Worker-level Responses to the USMCA High Wage Labor Value Content Rules Requirement

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Abstract

There is robust empirical evidence that overall, NAFTA has had, at most, a small aggregate effect on wages, employment, unemployment, and GDP growth. However, NAFTA's negligible net effects mask significant negative effects on employment and wages for some industries and regions, and by gender. Under the United States–Mexico–Canada Agreement (USMCA), multiple measures were included to safeguard against U.S. job losses. One such measure is USMCA's high wage components of the labor value content (HW-LVC) requirement. In this paper, we investigate if the announcement of these measures ameliorated the demographically asymmetric labor adjustment effects of NAFTA. Our baseline results indicate that in the anticipatory period since USMCA's HW-LVC publishing and before the rules entered into force, overall auto industry hours worked have remained unchanged, and auto worker wages have experienced a 6.6% increase. In contrast to these baseline estimates, we find that female production workers experienced lower wage growth than their male counterparts during the in post-publishing period before the rules entered into force. Black workers demonstrated no statistical change in wages or hours from the pre-USMCA period. The divergence of female production worker wage growth from the aggregate autoworker estimates highlight the importance of a distributional approach to analyses of worker-level welfare effects, as our aggregate worker estimates masked relevant subgroup heterogeneity.

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1 Introduction

There is robust empirical evidence that overall, NATFA has had, at most, a small aggregate effect on numerous U.S. welfare indicators, including wages, employment, unemployment, and GDP growth. However, NAFTA's negligible net effects mask significant negative effects on employment and wages for some industries and regions, and by gender (Romalis (2007), Francis and Zheng (2011), Cimino-Isaacs, Hufbauer and et al. (2014), Caliendo and Parro (2015), U.S. International Trade Commission (2016), and Woldu, Alborz and Myneni (2018)). This geographic and industry concentration of employment displacement, especially in the automotive sector, prompted the Trump administration to renegotiate the Agreement's terms of trade (Chatzky, McBride and Aly Sergie (2020)). Under the United States–Mexico–Canada Agreement (USMCA), NAFTA's successor, multiple measures were included to safeguard against further U.S. job losses. One such measure is USMCA's high wage components of the labor value content (HW-LVC) requirement, which conditions vehicle producers' preferential tariff treatment on fulfillment of an average wage benchmark. Specifically, 40-45 percent of the vehicle's value must be produced at a facility where the hourly base rate is $16 dollars per hour or its national equivalent (Department of Labor (2020)).

The HW-LVC provision is intended to "support North American jobs", "benefit American workers", and "drive higher wages" in the United States by raising Mexican wages (Office of the U.S. Trade Representative (2020c)). In theory, raising Mexican auto wages to U.S. levels and thus eliminating wage savings gained by Mexican production would promote greater auto investments at home. Increases in domestic employment would follow increases in domestic investment, rejuvenating U.S. auto manufacturing.

So far, however, early anecdotal evidence suggests that practice has not followed theory. On the contrary, producers have doubled-down on their commitments to do business in

Mexico: some have raised hourly wages to the requisite \$16/hr., stated willingness to pay the tariff associated with missing the HW-LVC \$16 benchmark, and planned to offset the cost of tripling Mexican worker wages by installing robots to replace workers (Kim (2020) and Enriquez (2020)). This anecdotal divergence from the intended outcome motivates our empirical analysis. How have automotive workers fared in the anticipatory, pre-entry into force period since the announcement of the HW-LVCs? Have Blacks and females, groups who have historically experienced a wage penalty in manufacturing employment, fared differently than others?

Our baseline results indicate that during the anticipatory window since USMCA's HW-LVC publishing and before the rules' entry into force, auto worker wages experienced a 6.6% increase. In contrast to these baseline estimates, we find that female production workers earned less than their male counterparts during the anticipatory window. Notably, female production worker wage density shifts from the pre- to post- period show that the greatest employment gains came in the annual wage range commensurate with a \$16 an hour wage, the published minimum wage under the HW-LVC. Black workers demonstrated no statistical change in wages from the pre-USMCA period.The divergence of female production worker wage growth from the aggregate autoworker estimates highlight the importance of a distributional approach to analyses of worker-level welfare effects, as aggregate worker effects masked relevant subgroup heterogeneity. In addition, as these trends began before HW-LVC implementation, estimates of the effect of the rules' implementation should incorporate these anticipatory trends into empirical analyses.

This paper proceeds as follows: in section 2, we begin with a literature review covering the effect of NAFTA on the employment outcomes of American workers, both in the aggregate, and separated by auto industry, gender and "race".[1] We then provide background on the high wage labor value content requirements, including the conditions motivating their

[1]We use the term "race", acknowledging that it is a social construct, rather than a biological distinction.

inclusion in USMCA and the details governing their implementation and entry into force, in section 3. The empirical methodology follows in section 4, where we detail our identification strategy and explain our two-part econometric methodology. In sections 5 and 6, we discuss our results, propose robustness checks, and examine the economic implications of our findings. We conclude in section 7 by summarizing our findings and proposing next steps for subsequent phases of our research on the USMCA HW-LVC.

2 Literature Review

During the NAFTA period (1994-2020), the combination of the low wage rate and increasingly comparable productivity to U.S. levels influenced industry investment and employment increases in the Mexican auto sector (Figure 1) (Maranger Menk and Swiecki (2016) and Klier and Rubenstein (2017)). During same period, U.S. auto factories closed, and U.S. auto manufacturing wages stagnated from 2002-2018 (Klier and Rubenstein (2017) and U.S. Bureau of Labor Statistics (2021)). Though not diagnostic, the synchronicity of auto sector labor market growth in Mexico and market shrinkage in the U.S. raised alarm bells among manufacturing workers, politicians, and industry representatives.[2]

Though we are unaware of current studies that disaggregate auto industry welfare effects by gender or race, national, sector-nonspecific effects by gender follow a similar pattern to those in the NAFTA-region auto industry: NAFTA's establishment increased Mexican women's wages and employment, and NAFTA's tariff reductions raised employment and wage bill shares for Mexican females employed in blue collar jobs (Aguayo-Tellez, Airola and Juhn (2012)). For U.S. women, however, NAFTA slowed wage growth, especially for married blue collar women, and led to employment declines (Saure and Zoabi (2014), Hakobyan and

[2]The viral 2016 video of a Carrier executive informing Indiana manufacturing employees that their jobs would be offshored to Mexico became a major talking point in the 2016 election, and further reinforced the prevalent public opinion that NAFTA is in part responsible for the demise of U.S. manufacturing (Schwartz (2016)).

McLaren (2016), and Hakobyan and McLaren (2017)).

