Increasing Top Wages and the Growth of Non-tradable Jobs: an Analysis at the Local Labor Market Level

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ABSTRACT

Census data show that low-skill workers in the United States are increasingly employed in non-traded jobs. As a consequence, their employment opportunities and their earnings are increasingly dependent on physical proximity to high-wage earners that are the customers for these services. We present a model for a local economy that captures this idea and delivers testable implications that can help in separating our consumption-driven story from the effects of production complementarities and human capital externalities. We find evidence consistent with the predictions of the model and we explore how this approach can improve our understanding of the recent observed divergence in inequality trends at the top and the bottom of the U.S. wage distribution.

I. Introduction

Because of international trade and outsourcing on the side of domestic firms, the employment opportunities of low-skill workers in the United States and other advanced economies are increasingly represented by non-tradable activities, such as sale jobs and personal services. Between 1980 and 2005, the share of U.S. wage earners in the lowest tenth percentiles of the wage distribution who are employed in non-traded activities has increased from forty-height to sixty percent.

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As emphasized by Manning (2004), if low-skill workers are heavily employed in non-traded tasks, then their employment opportunities and their earnings depend on physical proximity to high-wage earners, since the latter are likely to generate a substantial part of the demand of these tasks. This paper provides evidence of this dependence, and investigates its consequences for the dynamics of low-skill labor outcomes.

We present a simple theoretical model for a local economy (a "city") with both a traded and a non-traded sector. We characterize the latter as a sector where individuals can either do the work themselves or hire someone to do it for them. If workers have different levels of productivity in the production of the traded good, but are equally effective in the production of the non-traded good, then only unskilled workers perform paid work in the non-traded sector, while high-skill workers (with their high opportunity cost of time) are the consumers of the non-tradable tasks. In this setting, differences across cities in the proportion of high-skill workers and in their wages are predicted to explain differences in the employment distribution across sectors and in the wages of low-skill workers.

We use data from the Consumer Expenditure Surveys to study buying habits by income and education of the members of the household. We investigate whether, as we posit, consumption of non-traded services primarily consists of expenditures by high-skilled individuals. We find that—of the total expenditure in non-traded services in the economy—around seventy percent is represented by consumption of households headed by individuals with some college education (with a higher and increasing share represented by consumption of college graduates). We also find that the wage-income elasticity of consumption of non-traded services is very high (around one) among households in top deciles of the wage-income distribution. The magnitude of the estimated elasticities provides evidence against the potential concern that, beyond a certain earnings threshold, consumption of non-traded services might level off.

The predictions of the model are tested on data from the 1980, 1990 and 2000 decennial censuses and the 2005 American Community Survey. We find that across cities there is a positive correlation between the share of college graduates in the labor force and the average wage of low-educated workers. This finding is consistent with our theory, but it might as well arise from either (or both) imperfect substitution between labor inputs and human capital externalities (Moretti, 2004a and 2004b). However, we also find a positive correlation between the share of college graduates in a city and the proportion of low-educated workers employed in non-traded sectors, which is consistent with our theory, but not with the two alternative explanations—unless complementarity and externality effects are assumed to be stronger in the non-traded sector than in the traded one, a case we argue against.

The last part of the paper investigates the relationship across cities between relative wage growth at the top of the wage distribution and relative wage growth at the bottom (both respect to the growth at median) over three time periods (1980-1990, 1990-2000, 2000-2005). We find evidence of a positive association between wage growth at the top and the bottom of the distribution, but, consistent with our story, the association is statistically and economically significant only in cities with a larger proportion of low-skill workers employed in non-traded sectors. Thus, the consumption-driven explanation for low-skill labor outcomes we put forward might improve our understanding of the phenomenon of wage inequality in the United States: in particular, our approach points to a neglected dimension of the demand structure that should drive part of the low-skill wage dynamics.

In the early 1990s, some seminal papers documented a large and ubiquitous increase in wage inequality since the late 1970s (Bound and Johnson, 1992; Katz and Murphy 1992; Juhn, Murphy and Pierce, 1993). Inequality was found to increase at any point of the wage distribution and across almost all dimensions—the narrowing of the gender wage gap being a notable exception. Even if fluctuations in the supply of skills, and the erosion of labor market institutions, such as labor unions and the minimum wage, have been shown to be important contributors to the observed increasing inequality, a number of influential studies argue that the surge in inequality in the 1980s reflected a secular rise in the demand for skills attributable to skill-biased technological change (see Katz and Autor, 1999, for a review of this literature). Still divided between institutional and market driven explanations, the more recent literature faces the challenge of explaining divergent trends in inequality at the bottom and the top of the wage distribution. As documented in Autor, Katz and Kearney (2006, AKK hereafter), changes in the U.S. earnings distribution in the last 15 years are characterized not only by a persistent rise in inequality in the upper half of the distribution, but also by a slowing (or reversal) of inequality trends in the lower half. AKK show that the recent divergence of upper- and lower-tail wage inequality is due to the fact that wage growth has polarized in the 1990s: as in the previous decade, wage growth has been the fastest for top earners (even more convex than before), but, as opposed to previous trends, it has also been higher (or at least not lower) at the bottom than in the middle. The authors show that the polarization in the earnings growth was accompanied by a phenomenon of employment polarization: employment shares in both the highest and lowest skill occupations increased, while employment shares in middling occupations contracted. Following Goos and Manning (2007), AKK argue that these patterns are consistent with the model of computerization proposed by Autor, Levy and Murnane (2003, ALM hereafter). In this model, information technology complements highly educated workers engaged in non-routine abstract tasks, substitutes for moderately skilled workers performing routine tasks, but has little direct impact on the manual tasks used in many low-skill service jobs.

Our approach points to a further potential demand-driven explanation for the recent observed twisting of the wage growth at the bottom of the distribution: the steady growth of wages for high-skilled workers observed over the past three decades is likely to have raised, through both income and substitution effects, the consumption of non-traded tasks, and so the demand for low-skilled labor. Our approach is limited in scope because it only provides an explanation for changes in lower-tail wage inequality. It is nevertheless novel in that it proposes a causal link between the several years of sustained wage growth at the top of the distribution and the more recent rise in relative wage growth at the bottom. The appeal of this approach is that it might account for the apparent time inconsistencies of explanations based on technological progress. Why should the effect of information technology explain monotonic wage and employment growth along the skill distribution in the 1980s, but a U-shaped growth in the 1990s? If the personal non-traded tasks that increasingly absorb low-skill work are not modeled as complement (in production) to the market activities performed by high-skilled workers (as in AKK), but are, as in this paper, considered substitutes for a different kind of activities (home production), then (i) technological progress—and the secularly declining price of computer capital—are consistent with the increase in the last three decades in the wages of high-skilled workers performing abstract problem-solving and managerial tasks relative to those of middle-skilled workers performing routine tasks; (ii) wages of low-skill workers (increasingly performing non-traded tasks that are consumed by high-skilled workers) is expected to be positively (and increasingly) affected by past and current wage gains at higher levels of the distribution.

II. Tradable and non-tradable jobs: definition and trends

Given that low-skill labor is much cheaper in developing countries, whose products are then traded across national borders, low-skill employment in developed economies is expected to progressively shift out of traded sectors (such as manufacturing) and into non-tradable activities. Manning (2004) notes that among the ten occupations with the largest employment growth in the United Kingdom between 1979 and 1999, three out of ten are low-paid jobs, all of which non-tradable: care assistants, educational assistants and hospital assistants.

To explore this phenomenon for the United States, we use data from the decennial censuses and we analyze employment shares over time in traded and non-traded sectors by different levels of skill. Skills are defined both in terms of educational achievement (high-school drop-outs, high-school graduates, individuals with some college education but no degree, and college graduates) and relative position in the wage distribution (wage-earners from each tenth of the wage distribution).

Workers are classified in traded and non-traded jobs using either the industry in which they are employed or the occupation they hold. The criterion of assignment consists in whether the producer of a good or service has to be located in physical proximity to the consumer for the job to be done. On the base of the industry of work, we divide employment into eight categories: clearly non-traded; clearly traded; construction; wholesale, transport and utilities; financial services; business services; government; and education. Table A1 (in Appendix) provides details on the mapping between industrial classification and these categories. Non-traded activities include retail trade; land transportation (e.g., bus and taxi services); consumer goods rentals; health and social services; recreation and food services; personal and household goods repair and maintenance; personal services (e.g., barber shops and laundry services). Traded activities include manufacturing and clearly traded services (e.g. publishing industry; radio and television broadcasting). While the criterion of physical proximity is easy to apply in many cases, space for considerable ambiguity remains. For this reason, other categories are left out of the traded/non-traded classification. For instance, many financial and business services are increasingly performed and delivered electronically. Construction work has been traditionally thought as non-tradable labor. On the one hand, residential construction jobs surely satisfy the proximity requirement. On the other hand, some construction jobs (e.g., production plants, infrastructures) may fail the proximity requirement, to the extent that those financing, or ultimately using the construction projects, are not necessarily local residents.[1]

In the occupation-based classification, non-traded status is assigned to sales jobs and a restricted list of services, such as private household, food preparation, cleaning, and personal services. Table A2 provides a more detailed list of the occupations that are classified as non-traded.

