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Spillovers from High-Skill Consumption to Low-Skill Labor Markets

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ABSTRACT

The least-skilled workforce in the United States is disproportionally employed in the provision of time-intensive services that can be thought of as market-substitutes for home production activities. At the same time, skilled workers—with their high opportunity cost of time— spend a larger fraction of their budget in these services.
Given the skill asymmetry between consumers and providers in this market, product demand shifts—such as those arising when relative skilled wages increase—should boost relative labor demand for the least-skilled workforce. We estimate that this channel may explain one-third of the growth of employment of non-college workers in low-skill services in the 1990s.

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I. Introduction

Census data show that the least-skilled workforce in the United States is disproportionally employed, relative to more skilled workers, in the provision of time-intensive services like food preparation, cleaning, repair and delivery, which can be broadly defined as market-substitutes for home production activities. In 2005, this sector absorbed almost 25% of the workforce in the lowest decile of the wage distribution, while it employed only 5% of workers earning the median wage, and less than 2% of top-wage earners. While employment shares in this sector monotonically decline along the skill distribution, consumer expenditure data show that consumption of home production substitutes, as a fraction of total expenditures, monotonically increases with an individual's skills. These facts (documented in Section II) are consistent with economic theory: more skilled workers—with their high opportunity cost of time—should be net buyers of home production substitutes, while less-skilled workers should be net sellers.

From the asymmetry between the skills of consumers and providers in the market for services that substitute for home production arises the hypothesis of "consumption spillovers" put forward in this paper: product demand shifts in this sector—driven by the consumption choices of skilled workers—will cause labor demand shifts that favor the least-skilled workforce, where the mapping between product demand and labor demand shifts is meaningful in light of the non-tradeable nature of the services we focus on.

Manning (2004) is the only study that has previously emphasized the dependence of unskilled employment opportunities to physical proximity of skilled workers, because the latter are more likely to buy low-skill time-intensive services that free them from home production tasks. Manning tests for this idea by studying the cross-city association between the fraction of college graduates and either employment rates of low-educated workers or their employment shares in non-traded activities. We instead test whether the demand for home production substitutes (and for workers providing them) increases with measures of relative wage income inequality, such as the share of income accruing to the higher-income groups. Since the fraction of expenditures in home production substitutes is larger in higher income percentiles, we expect economies with higher income inequality to allocate a larger share of aggregate income towards these services, and to demand more of the unskilled labor that provides them.

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As shown in Section II-C, time series evidence at the national level supports the existence of consumption spillovers. The growth in wage inequality over the last three decades is one of the better-documented facts about the U.S. labor market (see Katz and Autor (1999) and Acemoglu (2002) for reviews). Over the same period, the share of wage earners at the bottom of the U.S. wage distribution employed in the provision of market substitutes for home production activities has steadily increased, from 16% in 1980 to 25% in 2005. Employment growth in this sector might as well stem from labor supply shifts, such as those caused by the large influxes of low-skill immigrants into the United States in recent decades (Cortes, 2008). Quantile regressions of individual log hourly wages on sector of employment, however, show that since 1980 the wage penalty for providers of home production substitutes has decreased, especially at the lowest quantiles. Positively correlated employment and wage changes suggest a central role for labor demand shifts, such as those predicted by consumption spillovers.

In Section III we turn to test our hypothesis on city-level data, where the gain in degrees of freedom gives us the chance of improving the characterization of the source of demand shifts from consumption spillovers. We pool data from the 1980, 1990 and 2000 censuses and the 2005 American Community Survey and study the cross-city association between employment growth in home production substitutes and variation in the top wage bill share. To the extent that changes in the latter are driven by falling bottom end wages—wages that largely determine the price of low-skill time-intensive services—then estimation of the effects of consumption spillovers on the demand for these services is potentially confounded by own-price effects. To address this concern, we instrument changes in top wage shares using *predicted* changes in the wage bill accruing to top wage earners. We find that growth in a city top wage bill share is associated with economically (and statistically) significant low-skill employment growth in the sector of services that substitute for home production activities.

Our paper relates to the large literature on wage inequality. Differently from most other work, however, it investigates a consequence of increasing inequality, rather than its causes. Consumption spillovers predict that the growth of wage inequality—a phenomenon that has been often explained as arising from growth in the demand for skilled labor—should in turn give rise to increasing relative demand for the least-skilled labor. This is of particular relevance in light of recent evidence on the "polarization" of

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the U.S. labor market. While a feature of the growth of earnings inequality in the 1980s was the decline in employment and earnings of the least-skilled workforce (Bound and Johnson, 1992; Katz and Murphy 1992; Juhn, Murphy and Pierce, 1993), Autor, Katz and Kearney (2006) show that since 1990 to the mid-2000's changes in occupational shares are U-shaped.[1] At the same time, the 90-50 wage gap kept expanding, whereas the 50-10 gap declined.[2]

Autor, Katz and Kearney (2006, 2008) argue that wage and employment growth "polarization" is consistent with a model of technological change in which information technology can only replace human labor routine tasks (Autor, Levy and Murnane, 2003; ALM henceforth). Because jobs that can be routinized are not distributed uniformly across the wage distribution (Goos and Manning, 2007), the secularly declining price of computer capital has non-monotone impacts: it raises demand for the non-routine abstract tasks that are performed by educated professionals and managers, while it lowers demand for the routine tasks that tend to be performed by moderately skilled workers. Even if improvements in technology have no direct impact on the non-routine manual tasks performed by low-skill workers, they do cause labor to be reallocated away from repetitive, traditionally middle-skilled tasks towards lower-skilled activities that require a higher degree of interpersonal and environmental adaptability. As such, the ALM framework predicts employment growth polarization. Labor supply shifts towards the least-skilled jobs, however, might depress observed unskilled relative wages and expand lower-tail inequality.

Demand forces like consumption spillovers can complement technological-based explanations that focus on the production side of the economy, and provide a viable explanation for positively correlated employment and wage changes at the bottom of the skill distribution. In our setting it is the growth in earnings at the top end of the distribution that should spur demand for services consumed by high-income people. Since it is the least-skilled workers that provide these services, this will in turn increase

[1] A similar polarization of employment has been shown to take place in other industrialized economies. See Goos and Manning (2007) for the case of the United Kingdom; Spitz-Oener (2006) for Germany; and Goos, Manning and Salomons (2009) for a larger set of European countries.

[2] Murphy and Welch (2001) and Angrist, Chernozhukov and Fernandez-Val (2006) also document divergent trends in upper and lower-tail U.S. wage inequality in the 1990s.

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labor demand for workers at the bottom end, but not in the middle, of the distribution. Analyses of tax return data (Piketty and Saez, 2003) show that, after increasing steadily until the mid 1980s, the wage income shares of the (very) top percentiles of tax units in the United States underwent unprecedentedly sharp rises in the late 1980s, and then again in the mid to late 1990s. Larger growth in the driving force of consumption spillovers in the 1990s implies that they account well for the timing of changes in the U.S. labor market—that has started to polarize in the 1990s.

II. The market for home production substitutes

A. Theoretical Overview and Related Work

The main intuition of the consumption spillovers hypothesis put forward in this paper is the notion that consumers and providers in the market of services that substitute for home production activities belong to groups at the opposite ends of the skill distribution.

The prediction that skilled workers do less home production than unskilled workers, and consume more market substitutes for home goods and services, is a standard result in the theory of allocation of time—as pioneered by Mincer (1963) and Becker (1965) and formalized by Gronau (1977). Following Manning (2004), we embed this concept in a model for an economy with two types of workers ("skilled" and "unskilled") who derive utility from consuming two types of goods: a general good y—produced by firms using a technology in both skilled and unskilled labor, and a domestic good x—which is the output of time-intensive activities (such as cooking and cleaning the house) that an individual can either produce domestically (using her own time), or purchase in the market (by buying-in someone else's time). Assuming that individuals are equally effective at producing the home good, regardless of their different skills in the production of y, then skilled workers, with their high opportunity cost of time, will be net buyers of time-intensive services that substitute for home production, while unskilled workers will be net sellers. In the extreme case that time is the only input in the production of x, no skilled worker will ever work in the household sector and the wage at which domestic help can be hired will be w_u, the unskilled wage. In the presence of agency costs, no unskilled worker will ever hire any help in household production and the demand for

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domestic help will be an increasing function of the real skilled wage and a decreasing function of the unskilled wage.

In this setting, a rise in skilled market wages—as long as it is higher than the rise in unskilled wages—will cause a positive shift in the demand for unskilled labor in the sector of services that substitute for home production. We test for this prediction both on time-series data (Section II-C) and on cross-city data (Section III).

Our framework closely relates to the one proposed by Autor and Dorn (2010), who also emphasize the role of growing low-skill in-person service jobs in explaining the twisting of the lower tail of the U.S. wage and employment distributions observed in recent decades. Building upon ALM, the authors identify personal services as a sector that is less likely to experience technological improvements, since it delivers manual non-routine tasks. Even if we emphasize different parts of our models, our approaches are complementary. We stress a consumption explanation, but by positing that technical change in the home production substitute sector is limited, we make an assumption that is similar to the one in Autor and Dorn (2010) and is crucial for consumption spillovers to exist: only if home production is time-intensive, rising returns to skill, by raising the opportunity cost of time of skilled workers, spur their demand for household services. Autor and Dorn focus on the production side of the economy and on the effects of non-neutral changes in productivity, but also make an assumption on consumers' preferences: in their framework, as in Weiss (2008), rising demand (and wages) in the service sector crucially depend on the elasticity of substitution between goods and services.

In what follows, we use consumption expenditure data and employment data to test the main prediction of our framework, that is, consumption of home production substitutes should increase with measures of an individual's skills, while employment in these services should decrease with them. We measure skills either in terms of highest educational attainment or hourly wages. The basic rule to identify the *x*-sector is that it must provide goods/services that an individual would be able to produce domestically using her own time as a primary input. We also impose the criterion that the producer of the good/service has to be located in physical proximity to the consumer of that product, as only in the case of non-tradable goods, prices will reflect the local cost of labor inputs—a crucial feature to map product-demand shifts into demand shifts.

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B. The consumers of home production substitutes

The Consumer Expenditure Survey (CEX) is the only micro-level data reporting comprehensive measures of consumption expenditures for large cross-sections of households in the United States. It consists of two independent nationally representative surveys, one based on retrospective interviews about expenditures in the previous quarter (the Interview Survey) and one based on weekly diaries (the Diary Survey). We use data from the Diary Survey, because weekly record keeping more accurately accounts for the kind of expenditures that we want to measure: Services that are substitutes for home production activities are likely to constitute small and frequent purchases, difficult to recall over longer periods of time (Attanasio, Battistin and Ichimura, 2007).

For each household we calculate both a measure of total weekly expenditures, and a measure of expenditures in goods and services that substitute for home production activities. The latter measure includes purchases of food and drinks consumed away from home at full service places; repair and maintenance, delivery, babysitting, housekeeping and personal care services.[3] On a sample drawn from the 2004 Diary Survey and restricted to households headed by individuals at least 18 and no more than 65 who worked for salary in the twelve months before the interview, we investigate the correlation between the head's education and hourly wage,[4] and the household's expenditure share of home production substitutes.[5] To shed light on the potential differences across family types, we also run separate analyses for (i) husband/wife families where only the head works (15% of the sample), (ii) husband/wife families where both spouses work (40%), and (iii) other households (45%).

As shown in the last panel of Figure 1, the household budget share of home production substitutes monotonically increases with the head's educational attainment: these consumption items represent 4.5 percent of the total expenditures of households headed

[3] Table A1 (in the web-appendix available at ADDRESS) provides details on the way in which specific expenditure items are mapped into these categories.
[4] The family head is conventionally fixed to be the male in all husband/wife families. Hourly wages are calculated as annual earnings (in the 12 months before the interview) divided by annual hours of work.
[5] We study budget shares, instead of dollar amounts spent, to abstract from differential saving decisions across skill groups.

