CHAPTER 8

From 'Labour Dividend' to 'Robot Dividend': Technological Change and Workers' Power in South China

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China became the world's largest market for industrial robots in 2013. The robotic revolution gained pace and occurred after the 2008 financial crisis as many export-oriented firms coped with dwindling orders, rising labour costs and growing concerns over occupational safety. Unlike workers in the Global North who experienced automation in the 1960s and

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1970s against a backdrop of strong union activism, whether semi-proletarian peasant-workers in China ultimately enjoy the 'beneficial' effects of industrial upgrading is questionable. However, very little social science research has investigated how automation, in light of the negative consequences of unemployment and deskilling, can continue to be advanced. Drawing on Beverley Silver's concept of workers' power, this article explores how workers' *marketplace* and *workplace* bargaining power interfaces with technological change. The Chinese case may offer important lessons to those in the under-technologized South seeking to conceptualize strategies for social change in the context of industrial upgrading.

Introduction

In summer 2011, Foxconn Technology Groups, one of China's largest employers, declared that it would use one million robots to replace human labour over the next three years. The company, which has excelled by deploying a military-style management and has rapidly become the world's largest contract manufacturer of electronics, cranking out gadgets for Western firms such as Apple, decided to alter its mix of capital and labour (Pun et al. 2016; The Economist 2011). Although the adoption of robots proceeded at a slower pace than expected, when news came in May 2016 that the Foxconn factory in Kunshan, Jiangsu Province had retrenched 60,000 workers, over half of the total workforce, it triggered ambivalent feelings among analysts and observers there (of the shift towards use of industrial robots) (Zuo 2016). The city of Kunshan had grabbed headlines in 2014 following an explosion in a sand-blasting workshop in an auto parts factory, killing 75 people in one of the most serious recent industrial accidents. Since then, the Kunshan municipal government has been trying to shift its growth strategy by replacing humans with robots.

The trajectory of Foxconn's industrial policy change warrants academic attention because it reflects the transformations in the dynamics between the state, capital and labour as China witnesses gradual change in development strategy gradually shifting from leveraging its 'demographic dividend' to developing a 'robot dividend' (Dongguan People's Government 2014). Until the 2008 global financial crisis, China's economic growth was rooted firmly in its massive workforce, a dividend associated with a relative increase in the age and participation rate of the labour force. However, China's traditional low-end, labour-intensive and export-oriented mode of production encountered a bottleneck following the

financial crisis. In 2014, China's economy recorded GDP growth of 7.4 per cent, its slowest rate of expansion since 1990 (Bird 2015). The government and media began to champion the 'robot dividend' that emphasized accelerating efforts to use automated machinery and robots in place of human labour.[1] Premier Li Keqiang, when presenting the 'Made in China 2025' policy, vowed that the government would upgrade China's manufacturing industry within a decade through 'intelligent manufacturing'[2] backed by automated factories and 'big data' to develop an innovation-driven and value-added sector (Xinhua Net 2015). Local governments in the major manufacturing bases of the Yangtze River Delta (YRD) and the Pearl River Delta (PRD) also actively echoed the central government's initiative. For example, in the city of Dongguan, where this study was conducted, the municipal government launched a policy called 'Replacing Humans with Robots' (*jiqi huanren*) and pledged to offer 10–15 per cent subsidies to qualified firms to upgrade their equipment (Dongguan People's Government 2014).[3]

In fact, Foxconn is not the only Chinese manufacturer betting on automation, as China's robotic revolution is well under way, albeit without great fanfare. China became the world's largest market for industrial robots in 2013, with demand skyrocketing to 57,096 units in 2014, a 25 per cent share of the total global supply (IFR 2015). Demand is expected to continue to rise in the foreseeable future as robot density in China, which is only 30 units/10,000 workers, remains very low, less than half of the world's average and far behind countries with higher levels of automation such as Korea and Germany (Ministry of Industry and Information Technology [MIIT], 2016).

China's robotic revolution might paint a rosy picture for the state and capital, but its impact on labour remains very controversial. As shown in the Foxconn case, automation might improve workers' well-being by taking over operations that are repetitive, monotonous and hazardous. On the other hand, in light of the lethal power of robots to cull the workforce in the world's most populous country, one might hesitate to embrace the robotic revolution without reservation. Therefore, it is surprising that the 'Made in China 2025' plan, drafted by the Ministry of Industry and Information Technology (MIIT) with the input of more than 20 other ministries, did not invite any suggestions from either the trade unions or the Ministry of Labour and Social Security and the Labour Bureaus at the provincial and local levels (Butollo and Lüthje 2017). Even though the plan saw 'labour' as factor 'cost' to be reduced, there were no assessments

of the mid- and long-term impacts on the labour market or skill development (Ernst 2017). Paralleling the 'labour blind' tendency of the government agencies, labour scholars on China tend to be 'technology blind' as they focus largely on workers' misery in labour-intensive and dehumanizing environments while being slow to respond to the impact of industrial upgrading on workers (Chan 2013; Friedman and Lee 2010).

