Exchange Rates and Wages

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Abstract

Globalization exposes labor markets to international fluctuations. Using Current Population Survey data for the period 1976 through 2000, we show that exchange rate movements influence the wages of U.S. workers across manufacturing and non-manufacturing industries. When averaged across appreciation and depreciation periods, and across all workers, the overall impact of exchange rate movements on wages appears modest. However, for specific groups of workers the wage effects can be very large. Moreover, these effects are asymmetric across appreciation and depreciation periods, and across workers who remain employed versus those that transition between jobs. The least educated workers experience significant wage declines during dollar appreciations and at times of job transitions. By contrast, the most educated workers who remain with their same employer experience wage gains when the dollar appreciates. We find that the effects of exchange rates on the incidence of job changing are secondary in importance to the effects via the wage consequence of job changing. Our analysis shows that more than half of the change in the skill premia in the labor market over the period from 1980 to 1995 can be attributed to changes in the strength of the dollar.

JEL codes: F31, F4, J31

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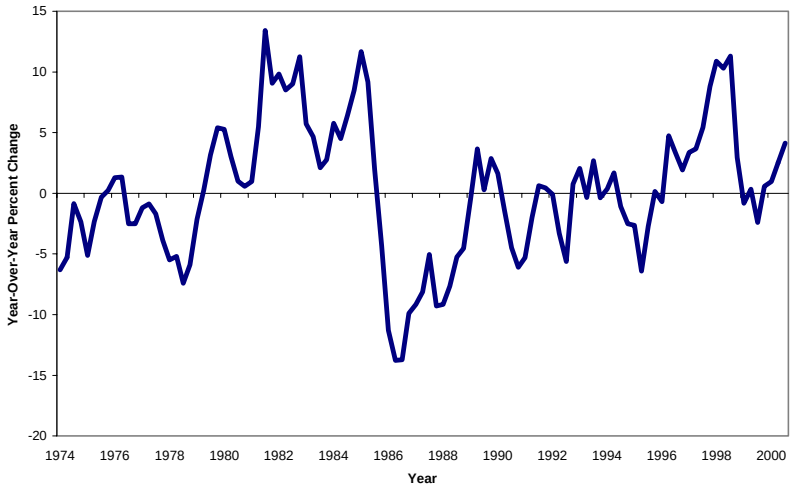
I. Introduction

The continuing globalization of economic activity exposes U.S. workers to international fluctuations. Among these fluctuations are those induced by movements in the value of the dollar: over the past twenty-five years the real exchange value of the dollar has frequently moved by more than five percent per annum, with the dollar experiencing prolonged periods of appreciations and depreciations (Figure 1). An important issue is whether these fluctuations have implications for labor markets. While an evolving literature suggests that the wage effects arising from dollar movements can be significant, there are extensive gaps in our understanding of the incidence of these wage effects on different groups of workers and the transmission mechanisms behind these effects.

Figure 1. Change in the Real Exchange Value of the Dollar



Notes: Quarterly, year-over-year growth rates in the real value of a basket of currencies expressed relative to the U.S. dollar.

In this paper, we confront these issues by examining a rich source of data covering individual workers employed in U.S. manufacturing and non-manufacturing industries. These data, covering male respondents to the March Current Population Survey (CPS) for the period 1977 through 2001, present us with a key advantage over the previous industry-level studies. We are able to control for individual characteristics, to

sort workers by skill levels and to distinguish between workers who stay with their same employer and those who make job transitions. Our analysis of the CPS data complements previous research conducted using industry-level data or plant level information (Branson and Love 1988, Revenga 1992, Gourinchas 1999, Campa and Goldberg 2001), but which cannot track consequences for individual workers. While such studies can identify the net employment and average wage effects arising from dollar fluctuations, they cannot control for resulting changes in the composition of workers across industries, nor can they identify which types of workers are most effected or shed sufficient light on the channels for these effects.

Our in-depth look at individual workers confirms that while the overall elasticity of wages to the exchange rate is quite small, the wage effects for some workers can be quite large. Moreover, wage adjustments to dollar movements are asymmetric: the most pronounced effects occur during periods of real dollar appreciations when the competitive pressures on some U.S. producers intensify. At these times, the wages of the skilled workers who stay on their jobs actually increase significantly. By contrast, the least educated workers who make job transitions during dollar appreciations suffer large real wage losses. The wage losses incurred by low skilled workers during dollar appreciation periods are not recouped during periods when the dollar depreciates. Swings in the value of the dollar are associated with persistent shifts in the skill premia in the labor market.

The process and timing of adjustment that we identify meshes well with recent research on the productivity enhancements, plant survival, and skill-biased product upgrading that occur under conditions of enhanced competitive pressures. Recent research using U.S. plant-level data shows that those plants active in export markets tend to be larger, are more productive, and pay higher wages compared with non-exporting plants in the same industries (Bernard and Jensen 1999). Moreover, under intensified import competition, U.S. manufacturing plants tend to reallocate toward industries and products that are more skill and capital intensive: the least productive firms and those more concentrated in unskilled labor have lower survival rates (Bernard, Jensen, and Schott 2002). This type of adjustment process,[1] as well as quality-ladder upgrading of the

[1] Melitz (2002) provides a theory-based counterpart to these empirical findings. International trade serves

type stressed by Grossman and Helpman (1991), may be triggered under dollar appreciations which reduce foreign costs of production relative to those in the United States. Conversely, protection from trade and reduced competitive pressure shelter the inefficient producers.[2] While the overall effects of an adverse shock may be small, such shocks could have long-lasting effects on specific groups of workers.

The paper is organized as follows. Section II provides theoretical underpinnings for the wage and exchange rate interactions that we examine empirically. Section III describes our data, details the criteria used in choosing the estimation sample and discusses issues involved in constructing our job changing measures. Section IV presents our empirical methodology and results. Section V concludes.

II. Theoretical and Conceptual Underpinnings

We use the concept of a worker's expected wage to motivate a decomposition of the overall wage elasticity into three channels that characterize the transmission mechanism for how exchange rate fluctuations impact the labor market. We express the expected log wage for a worker as the probability that the worker remains with his same employer multiplied by the expected log wage conditional on no job change, plus the probability that the worker changes jobs multiplied by the expected log wage conditional on a job change. Letting P_{it} denote the probability of a worker making a job change and JC_{it} an indicator for a job change, we can express the expected log wage w_{it} for the i^{th} worker in year t as follows:

$$E(w_{it}) = (1 - P_{it})E(w_{it} \mid JC_{it} = 0) + P_{it}E(w_{it} \mid JC_{it} = 1) \qquad (1)$$

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as a catalyst for inter-firm reallocations within an industry and has implications for industry performance and welfare. Using a theoretical model of an industry with heterogeneous firms, Melitz shows that exposure to trade induces the most productive firms to enter export markets (while some less productive firms continue to service domestic markets) and also forces some of the least productive firms to exit. In the case of Korea, exposure to trade forces the least productive firms to exit the industry (Aw, Chung and Roberts 2000). Davis and Haltiwanger (1999) provide complementary results for the United States in the context of oil price shocks. Foster, Haltiwanger, and Krizan (1998) provide an excellent survey of establishment level results on entry and exit effects.

[2] A related literature attempts to determine whether this causality chain actually works, in part, in the opposite direction. Belassa-Samuelson arguments maintain that real exchange rates are endogenous to the relative competitiveness of firms in traded goods industries and nontradables industries at home and abroad. Despite the theoretical appeal of this point, empirical studies continue to have difficulty pinning

Differentiating the expected wage with respect to the log real exchange rate (rer_t) yields equation (2):

$$\frac{\partial E(w_{it})}{\partial rer_t} = \frac{\partial E(w_{it} \mid JC_{it}=0)}{\partial rer} + P_{it}\frac{\partial [E(w_{it} \mid JC_{it}=1) - E(w_{it} \mid JC_{it}=0)]}{\partial rer} + [E(w_{it} \mid JC_{it}=1) - E(w_{it} \mid JC_{it}=0)]\frac{\partial P_{it}}{\partial rer} \quad (2)$$

From equation (2) we observe the three channels through which exchange rates influence the expected wages of individual workers. First, there can be on-the-job wage adjustment, so that exchange rates affect a worker's wage in the absence of any job transitions. Second, given the normal frequency of job transitions, exchange rate movements may affect the wage premium or penalty associated with a job change. Third, given the normal wage premium or penalty for job changing, the frequency of job transitions may be responsive to the exchange rate.[3]

Prior theoretical studies provide guidance on the empirical specifications that are appropriate for estimating the decomposition given in equation (2).[4] The sensitivity of labor demand to exchange rates arises primarily through impacts on producer profits. As exchange rate movements alter the relative costs of domestic and foreign production, producers optimally set prices and production quantities, with associated revenue and profit adjustments. Optimal pricing responses to exchange rates – exchange rate pass through rates – are explored in an industrial organization based literature (Dornbusch 1987, Goldberg and Knetter 1997) and more recently in the context of "new open economy macro" models (Corsetti and Dedola 2002, Bacchetta and van Wincoop 2002). If a depreciation of the home currency leads to local production expansion (as would occur for most home export-oriented and import-competing producers), labor demand

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down the high frequency effects of productivity on exchange rates.

[3]This decomposition links the growing literature on exchange rate effects on job churning (Gourinchas 1999, Goldberg, Tracy, and Aaronson 1999, and Klein, Schuh and Triest 2001) to the literature on exchange rates and wages.

[4] See for example Goldberg and Tracy (2000).

expands, potentially raising wages and changing the probability of worker turnover between firms. Depending on assumptions about the scope of local labor markets and the specificity of human capital, these wage effects can span groups of workers well beyond those directly involved in the trade-exposed industry.[5]

Further relevant insights into this process are generated by dynamic labor demand models.[6] For any employer, wage elasticities and the sensitivity of the turnover probability to exchange rates depend on the size of the adjustment costs associated with hiring and firing workers. These adjustment costs generally rise with the worker's skill level. All else equal, higher skilled workers are likely to have more wage sensitivity and less employment sensitivity in response to shocks. Firms also will be more willing to make costly labor adjustments in response to exchange rate movements that are perceived to be permanent, rather than transitory.