The importance of our study is emphasized by the limited literature that disaggregates effects of NAFTA by race or ethnicity. Benguria (2020)'s working paper estimating the effect of tariff changes under NAFTA on employment outcomes is the sole source of econometric analysis. Benguria finds that tariff liberalization under NAFTA reduced employment and increased unemployment of Nonwhite workers by more than White workers. EPI finds that, controlling for education, Black and Latino manufactures workers earn 23 and 25 percent less, respectively, than their White peers (Watch (2021)). Additionally, research by Public Citizen suggests that Black workers are disproportionately affected by offshoring of transportation investment and jobs (Watch (2021)). This disproportionate effect on Black workers is, in part, due to the fact that during the NAFTA period (1993-2019), Black workers were over-represented in the transportation equipment industry. The United States General Accounting Office's (GAO) Trade Adjustment Assistance (TAA) report (2000) assesses how both TAA and the North American Free Trade Agreement TAA (NAFTA-TAA) program that operated from 1994 to 2002 have "met the needs of workers affected by greater foreign trade and increased imports." The report's descriptive statistics for FY 1999, when compared to descriptive statistics from the 1999 the nationally representative American Civilian Labor Force (ACLF) dataset, indicate that Blacks and Hispanic/Latino workers were over-represented in the certified TAA rosters, and Hispanic/Latino workers were over-represented in the certified NAFTA-TAA roster.[3] More recently, the U.S. Department of Labor's (US-DOL) FY 2019 Annual Report of the TAA for Workers Program (2020) indicates that Blacks are over-represented among TAA program enrollees, and Whites and Hispanics are under-represented.[4]

[3]Forty-seven percent of certified NATFTA-TAA participants in 1999 were Hispanic/Latino, while the Hispanic/Latino ACLF for 1999 was 10.5%. The 1999 percentages of certified NATFA-TAA participants by race are documented in Appendix I of the GAO report. The 1999 percentages ACLF workforce participants are sourced from BLS, and are linked here.

[4]Note that TAA self-reported race indicators are only available for TAA program enrollees. Of the

One of the difficulties in estimating the effect of NAFTA on the welfare of U.S. autoworkers is the need to disentangle the contributions of technological change from the contributions of trade liberalization. In the United States and Mexico, both aggregate auto industry and overall manufacturing employment fell over the NAFTA period. Wen and Reinbold (2019) note that the U.S. auto manufacturing employment decline—which trends closely with the overall U.S. manufacturing decline—is due mostly to increased worker productivity, but that reducing the vehicle trade deficit could appreciably increase auto employment. Hufbauer and Schott (2005) estimate that the downward effect of technology on U.S. auto employment dominates the downward effect of Mexican employment. U.S. real auto compensation, which remained stagnant over the period from 1994 to 2004, is estimated to have declined due to a shift toward imports from low-wage countries.

Fukao, Okubo and Stern (2003) find that FDI inflow was the key driver influencing Mexico's growing share of U.S. auto imports. Indeed, over the period from 1993, just before NAFTA's entry into force, to 2016, U.S. auto imports from Mexico increased by 765%, while exports to Mexico increased by 262% (Koopman, Powers, Wang and Wei (2010) and Villareal and Fergusson (2017)). A combination of high U.S. production costs, easy access to inexpensive raw materials, and a Mexcan labor force of varying skill levels attracted and sustained U.S. FDI growth in the Mexican automotive sector (Cuevas and Lopez (2019)). These results validate long-held U.S. autoworker concerns of company relocations to Mexico, fueled by Mexican plants boasting "high quality workers at low wages" (Congressional Budget Office (1993)). Indeed, even those who believe that NAFTA helped the domestic auto industry note that NAFTA resulted in auto industry "rationalization of production and

universe of U.S. workers affected by trade, some will be covered under filed TAA petitions, and others will not. Of those covered under filed petitions, some will have their petitions certified, and some will not. Of workers covered under certified petitions, some will enroll in the TAA program and become a certified participant enrollee, and some will not. Because the sample from which TAA estimates are derived is such a filtered subset of workers potentially affected by trade, users of TAA estimates should exercise caution when generalizing the estimates to a broader context.

hence job displacements" (Burfisher, Robinson and Thierfelder (2001)).

USMCA's imposition of a production price floor within the LVC provision seeks to balance the U.S.-Mexico wage inequality by giving Mexican producers a choice: tariffs or higher wages. If producers choose tariffs, U.S. workers stand to benefit. Historically, workers in tariff protected industries have benefited from tariff imposition (Gertz (2020)). Trade protection increases relative wages for workers in protected industries, and when trade is liberalized, relative wages in industries facing the deepest cuts fare the worst (Goldberg and Pavcnik (2005)). Under the Canada-U.S. Free Trade Agreement, for example, this relationship between tariff cuts and wage cuts dominated the industry-specific human capital effect (Townsend (2020)). If, however, Mexican producers choose higher wages over tariffs, forfeiting the low-wage premium that make Mexico a more attractive destination than the U.S. for auto producers, U.S. workers may still benefit if producers' response to reduced wage savings is to shift production and investment to the U.S.

3 Background

USMCA's passage was touted as a "triumph. . . for workers everywhere across America" (Pramuk (2020)). By including the HW-LVC requirements, USMCA committed "all parties to. . . encourage more production of automobiles and auto parts in the United States" (United States Senate Committee on Finance (2019)). The USTR stated that "the new rules of origin will achieve (the) goal" of "discourag(ing) the outsourcing of American automotive jobs, and instead encourage more investment and manufacturing jobs here in the United States" (Office of the U.S. Trade Representative (2019b)).

The HW-LVC establish, for the first time in a trade agreement, a rules of origin (ROOs) requirement stipulating that a minimum of 40(45) percent labor value content for passenger cars (light trucks) be produced in a North American facility where the average production worker wage is a minimum of $16 per hour (Office of the U.S. Trade Representative (2020c)).

Under the standard staging regime, producers have three years to meet specified LVC thresholds that gradually increase over the period (table 1a). Producers also had the option to petition for an alternative staging regime with a longer transition period—five years—to ensure future production will meet the new LVC standards (table 1b) (Office of the U.S. Trade Representative (2020b)). Alternative staging regime criteria for approval differed according to whether the vehicles covered under the petition constituted more than ten percent of the producer's total passenger vehicle or light truck production.[5]

Between 2018 and 2019, numerous companies, including several of those whose petitions subsequently were approved, have stated either in public press statements or in conversations with USTR that USMCA will cause them to increase domestic auto investment (Office of the U.S. Trade Representative (2019a)). According to USTR, within five years, USMCA is estimated to support an additional 76, 000 automotive sector jobs. This figure, which would increase the domestic workforce by 7.6 percent, includes 22,800 assembly jobs, as detailed by specific information or public announcements made by automakers (Office of the U.S. Trade Representative (2019a)).

