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Global value chains and racial inequality in the US labor market, 1979–2017

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ABSTRACT

We examine how global value chains (GVCs) impact "between" and "within-race" US labor market inequalities. GVCs change the returns to occupations and human capital categories (economic effects), as well as the share of the population within these categories (compositional effects). US racism should interact with GVCs to produce racially disparate GVC effects. We employ variance function regression to examine between and within-race inequality simultaneously, and innovate on classical decompositions to quantify how much of the change in each can be attributed to racially disparate effects of GVCs. GVCs increase inequality within *and* between races. These effects are largest *within races*, where almost no racial differences are observed. *Between races*, racially disparate GVC effects were often inconsistent with contemporary theories of US racial inequality. Economic effects were always most beneficial for Asian Americans, and frequently more beneficial for African Americans and Latino/a workers than for Whites. Compositional effects were nearly always most beneficial for Asian Americans, and reduced between-race inequality in aggregate. Overall, then, GVCs increased between-race inequality because large occupational and skill income gaps persisted between races, because Asian American gains are net inequality increasing, and because absolute and/or relative (to White) gains by African American and Latino/a workers in some categories were too small to offset the absolute and/or relative gains of Asian Americans and Whites in others.

1. Introduction

Two broad trends came to define the American economy in the early part of the 20th century: rising income inequality owing to structural changes to the US economy, and racial disparities owing to historical and contemporaneous forms of racism in the United States. Fig. 1 shows the overall inequality trend, alongside the trends in between and within race inequality. The scales are vastly different for within and between-race inequality, so we show the former on the right-hand side and the latter on the left. Both components increase over time. The share of total inequality that lies between races increased from just over 1 percent in 1979–3.57 percent in 2012, before falling to about 3.3 percent in 2017.

By and large, however, the literatures on structural changes to the US economy and racial disparities have not developed in tandem. Studies of rising income inequality owing to structural economic changes rarely consider their racial dimensions. Similarly, contemporary studies of racial inequality rarely consider the role of structural economic changes as a source of racial disparities (c.f. Wilson, 1978, 2011), particularly when those changes originate external to the United States. Thus, contemporary scholars of racial inequality call for more advanced methodological and theoretical inquiries to understand how "structural changes that are occurring at the systematic level" matter for racial inequality both within and between racial groups (Wingfield, 2020: 142). Our study answers this call by utilizing variance function regression along with an innovative decomposition approach to examine how an important structural change– offshoring via global value chains (GVCs) – contributes to the patterns of inequality between and within racial groups shown in Fig. 1.

Indeed, offshoring via GVCs has been one of the more important macro-economic changes to the economies of rich democracies like the United States over the past thirty years (Milberg & Winkler, 2013; Mahutga, Gao, & Pandian, 2025; Mahutga & Maldonado, 2018). The impacts of this structural change on income inequality are by now well understood (Alderson & Nielsen, 2002; Mahutga, Roberts, & Kwon,

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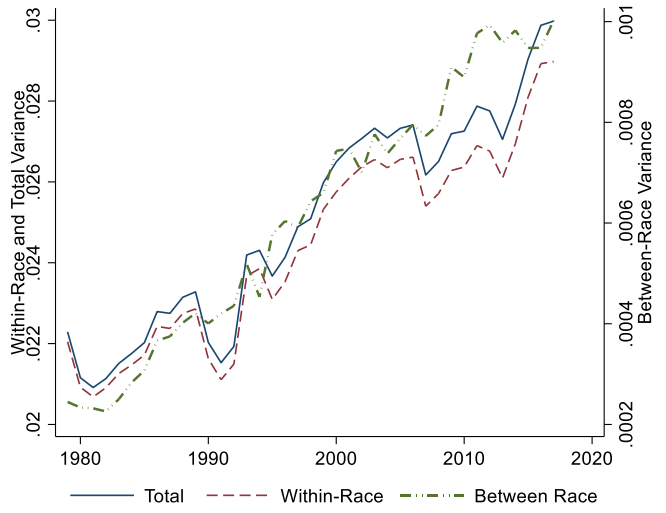

Fig. 1. Total, Between and Within-Race Labor Market Income Inequality. Note: Left axis shows scale for between-race component; right axis shows scale for within-race component and total. See Eq. (1) for decomposition.

2017). Rising manufacturing imports from low-wage countries in the global South increase income inequality through both economic and compositional effects. With respect to economic effects, Southern imports increase the wages and salaries of managers and workers with high skills, and decrease those of workers with low skills (Mahutga & Curran, 2022; Wood, 1994).[1] With respect to compositional effects, GVCs should (1) lead to systematic employment declines in manufacturing, and (2) incentivize workers to shift into managerial occupations and attain human capital.

However, it is unknown whether GVCs contribute to rising racial inequality in the labor market, which is frequently described as a function of two general types of mechanisms. First, a large body of literature documents various specific mechanisms by which minority workers earn less than White workers *within the same occupations or at fixed levels of human capital* (e.g. Bielby & Baron, 1986; Tomaskovic-Devey & Avent-Holt, 2019; A. Wingfield, 2020; A. H. Wingfield & Chavez, 2020). The second is racially disparate labor market sorting effects, whereby racial minorities are less likely to be employed in high status occupations, and are excluded from institutions of higher education more frequently than Whites (Bonacich, 1976; Card, Domnisoru, & Taylor, 2022; Cook & Glass, 2013; Huffman & Cohen, 2004; Kaufman, 2002; Kluger, 2011; Maume Jr, 1999; Ray, 2019). Here, racial minority groups may simultaneously experience vertical segregation (underrepresentation in high income positions like managers), horizontal segregation (concentration within lower paying occupations or sectors), or barriers to the attainment of credentials.

When considering these two sources of inequality in tandem, we outline key theoretical overlaps that speak to how GVCs might shape *racial* income inequality in two distinct ways. In particular, we argue that GVCs may interact with racism in the US labor market to produce racially disparate GVC effects. First, the *economic effects* of GVCs can be racially disparate. That is, rising Southern imports may yield a smaller bonus to racial minorities in the occupations and human capital categories it rewards, and/or a larger deficit to minorities in the occupations and human capital categories it penalizes. Similarly, GVCs might increase the income variance *within* these categories in racially disparate ways. Second, GVCs' *compositional effects* will also be racially disparate if racial minority groups shift into occupations and human capital categories that are rewarded by GVCs, or out of those that it penalizes, more slowly than White workers.

To assess these potential mechanisms empirically, we use data from the Luxembourg Income Study (LIS). LIS data provides one of the largest data sets with over three million employed US workers from 1979 to 2017. This period of economic history is strategic because it includes time before and after the US GVCs became the modal organizational form globally in the 1990s (Mahutga et al., 2017). We also advance the racial disparities literature by leveraging variance function regressions that allow researchers to disentangle income outcomes related to GVC expansion into its "between race" and "within race" components. Here, we estimate both a racial mean and variance of income conditional on managerial and manufacturing occupations, and college and graduate degree attainment. We then examine the compositional effects of GVCs by describing changes in the probabilities of occupying a given occupational/human capital category by race. Finally, we quantify the percent of observed changes in between and within-race inequality owing to each GVC mechanism using an innovative augmentation of a classical decomposition method and counterfactual analysis.

Our results suggest that GVCs increased inequality both between and within races, but in unexpected ways. Each GVC mechanism increased within-race inequality to roughly the same degree. The amount of racial disparity in the between-race economic effects of GVCs varied across GVC mechanisms. In most cases, racially disparate between-race economic effects did not benefit the privileged White majority of workers vis-à-vis all other races, and in many cases helped close the income gap between White and minority workers. Similarly, racially disparate *compositional* effects did not accrue directly to White workers, and reduced between-race inequality in aggregate. We conclude by drawing out the implications of these results for our understanding of the distributional effects of economic GVCs and racial inequality more generally.

2. Theoretical background

2.1. Economic and compositional effects in the generation of group-wise inequality

Groupwise labor market inequality is a function of two orthogonal components: between-group and within-group inequality. The classic works that study these processes jointly further recognize that the temporal dynamics of each component are a function of *income* effects and *demographic* effects.

> "Overall inequality has between-group and within-group components. Between-group inequality rises when the average incomes of different groups move further apart (an income effect), or when the population grows in groups that are widely spaced on the income distribution (a demographic effect)…Within-group inequality rises when incomes become more dispersed within groups (an income effect) or when population grows in groups with highly dispersed incomes (a demographic effect)" (Western, Bloome, & Percheski, 2008: 908; also see Western & Bloome, 2009).

Put differently, changes to inequality are driven by changes in the mean income of groups, the average dispersion of each individual member of the group around the group mean, and through changes in the relative size of the group. Western et al. (2008) referred to the first two as "income effects," and to the latter as "demographic effects."

In the framework for group-wise inequality we advance here, we augment this terminology. First, we speak in terms of *economic effects*, which refer to changes in the mean and/or variance of income associated with different occupational and skill categories. We use the term "economic" instead of "income" because we are describing a specific economic process (GVCs) that causes changes in the labor market incomes of particular occupations (management and manufacturing) or human capital categories (college and graduate degrees). We adopt the term *compositional effects* to refer to changes in the *attainment rates* of

[1] To the extent that occupations or sectors are more or less skill intensive, these effects also contribute to between-occupation/sector inequality.

these occupational and skill categories. Given that our interest is in groupwise inequalities, compositional effects operate as weights for the occupational and human capital incomes that "add up" to group means and variances. For example, if GVCs disproportionately increase a particular racial group's income premium to education, but decrease the rate of educational attainment (absolutely or relative to other racial groups), then the economic and compositional effect of GVCs will countervail each other.[2] Demographic effects are untheorized by the literature on GVCs, and we return to this discussion in the conclusion.

We are not only interested in economic and compositional effects of GVCs, but also how they vary by racial categories. As the reader will see, GVCs should elevate the income premium for certain occupational and skill categories (managerial occupations and educational credentials) and reduce them for others (manufacturing occupations). Literature on racial discrimination suggests it should cause *racially disparate economic effects of GVCs*. GVCs should also have compositional effects, by influencing changes in the share of the population in particular occupations or human capital categories. The literature on racial discrimination suggests that racism could also produce *racially disparate compositional effects*, by introducing race-based variation in the ease with which individuals from particular racial groups transition into (out of) occupations/skill categories with positive (negative) economic effects.