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by high-school dropouts, but 11 percent of those of households headed by college post-graduates. The first three panels show that this pattern is common across family types.[6]

Table 1 reports Ordinary Least Squares (OLS) regressions of household budget shares on head's log hourly wages: as shown in column 1, we find evidence of a statistically significant positive relationship. Columns 2 through 5 report estimated coefficients from regressions separately run for different family types. A ten percent increase in the male head's hourly wage is associated with around a 0.1 percentage point increase in the budget share of home production substitutes in husband/wife families (columns 2 and 3). As shown in column 4, in husband/wife families where the woman works, we find a stronger relationship between budget shares and the woman's wage, suggesting that when the woman participates in the labor market, the opportunity cost of home production time is more closely tied to her wage than the male's wage. Also in the case of other families (column 5), there is a statistically significant relationship between budget shares and head's hourly wages. The magnitude of the relationship is smaller than for other family types, but the fraction of expenditure on these services is on average higher.

These stylized facts show that consumption of outsourced home production activities monotonically increases with proxies for family members' opportunity cost of time. If workers are more likely to consume these services because by doing so they can substitute their own "costly" time in home production activities with cheaper bought-in-time, then they should be more likely to do so the larger is the difference between their own skills and the skills of those providing these services—who, as we show next, are predominantly the least-skilled in the economy.

C. The providers of home production substitutes

To evaluate the skills of the providers of home production substitutes, we use data from the 1980, 1990 and 2000 censuses and the 2005 American Community Survey (ACS), specifically the Integrated Public Use Microsample Series (IPUMS) files

[6] The strictly increasing pattern is less pronounced for married couples where the wife works. However, as shown in Figure A1 (in the web-appendix), when setting the family head in husband/wife families to be the female (instead of the male), the pattern is sharp for these families as well. As documented in Figure A2, the monotonically increasing pattern is also similar across specific service categories.

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(Ruggles et al., 2004).[7] We use industry of work to identify those service jobs that are likely to provide the labor inputs for the production of the items we study in CEX data.[8] "Outsourced home production" jobs include personal services (other than in hotels or lodging places), repair, protective, cleaning and child care services. All of these services cannot be traded outside of a local labor market, and their price is likely to reflect the costs of labor inputs in the place where the consumer lives.[9] We also separately identify other clearly non-traded jobs, which include retail trade (except jobs at eating and drinking places that are categorized as outsourced home production activities), health, social and entertainment services.

When calculating employment shares in different sectors for workers in each decile of the hourly wage distribution,[10] we find that in any given year the share of workers employed in outsourced home production jobs drops monotonically and sharply along the wage distribution. For instance, as shown in the first panel of Figure 2, in 2005 these services employed 25% of wage earners in the first decile of the distribution, 19% in the second, 12% in the third, 9% in the fourth, and so on, down to 1.6% in the top decile. There are other sectors where employment shares systematically vary along the wage distribution, but only outsourced home production services exhibit this striking strictly-monotonic downward pattern. Employment shares in other non-traded activities are stable at around 30% in deciles in the lower half of the wage distribution and drop only in the upper-half; those in constructions and personal services in lodging places are fairly constant along the entire wage distribution, while those in other sectors monotonically increase along the distribution. Overall, these figures suggest that the sector of home production substitutes is peculiar in that: (i) product demand shifts in this sector can be

[7] The analysis is restricted to respondents aged 16 through 65 who did not live in group quarters, were employed in the civilian labor force at the time of the survey and received positive salary in the previous year. For consistency with later analyses, the sample is restricted to respondents who resided in census-defined metropolitan areas. Hourly wages are calculated by dividing total wage and salary income by annual hours worked (the product between weeks worked and hours usually worked per week).

[8] Appendix Table B1 (in the web-appendix) provides details on the mapping between industrial classification and the categories of employment that we want to analyze separately.

[9] Personal services provided in hotels, motels and other lodging places are likely to be consumed while away from the place where one lives, so they might be thought of as traded goods, where the consumer is transported instead of the good.

[10] Table B2 (in the web-appendix) reports all figures for all years. Results discussed in this section are robust to using education, instead of hourly wages, as a measure of individual skills.

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expected to predominantly affect labor demand for the very least-skilled workforce; (ii) the higher the percentile a wage-earner belongs to, the larger the expected gap between his own wage and the average wage of those delivering home production substitutes.

Disaggregating the analysis by specific subcategories of outsourced home production services shows that the strictly decreasing pattern of employment shares along the skill distribution is common across categories. Moreover, an analysis of the socio-demographic characteristics of the workforce employed in these services versus the workforce in other industries reveals that this sector employs a close to average share of females, but a higher-than-average share of immigrants.[11]

Another peculiar feature of outsourced home production services emerges when studying changes over time in the sectoral distribution of employment. Between 1980 and 2005, employment opportunities in the United States have been increasingly represented by non-traded jobs. This is not surprising, since labor is cheaper in developing countries and transportation and shipping costs have been decreasing over time. As shown in Figure 3, the employment trend out of traded activities is common to the least skilled (wage-earners in the bottom two deciles of the hourly wage distribution) and the rest of the workforce. However, peculiar to the least-skilled workforce is the fact that employment shifts into outsourced home production services have been more pronounced than shifts into other non-traded activities. Based on our simple theoretical framework, we could argue that what drives employment growth of the least-skilled workforce in outsourced home production jobs in decades of growing wage inequality is the increasing demand for these services generated by skilled workers. The latter should find it profitable to buy more (and a wider varieties of) home production substitutes when the gap between the wage of those providing these services and their own wage increases. It is well known that the rise in wage inequality in the United States (at least in the 1980s) was due not only to wage gains for high-paid workers, but also to real wage drops for the least skilled, arising for example from the decline in the real value of the minimum wage. As such, increasing employment in home production substitutes might not only be explained by positive demand shifts, but might as well occur along a downward sloping demand function. The role of own-price effects arising from labor supply shifts can also be expected to be relevant in light of (i) the large inflows of low-skill immigrants into the

[11] See Figures B1-B3 in the web-appendix.

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United States in recent decades, and (ii) the fact that immigrant inflows have been shown to reduce the price of immigrant-intensive services, such as the ones we study here (Cortes, 2008).

We use quantile regressions of individual log hourly wages to explore whether positive demand shifts plausibly play a role in explaining the observed employment shifts into home services. Figure 4 reports the coefficients on a dummy variable for employment in the "home service" sector from quantile regressions that also include controls for individual characteristics (gender, age, education, race, Hispanic origin, foreign-born status) and are separately run for 1980, 1990, 2000 and 2005. The coefficients are always negative, confirming the well-known fact that these services are traditionally low-paid jobs. The wage penalty associated with working in this sector, however, has decreased over time, especially at lower quantiles, as graphically shown by the fact that lines connecting coefficients estimated for each subsequent year lie above those for the previous year, and the upward shift is particularly pronounced at the bottom. Since these estimated wage changes are positively correlated with the employment shifts documented above, time-series evidence appears to be consistent with the existence of demand shifts.

III. Consumption spillovers within cities

To this point we have provided time series evidence on employment and wage changes in low-skill labor markets at the national level that is consistent with the existence of positive demand shifts for home production substitutes such as those we would expect to arise from increasing consumption of these services by skilled workers in decades of rising wage inequality. There are however too many secular changes, such as the increasing labor force participation of women, that might drive the rise in the demand for outsourced home production services over time. Since these contemporaneous changes prevent drawing any conclusive inference from time-series evidence alone, we now turn to an analysis of local level data. As a proxy for local labor markets, we use Metropolitan Statistical Areas (MSAs).[12] City-level figures are

[12] MSA's are geographic entities defined by the U.S. Office of Management and Budget, and include counties that center on a urban core and are characterized by a high degree of social and economic integration (as measured by commuting to work) with the core.

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constructed using individual records from IPUMS extracts from the 1980, 1990 and 2000 censuses and the 2005 ACS. We restrict the analysis to the 242 MSAs that are defined throughout the sample period.[13]

Because of the non-tradeable nature of the time-intensive services that substitute for home production activities, the consumption spillovers hypothesis predicts that employment in this sector should increase with measures of the inequality of a city's wage income distribution. Predictions on wage effects, on the contrary, crucially depend on the assumptions we make about labor mobility and local prices. For example, in response to an unexpected demand shock for unskilled workers, wage rates might rise temporarily. In the long-run, however, labor mobility will re-equilibrate wage rates across locations. On decennial censuses—the only data providing large enough sample sizes for city-level analyses—it is impossible to distinguish between the short-run and long-run effects of demand shocks. The dynamics of local prices is another complicating factor. If unskilled workers spend a higher fraction of their budget on housing and if land values are higher where the fraction of high-income families is larger (Gyourko, Mayer and Sinai, 2006), then a positive correlation between inequality measures and unskilled wage growth might arise from compensating wage differentials. In light of these considerations, the wage analyses carried at the city level should be viewed as suggestive at best.

D. Employment effects

We start by investigating the employment effects of consumption spillovers. Our main analyses consist in studying the cross-city relationship between decadal changes in the wage bill share of a city top decile of wage earners (calculated as the ratio between the wage bill accruing to the ten percent of highest wage-earners in a city and the total city wage bill) and the percentage employment growth in the sector of services that substitute for home production (calculated as the change in the log of hours worked in home services in a city). The specification of the dependent variable is meant to avoid the

[13] The geographic definition of MSA's is periodically adjusted to reflect the growth of cities. Even if here we do not correct for potential inconsistencies over time, other work suggests that this issue should not significantly affect the results. For example, in his analysis of the correlation between employment growth and growth in the share of college graduates across MSA's, Shapiro (2006) shows that his results are robust to examining only those areas whose definitions did not change over time.

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potentially confounding effects of other forces—extraneous to our model (demographic changes, human capital externalities, international outsourcing)—driving either changes in the area's total employment or demand changes in other sectors. These effects would be captured by relative measures, such as changes in the ratio between employment in home services and the population, or changes in the share of hours worked in this sector. As shown later, the results are robust to using alternative measures of income inequality and to the way in which employment growth is measured.

Employment figures by MSA are obtained for people in the 16 to 65 age range, who worked at least one week and received positive salary in the year prior to the survey. They are constructed by weighting each individual by the product of the sample weight and a labor supply measure (the product between number of weeks worked last year and usual number of hours worked per week). Percentiles of the hourly wage distribution in a city and a given year are weighted as well.

We pool data from various years and estimate first-difference models of the relationship between decadal changes in employment and inequality:

$$(1) \qquad \Delta log(Employment)^{HP\ sub's}_{ct} = \alpha + \beta \Delta WB^{90} share_{ct} + \gamma_t + \varepsilon_{ct}$$

where γ_t is a period fixed effect. Since the third period available (2000-2005) is half the length of the first two, all 2000-2005 changes are multiplied by two. Estimates are weighted by the average share of national workforce in each city over the sample period. Standard errors are corrected for general heteroskedasticity and clustered at the city level.

As reported in column 1 of Table 2, the OLS estimate of β is positive, as predicted by the consumption spillovers hypothesis. However, even if first-difference models net out the effects of time-invariant city-specific characteristics that may otherwise be picked up by the estimated β, there remains a series of potentially confounding factors.

First, alongside the demand shifter represented by high skill workers' consumption patterns, a host of other time-varying factors, potentially correlated with a city distribution of income, may explain differences across metro areas in the growth of service employment. As shown in column 2, the estimated β decreases but remains positive and significant when controlling for other city-level contemporaneous changes that capture shifts in the demand for low-skill services (that is, changes in female labor force participation rate, in the proportion of college educated individuals in the workforce

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of the city, and in the share of elderly in the population) or shifts in the supply of unskilled labor (changes in the share of workers aged 16 to 25 and in the share of low-skill foreign-born workers, as in Cortes, 2008). Rather than driving service employment growth, however, these factors may themselves result from it: for example, female labor supply may respond to the availability of home production substitutes, and immigrants' location choices may be endogenous to employment opportunities in an area. As such, controlling for these factors arguably biases all of the estimated coefficients, also the one of interest.