Drawing from Beverly Silver's (2003) theory of 'workers' power', this article explores contradictions between technological upgrading and labour activism in China's burgeoning robotic revolution. Countries in the Global North such as the USA, Japan and Germany achieved automated production in the 1960s and 1970s, when labour unions still wielded strong bargaining power. This process also predated the emergence of the global value chains that assign value-added tasks of R&D and marketing to the Global North and low-value jobs of Original Equipment Manufacturer (OEM) production and parts supply to the Global South (Chan et al. 2013; Lüthje 2002).[4] In contrast, China's automation took place during an economic downturn in the aftermath of the 2008 financial crisis. Chinese migrant workers, as a semi-proletarian labour force with weak trade unions and low labour protection standards, might find it very difficult to enjoy the beneficial effect of an industrial upgrading (Butollo and Lüthje 2017). However, very few social science studies have investigated the impact of automation, in light of the negative consequences of unemployment and deskilling. In this conceptual context, this article seeks to answer the following questions: (1) How did automation takes place in a country in the Global South and how did the semi-proletarian status of migrant workers make China amenable to industrial upgrading? (2) Despite the lack of protection for craft or industrial unions, how might workers' identity as 'peasant-workers' give them bargaining power that will affect the trajectory of technology-driven accumulation? The case of China, a late industrializing nation, is likely to offer important lessons for those in the under-technologized South who seek to conceptualize strategies for social change in light of weak union protection.

Technological Change and Workers' Power

Mainstream economists insist that industrial upgrading and innovation are necessary steps for establishing and maintaining competitive edge in the globalized economy (Dai and Zhang 2016; Freeman and Soete 1997). They often adopt a Schumpeterian perspective to consider innovation to

be relevant only to a firm's entry into and exit from the market (Howell 2015; Li 2011), but they have largely dismissed the role of workers in the labour process as a whole. In this model, 'labour' is seen as a 'static factor of production, something that pre-exists in a raw homogenous form awaiting mobile capital to touch down and set it to work' (Taylor 2009, p. 439). Labour is not, however, a homogenous factor, as industrial upgrading might weaken some kinds of workers' power and strengthen others. Moreover, labour's reaction will also influence the path of technological change.

In the 1970s and 1980s, labour scholars explored changes in union power after automation in the Global North. Harry Braverman (1998 [1974], p. 8) lamented that the unionized working class 'lost the will and ambition to wrest control of production from capitalist hands' when automatic numerical control (NC) machines were introduced in the postwar era. Unlike Braverman, Tessa Morris-Suzuki (1988) adopts a less deterministic and more contextualized understanding of the response of the union. In her account of the automobile industry's automation process in the 1970s in Japan, the Nissan union initially played a central role in the company's policymaking and disavowed the dismissal of workers. However, entering the 1980s, an economic crisis and union split severely weakened the union's bargaining power as its members had to compromise with the employer's demand for substantial layoffs. To obtain a dialectical understanding of workers' power, Silver (2003) draws on Erik Olin Wright's concept of 'structural power' to show that industrial development does not necessarily disempower workers, although it may have divergent effects on workers' *marketplace* and *workplace* power.

Despite Silver's call to follow labour movement dynamics in the Global South, few studies have investigated the effects of technological change on labour activism in countries that have industrialized recently. Scholars studying Chinese labour issues tend to be, as noted above, 'technology blind' as they continue to prioritize research on sweatshop-like, alienating, welfare-deficient and labour-intensive working conditions (Chan 2013; Friedman and Lee 2010). Zhang's (2015) ethnographic study of the dilemmas facing the Chinese automobile industry is an exception. She shows that, while just-in-time (JIT) production methods may jeopardize workers' *marketplace* bargaining power by widening the gap between full-time and temporary workers, the automation system itself is extremely vulnerable to disruption and thus augments workers' *workplace* power. Zhang's research has helped us conceptualize the complex relationships

between technological change and labour politics. However, she focuses mainly on skilled and well-paid workers in the automobile industry, but has not studied workers employed in more volatile OEM industries.

This research is based on a larger project that investigates the barriers to and incentives for adopting automation in the city of Dongguan in South China. Three months of ethnographic fieldwork was conducted between September 2015 and January 2016. The study was based on participant observations and interviews with managers in 12 firms, comprising four robot suppliers and eight robot users. Eight of these factories adopted automation in the metal processing, electronics, automobile parts, furniture and bicycle and motorcycle helmet manufacturing industries. Among them, four factories were recipients of Dongguan government subsidies under the 'Replacing Humans with Robots' programme. In addition, 51 interviews were conducted with workers, labour NGO staff and volunteers, factory owners and managers and academics and government officials. Further, 31 of these informants were directly involved in the automation process.

The Semi-Proletarian 'Peasant-Workers'

> A gust of wind blew upon us
> Lifting us up beyond the soil
> Descending upon machines and assembly lines in a distant land
> Immersed in noise, engine oil, red and black adhesives, lead powder, and rust
> We were lashed together, screwed down, and nailed tight
> We were spun around so fast
> Draining our rustic accent, howls, and hot tears
> Until our last drop of sweat was shed
> And we were ossified into a rock
> Only to be discarded along the roadside
> Crops will not grow even if we were to return to the fields
> The rocks keep piling up along the roadside
> One by one, cheek to cheek, in the cold (A Rock along the Roadside,[5] Ji 2013)

The poem vividly portrays how migrant workers, troped as soil, have their life sucked up by machines and then dispersed back to the countryside when they are no longer required in the workplace. Now, drained of all nutrients, the once-fertile soil has turned into a barren rock, unfit to

grow crops. During the Chinese New Year Holiday in 2017, Dongguan captured news headlines as the top ghost town in the country. Nearly 70 per cent of its population migrated during the *Chunyun* (Lunar New Year Travel Rush) (Ye 2017). Covering an area of 2460 km^2, the city hosts over 80,000 manufacturers and has a population of 8.3 million. Of these only 1.9 million are permanent residents with urban *hukou* (household registration) and 6.4 million are migrants mostly employed in factories (Dongguan Statistical Yearbook 2015).