In the following sections, we elaborate on how GVCs contribute to labor market income inequality through these two mechanisms, and how they can produce racially disparate economic and compositional effects, as a result of racial discrimination within the U.S. labor market.

2.2. GVCs and labor market inequality

There are three key mechanisms by which GVCs should increase labor market inequality in the United States. The first draws largely from Heckscher–Ohlin (H-O) trade theory. Asymmetrical global offshoring relations between leading firms in the global North and their suppliers in the global South, embodied in North-South trade in both finished *and* intermediate goods, reduce the price of production factors toward that which prevails in the countries where they are most abundant (Bair & Mahutga, 2023; Wood, 1994). Because low-skilled labor is relatively abundant in the global South, Southern imports reduce the demand for (relatively more expensive) low-skilled labor in Northern countries like the United States. In fact, GVC scholars contend that the exchange conditions characterizing interfirm relations between leading GVC firms and their suppliers in the global South exacerbate these demand effects vis-à-vis what would exist under normal conditions of trade (e.g. Mahutga et al., 2025). By the same token, Southern imports increase the demand for skilled labor in these same countries. In tandem, these changes in the relative demand for skill increase inequality by increasing the relative wages of skilled labor (Alderson & Nielsen, 2002; Mahutga et al., 2017). Moreover, these GVC induced changes in the skill premium should incentivize a growing share of US workers to seek skill credentials in the form of college and graduate degrees (Horowitz, 2018). Thus, we expect that Southern imports increase the labor market income premium to college and graduate degrees, and to incentivize a greater share of the workforce to pursue these degrees. To the extent that the education sector responds to public demands for educational credentials, we would also expect GVCs to increase the supply of educational credentials.[3]

The second mechanism is sectoral in nature. GVCs have been most thorough in the manufacturing sector (Lanz & Maurer, 2015), where both distinct phases and entire categories of manufacturing goods have been offshored to lower-cost locations (Mahutga, 2012). Thus, US manufacturing workers are in direct competition with lower-cost workers abroad. On one hand, this direct competition has caused a dramatic decline in manufacturing employment (Alderson, 1999; Autor, Dorn, & Hanson, 2013). On the other hand, residual manufacturing jobs should experience downward wage pressure (Mahutga, Curran, & Roberts, 2018). Thus, we expect to observe that GVCs reduce the labor income of manufacturing occupations, as well as the share of workers in the sector.[4]

The third is rooted in sociological theories involving the social relations among labor, management and capital. Here, offshoring through GVCs expands the effective size of the labor market in two respects. First, workers in trade competing sectors compete with lower-paid alternatives in the global South. Second, workers with the skill (or, equivalently, task) profiles demanded by trade competing sectors made redundant in one period expand the size of the skill/task-specific domestic surplus labor pool in the next period. In the aggregate, both processes tend to increase the relative income of management vis-à-vis labor, on average (Freeman, 2007; Mahutga et al., 2017). However, GVCs are also thought to increase the demand for talented managers capable of identifying capable suppliers and managing the far-flung contracting relations in the global South (Dencker, 2009; Streeck, 1987). Thus, we expect that GVCs increases the labor income premium to managers and incentivizes US workers to shift into managerial positions. Theories of GVCs are agnostic with respect to their effect on the overall supply of managerial occupations.

2.3. Are the economic and compositional effects of GVCs racially disparate?

While the literature linking GVCs to income inequality is fairly well developed, to our knowledge no study has linked GVCs to racial inequality. To elucidate the mechanisms by which GVCs might increase racial inequality, we turn to a parallel literature on racialized discrimination in the US labor market. The literature on racism and labor market inequality highlights how both historical and contemporaneous discrimination contribute to racial inequalities in the labor market. Historically, African, Asian, and Latino/a Americans were systematically excluded from institutions of higher education and high-income occupations. Even in the absence of contemporaneous discrimination,

[2] Compositional effects may result from economic effects, changes in the supply of particular occupations or human capital categories, both, or neither. For example, If GVCs increase the economic returns to managerial positions, more individuals may apply for these roles. Holding the supply of managerial positions fixed, the ratio of applicants to positions would rise, but the share of the population, or racial groups obtaining managerial positions would remain unchanged. This *could* put downward pressure on the bargaining power (and thus salaries) of workers in those positions, *unless there was a concurrent increase in the requisite skills required for the occupations*. However, if the supply of managerial positions increased alongside applicants, the income premium and occupational share would depend on the relative growth rates of both. If the supply of managerial occupations increased, we would expect both a rising income premium and a rising share of the population (or particular racial group) in managerial occupations. Finally, compositional effects could reflect *neither* of these, if for example there was a "reshuffling" of racial categories within an occupation or human capital category, but no net change in the overall share of that occupation in the labor force.

[3] Here, GVC effects are not directly proportional to an individual's exposure to trade in their occupation. The H-O trade theory links GVCs to incomes through skills (or, equivalently, tasks), not occupations. Moreover, it suggests precisely that rising income premiums induced by GVCs *should be greatest in occupations that employ skills (tasks) that do not compete with Southern imports*. Thus, GVC effects can be channeled through changes in demand for skills (tasks) across the entire economy. To the extent that our argument does link GVCs to economic and compositional effects through occupations, we measure these occupations directly and at the appropriate level of aggregation (management and manufacturing) given our theoretical foci.

[4] We acknowledge potential treatment heterogeneity within the manufacturing sector, as GVC effects may vary by sub-sectors and skill levels. While our analysis focuses on manufacturing as a broader category, future research could explore these variations in greater detail.

these historical exclusions have lasting effects because most forms of capital are transmitted intergenerationally (Lang & Spitzer, 2020; Oliver & Shapiro, 2013). Contemporaneously, implicit and explicit forms of discrimination are thought to both lower the incomes of minority workers, conditional on earned forms of human capital within the same occupations, and block minority workers from educational attainment and higher income and authority occupations.

Combining the literature on GVCs and income inequality with the literature on racism and racial inequality in the labor market, we argue that GVCs may interact with contemporaneous and historical forms of racial discrimination, resulting in racially disparate economic and compositional effects of GVCs. First, GVCs may have racially disparate *economic* effects if the changes they induce to the incomes associated with managerial/ manufacturing occupations and/or educational credentials vary across racial groups. Research shows that various forms of racism lead to higher economic returns for White workers compared to minority workers *within the same occupations and human capital categories*. For example, employers pay minority workers lower salaries relative to their White counterparts despite equal rates of productivity, through inter-firm variation in organizational culture (Tomaskovic-Devey & Avent-Holt, 2019), biased perceptions regarding racial differences in productivity (Bielby & Baron, 1986), and other racialized forms of discrimination (Feagin & O'Brien, 2004; Lieber, 2009). Similarly, job discrimination and harassment are disproportionately directed at minority workers, and lower their productivity *vis-à-vis* their white counterparts (A. Wingfield, 2020; A. H. Wingfield & Chavez, 2020).[5] All of these processes should also matter for racial disparities in the returns to educational credentials.

Thus, we hypothesize that GVC's economic effects can be racially disparate.

Hypothesis 1. : the economic effects of GVCs should increase income premiums for managers and higher education (college and graduate degrees) more for White workers than for minority workers, while reducing wages in manufacturing occupations more sharply for minority than for white workers.

Second, GVCs may have racially disparate *compositional* effects if the rate of inclusion/exclusion from occupations and human capital categories impacted by GVCs differ by race. Racial discrimination creates disparities in the occupational and human capital composition of racial groups. Generally referred to as "social closure," various practices including "statistical discrimination," or "taste discrimination," describe how White employers, consumers and even labor unions sort minority workers into lower-paying occupations (Bonacich, 1976; Huffman & Cohen, 2004; Kaufman, 2002; Roscigno et al., 2007). For example, minority workers take longer to ascend to managerial positions compared to their White counterparts (Cook & Glass, 2013; Maume Jr, 1999; G. Wilson & Maume, 2013). Racial stereotyping or discrimination at the point of hiring also sorts minorities into lower paying occupations (Huffman & Cohen, 2004; Kaufman, 2002; Ray, 2019; Semyonov & Herring, 2007). Thus, both processes would lead us to predict that GVCs would increase the share of managerial occupations among whites faster than among minorities workers, and decrease the share of manufacturing occupations more slowly among minority than white workers.

Likewise in educational settings, minority workers have been excluded from the attainment of high-income credentials relative to Whites (Kluger, 2011). Through the late 1960s, African American and Latino/a students were educated in entirely segregated schools that received much lower funding levels than majority white schools. This structural divide has longer-term implications for educational attainment because it is transmitted intergenerationally (Card et al., 2022). Moreover, contemporary research suggests that teachers are more likely to discipline minority students relative to white counterparts (Okonofua, Walton, & Eberhardt, 2016), that school segregation remains stubbornly high (Caetano & Maheshri, 2023), and that predominately white schools continue to receive significantly more funding than majority-minority schools (Weathers & Sosina, 2022).

Therefore, racial discrimination produces differing rates of representation in high-income occupations and human capital categories. Such processes should produce racially disparate *compositional effects* of GVCs.

Hypothesis 2. :racial minority groups should be disproportionately excluded from occupations and human capital categories that benefit from GVCs (e.g., managerial roles and college/graduate degrees) and disproportionately locked-in to occupations and skill categories that are particularly harmed by GVCs (e.g. manufacturing occupations or low education) at higher rates than Whites.

In summary, the complex labor market pressures produced by GVCs likely shape differences in the ways in which occupational and sectoral changes generate racial wage penalties or premiums both within and between racial categories. These complexities require methodological tools that allow for the simultaneous decomposition of income within and between racial categories. We use variance function regressions that are rarely used in the racial income inequality literature, but allow us to identify the effects of GVCs on the level and variance of income in occupational and human capital categories, and the degree to which these effects are racially disparate. In the section below, we provide a detailed decompositional strategy that allows us to quantify the impact of all of these on inequality between and within racial groups.

3. Data and methods

3.1. Data and sample

Our sample comes from the LIS cross-national data center. The LIS houses comprehensive US micro data from the Annual Social and Economic (March) Supplement to the Current Population Survey. In total, the sample includes 3,142,970 employed workers from 1979 to 2017, regardless of their full-time or part-time employment status and age.

