. *Pieces* are the number of units ordered from the factory in the year.

Panel A: Wage Program Distribution

Typical sequence	2012	2013	2014	2015	2016	2017	2018	2019
WDP only	0	0	40	16	0	206	172	125
WDP and WMS only	0	0	3	2	0	117	329	463
WDP, WMS, and Wage Grid	0	0	0	1	0	48	96	196
Atypical sequence								
WMS only	0	2	0	4	0	24	34	37
WMS and Wage Grid only	0	0	0	0	0	5	7	9
WDP and Wage Grid only	0	0	0	0	0	1	2	0
Wage Grid only	0	0	0	1	0	3	1	0
Any program present	0	2	43	24	0	404	641	830
Untreated factories	887	630	820	391	0	1100	741	562

Panel B: Summary Statistics

	Mean	SD	Min	Max	Obs
Wage metrics					
Base wage (monthly, 2019 constant USD)	297	210	29	1166	6169
ln(*base wage*)	5.43	0.75	3.36	7.06	6169
Wage programs					
Workplace Dialogue Program (WDP)	0.29	0.45	0	1	6169
Wage Management System (WMS)	0.22	0.41	0	1	6169
Wage Grid	0.06	0.24	0	1	6169
Any Wage Program	0.31	0.46	0	1	6169
Other Factory Features					
Union Presence	0.21	0.41	0	1	6169
Supplier Score	65.5	6.9	36.2	87.7	2691
Units Ordered					
Pieces (millions)	2.04	6.43	0	127.5	5397
ln(*pieces*)	0.59	0.81	0	4.86	5397

Table 2:
Selection into Wage Programs

This table compares factories that adopted wage programs (treated) to non-adopters (control) in each year. The treated column reports the means of variables in the prior year (i.e., pre-treatment) for factories treated in each corresponding year in the first column. The control column summarizes the same statistic for factories that were untreated in that year. Panel A reports the means of wages and units ordered, and panel B reports the means of the supplier scores and trade union presence. Wages are de-meaned by the country-year average, as average wages vary greatly across countries. Note that wage data for 2016 are missing.

Panel A: Wage and Units Ordered

	ln(base wage), de-meaned			Pieces (millions)		
Adoption Year	Treated	Control	P-value	Treated	Control	P-value
2014	-0.014	-0.001	0.8491	4.301	0.872	<0.0001
2015	-0.021	0.005	0.4253	3.722	0.962	<0.0001
2016	-0.068	0.001	0.2979	4.1	0.791	<0.0001
2017				2.928	0.667	<0.0001
2018	0.007	0.017	0.6275	1.689	0.481	<0.0001
2019	-0.047	0.03	0.0005	0.942	0.37	0.0019

Panel B: Other Factory Features

	Supplier Score (0-100)			Union Presence (indicator)		
Adoption Year	Treated	Control	P-value	Treated	Control	P-value
2014	61.562	65.603	0.0513	0.178	0.181	0.9609
2015	67.894	66.68	0.2105	0.255	0.176	0.0445
2016	68.513	67.78	0.3715	0.228	0.172	0.1308
2017	61.576	58.063	<0.0001	0.201	0.169	0.3135
2018	65.26	63.21	0.0011	0.279	0.146	<0.0001
2019	63.158	64.302	0.1407	0.188	0.16	0.3913

Table 3:
Program Effects on Base Wages

Panel A reports the results of OLS estimations for different specifications of the two-way fixed effects model in equation (1). The dependent variable is the natural logarithm of the average factory base wage in 2019 constant USD. Columns 1-4 include separate indicators for implementation of each program element. Column 5 models the wage-related program implementation using the indicator *Any Wage Program*. The bottom of column 4 reports point estimates for linear combinations of the coefficients on the three individual program elements modeled together. All specifications include factory fixed effects and country-year fixed effects. Standard errors are clustered at the factory level. *, **, and *** represent significance levels of 0.10 [or 10 percent], 0.05 [or 5 percent], and 0.01 [or 1 percent], respectively. Panel B summarizes the calculations of the program effect sizes and associated costs on a per worker basis in dollars. The counterfactual total wage is calculated based on country-specific estimates of equation (1). For each factory-year enrolled in one of the programs, the estimated effect of the combination of programs is subtracted from the total actual annual wage bill to produce an estimate of the counterfactual annual wage.