4 Empirical Strategy and Data

We investigate how the welfare of specific worker subgroups fares during the HW-LVC anticipatory window spanning publication to entry into force. The HW-LVC are novel (no other U.S. trade agreement has them) and new (they were first made public on September 30, 2018). While their novelty presents no barrier to robust analysis—the economic effects of

[5]Thirteen companies' petitions were approved. The companies are Cooperation Manufacturing Plant Aguascalientes (COMPAS), FCA North America Holdings LLC, Ford Motor Company Honda North America, Inc., Hyundai Motor America, Kia Motors Manufacturing Georgia, Kia Motors Mexico, Nissan North America Inc., Tesla Inc., Toyota Motor North America Inc., Volkswagen Group of America, Inc. Volvo Car Corporation (Office of the U.S. Trade Representative (2020a)). See table 2 for data about the companies listed.

both price floors and trade liberalization have a vast literature—their newness severely limits post-implementation data availability. Frictions in the labor market and multi-year phase in periods for both the standard and alternative staging schedules call for informed decision making in construction of the identification strategy. In the next section, we discuss our identification strategy, the data used, and the details of our multistep econometric approach.

4.1 Identification

To determine the anticipatory effect of USMCA's HW-LVCs on U.S. auto workers, we begin by identifying workers associated with any of four auto related manufacturing industry groups, as classified under the North American Industry Classification System (NAICS).[6] These auto workers are considered treated.

Then, under denoted specifications of our model, we disaggregate treatment cohort status by gender and race. As discussed in section 2, under NAFTA, female workers disproportionately fared worse than their male counterparts, and Blacks were over-represented among workers certified by USDOL to have been negatively impacted by NAFTA. Under specification A, we classify female workers as treated and male workers as untreated. Under specification B, we classify Black workers as treated and non-Black workers as untreated.

We then proceed to establish a treatment start date. The earliest possible start date is September 30, 2018, the date when the first draft of USMCA was made public. Numerous later dates are also viable. On May 17, 2019 the U.S. removed the Section 232 steel and aluminum tariffs on Canada and Mexico, thus eliminating a diplomatic hurdle to USMCA's passage in Congress (Law360 (2019)). On December 13, 2019, the Agreement passed the House. It passed the Senate on January 16, 2020, was signed by the President on January 29, 2020, and entered into force on July 1, 2020. The standard regime phase-in period will

[6] NAICS 3361 (motor vehicle manufacturing), 3362 (motor vehicle trailer manufacturing), 3363 (motor vehicle parts manufacturing), and 3369 (other transportation equipment manufacturing). (U.S. Census Bureau (2020))

be complete on July 1, 2023, and the alternate regime phase-in period is scheduled to be completed on July 1, 2025. A case could be made for choosing any of these dates.

We choose September 30, 2018 as our starting point for a treatment date. The HW-LVC's publication eliminates information asymmetry for industry stakeholders. Indeed, in the months following the announcement of the published ROOs, six automakers publicly announced domestic investments totaling 15.4 billion, due, in part, to the need to comply with USMCA's ROOs (Office of the U.S. Trade Representative (2019a)). We balance the need to capture agile industry reaction to the HW-LVCs with the acknowledgment that the labor market responds slowly to trade shocks, and that results generated from an aggressive treatment start date might suffer from underestimation (Artuc, Chaudhuri and McLaren (2010)). Even so, we see October 1, 2018 as a viable start date. Because certain indicators are surveyed monthly, and others are surveyed yearly, we synchronize the start date of monthly and yearly samples of our data and choose March 2019 as our treatment start date. Our choice of a treatment start date that predates the fullness of liberalization is in line with Hakobyan and McLaren (2016), which uses data from the 2000 decennial census as the treatment date for assessing NAFTA's local labor market effects (although NAFTA was only fully liberalized in 2008) (Hakobyan and McLaren (2016)).

Cross-sectional microeconomic data on worker demographics is sourced from the monthly Current Population Survey (CPS), where we retain workers age 16-64 for whom industry of employment is reported at the North American Industry Classification System (NAICS) 4-digit industry group code level. We control for sex, "race", education, state of residence, age, union membership, and veteran status.

4.2 Model

To determine the effect of the HW-LVC's announcement on the hours and wages of U.S. auto workers, we begin by estimating a baseline, two-period equation in which the outcome variable is either average hours worked or natural log wage. We restrict our sample to U.S. based auto workers, as explained in the identification section. Under model 1, the outcome variable Y_it represents either hours worked at an individual's "main job" in the previous week or worker's total wage and salary income from the previous calendar year. The variable "average hours worked" is collected in the monthly CPS sample. The variable "wage and salary income" is collected in the yearly CPS Annual Social and Economic Supplement (ASEC) sample. $Post_t$ is an indicator variable with a value of "1" if a worker was interviewed on or after the treatment start date of March 2020. Under the baseline specification, the coefficient of interest precedes the variable $Post_t$. X_i is a vector of demographics measuring age, education, race and sex. We implement increasing levels of controls by implementing union membership and state of residence, denoted FE_i.

$$Y_{it} = \theta_i + \gamma_1 Post_t + \gamma_2' X_i + \gamma_3' FE_i + \epsilon_{it}{}^7 \tag{1}$$

We extend the two-period baseline specification to incorporate a second difference, namely whether the auto industry worker is employed in a production occupation. In so doing, we hone our focus on the group of workers directly impacted by the HW-LVC, which stipulates that a given fraction of an automobile must be produced in a facility where the average production wage is \$16/hr or higher (table 1a and b). Under (2), $Production_i$ is an indicator variable with a value of "1" denoting workers in production occupations. Under this difference-in-differences specification, the coefficient of interest precedes the variable $(Post * Production_{it})$, denoting the treatment group of production workers surveyed during the post-HW-LVC-announcement period. The remainder of the variables and coefficients from (1) retain their denotations.

[7] Baseline Equation: (Two-Period Difference)

$$Y_{it} = \alpha_i + \beta_1(Post * Production_{it}) + \beta_2 Post_t + \beta_3 Production_i + \beta' X_i + \beta_5' FE_i + \epsilon_{it}{}^{8} \quad (2)$$

After establishing baseline estimates for the HW-LVC effect on all automotive industry workers (equation 1) and on production workers (equation 2), we move on to estimating whether traditionally fragile subgroups—women and Blacks—exhibit a disproportionate welfare response to the HW-LVC announcement. We employ the following differences-in-differences econometric strategy, with two specifications:

$$Y_{it} = \alpha_i + \beta_1(Post * Subgroup_{it}) + \beta_2 Post_t + \beta_3 Subgroup_i + \beta' X_i + \beta_5' FE_i + \epsilon_{it}{}^{9} \quad (3)$$

Under specification A, female workers in the post-announcement period comprise the subgroup of interest. Under specification B, Blacks in the post-announcement period are treated. Under this model, we estimate the effect of the HW-LVC on both the full sample of autoworkers and the subsample of workers who identify as associated with a production occupation.