Not only were the migrant workers drained of their sweat and blood in the rural exodus, the 'land' in Dongguan experienced a similar process of nutrient depletion. Despite its fame as the 'world's factory' in the past, it was better known as a 'land of fish and rice' (*yumi zhixiang*), as the fertile alluvial soils of the PRD turned the area into a grain basket for Guangdong Province (Liu 2010). At the beginning of the reform era, the Dongguan government was lured into the drive for rapid industrialization and pursued an export-oriented policy called 'both ends abroad' (*liangtou zaiwai*). This implied that the production process would begin and end in international markets, a prototype of OEM production that Dongguan firms continued to adopt in the later years of the reform (Dongguan Municipal Government Office 1998). The migrant labour population increased from only 156,222 in 1986 to 1.42 million in 1995, almost equal to the population of permanent residents (Dongguan Municipal Government Office 1998). After the privatization of Township and Village Enterprises (TVEs) in 2003, the population of migrant workers in Dongguan grew to 4.33 million, almost three times that of hukou-holding residents (Dongguan Statistical Yearbook 2003).

The massive rural exodus that started in 1985 in China can be understood as a process of 'the emaciation of the rural', after the post-Mao regime abandoned the pro-rural policy and reoriented economic development to an urban-centred approach (Yan 2008, p. 25). In 1978, the Household Responsibility System (HRS) instituted two-tiered land rights: Landownership was vested at the village level while land-use rights were distributed equally and leased for family contract farming.[6] With the decline of state investment in agriculture following decollectivization, family based production experienced a range of new problems, including the deterioration of irrigation systems, the fragmentation of farm land and a need for major investments in inputs and machinery (Huang 2015). After the state lowered grain procurement prices in 1985, the urban–rural income gap began to widen and remained wider, exacerbated by the exorbitant taxes

and charges that village and township governments imposed to compensate for their revenue shortfalls (Tao et al. 2011). The decline of grain production between 1999 and 2003 prompted the central government to launch incentive policies such as the grain subsidy programme (2004) and the abolishment of agricultural taxes (2006), partly contributing to the first round of a putative labour shortage (Chan and Nadvi 2014; Zhan 2009). However, sustained low prices for farm produce and the rising costs of agricultural inputs failed to deter farmers from opting for urban migration. Here, the countryside definitely serves as a reservoir for surplus labour, although during favourable seasons rural workers might enhance their *marketplace* bargaining power by choosing not to migrate.

At first glance, the rural exodus in China echoes migratory patterns that are similar to other late-industrializing countries of the Global South. However, the Chinese case stands out because of the institutionalized process of semi-proletarianization in what is known as the *hukou* system. Migrant workers, better known as *nongmingong*, are caught between being *nongmin* (peasants) and *gongren* (workers). As stated in the poem, migrants are called to work in the city but not to stay in the city. As rural hukou holders, they are supposed to return to the countryside for education, healthcare services, retirement and other socially reproductive activities. The roots of this 'spatial separation of production in urban areas and reproduction in the countryside' can be traced to the socialist era of the 1950s when it was instituted both as a population control mechanism and as a welfare package (Pun and Lu 2010, p. 497). In the reform era, the hukou system was re-deployed as a means by which authorities could maintain social stability by avoiding ghettoization. It was also seen as an excuse to legitimize low wages for migrant workers who are deprived of benefits being enjoyed by urban residents. By 2015, the average salary of a migrant worker was only 60 per cent that of an urban resident (Bai 2016).

In face of exploitative working conditions, China's migrant workers could rarely obtain the protection from the All-China Federation of Trade Unions (ACFTU), the only legal representative of workers in China (Chen 2016; Clark 2005). Set up at the founding of the People's Republic of China, the ACFTU represented urban workers employed in the *danwei* (work unit) system to guarantee workers' economic interests under socialism as well as the elimination of the capital-labour division (Chen 2009). In the mid-1990s, when the *danwei*, more commonly called state-owned enterprises (SOEs) in the reform era, had to undergo neoliberal restructuring, the ACFTU, as an organization subservient to the state, failed to

prevent the lay-off of over 30 million workers. In the aftermath of the drastic reduction of union membership, coeval with the quick expansion of private sector accompanied by growing labour conflicts, the ACFTU had reached out to private- and foreign-owned enterprises which employed largely *nongmingong*. However, workplace trade unions often lacked genuine linkage to rank-and-file workers. In many of the private firms, the management tended to oppose the establishment of a trade union. Even after trade unions were forced to set up, union leaders were usually concurrent members of senior management. Hence, labour strikes in China are often launched by unorganized workers, who felt excluded from power and decision-making processes in trade unions, while trade unions that have lost their role of representing workers end up pre-empting workers' collective actions and thwarting workers' demand for the right to organize (Chen 2009).