Table 1 and Table 2 report employment shares in different sectors/occupations by education and wage percentile, respectively. There are substantial differences in the employment distributions by skill groups (with higher employment shares in non-traded jobs among low-skill individuals), and these differences have grown over time. Reflecting the sharp employment drops in manufacturing, employment in the traded sector has declined for all skill levels between 1980 and 2005. However, while for the least-educated groups there has been a pronounced shift towards non-traded activities, employment of the most-educated has also shifted towards activities (such as financial and business services) that are increasingly tradable because of falling communication and transportation costs. Table 2 shows that occupational differences across skill groups over time are even more marked when skills are identified by a worker's relative position in the wage distribution. The shift into the non-traded sector has been systematically higher among low-wage earners. In 2005, 60 percent of wage earners in the lowest decile

[1] See Manning (2004) for a discussion of more issues related to assigning non-traded status to different industries.

of the wage distribution were employed in non-traded jobs, versus only twenty percent of the wage earners in the highest decile. Summarizing, these figures show unambiguously that the share of employment in the non-traded sector has been increasing in the last decades, but the bulk of this increase is due to the fact that the employment of low-skill workers in the United States has progressively concentrated in non-traded activities.

Table 3 reports different statistics (mean, median, 10^{th} percentile and 90^{th} percentile) for hourly wages by education and sector from 1980 to 2005. For the entire period and for all educational levels, wages in non-traded sectors are lower than wages in traded sectors. This evidence is consistent regardless of the summary statistic we look at. The wage differential across sectors is a well-known fact, but it is at first surprising in light of the evidence of recent higher relative wage growth at the bottom of the distribution (Autor, Katz and Kearney, 2006). In the last 15 years, relative wage growth has been higher at the bottom than in the middle of the distribution despite the fact that employment of the least-skilled has shifted more heavily into traditionally low-paid jobs. The explanation is that the non-traded/traded wage gap has declined significantly over time. The last two columns of Table 3 report the non-traded/traded wage gap in 1980 and 2005—the gap is defined as the ratio between hourly wages paid in the non-traded and traded sectors respectively. The gap dropped the most for the least-educated group, which is also the group that experienced the highest relative increase in non-traded employment. The positive correlation between wage and employment changes points to the importance of demand shifts.

Who are the customers for the non-traded tasks increasingly performed by low-skill individuals? By definition, the customers must reside in the same geographical area. Also, to the extent that these non-traded activities substitute for goods and services that could otherwise be produced at home, then the consumers should predominantly be high-wage earners, because of their high opportunity cost of time. In the next section we develop a simple theoretical model for a local economy that includes both a traded and a non-traded sector. The model shows how—because of this consumption mechanism—the labor outcomes of the low-skilled depend on the presence and the earnings of the more-skilled. In the following sections we then use different datasets to test the predictions of the model.

III. Conceptual framework

To aid in the interpretation of our empirical work, we start by presenting a simple model of local labor markets that follows Manning (2004). In each city there are two types of composite goods: Y—nationally traded—and X_m—locally traded. The composite good X_m includes services that can be either purchased on the local market or produced domestically. Individuals are assumed to be equally effective at producing this non-traded "household" good, but they can be either "skilled" or "unskilled" in the production of Y. All cities contain both skilled and unskilled workers (in numbers L_s and L_u respectively).

The individual maximization problem

Both skilled or unskilled individuals ($j=s,u$) have preferences described by $U=U(y,x_m,x_h,T_m,T_h,L)$, where y and x_m denote market goods, nationally and locally traded respectively, x_h home-produced goods, T_m market time, T_h work at home time, and L leisure. The home production function is $x_h=F(T_h)$, subject to decreasing marginal productivity $F'>0$, $F''<0$. The constraints confronting the individual are the time constraint $T_m+T_h+L=1$, and the budget constraint $p_y y+p_{xm}x_m= w_jT_m+V_j$, where w_j and V_j are the real wage rate and non-labor income for individuals of skill j.

The first-order conditions for an interior solution (i.e., $T_m>0$ and $T_h>0$) are:

$$U_y/U_{xm} = p_y/p_{xm}$$

$$U_L = U_{Th} + U_{xh}F'$$

$$U_L = U_{Tm} + U_y(w_j / p_y)$$

$$U_L = U_{Tm} + U_{xm} (w_j / p_{xm})$$

where U_z denotes the partial derivative of the utility function relative to z, $U_z \equiv \delta U/\delta z$.

As it is, the model is not identified. To avoid this problem, as in Gronau (1977), we assume $x=x_m+x_h$ and $T=T_m+T_h$, i.e., home goods and market goods are perfect substitutes—$U_{xm}=U_{xh}=U_x$—and the same is true for work at home and work in the market—$U_{Tm}=U_{Th}=U_T$.[2] Then, the preference function can be rewritten as $U(y,x,T,L)$ =

[2] The assumption of perfect substitutability between market goods and home products, and between work in the market and work at home, is obviously a strong one. It rules out the possibility that an individual may attach extra value to goods produced by herself rater than

$U(y,x,1\text{-}L,L) = V(y,x,L)$. This simplification yields the following conditions for an interior solution:

$V_y / V_x = p_y / p_{xm}$

$V_L / V_Y = w_j / p_y$

$V_L / V_x = F' = (w_j / p_{xm})$

In this framework, the choice of the optimal bundle *(y,x,L)* is governed by preferences and relative prices prevailing in the market, and the allocation of work time between home and market is determined by home technology. In particular, exogenous changes in the own wage rate w can be used to trace the demand for home time (i.e., the value of marginal productivity of T_h). An increase in w will definitely cut work at home, because of the increase in the shadow price of time, and will shift the composition of x towards goods purchased in the market (x_m) and away from goods produced at home (x_h).

Market production

Assume that there is a CES technology that employs skilled and unskilled workers in the production of the traded good:

(1) $$Y = A[\theta(\alpha_u N_{uY})^{\sigma} + (1-\theta)(\alpha_s N_{sY})^{\sigma}]^{\frac{1}{\sigma}}$$

where N_{jY} is the number of workers of skill j working in the traded sector; A, θ, and the α's are productivity shifters that can vary across cities and over time.

A. Perfect substitution between skilled and unskilled labor in the traded sector; no human capital spillovers

To keep things simple, let's first assume both that skilled and unskilled workers are perfect substitutes in this sector—that is, $\sigma = 1$—and that there are no human capital

someone else, and that some housework activities provide extra benefits beyond the consumption value of household production. These shortcomings are clear in the case of childcare. See Graham and Green (1984) and Kerkhofs and Kooreman (2003) for attempts to address them. These problems should not affect our basic results, however, as long as there is a nontrivial number of activities for which the assumptions are plausible. This is likely to be the case for activities like cleaning the house, doing the laundry, maintenance and repair services, waste management,..).

spillovers—that is, the productivity shifters do not depend on the share of skilled workers in the city.

If wages in the traded sector are equal to the marginal product of each type of labor,[3] and p_Y is normalized to one, then:

(2) $$w_u = A\theta\alpha_u,\ \ w_s = A(1-\theta)\alpha_s$$

As regards the market of non-traded goods, we model it as a market of private household workers. Given that skilled and unskilled workers are assumed equally effective at producing the household good, then the non-traded sector exists if and only if no skilled worker performs paid work in it.[4] The unskilled workers, on the contrary, might be employed in both sectors. So, their wage must be equalized across sectors, and will be equal to the marginal productivity in the traded sector, w_u. We assume that purchasing x_m entails an "agency" cost c per unit purchased,[5] and that $\bar{c}_u < c < \bar{c}_s$, where $\bar{c}_j$ is the threshold above which workers of skill $j=u,s$ do not find it optimal to purchase any household good in the non-traded sector.

Equilibrium in the non-traded sector

The individual demand schedule for x_m resulting from the utility maximization problem of a skilled individual (x_m^d) is an increasing function of the opportunity cost of household production (that is, her wage w_s) and a decreasing function of the cost of purchasing the services in the market (that is a function of w_u and agency cost).

(3) $$x_m^d = f(w_s, w_u, \beta) \quad , \delta f/\delta w_s > 0,\ \delta f/\delta w_u < 0,\ \delta f/\delta c < 0$$

Assuming a high enough agency cost c, the total demand for domestic help in the city (X_m^D) is then given by the sum of the individual demand schedules of skilled individuals only.

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[3] This follows from assuming that firms can relocate across cities.