As the first step toward estimating the expected wage decomposition given in equation (2), we specify the evolution of an individual worker's wage. To capture observed heterogeneity in skill levels across workers, we include in the wage specification a set of individual (*i)* characteristics, Z_{it}, containing the worker's education, potential job experience, race and marital status. We interact education and experience so that education is allowed to affect both the level and growth rate of wages. To control for local labor market conditions we introduce regional (*r*) cyclical shocks, V_{rt}, based on Topel (1986). Finally, aggregate macroeconomic variables are captured in Y_{jt}, which contains real GDP growth and industry-specific (*j*) indices for the real exchange rate. The construction of the variables in these control variables is discussed in Section III. To the extent that exchange rate fluctuations may impact industry trends and national or local cycles, by controlling for these factors we will only pick up the direct exchange rate effect on wages.

Our empirical model for individual *i*'s wages can be summarized as follows.

$$\begin{aligned} w_{ijrt} &= Z_{it}\beta + V_{rt}\gamma + Y_{jt}\delta + \nu_{ijrt} \\ \nu_{ijrt} &= \mu_{i1} + \mu_{i2}t + \mu_{j1} + \mu_{j2}t + \mu_{r1} + \mu_{r2}t + \varepsilon_{it} \end{aligned} \tag{3}$$

[5] See Goldberg and Tracy (2000) for empirical measurement of these local spillover effects.
[6] Hamermesh (1993) presents an insightful and extensive overview of dynamic labor demand models.

We consider an error components structure to model the various sources of unobserved heterogeneity at the individual, industry and regional levels. We assume that unobserved individual, industry and regional heterogeneity may affect both the level (μ_1) and growth rate (μ_2) of wages.

Since aggregate industry real wages, industry-specific real exchange rates and real GDP display unit roots, using specification (3) to estimate the wage elasticities would be problematic. We deal with this issue by first-differencing wages across adjacent years to derive one of our key estimating equations:

$$\begin{aligned} \Delta w_{ijrt} &= \Delta Z_{it}\beta + \Delta V_{rt}\gamma + \Delta Y_{jt}\delta + \Delta v_{ijrt} \\ \Delta v_{ijrt} &= \mu_{i2} + \mu_{j2} + \mu_{r2} + \Delta\varepsilon_{it} \end{aligned} \qquad (4)$$

Observe that the individual, industry and region-specific error components from (3) have dropped out of equation (4), with the exception of the time trends, which enter as level effects in the differenced residual.[7] Equation (4) models an individual's wage growth is a function of his education, experience, any change in his marital status, and the growth rates of the macro and regional variables. We control for the industry-specific error component, μ_{j2}, using 2-digit industry fixed-effects and the region-specific error component, μ_{r2}, using Census region fixed-effects. The individual-specific error component, μ_{i2}, which captures unobserved heterogeneity in wage growth rates and the transitory wage shocks, $\Delta\varepsilon_{it}$, remain part of the composite error term.

Our empirical strategy applies variations of specification (4) to estimate the three components of the wage elasticity decomposition given in equation (2). In some specifications we restrict the estimating sample to explore how the wage elasticity varies by occupational category and skill level. To estimate the specific channels through which exchange rate movements influence wages, we include in specification (4) an indicator JC_{it} for whether a worker changes jobs over the two-year period, and we interact this indicator with the change in the industry-specific exchange rate, Δrer_{jt}. We write this expanded specification as follows.

[7] In particular, first-differencing further controls for worker skill differences since the individual specific

$$\Delta w_{ijrt} = \Delta Z_{it}\beta + \beta_c JC_{it} + \Delta V_{rt}\gamma + \gamma_r \Delta rer_{jt} + \gamma_{cr} JC_{it}\Delta rer_{jt} + \Delta Y_t\delta + \Delta v_{ijrt} \qquad (5)$$

Using specification (5), we jointly estimate the elasticities with respect to exchange rates of wage growth for workers who do not change jobs, γ_r , the average wage growth differential between job-changes and job-stayers, β_c, and the impact of the exchange rate on the wage consequence of job-changing, γ_{cr}. We further generalize specification (5) to allow for asymmetric exchange rate effects of dollar appreciations and depreciations. In our section on Robustness Tests, we briefly discuss a range of additional specifications that we test.

III. The Data

A. CPS Data. The main data for our analysis consist of characteristics of individual workers drawn from the March CPS surveys from 1977 through 2001, and related wage information for 1976 through 2000. We restrict our sample to civilian men between the ages of 18 and 63 who are employed in the private sector outside of Agriculture, Forestry, Fisheries and Mining.[8] The main strength of the CPS data are the large sample sizes and the level of detail available on individual workers characteristics and earnings.

While the CPS data is primarily used for cross-sectional analysis, the interview structure of the CPS survey also allows researchers to create short panels. In the CPS, a household is interviewed for four consecutive months, is rotated out of the survey for eight months, and is then reinterviewed for four more months. Half of the sample in any March survey are on their first four months rotation of interviews and are potentially matchable in the following March survey, while the other half of the sample are on their last four months rotation of interviews.

The main shortcomings of the CPS data are twofold. First, as a household-based survey, it does not follow individuals who change residences from one year to the next. If

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error component, μ_{i1} , drops out of the specification.

[8] The sample is further limited to workers who were not in school, who were not primarily self-employed, and who had positive weeks worked and earnings in both years. We symmetrically trimmed the top and bottom 2 percent of workers based on income (in survey year 1981 we trimmed the top and bottom 2 ½ percent). This effectively eliminates the problem of top-coding of earnings data. We also eliminate observations with allocated or missing values for the variables we use in the analysis.

the entire household moves or if the worker leaves the household, he cannot be matched across March Surveys. This distinguishes the matched-CPS from other panel data series that attempt to follow individuals across geographic moves. The other main shortcoming of the CPS is that, while we know the industry in which an individual is employed, we do not have information on the international trade exposure of the specific establishment in which he works. For example, as documented by Bernard and Jensen (1999), there is considerable heterogeneity in export orientation across establishments even at the 4 digit SIC level.

We adopt a conservative approach to matching individuals across March surveys in order to minimize inducing more measurement error in the wage growth rates. The CPS provides a household identifier that allows the match of households across surveys. Our next step is matching individuals within the household across the surveys. Prior to the 1994 survey, we use a set of demographic variables to do this individual matching. Starting in 1994, the CPS provides a unique person identifier that can be used to match individuals across surveys. We continue to verify that the demographic information matches across years. For the years 1977 through 2001, there are 231,504 matchable individuals who meet our sample restrictions.[9] Using our matching criteria, we matched 62% of this sample. Restricting this matched sample to those workers who also report (nonallocated) earnings in both years gives us an estimation sample of 113,612 individuals. We also retain the broader "unmatched" sample to determine whether the matching process leads to sample selection issues that need to be addressed in the estimation.

Characteristics of the unmatched (but potentially matchable), matched, and estimation samples are provided in Appendix Table A1. While the matched and estimation samples are similar, there are notable differences. One example is the lower homeownership rate in the unmatched sample. This difference is expected since renters are more mobile than homeowners. Moreover, unmatched individuals tend to be younger, less likely to be married and have a higher incidence of job changing in the year prior to the first March survey.

[9] Due to survey limitations, we are unable to match workers for the survey years 1985/86 and 1995/96.

B. Who is a Job Changer? In order to investigate the role of job changing in affecting the elasticity of wages to exchange rates, we construct an indicator for whether the worker changed jobs over the two-year period.[10] The CPS data has the advantage of allowing us to construct a reasonably consistent measure of job changing over a long sample period. Our primary indicator for whether a worker changes jobs is based on a question introduced in 1977 regarding how many primary employers a worker had over the prior year.[11] We classify a worker as a job changer if he reports more than one primary employer in either of the two years. This question identifies 88 percent of the job changers.

A job changer can answer that he had only one primary employer in each year if the job transition was preceded by a spell of nonemployment that spanned the end of the first year of the two-year period (and the worker makes no other job changes over the two-year period). The way we resolve these cases depends on whether the worker is reemployed as of the first March survey. If the worker is employed as of the first March survey, then we use the industry classification of the worker's current job and primary job last year to determine if a job change occurred. During our sample period, the CPS uses "dependent" industry coding. If the interviewer ascertains that the current job is the same as the primary job last year, then the same industry code is assigned to the current job and to the primary job last year. If these codes differ, then we classify the worker as having changed jobs.[12] Dependent industry coding identifies 8 percent of the job changers.

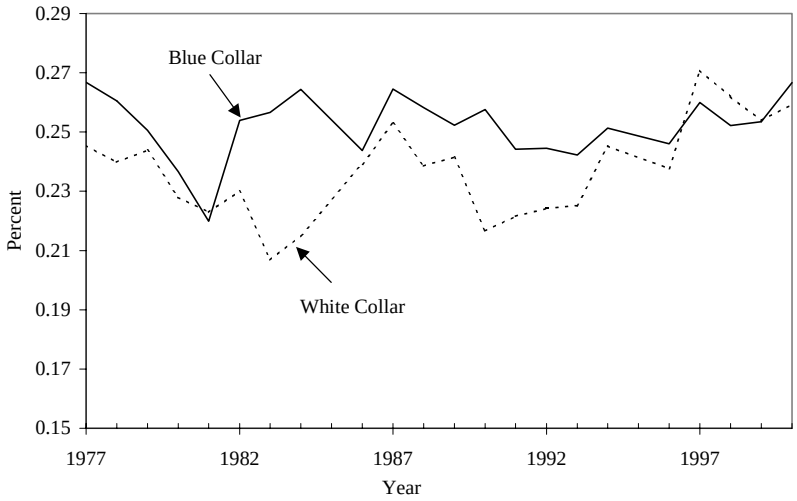
Finally, we consider the case where a worker responds that he has only one primary employer in each year, but is not working as of the first March Survey. Starting in 1994, the CPS ascertains whether a non-employed worker is actively looking for employment. We classify workers who were coded as actively looking for employment as job changers. For workers who were not actively looking for employment, we assume that they are on a temporary layoff, and are subsequently re-employed by their same employer. For the pre-1994 period, we use information on the worker's primary use of time in the prior week and a series of questions on methods of job search to classify the

[10] We focus on a two year job change rate rather than the more traditional one year rate, since this matches up with the time interval we use to measure a worker's wage growth.
[11] Workers with dual jobs are instructed to consider these as one job for the purpose of this question.
[12] We will fail to classify a worker as a job changer if he changes jobs at the end of the year and his new job

workers as either actively looking for work or not. Unemployed workers who are actively looking for employment account for the remaining 4 percent of the job changers.