However, it is wrong to say that the ACFTU (backed by the Chinese government) are inherently 'anti-labour'. What the Chinese state enforces is actually a 'bifurcated strategy' that restricts workers' collective rights on one hand but confers on their individual rights on the other (Chan and Nadvi 2014; Chen 2016, p. 27). However, as the migrant workers hardly constitute a unified force, even individual labour rights are hard to come by. Before enactment of the Labour Contract Law in 2008, migrant workers had to endure low wages, abusive work conditions and lack of employment security (Gallagher and Dong 2011). Even by 2015, that is, eight years after its implementation, 63.8 per cent of migrant workers had not signed labour contracts (National Bureau of Statistics 2016). Though the Labour Contract Law was drafted to stabilize industrial relations, the power imbalance between labour and capital in the legislative process influenced the final draft of the law to enlarge the permissible reasons for layoffs to include technological upgrading and management reshuffling in favour of capital (Gallagher and Dong 2011). Further, despite the significant contributions of migrant workers to urban GDP figures, local city governments lack incentives to support their labour and social rights. This is evident by their passive enforcement of labour laws, especially during economic downturns.

*Nongmingon*g, as a quasi-identity, has trapped migrant workers in the process of 'unfinished proletarianization' as they shifted between the city and the countryside while finding no permanent home (Pun and Lu 2010, p. 498). While the *hukou* system played a major role in legitimizing the minimal costs of labour reproduction, the conditions it produced were

similar to that in other countries of the Global South where workers have low incomes and weak social protection, often denied of decent wage and access to consumer goods. This may be seen as a specific characteristic of accumulation in peripheral capitalism (Jha et al. 2017).

In all, the semi-proletarian status of migrant workers' significantly affects the trajectory of technological change in the urban manufacturing sector. First, rural development and livelihoods are intimately linked to *nongmingong*'s decision of migration and indexing of labour market changes that influence industrial upgrading decisions. Second, the high turnover rate among migrant workers can affect how employers weigh the comparative costs between human labour and automated equipment. Third, without collective rights, senior workers are likely to experience the process of deskilling brought about by automation and thus will fail to prevent their replacement by machines. Some of these factors are considered in the next section.

Automation and Labour Politics

Workers' Marketplace Bargaining Power

The Myth of 'Labour Shortage'

In August 2014, the Dongguan Municipal Government passed a resolution called 'Promotion of Dongguan Enterprises for "Replacing Humans with Robots" (2014–2016).' This outlined the government's determination to transform the city from being the workshop of the world to serving as a base of intelligent manufacturing. As the policy stated, in three years' time, the government would allocate an annual fund of 200 million yuan to sponsor firms that adopt 1000–1500 automation programmes, helping to boost the per capita productivity rate from 80,000 yuan to over 110,000 yuan. Purchasing the capital equipment to automate does not alone qualify a manufacturer for the subsidy; such a firm needs to demonstrate how its industrial upgrading has fulfilled four criteria: workforce reduction, productivity increase, quality upgrade and improvement of work safety protections (Dongguan People's Government 2014).

Considering the dramatic increases in labour costs for the past few years, it is not surprising that 'work force reduction' topped the list of criteria for eligibility. According to official statistics, the city's annual average salary increased by 1.56 times in five years, from only 16,108 yuan in 2010 to 41,285 yuan in 2015 (Tang 2016). The recent round of labour

shortage began in earnest as early as the summer of 2009, even though its early origins lay in the spring of 2004 (Xinhua Net 2010). Soon after the Chinese New Year Holiday in 2010, Dongguan witnessed a workforce deficit exceeding one million which was explained as a labour shortage of a stunning 30 per cent. Labour-intensive industries were hit extremely hard, including electronics, furniture, garments, toys and others (Wuhan Evening News 2010). This shortage has been explained by prevalent scholarly interpretations in the theory of the 'Lewisian turning point', which adopts an analysis of demographic change to posit new mechanisms of rural-to-urban migration. Cai Fang and his colleagues were among the first to propose such a thesis as they showed how the one-child policy took a steep toll in ending the seemingly unlimited supply of migrant labour (Cai 2007; Hung 2009). To justify the 'Replacing Humans with Robots' policy, both the media and the Dongguan government offered statistics indicating demographic change: China's working age population dropped from the peak level of 941 million in 2011 to 916 million in 2014, a decline of 25 million in three years (Li and Yang 2015; National Bureau of Statistics 2015).

The problems with the 'Lewisian turning point' hypothesis are twofold. First, it is predicated on a rigid divide between urban industrial and rural agricultural sectors and hence assumes that the subsistence-based economy of the countryside will continue to send out 'surplus' labour to the city (Zhan and Huang 2013). Here labour migration is understood in terms of the law of supply and demand of the labour markets. But this approach fails to consider migrant workers' voluntary choices or even involuntary struggles. Recently, scholars have increasingly begun to unveil the dynamics of the relationship between the urban and rural sectors in a critique of this rigid hypothesis (Arrighi 2008; Weil 2006; Zhan and Huang 2013). For example, rural 'surplus' labour is far from being exhausted. In fact, the total number of migrant workers has continued to rise, from 253 million in 2011 to 274 million in 2014, an increase of 21 million (National Bureau of Statistics 2015). In 2009, just less than one third (31 per cent) of the total rural labour force of 469 million chose to migrate. Zhan and Huang (2013) reveal how rural development, especially the rise in TVEs in the 1990s and the government's 'Developing the West' and 'Constructing the Socialist Countryside' programmes of the 2000s, contributed the major portion of income growth in the countryside. Moreover, it has been found that rural labourers prefer local nonfarm employment to labour migration if the two offer commensurable economic rewards. Zhan and Huang (2013) cogently unveil how rural

development helped increase the *marketplace* bargaining power of migrant workers in the urban manufacturing sector. This is evident in the 153.8 per cent increase in wages between 2003 and 2009.