Under model 3, Y_{it} represents hours worked or total wage and salary income from the previous calendar year at an individual's primary employment in the previous week. $Subgroup_i$ is an indicator variable with a value of "1" denoting workers who are part of the treatment subgroup according to specification (females under specification A and Blacks under specification B). The remainder of the variables from previous equations retain their denotations.

Lastly, we use a triple differences model to estimate the effect of the HW-LVC announcement on production workers surveyed in the post-announcement period who are members

[8] Baseline Equation (Difference-in-Differences: Production Workers)

[9] Difference-in-Differences (Subgroup Analyses)

of one of subgroups of interest. The coefficient of interest precedes the treatment group variable $Post_t * Subgroup_i * ProdWorker_i$, and all other variables from previous equations retain their denotations.

$$Y_{it} = \alpha_i + \beta_1(Post * Subgroup_i * ProdWorker_i) + \beta_n D + \beta_k DD + \beta_g' X_i + \epsilon_{it}{}^{10} \quad (4)$$

Under this model, equation (4), we use the full sample of workers.

Altogether, we estimate the effect of the HW-LVC using four models, two specifications, and 2 samples.

4.3 Descriptive Statistics

A key assumption in difference-in-differences estimation is that treatment and control groups exhibit parallel trends prior to an intervention, such that post-period treatment group deviation from smooth cohort trends can be causally attributed to the intervention. Figures 2, 3, 4, and 5 illustrate the pre-period trends for hours worked and wages. Wages trended similarly for groups separated by gender and race (figures 3 and 5). Hours worked also trended similarly for both groups over time, with the exception of the fourth quarter of 2018, which exhibited a non-parallel uptick in hours worked for both women (figure 2) and Blacks (figure 4).

In the pre-HW-LVC announcement period, the difference in mean hours worked between women and men was a statistically significant 1.72 hours per week, with women working fewer hours than men (Table 3). In addition, the wages for women were lower than for men (a difference of over $13,000) For all covariates listed, with the exception of duration of

[10] Triple Differences (Production worker and Subgroup Analyses). In the term $\beta_n D$, n=3, and D denotes the single term FE variables $Post_t$, $Subgroup_i$, and $ProdWorker_i$. In the term $\beta_k D$, k=3, and DD denotes the two-variable interaction terms, $Post_t * Subgroup_i$, $Post_t * ProdWorker_i$, and $ProdWorker_i * Subgroup_i$

unemployment, there was a statistically significant difference in levels in the pre-HW-LVC publication period.

Between Blacks and Nonblacks, the pattern was similar to the pattern exhibited by females/males: Blacks worked fewer hours than Nonblacks in the pre-period (a statistically significant 0.88 hour difference) and had an average wage income lower than their Nonblack counterparts (a difference of approximately $8.50) (table 4). One notable difference, however, was that within production occupations, Blacks were as likely as their Nonblack counterparts to hold supervisory positions. Between women and men, men had a statistically significant higher incidence of supervisory status in production occupations (table 3).

5 Results

Table 5 reports the results of the effect of the HW-LVC on all autoworkers generally, using baseline equations (1) and (2). We use Current Population Survey data from 2016 to 2020. Columns (1) – (3) have increasing levels of control: column (1) implements demographic controls, including education, veteran status, age, gender, and Black/Nonblack. Column (2) includes both demographic controls and controls for union membership. Households of union members historically have boasted a 10-20% higher family income than non-union households, with returns that are, on average, even higher for Nonwhites (Farber, Herbst, Kuziemko and Naidu (2021)). Column (3) includes demographic controls and union membership, and adds state fixed effects. By implementing state fixed effects, we control for state-specific macroeconomic trends, such as unemployment rate, minimum wage, and "right to work" status.

Under the baseline specification, estimated with the full set of demographic controls, union status and state-of-residence fixed-effects, the outcome "average hours worked" remain statistically unchanged in the post-HW-LVC-publishing period both for auto workers generally (table 5, full sample, column 3) and for production autoworkers specifically (table 5, full sample, column 4). During the same period, the wages of the full sample of workers increased. The coefficient (0.064***) in column (3) of table 5 represents a 6.6%, statistically significant increase in wages for the general autoworker population.[11] Production workers, however, see no such pay bump: their coefficient of -0.096 is negative and greater in magnitude of the general population's coefficient, though it is not statistically significant. Thus, when compared to their wages in the pre-announcement period and the wages of non-production occupation autoworkers from both periods, production worker wages post-announcement show no improvement.

The production worker subsample limits analysis of the effect of the HW-LVC to production occupation autoworkers, the group whose wages are utilized in HW-LVC calculations to determine the rules of origin. In contrast to the full subsample of auto industry workers, production occupation autoworkers do not earn a wage premium in the post-announcement period; across the increasing levels of controls (table 5, production workers subsample, columns 1-3), coefficients on wage remain small in magnitude and not statistically significant. Thus, when compared to their wages in the pre-announcement period, production worker wages post-announcement show no improvement.

A reduction in average hours worked might be a contributing factor to production workers' lackluster wage results. Though the estimates for average hours worked are negative and not significant in the full sample, in the production worker subsample, the estimates are larger in magnitude and weakly significant under the full set of controls, indicating a 1.1% decline in hours worked in the post period (table 5, production worker subsample, column 3).

Given these baseline estimates—no change in wages for production workers, a slight decrease in hours worked for production workers, an increase in industry wages, and no

[11] Percent change under a log-linear model with a categorical independent variable and log dependent variable is calculated as $100(e^{\beta_1} - 1)$, where β_1 is the coefficient on $Post_t * Subgroup_i$ of equation (1a) or (1b).

change in industry hours worked—we turn to comparing the estimates for our subgroups to our baseline estimates. The difference-in-differences full autoworker sample estimates in table 6 are the gendered corollary for the full sample estimates for table 5, columns 1-3. The difference-in-differences production worker sample estimates in table 6 are the gendered corollary for table 5.

The full sample estimates under table 6 indicate that post-announcement female autoworker wages and hours were not statistically distinct from the wages and hours of females in the pre-period or males in either period. In addition, post-announcement female production worker hours were not statistically distinct from the wages and hours of female production workers in the pre-period or male production workers in either period.

Female production workers wages, however, are substantially different from the control group, comprised of female pre-period peers and male peers of either period. Female production workers' coefficient of (-0.243**) (table 6) indicates that in the post period, female production workers earned 21.6% less than their peers. [12] Thus, the HW-LVC publishing is associated with a slight bump in overall wages for autoworkers, but a dramatic decline in wages for post-announcement period female production autoworkers.

Next, we juxtapose the effect of the HW-LVC on Black workers, as denoted in table 7. The difference-in-differences full autoworker sample estimates in table 7 are the "race" disaggregated corollary for the full sample estimates for table 5, columns 1-3. The difference-in-differences production worker sample estimates in table 7 are the race disaggregated corollary for table 5.