A second, even more serious issue in interpreting a positive estimated β as evidence of consumption spillovers is that an increase in the top wage bill share ($\Delta WB^{90}share_{ct}$) might depend on changes that happen at any point of the distribution—also at the very bottom, where wages are proxies for the price of home production substitutes. To purge our main regressor from "own price" effects and to decrease the risk that it is correlated with other city-specific shocks to local low-skill labor markets, we instrument the change in the wage bill of top wage earners in city c and decade t (ΔWB_{ct}^{90}) with its prediction based on *nationwide* decadal growth of wages of workers in different occupations, weighted by the city-specific employment share in those occupations among top wage earners at the start of the sample period:

$$(2) \qquad \overline{\Delta WB_{ct}^{90}} = \sum_{j} \delta_{jc,1980} \Delta w_{(jt)-c}$$

where $\delta_{jc,1980}$ is the share of wage-earners in the top decile of the city wage distribution in 1980 employed in occupation j, and $\Delta w_{(jt)-c}$ is the change over decade t in the log wages of workers in that same occupation living in cities other than c. Occupations are defined on the basis of 41 roughly two-digit occupation cells.

First-stage regressions reveal that $\overline{\Delta WB_{ct}^{90}}$ is a good predictor of the change in a city top wage bill share. Notably, these predicted values are based exclusively on variation in top wages, so this instrument addresses the second of the issues raised above.[14] It only addresses the first issue under the assumption that other city specific shocks that affect low-skill employment growth are not systematically related to the occupational structure

[14] See Table B3 in the web-appendix, which also shows that $\overline{\Delta WB_{ct}^{90}}$ is a good predictor for changes in the 90th percentile, not the 10th.

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of the top decile of wage earners in the city at the start of the period. Initial market conditions, however, have been shown to matter for subsequent labor demand and supply shocks. In particular, they may influence the direction of research and favor innovations that are biased towards or against a particular factor of production or sector: for example, a high-proportion of skilled workers in the labor force might encourage skilled-biased technical change (Acemoglu, 1998 and 1999; Beaudry, Doms and Lewis, 2006). Moreover, because of network effects, an initial large settlement of foreign-born individuals might attract large subsequent immigrant inflows, especially from the same countries of origin as the existing immigrant community (Card, 2001). To the extent that a city top decile initial occupational structure is correlated with these or other initial conditions that also predict subsequent shocks to a local labor market, then the estimated β would pick up as well the effects of these shocks. To address this concern, we expand Equation (1) to include a series of city characteristics measured as of the beginning of the sample period.

Columns 3 through 7 of Table 2 present Instrumental Variables (IV) estimation results of Equation (1) and test their robustness to a series of specification checks. IV estimates reported in column 3 indicate that a one-standard deviation (4 percentage points) differential growth in a city top wage bill share is associated with one-fourth of a standard deviation (8 percent) percentage growth in the number of hours worked in home services. As shown in column 4, the results are robust to the inclusion of those city-level contemporaneous shifts also specified in column 2. However, to the extent that places where inequality grows more are also places where average income grows more, our estimates might simply reflect a general positive income effect favoring locally-produced non-traded goods. Against this notion, the estimated association between income inequality and employment growth in services that substitute for home production activities is robust to controlling for city-level changes in median hourly wages (column 5). We turn next to include controls for local time-invariant characteristics in an attempt to rule out that confounding factors are driving the results. In column 6, we add region fixed effects,[15] and we also control for initial values (instead of changes) of the socio-

[15] We consider the following nine divisions, corresponding to groupings of states: New England, Middle Atlantic, East North Central, West North Central, South Atlantic, East South Central, West South Central, Mountain and Pacific Division.

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demographic characteristics of the workforce and the population of the city. We find evidence of an even larger relationship between inequality and home service employment: a one-standard deviation differential growth in a city top wage bill share is found to be associated with half of a standard deviation (16 percent) percentage growth in the number of hours worked in home services. Finally, column 7 adds two variables capturing the occupational structure of the city as of the beginning of the sample period, that is, the share of employment in home production substitutes and the share of employment in the 10 most routine-intensive occupations (Autor and Dorn, 2010). The estimated association is found to be robust to the inclusion of these variables, suggesting that our results are not confounded with path-dependent changes in the occupational structure of a city, or changes due to forces other than consumption spillovers, such as unbalanced productivity growth across sectors that depends on the degree to which tasks can be routinized. [16]

Table 3 presents results from additional specification checks based on variants of Equation (1), which are meant to test the robustness of our findings to (i) splitting the analysis of sectoral employment growth by workers' skills (we consider separately non-college educated and college educated workers, in columns 3 and 4 respectively) (ii) different choices of the measure of inequality (panel A), (iii) different ways of measuring employment growth (panels B and C), and (iv) studying employment growth in other non-traded sectors (panel D). Each entry in the table corresponds to a different regression and reports the IV estimated coefficient on the variable measuring the change in wage inequality. For comparison, OLS estimates are reported in column 1. All regressions include controls for city-level contemporaneous changes that capture demand and supply shifts in the market of home-production substitutes (as in columns 2 and 4 of Table 2). The results of our robustness checks can be summarized as follows.

[16] As shown in Autor and Dorn (2010), if technological progress raises productivity in routine tasks but does little to augment manual tasks, then markets with higher initial concentration in routine tasks are predicted to experience greater growth of service employment. To test this prediction, the authors use task measures from the Dictionary of Occupational Titles and develop an index of the share of labor employed in routine task-intensive occupations. We proxy for this variable using the share of labor in the 10 most routine-intensive occupations, that are: secretaries and stenographers, bank tellers, pharmacists, payroll and timekeeping clerks, motion picture projectionists, boilermakers, butchers and meat cutters, accountants and auditors, actuaries and proofreaders (Autor and Dorn, 2010, Appendix Table 1).

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First, increasing inequality is associated with employment growth in the sector of home production substitutes among non-college educated workers, while the relationship is not statistically significant among college educated ones. This is consistent with our hypothesis: consumption of home production substitutes creates employment opportunities for unskilled workers. On the contrary, for college-educated workers, we expect other forces—extraneous to our model—to be at play (e.g., human capital externalities) and to drive employment shifts into other more skilled sectors (e.g., financial and business).

The estimation results are robust to the use of alternative measures of income inequality, such as the 90-10 log hourly wage gap. This measure of inequality is a better proxy for the relative skilled-unskilled wage, which –as predicted by our model– should influence skilled workers' decision to buy market substitutes for home production. Since it mechanically varies with wages of the least-skilled, however, it is also more likely to pick up the effects of labor supply shifts. The issue is addressed by using as an instrument the index defined in (2), which exploits predicted differences in the growth of wages for top earners only. Moreover, the results are robust to using the 90-50 log wage gap as a measure of wage inequality. Notably, as shown in the last row of panel A, results are qualitatively unchanged when using changes in the 90^{th} percentile of the distribution of log hourly wages as the main regressor.

Our finding of a positive association between growth in wage inequality and employment growth in home services is also robust to the way in which we measure employment growth. To address the concern that our estimates might simply pick up a general increase in city scale associated with upper tail inequality, the dependent variable in panel B is specified as the percentage growth in the number of hours worked in home services net of the growth in the area's population: as shown in column 3, our findings appear not to be driven by a scale effect. Changes in the share of hours worked in home services are the dependent variable of regressions displayed in panel C.

We can use these city-level estimates to quantify how much of the growth of employment of non-college workers in home production substitutes observed at the national level may be attributed to the channel suggested in this paper. The wage bill share of the top decile of wage earners was 28.1 in 1980 and increased by 0.5 and 2.9 percentage points in the 1980s and the 1990s respectively. The share of non-college

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workers employed in home production substitutes was 10.1 in 1980 and increased by 1.4 and 1.6 percentage points in the 1980s and the 1990s respectively. Using the coefficient estimated in column 3 of panel C, consumption spillovers may explain one-tenth of the growth in employment in home services in the 1980s but around one-third of the growth in the 1990s.[17]

Even if our model has no predictions on changes in sectors other than the one of home production substitutes, studying employment growth in other non-traded activities is a meaningful exercise, since it can serve as a test to separate our hypothesis from the effects of increasing demand for any kind of locally produced good. As shown in Panel D, increasing inequality is associated with low-skill employment growth in other non-traded activities that is no more than a half of the growth in home production substitutes and not statistically significant.

E. Wage analysis

We turn next to study whether within-city changes in the wage structure between sectors are consistent with the existence of demand shifts arising from consumption spillovers. As before, we pool data from 1980, 1990, 2000 and 2005, but this time we model *individual* log hourly wages of non-college workers, which allows to control for individual demographic characteristics (X_i):

$$(3) \qquad w_{ict} = \alpha + \beta_1 WB^{90}sh_{ct} + \beta_2 HPS_i + \beta_3 (WB^{90}sh_{ct} \times HPS_i) + X_i\delta + \gamma_t + \gamma_c + \varepsilon_{ict}$$

The inclusion of MSA-fixed-effects implies that we consider variation within cities. To assess whether increasing top wage bill shares are associated with differential unskilled wage changes across sectors, we include not only controls for a city top wage bill share ($WB^{90}sh_{ct}$) and for whether the individual is employed in the provision of home production substitutes (HPS_i), but also their interaction. If the positive association between changes in top wage bill shares and employment shifts into home production substitutes documented in the previous section is demand-driven, then we would expect the coefficient of the interaction term (β_3) to be non-negative.

Table 4 reports the estimated β's when Equation (3) is estimated with OLS (column 1) or with quantile regressions for the median (column 2) as well as for lower deciles (from

[17] The calculations are as follows. For the 1990s: (0.175 × 0.029)/0.016≈33%; for the 1980s: (0.175 × 0.005)/0.014≈10%.

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the 4th to the 1st in columns 3 through 6). The estimation results can be summarized as follows. Working in the provision of home production substitutes is associated with a large wage penalty at any point of the distribution, as captured by a negative β_2. The coefficient of a city top wage bill share is positive and of similar magnitude in columns 1 and 2, implying that a larger top wage bill share is associated with larger (and similar) growth of mean and median hourly wages of non-college workers employed in sectors other than the one under study here. The estimated β_1, however, decreases and turns negative for lower quantiles – which is consistent with widening wage inequality within cities. As regards the estimated coefficient of the interaction term, two facts are worth noting. First, the estimated β_3 is always positive, which implies that non-college workers in cities with larger growth in the wage bill share of top earners experience relative wage growth if employed in home production substitutes. A one-standard deviation (4 percentage point) larger top wage bill share is associated with 1.6 percent growth of mean hourly wages of non-college workers in home production substitutes versus 1.1 percent growth in other sectors.[18] At the median, the differential wage growth is even larger: 1.9 versus 0.8 percent. Second, as shown by the increasing magnitude of β_3 across columns, relative wage growth in home services is larger and larger at lower percentiles. For example, at the tenth percentile, a 4 percentage point larger top wage bill share is associated with a 0.4 percent growth of hourly wages of non-college workers in home production substitutes but with a 1.2 percent drop in other sectors. The increasing magnitude of the estimated β_3 in lower quantile regressions suggests that differential wage changes in home production substitutes associated with increasing top wage shares may mitigate the widening of wage inequality towards the bottom of the distribution.

IV. Conclusions

The growth in wage inequality over the last three decades is one of the better-documented and more extensively researched facts about the U.S. labor market. A voluminous amount of research has investigated the causes for this phenomenon and has identified two leading explanations: the increase in the relative demand for skills—due to

[18] Using the coefficients reported in column 1 of Table 5, the figures are calculated as: 100(0.284 x 0.04)=1.1% and 100[(0.284 + 0.112) x 0.04)=1.6%.