[4] If the skilled worked in the non-traded sector, then it would always be convenient for both types of workers to do the housework themselves, and a market for the non-traded good would not exist.

[5] The cost might arise from a standard principal-agent problem, or it might simply reflect tax wedges.

(4) $X_m^D = L_s f(w_s, w_u, c)$, $\delta f/\delta w_s > 0$, $\delta f/\delta w_u < 0$, $\delta f/\delta c < 0$

There are two possible types of equilibria.

1. Unskilled workers work in both sectors, at the same wage, equal to their marginal productivity in the traded sector. The number working in the non-traded sector depends on the demand for non-traded goods by the skilled workers at this real wage, and so it is increasing both in the fraction of skilled workers in the city, and in their wage.

2. If at the wage payable by the traded sector to unskilled workers, the demand for non-traded goods is high enough, then unskilled workers work only in the non-traded sector at the market-clearing wage w_u^*, that solves

(5) $L_u n(w_u) = L_s f(w_s, w_u, c)$, $\delta n/\delta w_u > 0$

where $n(.)$ is the labor supply function for unskilled workers. In this equilibrium, the unskilled wage is increasing in the fraction of skilled workers in the city, and in their wage.

Hence, the model has the following predictions:

<u>Prediction 1:</u> *the fraction of unskilled workers employed in the non-traded sector is increasing in the share of skilled workers in the city, and in their wage.*

<u>Prediction 2:</u> *the unskilled wage is non-decreasing in the fraction and wage of skilled workers in the city.*

B. Imperfect substitution (complementarity) between skilled and unskilled labor in the traded sector; no human capital spillovers

If there is imperfect substitution between workers of different skills in the production of the traded good, then a higher share of skilled workers in a city is associated with higher productivity of low-skill labor employed in the traded sector. Productivity gains in the traded sector will be reflected in higher wages in both sectors, because of worker mobility.

In this case, Prediction 2 is not exclusive to our consumption-driven mechanism, but would arise from complementarity as well. However, Prediction 1 is unique to our story, and can be used as a test to separate the two effects.

C. Imperfect substitution (complementarity) between skilled and unskilled labor in the traded sector and human capital spillovers.

If there are human capital spillovers in the traded sector,[6] then a higher share of skilled workers raises productivity and wages of both skilled and unskilled workers in the traded sector. So, Prediction 2 might arise from spillovers as well as from our "consumption" story or from imperfect substitution in production. However, as long as spillovers are internal to the traded sector, Prediction 1 is still a valid test to separate our story from the effects of both human capital spillovers and complementarity.[7]

In the next sections we test Predictions 1 and 2. We recognize that the model presented above is very simple in a number of dimensions. We discuss here two aspects we find of particular importance for the identification of the consumption effects we are interested in detecting.

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[6] In the literature, there exist different types of models of human capital spillovers. If workers learn from each other, and they learn more from more skilled individuals, then positive human capital externalities would naturally arise from formal and informal interactions across workers (Lucas, 1988). Other authors focus on the importance of basic research in fostering technological innovation and productivity, the public good nature of the research and the resulting positive externalities in the form of knowledge spillovers (Arrow, 1962; Griliches, 1979). More recently, Acemoglu (1996) shows that, when the labor market is characterized by costly search, then social increasing returns in human capital arise as pecuniary externalities.

[7] Alternatively, a different way to separate our story (that is, part of the demand for low-skilled labor comes from the consumption of non-tradable goods by high-skill individuals living in the same area) from the effects of complementarity and human capital spillovers is to investigate whether there is any effect on the labor outcomes of low-skill workers from the fraction of the *older* population with high levels of education. Also, we could use variation in non-earned income of high-skilled workers across cities: for example, we could look at the share of stock holders in a city and use variation in the stock market returns over time. We plan to explore these approaches in future work.

First, a crucial assumption of the model is that imperfect substitution and human capital externalities can only occur in the traded sector. We rule out these effects in the non-traded sector by modeling it as a market of private household workers where no skilled individual finds it profitable to work. In fact, even if employment shares in non-traded activities are the highest for the least-skilled individuals, we know that skilled individuals do work in this sector (Tables 1 and 2). In the model, it would then be more reasonable to assume a market production function for non-traded goods that employ both skilled and unskilled workers. In this case, for Prediction 1 to be consistent exclusively with our consumption mechanism, we would have to assume perfect substitution between labor inputs and rule out human capital spillovers. We come back to this point later, but to preview the discussion, we argue that what we need in order to use Prediction 1 as a test for our consumption story is indeed a much weaker and more plausible assumption: the effects of more skilled workers on the low-skilled can arise from production complementarities/spillovers in both sectors, but these effects are not as strong in the non-traded sector as in the traded one. Given that within-sector effects of production complementarities and human capital externalities are increasing in the sector skilled share, we find this assumption plausible in light of the fact that the skilled share in most of the non-traded sectors we have coded is significantly lower than in the traded sectors.

Second, we have presented a model for a local economy that abstracts from general equilibrium considerations. A crucial issue is labor mobility. Labor mobility of unskilled workers would be expected to equalize the unskilled wage, so it should work against finding any effect. Empirical evidence shows limited labor mobility among the low-skill population (Bound and Holzer, 2000), so we might still expect to find wage differences across cities. A more serious identification issue, however, arises from the possibility of differential influxes across cities of low-skill immigrant workers primarily performing non-traded tasks. If we allow immigrants' location decisions to be endogenous to their expected employment opportunities (that are correlated with the presence of high skilled workers), then immigrant influxes might be an alternative explanation for Prediction 1. To address this concern, we run an analysis of employment distributions across sectors by nativity and we find that foreign-born are not overrepresented in non-traded activities.[8] We argue this provides some preliminary evidence in favor of our results not being driven by the endogenous location of low-skill immigrants.

IV. Consumption expenditures: data and trends

Before testing the predictions of the stylized model presented in the previous section, we present an analysis of data on consumption expenditures of households in the United States. The goal of the analysis is to investigate whether, as we posit, at the aggregate level consumption of non-traded services primarily consists of expenditures by high-skilled individuals. In order to shed some light on the expected relationship between wage increases for top-earners and consumption of non-traded services, we also calculate wage-income elasticities of consumption of non-traded services for families in different income ranges.

The Consumer Expenditure Survey (CEX)

The CEX is currently the only micro-level data reporting comprehensive measures of consumption expenditures for large cross-sections of households in the United States. The CEX consists of two separate surveys, one based on retrospective interviews about expenditures in the previous twelve months (the Interview Survey, IS thereafter) and one based on weekly diaries (the Diary Survey, DS). The surveys are independent nationally representative samples of the U.S. population, and they are both almost exhaustive. Given their different survey methods, however, large and infrequent expenditure items are expected to be better measured in the IS, while frequently purchased and small items are expected to be better measured in the DS (Bureau of Labor Statistics, 2003). In this paper we use data drawn from the DS samples, because weekly record keeping should more

[8] Foreign-born individuals make up a substantial part of the low-skill workforce in the United States: in 1980, they represented 11 percent of the total workforce without a high school degree, while in 2005 this share increased to 32 percent. In all years, however, low-skill foreign-born are under-represented in non-traded sectors and over-represented in traded sectors. For example, in 1980 and 2005 they made up respectively 10 and 26 percent of the low-skill workforce in non-traded sectors, and 14 and 42 percent of the low-skill workforce in traded sectors.

accurately account for expenditures in non-traded services, which are likely to constitute small and frequent purchases, difficult to recall over longer periods of time.

In the DS, consumer units (that are households) are asked to self-report their purchases over two consecutive one-week periods using product-oriented diaries.[9] Individual commodities are identified by several hundreds of Universal Classification Codes (UCC). For each household we calculate a measure of monthly total expenditure, defined as 2.16 times the expenditure observed over two weeks (or, for the small fraction of households that only fill one weekly diary, 4.33 the expenditure observed over one week). In addition, we aggregate some consumption items and calculate monthly household expenditure in non-tradable services, also disaggregated in ten sub-categories: food away from home, drink away from home, repair and maintenance services, delivery, babysitting, housekeeping, care for the elderly, city transportation, auto repair services and personal care services. Table A3 provides details on the way in which UCC's are mapped into the ten categories mentioned above.

The DS also includes information on household characteristics (e.g. family size and composition, region and state of residence[10]) and numerous characteristics for each member in the household (e.g., age, gender, race, marital status, relationship to the reference person, education, and employment and wage income in the twelve months before the interview).

Facts

In what follows we present results from a preliminary analysis on data from the 1996 and 2004 Diary Surveys. We plan to extend the analysis to more years. Yearly diary surveys are available since 1990. Two earlier years (1980 and 1981) are also available, but the UCC's in these surveys do not include items of interest such as housekeeping or babysitting services. Unless otherwise noted, the sample is restricted to households with the reference person between the age of 25 and 64. All figures are weighted using weights provided by the Bureau of Labor Statistics.