3.2. Measures

3.2.1. Income

Theories linking GVCs to income inequality work primarily through the labor market, and our theoretical and substantive interests concern pre-transfer incomes. Thus, we employ personal labor income, which includes cash payments and value of goods and services received from dependent employment, as well as profits/losses and value of goods received from self-employment, but excludes capital income and transfer payments. This income is measured in US dollars and adjusted for inflation and logged.

3.2.2. GVCs

Most commonly, studies of GVCs have measured Southern import penetration in rich democracies as the total value of imports from non-OECD countries (Alderson & Nielsen, 2002). Following more recent measurement advances in GVC studies, we normalize Southern imports by the ratio of manufacturing imports from the global South to total imports that capture the patterns rather than the level of trade, and overcome metric biases arising from measures of the latter (see Mahutga

[5] Indeed, case studies that examine serious violations of Equal Employment Opportunity Commission (EEOC) guidelines outline five distinct discriminatory processes related to exclusion, expulsion, promotion, demotion, and harassment at different stages of employment (Roscigno, Garcia, & Bobbitt-Zeher, 2007).

et al., 2017).[6]

3.2.3. Racial/ethnic groups

As is well known, the racial categories available in these census data vary dramatically over time. Thus, there is a substantial tradeoff between the period of coverage and granularity in racial classifications. Because GVCs are a time-varying phenomenon, it is important to maximize the period of coverage as much as possible. Thus, we choose 1979 as our starting point because it gives us the largest coverage, while allowing us to identify three of the four largest racial/ethnic groups in the United States: African Americans, Latino/a (Hispanic) and Whites. Our "Other races" category is heterogeneous, but is ~75 to ~88 percent composed of Asian Americans over the period with the balance going to Native Americans and, after 2002, individuals of mixed racial heritage.[7] We thus attribute most of this category to Asian Americans, which necessarily results in some degree of measurement error. To evaluate the impact of this error, we conducted an additional sensitivity analysis, distinguishing Asian Americans/Pacific Islanders and Native Americans within the "Other races" category for the years where such a distinction was feasible (1987 – 2017). The results are substantively similar to the current results, with small changes in statistical significance (see Appendix 2 for detailed results and discussion).

3.2.4. Managerial occupations

Managerial occupations are coded 1 if LIS variable occb1 = 1 "Managers." This is based on the International Standard Classification of Occupations (ISCO) 88 and 08. Between survey waves of the LIS, managerial occupations were harmonized consistently, which is a key strength of LIS data.

3.2.5. Manufacturing occupations

Manufacturing occupations are coded 1 if LIS variables indd1 or indc1 = "Manufacturing." These are based on the International Standard Industrial Classification (ISIC) Rev 3 and Rev 4.

3.2.6. Higher education

We create two higher education variables. Using the US specific educ_c variable, College Degree = 1 if the respondent graduated with a four-year degree. Graduate Degree = 2 if the respondent completed either a Master's or PhD degree. Less than College Degree is the reference category.

3.3. Methods

We combine variance function regression with decompositions, building on the methodology in Western and Bloome (2009). To describe our procedure, we begin with the classic decomposition of income inequality into "between-group" and "within-group" components owing to Western and Bloome (2009). We then describe how we evaluate the racial heterogeneities of GVC effects using the variance function regression. Finally, we describe how we augment this classic decomposition to decompose changes in racial inequality in terms of economic and compositional effects, and our procedure for counterfactual analysis in light of our augmented decomposition.

To understand the pattern and the change of racial inequalities, we begin by decomposing the racial inequality into "between-race" and "within-race" components. In the classic intervention (Western & Bloome, 2009), inequality in a given year t can be written as a variance and decomposed into a "between group" and "within group" component as in:

$$V_t = \sum_{j=1}^{J} \pi_{jt}\left(\bar{y}_{jt} - \bar{y}_t\right)^2 + \sum_{j=1}^{J} \pi_{jt}\sigma_{jt}^2, \tag{1}$$

Western et al. (2008) defined groups with the cross of education, family type and race. For this study, we are interested specifically in the implications of GVCs for inequality between and within *racial groups*. Thus, we let j index racial groups 1, 2…J such that $\bar{y}_{jt}$, π_{jt}, and σ_{jt}^2 refer to the mean, population share, and variance of racial group j in year t. The overall mean income for a given year t, and the population share of each race are directly derived from the data. The predicted mean and variance for each racial group is obtained from the variance function regression presented below.

3.3.1. Variance function regression

Next, we investigate whether the effects of GVCs on between-race and within-race inequality are racially disparate. Theories linking GVCs to between and within race inequality work through the mean and variance of specific occupational/human-capital categories, the degree to which these GVCs' effects differ by race (economic effects), as well as the distribution of races across occupational/human capital categories (compositional effects). We first examine the racial dispersion of economic effects, using variance function regression. This approach enables modeling both the mean (reflecting between-race inequality) and variance (capturing within-race inequality) of income. As GVCs impact between and within race inequality through the mean and variance of specific occupational/human capital categories, we further decompose racial means and variances into occupational/human capital categories. Here, the groups are defined with all possible combinations of occupational/human-capital categories.We let k index the set of occupational and human categories across which race j is composed. With 3 covariates (Managerial occupations, manufacturing occupations, and education), and with levels 2, 2, and 3, the covariates define a total of $K = 2 \times 2 \times 3 = 12$ groups for race j in each year.

To proceed, we first note that the unweighted $\bar{y}_{jt}$ in (1) can be written:

$$\bar{y}_{jt} = \sum_{k=1}^{K} \bar{y}_{jkt} p_{jkt} \tag{2}$$

where k indexes the set of occupational and human categories across which race j is composed, and p_{jkt} is the proportion of racial group j in occupational/human capital category k in year t. That is, p_{jkt} sums to 1 within a certain racial group j for year t.

Similarly, we can write σ_{jt}^2 with:

$$\sigma_{jt}^2 = \sum_{k=1}^{K} \sigma_{jkt}^2 p_{jkt} \tag{3}$$

where σ_{jkt}^2 is the variance of logged incomes for the subset of race j in occupational/human capital category k for year t.

Then, we use variance function regressions in (4) and (5) to estimate race-specific occupational/human-capital means ($\bar{y}_{jkt}$) and variances (σ_{jkt}^2) at each observed level of GVCs. We derive p_{jkt} – the proportion of racial group j in occupational/human capital category k in year t directly from the data.

The regression models are specified as following:

[6] We appreciate one anonymous reviewer' suggestions regarding alternative measures of GVCs from sources such as the OECD, World Bank, and the U.S. Input-Output Database (Antràs et al. 2012; Antràs and Chor, 2013; Borin et al. 2021; Mancini et al. 2024). However, nearly all of the variables in these databases assess different theoretical concepts (e.g., types of intermediate goods supply integration) than our focus. The only variable conceptually comparable to LDC imports is the share of foreign value-added in final demand from non-OECD countries (OECD, 2024), it is highly correlated with our Southern import measure (0.832), but they are only available from 1995 onward.

[7] In 1987, it became possible to identify Asian Americans and Pacific Islanders. From 1995 to 2001, these two categories were collapsed. In 2002, these two categories were again separated, and a mixed-race category was added.

$$\log\left(y_{jkt}\right) = \beta_0 + o_{kt}\beta_1 + r_{jt}\beta_2 + x_t\beta_3 + o_{kt}x_t\beta_4 + o_{kt}x_t r_{jt}\beta_5 + \varnothing\beta_6 + z_t\beta_7 + r_{jt}z_t\beta_8 \quad (4)$$

and

$$\log(\sigma^2_{jkt}) = \lambda_0 + o_{kt}\lambda_1 + r_{jt}\lambda_2 + x_t\lambda_3 + o_{kt}x_t\lambda_4 + o_{kt}x_t r_{jt}\lambda_5 + \varnothing\beta_6 + z_t\lambda_7 + r_{jt}z_t\lambda_8 \quad (5)$$

where y_{jkt} and σ^2_{jkt} refer to the income and variance of racial group j in occupational/human capital categories k for year t, o refers to a set of k-1 occupational/human capital categories, r is a j-1 set of dummies for racial groups, x is a measure of Southern imports that varies by time. The coefficients on the two-way interactions capture the effect of GVCs on the mean/variance of occupation/human capital category k, while those on the three-way interaction capture the degree to which these GVCs effects are racially disparate. $\varnothing$ is a matrix of additional two-way interactions required to correctly estimate the focal two and three-way interactions, and z is a set of t-1 dummies for time. The last term is the interaction of the racial dummies with time, which sweeps up any unobserved time invariant factors correlated with race, race invariant factors correlated with time, and the interaction of these unobserved factors that might impact the mean or variance of racial groups (Giesselmann & Schmidt-Catran, 2018). βs and λs are coefficients of the corresponding covariates and capture effects on mean and variance of income, respectively. To estimate these equations, we use Stata's *hetregress*, which uses the maximum likelihood approach as the estimation strategy discussed in Western and Bloome (2009).

Next, we explore whether the compositional effects vary across races. We calculate the predicted probabilities of being in a given occupational/human capital category by race using linear probability models (ordinary least square models), where each binary occupational/human capital category is regressed on the interaction between race and Southern imports, controlling for the interaction between race and year. In all regression analyses, the standard errors are clustered at the year level to account for within-year correlation and heteroscedasticity. We also applied the normalized person weight (pwgt) in all analysis so that the results are representative of the whole population.