On average, job changers have different characteristics than job stayers (Appendix Table A1). Job changers are younger, less likely to be married and are less likely to own their home. Figure 2 shows the average 2-year job-changing rate for blue-collar and white-collar workers over the mid-1970s through 2000.[13] Overall, there is a 25 percent probability that a worker changes jobs over a 2-year period. Blue-collar workers have higher job-changing rates than white-collar workers, although the job-change rate by white-collar workers has trended upward since the early 1990s. By the end of the 1990s, white-collar workers experienced the same degree of job instability as blue-collar workers.[14]

Figure 2. Two-Year Job Changing Rates: By Occupation



Notes: 2-year job turnover rates. Turnover rates could not be calculated for 1985 and 1995 and were imputed using linear interpolation.

C. Industry-Specific Real Exchange Rates. Labor demand changes could result from exchange rate induced adjustments in producer revenues from domestic and foreign

is in the same detailed industry category as his primary job last year.

[13] Blue collar workers include those employed in precision production, craft and repair occupations and operators, fabricators and laborers.

[14] Farber (1997) provides a detailed discussion of trends in job stability based on the CPS Displaced Worker Surveys.

sales, as well as adjustments in the costs of imported inputs. Industries differ in the international destinations of their exports and in the countries generating import competition, implying that a common exchange rate measure applied to all industries may not be an appropriate indicator of changes in competitive conditions for different industries.

The best available proxies for trade-related competitive pressures are industry-specific exchange rate series.[15] For each industry and year, we construct each industry-specific real exchange rate series by trade-weighting the bilateral real exchange rates of that industry's trading partners (bilateral real exchange rates are from the IMF's *International Financial Statistics*). The weights used in this construction are the shares in industry exports and imports of each U.S. trading partner, which vary across industries and over time.[16] Throughout our empirical analysis, exchange rates are defined in terms of U.S. dollars per unit of foreign currency, following the convention that upward movements in exchange rates reflect real dollar depreciations.

Theoretical arguments, as well as related empirical investigations, argue for the use of the permanent component of the exchange rate in analyses of wage and employment specifications There are many available methods of decomposing a macro time-series into its permanent and transitory components. Below we apply a Beveridge and Nelson (1981) (BN) filter to each of the country specific real bilateral exchange rate series (see Appendix description).[17] The industry specific exchange rates that we utilize are constructed using the permanent components of the real bilateral exchange rates, weighted by time-varying and industry-specific trade shares.

[15] See Goldberg (2002). While some studies use industry specific import prices as proxies for industry specific exchange rates, this proxy choice is inappropriate. Industry import prices already incorporate the exchange rate pass-through response of foreign producers supplying the U.S. market, as documented in Campa and Goldberg (2002).

[16] We used three year averages lagged by two years of trade shares for bilateral transactions with 34 U.S. trading partners. Using lagged trade shares helps avoid any issue of endogeneity of the composition of U.S. trade flows with respect to exchange rate movements. Using three year averages of the trade shares ensures that the changes in the industry exchange rate reflect primarily changes in the underlying bilateral exchange rates and not changes in the composition of trade flows. See Goldberg (2002) for an extensive treatment of the properties of alternative constructions of industry-specific versus aggregated real exchange rate series.

[17] Two frequently utilized approaches for this decomposition are the Beveridge and Nelson (1981) (BN) and the Hodrick and Prescott (1997) (HP) filters. For a discussion of the relative merits of the BN and HP filters, see Pedersen (2001).

D. Aggregate and Local Demand Variables. In specifications (4) and (5), we stress that identification of the effect of exchange rates on wages requires isolating these effects from other time-series factors such as industry secular trends and aggregate or local cycles. Industry and regional wage trends are captured by a set of 2-digit industry and Census region fixed effects. Aggregate cyclical conditions are proxied by real GDP growth.

To control for local labor market demand conditions, we construct state-level variables using a methodology developed by Topel (1986). For each state, we regress the logarithm of state private-sector non-agricultural employment on a quadratic time trend. The residuals from these regressions, γ_{rt}, measure the deviations of actual state employment from trend employment. Similarly, we regress the logarithm of national private sector non-agricultural employment on a quadratic time trend. The residuals from this regression, γ_t, control for the aggregate business cycle. The proxy for local relative demand conditions, y_{rt}, is given by:

$$y_{rt} = \gamma_{rt} - \gamma_t \tag{6}$$

This local relative demand conditions variable, γ_{rt}, measures in a given year each state's employment residual as a deviation from the national employment residual. Positive values for γ_{rt} imply that the state has tighter conditions than does the country as a whole at time *t*.

E. Sample Selection. A potential concern is that our matched-CPS sample is not a random subsample of male workers from the March CPS surveys. This sample selection concern arises because, in order to be matched across consecutive March surveys, a worker must remain in the same house over the intervening year. A second selection issue arises because we restrict our estimation sample to workers who have reported earnings in each of the two years. This restriction is necessary because the dependent variable is an individual's wage growth. If a worker is out of the labor force for an entire year, or if he is employed but refuses to answer the earnings question, we cannot compute his wage growth. These restrictions may give rise to sample selection bias when

estimating the wage growth specifications given in (4) and (5).

Analysis of the matched CPS data by Neumark and Kawaguchi (2001) dispelled some of these sample selection concerns.[18] While we find their analysis compelling, their conclusions may nonetheless be sensitive to the empirical question being asked. As a precaution, we proceed by modeling the two potential sources of selection bias for our estimation sample. First, we empirically model the processes for matching an individual across March surveys and for having reported earnings. Given that non-matches are primarily due to geographic mobility, our empirical specification borrows from the migration literature which shows that mobility is strongly tied to many individual characteristics (such as age, education, and marital status) and factors affecting the transaction costs of moving.[19] We proxy these transactions costs with indicator variables for whether the individual owns a house and for whether children are present in the household. We use these same variables to help control for whether a worker has reported earnings. The Appendix provides the details of the construction of the Mills ratio variables that we include in our regression specifications.[20] The first Mills ratio corrects for any selection effects arising from matching across surveys while the second Mills ratio corrects for any selection effects arising from requiring a worker to have reported earnings.

IV. Estimation and Results

In this section we present our estimates of wage and job changing elasticities with respect to exchange rates. We first provide baseline empirical specifications covering all workers, and then introduce subsample restrictions in order to focus on the importance of occupation and educational attainment in identifying the incidence of exchange rates on wages. We subsequently test for asymmetry in the effects of dollar appreciations and depreciations. Next, we document the mechanisms for these wages effects as delineated

[18] The extent of the resulting sample selection or attrition bias can be estimated by comparing the matched-CPS data to a similar survey where movers are followed. Neumark and Kwaguchi (2001) compare the matched-CPS to the Survey of Income and Program Participation (SIPP) data for empirical specifications of the union wage premium and the marriage wage premium. The SIPP uses a similar sampling frame and design as the CPS, but makes a substantial effort to track people who change residences between surveys. They find negligible and statistically insignificant evidence of attrition bias arising from the inability to follow movers as in the matched-CPS.

[19] See for example, Bartel (1979).

in equation (2), and identify the extent to which these effects arise for workers who remain on the job, through the wage penalty for workers who change jobs, or through a change in the probability of job transitions. We further examine whether the subset of job changers who are also industry-switchers have more extreme wage outcomes than the workers who change jobs but remain within their same 2-digit industry of employment. We conclude this estimation and results section with a number of robustness checks on the reported results.

A. Baseline Specifications. The results for our baseline wage growth and job changing specifications are given in Table 1. Real wage growth varies positively with both aggregate and local demand conditions, with both types of cycles having qualitatively similar effects. In our baseline specification, exchange rates have a small and statistically insignificant effect on wage growth. A ten percent dollar depreciation is estimated to lower real wages by 0.4 percent. This finding contrasts with the results in the literature where depreciations are sometimes associated with small but significant industry wage growth. In aggregate, when all workers are taken together, when dollar depreciations and appreciations enter symmetrically, and when we control for worker characteristics and macroeconomic conditions, dollar movements do not have economically important implications for wages.

Turning to the results of worker characteristics, we find that wage growth is declining in age at a diminishing rate until a worker reaches his late forties. From a worker's fifties until retirement, wage growth continues to decline but at an increasing rate. College workers experience 1.5 percent faster wage growth than high school dropouts. While married men earn a wage premium, the transition into marriage is not associated with higher wage growth, while the transition from marriage is associated with a 2.1 percent higher wage growth.

Table 1 also shows the implications of controlling for sample selection in the baseline specification: columns (1) and (2) contrast wage growth results with and without sample selection controls. Both Mills ratios have positive and significant coefficients, indicating that workers with faster trend wage growth and those who experience a

[20] See Maddala (1983, pg 278-283) and Ham (1982).