The first notable distinction between tables 5, 6, and 7 is that the coefficient on hours per

[12] The two-period baseline specification's 6.6% change in wages denotes wage growth relative to the pre-announcement period. The difference-in-differences estimate for female production workers denotes a change in wages for post-announcement female production workers relative to their peers (males from both periods and pre-announcement female production workers, and as such, might not indicate wage decline for the treatment group. For example, if peer wages rose and post-announcement female production worker wages remained unchanged, the relative change could still be negative.

week is largest in the Black full worker subsample. The estimate falls outside the traditional bounds of statistical certainty, but could be a facet influencing the larger positive (yet still not significant) coefficient on wages for the full sample of autoworkers. The second notable distinction among the tables is that Black workers have no statistically significant results. This lack of significance could be statistical power issue, given that more detailed demographic analysis necessarily lowers the number of treated observations. Nevertheless, among production workers, Black post-period workers—whether or not in production occupations–fared no worse statistically than the control group comprised of their Nonblack peers from both periods and their Black peers from the pre-period.

Last, we consider the triple difference estimators, which quantify the association of the HW-LVC with a worker's status as a female (Black) post-period production worker versus the field. The tiny and statistically insignificant triple differences estimates, reported in table 8, for post-period female production worker hours and post-period Black production worker wages affirm our previous statements that these indicators trended similarly to aggregated baseline. Though the coefficient on the triple differences Black post-period production worker hours worked estimate is larger in magnitude, the large standard error, combined with trivial size and insignificance of the difference-in-differences estimate in table 7, suggests that Black production workers are not driving the estimate. As in table 6, we see that female post-period production workers fared worse than their peers; the coefficient (-0.438***) in column (3) of table 8 represents a 35.5%, statistically significant decrease in wages for the post-period female production autoworker.

We delve further to investigate the source of the dramatic change in wages for post-period female production workers, especially given that Black production worker wages and hours, and female production worker hours, trended similarly to the larger, aggregated sample. Figures 6 and 7 picture the kernel density estimates for female and male production workers, respectively, over our period of study.[13] For male production workers, the post-period density plot in figure 7 has shifted right; while the pre-period plot has a pronounced mass at lower wages (less than $10,000 dollar range), the post-period plot has a pronounced mass at higher wages ($40,000 to $60,000). In contrast, for female production workers, the post-period density plot in Figure 4a has become more peaked relative to the pre-period plot. Notably, the post-period peak centers around the value $33,600 (the dashed green line in the plot), which is the yearly wage income that corresponds with an hourly wage of $16/hour.[14] As contrasted with the pre-period female plot, which has mass at lower wages ($0 to $20,000 dollar range) and higher wages ($50,000 to $90,000), the post-period plot has less mass at those aforementioned wage ranges, and a pronounced mass at the more central wages of ($30,000 to $50,000). This distributional evidence suggests higher wage female production jobs loss as a possible mechanism for the reduction in wages associated with the publishing of the HW-LVC rules.

Last, we investigate industry level events around the time of the HW-LVC publishing to shed more light on the marked decrease in female wages. On November 26, 2018, approximately 2 months after the HW-LVC's publishing, GM announced that future products would be allocated to fewer plants in 2019, and that five North American plants would be "unallocated" in 2019, leaving thousands of workers at those plants unemployed.[15] We regressed the natural log wage/average hours worked on a triple differences interaction term equal to one for post-period female(Black) production workers living in the metro areas associated with the idled plants. As in Table 6, where we report estimates for the nationwide sample

[13]The kernel density estimator is a nonparametric means of estimating the probability density function of a given variable.

[14]We compute a back-of-the-envelope yearly income figure of $33,600 by multiplying 50 weeks*42 hours per week (given the average hours worked from tables 3 and 4)*$16/hour.

[15]The unallocated plants were located in Michigan (Detroit-Hamtramck Assembly in Detroit and Warren Transmission Operations in Warren, Michigan); Canada (Oshawa Assembly in Oshawa, Ontario, Canada); Ohio (Lordstown Assembly in Warren, Ohio.); and Maryland (Baltimore Operations in White Marsh, Maryland.) (General Motors (2018)) It was reported that some workers employed at plants slated for idling will be offered jobs at other plants, but these job will require long-distance moves. (Lawrence and Hall (2018))

of female production workers, the results for average hours worked for female production workers in the GM closure metro areas estimated under the triple differences specification is positive, but not significant (table 8, column 4).[16] At -1.229, the estimate for natural log wage under the triple differences specification, while not statistically significant, is negative and large, representing a 70.7% decrease in wages for treated individuals. In addition, the average hours estimate for Black production workers in the region is very large and highly significant, representing a 15.9% reduction in hours worked for Blacks living in the plant closure region. This result for Black hours is curious, especially when paired with the coefficient on wages that continues to be small and insignificant.

6 Robustness

As a robustness check, we run a placebo regression to assess the validity of the difference-in-differences estimator. We estimate the relationship between and hours worked/wages and gender over all specifications in the years 2010 to 2016, a period predating widespread political discussion of NAFTA's renegotiation. We estimate the placebo regression using the progressive controls implemented in tables 6 and 7, and, as reported in table 9, no gendered divergence from smooth cohort trends.

7 Conclusion

We examine the wages and employment of U.S. auto workers to see if publication of the high wage labor value content rules (HW-LVC), announced in September 2018, exerted a disparate effect on female and Black workers. Multiyear phase-in periods for enforcement of LVC requirements could result in gradual labor responses from Mexican auto manufacturers

[16]The coefficient on the triple interaction term is 2.041, standard error is 2.104.

(and correspondingly attenuated follow-on responses from American auto manufacturers), but anecdotal evidence suggests that upon publication, some automotive companies moved quickly to articulate plans for dealing with the $16 average production wage stipulated under the USMCA rules of origin. Generally, we find that announcement of the HW-LVC had no statistically significant effect on the wages or hours of Black or female workers. The exception was for female production workers, who experienced a 21.6% decline in wages relative to their peers in the period subsequent to the rules' publishing. Our results indicate that, at least in the short term before the HW-LVS's implementation, U.S. female production workers have yet to experience the rules' welfare benefits. As these trends were established before entry into force, empirical analyses of HW-LVC implementation should incorporate these anticipatory effects.