The second critique of the 'Lewisian turning point' is from the perspective of the importance of workers' struggles in elevating social and economic status (Chan 2013; Pun et al. 2016). A most inspiring case was the workers' strike at the Honda Auto Parts Manufacturing plant in Foshan in May 2010 that involved 1800 workers and lasted for 17 days, forcing management to accede to the workers' demand for a significant 32.4 to 70 per cent wage increase and democratic election of new trade union leaders (Chan 2013). In addition to the struggle for higher wages, migrant workers have been fighting for worker's rights and recognition, forcing the government to pass a series of laws such as the Social Security Law (Gallagher and Dong 2011).

Therefore, the so-called labour shortage discourse reflected workers' growing *marketplace* bargaining power rather than a real shortage in the labour supply. However, rising labour costs can also turn against workers if employers refuse to offer higher salaries, instead replacing workers with robots. Currently, the average monthly salary in the manufacturing sector in Dongguan was 4062 yuan,[7] and with social security expenditures labour costs easily exceeded 50,000 yuan per year. In comparison, industrial robots averaged less than 100,000 yuan/unit (General Administration of Customs 2015). Therefore, typically it takes only two years for employers to get their investment back from upgrading their equipment, a tempting solution to the pressing 'labour shortage' issue.

According to Dongguan government statistics, from September 2014 to December 2015, among the 1262 subsidized programmes, work force reduction totalled 71,253. Our research identified an alarming rate of job replacement. As seen in Table 8.1, a dramatic reduction in the labour force ranging between 67 and 85 per cent took place after technological upgrading in the four factories studied in this project.[8,9] Factory P cut its operational workers by 80 per cent after the introduction of robotic arms that took finished products out of the injection moulding machines, enabling one worker to manage five machines in contrast to only one worker per machine before automation. Still, the facility increased productivity by 10 per cent. The production line for bicycle helmets, cut the workforce even more dramatically, from 40 to 10.

Surprisingly, most of the workers we interviewed welcomed the encroachment of industrial upgrading, which perhaps they saw as

Table 8.1 Workforce Change Before and After Automation

Factory	*Product*	*Equipment*	*Previous workforce*	*Present workforce*	*Workforce reduction*
P	Printer transmission wheels (plastic)	Industrial robots for plastic injection moulding machine	1 worker 1 machine	1 worker for 5 machines	80%
C	Auto parts (plastic)	Industrial robots for plastic injection moulding machine	1 worker 1 machine	1 worker for 3 machines	67%
H	Bicycle helmets	Industrial robots for helmet venting hole cutting	40 workers	10 workers	75%
L	Mobile Phone LED die-cut modules	Automation system	20 workers/ line	3 workers/ line	85%

Source: Fieldwork data

inevitable 'progress'. In a focus group discussion, Meng,[10] a fourth-generation carpenter, suggested that the new automatic sculpturing machines helped reduce work intensity, lowered workers' exposure to dust and yet turned out higher quality doors. Later in a personal interview, however, he did mention a case in which veteran workers resisted reductions in salary. Another worker, Gang, who worked in an electronics factory but suffered from Myelodysplastic Syndromes (MDS), a kind of blood disorder associated with exposure to toxic chemicals, highlighted the advantages of automation:

> The automation process in Dongguan epitomizes social progress[…]. Some people are concerned about the consequences of worker displacement. I don't think that this is a problem to be worried about. I feel that the government should guarantee resource sharing. I used to be a farmer. Initially farming was manual work. The crops 100 farmers grew were not enough to feed 100 people. Now (with machines), two farmers can feed 100 people. With automation, fewer workers will be needed as per capita productivity increases.

However, after hearing about the government's subsidy to employers, the focus group participants began asking why the government did not subsidize laid-off workers. Responding to these issues raised by workers.

Mr Tan from the Dongguan government implied that it was the workers' responsibility to keep up with the 'wave':

> There is a saying that in the Yangtze River the waves from behind push forward those in the front. […] At this time, it is difficult for the government to consider offering them humanistic care […] such as assigning them psychiatrists. It is not feasible. Workers can only depend on themselves to learn new technology. […] Everyone needs to cultivate themselves so as to develop a competitive edge. […] This is a trend. […] A society's progress comes with costs.[…] Everyone here endures the pressure of survival.

We can see here that local governments benefited from migrant workers' economic contributions but neglected their social wellbeing as they were reluctant to take responsibility for the migrants who were considered as 'non-residents'. However, Mr Tan later admitted that the government's indifference to the adverse outcomes of automation was due partly to the workers' muted reaction. 'Now for people who petition the State Bureau for Letters and Visits (*shangfang*), they do it because of wage arrears and runaway bosses. I haven't heard any case of a petition due to replacement by machines'. Mr Tan's position is revealing for two reasons: On one hand, it uncovers how little opposition there is to the machines, and on the other, it shows that worker's response and the development of their consciousness is inadequate.

High Labour Turnover

Laying off workers does not present a major problem to employers. The manager of Factory H reported that they had 240 employees in their plastic injection moulding department prior to automation in 2010 and now have only 120 workers, but they never had to ask the workers to quit.

> The high turnover rate is a very special phenomenon in China. Therefore, I adhere to the law of natural selection, separating the wheat from the chaff (*quwu cunjing*). For a corporation, you can't lose your human rights as a result of evolution. That is a fundamental social right. The turnover rate is high in China, which matches my hiring freeze initiative. This works like an ecological cycle in nature. We utilize this natural cycle to add to or reduce our workforce.