Table 1. Baseline Specifications for Wage Growth and Job Changing

	Wage Growth		Job-Changing	
Variable	(1)	(2)	(3)	(4)
Individual Characteristics ΔZ_{it}				
Age	–0.024**	–0.024**	–0.209**	–0.200**
	(0.005)	(0.005)	(0.013)	(0.012)
Age squared (x100)	0.049**	0.051**	0.406**	0.424**
	(0.012)	(0.012)	(0.034)	(0.032)
Age cubed (x10,000)	–0.033**	–0.038**	–0.275**	–0.310**
	(0.009)	(0.009)	(0.028)	(0.026)
Becomes married	–0.000	0.001	–0.068**	–0.058**
	(0.008)	(0.008)	(0.026)	(0.024)
Becomes single	0.004	0.021**	–0.035	0.052
	(0.009)	(0.009)	(0.026)	(0.024)
High school graduate	–0.004	0.002	–0.041**	0.014
	(0.004)	(0.004)	(0.013)	(0.012)
Some college	0.001	0.006	0.041**	0.086**
	(0.007)	(0.007)	(0.014)	(0.013)
College graduate	0.011*	0.015**	0.023	0.067**
	(0.006)	(0.006)	(0.015)	(0.014)
Change jobs	–0.014**	–0.014**		
	(0.005)	(0.005)		
Regional Conditions ΔV_{rt}				
Change in local relative demand conditions	0.487**	0.490**	0.447*	0.434*
	(0.121)	(0.120)	(0.269)	(0.254)
Aggregate Macroeconomic Conditions ΔY_{it}				
% change in real GDP	0.511**	0.450**	0.667**	0.409**
	(0.160)	(0.138)	(0.210)	(0.199)
% change in real exchange rate	–0.057	–0.042	0.134*	0.108*
	(0.051)	(0.046)	(0.069)	(0.066)
Sample Selection Corrections				
Mills ratio – Match across surveys		0.038**		1.213**
		(0.012)		(0.066)
Mills ratio – Nonmissing wage		0.087**		0.301**
		(0.025)		(0.072)
2-Digit industry & Region effects included	Yes	Yes	Yes	Yes
N = 113,612				

** denotes significant at the 5% level. * denotes significant at the 10% level.
Notes for columns 1 and 2: OLS with standard errors in parentheses.
Notes for column 3 and 4: Probit coefficients for 2-year job changing with standard errors in parentheses. The Mills ratios in the Probit model are used to adjust both the conditional mean and variance.

transitory wage gain are more likely to stay in their current residence and to report earnings. However, controlling for selection effects has a minimal impact on the exchange rate elasticity in our baseline specification as well as in the other subsamples that we explore. The issue of selection or attrition bias in the matched-CPS does not seem critical for our application, consistent with the Neumark and Kawaguchi (2001) findings.

Finally, the baseline job changing Probit results are given in columns (3) and (4) of Table 1. Here we estimate simple Probit and selection corrected Probit models where the dependent variable is our two-year job changing indicator and the control variables are the same as in our wage growth specification. Individual characteristics are important for the probability of job-changing, as are aggregate economic conditions. The data indicate that the likelihood of changing jobs declines with age and with a transition to marriage, is higher for workers with at least some college education and is procyclical with respect to changes in real GDP. In the baseline specifications, exchange rate movements are not statistically important for job-changing.

B. Exchange rates and wages. To delve further into the implications of exchange rates for wages, we re-estimate the baseline specification and distinguish between the exchange rate wage elasticities of workers sorted by occupational category (White Collar versus Blue Collar) and by educational attainment (less than high school graduation, high school graduate, some college plus). The resulting average wage elasticities are reported in Table 2, column 1. In columns (2) and (3) we investigate whether these effects are asymmetric across dollar appreciation and dollar depreciation periods. Positive coefficients in these columns indicate increased wage growth from dollar appreciations (column 2) or from depreciations (column 3).

The wage elasticities of individuals disaggregated by occupational and educational groups, shown by the other entries in the first column ("Overall") of Table 2, begin to demonstrate the importance of more finely distinguishing between worker types. First, the negligible overall impact of exchange rates on wages reflects contrasting effects on Blue Collar versus White Collar workers. For Blue Collar workers, we find a small positive wage elasticity of 0.02 percent – one quarter the size of the earlier Revenga

Table 2. Wage Elasticities from Exchange Rates, by Occupation and Educational Attainment and by Appreciation versus Depreciation

	Overall (1)	Appreciation (2)	Depreciation (3)	$\chi^2(1)$ [P Value][a]
Private Non-agricultural 113,612	–0.042 (0.046)	0.137 (0.094)	0.043 (0.051)	2.14 [0.14]
Occupation:				
Blue Collar 57,342	0.023 (0.045)	0.002 (0.094)	0.044 (0.058)	0.13 [0.71]
White Collar 56,270	–0.102* (0.060)	0.259** (0.118)	0.045 (0.067)	3.64 [0.06]
Educational Attainment:				
Less than high school degree 19,128	0.087 (0.069)	–0.088 (0.122)	0.087 (0.106)	0.00 [0.99]
High school graduates 46,145	–0.009 (0.052)	0.107 (0.105)	0.076 (0.077)	1.37 [0.24]
Some college + 48,339	–0.119** (0.049)	0.261** (0.099)	0.010 (0.038)	4.76 [0.04]

Notes: Reported coefficients are wage elasticities with respect to dollar depreciations. See text for list of control variables. Standard errors are given in parentheses and have been adjusted for any non-independence of observations within a year. ** significant at the 5% level. * significant at the 10% level. The number of worker-observations is presented below each occupational or educational grouping. Reported results are from specifications that contain corrections for potential sample selection issues.

[a]Test for symmetry of appreciation and depreciation exchange rate effects.

findings that were based a sample of production workers in highly trade-exposed manufacturing industries between 1977 and 1987. However, our estimated wage elasticity for White Collar workers is estimated to be –0.10 percent. Given the roughly equal numbers of Blue and White Collar workers in the sample, these two effects offset each other when we pool together the two groups of workers. The sign of the White Collar exchange rate effect raises a number of interesting issues that we explore later in this paper.

Continuing down the "Overall" column of Table 2, we show that the dichotomy in results for Blue and White Collar workers reflects average skill differences across these occupation groups. We disaggregate workers into three broad skill groups based on their education attainment – a low skill group consisting of workers who did not complete high school, a moderate skill group consisting of workers who completed high school who but

did not continue their education beyond high school, and a high skill group consisting of workers with at least some college education.

The estimated wage elasticities show a sharp contrast between low and high skill workers. The wage elasticity for low skill workers exceeds 0.08 percent (four times the Blue Collar elasticity), implying that a ten percent dollar depreciation is associated with an 0.8 percent increase in real wages for the least educated workers. In contrast, the wage elasticity for high skilled workers is nearly –0.12 percent, implying that a 10 percent dollar depreciation is associated with a 1.2 percent *decrease* in wages for the most educated workers. Finally, on average wages for high school graduates are insensitive to exchange rate movements. The "overall" column shows that wages *are* responsive to movements in the value of the dollar for some groups of workers, but this responsiveness is muted in the aggregate.

The wage elasticities reported in column (1) of Table 2 impose the restriction that exchange rate appreciations and depreciations have symmetric wage effects. We relax this restriction in columns (2) and (3). For high skilled workers (white collar and those with at least some college education) we reject the symmetry assumption. Only for very low skilled workers do we find the point estimates for appreciations and depreciations to be opposite in sign. For skilled workers, wages appear to be substantially more responsive to dollar appreciations than to dollar depreciations. Surprisingly, we find that wage growth *accelerates* with a dollar appreciation for all but the least skilled workers. The elasticity of wages to dollar appreciations is roughly 0.26 for both white collar workers and workers with at least some college education. It is only for high school dropouts that we observe wages declining on average in response to dollar appreciations.

These findings imply that the periods when the dollar is strengthening are ones in which there are significant shifts in the relative wage structure in the U.S. labor market. A stronger dollar – often viewed as increasing competitive pressures on U.S. import-competing producers – is associated with a widening of the wage gap between skilled and less skilled workers. A ten percent dollar appreciation is associated with a 3.5 percent increase in the relative real wage between high and low skilled workers (and a 2.6 percent increase in relative real wage between White and Blue collar workers). Notice also that dollar depreciations appear to exert much weaker effects on skill premiums in the labor

market. A ten percent dollar depreciation is associated with less than a 0.8 percent decrease in the relative real wages between high and low skilled workers (and leaves the relative real wage between white and blue collar workers unchanged). Consequently, shifts in the skill premia associated with dollar appreciation periods persist and are not reversed by comparable dollar depreciations.

These results complement studies of impact of trade and immigration on the wage structure, wherein the implied labor content of net imports and immigrants are estimated. These labor supply shifts are converted into wage impacts using an estimate of the elasticity of substitution between the different skill groups. One influential study by Borjas, Freeman and Katz (1997) reports that the high school graduate / high school dropout wage premium increased by 11.5 percent over the period from 1980 to 1995. They estimate that trade and immigration accounted for between 33 and 66 percent of this increase.[21]

Our analysis provides a complementary approach to this issue by directly estimating the shifts in the wage structure that are associated with changes in the external value of the dollar, and in this context, the effects of competitive pressures from a stronger dollar. We find that a 10 percent dollar appreciation is associated with a 1.9 percent increase in the high school graduate / high school dropout wage premium, while a similar depreciation reduces this premium by 0.1 percent. Using our estimates and the path of the dollar between 1980 and 1995, we calculate that the associated cumulative impact on the wage premium would have been 7.4 percent, with most of this occurring by 1986. This estimate of the trade impact accounts for 64 percent of the rise in the high school graduate / high school dropout wage premium over the period from 1980 to 1995.[22] Our finding is at the upper end of the range indicated by the factor proportions approach used by Borjas, Freeman and Katz (1997).

C. The Mechanism for Exchange Rate Effects on Wages. To better understand the process at work in generating these exchange rate related wage effects, we further explore

[21] See also Katz and Murphy (1992) and Berman, Bound and Griliches (1994). Feenstra (2000) provides an overview.