3.3.2. Counterfactual decomposition

Last, to assess the contribution of GVCs to between and within race inequality, and to discern the importance of different mechanisms (i.e., economic effects vs. compositional effects), we conduct a counterfactual analysis. Specifically, we construct counterfactual inequality series for both components in (1) by using variance function regression to estimate race-specific occupational/human-capital means and variances at each observed level of GVCs, and then manipulating these means/variances directly. We can also manipulate the composition of races across occupations, to generate counterfactual means and variances for each race in each year.[8] The following outlines our counterfactual procedure:

With (1), changes in inequality can be further decomposed into changes in the relative deviation of racial-specific occupational and human capital group means, changes in the variance of income within groups, and changes in the relative share of groups in the overall population. In the above, we use variance function regressions in (4) and (5) to estimate race-specific occupational/human-capital means ($\bar{y}_{jkt}$) and variances (σ^2_{jkt}) at each observed level of GVCs, and the observed p_{jkt}. The change in either the race-specific occupational/human-capital means and variances differences attributable to GVCs can be summarized by summing the coefficients on $o_{kt}x_t$ and $o_{kt}r_{jt}x_t$ for the focal racial group and occupational/human-capital category. Having identified the change in $\bar{y}_{jkt}$ and σ^2_{jkt} attributable to GVCs, we can estimate counterfactual values $\tilde{y}_{jkt}$ and $\tilde{\sigma}^2_{jkt}$ that would be observed in its absence. For example, to calculate the counterfactual values in the absence of the economic effect of GVCs on occupation K (e.g., manager), we assign occupation k ($k \in K$) among racial group j a mean $\tilde{y}_{jk0}$ and variance $\tilde{\sigma}^2_{jko}$ equal to that observed at the minimum observed value of GVCs at the baseline time ($t = 0$, year = 1979). In turn, we can use these counterfactual race-occupation/human capital category means and variances to estimate counterfactual values of $\tilde{y}^e_{jt}$ and $\tilde{\sigma}^{e2}_{jt}$ that account only for the changing mean or variance of race-occupation/human capital categories with

$$\tilde{y}^e_{jt} = \sum_{k=1}^{k\in K} \tilde{y}_{jk0}p_{jkt} + \sum_{k=1}^{k\notin K} \bar{y}_{jkt}p_{jkt} \quad (6)$$

and

$$\tilde{\sigma}^{e2}_{jt} = \sum_{k=1}^{k\in K} \tilde{\sigma}^2_{jko}p_{jkt} + \sum_{k=1}^{k\notin K} \sigma^2_{jkt}p_{jkt} \quad (7)$$

where K is the set of occupational and human capital categories impacted by GVCs that we manipulate on (e.g., manager). Note that in (6) and (7), the share of racial group j in occupational/human-capital category k (p_{jkt}) is always as observed.

Thus, to calculate the counterfactual values in absence of the compositional effect of GVCs occupation K (e.g., manager), we estimate the counterfactual values $\tilde{y}^c_{jt}$ and $\tilde{\sigma}^{c2}_{jt}$ that represent what the racial mean and variance would be if the race-occupation/human capital category means and variances are observed, but p_{jkt} is constrained to equal its proportional value at the minimum of GVCs with

$$\tilde{p}_{jkt} = (P_{jk0}/P_{jkt})p_{jkt} \quad (8)$$

Where P is the marginal probability of the occupation/human capital category K (e.g., manager) for race j. This quantifies the change in between and within race inequality owing to changes in the composition of races across occupational/human-capital categories. Thus, we would have

$$\tilde{y}^c_{jt} = \sum_{k=1}^{k\in K} \bar{y}_{jkt}\tilde{p}_{jkt} + \sum_{k=1}^{k\notin K} \bar{y}_{jkt}p_{jkt} \quad (9)$$

and

$$\tilde{\sigma}^{c2}_{jt} = \sum_{k=1}^{k\in K} \sigma^2_{jkt}\tilde{p}_{jkt} + \sum_{k=1}^{k\notin K} \sigma^2_{jkt}p_{jkt} \quad (10)$$

With these counterfactual estimates of the racial mean and variance in hand, we can then quantify the total effect of GVCs that works through (11) changes in the mean and variance of race-occupational/human-capital categories and (12) changes in the composition of races across occupational/human capital categories with

(11) $\tilde{V}^e_t = \sum_{jt=1}^{jt} \pi_{jt}(\tilde{y}^e_{jt} - \bar{y}_t)^2$ and $\sum_{jt=1}^{jt} \pi_{jt}\tilde{\sigma}^{e2}_{jt}$, for changes owing to GVCs' economic effects on between and within race inequality, respectively, and

(12) $\tilde{V}^c_t = \sum_{jt=1}^{jt} \pi_{jt}(\tilde{y}^c_{jt} - \bar{y}_t)^2$ and $\sum_{jt=1}^{jt} \pi_{jt}\tilde{\sigma}^{c2}_{jt}$, for changes owing to GVCs' compositional effects on between and within race inequality, respectively.

These counterfactual variance estimates can be interpreted as the inequality that would exist in time t if either $\bar{y}$, p or σ had not changed in

[8] Theories linking GVCs to between and within race inequality work through the mean and variance of specific occupational/human-capital categories, the degree to which these globalization affects differ by race (economic effects), as well as the distribution of races across occupational/human capital categories (compositional effects). But they do not speak to the overall share of the population for each racial group.

response to GVCs. Because $\widetilde{V}_0^e = \widetilde{V}_0^c = V_0$ by construction, we can use these counterfactual variances estimates to assess the *change* in inequality owing to the effect of GVCs on $\overline{y}$, p or σ with $\frac{\Delta V - \Delta \widetilde{V}}{\Delta V}$.

4. Results

4.1. Economic effects

We begin by examining the economic effects. Table 1 reports two versions of our variance function regression. In model 1, we regress logged income and the logged residual on Southern imports, managerial and manufacturing occupations and college and graduate degrees, and their interaction with Southern imports. Consistent with the broad literature on GVCs, these interactions suggest that GVCs increases the economic returns to managerial occupations and high-skills, while reducing the returns to manufacturing (column 1). Similarly, it increases the variance of income within all these categories (column 2).

To examine whether the economic effects of GVCs are racially disparate (Hypothesis 1), Model 2 introduces three-way interactions involving race (requisite constituent terms appear in Table A1), and adds the year fixed effects and their interaction with the racial categories (not reported). While we hypothesized that African American, Latino/a, and workers from Other races would experience smaller gains or larger deficits from GVCs than White workers, the results reveal a mixed racial pattern. Turning first to the first column, relative to White workers, only Latino/a college graduates and African American holders of graduate degrees experience significantly lower gains from GVCs.

Conversely, African American workers have non-significantly larger gains than White workers in managerial positions and college degrees, and non-significantly larger declines in manufacturing premiums. Latino/a workers experience significantly larger gains in managerial premiums, significantly smaller declines in manufacturing premiums, and non-significantly smaller gains in the college premium. Finally, workers in the Other racial group category, composed primarily of Asian Americans, experience significantly larger gains and significantly smaller declines on all of these.

Similarly, the final column suggests the rising variance in all these categories associated with GVCs is broadly shared by all racial groups, while the racial pattern is inconsistent. African Americans experience a significant lower rise in variance among managers. Latino/a workers experience a significantly lower rise in variance among workers with graduate degrees. Workers in the Other racial category experience a significantly larger variance increase among college graduates but a significantly smaller increase among holders of graduate degrees.

While the coefficients describe the degree to which the effects of GVCs are racially disparate, they elide deeper insight into the degree to which GVCs lead to converging or diverging income premia. Thus, Fig. 2 visualizes the marginal effect of each of these occupational/human capital categories on mean incomes for each race across varying levels of Southern imports. These "simple slopes" simultaneously illustrate both racial differences in the *effect of GVCs on the rate of change of each premium* (the slopes and slope coefficients noted on right-hand side of graph), and the degree of convergence/divergence of each premium across races (changes in the racial gaps).

For managerial income premiums, GVCs skew benefits away from Whites, with all other racial groups experiencing a larger boost. The largest boost is among managers in the Other racial category, followed by Latino/a managers and then African American managers. The Latino/a managerial premium *surpasses* that of Whites by the later stage of GVCs, while managerial premiums for the other two racial groups experience a significant but incomplete rate of convergence with Whites. Nevertheless, despite a slightly steeper GVC slope for African American managers, their managerial premium remains much lower than that of Whites (as well as Latino/a and Others) throughout.

In manufacturing, African American, Latino/a and White workers

Table 1
Select Coefficients from Heteroskedastic Regression of Personal Labor Market Income and Its Residual on Occupational/Human Capital Categories, Race, Southern Imports and their Interactions (Economic Effects).

	(1)		(2)	
	Mean	Variance	Mean	Variance
Southern Imports	**0.034 * ****	**0.039 ***	**0.050 * ****	**0.116 * ****
	(23.037)	**(2.563)**	**(26.615)**	**(6.749)**
Manager	0.096 * **	0.313 * **	0.096 * **	0.284 * **
	(37.166)	(27.067)	(37.589)	(24.609)
Manager X Southern Imports	**0.014 ***	**0.079 ***	**0.009**	**0.100 * ***
	(1.988)	**(2.310)**	**(1.338)**	**(2.751)**
Manager X African American X Southern Imports			**0.011**	**−0.288 ***
			(0.795)	**(−2.268)**
Manager X Latino/a X Southern Imports			**0.044 * ****	**−0.144**
			(4.825)	**(−1.125)**
Manager X Other Races X Southern Imports			**0.053 * ****	**−0.314**
			(4.029)	**(−1.639)**
Manufacturing	0.074 * **	−0.203 * **	0.080 * **	−0.232 * **
	(46.647)	(−12.495)	(44.366)	(−13.872)
Manufacturing X Southern Imports	**−0.042 * ****	**0.192 * ****	**−0.038 * ****	**0.158 * ***
	(−9.985)	**(4.084)**	**(−7.901)**	**(3.064)**
Manufacturing X African American X Southern Imports			**−0.002**	**−0.093**
			(−0.505)	**(−1.206)**
Manufacturing X Latino/a X Southern Imports			**0.024 * ****	**−0.069**
			(3.854)	**(−0.790)**
Manufacturing X Other Races X Southern Imports			**0.065 * ****	**0.076**
			(9.291)	**(0.582)**
College	0.080 * **	0.191 * **	0.081 * **	0.188 * **
	(37.658)	(16.656)	(33.065)	(15.632)
College X Southern Imports	**0.065 * ****	**0.516 * ****	**0.055 * ****	**0.450 * ****
	(11.381)	**(13.613)**	**(8.299)**	**(10.939)**
College X African American X Southern Imports			**0.006**	**0.003**
			(0.475)	**(0.029)**
College X Latino/a X Southern Imports			**−0.022 ***	**0.05**
			(−2.060)	**(0.308)**
College X Other Races X Southern Imports			**0.061 * ****	**0.312 * ***
			(4.757)	(3.002)
Graduate Degree	0.165 * **	0.462 * **	0.164 * **	0.426 * **
	(57.264)	(17.165)	(51.289)	(16.173)