Here the manager uses the trope of 'natural selection' to deflect employers' responsibility for compensating laid-off workers. Before 2014, the turnover rate in his factory was 150 per cent, having just recently dropped to 100 per cent in 2015. Although Chinese labour law requires employers to offer severance pay calculated at one-month's salary for each year of service, in reality there are various ways by which an employer can circumvent this regulation. Currently, the minimal salary in Dongguan is only 1510 yuan. Considering the average monthly salary of 4062 yuan in manufacturing, the bulk of workers' salaries comes from overtime work. Therefore, if an employer does not offer overtime tasks to its workers, the workers might quit their jobs 'of their own free will', obviating employers' mandate to offer severance pay.

Some labour scholars on China have not paid enough attention to the relationship between labour market factors and industrial upgrading. They tend to view high labour turnover as a phenomenon that threatens workers' skill development, employers' human capital accumulation and even social stability (Huang 2012; Li et al. 2012). The 'Migrant Workers' Employment Trends Report', released by Tsinghua University, indicates that the trend in temporary employment intensified in recent years, with the average duration of continuous employment for migrant workers lasting 3.8 years in the early 2000s while dropping to 1.4 years for the cohort entering employment in 2008. What is worse, frequent job shifting has not led to upward mobility, as has commonly happened in other countries, instead apparently representing nothing more than 'horizontal' career development or 'marking time' (Tsinghua Sociology Department Project Group 2013). Over one-third of their informants reported no improvement whatsoever in this respect.

Like the 'labour shortage' factor, the high turnover rate can be utilized by employers to enforce automation that further marginalizes workers' *marketplace* bargaining power.

Workers' *Workplace* Bargaining Power

Under labour shortage conditions as well as high turnover, some manufacturers consider automation as a viable solution to reducing their reliance on skilled labour. In our visit to Factory H, the manager explained to us that previously it took six months to train a novice operator to become proficient in cutting venting holes in a bicycle helmet. Now, the same worker who is assigned to operate the robotic arm can finish the tasks very

effectively in only three days. The reduction in the training period from six months to three days meant that, for employers, the ratio of the cost of training an operator to produce identical parts by conventional methods compared with the cost of using industrial robots is approximately 60 to 1. Braverman already observed this issue in his study of the automatic numerical control (NC) machinery in the post-WWII USA, when he reported the difference between training an artisanal machinist and a NC machine operator to be four years versus four months (Braverman 1998 [1974], p. 139). At that time, trade unions in the USA were still proactive and powerful so that employers had to '(in public at least) […] conceal the downgrading' of the trained machinist 'in the interest of a smoother transition and for public relations reasons' (Braverman 1998 [1974], p. 139). If veteran machinists in the USA silently accepted their labour degradation fate, how did non-unionized workers in China react to the encroachment of automation? Our Primary data show that with the increased productivity brought by advanced machinery, workers' pay immediately changed from a piece rate to a time rate. Employers used various strategies to persuade veteran employees to accept the reality of higher productivity for the same or even lower pay-scales.

The example of Rong who worked in a factory that produced metal car seat frames is illustrative of the impact of automation on categories of workers. In 2013, the owner purchased one automatic lathe for metal punching-stamping and one for welding. The punching-stamping lathe includes a series of tools that revolve to the next tool as the previous one completes its cycle, and is capable of finishing tasks that previously required 10 small lathes to accomplish. Rong estimates that the automatic lathe produces at least 30 items per minute, compared with only five items per minute produced by the 10 small lathes combined. The automatic welding lathe can weld at three points simultaneously and even remove welding slag and polish surfaces afterwards, replacing the labour of four to five workers. However, Rong's boss did not intend to replace all the old lathes immediately because the automatic lathes are economical only for large orders. The factory still relies on the skilled senior (40+) workers to operate the small outdated lathe. When the factory owner purchased the three automatic lathes, productivity increased almost tenfold. This time, rather than asking veteran skilled workers to operate the automatic machines, he hired three younger workers to operate them. This has a bearing on the wages of workers. Now, the younger operators are paid 5000 yuan per month, almost the same as the veteran workers with more advanced skills

and experience but lower productivity, leading to disquiet among veteran workers. Younger workers are preferred to veteran workers apparently because the younger workers are better able to adjust to small errors to which the machines are prone.

Factory H maintains dual payment systems for manual and robotic cutting of helmet venting holes. Manual cutting is paid at a piece rate, while robotic cutting operators are paid by time rate. At the time of the study, the latter group could produce 40 pieces per hour and were paid on average 4000 yuan per month. In contrast, manual workers produce 15 pieces per hour and are paid 5000 yuan per month in recognition of their skills. In the future, skilled workers will be replaced increasingly by robots. Currently, the factory uses the internal labour market to convert manual workers to robot operators rather than hiring younger unskilled workers from outside. The barrier is that the factory environment is noisy and dusty, making the job unattractive to younger workers.

The dilemmas of transition from labour intensive to robotic operations is reflected in the story of some veteran workers' experience with a failed strike. Jun is a third-generation carpenter and works with his father in Factory D, which specializes in manufacturing doors. The factory was set up in 2002 with fewer than 20 workers, but expanded to over 300 workers in 2009. Today it has only a little more than 100 workers. However, replacing workers was not a smooth process because the veteran skilled workers organized a strike to protest the drop in pay that automation brought.