[22] For this exercise we use the permanent component of the Federal Reserve Board's broad measure of the dollar value.

whether job-changing plays an important role in the wage adjustment process. The results of this analysis are reported in Tables 3 and 4, wherein we continue to allow for asymmetric exchange rate effects. Recall that average wage elasticities could be attributable to wage adjustment on the job (i.e. for job stayers), at times of job transitions (i.e. for job changers), and/or because exchange rate movements may change the likelihood of transitioning between jobs. Table 3 focuses on the mechanisms associated with dollar appreciations. For a specific occupation or education group, reading across the appropriate row in Table 3 contrasts the wage elasticities from dollar appreciations for workers who stay with their same employer with those workers who change employers over the two-year period, and the impact on job turnover rates. In Table 4 we contrast the analogous wage mechanisms associated with dollar depreciations.

Table 3. Wage Elasticities from Dollar Appreciations, by Occupation and Educational Attainment and by Job Stayers versus Job Changers

	Wage Elasticity		**Marginal Effect on Job-Changing (10%)**
	Stayers (1)	**Job-Changers** (2)	(3)
All Private Non-agricultural	0.207** (0.109)	–0.081 (0.116)	–0.013** (0.004)
Occupation:			
Blue Collar	0.122 (0.112)	–0.347** (0.170)	–0.016** (0.006)
White Collar	0.284** (0.127)	0.179 (0.166)	–0.009 (0.006)
Educational Attainment:			
Less than high school degree	0.116 (0.139)	–0.719** (0.276)	–0.012 (0.010)
High school graduates	0.124 (0.108)	0.053 (0.258)	–0.016** (0.007)
Some college +	0.327** (0.120)	0.056 (0.106)	–0.010 (0.007)

Notes: Reported coefficients are wage elasticities with respect to a dollar appreciation. See text for list of control variables. The marginal effect on job-changing is the average derivative of the probability of a job-change given a 10% appreciation of the dollar. Standard errors are given in parentheses and have been adjusted for any non-independence of observations within a year. **,* significant at the 5%, 10 % level

Consider first the results for Blue Collar workers. For these workers, Table 2 showed that the overall wage elasticity in response to a dollar appreciation is 0.002. From Table 3 we find that this apparent unresponsiveness to appreciations masks sizeable offsetting effects based on their job mobility. For Blue Collar workers, when the dollar appreciates the wage elasticity for job stayers is 0.12, while the wage elasticity for job changers is a statistically significant –0.35. This pattern is even more striking for workers with less than a high school degree. Here we find that the wage elasticity during appreciations for job stayers is 0.12, while the wage elasticity for job changers is –0.72. These results show that strong dollar periods appear to exact a heavy price on wages for low skilled workers – but only for those low-skilled workers who have their employment relationship severed. Internal labor markets appear to insulate the wages of low skilled workers who are able to maintain their existing employment relationship. For these same workers, the wage implications associated with dollar depreciations are small and statistically unimportant.

A very different pattern emerges for skilled workers. For white collar workers and workers with at least some college education, wages for workers who remain with their same employer rise significantly during periods of dollar appreciations. In addition, high skilled workers who change jobs during periods when the dollar is strengthening do not on average suffer any adverse wage consequences. The positive impact of dollar appreciations on high skilled worker wages, as reported in Table 2, primarily reflects the wage responses of workers with ongoing employment relationships. When the dollar depreciates, high-skilled workers who stay with their employers have small improvements in wage growth, while job-changers experience modest wage losses.

Finally, in column (3) of Tables 3 and 4 we present the sensitivity of the rate of job changing to the dollar appreciations or depreciations for each occupation or education group. The reported numbers reflect the average change in the job-transition probabilities associated with a 10 percent change in the value of the dollar. Appreciation periods are associated with a significant decrease in job-changing rates, with the largest decrease occurring for Blue Collar workers and workers with a high school degrees. The direction of the wage effects suggests that in response to a stronger dollar there is an decrease in

voluntary job turnover among low-skilled workers that dominates any increase in involuntary job turnover.

Table 4. Wage Elasticities from Dollar Depreciations, by Occupation and Educational Attainment and by Job Stayers versus Job Changers

	Wage Elasticity		Marginal Effect on Job-Changing (10%)
	Stayers (1)	**Job-Changers** (2)	(3)
All Private Non-agricultural	0.077 (0.060)	–0.055 (0.101)	–0.005 (0.004)
Occupation:			
Blue Collar	0.084 (0.065)	–0.074 (0.140)	–0.009* (0.005)
White Collar	0.075 (0.076)	–0.045 (0.103)	–0.000 (0.006)
Educational Attainment:			
Less than high school degree	0.173 (0.135)	–0.161 (0.236)	0.005 (0.010)
High school graduates	0.062 (0.086)	0.109 (0.156)	–0.003 (0.006)
Some college +	0.072* (0.039)	–0.169** (0.069)	–0.012** (0.006)

Notes: Reported coefficients are wage elasticities with respect to a dollar depreciation. See text for list of control variables. The marginal effect on job-changing is the average derivative of the probability of a job-change given a 10% depreciation of the dollar. Standard errors are given in parentheses and have been adjusted for any non-independence of observations within a year. **,* significant at the 5%, 10% level.

We can now evaluate the relative importance of the three channels through which exchange rates affect wages. In general, we find that job changing affects the overall elasticity of wages to the exchange rate primarily through the impact of the exchange rate on the wage consequences of changing jobs, rather than through its impact on the incidence of job changing. To illustrate, consider the wage elasticity for Blue Collar workers to dollar appreciations. Recall from Table 2 that this elasticity is 0.002. The first channel, the elasticity for job stayers, is 0.122. The second channel, showing the wage consequences of job changing, is –0.119.[23] The third channel, showing the importance of

[23] This is computed as the probability of job changing times the impact of the exchange rate on the wage differential between changers and stayers, i.e. 0.254 multiplied by –0.468.

the change in the incidence of job changing for expected wages, is 0.0008,[24] and empirically unimportant. For the average worker, the difference between the overall wage elasticity and the wage elasticity for workers who stay with their same employer is almost entirely accounted for by the impact of exchange rates on the wage consequences of job changing.

D. Job Changing and Industry Switching. The job displacement literature stresses that whether a worker is re-employed in his same industry or has to switch industries is an important determinant of his post-displacement earnings.[25] Displaced workers who switch industries on average experience larger wage losses than workers who are re-employed in their same industry. This holds for our estimation sample where the average wage change for workers who change jobs but stay in their same industry is 1 percent, while for workers who change jobs and change industries the average wage change is −2.3 percent.

In the upper panel of Table 5 we expand our prior discussion to examine whether dollar movements affect the wage consequence of job changing primarily by shifting the incidence and wage consequences of switching industries, or by affecting wages for workers who change jobs but stay in their same industry. For this exercise, each job changer is differentiated according to whether he switches his 2-digit industry of employment. We focus on the impact of dollar appreciations on Blue Collar workers and workers with less than a high school education, i.e. the workers who had the largest wage responses in Table 3. In addition, we present the marginal effect on the probability that a worker switches industries (conditional on changing jobs) in response to an appreciation of the exchange rate.

Comparisons of entries in the rows of Table 5 show that industry switching *per se* does not appear to play a role in explaining the impact of the exchange rate on the wages of low skilled job changers. First, dollar appreciations are not associated with significantly higher probabilities that workers switch industries given a job change. Second, for low skilled workers, the wage elasticity for job changers who remain in their same industry is the roughly the same or larger in magnitude than the wage elasticity for

[24] This is computed as the average wage differential between changers and stayers times the impact of the exchange rate on the incidence of job changing, −0.005 multiplied by −0.160.

workers who both change jobs and switch industries. It appears, then, that the large wage losses suffered by low skilled workers who change jobs during strong dollar periods are not due to either a higher incidence of industry switching, or due to a differential impact for workers who both change jobs and switch industries.

Table 5. Job-Changer Wage Elasticities from Dollar Appreciations: Job-Changers Remaining in the Same Industry compared with those who Switch Industries

(a) Industry Switching

	Wage Elasticity		Change in Incidence of Industry Switch, Given a Job Change (10%)
	Job-Change into Same Industry	Job-Change with Industry Switch	
Blue Collar	–0.324 (0.265)	–0.401* (0.237)	–0.002 (0.014)
Less than high school degree	–0.940** (0.282)	–0.436 (0.453)	–0.004 (0.025)

(b) Sector-Switching

	Wage Elasticity		Change in Incidence of Sector Switch, Given an Industry Switch (10%)
	Industry Switch into Same Sector	Industry Switch with Sector Switch	
Blue Collar	–0.643 (0.410)	–0.030 (0.434)	–0.018 (0.022)
Less than high school degree	–1.345** (0.623)	1.360** (0.790)	–0.029 (0.039)

Notes: Reported coefficients are wage elasticities with respect to a dollar depreciation. See text for list of control variables. For industry switching we report the average derivative of the probability of an industry switch given a job change in response to a 10% appreciation of the dollar. Standard errors are given in parentheses and have been adjusted for any non-independence of observations within a year. **,* significant at the 5%, 10% level.

What is important for determining the wage consequence of a job change may not be just whether a worker changes industries, but more importantly if the new industry is in the same or a different sector. Jacobson, LaLonde and Sullivan (1993) explore this idea using a rich dataset of workers from Pennsylvania. They define a sector change as a worker who moves from manufacturing to nonmanufacturing (or vice versa). In their data, the average wage losses three years following displacement were around 20 percent for workers who stayed in their same industry and for those workers who changed

[25] See Carrington (1993), Kletzer (1998, 2001), Ong & Mar (1992) and Podgursky & Swaim (1987)

industry but stayed in their same sector. In contrast, workers who both change jobs and change sectors experienced an average wage loss three years after a job displacement of 44 percent. We find the same pattern in our estimation sample. For workers who change jobs and change industries but remain in the same sector the average wage loss is only 0.3 percent. However, for workers who have to change sectors, the average wage loss is 5.7 percent.