(*continued on next page*)

Table 1 (*continued*)

	(1)		(2)	
	Mean	Variance	Mean	Variance
Graduate Degree X Southern Imports	**0.083** * **	**0.760** * **	**0.073** * **	**0.731** * **
	(9.227)	**(9.584)**	**(7.017)**	**(9.200)**
Graduate Degree X African American X Southern Imports			**−0.029** *	**0.256**
			(−2.226)	**(1.313)**
Graduate Degree X Latino/a X Southern Imports			**−0.024**	**−0.489** * *
			(−1.768)	**(−2.875)**
Graduate Degree X Other Races X Southern Imports			**0.058** * *	**−0.598** * **
			(3.069)	**(−3.903)**
Constant	4.852 * **	−3.884 * **	4.855 * **	−3.835 * **
	(8670.636)	(−879.771)	(7402.170)	(−793.498)
N	3142970			

Notes: Standard errors are clustered on year. Regression coefficients are presented with t statistics in parentheses. Model 1 includes time fixed effects. Model 2 includes race, time and race X time fixed effects. Model 2 also includes additional constituent terms (two-way interactions) necessary to correctly estimate the three-way interactions. These appear in Table A1.

experience steep declines in the manufacturing premium, with the largest decline among African American and White workers and the smallest among Latino/a workers. In contrast, GVCs actually increase the manufacturing premium for workers in Other racial categories. The non-significantly steeper decline among African American workers (relative to White) produced no convergence, while the significantly shallower decline among Latino/a workers (relative to White) produced small convergence. However, the low manufacturing premium for Other races would have reduced between-race inequality in the earlier period, but increases between-race inequality by the period's end.

Consistent with theories linking GVCs to rising inequality through human capital, Southern imports boost the income premium for workers with college and graduate degrees across all races. For college degrees, the boost is highest among workers from Other racial categories, followed by African Americans, Whites and Latino/a workers. The steep boost for the Other racial category resulted in average premia that far surpass those of all other racial groups, including Whites, by the end of the period. Conversely, college income premia among Latino/a workers diverged from that of White workers, while African Americans premia converged slightly with that of Whites but diverged from that of Other races. For graduate degrees, the Other racial premium experienced the largest boost, followed by Whites. Latino/a and African American workers experienced a comparable premia boost. The graduate degree premium among Other workers diverged significantly from all racial groups, including that of Whites, while graduate degree premia of Latino/a and African American workers also diverged from that of White workers.

Fig. 3 repeats this exercise with the marginal effects on group variances. For managerial incomes, all racial groups except White experienced absolute declines in relative variance of managerial incomes, producing convergence in managerial income-variance among all racial groups but African Americans. In manufacturing, Southern imports increased the relative income for all groups and thereby reduced the long-observed equalizing effect of manufacturing occupations. This produced a degree of upward between-race convergence in the within-race variance of the manufacturing premium. The disequalizing effect

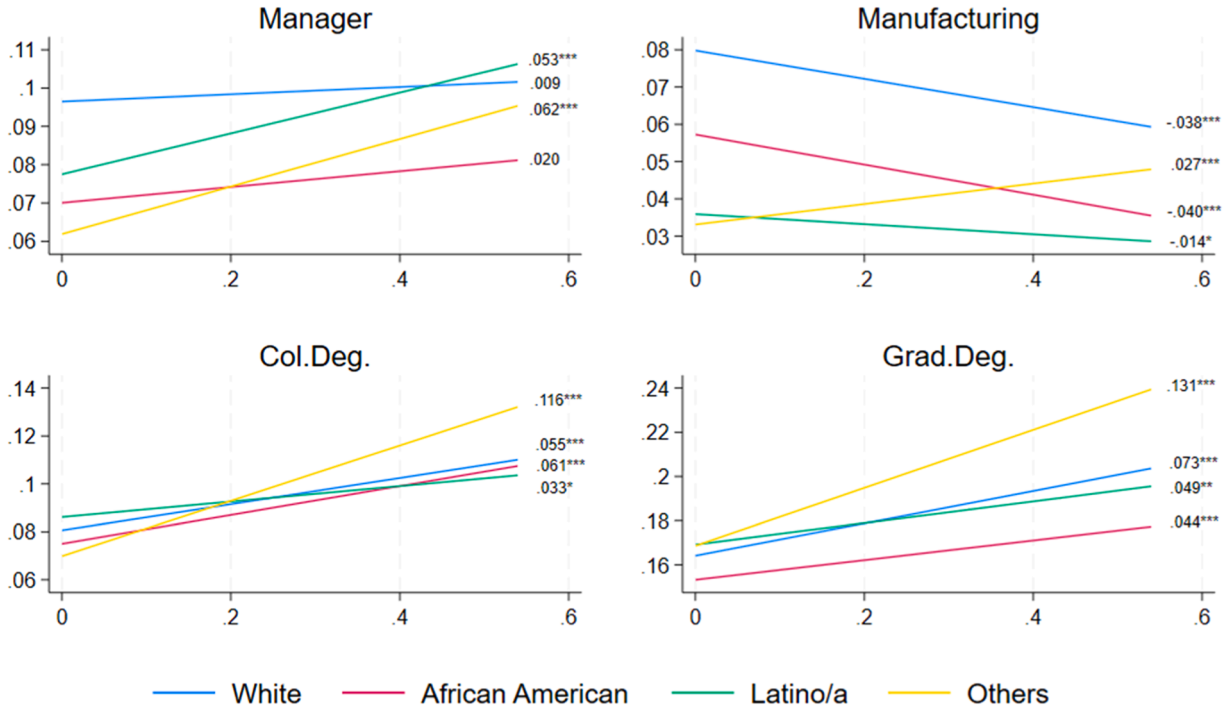

Fig. 2. Marginal Effects of Southern Imports on Income by Occupational/Human Capital Categories and Race. Notes: y-axis is the difference in mean income between focal category and those in non-managerial and non-manufacturing occupations with less than a college degree. x-axis is the ratio of Southern imports to total imports centered so that the minimum value equals zero. The numbers on the right denote the slope coefficient of each line, i.e. the marginal effects of Southern imports on the income difference between a focal occupational/human capital category and non-focal occupational/human capital category. The coefficients of each slope are labeled based on their position from top to bottom along the right side of the figure. For example, the slopes on the manager plot indicates the effect of Southern imports on income difference between managerial and non-managerial positions (with the other occupations setting at the reference level, i.e. non-manufacturing occupations with less than a college degree). * $p < 0.05$, * * $p < 0.01$, * ** $p < 0.001$.

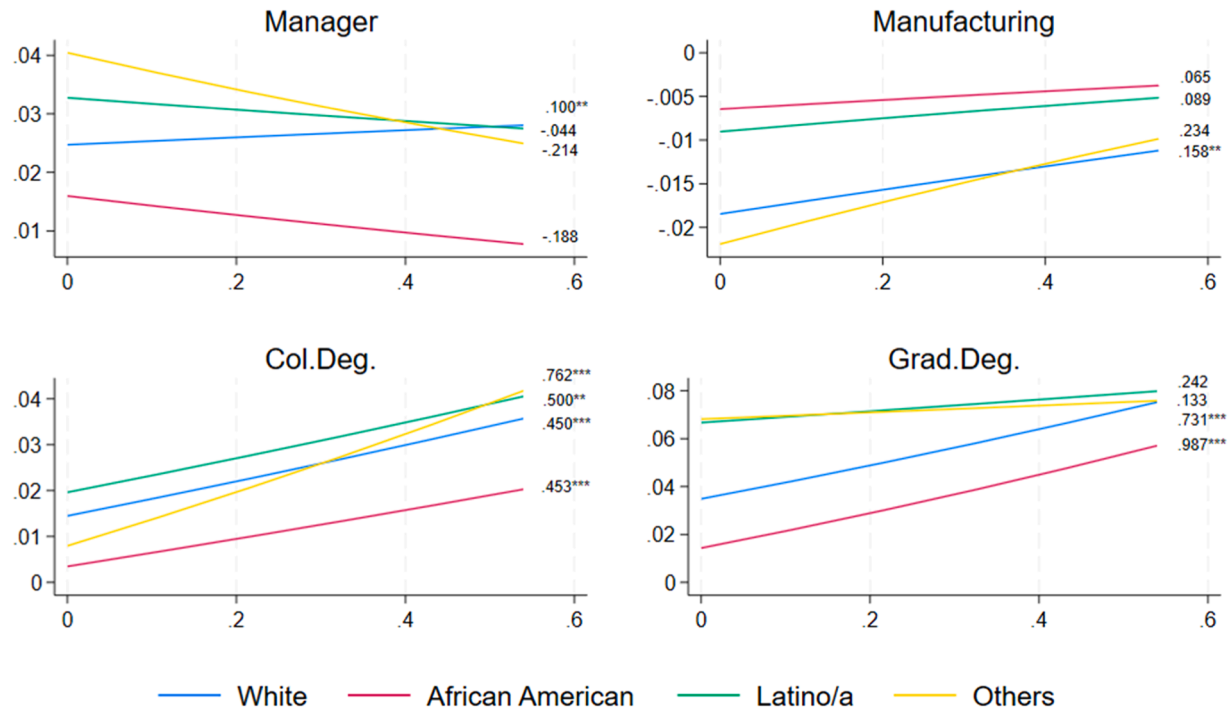

Fig. 3. Marginal Effects of Southern Imports on Variance by Occupational/Human Capital Categories and Race. Notes: y-axis is the difference in variance between focal category and those in non-managerial and non-manufacturing occupations with less than a college degree. x-axis is the ratio of southern imports to total imports centered so that the minimum value equals zero. The numbers on the right denote the slope coefficient of each line, i.e. the marginal effect of Southern imports on the variance between focal category and non-focal category when all other occupational/human capital groups are set to 0. The coefficients of each slope are labeled based on their position from top to bottom along the right side of the figure. For example, the slopes on the manager plot indicates the effect of Southern imports on variance difference between managerial and non-managerial positions (with the other occupations setting at the reference level, i.e. non-manufacturing occupations with less than a college degree). * $p < 0.05$, * * $p < 0.01$, * ** $p < 0.001$.

was largest among "Other" and "White" manufacturing workers, and smallest among African American manufacturing workers. Nevertheless, Latino/a and African American manufacturing workers have significantly more inequality than their counterparts in the White and Other racial categories throughout the period of GVCs.