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[9] Response rates are high: more than 90 percent of households complete both diaries.

[10] To ensure confidentiality, in a non-negligible number of records, state identifiers are either suppressed or replaced with codes of states other than the state where the household resides. For these reason, CEX data are not suitable for an analysis of cross-state differences.

In the two years of observation, non-traded services represent a fairly stable fraction of total household expenditures (14 and 15 percent in 1996 and 2004 respectively). There is however some variation across educational groups.[11] As in census data, we define four educational categories (high-school drop-outs, high-school graduates, some college and college graduates) and find that the average share of non-traded services in total household expenditures slightly but monotonically increases with the education of the reference person, from 10 percent to 17 percent.[12]

The assumption we hold in our theoretical model (that is, only skilled workers buy in the non-traded sector) seems reasonable once we look at the share of the total expenditure in non-traded goods in the economy that pertains to different educational and earnings groups. As shown in Table 4, household headed by people with at least some college education absorb more than two-thirds of the total consumption of non-traded services, and the share represented by consumption of college graduates is increasing over time.

To explore the potential concern that beyond a certain earnings threshold consumption of non-traded services might level off, we calculate income elasticities of the consumption of non-traded goods. We regress the logarithm of household expenditure in non-traded services on the logarithm of total income from wages and find substantial variation across income subgroups. In the full 1996 and 2004 samples, a 1 percent increase in household wage income is associated respectively with a .31 and .36 percent increase in expenditures for non-traded services. When calculating income elasticities for households from each fourth of the wage income distribution, however, we find that they increase in the income quantile (from the first to the fourth quartile: .07, .15, 1.08 and .75 in 1996 and .11, .40, .76, .84 in 2004). The magnitude of the estimated elasticities for high-income groups shows that, among high-wage earners, wage rises should be expected to significantly increase consumption of non-traded goods.

[11] When not otherwise noted, we classify households based on the characteristics of the reference person.

[12] Given that education is a strong predictor of income, this pattern suggests that non-traded services might be superior goods, that is, goods that make up a larger proportion of consumption as income increases.

Ideally, we would like to use consumption expenditure data to test the micro-level predictions of our model, that is, an increase in the wage rate, by increasing the shadow price of time, should decrease hours of home production. A way to indirectly test for this prediction would be to study whether consumption of non-traded services (that are market substitutes for the output of home production) is positively correlated with hourly wages. There are two issues involved in implementing this test. First, while the survey provides information on expenditures in a specific and defined period (over two weeks), it does not include information on individual hourly wage rates *at a point in time*. Hourly wages can only be computed by dividing annual earnings by annual hours (i.e., by the product of weeks worked and weekly hours). So, it is impossible to separate the labor supply decision from the decision about work at home. Second, our model considers the individual as the utility maximizing agent, while in a multi-person household each member's allocation of time stems from a bargaining process that might result in some degree of specialization. So, at a minimum, we should run separate analyses for different household types, and test our prediction for one-adult families.

Due to these difficulties, we now turn to test the predictions of our model on data on metropolitan areas skill levels, and employment and wages of low-skill workers.

V. Cross-city analysis: metropolitan areas skill levels and the labor outcomes of low-skill workers

The model in section III shows that part of the demand for low-skilled labor may come from the consumption of non-tradable goods by high-wage individuals living in the same area. If so, low-skilled workers in cities with higher shares of high-skilled workers (and higher wages for them) should be more likely to be employed in non-traded activities, and might have higher wages.

We now turn to test whether the theoretical predictions are supported in the data. In this section we focus on the relationship between the share of skilled workers in a city and the employment and wage outcomes of low-skill workers. In the next section we will focus on the effects of differences across cities in the wage growth experienced by high-skill workers.

We use data from the 1980, 1990 and 2000 censuses and from the 2005 American Community Survey.[13] We use the Metropolitan Statistical Area (MSA) as a local labor market. Metropolitan areas are counties or combinations of counties centering on a substantial urban area. There are between 270 and 280 MSAs in each year.[14]

On individual level data restricted to workers 16-65 years old, we define average measures of labor outcomes (hourly wages and employment shares in different sectors) for four separate education groups: high-school dropouts (HSD), high-school graduates (HSG), individuals with some college education but no degree (CD), and college graduates (CG). For each education group *e*, we estimate the following model for the mean of the labor outcome prevailing in a city *c* in year *t*:

$$Outcome^{e}_{ct} = \alpha + \beta(CollegeShare)_{ct} + \gamma_t + \gamma_c + \delta X_{ct} + \varepsilon_{ct} \quad (6)$$

where *CollegeShare* is the fraction of college graduates in a city workforce, γ_t and γ_c are year and city fixed effects, and X_{ct} is a vector of city characteristics: the proportion of women, blacks, Hispanics, foreign-born, foreign-born arrived in the United States 5 or fewer years ago (these variables vary by city and year), and the fraction of each education group aged 16-24, 25-34, 35-44 and 44-55.

The coefficients of interest are the β's in regressions for mean labor outcomes for the least educated. When *e=HSD*, the consumption mechanism presented in the previous section predicts $\beta>0$ in a specification for the employment share in the non-traded sector

[13] The data are extracted from the Integrated Public Use Microdata Series (IPUMS) files (Ruggles et al., 2004).

[14] Even if the concept of "metropolitan area" has remained essentially the same over time, there are some comparability issues that we plan to take more seriously under account in future work. First, most metropolitan areas encompassed less territory during earlier years than in later years because the Census Bureau reconsidered and adjusted the boundaries of each metropolitan area to account for growth during each ten-year period. Second, as population grows and people migrate to urban areas, new metropolitan areas regularly emerge, so the number of metropolitan areas has increased over time. Finally, some metropolitan areas are only partly identified in the 1980, 1990, and 2000 samples.
We plan to consider metropolitan areas that are consistently defined over time. Jaeger et al. (1998) suggest matches for the geographical coding of metropolitan areas in the 1980 and 1990 censuses. We plan to extend their proposed procedure to 2000.

(Prediction 1), and $\beta \geq 0$ in a specification for mean hourly wages.[15] For comparative purposes, we also estimate specification (6) for other educational groups.

Findings

Table 5 presents estimates of the effect of college share on the wages of different education groups. In specifications that only include year fixed effects (column 1) we find a larger coefficient for more educated groups, while, when including city effects (columns 2 and 3), we find a larger coefficient for less educated groups, as we would expect from a conventional demand and supply model. The difference might be due to the higher mobility of high-educated individuals that allow them to locate in those cities where the returns for their skills are higher.

Focusing on the most complete specification in column (3), a 10-percentage-points increase in the college share[16] is associated with a 9.4 percent increase in wages for high-school dropouts, a 5.5 percent increase in wages for high-school graduates and those with some college education and a 4 percent increase in wages for college graduates. The larger effect of college share on wages of lower educated workers is consistent with the hypothesis that skilled workers raise the demand for less-skilled workers through the increased demand for non-tradable employment, but it might as well be due to the effects of production complementarities or human capital externalities. In fact, there is a large literature that has investigated the linkages between the fraction of skilled workers and the average wages in a city, and has faced the challenge of separating complementarities from spillover effects.[17]

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[15] Instead of defining skills in terms of educational achievement, we can alternatively use a worker's relative position in the wage distribution. To this end, to test Prediction 2 we plan to also run quantile regressions for the logarithm of hourly wages and evaluate the β's for low quantiles τ's.

$$Quantile^{\tau}(lnw^{u}_{ict}) = \alpha^{\tau} + \beta^{\tau}(CollegeShare)_{ct} + \gamma^{\tau}_{t} + \gamma^{\tau}_{c} + \delta^{\tau}x_{ict} + \varepsilon^{\tau}_{ict}$$

[16] The average college share across cities and years is 0.24, with a standard deviation of 0.08.

[17] Recently, Moretti (2004a, 2004b) has proposed to separately estimate the effect of the college share on the wages of different education groups based on the intuition that finding a positive effect on college graduates wages must be evidence of human capital spillovers, because for this group it is more plausible to rule out the confounding effect arising from production complementarities.

As a way of distinguishing the effects of different hypotheses, we investigate the impact of the share of skilled workers on the structure of employment. If the consumption-driven mechanism we have in mind plays a role, we should see more low-skill employment in non-tradable sectors in cities with more skilled workers (Prediction 1). If the wage effects were due to complementarity/externality effects, then we would expect a higher employment concentration in those sectors where the effects through the production function are larger. As shown in Table 6, the presence of more skilled workers in a city is associated with a higher fraction of low-skill workers in non-traded sectors and a lower share in traded sectors. These effects are strongest for high-school drop-outs, weaker but still present for high-school graduates, while they either disappear or have the opposite sign for higher educated groups. These results are consistent with our consumption-driven hypothesis, while they would only be consistent with complementarity/externality effects if the latter were larger in the non-traded sectors than in the traded. We argue this is not likely to be the case. On average, the fraction of college graduates in the total employment in non-traded sectors is 13 percent in 1980, 17 percent in 1990, 19 percent in 2000 and 23 percent in 2005. The corresponding average figures for other sectors are 21, 25, 30 and 36 percent. The fact that the share of college graduates is lower in non-traded sectors than in the rest of the economy should predict weaker complementarity effects or human capital spillovers.