We explore the role of sector switching in the bottom panel of Table 5. Following the pattern of our earlier results, we find no evidence that movements in the exchange rate influence the likelihood that a worker who changes jobs and switches industries also switches sectors. In addition, the data indicate that the negative effects of a stronger dollar on wages of low skilled job changes is concentrated on those workers who remain in their same sector. Surprisingly, for workers with less than a high school degree, we find that job changers who change sectors on average experience strong wage gains. Despite the loss of any sector-specific skills that results from a sector change, the message for low skilled workers displaced from their current job by a strong dollar is that their wage outcomes are better if they break from their former sector rather than trying to preserve their employment in that sector.

E. Robustness checks. Before turning in the concluding section to interpretations of our findings, in this section we discuss the robustness of our findings to a number of specification changes. First, we explore the implications of using alternative exchange rate indices. We then consider whether there are clear links between the wage elasticities to exchange rates and measures of industry trade exposure. Finally, we examine whether our findings are sensitive to omitted macro variables.

The estimation results reported in Tables 1 through 5 are based on the permanent components of industry-specific exchange rates. We find that these results are qualitatively robust to using the actual bilateral exchange rates. Our results also are robust to exchange rate measures that are not differentiated across industries. In particular, we generate similar point estimates when we use the permanent component of the Federal Reserve Board's "broad exchange rate" measure.[26] The industry-specific exchange rates

[26] http://www.federalreserve.gov/releases/H10/Summary/. From the Federal Reserve Bulletin, October

on average produce tighter standard errors.

An important related question is whether the wage responsiveness to exchange rates have increased over time as U.S. industries have become more open to international trade. Theory suggests that the labor demand response by firms in an industry to exchange rate movements should depend on the degree of "trade openness" of that industry. Indeed, similar arguments have had been made, and empirically validated, in the context of U.S. industry investment activity and stock prices.[27] A common measure of trade openness is the average of the industry export and import trade shares.[28] As defined, trade exposure increased from an average of 3.7 percent in 1977 to 6.0 percent in 2000 (weighted by the number of workers in each industry). There are also large differences in trade exposure at a point in time across industries. For example, in 2000 this measure of trade exposure ranged from a high of 45 percent in Leather and Leather Products to below 1 percent in Construction and Business Services.

When we interact the change in the exchange rate with the average industry trade share, we find that the interaction effect is positive and significant at the 10 percent level for both appreciations and depreciations. For the private non-agricultural sector as a whole, a ten percentage point increase in the average trade share is associated with a 0.09 increase in the appreciation wage elasticity and with a 0.07 increase in the depreciation wage elasticity. The appreciation effect is entirely driven by the within industry time-series variation in the average trade share.[29] This could reflect problems in accurately measuring the level of trade exposure across industries, which are less of an issue for measuring the change in trade exposure over time within a given industry.

We performed other robustness checks with the intent of characterizing the industries in which worker wages were significantly more sensitive to exchange rate movements. We found that, consistent with aforementioned results related to industry

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1998, "The currencies of all foreign countries or regions that had a share of U.S. non-oil imports or nonagricultural exports of at least ½ percent in 1997 are included in the broad indices, as rankings of U.S. trading partners by share of U.S. trading partners by share of U.S. trade in that year show."

[27] Allayannis and Ihrig (2001), Clarida (1997), and Campa and Goldberg (1999).

[28] Measuring trade exposure by averaging the export and import shares is relevant if the primary effects of exchange rate movements are on producer revenues derived from both foreign sales and domestic sales due to import penetration of domestic markets. Empirically industry import penetration and the industry's use of imported inputs are highly correlated and similarly scaled. See Campa and Goldberg 1997.

[29] A 10% increase in time-series (cross-section) variation in the average trade share increases the appreciation elasticity by 0.29 (0.03). We find the same pattern for both blue and white collar workers.

trade orientation, the pattern of industry wage sensitivity to exchange rates did not cleanly map to industries sorted into manufacturing versus non-manufacturing. While this poses a challenge for basic theoretical models of wage effects of exchange rates, the empirical results are also consistent with studies which focus on stock price sensitivity to exchange rates (Dominguez and Tesar 2001), which also have not found systematic relationships with firm size, industry affiliation, multinational status, or international trade. More extensive research on these issues is warranted, perhaps better detailing the role of nontradeables and services in the distribution and pricing of traded goods, as in Burstein, Neves and Rebelo (forthcoming) and Bacchetta and vanWincoop (2002), or using more extensive information on the competitive conditions in specific industries.

Next, we examined the impact of exchange rate changes on wages for women.[30] The overall elasticity for women is more negative than for men [–0.122 vs. –0.042]. This reflects stronger wages gain by women during appreciation periods [0.319 vs. 0.137]. In contrast to men, both blue and white collar women as well as women in each of the three educational groups benefit from a strengthening of the dollar. In addition, low skilled women (both blue collar and those with less than a high school degree) who change jobs during strong dollar periods do not suffer significant wage losses, as is the case for low skilled men. Finally, high skilled women (white collar and those with at least some college) who change industries when they change jobs during strong dollar periods experience on average strong wage gains.

Finally, we consider a critique by Card and DiNardo (2002) of research that has argued that the shift in the labor market skill premium was driven by skill-biased technological change. They raise several issues concerning the timing of periods when the skill premium was increasing compared with the timing of expanded use of computers in the workplace. Card and Dinardo also pose an alternative explanation for the shift in the skill premium, arguing for the role of an eroding real value of the minimum wage in the early 1980s. To explore this, we include in our specifications the percent change in the real minimum wage.[31] The minimum wage enters significantly for Blue Collar workers and for high school dropouts. The elasticity of wages to the

[30] The sample size for the women was 101,022.

[31] We use the maximum of the Federal and the State minimum wage for each year. We thank Bill Wascher for providing us with data on State minimum wages.

minimum wage is 0.11 for blue collar workers and 0.25 for workers with less that a high school degree. In addition, including the minimum wage in the specification slightly reduces the appreciation elasticity for blue collar job changers from –0.35 to –0.33, and for high school dropout job changers from –0.72 to –0.68. Controlling for the minimum wage also slightly lowers our estimate of the contribution of the exchange rate to the increase in the high school graduate / high school dropout wage premia over the period 1980 to 1995 from 64 to 58 percent, but does not otherwise qualitatively alter our findings.[32]

V. Concluding Discussion

In this paper we explore the elasticity of wages to the exchange rate. We estimate wage elasticities for different skill groups delineated either by occupation or educational attainment. We also decompose these overall wage elasticities into three separate channels: (1) the elasticity for workers who remain with their same employer, (2) the impact of the exchange rate on the wage consequence of job changing and (3) the impact of the exchange rate on the incidence of job changing.

While we find that the overall wage elasticity with respect to the exchange rate is negligible, we also have demonstrated that the process of aggregation masks large and significant wage responses to dollar movements for particular occupation and skill groups**.** Dollar movements are associated with distributional effects within the labor market. Appreciations are linked to wage gains by skilled workers who stay with their same employer, but large wage losses for blue collar workers who change jobs. In addition, we find little role for industry switching as an explanation for the impact of exchange rates on the wages of job changers.

By disaggregating the wage elasticities by worker skill level and allowing for asymmetric responses to dollar appreciations and depreciations, we have produced a set of empirical results that challenge the standard model of how trade impacts labor markets. As future work, a number of extensions to this model are worth exploration using different data sources. One possibility is that a strong dollar creates cost pressures,

[32] We also checked a measure of the real interest rate and a trade weighted measure of world real GDP and found neither were significant.

which firms attempt to offset through higher labor productivity. In response to these cost pressures, firms may invest in processes that are complementary with high skilled workers, as argued in other contexts by Acemoglu (1998). In addition, firms may shift to products that use relatively more high skilled labor. As a result, while the direct affect of a dollar appreciation is an inward shift in the demand for labor, there also may be important shifts in the composition of labor demand toward high skilled workers.[33] These types of dynamics might be linked to the characteristics of exporters and import-competing firms, as documented in ongoing research by Bernard, Jensen, and Schott (2002).

Our findings on wage adjustments also shed light on the debate over the importance of immigration, import competition and skill-biased technological change in shifting the skill premia observed in the labor market. One point on which there is consensus in this debate is the need for more work that links exogenous forces attributable to international trade to actual product price changes (Freeman, 1995).[34] In our own analysis, movements in the real exchange rate of the dollar can be viewed as proxying for pressures on product prices of U.S. producers vis-à-vis foreign competitors.[35] Our estimates suggest that exchange rate movements can explain more than half of the rise in the high school graduate / high school dropout wage premia from 1980 to 1995.

Overall, we show that when averaged across appreciation and depreciation periods, and across all workers, the overall impact of exchange rate movements on wages appears modest. However, for specific groups of workers the wage effects can be very large. Moreover, these effects are asymmetric across appreciation and depreciation

[33] This adjustment process may vary by industry. See, for example, Cline (1987) for a discussion of the contrast between the Apparel and Textile industries in their ability to increase productivity in response to import pressures.

[34] The thoughtful "mandated factor price" approach of Leamer (1998) and others decomposes product price changes into those induced by technological progress or globalization. Feenstra and Hanson (1999) provide evidence on the role of immigration. Slaughter (2000) provides a nice summary of the trade versus technology debate.

[35] Exchange rate movements can be a better indicator of such competitiveness pressures than import price changes, which also incorporate cross-product differences in elasticities of exchange rate pass through. Campa and Goldberg (2002) provide extensive cross-country and industry evidence on exchange rate pass through elasticities. For an excellent survey of earlier research see Goldberg and Knetter (1997).

periods, and across workers who remain employed versus those that transition between jobs.

References

Acemoglu, Daron. "Why Do New Technologies Complement Skills? Directed Technical Change and Wage Inequality." *Quarterly Journal of Economics* 113 (November 1998): 1055-1089.

Allayannis, George, and Jane Ihrig. "Exposure and Markups." *The Review of Financial Studies* 14 (Fall 2001): 805-835.

Aw, Bee, Sukkyun Chung, and Mark J. Roberts. "Productivity and Turnover in the Export Market: Micro-level Evidence from the Republic of Korea and Taiwan (China)." *World Bank Economic Review* 14 (January 2000): 65-90.