Among college educated workers, Southern imports again increased income variance for all racial groups, with the largest increase observed among degree holders from Other racial categories. Overall, GVCs appears to have reproduced racial gaps in the variance for all but workers in the Other racial category, who surpassed all other groups by the end of the period. For graduate degree holders, we also observe a disequalizing effect among all workers. However, the effect is largest among African Americans, then Whites and lowest among Other races. Overall, workers in the White and African American category *converge* with Latino/a and Other workers in their level of within-race income premium variance in response to GVCs.

4.2. *Compositional effects*

To evaluate whether the compositional effects of GVCs are racially disparate (Hypothesis 2), Table 2 reports linear probability regressions of managerial and manufacturing occupations, and college and graduate degree attainment, on Southern imports, race and their two-way interactions.[9] The top row shows the coefficient on Sothern imports which, given the two-way interactions at the bottom of the Table, represents the unit change in occupational/educational attainment per one unit change in Southern imports *among Whites*.

Among Whites, Southern imports reduce the probability of

Table 2
Select Coefficients from Regression of Occupational/Human Capital Categories on Race, Southern Imports and their Interactions (Compositional Effects).

	Manager	Manufacturing	College	Graduate Degree
Southern Imports	−0.012 * **	−0.208 * **	0.270 * **	0.139 * **
	(−540)	(−380)	(1100)	(11000)
African American X Southern Imports	0.054 * **	−0.039 * **	−0.057 * **	−0.017 * **
	(330)	(−530)	(−140)	(−91)
Latino/a X Southern Imports	−0.001 * **	−0.107 * **	−0.124 * **	−0.102 * **
	(−0.0083)	(−1300)	(−240)	(−310)
Other Races X Southern Imports	−0.036 * **	0.015 * **	0.002 * **	0.021 * **
	(−660)	(1100)	(9)	(19)
African American	−0.091 * **	0.002 * **	−0.050 * **	−0.048 * **
	(−1100)	(80)	(−430)	(−560)
Latino/a	−0.068 * **	0.053 * **	−0.068 * **	−0.048 * **
	(−1100)	(3400)	(−400)	(−280)
Other Races	−0.015 * **	−0.004 * **	0.021 * **	0.055 * **
	(−510)	(−2800)	(260)	(91)
Constant	0.138 * **	0.219 * **	0.126 * **	0.081 * **
	(13000)	(17000)	(1800)	(14000)

Notes: Original t statistics are divided by 1 million for presentation purposes (shown in the parenthesis). Standard errors are clustered on year. All models include race, time and race X time fixed effects. N = 3142,790.

[9] Standard errors are adjusted in the same manner as those for income and variance.

managerial and manufacturing occupations, but increase the probability of college and graduate degrees. Turning to the two-way interactions, the effects differ by race. For African Americans, Southern imports increase the probability of managerial occupations, but decrease the probability of manufacturing occupations, college and graduate degrees *relative to Whites*. Conversely, for Latino/a workers, Southern imports reduce the probability of all these occupational/educational categories compared to Whites. Among Other racial groups, Southern imports reduce the probability of managerial occupations, but increase the probability of manufacturing occupations and both educational credentials relative to Whites. Thus, and similar to the economic effects noted above, GVCs have a complex mix of racially disparate compositional effects. African Americans fare better than Whites in managerial and manufacturing occupations (because of the declining premium to manufacturing), but worse in education. Latino/a workers fare worse than Whites in all categories but manufacturing, while Other racial groups fare better than Whites in education.

To better understand the coefficients in Table 2, Fig. 4 displays total compositional changes for each racial group. Among managerial occupations, Southern imports uniquely increased the share among African Americans, but persistent gaps remain between African Americans and both Whites and Other races. African Americans also began with the lowest rate. All other groups experienced a decline in managerial occupations, but this decline was largest among individuals in the Other racial category. Overall, Whites diverged with all other racial categories except for African Americans. Consistent with GVCs' theoretical effects on manufacturing employment, all racial groups experienced a precipitous decline, with the largest decline observed among Latino/a workers and the smallest among Other races. Overall, there was a large degree of downward convergence in the proportion of manufacturing occupations among each racial group.

With respect to college degrees, all groups experienced an increase in educational attainment, with Other races growing most rapidly, followed by Whites, African Americans and Latino/as. There is a similar trend among workers with graduate degrees. Thus, while the occupational effects of Southern imports are more racially mixed, the human capital effects are less mixed: Southern imports boosted the share most among the "Other" racial category, followed by Whites. African Americans fared better than Latino/a workers, particularly with respect to graduate degrees. Overall, Southern imports lead to a clear racial divergence in the attainment of college and graduate degrees, but one that favored Other races more than Whites.

4.3. *Counterfactual decomposition*

Thus far, we have demonstrated that Southern imports have racially disparate economic and compositional effects, but also that the racially disparate pattern differs from that anticipated by much contemporary theory. We also show that the magnitude of racial disparity appears much smaller with respect to racial variances than racial means. But how do these effects matter for between race and within race inequality overall? To begin this discussion, we direct the reader to Fig. 5, which shows the unweighted average income (top pane) and variance (bottom pane) for each racial category. The top panel of Fig. 5 shows that the increasing between-race inequality demonstrated in Fig. 1 is driven by the widening income gap between White workers and workers from the "Other" racial category (composed primarily of Asian Americans), *vis-a-vis* African American and Latino/a workers. This is because the former two groups begin and remain above the mean income throughout the period, while the latter begin and remain below the mean.

Given this pattern, GVCs can only reduce between race inequality if it *reduces* the occupational/human capital premiums for White *and* Other workers more quickly than for African American and/or Latino/a workers, or *increases* these premia for African American and Latino/a workers more rapidly than for White *and* Other workers. Relative gains of workers in the "Other" categories vis-à-vis White workers, and of African American vis-à-vis Latino/a workers, matter less for between-race inequality because the two sets of racial groups are above and

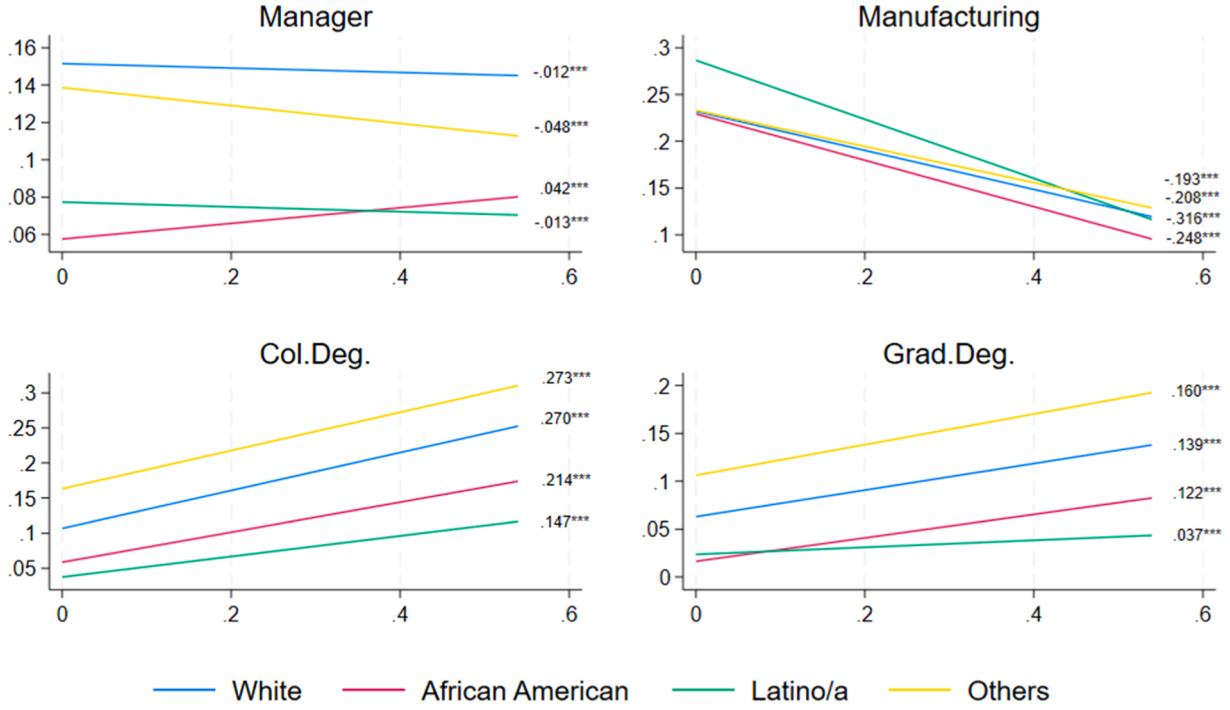

Fig. 4. Marginal Effects of Southern Imports on Composition by Occupational/Human Capital Categories and Race Notes: y-axis is the predicted proportion of a specific occupational/human capital category. x-axis is the ratio of Southern imports to total imports centered so that the minimum value equals zero. The numbers on the right denote the slope coefficient of each line, i.e. the marginal effect of Southern imports on linear probability of being a specific occupational/human capital category. The coefficients of each slope are labeled based on their position from top to bottom along the right side of the figure. * $p < 0.05$, * * $p < 0.01$, * ** $p < 0.001$.