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SBTC (Krueger, 1993; Berman, Bound and Griliches, 1994) or international trade (Feenstra and Hanson, 2003); and changes in wage setting institutions, such as the decline in unionization (Freeman, 1993), the drop in the real value of the minimum wage (DiNardo, Fortin and Lemieux, 1996; Lee, 1999) and the growth in performance-pay schemes (Lemieux, Macleod and Parent, 2006). On the contrary, what changes have resulted from growing wage inequality is still a question that "should embarrass social scientists, because there is so little we can point to" (Welch, 1999). Evidence presented in this paper suggests that increasing demand for market substitutes of home production activities is a change we might be able to add to this sparse list.

We build on the observation that there is a sharp asymmetry in the skills of providers and consumers in the sector of services that substitute for home production activities. Since consumers are disproportionally drawn from the highest percentiles of the skill (wage) distribution, we form the prediction that demand for these services should increase where and when the share of income accruing to the highest-paid workers increases. In turn, these product demand shifts are expected to raise the relative demand for the least-skilled workers, since the latter are the primary providers of these services.[19]

The main empirical challenge we face in this paper is to identify an arguably exogenous source of growth in the wage bill share accruing to skilled workers—exogenous to changes in low-skill labor markets. On city level data, we propose predicting changes in top wage bill shares using national level changes in wages paid in different occupations weighted by city-specific start-of-period employment shares in those occupations among top wage earners. In this way we arguably break the direct link between city-level changes in high-skill and low-skill labor markets. We find evidence of a strong positive relationship between the change in a city top-wage bill share and the growth in local employment in jobs that substitute for home production. When using city-level estimates to predict national changes, we find that consumption spillovers may

[19] In stressing that consumption demand shifts can lead to changes in the relative demand for skills, a paper closely related to ours is Leonardi (2008). Leonardi highlights those skill-intensive goods that are more heavily consumed by more educated and richer workers (such as education and professional services), and investigates the importance of changes in the demand for these goods in explaining the increase in the relative demand for skilled workers in the United States and the United Kingdom between 1980 and 2000.

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account for one-third of the growth of employment in home production substitutes experienced in the 1990s by non-college workers in the United States.

Within-city changes in the wage structure across sectors are also consistent with the existence of positive demand shifts arising from consumption spillovers. We find a positive association between a city top wage bill share and relative wages paid to non-college workers in the home production sector– which is consistent with employment shifts into this sector being demand-driven. Interestingly, the association is larger when modeling lower quantiles of the wage distribution, suggesting that consumption spillovers may contribute to a compression of wages in the lower end of the distribution.

Because workers in home production substitutes are heavily concentrated at the very bottom of the wage distribution, our findings of relative labor outcome gains for them suggest that consumption spillovers may explain some of the earnings improvements experienced in recent periods by workers at the bottom of the U.S. wage distribution relative to those in the middle. Quantifying these effects would be of great interest. Unfortunately, this is not straightforward since predicting changes in aggregate wage inequality using city-level estimates would require aggregating local economies in a way that takes into account their position in the national distribution of wages. To illustrate this point, consider the case of the metropolitan area of Minneapolis and Saint Paul, which in the 1990s experienced above average increases in the wage bill share of top earners and in employment in home production substitutes, as well as a rise in the tenth percentile of the wage distribution relative to the median. Even if this case is consistent with the existence of consumption spillovers and contemporaneous compression of lower tail inequality, it is not clear how much it can explain of the compression observed at the national level, since the 10^{th} percentile of the wage distribution in Minneapolis-Saint Paul corresponds to the 20^{th} percentile of the national wage distribution.

An important extension of the present paper would be an attempt to provide a more complete assessment of changes in the *well-being* of low-skilled workers arising from the existence of consumption spillovers and, more broadly, from the increasing dependence of unskilled employment opportunities to the physical/geographical proximity of skilled workers. This assessment would entail a local-level analysis of changes in employment rates, local prices (including housing values), *real* wages and commuting time to work for low-skill workers.

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Table 1

Correlation between household budget share of home production substitutes and household members' hourly wages; 2004

	All Families	Husband/Wife Families			Other Families
		Woman does NOT work	Woman works		
	(1)	(2)	(3)	(4)	(5)
Head's log hourly wage	0.004***	0.012***	0.008***	0.004***	0.0003***
	(0.001)	(0.003)	(0.001)	(0.000)	(0.000)
Wife's log hourly wage				0.008***	
				(0.000)	
Constant	0.058***	0.026***	0.050***	0.041***	0.068***
	(0.004)	(0.011)	(0.008)	(0.000)	(0.000)
Observations	6,058	933	2,373	2,373	2,752

Note: OLS estimates. The dependent variable is the household expenditure share of goods and services that substitute for home production (see Table A1). Sample restricted to household headed by individuals at least 18 and no more than 65 who worked for salary in the 12 months before the interview. The family head is conventionally fixed to be the male in all husband/wife families. "Other families" in column 5 include single-adult families (72%) and other mixed families (28%).

Source: 2004 Consumer Expenditure Diary Survey.

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Table 2: *Cross-city regressions of employment growth in the sector of services that substitute for home production activities on changes in the top decile wage bill share*

	(1) OLS	(2) OLS	(3) IV	(4) IV	(5) IV	(6) IV	(7) IV
Δ Top decile wage bill share	0.977*** (0.368)	0.631** (0.319)	1.974** (0.981)	2.493** (1.210)	2.482** (1.211)	3.920* (2.319)	4.053* (2.377)
1990-2000 dummy	-0.069** (0.030)	0.030 (0.053)	-0.077** (0.032)	-0.012 (0.061)	-0.016 (0.064)	-0.088*** (0.034)	-0.090*** (0.034)
2000-2005 dummy	-0.131*** (0.034)	-0.051 (0.060)	-0.144*** (0.039)	-0.090 (0.064)	-0.101 (0.068)	-0.172*** (0.044)	-0.174*** (0.045)
Δ Female labor force participation		1.589*** (0.371)		1.386*** (0.409)	1.441*** (0.405)		
Δ Low-skill foreign share of workforce		1.124** (0.504)		0.290 (0.801)	0.288 (0.802)		
Δ 16-24 share of workforce		-0.925* (0.510)		-0.850* (0.512)	-0.964* (0.501)		
Δ 65+/population share		-1.266 (0.897)		-2.087* (1.112)	-1.919* (1.097)		
Δ College graduates share of workforce		-1.823*** (0.601)		-1.925*** (0.633)	-2.191*** (0.614)		
Δ log median wage					0.260 (0.183)		
Female lf particip. in 1980						-0.092 (0.334)	-0.240 (0.343)
Low-skill foreign share in 1980						-0.148 (0.331)	-0.144 (0.351)
16-24 sh. in 1980						1.754** (0.736)	2.060*** (0.755)
65+/pop in 1980						-0.397 (0.402)	-0.189 (0.385)
College sh. in 1980						-0.514 (0.375)	-0.701 (0.438)
Emp. sh. HP sub's in 1980							-2.166** (1.096)
Emp. sh. in routine occup. in 1980							1.821 (1.404)
Constant	0.329*** (0.027)	0.282*** (0.069)	0.307*** (0.032)	0.294*** (0.071)	0.300*** (0.072)	0.173 (0.204)	0.216 (0.209)
Region dummies	No	No	No	No	No	Yes	Yes

Note: Three periods (1980-1990, 1990-2000, 2000-2005) and 242 MSA's are considered, for a total of 726 observations. The dependent variable is the percentage growth in the number of hours worked in the sector of services that substitute for home production activities. The instrument is a weighted sum of nationwide decadal growth of wages of workers in different occupations, where the weights are city-specific employment shares in those occupations among the top 10% of wage earners in 1980. Estimates weighted by the average share of national workforce in each MSA between 1980 and 2005. Standard errors (in parentheses) adjusted for heteroskedasticity and clustering across MSA's. * significant at 10% ** significant at 5% *** significant at 1%.
Source: IPUMS extracts from 1980-1990-2000 censuses and 2005 American Community Survey.

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Table 3: *Alternative specifications of inequality and employment measures*

Workforce	(1) OLS All	(2) IV All	(3) IV Non-college graduates	(4) IV College Graduates
A. Δ Log(Employment in Home Production Substitutes)				
Δ 90-10 wage gap	0.272**	1.766*	1.575*	0.777
	(0.107)	(0.936)	(0.942)	(1.253)
Δ 90-50 wage gap	0.202	2.736*	2.440	2.537
	(0.138)	(1.609)	(1.604)	(3.703)
Δ 90^{th} wage percentile	0.350**	2.013*	1.795*	1.855
	(0.156)	(1.086)	(0.085)	(2.742)
B. Δ Log(Employment in Home Production Substitutes) *minus* log (Population)				
Δ Top decile wage bill share	0.582**	1.617*	1.650*	2.682
	(0.252)	(0.892)	(0.935)	(3.249)
C. Δ Employment Share in Home Production Substitutes				
Δ Top decile wage bill share	0.043**	0.115	0.185*	0.077
	(0.022)	(0.077)	(0.110)	(0.101)
D. Δ Log(Employment in Non-Tradeable activities other than HP sub's)				
Δ Top decile wage bill share	-0.067	0.756	0.702	-0.535
	(0.237)	(0.904)	(0.903)	(1.271)

Note: Three periods (1980-1990, 1990-2000, 2000-2005) and 242 MSA's are considered, for a total of 726 observations. Dependent variables are as indicated in the title of each panel. The instrument is a weighted sum of nationwide decadal growth of wages of workers in different occupations, where the weights are city-specific employment shares in those occupations among top wage earners in 1980. All regressions include controls for the city-level variables also included in column 2 and 4 of Table 2. Estimates weighted by the average share of national workforce in each MSA between 1980 and 2005. Standard errors (in parentheses) adjusted for heteroskedasticity and clustering across MSA's. * significant at 10% ** significant at 5% *** significant at 1%.
Source: IPUMS extracts from 1980-1990-2000 censuses and 2005 American Community Survey.

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Table 4: *Within-city changes in the wage structure across sectors*

	(1) mean	(2) median	(3) p40	(4) p30	(5) p20	(6) p10
Top decile wage	0.284***	0.213***	0.132***	0.002	-0.118***	-0.310***
Bill share ($WB^{90}sh$)	(0.031)	(0.020)	(0.021)	(0.024)	(0.034)	(0.062)
HPS dummy	-0.288***	-0.344***	-0.359***	-0.370***	-0.385***	-0.410***
	(0.013)	(0.009)	(0.009)	(0.010)	(0.012)	(0.023)
$WB^{90}sh \times HPS$	0.112**	0.269***	0.288***	0.297***	0.333***	0.420***
	(0.045)	(0.032)	(0.031)	(0.037)	(0.042)	(0.079)

Note: Dependent variable: individual log hourly wages of non-college workers. Estimation: OLS (column 1); quantile regressions for the median hourly wage (column 2), and the 40^{th}, 30^{th}, 20^{th} and 10^{th} percentiles in the remaining columns. All models include an intercept, three year dummies (1980, 1990, 2000), 241 MSA's dummies, dummies for age (16-24, 25-34, 35-44 and 45-54), education (no high-school degree, high-school graduates), black, Hispanic, and foreign-born, and interactions of individual level controls with year dummies. Estimates weighted by the product of personal weights and individual annual labor supply. Robust standard errors (in parentheses). * significant at 10% ** significant at 5% *** significant at 1%.
Quantile regressions are estimated exploiting the sparsity of the regression matrix, using the Frisch-Newton interior point algorithm programmed by the authors in R. Standard errors are obtained using methods by Powell (1986) and Koenker (2005). The code is available upon request.
Source: IPUMS extracts from 1980-1990-2000 censuses and 2005 American Community Survey.