Bacchetta, Philippe, and Eric van Wincoop. "Why Do Consumer Prices React Less Than Import Prices to Exchange Rates?" Working Paper No. 9352. National Bureau of Economic Research, November, 2002.

Bartel, Ann P. "The Migration Decision: What Role Does Job Mobility Play?" *American Economic Review* 69 (December 1979): 775-786.

Berman, Eli, John Bound, and Zvi Griliches. "Changes in the Demand for Skilled Labor Within U.S. Manufacturing: Evidence From the Annual Survey of Manufacturers." *Quarterly Journal of Economics* 109 (May 1994): 367-97.

Bernard, Andrew B., and J. Bradford Jensen. "Exceptional Exporter Performance: Cause, Effect or Both?" *Journal of International Economics* 47 (February 1999): 1-25.

Bernard, Andrew, J. Bradford Jensen, and Peter Schott. "Survival of the Best Fit: Competition from Low Wage Countries and the (Uneven) Growth of U.S. Manufacturing Plants." Working Paper, March, 2002.

Beveridge, Stephen, and Charles R. Nelson. "A New Approach to the Decomposition of Economic Time Series Into Permanent and Transitory Components with Particular Attention to Measurement of the 'Business Cycle'." *Journal of Monetary Economics* 7 (March 1981): 151-174.

Borjas, George J., Richard B. Freeman, and Lawrence F. Katz. "How Much Do Immigration and Trade Affect Labor Market Outcomes?" *Brookings Papers on Economic Activity*, no. 1 (1997): 1-67.

Branson, William H., and James P. Love. "United States Manufacturing and the Real Exchange Rate." In *Misalignment of Exchange Rates: Effects on Trade and Industry*, edited by Richard C. Marston. Chicago, University of Chicago Press, 1988.

Burstein, Ariel, Joao Neves, and Sergio Rebelo. "Distribution Costs and Real Exchange Rate Dynamics During Exchange Rate Based Stabilizations." *Journal of Monetary Economics*, (forthcoming) 2003.

Campa, Jose, and Linda S. Goldberg. "The Evolving External Orientation of Manufacturing: Evidence From Four Countries." *Economic Policy Review* 3 (July 1997): 53-81.

------, and Linda S. Goldberg. "Investment, Pass-Through, and Exchange Rates: A Cross-Country Comparison." *International Economic Review* 40 (May 1999): 287-314.

------, and Linda S. Goldberg. "Employment versus Wage Adjustment and the U.S. Dollar." *The Review of Economics and Statistics* 83 (August 2001): 477-489.

------, and Linda S. Goldberg. "Exchange Rate Pass-Through into Import Prices: A Macro or Micro Phenomenon?" Staff Report 149. Federal Reserve Bank of New York, May, 2002.

Card, David, and John E. DiNardo. "Skill Biased Technological Change and Rising Wage Inequality: Some Problems and Puzzles." Working Paper No. 8769. National Bureau of Economic Research, February, 2002.

Carrington, William J. "Wage Losses for Displaced Workers: Is It Really the Firm that Matters?" *Journal of Human Resources* 28 (Summer 1993): 435-462.

Clarida, Richard H. "The Real Exchange Rate and U.S. Manufacturing Profits: A Theoretical Framework with some Empirical Support." *International Journal of Finance and Economics* 2 (July 1997): 177-187.

Cline, William R. *The Future of World Trade in Textiles and Apparel*. Washington, DC, Institute for International Economics, 1987.

Corsetti, Giancarlo, and Luca Dedola. "The Macroeconomics of International Price Discrimination." Working Paper. University of Rome, 2002.

Davis, Steven, and John Haltiwanger. "Sectoral Job Creation and Destruction Responses to Oil Price Changes and Other Shocks." Working Paper No. 7095. National Bureau of Economic Research, April, 1999.

Dominguez, Kathryn M.E., and Linda L. Tesar. "A Reexamination of Exchange-Rate Exposure." *American Economic Review Papers and Proceedings* 91 (May 2001): 367-370.

Dornbusch, Rudiger. "Exchange Rates and Prices." *American Economic Review* 77 (March 1987): 93-106.

Farber, Henry S. "The Changing Face of Job Loss in the United States, 1981-1995." *Brookings Papers on Economic Activity* Microeconomics, no. 0 (1997): 55-128.

Feenstra, Robert C. "Introduction." In *The Impact of International Trade on Wages*, edited by Robert C. Feenstra, 1-14. Chicago and London, The University of Chicago Press, 2000.

------, and Gordon H. Hanson. "The Impact of Outsourcing and High-Technology Capital on Wages: Estimates for the United States, 1979-1990." *Quarterly Journal of Economics* 114 (August 1999): 907-940.

Foster, Lucia, John Haltiwanger, and C.J. Krizan. "Aggregate Productivity Growth: Lessons from Microeconomic Evidence." Working Paper No. 6803. National Bureau of Economic Research, November, 1998.

Freeman, Richard B. "Are your Wages Set in Bejing?" *Journal of Economic Perspectives* 9 (Summer 1995): 15-32.

Goldberg, Linda S. "Industry Specific Exchange Rates for the United States." Working Paper. Federal Reserve Bank of New York, April, 2002.

------, and Joseph S. Tracy. "Exchange Rates and Local Labor Markets." In *The Impact of International Trade on Wages*, edited by Robert C. Feenstra, 269-308. Chicago, University of Chicago Press, 2000.

------, Joseph S. Tracy, and Stephanie Aaronson. "Exhange Rates and Employment Instability: Evidence from Matched CPS Data." *American Economic Review, Papers and Proceedings* 89 (May 1999): 204-210.

Goldberg, Pinelopi Koujianou, and Michael M. Knetter. "Goods Prices and Exchange Rates: What Have We Learned?" *Journal of Economic Literature* 35 (September 1997): 1243-1272.

Gourinchas, Pierre-Olivier. "Exchange Rates and Jobs: What do We Learn From Job Flows?" In *NBER Macroeconomics Annual 1998*, edited by Ben S. Bernanke and Julio J. Rotemberg, 153-208. Cambridge and London, MIT Press, 1999.

Grossman, Gene M., and Elhanan Helpman. *Innovation and Growth in the Global Economy*. Cambridge MA, The MIT Press, 1991.

Ham, John C. "Estimation of a Labour Supply Model with Censoring Due to Unemployment and Underemployment." *Review of Economic Studies* 49 (July 1982): 335-354.

Hamermesh, Daniel S. *Labor Demand*. Princeton, NJ, Princeton University Press, 1993.

Hodrick, Robert J., and Edward C. Prescott. "Postwar U.S. Business Cycles: An Empirical Investigation." *Journal of Money, Credit and Banking* 29 (February 1997): 1-16.

Huizinga, John. "An Empirical Investigation of the Long Run Behavior of Real Exchange Rates." *Carnegie-Rochester Series on Public Policy* 27 (Autumn 1987): 149-214.

Jacobson, Louis S., Robert J. LaLonde, and Daniel G. Sullivan. "Earlings Losses of Displaced Workers." *American Economic Review* 83 (September 1993): 685-709.

Katz, Lawrence F., and Kevin M. Murphy. "Changes in Relative Wages: 1963-1987." *Quarterly Journal of Economics* 107 (February 1992): 35-78.

Klein, Michael W., Scott Schuh, and Robert K. Triest. "Job Creation, Job Destruction, and the Real Exchange Rate." Working Paper. Fletcher School, Tufts University, August, 2001.

Kletzer, Lori G. "Job Displacement." *Journal of Economic Perspectives* 12 (Winter 1998): 115-136.

------. *Job Losses From Imports: Measuring the Costs*. Institute for International Economics, 2001.

Leamer, Edward E. "In Search of Stolper-Samuelson Linkages Between International Trade and Lower Wages." In *Imports, Exports and the American Worker*, edited by Susan Collins, 141-214. Washington, DC, Brookings Institution, 1998.

Maddala, G.S. *Limited-Dependent and Qualitative Variables in Econometrics*. London and New York, Cambridge University Press, 1983.

Melitz, Mark J. "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity." Working Paper No. 8881. National Bureau of Economic Research, April, 2002.

Neumark, David, and Daiji Kawaguchi. "Attrition Bias in Economic Relationships Estimated with Matched CPS Files." Working Paper # 8663. National Bureau of Economic Research, December, 2001.

Ong, Paul M., and Don Mar. "Post-Layoff Earnings Among Semiconductor Workers." *Industrial and Labor Relations Review* 45 (January 1992): 366-379.

Pedersen, Turben M. "The Hodrick-Prescott Filter, the Slutzky Effect and the Distortionary Effect of Filters." *Journal of Economic Dynamics and Control* 25 (August 2001): 1081-1101.

Podgursky, Michael, and Paul Swaim. "Job Displacement and Earnings Loss: Evidence From the Displaced Worker Survey." *Industrial and Labor Relations Review* 41 (October 1987): 17-29.

Revenga, Ana. "Exporting Jobs? The Impact of Import Competition on Employment and Wages in U.S. Manufacturing." *Quarterly Journal of Economics* 107 (February 1992): 255-284.

Slaughter, Matthew. "What are the Results of Product-Price Studies and What Can We Learn from Their Differences?" In *The Impact of International Trade on Wages*, edited by Robert C. Feenstra, 129-165. Chicago, University of Chicago Press, 2000.

Topel, Robert H. "Local Labor Markets." *Journal of Political Economy* 94, no. 3, pt. 2 (1986): S111-S144.