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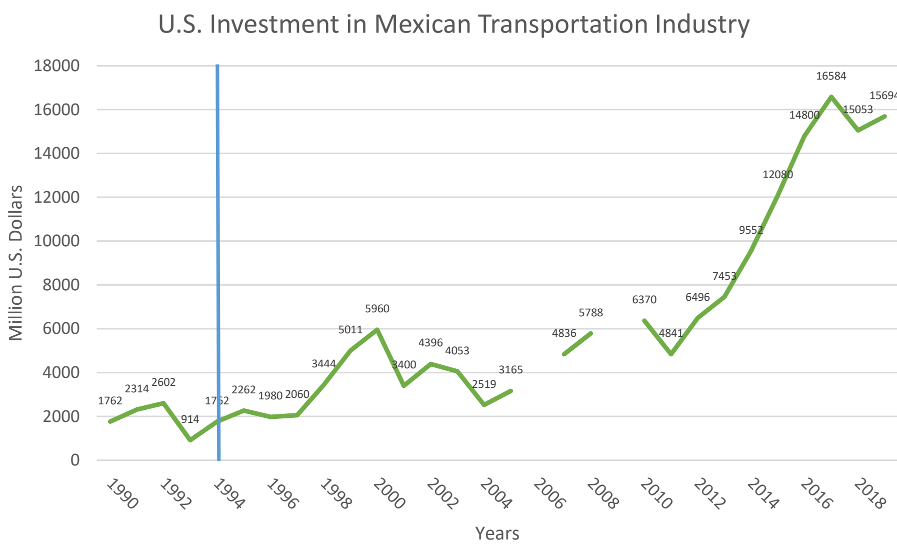

Figure 1: U.S. Direct Investment Position Abroad on a Historical-Cost Basis (Source: Bureau of Economic Analysis, Balance of Payments and Direct Investment Position Data, accessed 2/3/21)