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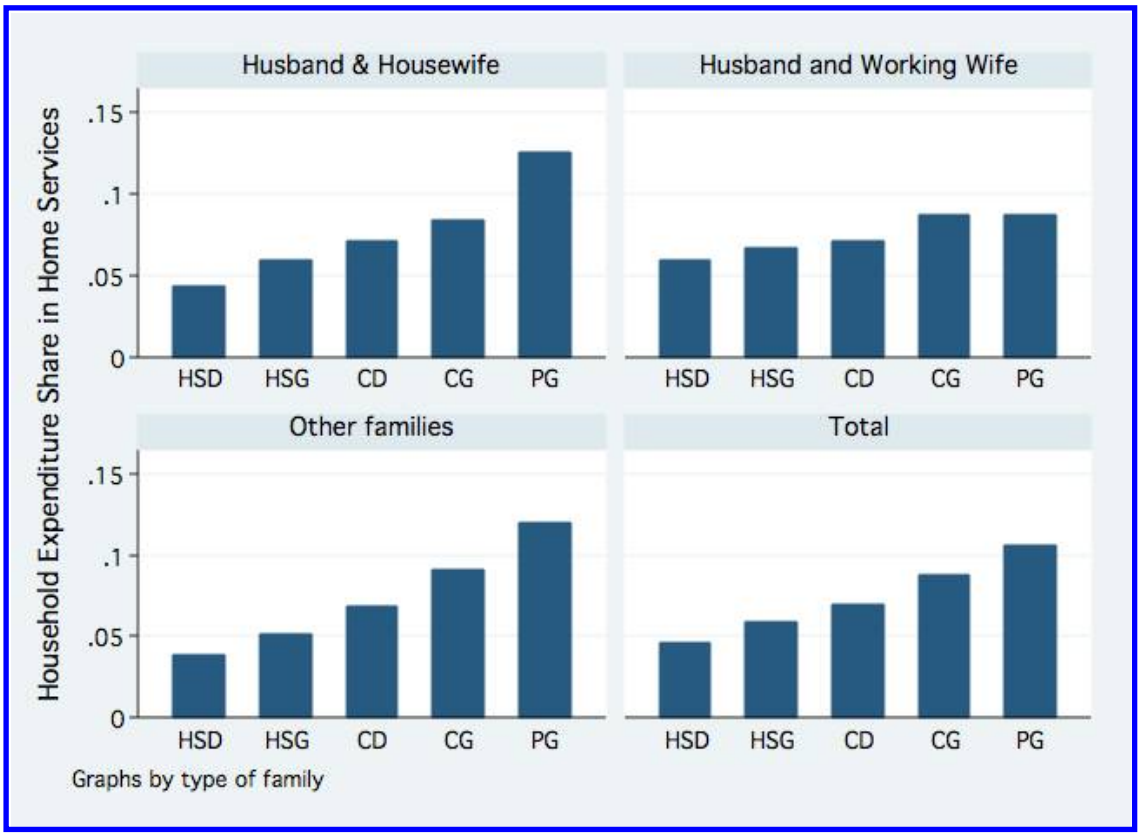
Figure 1

Household expenditure share of home production substitutes and head's highest educational attainment, by family type; 2004



Notes: The graph plots the average fraction of total household expenditure spent in home production substitutes across households headed respectively by high-school dropouts (HSD), high school graduates (HSG), individuals with some college education but no bachelor's degree (CD), individuals with Associate, BA or Master degrees (CG) and individuals with doctorate degrees (PG). The first three panels report budget shares separately calculated for husband/wife families and other families: the latter include single-adult families (73%) and mixed families (27%). All figures are weighted. The sample is restricted to households headed by individuals at least 18 and no more than 65 who worked for salary in the twelve months before the interview. The family head is conventionally fixed to be the ***male*** in all husband/wife families.

Source: 2004 Consumer Expenditure Diary Survey.

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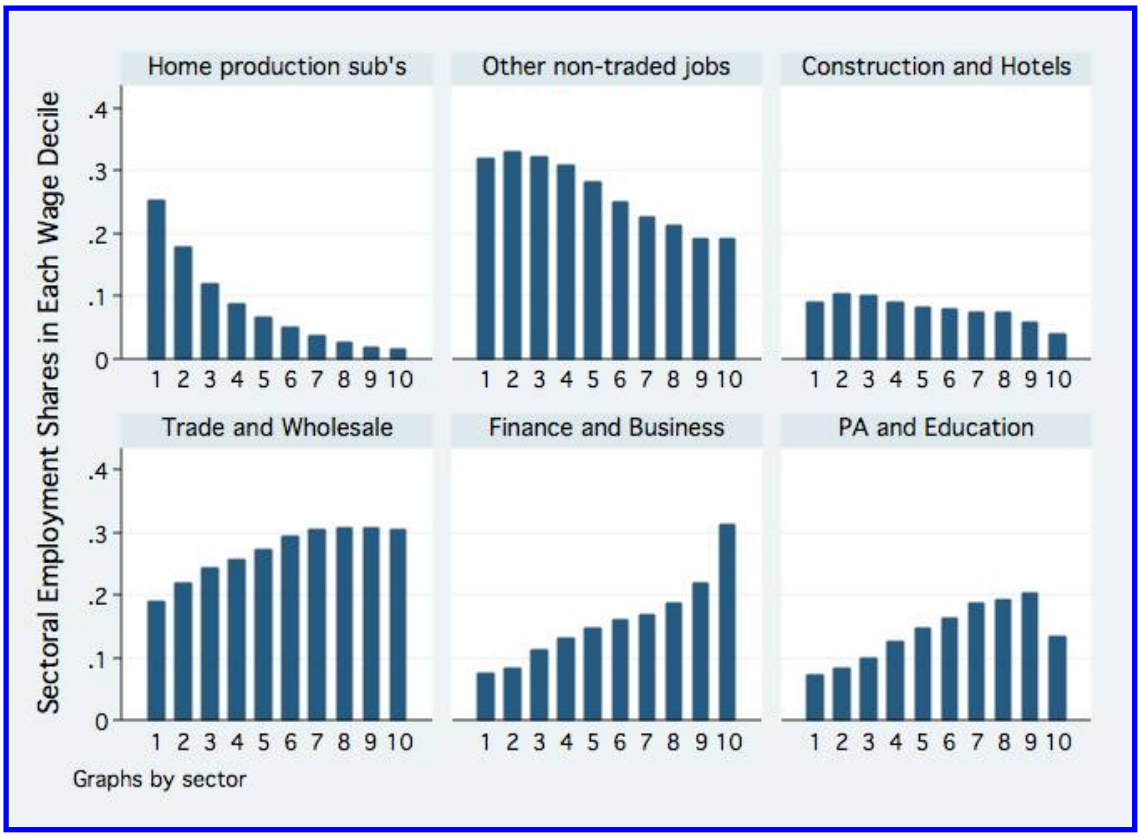
Figure 2

Employment shares in different sectors by decile of the hourly wage distribution; 2005



Notes: Each bar represents the fraction of the workforce in each decile of the hourly wage distribution employed in a given sector in 2005. So, the bars for each decile across the six sectors sum vertically to one.
Sample restricted to individuals aged 16 through 65 who were employed in the civilian labor force at the time of the survey, were not unpaid family workers, who did not live in group quarters and who resided in a Metropolitan Statistical Area (MSA). Earnings deciles based on hourly wages, defined as annual wages divided by annual labor supply (the product between number of weeks worked and usual number of hours worked per week).
Figures are weighted by the product of IPUMS weights and annual labor supply.
Source: IPUMS extract from the 2005 American Community Survey file.

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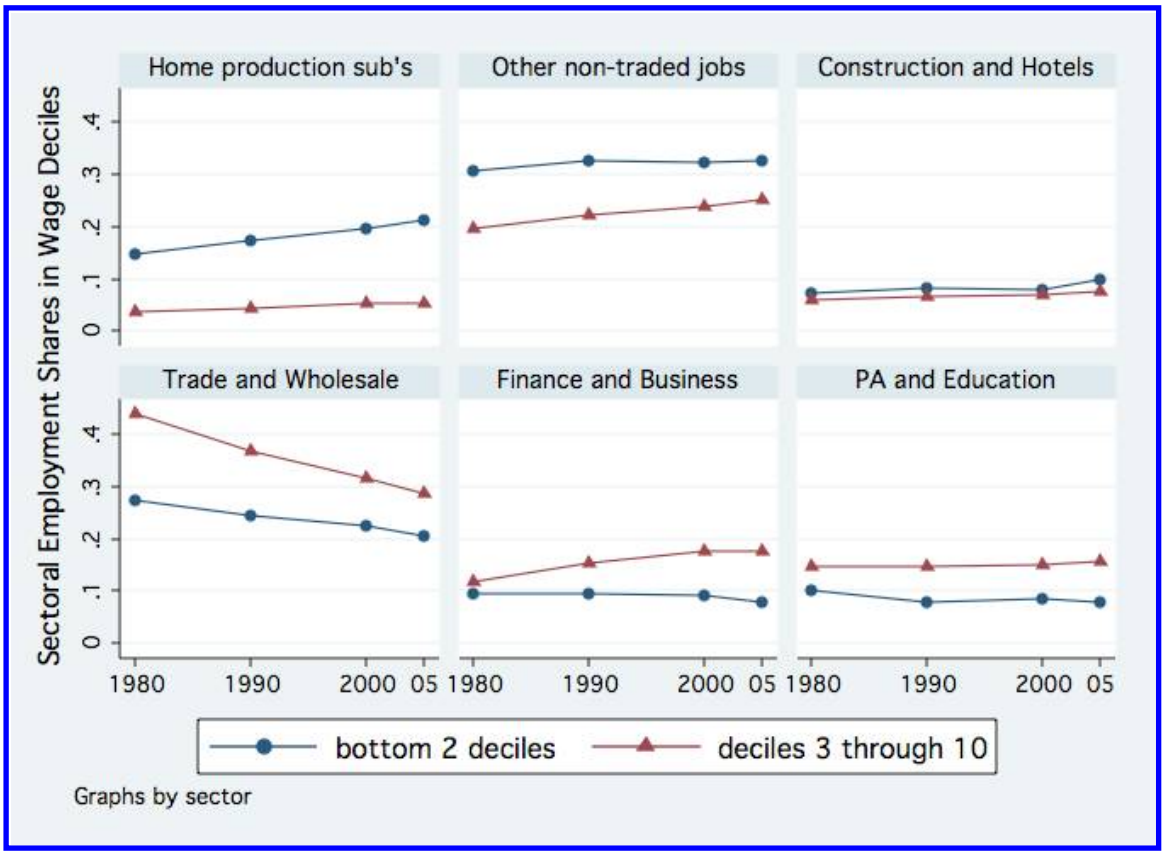
Figure 3

Employment shares in different sectors of the workforce in the bottom two and the eight highest deciles of the hourly wage distribution; 1980, 1990, 2000 and 2005



Notes: Each circle and each triangle represents the shares of the workforce in either the bottom 2 deciles or the highest 8 deciles of the hourly wage distribution employed in a given sector in a given year. So, the shares for each group and year across the six sectors sum to one.
Sample restricted to individuals aged 16 through 65 who were employed in the civilian labor force at the time of the survey, were not unpaid family workers, who did not live in group quarters and who resided in a Metropolitan Statistical Area (MSA). Earnings deciles based on hourly wages, defined as annual wages divided by annual labor supply (the product between number of weeks worked and usual number of hours worked per week).
Figures are weighted by the product of IPUMS weights and annual labor supply.
Source: IPUMS extracts from 1980-1990-2000 censuses and 2005 American Community Survey file.