Appendix

Correction for Sample Selection: The structure for the selection processes which generate our estimation sample consists of two selection equations. Let I_{1it}^{*} denote an unobserved index of the desire by an individual *i* to stay in the same house during period *t*. If this index exceeds zero, the individual does not move and we can match him across surveys. The indicator I_{1it} takes a value of one if we match the individual, and zero if we cannot match him. Similarly, let I_{2it}^{*} and I_{2it} denote the unobserved and observed indices for whether an individual *i* has reported earnings in the base year. Let X_i denote a vector of demographic characteristics for individual *i* that affect his mobility and propensity to report earnings. Combining these indices with our earlier wage growth equation yields the following joint specification (where we have relabeled the composite residual in the wage growth equation for ease of exposition, i.e. $\nu_{3ijt} = \mu_{2i} + \Delta\varepsilon_{it}$).

$$
\begin{aligned}
&I_{1it}^{*} = X_{it}\theta_1 + \nu_{1it} \\
&I_{1it} = 1 \text{ if } I_{1it}^{*} > 0,\ 0 \text{ otherwise} \\
&I_{2it}^{*} = X_{it}\theta_2 + \nu_{2it} \\
&I_{2it} = 1 \text{ if } I_{2it}^{*} > 0,\ 0 \text{ otherwise} \\
&\Delta w_{ijrt} = \Delta Z_{it}\beta + \Delta V_{rt}\gamma + \Delta Y_t\delta + \nu_{3ijt} \\
&\begin{pmatrix} \nu_{1it} \\ \nu_{2it} \\ \nu_{3ijt} \end{pmatrix} \sim N(0,\Sigma) \text{ where } \Sigma = \begin{bmatrix} 1 & \sigma_{12} & \sigma_{13} \\ \bullet & 1 & \sigma_{23} \\ \bullet & \bullet & \sigma_3^2 \end{bmatrix}
\end{aligned}
$$

The expression for the expected wage growth, conditional on an individual being matched across surveys and having reported earnings is

$$
\begin{aligned}
\mathrm{E}(\Delta w_{ijrt} \mid I_{1it}=1,\ I_{2it}=1) &= \Delta Z_{it}\beta + \Delta V_{rt}\gamma + \Delta Y_t\delta + \mathrm{E}(\nu_{3ijt} \mid \nu_{1it} > -X_{it}\theta_1,\ \nu_{2it} > -X_{it}\theta_2) \\
&= \Delta Z_{it}\beta + \Delta V_{rt}\gamma + \Delta Y_t\delta + \sigma_{13}\lambda_1 + \sigma_{23}\lambda_2 \ ,
\end{aligned}
$$

where the variables λ_1 and λ_2 are generalizations of the standard Mills ratios used to correct for sample selection:

$$\lambda_1 = \phi(X_{it}\theta_1)\Phi\left(\frac{X_{it}\theta_2 - \sigma_{12}X_{it}\theta_1}{(1-\sigma_{12}^2)^2}\right) / F(X_{it}\theta_1, X_{it}\theta_2, \sigma_{12})$$

$$\lambda_2 = \phi(X_{it}\theta_2)\Phi\left(\frac{X_{it}\theta_1 - \sigma_{12}X_{it}\theta_2}{(1-\sigma_{12}^2)^2}\right) / F(X_{it}\theta_1, X_{it}\theta_2, \sigma_{12}) \quad ,$$

and φ( ) and Φ( ) are the standard normal univariate density and cumulative density functions and *F* is the standard normal cumulative bivariate distribution function. Note that when $\sigma_{12}=0$, these two Mills ratios simplify to their more familiar form, $\lambda_k = \phi(X_{it}\theta_k) \big/ \Phi(X_{it}\theta_k)$.

The first Mills ratio corrects for selection effects arising from matching across surveys, while the second Mills ratio corrects for selection effects arising from requiring a worker to have reported earnings. We calculate these two Mills ratios using estimated values of θ_1, θ_2, and σ_{12} from a bivariate Probit model. These parameter estimates are presented in Appendix Table A2.[36] As expected, married men with older children who own their own home are much more likely to be matched across surveys. The probability of being matched also increases with age and is higher for individuals who have at least a high school education and for nonwhites. These same results carry over to the probability of having reported earnings, except that the probability is lower for nonwhites and for individuals who own their home.

Computation of Permanent Exchange Rates: The Beveridge-Nelson procedure decomposes an I(1) time series into its transitory and permanent components. We follow Beveridge and Nelson (1981) and Huizinga (1987), and model the exchange rate decomposition using lags of the real exchange rate. In particular, we assume that the first differences of the quarterly (log) real exchange rate follow an AR(4) process, so that the transitory departure of the real exchange rate from its expected long-run equilibrium, e_t^{BN}, is given by:

[36] We use our transaction costs of moving variables to help identify any selection effects since these are excluded from the wage growth specification. The probit specifications also include year effects that are excluded in the wage growth specification. In addition, marital status enters in its level form in the probits, and in change form in the wage growth specification.

$$E_t\left(e_t^{BN}\right) = -E_t\left(\sum_{j=1}^{\infty} \Delta e_{t+j} \mid \Delta e_t, \Delta e_{t-1}, \Delta e_{t-2}, \Delta e_{t-3}\right)$$

The actual variance decomposition results suggest that the temporary component of exchange rate changes accounts for only a small proportion of the variance of the real exchange rate series.

Appendix Table A1. Description of the Population of Male Workers

	All Observations Variable Means			Job Changers Variable Means		
	Unmatched	Matched	Estimation	Unmatched	Matched	Estimation
Blue Collar	0.51	0.51	0.50	0.54	0.53	0.53
White Collar	0.49	0.49	0.50	0.46	0.47	0.47
Job changers (1-year rate)	0.19	0.15	0.14			
Less than High School Degree	0.19	0.18	0.17	0.19	0.18	0.17
High School Graduates	0.40	0.40	0.41	0.41	0.41	0.41
Some College	0.21	0.21	0.21	0.18	0.19	0.20
College Graduates	0.20	0.21	0.21	0.18	0.19	0.20
Age in years (standard deviation)	36.9 (11.8)	38.8 (11.6)	38.6 (11.3)	32.0 (10.7)	34.0 (11.1)	33.8 (10.8)
Race (Non-white)	0.10	0.10	0.09	0.19	0.10	0.09
Married	0.67	0.74	0.75	0.55	0.63	0.65
Own home	0.66	0.77	0.77	0.53	0.66	0.66
Number of Observations	231,504	143,399	113,612	44,392	21,294	16,513

Notes: **All statistics for Matched CPS use base year values. Unmatched sample excludes individuals with missing earnings.

Appendix Table A2. Probability of Matching Individual Across Surveys & Nonmissing Wage		
	Match Across Surveys	Nonmissing Wage
Variable		
Married	0.144**	0.293**
	(0.006)	(0.007)
Unmarried kids < 18 years old	0.043**	0.058**
	(0.006)	(0.007)
Unmarried kids < 6 years old	–0.016**	0.151**
	(0.008)	(0.009)
Age of household head	0.915**	0.406**
	(0.026)	(0.028)
Age squared	–0.037**	–0.016**
	(0.001)	(0.001)
Age cubed (x100)	0.065**	0.026**
	(0.002)	(0.002)
Age fourth (x10,000)	–0.042**	–0.016**
	(0.001)	(0.001)
High school graduate	0.128**	0.095**
	(0.006)	(0.007)
Some College	0.081**	0.102**
	(0.007)	(0.008)
College Graduate	0.082**	0.033**
	(0.008)	(0.008)
Nonwhite	0.037**	–0.319**
	(0.007)	(0.007)
Own a home	0.598**	–0.119**
	(0.005)	(0.006)
Correlation coefficient	0.128**	
	(0.003)	
Year effects included	Yes	Yes
2-Digit industry effects included	Yes	Yes
N = 328,663		

Reference callouts in the paper:

Acemoglu (1998), 29
Allayanis and Ihrig (2002),, 26
Aw, Chung and Roberts (2000), 3
Bacchetta and van Wincoop 2002, 4
Bacchetta and vanWincoop (2002), 27
Bartel (1979), 13
Berman, Bound and Griliches (1994), 19
Bernard and Jensen (1999), 8
Bernard and Jensen 1999, 2
Bernard, Jensen, and Schott (2002)., 29
Bernard, Jensen, and Schott 2002, 2
Beveridge and Nelson (1981), 11, 35
Borjas, Freeman and Katz (1997), 19
Branson and Love 1988, 2
Burstein, Neves and Rebelo (forthcoming), 27
Campa and Goldberg (1999)., 26
Campa and Goldberg (2002, 29
Campa and Goldberg (2002), 11
Campa and Goldberg 1997, 26
Campa and Goldberg 2001, 2
Card and Dinardo (2002), 27
Carrington (1993), 24
Clarida (1997),, 26
Cline (1987), 29
Corsetti and deDola 2002, 4
Davis and Haltiwanger (1999), 3
Dornbusch 1987, 4
Farber (1997), 10
Feenstra (2000), 19
Feenstra and Hanson (1999, 29
Foster, Haltiwanger, and Krizan (1998), 3
Freeman, 1995, 29
Goldberg (2002), 11
Goldberg (2002)., 11
Goldberg and Knetter (1997)., 29
Goldberg and Knetter 1995, 4
Goldberg and Tracy (2000), 5
Goldberg and Tracy (2000)., 4
Goldberg, Tracy, and Aaronson (1999), 4
Gourinchas (1999), 4
Gourinchas 1999, 2
Grossman and Helpman (1991),, 3
Ham (1982)., 14
Hamermesh (1993), 5
Hodrick and Prescott (1997), 11
Huizinga (1987),, 35
IMF's *International Financial Statistics*, 11
Jacobson, LaLonde and Sullivan (1993), 24
Katz and Murphy (1992), 19
Klein, Schuh and Triest (2001), 4
Kletzer (1998, 2001), 24
Leamer (1998), 29
Maddala (1983, pg 278-283), 14
Melitz (2002), 2
Neumark and Kawaguchi (2001), 13
Neumark and Kawaguchi (2001)., 16
Neumark and Kwaguchi (2001), 13
Ong & Mar (1992), 24
Pedersen (2001), 11
Podgursky & Swaim (1987), 24
Revenga 1992, 2
Slaughter (2000), 29
Tesar and Dominguez 2002, 27
Topel (1986)., 5
Topel's (1986), 12