Panel A: Fixed Effects Model

	DV: ln(base wage)				
	(1)	(2)	(3)	(4)	(5)
Workplace Dialogue	0.020**			0.005	
	(0.009)			(0.010)	
Wage Management System		0.028***		0.022**	
		(0.009)		(0.009)	
Wage Grid			0.031**	0.022*	
			(0.014)	(0.013)	
Any Wage Program					0.027***
					(0.009)
Constant	5.455***	5.452***	5.459***	5.449***	5.451***
	(0.006)	(0.005)	(0.005)	(0.006)	(0.006)
Factory FE	Yes	Yes	Yes	Yes	Yes
Country-year FE	Yes	Yes	Yes	Yes	Yes
Observations	6,169	6,169	6,169	6,169	6,169
R-squared	0.554	0.555	0.554	0.555	0.555
Number of factories	1,803	1,803	1,803	1,803	1,803

Combined program effects from estimates in Panel A, column (4)	
Workplace Dialogue alone	0.005
	(0.010)
Workplace Dialogue + Wage Management System	0.027***
	(0.010)
Workplace Dialogue + Wage Management System + Wage Grid	0.049***
	(0.017)

Panel B: Quantifying Economic Magnitudes

Total enrolled factories with data (either program)	813
Total factory-years	1,845
Total worker-years	2.82 million
Actual total wage in enrolled factory-years (2019 USD)	$5,650.7 million
Counterfactual total wage in enrolled factory-years	$5,526.1 million
Total change in wages	$124.6 million
…divided by 2.82 million worker-years in enrolled factories	
Change in wages per worker-year	$44.17
Total cost to H&M for implementing the programs in analyzed factories	$4.57 million
…divided by 2.82 million worker-years in enrolled factories	
Cost per worker	$1.62
Estimated per-worker increase in wages	**$44.17**
Estimated per-worker cost in analyzed factories	**$1.62**

Table 4:
Heterogeneous Wage Effects by Supplier Rating

This table reports the results of OLS estimations that examine heterogeneous effects of the wage programs depending on supplier performance ratings. Columns 1-2 estimate the same specification as in columns 4-5 of Table 3, Panel A within the subsample of factories that belong to a supplier with a rating of Silver and below. Columns 3-4 repeat this analysis using the subsample of factories that belong to a supplier with a rating of Platinum or Gold. The dependent variable is the natural logarithm of the average factory base wage in 2019 constant USD. All specifications include factory fixed effects and country-year fixed effects. Standard errors are clustered at the factory level. *, **, and *** represent significance levels of 0.10 [or 10 percent], 0.05 [or 5 percent], and 0.01 [or 1 percent], respectively.

	DV: ln(base wage)			
	Subgroup: Lower-rated suppliers		Subgroup: Higher-rated suppliers	
	(1)	(2)	(3)	(4)
Workplace Dialogue	0.0235		0.0140	
	(0.0151)		(0.0260)	
Wage Management System	0.00267		-0.0254	
	(0.0143)		(0.0260)	
Wage Grid	-0.00719		-0.0169	
	(0.0210)		(0.0262)	
Any Wage Program		0.0347**		0.00189
		(0.0142)		(0.0285)
Constant	9.371***	9.365***	9.252***	9.238***
	(0.0110)	(0.00974)	(0.0255)	(0.0230)
Factory FE	Yes	Yes	Yes	Yes
Country-year FE	Yes	Yes	Yes	Yes
Observations	2,296	2,296	872	872
R-squared	0.590	0.591	0.610	0.608
Number of factories	964	964	473	473

Table 5:
Labor Union Presence and Wage Effects

This table reports the results of OLS estimations that examine heterogeneous effects of the wage programs based on labor union presence. The model adds an interaction term between *Any Wage Program* and *Union Presence* to the specification reported in column 5 of Table 3, Panel A. The dependent variable is the natural logarithm of the average factory wage in 2019 constant USD. The bottom of this table compares the coefficient on *Any Wage Program* to the linear combination of the coefficient on *Any Wage Program* and the interaction term. Factory fixed effects and country-year fixed effects are included. Standard errors are clustered at the factory level. *, **, and *** represent significance levels of 0.10 [or 10 percent], 0.05 [or 5 percent], and 0.01 [or 1 percent], respectively.