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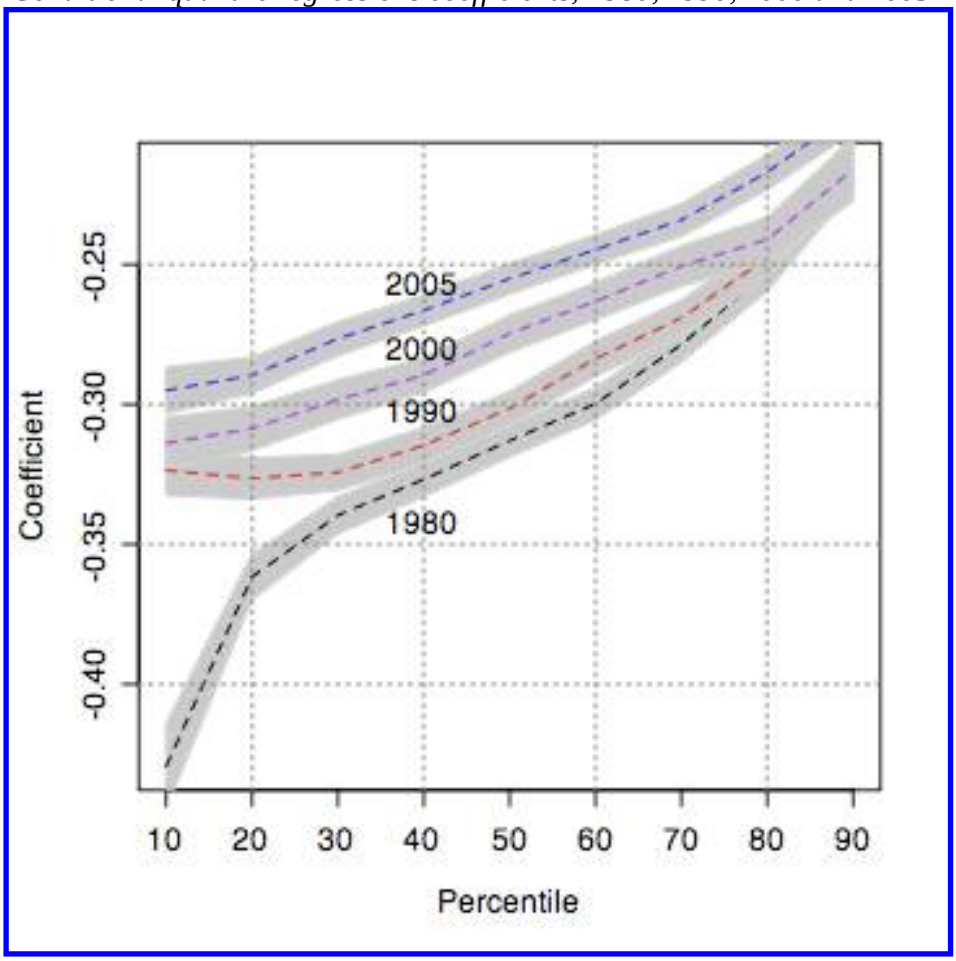
Figure 4

Conditional quantile regressions coefficients; 1980, 1990, 2000 and 2005



Notes: Each line connects the estimated coefficients on a dummy variable for employment in the sector of home production substitutes from quantile regressions of individual log hourly wages. Models also include controls for individual characteristics (age, age squared, 4 dummies for highest educational attainment, dummies for black, Hispanic origin, foreign-born) and are estimated separately for each year and each percentile 1 through 10 and each decile 20 through 90.
The grey areas plot pointwise 95% confidence intervals.
Sample restricted to individuals aged 16 through 65 who were employed in the civilian labor force at the time of the survey, were not unpaid family workers, who did not live in group quarters and who resided in a Metropolitan Statistical Area (MSA). All estimates are weighted by the product of IPUMS weights and annual labor supply (the product between number of weeks worked and usual number of hours worked per week).
Source: IPUMS extracts from 1980-1990-2000 censuses and 2005 American Community Survey file.

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APPENDIX A
Consumption Expenditure data

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Table A1
Identifying expenditure items corresponding to purchases of goods and services that substitute for home production activities

Category	Universal Classification code (UCC)
Food away from Home	190112, 190212, 190312, 190322 Lunch, Dinner, Snacks and Breakfast at Full Service.
Drinks away from Home	200512, 200522, 200532 Beer, Wine and other Alcoholic beverages at Full Service.
Repair & Maintenance Services	230000 Repair, maintenance, and improvements for built in dishwasher, garbage disposal, and range hood 230110 Maintenance of property, including items such as ceiling repair, black top, brick, or masonry work, air conditioner repair, roof and awning repair, house painting, papering, chimney cleaning, electrical inspection, furnace inspection and repair, wiring, pest control, carpenter, plumber, etc. 270210 Water and sewerage maintenance 270410 Garbage, trash collection 270900 Septic tank cleaning 340610 Repair of television, radio, and sound equipment, excluding installed in vehicles 340620 Repair of household appliances; including stove, vacuum, washer, dryer, sewing machine, refrigerator, and calculator; excluding garbage disposal, range hood, and built-in dishwasher 340630 Furniture repair, refurnishing, or reupholstery 340903 Miscellaneous home services and small repair jobs not already specified 340913 Repair and alterations of miscellaneous household equipment, furnishings, and textiles 440110 Shoe repair and other shoe services 440130 Alteration, repair, tailoring of apparel and accessories 440150 Watch and jewelry repair
Delivery Services	340120 Delivery services
Babysitting Services	340210 Babysitting or other home care for children
Housekeeping Services	340310 Housekeeping service, such as housekeeping, cooking, maid service, and carpet and upholstery cleaning services 340410 Gardening and lawn care services, such as mowing, tree services, fertilizing, and yard work 340510 Moving, storage, and freight express 340520 Household laundry and dry cleaning, not coin operated 440210 Apparel laundry and dry cleaning, not coin operated
Personal Care Services	650110 Personal care services for females, including haircuts 650210 Personal care services for males, including haircuts

Notes: The classification is based on the Universal Classification Code (UCC) Titles in the 2004 Consumer Expenditure Diary Survey.

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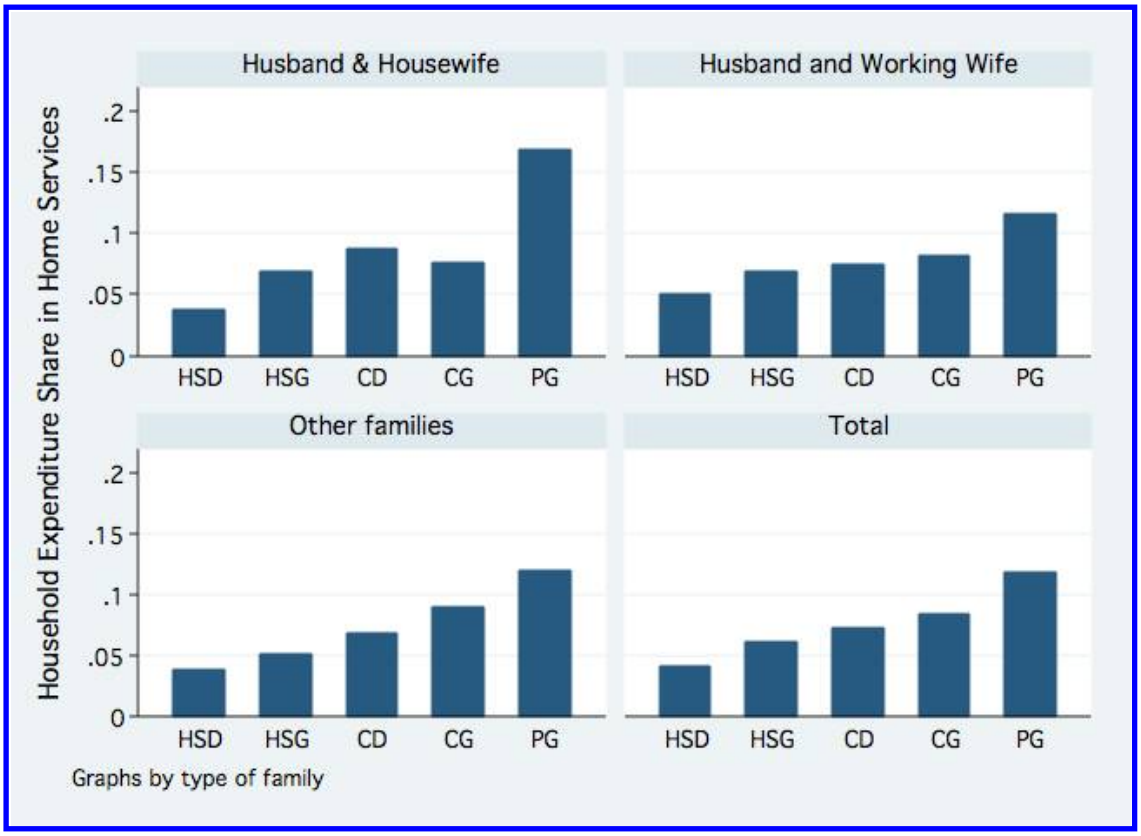
Figure A1

Household expenditure share of home production substitutes and head's highest educational attainment, by family type; 2004

Family head fixed to be the female in all husband/wife families.



Notes: This graph plots similar figures to the ones reported in Figure 1. The only difference is that the family head is conventionally fixed to be the *female* in all husband/wife families, while in Figure 1 it is fixed to be the male.

Source: 2004 Consumer Expenditure Diary Survey.

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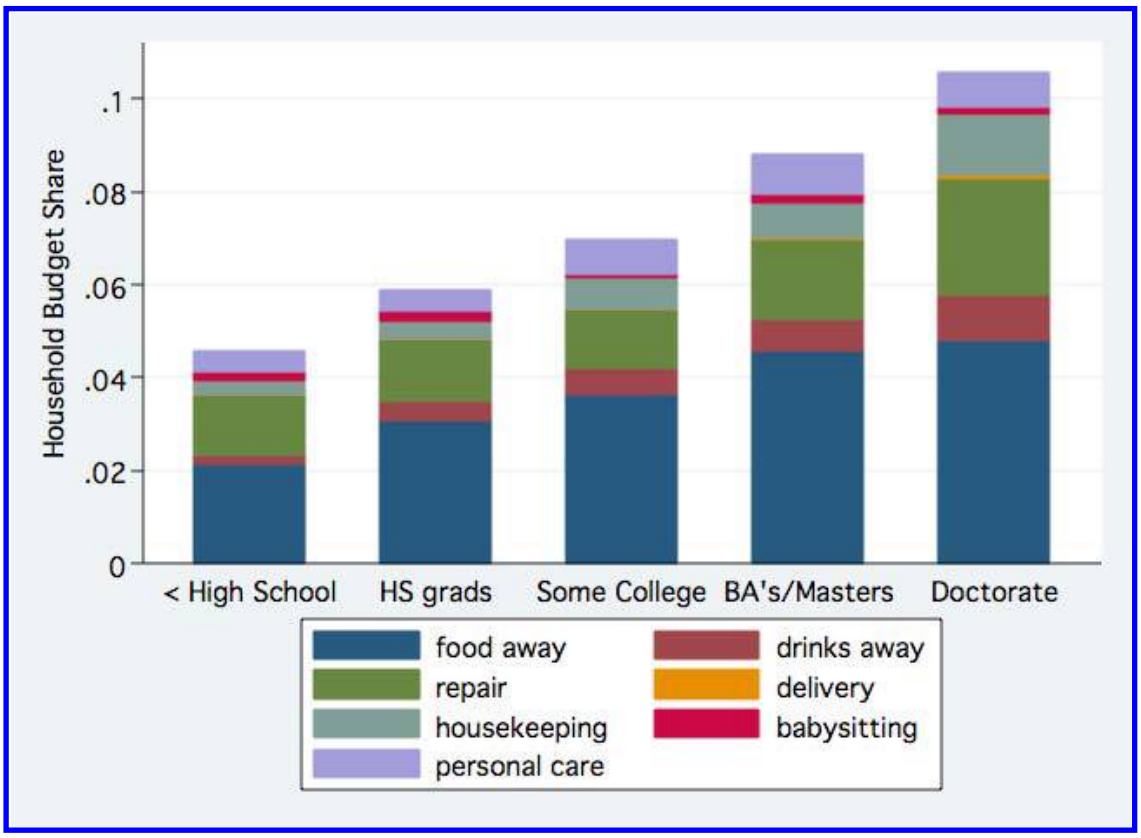
Figure A2

Household expenditure share of home production substitutes and head's highest educational attainment; 2004

Assessing the contribution of specific service categories.