Before the introduction of automatic lines, the factory had already launched a Taylorized approach to manufacturing that divided the production process into small steps. Jun's father had joined the factory soon after its establishment. At that time, his co-workers were all rural craftsmen who acquired woodworking skills from generations of practice. As the factory expanded, the owner found it hard to recruit a sufficient number of experienced carpenters and started to organize a division of labour, forming five door manufacturing units: feeding raw materials, cutting parts, pressing boards, assembling doors and painting. In the past, the factory manufactured conventional doors, catering to the booming real estate industry. However, after the 2008 global financial crisis, the factory owner incurred losses in the business that he chose to compensate for by attempting to extract higher profits on the product manufactured in the factory. This was the trigger for automation that leads to a drive to increase in the factory's competitiveness and shift its market from conventional

doors selling at 1000 yuan per piece to high-end, fire-resistant doors with average prices of 5000–6000 yuan per piece. In order to make the fire-proof door, the factory launched automatic and semi-automatic lines for laminating, cutting and painting.

The urgency to continue automating also came with the need to reduce pollution in the workshop. Manufacturing fire-proof doors required the insertion of asbestos and gypsum plaster. Long-term exposure to asbestos increases the risks of lung cancer, while immediate exposure will cause skin irritation. In 2011, the factory owner introduced a semi-automatic veneer pressing machine that accomplished a series of tasks from glue application to pressing the asbestos and gypsum plaster together. Before automation, veteran workers in the veneer pressing unit were paid at a piece rate of about 6000 yuan per month. The first month after automation, increased productivity helped push the average salary to 8000 yuan per month.

The owner quickly began recruiting younger workers. The head of the pressing unit became angry because his unit was composed mostly of workers who had worked at the plant for more than four years and even a few who had joined the factory at its inception in 2002 while union did not exist in the firm. After a quick discussion with his fellow workers, the pressing-unit head decided to call on a strike early one morning. He successfully used his authority to gain the support of not only veteran workers but also newly recruited younger ones. They halted production for about two hours before the owner came to yell at them: 'Do you still want to work here or not? If you choose to quit today, I will settle your wages'. The veteran workers suddenly realized that they were no longer the backbone of the factory and their skills no longer automatically granted them *workplace* bargaining power. In their 40s, most feared that they would have great difficulty finding other jobs if they were fired, and quickly returned to their positions. Each striking worker was fined 100 yuan as punishment. After the strike, the owner accelerated the automation process to cover operations in painting and cutting. Later, in their bi-monthly assembly, the owner would scold the workers: 'You are just a speck. The factory won't stop without you'.

Jun attributed the failure of the strike to the lack of solidarity among the workers. In the factory, the head of each unit liked to recruit fellow workers from their hometowns, a trend that became more pronounced after the factory introduced Taylorized form of production. For example, the veneer pressing unit is composed of workers from Hunan, while the painting unit has workers mostly from Henan. As the employer

introduced automation to various production units, workers from automated units installed later lacked incentives to support workers from units that had been automated earlier. Jun thought that if all the workers had participated in the strike together, the employer would have had to yield to the workers' requests. Jun did notice that, with the introduction of automation machines, veteran workers like him were no longer desirable. After the strike, the skilled workers all experienced pay cuts, while younger workers, although still earning lower salaries than the veteran workers, were paid slightly above the market rate. In a sense, automation stirred up tensions between skilled and younger workers through the process of de-skilling.

Finally, we can see from the above examples that workers do not resist deskilling but rather the unfair treatment they experience in the transition to deskilling. As semi-proletarians lacking union representation, workers were omitted from industrial policy decision making, giving free reign to employers to determine the process of industrial upgrading and to reduce salaries as they desired. Worker's semi-proletarian status in this regard has weakened their *workplace* bargaining power.

Conclusion

China, as the country with the world's largest population, is shifting from an economy based on exploiting its 'demographic dividend' to one based on possibly leveraging the upcoming 'robotic dividend'. This article shows the significant impact that this process of industrial upgrading is having on the labour force. Drawing on Beverly Silver's theory of the 'structural' power of workers, this article seeks to disentangle the complex relationship between technological change and workers' power. While a 'labour shortage' and high turnover rate might epitomize workers' increasing *marketplace* power, the rising labour costs that result might jeopardize workers' interests, as employers are incentivized to use robots to replace human labour. Moreover, employers can capitalize on the high turnover rate to avoid offering severance pay. In terms of workers' *workplace* bargaining power, in the absence of broad labour movements, the potential for initiating large-scale, well-organized resistance against deskilling might be weak.

Hence a dialectical analysis of the relation between technological change and workers' power is necessary. A dialectical approach on one hand refutes mainstream economists' notion of technological

determinism that views labour as a static and passive force awaiting capital's manipulation. On the other hand, it also cautions against an opposite tendency that champions workers' power as inherently insurmountable to machines. Automation machineries have the dual effects of increasing efficiency and improving work safety on one hand and causing worker displacement and deskilling on the other. Will technological change help provoke class consciousness? How might worker activism be organized in the era of robotic revolution?

While Silver offers insightful theories to examine how workers' bargaining power interfaces with technological change, she has not systematically discussed how workers in the Global South might be affected by automation different from their predecessors in the Global North. We try to fill in this gap by introducing the concept 'semi-proletarianization' into the analysis of workers' power.