Identification issues

In a cross-city analysis like the one we run, the source of identification consists in the comparison of wages and employment distributions of otherwise similar unskilled individuals who work in cities with different shares of skilled workers in the labor force, and different wage levels for them. A key issue in this comparison is the presence of unobservable city characteristics that might be correlated with both our explanatory variable—the share of high-skill workers—and with the low-skill labor outcomes we would like to explain. In this section we elaborate on this point, and we show which are the identification issues we are most concerned with, and how we are addressing them.

Differences in the relative number of skilled workers across cities are due to differences in the relative supply and/or the relative demand of skilled workers in a city.

Depending on which effect prevails, we expect different average wages for the high-skill workers. Consider the case of two cities, A and B, observed in a certain year. The relative supply of skilled workers will be higher in A than in B if city A has a higher level of local amenities that are valued by skilled workers, but not by unskilled workers. Because of the amenity, skilled workers would in this case accept lower wages in city A, so that the net effect on the demand for domestic help would be uncertain. This mechanism would generally work against finding the consumption effect we are interested in detecting.

On the other side, the relative demand of skilled workers will be higher in A than in B if skilled workers are particularly productive in A, because, for example, of technological differences. The effect on the demand for non-traded services is in this case positive, because of both the increase in the share of skilled workers and the increase in their wage.

In both cases, some of the association between the share of skilled workers in the city and the wages of low-skilled workers might arise from production complementarities or human capital spillovers. As long as the effects mediated through the production side of the market are expected to be stronger in the traded sector than in the non-traded sector, however, our finding of a higher concentration of low-skill employment in non-traded sectors in more-skilled cities is only consistent with a consumption effect.

As a way to further control for the effects of the presence of high-skilled workers that are due to production complementarities or spillovers, we also plan to run specifications that include direct controls for the demand for high-skilled workers that would be predicted on the base of a city industry mix in a base year. In particular, we plan to include in the estimating equation a measure of labor demand shifts that is a variant of the fixed-coefficient measures of demand often used in the literature (Katz and Murphy, 1992; Bound and Holzer, 2001; Moretti, 2004b). We propose to calculate the demand shift for the skilled group *s* in city *c* as:

$$\overline{D}_{sc} = \sum_{k} \gamma_{sck} \eta_{ck} \tag{7}$$

where γ_{sck} represents the share of skill group *s* in metro area *c* employed in industry *k* in a certain base year, while η_{ck} represents the growth rate of industry *k* in area *c*. In practice, by including this index, we should be able to separately control for variation in the share of skilled workers in a city arising from shocks that affect the relative demand of skilled workers because of a city historical industrial structure.

VI. Wage inequality changes

In this section we explore whether the consumption-driven mechanism proposed in this paper might improve our understanding of the phenomenon of wage inequality in the United States. Our approach points to a neglected dimension of the demand structure that might drive the low-skill wage dynamics. It unveils a mechanism through which rising wage inequality at the top of the distribution might feedback into lower wage inequality at the bottom: where and when wage growth is the highest for high-skilled workers, the demand for non-traded goods should increase the most, exerting an upward pressure on the wages of the workers that perform these jobs, who are predominantly low-skilled.

We explore whether this mechanism accounts for differences across cities in the wage growth in the lower tail of the wage distribution. We do so by studying the relationship between relative wage growth at the top of the wage distribution and relative wage growth at the bottom (both respect to the growth at median) across cities from 1980 to 2005.

Cross-city analysis

We use data from the 1980, 1990 and 2000 censuses and the 2005 American Community Survey to calculate changes in log real hourly wages (*lw*) by percentile from 1980 to 1990, from 1990 to 2000 and from 2000 to 2005. Earnings growth figures are calculated by city.[18] Let $Q_{ct}(\tau)$ for $\tau \in (0,1)$ denote the 100τ-quantile of the distribution of log wages (*lw*) in city c and year t. We calculate earnings growth at percentile 100τ in city c between $t-1$ and t ($\Delta Q_{ct}(\tau)$) by estimating the coefficient $\beta(c,\tau)$ of the following linear quantile specification:

(9) $$Quantile(lw|c,\tau) = \alpha(c,\tau) + \beta(c,\tau)\, year_t$$

[18] We restrict the analysis to the 242 MSAs that are defined in the entire period.

where $year_t$ is an indicator that equals 1 if the observation refers to year t, and zero otherwise. Individual hourly wages are weighted by the product of IPUMS frequency weights and the number of hours worked in the previous year.

Let $\Delta \underline{Q}_{ct} = \Delta Q_{ct}(\underline{\tau}) - \Delta Q_{ct}(.5)$ and $\Delta \overline{Q}_{ct} = \Delta Q_{ct}(\overline{\tau}) - \Delta Q_{ct}(.5)$, for $\underline{\tau} < 0.5 < \overline{\tau}$. $\Delta \underline{Q}_{ct}$ and $\Delta \overline{Q}_{ct}$ represent respectively changes in log wages at percentiles $\underline{\tau}$ and $\overline{\tau}$ relative to changes in the median log wage.

A positive correlation between $\Delta \underline{Q}_{ct}$ and $\Delta \overline{Q}_{ct}$ is an indication that in cities and years where relative earnings growth has been higher at the top, it has also been higher at the bottom. The consumption mechanism we have described in the previous section suggests that this positive relationship, if any, should be stronger where a higher fraction of low-skill workers is employed in non-traded activities. We explore this mechanism by specifying a model for $\Delta \underline{Q}_{ct}$ where the effect of $\Delta \overline{Q}_{ct}$ is allowed to vary with the share of low-skill workers employed in non-traded activities in city c in a base year ($NT\_Share_{c(t-1)}$).

Table 7 reports OLS estimates for the coefficients on $\Delta \overline{Q}_{ct}$, $NT\_Share_{c(t-1)}$ and the interaction between these two variables for the case $\underline{\tau} = .15$, $\overline{\tau} = .85$. $NT\_Share_{c(t-1)}$ is calculated as the fraction of wage-earners employed in non-traded activities among those with hourly wages below the 15th quantile. Employment shares refer to the base year for each period. Non-traded status is assigned either on the base of industry (column 2) or occupation (column 3). To ensure that the results are not confounded by differences across cities and over time in the composition of the workforce, we calculate wage growth for hourly wages at different percentiles after the effect of observable personal characteristics is controlled for. This amounts to estimating log wage percentiles from equation (9) augmented for a set of individual characteristics: gender, race (white or else), Hispanic origin, foreign-born status, age (quartic specification) and education (less than a high school degree, high school degree, some college education, college degree).

While the relationship between relative wage growth at the top and the bottom of the distribution is not statistically different from zero in the full sample of cities and periods (column 1), we find evidence that wage growth at the top is positively associated with wage growth at the bottom in cities with a higher proportion of low-wage workers employed in non-traded activities (columns 2 and 3). For example, using the point estimates in column 2 as a reference, in cities with *NT_Share* in the base year larger than .3, there is a positive and statistically significant relationship between wage growth at the top and at the bottom. In particular, in a city where *NT_share* is equal to .5, a 10 percent increase in the relative wage growth at the 85th percentile with respect to the median is associated with around a 4.5 percent increase in the relative wage growth at the 15th percentile with respect to the median. The magnitude of the estimated association is even larger when employment shares in non-traded sectors are calculated on the base of a worker's occupation (column 3).

An alternative explanation to the consumption mechanism we are interested in detecting is an association between high-skill and low-skill workers' wage growth that is due to production complementarities or human capital externalities. Column 4 of Table 7 presents a piece of information relevant to distinguish between the two hypotheses. When interacting the top-end relative wage growth with the share of college graduates in the base year, we do not find evidence of a positive relationship between wage growth at the two ends of the distribution.

VII. Conclusions

This paper starts by documenting how, over time, the employment of low-skill workers in the United States has come to be increasingly concentrated in non-traded sectors, such as sale jobs and personal services. Manning (2004) documents a similar tendency in the United Kingdom. These trends are not at all surprising in light of evolving globalization: low-skill labor is still much cheaper in developing countries, and the costs of large scale international trade of goods and services have been steadily falling over time.