Notes: See notes to Figure 1. For details on specific expenditure categories, see Table A1.
Source: 2004 Consumer Expenditure Diary Survey.

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APPENDIX B
Employment and Wage data

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Table B1
Identifying Sectors of Employment that deliver services that substitute for home production activities

Category (IPUMS variable IND1990)	Codes	Classification
Agriculture, Forestry and Fisheries	10-32	TR
Mining	40-50	TR
Construction	60	CO
Manufacturing	100-392	TR
Transportation	400, 410-432	WT
Except: **Bus service and urban transit**	**401**	**other NT**
Taxi and limousine service	**402**	**other NT**
Communications	440-442	WT
Utilities and Sanitary Services	450-472	WT
Wholesale Trade	500-571	WT
Retail Trade	**580-691**	**other NT**
Except: **Eating and Drinking Places**	**641**	**HP sub's**
Finance, insurance and real estate	700-712	FI
Business and Repair Services	721, 731-732, 741	BS
Except: **Services to buildings**	**722**	**HP sub's**
Detective and Protective Services	**740**	**other NT**
Automotive Rental and Leasing	**742**	**other NT**
Automotive Parking and Carwashes	**750**	**HP sub's**
Automotive & Other Repair Service	**751-760**	**HP sub's**
Personal Services	**761, 771-791**	**HP sub's**
Except: Hotels and other lodging places	761-762	Hotels
Entertainment and Recreation services	**800-810**	**other NT**
Health and Social Services	**812-40,852, 861, 870-81**	**other NT**
Except: **Child Care Services**	**862-863**	**HP sub's**
Legal Services	841	BS
Educational Services	842-851, 860	ED
Engineering, Management & Professional Services	882-893	BS
Public Administration	900-932	PA

Notes: The codes refer to the IPUMS variable IND1990, which is a modified version of the 1990 Census Bureau industry classification scheme and provides a consistent set of industries codes for 1980, 1990 and 2000 Censuses, and for the American Community Surveys (Ruggles et al. 2004). IND1990 was created in the IPUMS using a series of technical papers (published by the Census Bureau) that provide detailed analyses of how the industrial coding scheme for each census year differed from the scheme used during the previous census year. These industrial "crosswalks" are based on samples of cases that are "double coded" into the industrial schemes of the current and previous census year. The original Census Bureau crosswalks are available via links, at http://usa.ipums.org/usa/chapter4/chapter4.shtml#crosswalks

Legend: HP sub's: home production substitutes; other NT: other clearly non-traded sectors; TR: clearly traded sectors; CO: construction; WT: wholesale, transport and utilities; FI: financial services; BS: business services; PA: Public Administration; ED: education.

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Table B2
Employment shares in different sectors by wage decile and year, 1980-2005

	1980	1990	2000	2005	1980	1990	2000	2005
Wage decile	*First decile*				*Second decile*			
HP substitutes	**0.16**	**0.21**	**0.23**	**0.25**	**0.13**	**0.15**	**0.17**	**0.18**
Other non-traded	0.29	0.33	0.31	0.32	0.32	0.33	0.33	0.33
Traded industries	0.20	0.15	0.14	0.12	0.21	0.18	0.15	0.14
Services in hotels	0.05	0.04	0.03	0.03	0.03	0.03	0.02	0.03
Construction	0.04	0.04	0.05	0.06	0.03	0.05	0.06	0.08
Wholesale trade et al.	0.07	0.07	0.07	0.07	0.07	0.09	0.09	0.08
Financial Services	0.05	0.05	0.04	0.04	0.07	0.07	0.05	0.04
Business Services	0.03	0.04	0.05	0.04	0.03	0.04	0.05	0.04
Public Administration	0.03	0.02	0.02	0.02	0.03	0.03	0.02	0.02
Education	0.07	0.06	0.07	0.06	0.07	0.06	0.07	0.06
Wage decile	*Third decile*				*Fourth decile*			
HP substitutes	**0.09**	**0.10**	**0.12**	**0.12**	**0.06**	**0.07**	**0.09**	**0.09**
Other non-traded	0.30	0.31	0.32	0.32	0.27	0.28	0.29	0.31
Traded industries	0.22	0.18	0.16	0.14	0.24	0.19	0.17	0.15
Services in hotels	0.02	0.02	0.02	0.02	0.01	0.02	0.01	0.01
Construction	0.04	0.05	0.06	0.08	0.04	0.05	0.06	0.08
Wholesale trade et al.	0.09	0.10	0.10	0.10	0.10	0.11	0.12	0.11
Financial Services	0.10	0.09	0.07	0.06	0.09	0.09	0.08	0.08
Business Services	0.04	0.05	0.05	0.05	0.04	0.05	0.06	0.06
Public Administration	0.05	0.04	0.03	0.03	0.06	0.05	0.05	0.05
Education	0.06	0.06	0.07	0.07	0.07	0.06	0.08	0.08
Wage decile	*Fifth decile*				*Sixth decile*			
HP substitutes	**0.05**	**0.06**	**0.07**	**0.07**	**0.04**	**0.04**	**0.05**	**0.05**
Other non-traded	0.25	0.25	0.27	0.28	0.22	0.23	0.24	0.25
Traded industries	0.26	0.21	0.17	0.15	0.28	0.22	0.18	0.16
Services in hotels	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Construction	0.05	0.06	0.06	0.07	0.05	0.06	0.07	0.07
Wholesale trade et al.	0.12	0.12	0.13	0.12	0.13	0.14	0.14	0.14
Financial Services	0.08	0.09	0.09	0.08	0.07	0.09	0.08	0.09
Business Services	0.05	0.06	0.07	0.06	0.04	0.06	0.08	0.07
Public Administration	0.08	0.07	0.06	0.06	0.08	0.07	0.07	0.07
Education	0.07	0.07	0.08	0.09	0.08	0.08	0.09	0.09

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(Table B2 continue)

	1980	1990	2000	2005	1980	1990	2000	2005
Wage decile	*Seventh decile*				*Eighth decile*			
HP substitutes	**0.03**	**0.03**	**0.04**	**0.04**	**0.02**	**0.02**	**0.03**	**0.03**
Other non-traded	0.19	0.21	0.22	0.23	0.15	0.19	0.20	0.21
Traded industries	0.31	0.23	0.18	0.15	0.33	0.25	0.20	0.16
Services in hotels	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.01
Construction	0.05	0.06	0.06	0.07	0.05	0.06	0.06	0.07
Wholesale trade et al.	0.16	0.17	0.16	0.15	0.21	0.18	0.15	0.14
Financial Services	0.06	0.08	0.08	0.08	0.05	0.07	0.08	0.09
Business Services	0.04	0.07	0.09	0.09	0.04	0.07	0.10	0.10
Public Administration	0.08	0.07	0.07	0.08	0.08	0.08	0.08	0.09
Education	0.07	0.08	0.09	0.11	0.07	0.08	0.10	0.10
Wage decile	*Ninth decile*				*Tenth decile*			
HP substitutes	**0.01**	**0.02**	**0.02**	**0.02**	**0.01**	**0.01**	**0.02**	**0.02**
Other non-traded	0.11	0.16	0.18	0.19	0.11	0.14	0.18	0.19
Traded industries	0.34	0.26	0.21	0.18	0.32	0.25	0.20	0.19
Services in hotels	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Construction	0.07	0.06	0.06	0.05	0.07	0.06	0.04	0.04
Wholesale trade et al.	0.20	0.17	0.13	0.13	0.16	0.15	0.13	0.12
Financial Services	0.05	0.07	0.08	0.09	0.08	0.12	0.12	0.15
Business Services	0.04	0.07	0.12	0.13	0.07	0.11	0.16	0.17
Public Administration	0.08	0.08	0.09	0.10	0.08	0.06	0.06	0.07
Education	0.09	0.10	0.10	0.11	0.09	0.10	0.08	0.07

Notes: Each entry represents the fraction of the workforce in a given decile of the hourly wage distribution in a given year employed in a given sector. So, entries within a decile and year sum vertically to one.
The *home production (HP) substitutes* sector include the following three-digit industries: eating and drinking places, services to buildings, detective and protective services, automotive rental and leasing, taxi and limousine service, other repair services, personal services, entertainment services, child care services. Traded industries include agriculture, mining and manufacturing. Wholesale trade et al. include transportation and utilities. For the detailed mapping of three-digit industry codes into the above categories, see Table B1.
Sample restricted to individuals aged 16 through 65 who were employed in the civilian labor force at the time of the survey, were not unpaid family workers, who did not live in group quarters and who resided in a Metropolitan Statistical Area (MSA). Earnings percentiles based on hourly wages, defined as annual wages divided by annual labor supply (the product between number of weeks worked and usual number of hours worked per week).
Figures are weighted by the product of IPUMS weights and annual labor supply.
Source: IPUMS extracts from 1980-1990-2000 censuses and 2005 American Community Survey file.

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Table B3.a: *First-stage regressions of the decadal change in the top decile wage bill share in a city on predicted changes in the wage bill of top wage earners.*

	(1)	(2)	(3)	(4)	(5)
Predicted Δ wage bill of	0.378***	0.326***	0.326***	0.214**	0.214**
top 10% of wage earners	(0.093)	(0.088)	(0.087)	(0.092)	(0.092)
1990-2000 dummy	-0.000	0.015**	0.016**	0.003	0.003
	(0.003)	(0.007)	(0.007)	(0.003)	(0.003)
2000-2005 dummy	-0.037***	-0.022*	-0.020	-0.015	-0.015
	(0.012)	(0.013)	(0.013)	(0.012)	(0.012)
Δ Female labor force		0.126**	0.118**		
participation		(0.060)	(0.059)		
Δ Noncollege foreign-born		0.396***	0.396***		
share of workforce		(0.082)	(0.082)		
Δ 16-24 share of		-0.016	0.001		
workforce		(0.081)	(0.078)		
Δ 65+/pop share		0.457***	0.432***		
		(0.134)	(0.138)		
Δ College graduates share		0.030	0.069		
of workforce		(0.057)	(0.061)		
Δ log median wage			-0.039		
			(0.026)		
Female labor force				0.036	0.035
participation in 1980				(0.037)	(0.038)
Noncollege foreign-born				0.120***	0.123***
share in 1980				(0.044)	(0.046)
16-24 share in 1980				-0.024	-0.021
				(0.074)	(0.078)
65+/pop share in 1980				0.025	0.036
				(0.048)	(0.055)
College share in 1980				0.058*	0.064*
				(0.031)	(0.039)
Emp. sh. HP sub's in 1980					-0.079
					(0.157)
Emp. sh. in routine					-0.044
occup. in 1980					(0.153)
Constant	0.020***	-0.005	-0.006	-0.020	-0.016
	(0.001)	(0.009)	(0.009)	(0.025)	(0.025)
Region dummies	No	No	No	Yes	Yes
R^2	0.09	0.18	0.19	0.19	0.19

Note: Three periods (1980-1990, 1990-2000, 2000-2005) and 242 MSA's are considered, for a total of 726 observations. The instrument is a weighted sum of nationwide decadal growth of wages of workers in different occupations, where the weights are city-specific employment shares in those occupations among top wage earners in 1980. Estimates weighted by the average share of national workforce in each MSA between 1980 and 2005. Standard errors (in parentheses) adjusted for heteroskedasticity and clustering across MSA's. * significant at 10% ** significant at 5% *** significant at 1%.
Source: IPUMS extracts from 1980-1990-2000 censuses and 2005 American Community Survey.