First, in the 1960s–1970s, under strong union activism and welfare state labour protectionism, industrial upgrading in the USA and Japan did bring forward the 'beneficial' effect of increased wage although the negative consequences of worker de-skilling and union weakening should not be overlooked. In contract, when the robotic revolution took off after the 2008 financial crisis in China, workers might find it hard to get a fair share of the 'robot dividends' under the backdrop of 'periphery capitalism' (Amin 1974; Jha et al. 2017) when workers' semi-proletarian status blocked their entitlement to decent wages and access to consumer goods. By far, despite the high work displacement rate we recorded in our study, robotization might still seem a lesser evil than factory shutdown or relocation to Southeast Asia. Second, for the Chinese migrant workers who are used to high turnover, the fact that the workers impacted are themselves easily able to relocate to different cities, and different factories in possibly differing industries, makes them unlikely candidates to lead a concerted effort to raise class consciousness. Third, the process of automation is not being questioned symmetrically from all angles. Mainstream discourse touts robotization as an unstoppable trend that will lead to workers' upskilling and creation of new jobs, although they have not offered any credible evidence on what kind and what percentage of workers will get job retraining and work replacement (Wu 2017; Xinhua Net 2015). In contrast, there is little symmetrical attention given to the plight of workers who are directly or indirectly impacted by such technological changes. Even the official 'Made in China 2025' plan did not include any long-term or mid-term assessment of the possible impacts of automation on labour.

Therefore, workers might easily internalize a discourse of 'progress' and view their sacrifice as an inevitable outcome rather than standing up to fight against it.

Therefore, although it is evident that automation might deteriorate Chinese workers' conditions, the rise of class consciousness faces a number of important, if not presently insurmountable, hurdles. However, we do believe in the importance of education and organization as a way to empower workers. As previously mentioned, when workers were informed of Dongguan government's policy of subsidizing firms for industrial upgrading, they immediately questioned why there was not a corresponding policy in place to subsidize displaced or de-skilled workers. In the future, we think it important to carry on our research-cum-activism work to focus on the following two areas. At the aggregate level, we would like to conduct labour market research to understand the industry, sector, regional and gender pattern of job displacement. With the help of labour activists, workers will learn how their semi-proletarian status might be taken advantage of by employers for industrial upgrading, but at the same time, they can develop informal labour organizing to request both central government and local government to not only cushion the adverse impact of automation, but more importantly, to get more income with less hours—a just share of the 'robot dividend'. At the more detailed level, we would conduct shop-floor labour process analysis to understand how advance machinery might de-skill workers on one hand, but become vulnerable to 'localized stoppage or disruption by a small group of workers' (Zhang 2015, p. 90). The large-scale adoption of automation equipment will likely create a homogenized workforce and revolutionize shop floor control, it is time for workers in the Global South to unite and fight strategically.

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Notes

1. Authorities classify robots as either industrial robots used in manufacturing or service robots performing tasks other than industrial automation. In our research, we studied only industrial robots, which are defined by the International Organization for Standardization ISO 8373 as 'automatically controlled, reprogrammable, multipurpose manipulator[s] programmable in three or more axes, which may be either fixed in place or mobile for use in industrial automation applications' (IFR 2015). An industrial robot is a typical component of programmable automated systems. The term 'automation' denotes technology designed to replace human labour in the manufacturing process, combining industrial technologies for physical operations and computer technology for information management (Siciliano et al. 2009, p. 16). Here we use these terms interchangeably because in introducing robots, manufacturers are, at the same time, automating their production lines.
2. For a full definition of 'intelligent manufacturing' please refer to 'Guidance on National Intelligent Manufacturing Standard System Construction (2015)', jointly published by the MIIT and the Standardization Administration of China.
3. The literal translation of this policy should be 'replacing humans with machines' (jiqi huanren). However, we decided to adopt the translation 'replacing humans with robots' because the application of machines in itself does not make a firm eligible for the subsidy, although some degree of automation is required. The 2014 plan awarded subsidies to 438 firms, but only 5 per cent adopted industrial robots, while 95 per cent used non-robotic automated equipment.
4. An OEM is a company that produces parts and equipment that may be marketed by another manufacturer. For example, when Foxconn manufactures mobile phones for Apple, Foxconn is the OEM.
5. Translation by Yu Huang and Edwin Schmitt.
6. In 1982, the term of the contract was designated to be 15 years. To stabilize agriculture production and overcome the problem of further fragmentation of farmland, the principle of 'more people but no more land, fewer people but no less land' (zengren bu zengdi, jianren bu jiandi) was adopted. In 1997, the contract term was extended to 30 years (Wen 1999).
7. The average annual salary for the manufacturing sector was 48,750 yuan in 2015. See Yu (2016).

8. We were able to collect data on four out of the eight factories that adopted robots and automation systems. For the four factories from which we were not able to gather data, Factory M already had automation equipment (CNC) at the time of establishment. Therefore, there was no information on the labour force before automation. We obtained information on Factory D mostly from workers who had grievances with the owner and did not feel it would be appropriate to interview the owner. Factory J was still testing its automation line, which was not yet in production. The owner of Factory K did not want us to take notes of our conversion and did not want his factory to be reported on, even anonymously.
9. The table reflects only workforce changes in the same production line, not in the whole factory. For example, Factory L reduced labour in the production unit but increased personnel in the still labour-intense QC unit. However, it is foreseeable that with automation technology implemented in QC, the overall workforce for the whole factory will decline significantly.
10. All informants' names have been anonymized.

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