If low-skill workers in developed economies are increasingly employed in non-traded tasks, then their employment opportunities and their earnings are increasingly dependent on physical proximity to high-wage earners, since the latter are likely to generate a substantial part of the demand of these tasks. We show this dependence with the use of a simple theoretical model for a local economy with both a traded and a non-traded sector: as long as we model the non-traded sector as providing services that can alternatively be produced at home, and we assume workers with different skills in the production of the traded good to be equally effective in home production, the demand of non-traded goods in a city is found to be generated by high-skilled workers, and to be increasing in their number and their wage.

On household expenditure data, we indeed find that consumption of non-traded services in the United States primarily consists of expenditures by households headed by high-skilled individuals. We also find that the wage-income elasticity of consumption of non-traded services is very high (around one) among households in top deciles of the wage-income distribution, and we interpret this result as evidence against the potential concern that, beyond a certain earnings threshold, consumption of non-traded services might level off.

The consumption-driven mechanism we stress in this paper predicts higher employment and earnings opportunities for low-skilled workers in cities where the number of high-skilled workers is higher. This is a channel already highlighted in Manning (2004), but otherwise largely neglected in the literature, which has focused instead on the linkages between skilled and unskilled workers that arise from production complementarities or human capital spillovers. We find that average wages for low-skill workers are higher in cities with higher shares of skilled workers. In favor of these effects being at least partly mediated through consumption rather than production, we find that in cities with a higher share of skilled workers, low-skill employment is more concentrated in non-traded activities.

We devote the last part of the paper to explore more carefully the linkages between the evolution of wages at the top and the bottom of the distribution. The consumption mechanism we have presented predicts that where and when wage growth is the highest for high-skilled workers, the demand for non-traded goods should increase the most, and this should exert an upward pressure on the wages of the workers that perform these jobs, who are predominantly low-skilled. We find evidence in favor of this link on data on cross-city wage growth by percentile in three time periods (1980-1990, 1990-2000, 200-2005).

In light of the supporting evidence in favor of a consumption-driven explanation for some of the dynamics of low-skill labor outcomes, we conclude that this approach might contribute to the literature on the evolution of wage inequality in the United States. The more recent evidence shows that in the last 15 years, as opposed to previous periods, wage growth has been higher at the bottom than in the middle of the distribution (Autor, Katz and Kearney, 2006). The recent observed twisting at the bottom of the distribution might be at least partly due to the increasing demand for non-traded tasks generated by the steady growth of wages of high-skilled workers observed over the past three decades. This "consumption" explanation has then the potential advantage of overcoming the timing inconsistencies of explanations for wage inequality that focus on the effects of technological change.

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Table 1
Employment shares in different sectors by education and year, 1980-2005

	1980	1990	2000	2005	1980-2005 Change
High-school drop-outs					
NT (sector)	0.31	0.37	0.40	0.40	0.09
TR	0.40	0.33	0.27	0.25	-0.15
CO	0.09	0.10	0.14	0.18	0.09
WT	0.11	0.11	0.10	0.10	-0.01
FI	0.02	0.02	0.02	0.02	0.00
BS	0.01	0.02	0.02	0.02	0.01
PA	0.03	0.02	0.01	0.01	-0.02
ED	0.03	0.03	0.02	0.02	-0.01
NT (occupation)	0.32	0.37	0.39	0.40	0.08
High-school graduates					
NT (sector)	0.29	0.34	0.36	0.39	0.10
TR	0.32	0.28	0.24	0.21	-0.12
CO	0.07	0.08	0.10	0.12	0.05
WT	0.15	0.14	0.14	0.13	-0.02
FI	0.06	0.06	0.05	0.05	-0.01
BS	0.03	0.03	0.04	0.04	0.01
PA	0.05	0.04	0.04	0.04	-0.01
ED	0.03	0.03	0.03	0.03	0.00
NT (occupation)	0.25	0.30	0.32	0.35	0.09
Some college					
NT (sector)	0.32	0.34	0.37	0.40	0.08
TR	0.24	0.20	0.17	0.15	-0.09
CO	0.05	0.06	0.07	0.07	0.02
WT	0.14	0.14	0.13	0.13	-0.02
FI	0.08	0.09	0.08	0.08	0.00
BS	0.05	0.06	0.07	0.07	0.02
PA	0.07	0.07	0.07	0.07	-0.01
ED	0.05	0.04	0.04	0.04	0.00
NT (occupation)	0.25	0.28	0.29	0.31	0.06
College graduates					
NT (sector)	0.24	0.26	0.27	0.28	0.04
TR	0.18	0.16	0.14	0.12	-0.06
CO	0.03	0.03	0.02	0.03	0.00
WT	0.08	0.09	0.08	0.08	0.00
FI	0.08	0.10	0.09	0.10	0.02
BS	0.10	0.12	0.15	0.14	0.05
PA	0.07	0.06	0.06	0.07	-0.01
ED	0.22	0.18	0.17	0.17	-0.05
NT (occupation)	0.13	0.16	0.15	0.17	0.03

Notes: Sample restricted to workers (for salary or self-employed) 16-65 years old. Figures are weighted. Legend: NT (sector): clearly non-traded; TR: clearly traded; CO: construction; WT: wholesale, transport, utilities; FI: financial services; BS: business services; PA: Public Administration; ED: education (see Tables A1-A2). Source: 1980-1990-2000 censuses and 2005 ACS file.

Table 2
Employment shares in different sectors by wage percentile and year, 1980-2005

	1980	1990	2000	2005		1980	1990	2000	2005
Wage percentiles									
Below 10					*Between 10 and 20*				
NT (sector)	0.48	0.57	0.56	0.60	NT (sector)	0.47	0.50	0.52	0.53
TR	0.23	0.18	0.15	0.14	TR	0.24	0.20	0.17	0.16
CO	0.04	0.04	0.05	0.06	CO	0.04	0.05	0.05	0.07
Other	0.25	0.21	0.24	0.21	Other	0.26	0.25	0.26	0.24
NT (occupation)	0.45	0.52	0.51	0.55	NT (occupation)	0.42	0.44	0.44	0.47
Between 20 and 30					*Between 30 and 40*				
NT (sector)	0.40	0.43	0.45	0.44	NT (sector)	0.33	0.37	0.39	0.41
TR	0.25	0.21	0.19	0.20	TR	0.27	0.22	0.20	0.17
CO	0.04	0.05	0.06	0.06	CO	0.05	0.06	0.07	0.08
Other	0.31	0.31	0.30	0.30	Other	0.35	0.35	0.35	0.34
NT (occupation)	0.33	0.35	0.36	0.36	NT (occupation)	0.26	0.29	0.30	0.31
Between 40 and 50					*Between 50 and 60*				
NT (sector)	0.30	0.32	0.34	0.36	NT (sector)	0.26	0.28	0.30	0.31
TR	0.28	0.23	0.20	0.17	TR	0.30	0.24	0.20	0.18
CO	0.05	0.06	0.07	0.07	CO	0.06	0.06	0.07	0.07
Other	0.37	0.39	0.39	0.39	Other	0.39	0.41	0.42	0.43
NT (occupation)	0.23	0.25	0.25	0.26	NT (occupation)	0.20	0.22	0.21	0.23
Between 60 and 70					*Between 70 and 80*				
NT (sector)	0.22	0.25	0.27	0.28	NT (sector)	0.17	0.21	0.24	0.25
TR	0.33	0.25	0.20	0.17	TR	0.34	0.26	0.21	0.17
CO	0.06	0.06	0.07	0.07	CO	0.05	0.06	0.06	0.07
Other	0.40	0.44	0.46	0.48	Other	0.44	0.47	0.49	0.51
NT (occupation)	0.18	0.19	0.18	0.19	NT (occupation)	0.16	0.17	0.16	0.17
Between 80 and 90					*Between 90 and 100*				
NT (sector)	0.12	0.18	0.21	0.22	NT (sector)	0.12	0.20	0.16	0.21
TR	0.35	0.27	0.22	0.19	TR	0.33	0.21	0.26	0.19
CO	0.07	0.06	0.06	0.06	CO	0.08	0.04	0.06	0.04
Other	0.45	0.48	0.51	0.53	Other	0.47	0.54	0.52	0.56
NT (occupation)	0.13	0.15	0.15	0.15	NT (occupation)	0.14	0.16	0.17	0.16

Notes: Sample restricted to individuals employed for salary 16-65 years old. Earnings percentiles based on hourly wages, defined as annual wages divided by the product between number of weeks worked and usual number of hours worked per week. Figures are weighted. Other (sectors) include: wholesale, transport and utilities; financial services; business services; public administration; education.
Source: 1980-1990-2000 censuses and 2005 ACS file.