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Table B3.b: *Additional First-stage regressions*

Dependent variable:	(1) Δ 90-10 wage gap	(2) Δ 90-50 wage gap	(3) Δ 90th wage percentile	(5) Δ 10th wage percentile
Predicted Δ in wage bill of top 10% of wage earners	0.784***	0.389***	0.618***	-0.166
	(0.180)	(0.120)	(0.144)	(0.169)
1990-2000 dummy	-0.033**	0.002	0.039***	0.073***
	(0.013)	(0.007)	(0.011)	(0.018)
2000-2005 dummy	0.010	0.034*	0.043*	0.033
	(0.030)	(0.018)	(0.023)	(0.024)
Constant	0.065***	0.036***	0.024***	-0.041***
	(0.009)	(0.005)	(0.008)	(0.010)
R^2	0.27	0.28	0.33	0.10

Note: Three periods (1980-1990, 1990-2000, 2000-2005) and 242 MSA's are considered, for a total of 726 observations. The prediction of the change in the wage bill of the top 10% of wage earners is a weighted sum of nationwide decadal growth of wages of workers in different occupations, where the weights are city-specific employment shares in those occupations among top wage earners in 1980. Estimates weighted by the average share of national workforce in each MSA between 1980 and 2005. Standard errors (in parentheses) adjusted for heteroskedasticity and clustering across MSA's. * significant at 10% ** significant at 5% *** significant at 1%.
Source: IPUMS extracts from 1980-1990-2000 censuses and 2005 American Community Survey.

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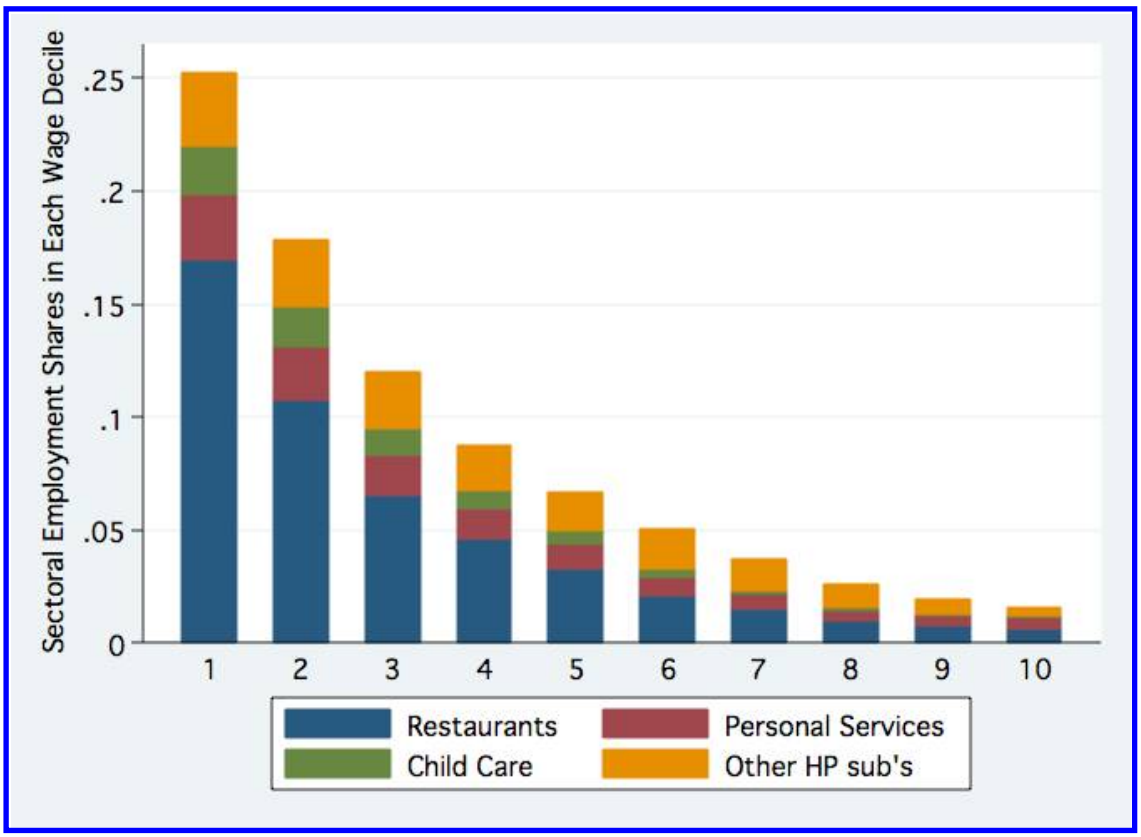
Figure B1

Employment shares in the sector of services that substitute for home production by decile of the hourly wage distribution; 2005

Assessing the contribution of specific service categories.



Notes: Each bar represents the fraction of the workforce in each decile of the hourly wage distribution employed in the sector of home production substitutes in 2005.
Sample restricted to individuals aged 16 through 65 who were employed in the civilian labor force at the time of the survey, were not unpaid family workers, who did not live in group quarters and who resided in a Metropolitan Statistical Area (MSA).
Figures are weighted by the product of IPUMS weights and annual labor supply.
Source: 2005 American Community Survey file.

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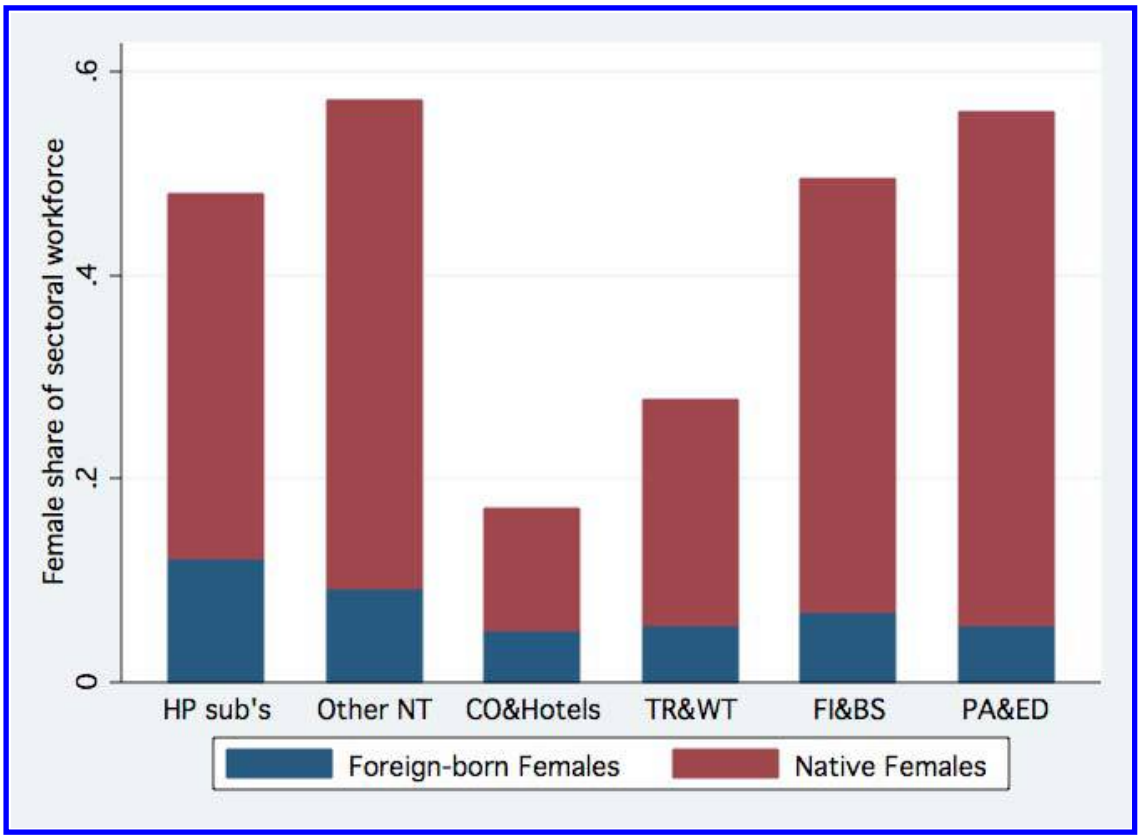
Figure B2
Female share in the workforce, by sectors; 2005



Notes: Each bar represents the fraction of females in the total workforce in a given sector in 2005. Sample restricted to individuals aged 16 through 65 who were employed in the civilian labor force at the time of the survey, were not unpaid family workers, who did not live in group quarters and who resided in a Metropolitan Statistical Area (MSA).
Figures are weighted by the product of IPUMS weights and annual labor supply.
Source: 2005 American Community Survey file.

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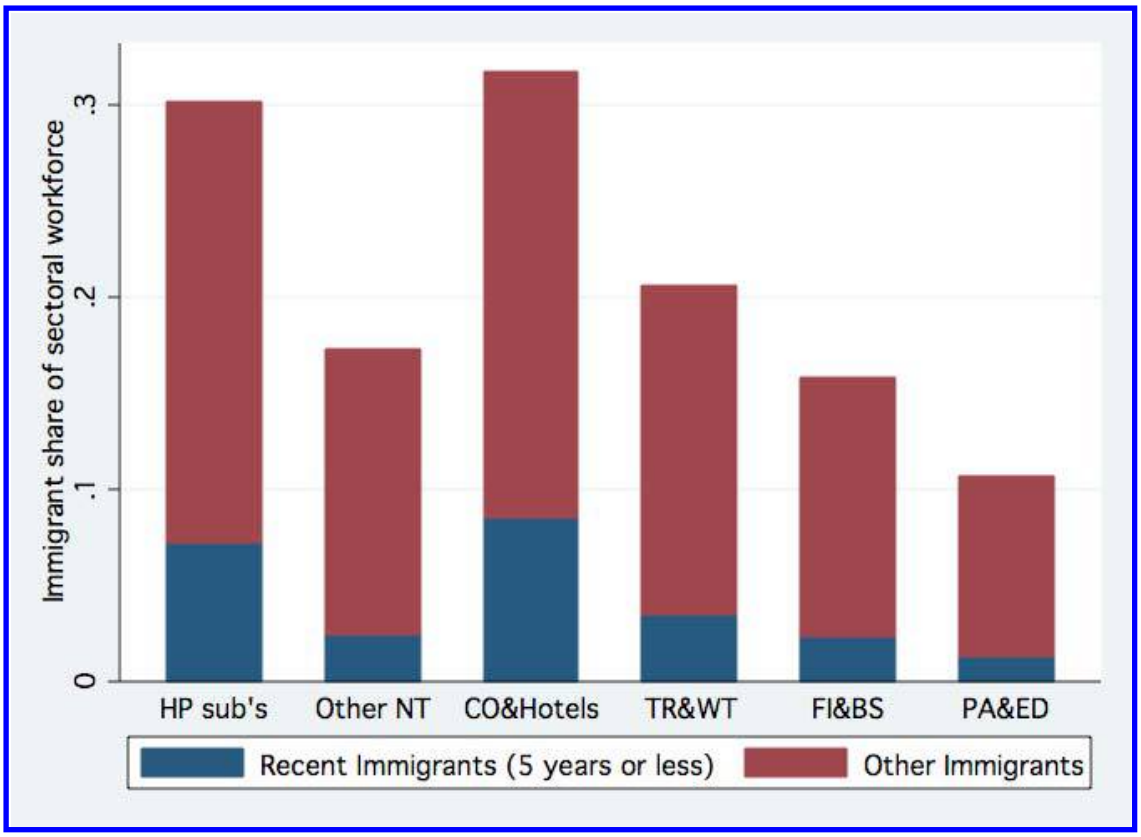
Figure B3

Immigrant share in the workforce, by sectors; 2005



Notes: Each bar represents the fraction of foreign-born individuals in the total workforce in a given sector in 2005.
Sample restricted to individuals aged 16 through 65 who were employed in the civilian labor force at the time of the survey, were not unpaid family workers, who did not live in group quarters and who resided in a Metropolitan Statistical Area (MSA).
Figures are weighted by the product of IPUMS weights and annual labor supply.
Source: 2005 American Community Survey file.