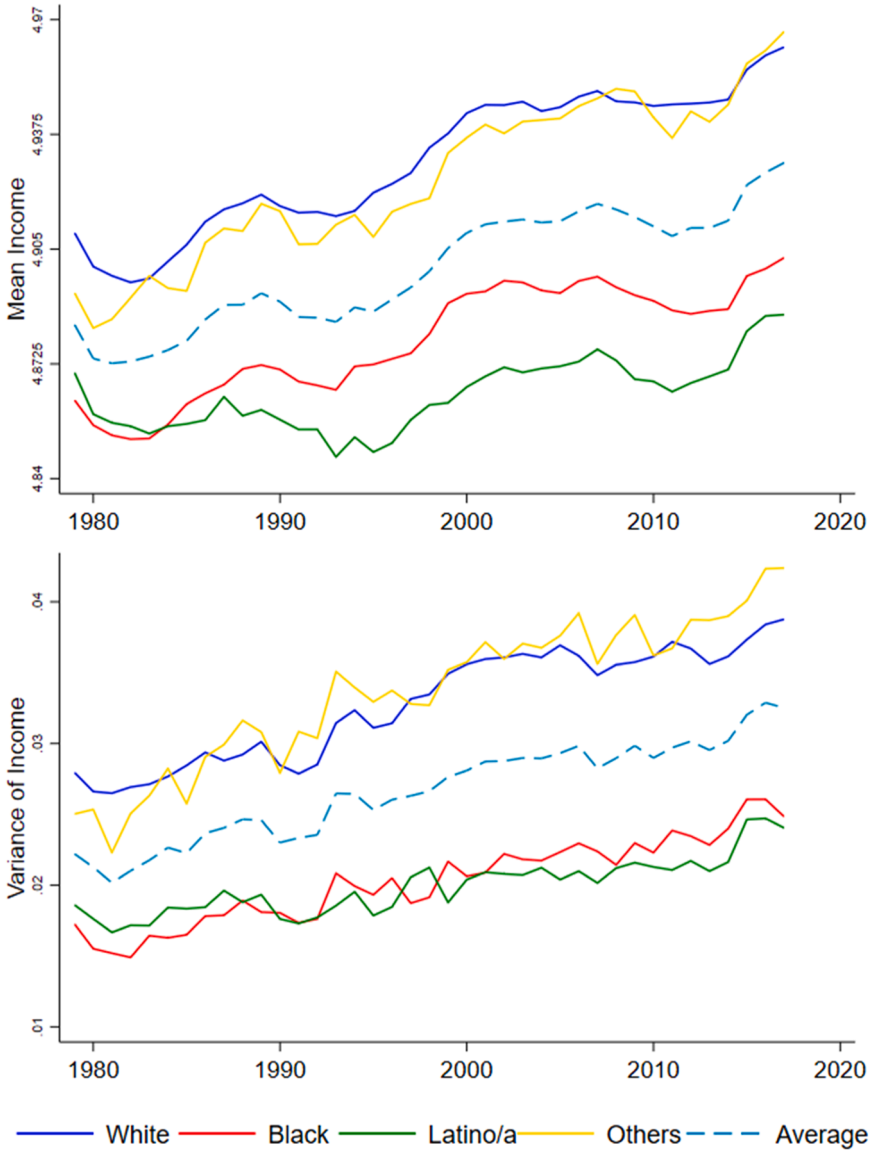

Fig. 5. Unweighted Observed Mean and Variance of Income by Race Note: Left axis shows logged unweighted predicted mean/variance income, estimated based on variance function regression in model 2 of Table 1.

below the mean income, respectively.

In fact, relative gains by "Other" workers vis-à-vis White workers more often *increase* between-race inequality because they also increase the variance of income between workers from Other races, on the one hand, and African American and Latino/a workers on the other. The bottom pane of Fig. 5 reveals the same conclusion for within race inequality: Whites and Other races have significantly more within-race inequality than do the African American and Latino/a groups. In short, positive three-way interactions involving the occupational/human capital premia and the Other racial categories are neutral or disequalizing with respect to between-race inequality, while those involving the African American and Latino/a categories reduce inequality. The same is true with respect to racial differences in within-race inequality, except that what is converging/diverging is racial variances rather than means.

With the discussion of Fig. 5 in mind, we can now proceed to quantifying the change in between and within-race inequality associated with global value chains, and decompose this association across each of the four mechanisms and racial categories. In Table 3, between-race effects are reported in columns 2–4, and within-race effects are reported in columns 5–7. Overall, between race inequality would be 42.6 percent lower in the absence of GVCs, while within race inequality would have been 146.8 percent lower (see the fourth and seventh column of the bottom row). Perhaps surprisingly, Southern imports' compositional effects *reduced* between-race inequality overall, even though they were more than offset by the racially inegalitarian economic effects. Moreover, the mechanisms by which GVCs increased between and within-race inequality vary across the two types, as does the degree of racial disproportionality. We discuss each component in turn.

Row one in columns 2–4 shows the economic, compositional and total effects of Southern imports on between-race inequality that operate through changes to managerial premia. Recall the racially disparate effect of Southern imports on managerial premiums favored Other > Latino/a > African American > Whites, but that significant gaps persisted between African Americans and all other races (Fig. 2). The net effect of these changes was an *increase* in between race inequality by 11.2 percent. Conversely, the racially disparate compositional effect of Southern import on managerial occupations was African American > White > Latino/a > Other (Fig. 4), and this pattern combined to

Table 3
Summary of Counterfactual Inequality Changes.

	Between Race Effects			Within Race Effects		
	Economic	*Compositional*	*Total*	*Economic*	*Compositional*	*Total*
Manager	**11.2**	**−6.3**	**4.9**	**18.8**	**−1.4**	**17.4**
African American	−4.3	−3.8	−8.1	0.9	0.3	1.2
Latino/a	−7.0	2.2	−4.8	0.9	−0.3	0.6
Others	3.7	−1.8	1.9	1.0	−0.5	0.5
White	18.7	−2.9	15.8	15.9	−1.0	15.0
Manufacturing	**7.3**	**−11.7**	**−4.4**	**9.3**	**8.3**	**17.6**
African American	−0.7	3.6	2.9	0.7	0.5	1.3
Latino/a	−1.6	7.5	5.9	0.8	1.2	1.9
Others	3.1	−2.4	0.6	1.1	0.5	1.7
White	6.5	−20.4	−13.9	6.7	6.1	12.8
Col. Deg.	**14.0**	**−3.9**	**10.1**	**36.7**	**13.7**	**50.4**
African American	−14.7	−14.8	−29.5	2.6	0.8	3.4
Latino/a	−10.1	−19.9	−29.9	3.1	2.3	5.4
Others	5.8	3.6	9.3	5.3	1.0	6.3
White	33.0	27.2	60.2	25.7	9.5	35.2
Grad. Deg.	**21.2**	**10.9**	**32.0**	**36.6**	**24.8**	**61.4**
African American	−6.2	−15.7	−21.9	3.3	2.2	5.5
Latino/a	−5.0	−9.2	−14.2	1.2	1.4	2.6
Others	5.7	5.4	11.1	2.5	2.5	5.0
White	26.6	30.4	57.0	29.7	18.7	48.4
Total	**53.7**	**−11.1**	**42.6**	**101.4**	**45.4**	**146.8**

Notes: Values are the difference between the observed and counterfactual changes expressed as a percentage of observed. Negative values indicate an equalizing effect relative to zero Southern imports. Race-specific effects are calculated by holding either the racial mean or variance at the base year for each occupational/human capital category:

Race-specific economic counterfactuals are given by $\sum_{jt=1}^{jt\neq it}\pi_{jt}(\bar{y}_{jt}-\bar{y}_t)^2 \quad +\pi_{it}(\tilde{y}^e_{i0}-\bar{y}_t)^2$ and $\sum_{jt=1}^{jt\neq it}\pi_{jt}\sigma^{e2}_{jt}+\pi_{it}\tilde{\sigma}^{e2}_{i0}$.

Race-specific compositional counterfactuals are given by $\sum_{jt=1}^{jt\neq it}\pi_{jt}(\bar{y}_{jt}-\bar{y}_t)^2 \quad +\pi_{it}(\tilde{y}^c_{i0}-\bar{y}_t)^2$ and $\sum_{jt=1}^{jt\neq it}\pi_{jt}\sigma^{e2}_{jt}+\pi_{it}\tilde{\sigma}^{e2}_{i0}$.

reduce between-race inequality by 6.3 percent. Thus, the total effect of Southern imports on between-race inequality through managerial occupations is 4.9 percent. In short, the racially egalitarian economic effects among Latino/a and African American managers, and compositional effects among African Americans (relative to whites) was more than offset by the racially inegalitarian absolute economic effects among Whites and Other (relative to Latino/a and African American) managers.

Row six of columns 2–4 shows the economic, compositional and total effects of Southern imports on between-race inequality that work through manufacturing occupations. Contrary to claims made elsewhere in the literature that suggest deindustrialization has been a source of between-race inequality (Wilson, 1978; 2011), we find that the deleterious effects of Southern imports on manufacturing income premia and employment *reduced racial inequality by 4.4 percent*. Here, Other races experienced a boost in the manufacturing income premium, while the rest experienced varying rates of decline: Latino/a < White < African American. These disparate economic effects increased between race inequality by 7.3 percent. Conversely, however, the shallower decline of manufacturing employment (amidst declining manufacturing incomes) among White and Other races helped to reduce between-race inequality by 11.7 percent.

Row 11 of columns 2–4 report the economic, compositional and total effects of Southern imports by virtue of their racial impacts on college degree premia and attainment. Overall, Southern imports increased inequality by 10.1 percent via its racial impact on college degrees, but the inegalitarian economic effects (14 percent) were counterbalanced by the egalitarian compositional effects (-3.9). Conversely, row 16 shows that Southern imports increased between-race inequality via graduate degrees because both its economic (21.2) and compositional (10.9) effects were racially disparate. In both cases, the relative and/or absolute gains of African American and Latino/a workers were more than offset by the relative and/or absolute gains of Whites and Others.

Turning to the within-race component, and consistent with our results in the last column of Table 1 and in Fig. 4, the within-race effects of Southern imports were much less racially disparate. In nearly all occupational/human-capital categories, GVCs increased within-race inequality through both economic and compositional effects. The compositional effects of managerial occupations on within-race inequality were negative for Latino/a, Other and White racial groups but these effects were very small. Moreover, the within-race effects are heavily skewed toward changes among whites because they are such a large share of the population despite relative population decline over the period. In total, GVCs increased within-race inequality by 17.4–61.4 percent across these occupational/human capital categories, and these effects were larger among human capital than occupational categories.