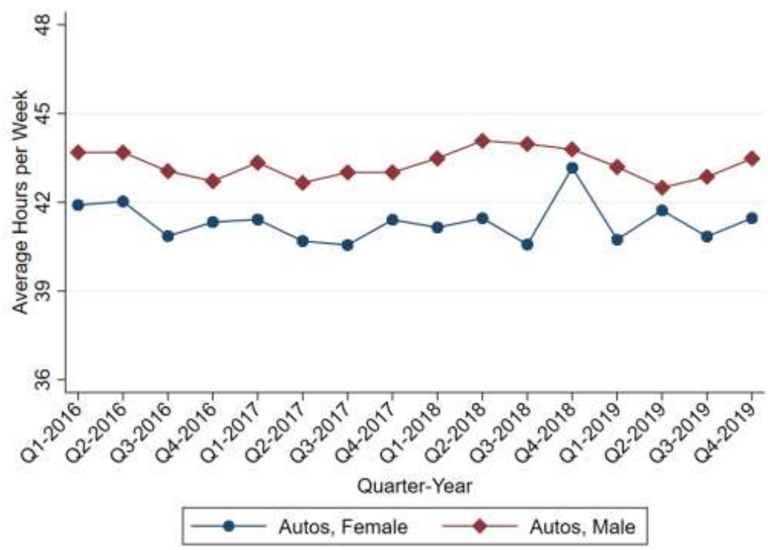

Figure 2: Female and male trends in average hours worked per week by quarter

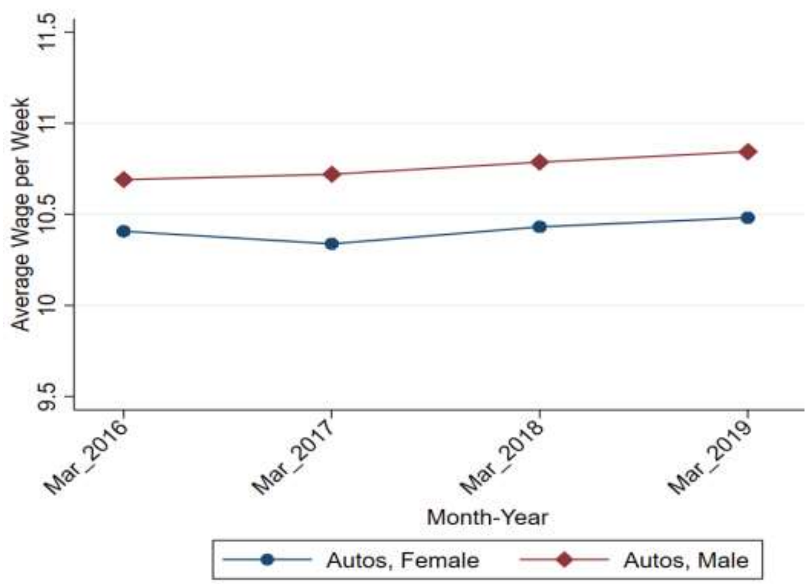

Figure 3: Female and male trends in average wages earned per week by year

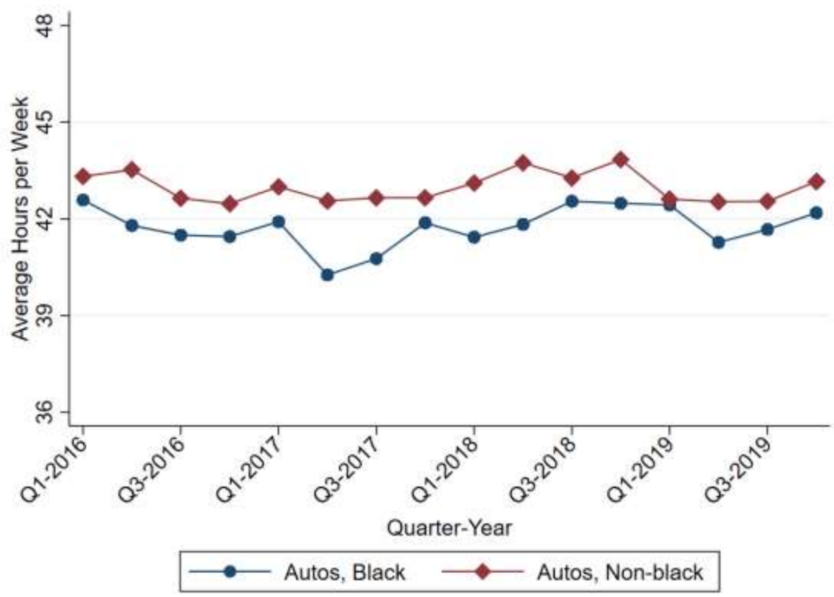

Figure 4: Black and non-black trends in average hours worked per week by quarter

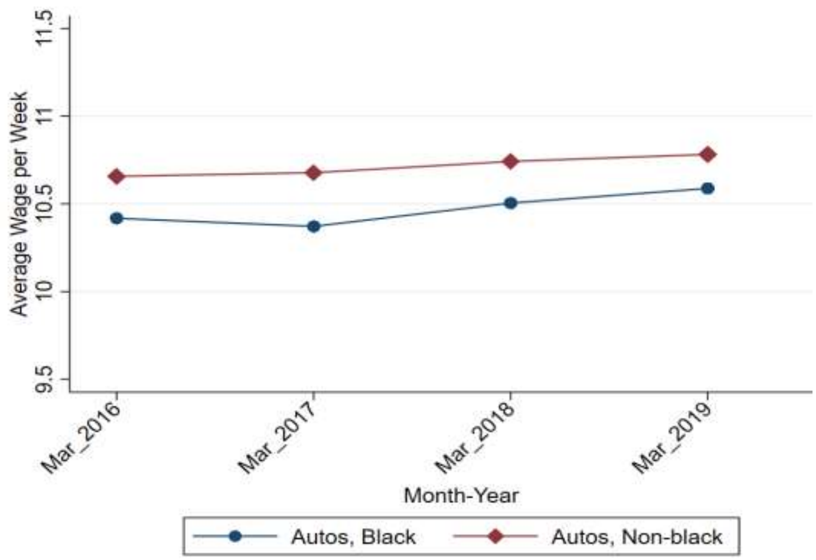

Figure 5: Black and non-black trends in average wages earned per week by year

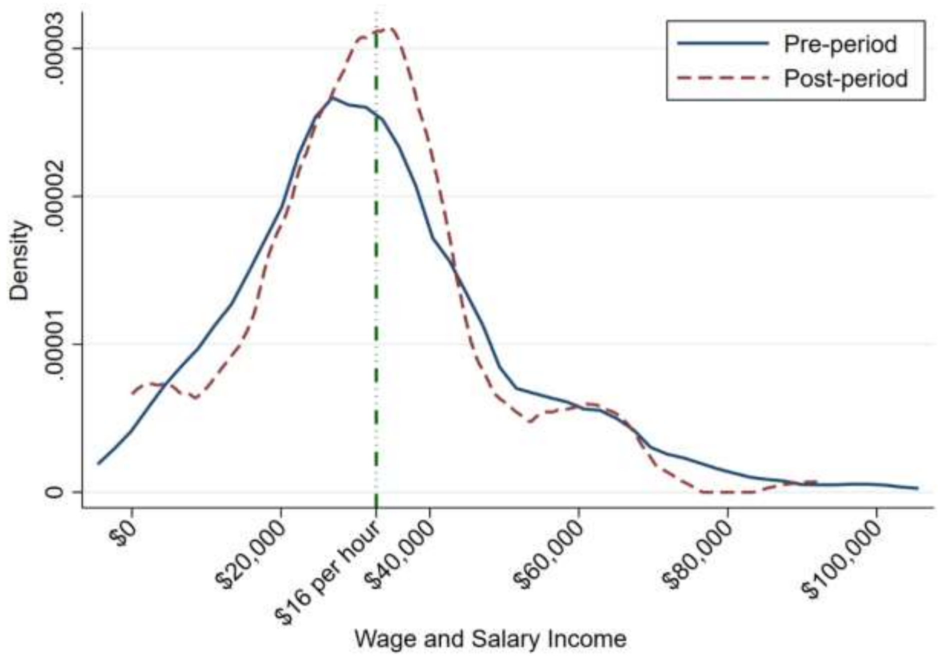

Figure 6: Estimated Kernel Density of Wage and Salary Earnings of Female Production Workers

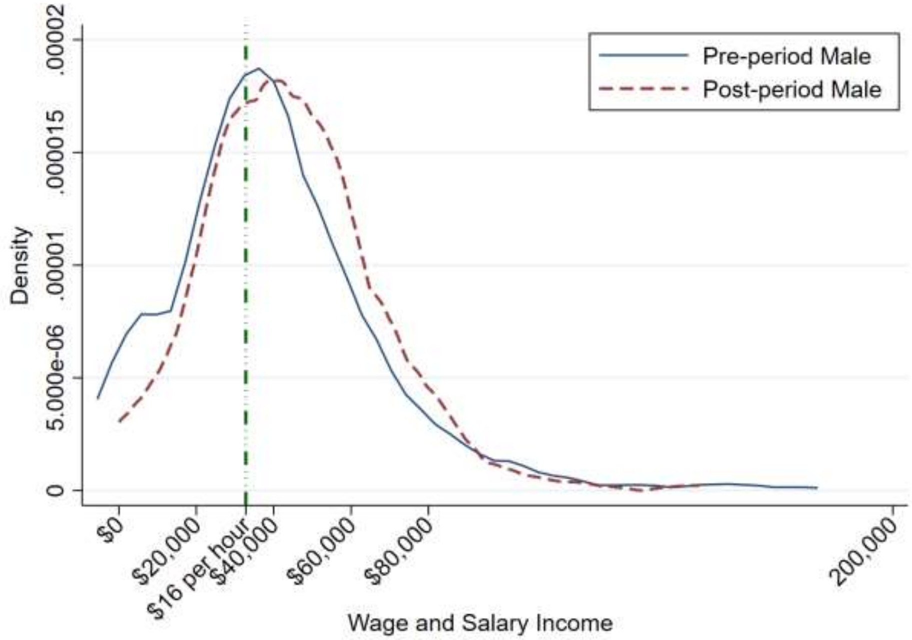

Figure 7: Estimated Kernel Density of Wage and Salary Earnings of Male Production Workers

Table 1a: Labor Value Content Standard Staging Regime--Passenger Vehicles

Entry into Force Date	LVC requirement	HW Material and Manufacturing Expenditures	HW Technology Expenditures	HW Assembly Expenditures
July 1, 2020	30%	15	10	5
July 1, 2021	33%	18	10	5
July 1, 2022	36%	21	10	5
July 1, 2023	40%	25	10	5

Table 1b: Labor Value Content Standard Staging Regime—Light or Heavy Truck

Entry into Force Date	LVC requirement	HW Material and Manufacturing Expenditures	HW Technology Expenditures	HW Assembly Expenditures
July 1, 2020				
July 1, 2021				
July 1, 2022				
July 1, 2023	45%	30	10	5

Table 1: Labor Value Content Requirements

Company name	Data date	Number of employees	Parent company/Global ultimate owner	Operating revenue (Company)
Cooperation Manufacturing Plant Aguascalientes	2015	1000	Daimler AG (Germany)	NA
FCA North America Holdings LLC	2021	NA	Fiat Chrysler Automobiles (USA)	NA
Ford Motor Company	2020	190000	NA (USA)	155.9 million
Honda North America, Inc.	2020/2021	NA	Honda Motor Co. Ltd. (Japan)	NA
Hyundai Motor America	NA	NA	Hyundai Motor Co., Ltd. (S. Korea)	NA
Kia Motors Manufacturing Georgia	NA	NA	Kia Motors Corporation (S. Korea)	NA
Kia Motors Mexico	2019	7,000	Kia Motors Corporation (S. Korea)	NA
Nissan North America Inc.	NA		Nissan Motor Co. Ltd. (Japan)	NA
Tesla Inc.	2011	48,106	NA (USA)	24.6 million
Toyota Motor North America Inc.	2020	At least 5137	Toyota Motor Corporation (Japan)	At least 131 million
Volkswagen Group of America, Inc.	2019	At least 15	As many as 14 companies with the same name, all listed as single locations, possibly within a corporate group	NA
Volvo Car Corporation	NA	NA	As many as 8 companies with the same name, all listed as single locations, possibly within a corporate group	NA