Table 3
Hourly wages (in $1989) by educational level and sector of employment, 1980-2005

		1980	1990	2000	2005	NT/TR wage gap 1980	NT/TR wage gap 2005
High-school drop-outs							
Non-traded	mean	7.5	6.9	7.0	6.7	0.73	0.85
	median	6.3	5.7	5.6	5.5	0.69	0.81
	10th percentile	2.8	2.9	2.8	2.8	0.66	0.77
	90th percentile	13.2	12.0	11.6	11.4	0.75	0.88
Traded	mean	10.3	9.0	8.5	7.9		
	median	9.0	7.7	7.1	6.8		
	10th percentile	4.3	3.8	3.7	3.6		
	90th percentile	17.5	15.4	14.2	12.9		
High-school graduates							
Non-traded	mean	8.7	8.1	8.4	8.3	0.73	0.78
	median	7.4	7.0	7.1	7.1	0.68	0.75
	10th percentile	4.0	3.5	3.7	3.6	0.75	0.73
	90th percentile	14.6	13.7	13.7	13.7	0.76	0.79
Traded	mean	12.0	10.9	10.7	10.7		
	median	11.0	9.6	9.5	9.5		
	10th percentile	5.4	4.8	5.0	4.8		
	90th percentile	19.3	18.1	17.5	17.5		
Some college							
Non-traded	mean	9.6	9.5	10.0	10.2	0.71	0.76
	median	8.2	8.2	8.5	8.6	0.67	0.74
	10th percentile	4.2	3.8	4.2	4.0	0.69	0.69
	90th percentile	15.6	16.2	16.7	17.6	0.73	0.80
Traded	mean	13.5	13.1	13.0	13.4		
	median	12.3	11.9	11.4	11.6		
	10th percentile	6.1	5.8	5.9	5.8		
	90th percentile	21.4	21.2	21.1	22.0		
College graduates							
Non-traded	mean	13.6	14.9	16.8	17.4	0.67	0.73
	median	11.2	12.0	12.8	13.4	0.62	0.68
	10th percentile	5.3	5.5	5.9	5.9	0.62	0.66
	90th percentile	23.0	25.0	28.5	32.9	0.70	0.70
Traded	mean	20.3	20.1	21.7	23.9		
	median	18.0	17.4	18.1	19.8		
	10th percentile	8.5	8.6	8.5	8.9		
	90th percentile	32.9	32.7	35.2	46.8		

Notes: Sample restricted to men 16-65 years old, not enrolled in school, reporting non-zero wage income over the year before the interview. Non-traded/traded status is assigned based on industry of employment (see Table A1). Statistics for hourly wages in other sectors not reported. Figures are weighted. Source: 1980-1990-2000 censuses and 2005 ACS file.

Table 4

Fraction of Total Expenditure in Non-traded Services that accrue to different educational groups, by year

1996

	Meals away from Home	Repair and Maintenance	Auto repair Services	Delivery Services	City Transportation
HSD	9.9	13.6	15.4	2.5	14.4
HSG	23.2	20.9	17.3	10.8	23.4
CD	29.0	28.0	37.4	9.4	26.0
CG	37.9	37.5	29.9	77.3	36.2

	House Keeping	Babysitting	Care for elderly	Personal Care	*Total NT Services*
HSD	6.0	5.1	5.7	9.3	*11.0*
HSG	21.9	21.3	8.0	24.7	*21.7*
CD	21.2	37.0	14.6	28.3	*29.6*
CG	50.8	36.6	71.7	37.7	*37.7*

2004

	Meals away from Home	Repair and Maintenance	Auto repair Services	Delivery Services	City Transportation
HSD	7.3	6.4	9.2	1.8	9.5
HSG	21.5	19.4	25.4	11.2	16.6
CD	30.5	31.4	29.5	12.8	23.4
CG	40.6	42.8	35.8	74.2	50.5

	House Keeping	Babysitting	Care for elderly	Personal Care	*Total NT Services*
HSD	6.2	6.5	0.0	5.7	*7.2*
HSG	16.2	20.4	48.6	17.7	*21.1*
CD	28.7	36.9	4.1	27.8	*30.1*
CG	48.9	36.2	47.3	48.7	*41.5*

Notes: Figures represent the percentage of total expenditure in each service category that accrue to different educational groups. Percentages sum to 100 vertically.
Legend: HSD: High-school drop-outs; HSG: High-school graduates; CD: College drop-outs (Some College); CG: College Graduates
For a list of non-traded expenditure items included in specific categories, see Table A3.
Source: CEX Diary Surveys, 1996 and 2004.

Table 5
The impact of the share of college graduates in a city on wage of education groups, 1980-2005

	(1)	(2)	(3)
High-school drop-outs	0.382***	0.637***	0.943***
	(0.073)	(0.177)	(0.204)
High-school graduates	0.532***	0.500***	0.556***
	(0.055)	(0.105)	(0.136)
Some college	0.634***	0.439***	0.548***
	(0.066)	(0.107)	(0.139)
College graduates	0.787***	0.398***	0.392**
	(0.084)	(0.128)	(0.157)
Year effects	Yes	Yes	Yes
City effects	No	Yes	Yes
Other Controls	No	No	Yes

Notes: Each entry is a separate regression. Dependent variables are education-city-year average log wages in a sample restricted to people 16-64 years old. Entries are the coefficients on the fraction of college graduates among the population in the city 16-64 working for salary. City-year controls included in specifications in column (3) are: the proportion of women, blacks, Hispanics, foreign-born, foreign-born arrived in the United States 5 or fewer years ago. Education-city-year controls are: the fraction aged 18-24, 25-34, 35-44 and 44-55. Each regression has 1,109 observations. Standard Errors (in parentheses) are corrected for clustering across cities.
Source: 1980-1990-2000 censuses and 2005 ACS file.

Table 6

The impact of the share of college graduates in a city on the structure of employment of education groups, 1980-2005

	(1)	(2)	(3)
High School Dropouts			
Non-traded	0.380***	0.425***	0.422***
	(0.040)	(0.103)	(0.134)
Traded	-0.527***	-0.358***	-0.476***
	(0.053)	(0.109)	(0.150)
Construction	0.108***	0.092	0.091
	(0.028)	(0.077)	(0.112)
Wholesale/Transport/	-0.063***	-0.082	-0.153*
Utilities	(0.018)	(0.058)	(0.081)
Business Services	0.014	-0.003	-0.045
	(0.011)	(0.029)	(0.046)
Financial Services	0.026***	0.021	0.025
	(0.006)	(0.022)	(0.032)
Public Administration	0.019	-0.027	0.003
	(0.014)	(0.036)	(0.052)
Education	0.068***	0.002	0.090**
	(0.012)	(0.029)	(0.039)
High School Graduates			
Non-traded	0.157***	0.201***	0.288***
	(0.025)	(0.070)	(0.082)
Traded	-0.408***	-0.218***	-0.371***
	(0.041)	(0.067)	(0.094)
Construction	0.061***	0.123***	0.104**
	(0.014)	(0.033)	(0.042)
Wholesale/Transport	-0.016	-0.039	-0.063
Utilities	(0.015)	(0.036)	(0.050)
Business Services	0.075***	0.028	0.023
	(0.007)	(0.022)	(0.032)
Financial Services	0.085***	0.026	0.004
	(0.009)	(0.022)	(0.027)
Public Administration	-0.040	-0.174***	-0.111*
	(0.032)	(0.063)	(0.063)
Education	0.075***	0.039*	0.077***
	(0.011)	(0.021)	(0.029)

(Table 6 continue)

	(1)	(2)	(3)
<u>*College Dropouts*</u>			
Non-traded	0.037	0.056	0.125
	(0.025)	(0.065)	(0.082)
Traded	-0.224***	-0.102*	-0.197**
	(0.034)	(0.060)	(0.080)
Construction	0.010	0.072**	0.105***
	(0.010)	(0.032)	(0.039)
Wholesale/Transport	0.005	-0.050	-0.057
Utilities	(0.014)	(0.035)	(0.056)
Business Services	0.133***	0.061**	0.016
	(0.012)	(0.030)	(0.045)
Financial Services	0.085***	0.114***	0.137***
	(0.013)	(0.030)	(0.039)
Public Administration	-0.092***	-0.177**	-0.165**
	(0.031)	(0.071)	(0.069)
Education	0.053***	0.011	0.026
	(0.013)	(0.024)	(0.032)
<u>*College Graduates*</u>			
Non-traded	-0.135***	-0.121*	-0.236**
	(0.028)	(0.072)	(0.100)
Traded	0.001	-0.031	-0.071
	(0.036)	(0.064)	(0.093)
Construction	-0.022***	0.036*	0.080***
	(0.006)	(0.021)	(0.030)
Wholesale/Transport	-0.005	0.062**	0.082**
Utilities	(0.011)	(0.030)	(0.041)
Business Services	0.308***	0.198***	0.219***
	(0.019)	(0.040)	(0.051)
Financial Services	0.150***	0.149***	0.095
	(0.023)	(0.041)	(0.064)
Public Administration	-0.068**	-0.176***	-0.165***
	(0.031)	(0.049)	(0.062)
Education	-0.287***	-0.107*	-0.056
	(0.037)	(0.060)	(0.072)
Year effects	Yes	Yes	Yes
City effects	No	Yes	Yes
Other Controls	No	No	Yes

Notes: Each entry is a separate regression. Dependent variables are education-city-year employment shares in each sector. Entries are the coefficients on the fraction of college graduates among the population 16-64 in the city working for salary. City-year controls included in specifications in column (3) are: the proportion of women, blacks, Hispanics, foreign-born, foreign-born arrived in the United States 5 or fewer years ago. Education-city-year controls are: the fraction aged 18-24, 25-34, 35-44 and 44-55. Each regression has 1,109 observations. Standard Errors (in parentheses) are corrected for clustering across cities.