5. Conclusion

In this article, we respond to the growing call to examine how structural economic changes impact racial inequality in the United States (Wingfield, 2020). We examine how an important structural change to the US labor market—GVCs —impacts racial labor market inequalities, and are unaware of *any* previous empirical or theoretical attempts to do so. Using variance function regression, we investigate whether the effect of Southern import penetration on the level and variance of labor market incomes are racially disparate. We further decompose labor market inequality into "between-race" and "within-race" components, and then examine how these components would have changed in the absence of GVCs. Innovating upon the methodological framework proposed by Western and Bloome (2009), our study presents a new methodology for examining racial disparities, particularly elucidating the diverse mechanisms through which broader structural factors like GVCs shape racial inequities. This nuanced approach allows us to dissect the specific mechanisms by which GVCs influence racial disparities in the labor market, and the degree to which any racially disparate effects occur between and/or within races. Our novel counterfactual analysis quantifies the relative contributions of each GVC mechanism, as well as their *economic* and *compositional* effects, to overall racial inequality.

Our results suggest that GVCs increased both between and within-race inequality. Racially disparate economic effects increased between-race inequality in both absolute terms, and as a share of total US inequality. However, our findings highlight the complex and nuanced ways in which GVCs affect racial inequality. Somewhat surprisingly from the perspective of the literature on racial inequality in the US, the "between race" economic and compositional effects were not entirely consistent with each other. For example, the economic effects were entirely disequalizing between races, while the compositional effects were largely equalizing, both overall and in three out of the four GVC mechanisms examined here (Table 3). While faster rates of college and graduate degree attainment among African American and Latino/a workers would have made the compositional effects of GVCs even more egalitarian, more attention should be paid to understanding the underlying causes of the racially disparate *economic effects* of GVCs.

The *within-race* inequality effects of GVCs we observe here were broadly shared by all races, however. This latter finding is consistent with the overall thrust of the literature linking GVCs to rising inequality (Alderson & Nielsen, 2002; Mahutga et al., 2017; Mahutga & Curran, 2022). It is also consistent with older calls to examine "new sources of inequality that may impact inequality *within* groups" (Leicht, 2008: 24). Our finding that GVCs increased within-race inequality rather similarly for all racial groups is particularly important with respect to the predominant focus of "gaps" research in American sociology. Not only did GVCs increase within-race inequality similarly across races, but within-race inequality accounts for *much* larger proportion of the overall US inequality than between-race inequality. Thus, our work punctuates the perhaps now even more prescient problem with racial "gaps research [, which] is that more is going on in the labor markets of most post-industrial societies besides […between-race] inequality" (Leicht, 2008: 241).

Even the racially disparate between-race economic effects we observe do not fit neatly within contemporary theorizing of racial inequality, which generally presupposes a system of economic and compositional effects that at all places and times benefits a privileged White majority at the expense of all other groups. For example, we find that Latino/a workers experience significantly larger gains in managerial premiums than Whites during the period of GVC expansion. Workers in the "Other" racial group category, composed primarily of Asian Americans, experience significantly larger gains from managerial occupations and college/graduate credentials than Whites.[10] African American workers in manufacturing experienced comparable economic effects, but their faster exit from manufacturing *vis-à-vis* Whites increased inequality in spite of the declining fortunes of the sector (c.f. Wilson, 2011). In short, our work shows that "group gaps do not mean the same thing, nor are they the same size, at different [occupations and skill categories]. The mechanisms that produce them (and, presumably, the policies that will close them) differ as well" (Leicht, 2008: 242).

The only two economic GVC effects that fit neatly with dominant theories of racial inequality are observed with respect to income premiums associated with African American graduate degrees, and Latino/a college degrees, which grow more slowly than that of Whites. Such a finding punctuates the need for research into why *changes in the returns to educational credentials overtime* would disadvantage African American and Latino/a workers, particularly in light of the Supreme Court's decision to gut affirmative action policies at institutions of higher learning that is likely to exacerbate the racially disparate compositional effects among these two groups in Table 2. Such explanations could include greater on the job discrimination in occupations requiring educational credentials, racial sorting into colleges with different post-graduate income trajectories, or both.

Our findings also point to methodological problems with contemporary gaps research. Most gaps research may say very little about the impact of a phenomenon (x_p) under study and racial income *inequality*, per se. The most common methodological intervention in gaps research (an interaction term between x_p and a dummy variable for a particular race) can only shed light on the gap between the excluded race and that represented by the dummy variable, but racial inequality is a function of the means, variances and population shares *of all races*. Moreover, 8/12 of the compositional effects we estimate in Table 2 were racially disparate (reflected a regressive gap between Whites and the focal minority category), but these nevertheless "added up" to an overall *reduction* in between-race inequality in three of the four mechanisms we considered, and overall, because of the particular combination of racially disparate compositional effects, initial gaps, and population shares we observed (Table 3). In the final analysis, gaps research may say very little about *racial inequality*.

We also encounter three methodological challenges. First, our decomposition technique limits our ability to include a broader set of relevant covariates (e.g., gender, marital status, age, historical racial regimes, and so on) in the regression models that identify the group means and variances we estimate (Baker, 2022). With c_k denoting the number of unique categories for covariate k, the required number of cells is $j \times t \times c_1 \times c_2 \times \ldots \times c_k$. Introducing an additional covariate with c_m levels to the variance function regression would further increase the number of required cells to $j \times tc_1 \times c_2 \times \ldots \times c_k \times c_m$, where j represents the number of racial groups and t the number of years. Quite clearly, this number grows exponentially rather quickly. As a consequence, the size of each cell diminishes rapidly with additional covariates, which makes it impossible to estimate the mean and variance of each cell with any confidence (Western & Bloome, 2009). Thus, our analysis certainly risks missing finer heterogeneities within each racial group.

Relatedly, we do not consider the role of institutions as either mediators or moderators of GVC effects or capture the effects of offshoring via GVCs outside of manufacturing (e.g. the service sector). Both GVC and racial inequality literatures underscore the importance of institutions (e.g., unionization, welfare institutions, right-to-work laws, minimum wage policies, education spending, unemployment insurance, wage-coordination, and vocational rehabilitation) in shaping labor market inequalities (Baker, 2022; Mahutga et al., 2017; Mahutga & Jorgenson, 2016; Wilson, 2009). On one hand, labor market institutions may act as mediators between GVCs and racial inequality in the labor market. For example, firms located in geographic regions where institutional regulations promote both a larger and more racially egalitarian labor share of income might be more likely to offshore manufacturing via GVCs (Mahutga et al. 2025). Thus, while omitting these institutions allows us to assess the total effects of GVCs, it does so with less theoretical precision *vis-à-vis* mechanisms. On the other hand, institutions may also serve as moderators. For example, it's entirely possible that GVCs produce more modest declines in manufacturing incomes among unionized than non-unionized workers, which would in turn disproportionately protect manufacturing incomes among racial groups with higher rates of unionization (Rosenfeld & Kleykamp, 2012). Moreover, while less extensive than in manufacturing (Lanz & Maurer, 2015), GVCs are also increasingly common in service industries that are not place-bound (e.g. call centers). Thus, the GVC effects we observe here might underestimate the total effect of GVCs. While the greater nuance envisioned here may preclude our empirical approach, our finding that the racially disparate effects of GVCs accrue primarily to the (smaller) between-race component of US labor market inequality may allow future research to integrate our framework with alternative

[10] The disproportionate increase in managerial Latino/a managerial incomes could be socio-linguistically tied to the need for bilingual managers to communicate with a growing Hispanic customer and worker base (P. J. Chen, Okumus, Hua, & Nusair, 2011). The managerial dynamic among Asian Americans may also be tied to socio-linguistic needs with an expanding global customer base in East and Southeast Asia (S. Chen, Geluykens, & Choi, 2006), while college premiums may be tied to the type of degree, where Asian Americans are more likely to declare STEM majors (Hsin & Xie, 2014).

decomposition techniques that impose fewer restrictions on the number of covariates in models of the relevant parameters, at the expense of distinguishing between within and between-group inequality (e.g. Parolin & Gornick, 2021).

Second, in the counterfactual analysis, we do not evaluate the counterfactual changes of the overall share of the population for each racial group. While racial demographic change certainly does drive racial inequalities in the labor market, theories of GVCs are silent with respect to demographic change across racial groups. Nevertheless, demographic change varied dramatically across the racial groups we analyze, perhaps most so in the rapid decline of the share of the White population and the equally rapid increase in the share of the Latino/a population. While this demographic change is reflected in the overall effect sizes in Table 3, we did not quantify its impact. Thus, future research could extend upon our methodological approach to delve deeper into multiple dimensional-intersectional inequalities, and analyze the theoretically informed mechanisms underpinning them.

Last, our analytic approaches do not account for selection into employment. Since our focus is on labor market income, our analysis is limited to employed individuals, which could introduce positive selection bias. Those who have exited the labor market due either to GVC-induced poorer job prospects, or to the racialized US criminal justice system (etc.), are excluded (Western & Pettit, 2000). Thus, our sample may overrepresent individuals with better skills or advantages. As a result, we may understate both between- and within-race inequality, as well as the effects of GVCs thereon (Western, 2002). Although we cannot directly address this limitation, it is important to acknowledge that differences in labor force participation may account for some of the observed shifts in racial disparities resulting from deindustrialization and globalization.

In conclusion, the results highlight the importance of considering the role of macro-structural changes as causes of racial, and likely other ascriptive types of inequality in the United States. GVCs interacted with a racialized US labor market to increase inequality between races, but in ways that were not entirely consistent with contemporary accounts of structural and systemic racism. Similarly, GVC effects on inequality *within* races were broadly shared by all races. Thus, our work reiterates the call that "sociologists need to put more effort into understanding the moving target that is represented by the globalized, segmented, winner-take-all labor market that we have seen developing over the past 20 years" some fifteen years later (Leicht, 2008: 252). *Redistributional* efforts to counteract the disequalizing effects of GVCs that appeal to broad cross-sections of society might help to ameliorate the fundamental problem of inequality within and between races in the US labor market (Barlow, 2003).

CRediT authorship contribution statement

Gao Manjing: Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Kwon Ronald:** Writing – review & editing. **Mahutga Matthew C.:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Declaration of Competing Interest

None.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.rssm.2025.101023.

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