Table 2: Companies with approved alternative staging plans

	Female--Mean	Male--Mean	Mean Difference	P-value
Average hours worked (Obs:27,086)	41.373	43.280	1.907***	0.000
Duration of unemployment (Obs: 505)	17.878	19.468	1.590	0.359
Age (Obs: 32,854)	42.119	41.958	-0.161	0.333
Education (Obs: 32,854)	2.716	2.780	0.064***	0.000
Production occupation (Obs: 32,854)	0.400	0.253	-0.147***	0.000
Production supervisors (Obs: 32,854)	0.039	0.053	0.014***	0.000
Natural log, wage (Obs: 3,250)	10.448	10.783	0.335***	0.000
Union membership (Obs: 32,854)	0.031	0.036	0.005**	0.0398
Black (Obs: 32,854)	0.235	0.141	-0.094***	0.000

Statistically significant at the 90*, 95** and 99*** percent confidence levels
Not significant at conventional levels (85 to 89 percent confidence levels)~

Table 3: Male/Female Pre-Period Difference of Means

	Black--Mean	Nonblack--Mean	Mean Difference	P-value
Average hours worked (Obs: 23,139)	41.768	42.979	1.212 ***	0.000
Duration of unemployment (Obs: 1,191)	17.318	19.684	2.366	0.152
Age (Obs: 13,400)	40.651	42.268	1.617***	0.000
Education (Obs: 28,245)	2.601	2.795	0.195***	0.000
Production occupation (Obs: 28,245)	0.457	0.259	-0.199***	0.000
Production supervisors (Obs: 13,400)	0.051	0.049	-0.003	0.474
Natural log, wage (Obs: 1,417)	10.490	10.741	0.251***	0.000
Union membership (Obs:13,400)	0.047	0.032	-0.015***	0.000
Female (Obs:13,400)	0.371	0.240	-0.131***	0.000

Statistically significant at the 90*, 95** and 99*** percent confidence levels
Not significant at conventional levels (85 to 89 percent confidence levels)~

Table 4: Black/Non-Black Pre-Period Difference of Means

		Column 1	Column 2	Column 3	Column 4
Full Sample	**Hours per week** Mean (Arithmetic): 42.790	-0.260 (0.216)	-0.256 (0.218)	-0.228 (0.161)	-0.289 (0.382)
	Natural Log Wage Constant: 9.165 Mean (Geometric): 45230.5	0.060** (0.029)	0.060** (0.028)	0.064*** (0.021)	-0.096 (0.067)
Production Workers Subsample	**Hours per week** Mean (Arithmetic): 41.719	-0.511* (0.306)	-0.506 (0.310)	-0.460* (0.281)	NA
	Natural Log Wage Constant: 9.494 Mean (Geometric): 33,754.65	-0.022 (0.046)	0.019 (0.046)	-0.040 (0.039)	NA
	Demographic controls	x	x	x	x
	Union membership		x	x	x
	State fixed effects			x	x
	Production worker difference-in-differences estimate				x

Statistically significant at the 90, 95** and 99*** percent levels*

Table 5: Baseline Estimates (Post-period autoworkers are "treated")

		Column 1	Column 2	Column 3
Full Sample	**Hours per week**	0.430 (0.471)	0.436 (0.472)	0.413 (0.441)
	Natural Log Wage	0.044 (0.052)	0.045 (0.052)	0.048 (0.054)
Production Worker subsample	**Hours per week**	0.443 (0.750)	0.454 (0.751)	0.417 (0.751)
	Natural Log Wage	-0.225** (0.109)	-0.223** (0.108)	-0.243** (0.109)
	Demographic controls	x	x	x
	Union membership		x	x
	State fixed effects			x

Statistically significant at the 90*, 95** and 99*** percent confidence levels

Table 6: Difference-in Differences Estimates Under Specification A (Females are "treated")

Full Sample	**Hours per week**	0.714 (0.471)	0.721 (0.468)	0.781 (0.493)
	Natural Log Wage	0.103 (0.073)	0.104 (0.073)	0.099 (0.069)
Production Worker subsample	**Hours per week**	0.006 (0.718)	0.011 (0.717)	-0.124 (0.736)
	Natural Log Wage	0.099 (0.098)	0.101 (0.099)	0.141 (0.091)
	Demographic controls	x	x	x
	Union membership		x	x
	State fixed effects			x

Statistically significant at the 90*, 95** and 99*** percent confidence levels

Table 7: Difference-in Differences Estimates Under Specification B (Blacks are "treated")

		Column 1	Column 2	Column 3	Column 4
Specification A (Female post-period production workers are "treated")	**Hours per week** Mean (Arithmetic): 42.790	0.025 (0.896)	0.055 (0.894)	-0.006 (0.894)	2.041 (1.912)
	Natural Log Wage Constant: 9.165 Mean (Geometric): 45230.5	-0.406** (0.137)	-0.406** (0.137)	-0.438*** (0.133)	-1.229 (-1.010)
Specification B (Black post-period production workers are "treated")	**Hours per week** Mean (Arithmetic): 42.790	-1.196 (1.232)	-1.185 (1.240)	-1.251 (1.230)	-6.795*** (1.351)
	Natural Log Wage Constant: 9.165 Mean (Geometric): 45230.5	-0.014 (0.138)	-0.015 (0.139)	-0.007 (0.141)	0.006 (0.246)
	Demographic controls	x	x	x	x
	Union membership		x	x	x
	State fixed effects			x	x
	GM plant closures region				x

Statistically significant at the 90, 95** and 99*** percent levels*

Table 8: Triple Differences Estimates (Post-period production workers in specific subgroups are "treated")

Full Sample	**Hours per week**	0.190 (0.316)	0.187 (0.316)	0.141 (0.309)
	Natural Log Wage	0.029 (0.061)	0.029 (0.061)	0.051 (0.061)
Production Workers	**Hours per week**	0.229 (0.543)	0.223 (0.545)	0.341 (0.551)
	Natural Log Wage	0.023 (0.107)	0.022 (0.106)	0.061 (0.103)
Production Workers in Unallocated Regions	**Hours per week**	-1.432 (1.468)	-1.412 (1.468)	-1.570 (1.472)
	Natural Log Wage	0.027 (0.446)	0.020 (0.443)	-0.011 (0.452)
	Demographic controls	x	x	x
	Union membership		x	x
	State fixed effects			x

Statistically significant at the 90*, 95** and 99*** percent confidence levels
Not significant at conventional levels (85 to 89 percent confidence levels)~

Table 9: Robustness Estimates for Difference-in Differences Estimates Under Specification A (Females are "treated")