	DV: ln wages (2019 constant USD)
Any Wage Program	0.025***
	(0.009)
Union Presence	-0.002
	(0.014)
Any Wage Program × Union Presence	0.011
	(0.017)
Constant	9.258***
	(0.006)
Factory FE	Yes
Country-year FE	Yes
Observations	6,166
R-squared	0.589
Number of factories	1,803
Estimated effect when no union present	**0.025*** **
	(0.009)
Estimated effect when union is present	**0.037** **
	(0.017)

Table 6:
Individual Program Wage Effects

This table reports results of OLS estimations seeking to isolate the effect of individual program elements. Panel A exploits factories that have only implemented either one of the two wage-related programs. Column 1 excludes factory-years where the WMS was present in the factory and column 2 excludes factory-years where the WDP was present in the factory. Panel B focuses on the set of factories with the "typical" implementation pattern of the individual elements – i.e., WDP, WMS, and Wage Grid in consecutive order. WDP Only is defined as one for factory-years in which only WDP was in place, and zero otherwise. WDP→WMS is defined as one for factory-years in which the WDP and WMS were in place, and zero otherwise. Finally, WDP→WMS→Wage Grid is defined one for factory-years in which all three elements were in place, and zero otherwise. All specifications include factory fixed effects and country-year fixed effects. Standard errors are clustered at the factory level. *, **, and *** represent significance levels of 0.10 [or 10 percent], 0.05 [or 5 percent], and 0.01 [or 1 percent], respectively.

Panel A: Either WDP or WMS

	DV: ln wages (2019 constant USD)	
	(1)	(2)
Workplace Dialogue	0.019	
(and no Wage Management System)	(0.014)	
Wage Management System		0.055**
(and no Workplace Dialogue)		(0.026)
Constant	5.019***	5.070***
	(0.017)	(0.024)
Factory FE	Yes	Yes
Country-year FE	Yes	Yes
Observations	4,809	4,354
R-squared	0.471	0.433
Number of factories	1,755	1,711

Panel B: Typical Implementation Pattern

	DV: ln wages (2019 constant USD)
WDP Only	0.017
	(0.010)
WDP→WMS	0.032***
	(0.011)
WDP→WMS→Wage Grid	0.041**
	(0.019)
Constant	5.450***
	(0.007)
Factory FE	Yes
Country-year FE	Yes
Observations	5,651
R-squared	0.539
Number of factories	1,675

Table 7:
Program Effects on Units Ordered

This table reports the results of OLS estimations for different specifications of equation (1) with a new dependent variable: the natural logarithm of units (in millions) ordered from the factory by H&M in the relevant year. The remaining specification details are identical to those reported in Panel A of Table 3. All specifications include factory fixed effects and country-year fixed effects. Standard errors are clustered at the factory level. *, **, and *** represent significance levels of 0.10 [or 10 percent], 0.05 [or 5 percent], and 0.01 [or 1 percent], respectively.

	DV: ln(pieces)				
	(1)	(2)	(3)	(4)	(5)
Workplace Dialogue	0.276***			0.180***	
	(0.021)			(0.022)	
Wage Management System		0.274***		0.148***	
		(0.021)		(0.023)	
Wage Grid			0.210***	0.071**	
			(0.037)	(0.035)	
Any Wage Program					0.286***
					(0.020)
Constant	0.318***	0.283***	0.265***	0.308***	0.326***
	(0.036)	(0.035)	(0.037)	(0.035)	(0.035)
Factory FE	Yes	Yes	Yes	Yes	Yes
Country-year FE	Yes	Yes	Yes	Yes	Yes
Observations	12,621	12,621	12,621	12,621	12,621
R-squared	0.107	0.103	0.070	0.116	0.112
Number of factories	1,803	1,803	1,803	1,803	1,803

Combined program effects from estimates in Panel A, column (4)	
Workplace Dialogue alone	0.180***
	(0.022)
Workplace Dialogue + Wage Management System	0.328***
	(0.023)
Workplace Dialogue + Wage Management System + Wage Grid	0.400***
	(0.042)