Table 7
Determinants of Relative Wage Growth at the bottom of the distribution

	(1)	(2)	(3)	(4)
Regressors				
$[\Delta Q_{ct}(.85) - \Delta Q_{ct}(.5)]$	.035	-.689***	-.931***	.111
	(.048)	(.269)	(.332)	(.325)
NT^{I}_Share		.025		
		(.042)		
$[\Delta Q_{ct}(85) - \Delta Q_{ct}(50)]$ * NT^{I}_Share		2.223***		
		(.840)		
NT^{O}_Share			-.014	
			(.059)	
$[\Delta Q_{ct}(85) - \Delta Q_{ct}(50)]$ * NT^{O}_Share			3.701***	
			(1.26)	
CollegeShare				-.018
				(.031)
$[\Delta Q_{ct}(85) - \Delta Q_{ct}(50)]$ * CollegeShare				-.291
				(.589)

Notes: The dependent variable is the change in log real hourly wages at the 15th percentile of the wage distribution net of change in log real hourly wages at the median. 242 MSA's and three periods (1980-1990, 1990-2000, 2000-2005) are considered, for a total of 726 observations in each regression. The explanatory variables include the change in log real hourly wages at the 85th percentile of the wage distribution net of changes in log real hourly wages at the median wage percentiles $[\Delta Q_{ct}(85) - \Delta Q_{ct}(50)]$, the share of college graduates in a city in the base year (1980, 1990 and 2000 respectively) and the share of workers with wages below the 15th percentile employed in non-traded activities in the base, where non-traded status is assigned based on the industry (NT^{I}*_Share*) or the occupation (NT^{O}*_Share*). All regressions include period fixed effects.
Standard errors (in parentheses) are corrected for clustering across cities.
Source: 1980-1990-2000 censuses and 2005 ACS file.

DATA APPENDIX

1. Processing of Census and ACS Samples

2. Appendix tables

Table A1: *Assigning industries to traded/non-traded status (Census and ACS data)*

Table A2: *Assigning occupations to non-traded status (Census and ACS data)*

Table A3: *Assigning expenditure items to non-traded service categories (CEX data)*

Processing of census and ACS data

We use data extracted from the Integrated Public Use Microdata Series (IPUMS) files (Ruggles et al., 2004). In particular, we use the census 1% extract for years 1980 and 1990, the census 5% extract for year 2000, and the 2005 sample of the American Community Survey (which is a 1-in-100 national random sample of the population. In all samples, the smallest identifiable geographic unit is the PUMA, containing at least 100,000 persons. To obtain comparable sample sizes for different years, we extract a 1-in-5 random sample of the census 5% extract for year 2000.

We restrict the samples to respondents ages 16 through 65 who were currently employed in the civilian labor force at the time of the survey, were not unpaid family workers, and who did not live in group quarters.

Employment figures include those self-employed. Wage figures are obtained on samples that further exclude the self-employed and those with missing hours (usual hours worked) or weeks worked in the previous year. Hourly wages are obtained dividing wage and salary earnings in the previous year by annual hours (weeks times usual hours per week). We drop the bottom 1 percent of hourly earners in each year, and multiply hourly wages of top-coded earners by 1.5. To prevent part-time workers from having higher hourly wages than full-time workers, as in Autor, Katz and Kearney (2007), we truncate the maximum hourly wage to 1.5 times the maximum annual income amount divided by 1,250 (35 hours per week for 50 weeks).

All figures and estimates are weighted by the product of census person weights (frequency weights) and a measure of annual labor supply (weeks times usual hours per week).

Wages are deflated using the Consumer Price index and expressed in $1989.

Table A1
Assigning <u>*industries*</u> *to traded/non-traded status*

Category (IPUMS variable OCC1990)	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**	**NT**
Taxi and limousine service	**402**	**NT**
Communications	440-442	WT
Utilities and Sanitary Services	450-472	WT
Wholesale Trade	500-571	WT
Retail Trade	**580-691**	**NT**
Finance, insurance and real estate	700-712	FI
Business and Repair Services	721, 731-732, 741	BS
Except: **Services to buildings**	**722**	**NT**
Detective and Protective Services	**740**	**NT**
Automotive Rental, Leasing, Repair	**742-751**	**NT**
Other Repair Services	**752-760**	**NT**
Personal Services	**761-791**	**NT**
Entertainment and Recreation services	**800-810**	**NT**
Health and Social Services	**812-840,852,861-881**	**NT**
Legal Services	841	BS
Educational Services	842-851, 860	ED
Engineering, Management & other 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 Census years 1980, 1990 and 2000, and for the American Community Service data from 2001 on. 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: NT: clearly non-traded; TR: clearly traded; CO: construction; WT: wholesale, transport and utilities; FI: financial services; BS: business services; PA: Public Administration; ED: education.

Table A2
Assigning <u>occupations</u> to non-traded status

Category (IPUMS variable OCC1990)	Codes
Sales occupations	243 - 283
Information clerks	316 - 323
Private household occupations	405 - 407
Protective service occupations	415 - 427
Food preparation and service occupations	434 – 469
Food preparation and service occupations	434 - 444
Health service occupations	445 - 447
Cleaning and building service occupations (except households)	448 - 455
Personal service occupations	456 - 465
Gardeners	486
Animal caretakers	487
Laundry workers	748
Roasting and baking machine operators	763
Washing, cleaning and pickling machine operators	764
Bus & taxi cab drivers	808 - 813
Freight, stock and material handlers	875 - 889

Notes: The codes refer to the IPUMS variable OCC1990, which is a modified version of the 1990 Census Bureau occupational classification scheme that provides a consistent set of occupations codes for Census years 1980, 1990 and 2000, and for the American Community Service data from 2001 on.
Specifics on the methods applied to insure consistency can be found in the BLS Working Paper "Proposed Category System for 1960-2000 Census Occupations", Peter B. Meyer and Anastasiya M. Osborne, U.S. Bureau of Labor Statistics, Working Paper 383, September 2005, available at http://usa.ipums.org/usa/chapter4/OCCBLS_paper.pdf

Table A3

Assigning expenditure items to non-traded service categories

Category	Universal Classification code (UCC): 1996 files
Food away from Home	190110 Lunch at restaurants, cafes, etc... 190210 Dinner at restaurants, cafes, etc... 190310 Snacks and non alcoholic beverages, including tip 190320 Breakfast and brunch at restaurants, cafes, etc... 190901 Food or board, at school and rooming/boarding houses
Drink away from Home	200510 Beer and ale away from home 200520 Wine away from home 200530 Other alcoholic beverages away from home
Repair and Maintenance	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... 230140 Repair disposal, dishwasher, range hood 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, interior decorating, and carpet and upholstery cleaning services 340410 Gardening and lawn care services, such as mowing, tree services, fertilizing, and yard work

(Table A3, continue)

	340510 Moving, storage, and freight express 340520 Non-clothing household laundry or dry cleaning not coin operated 440210 Apparel laundry and dry cleaning not coin operated
Care of the elderly	340906 Care for invalids, convalescents, handicapped or elderly persons in the CU
Auto Repair Services	490000 Miscellaneous auto repair and servicing 490110 Body work, painting, repair and replacement of upholstery, vinyl/convertible top, and glass 490211 Clutch and transmission repair 490212 Drive shaft and rear-end repair 490220 Brake work, excluding brake adjustment 490231 Steering or front end repair 490232 Cooling system repair 490311 Motor tune-up 490312 Lubrication and oil changes 490313 Front end alignment, wheel balance and rotation 490314 Shock absorber replacement 490315 Brake adjustment 490316 Gas tank repair and replacement 490411 Exhaust system repair 490412 Electrical system repair 490413 Motor repair and replacement
City Transportation	530210 Intercity bus fares 530311 Intracity mass transit fares 530412 Taxi fares 530510 Intercity train fares 530901 Ship fares 530902 Private school bus 530903 Car/van pool & non-motorized transportation
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 1996 CEX Expenditure files. Some UCC have been added over time. For example, the 2004 classification includes more detailed codes on meals away from home.