

Falling Labor Share and Rising Inequality: The Role of Wage Contracts.

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PRELIMINARY

Empirical results are preliminary.
Further results and revisions are pending disclosure.
The most updated draft can be found at:

<https://sites.google.com/site/donigerc/research/drafts>

Abstract

I study trends in labor share and earnings inequality in the context of an on-the-job search model featuring heterogeneous wage contracts. In the model, a shift toward employment contracts with upwardly-re-negotiable wages implies a decrease in labor share and an increase in inequality. Using the German social security register, I assess the ability of this mechanism to account for trends in inequality and labor share observed in that country. I find a secular trend toward renegotiable wage contracts which accelerates in the late 1990's matching the observed series for inequality and labor share over the same horizon. Further, I find that industries in which the incidence of renegotiable contracts increases most also experience larger increases in inequality and larger declines in labor share.

*Email: Cynthia.L.Doniger@frb.gov. I acknowledge diligent research assistance of Carter Bryson. This study uses the weakly anonymous Sample of Integrated Labour Market Biographies (Years 1975-2010). Data access was provided via on-site use at the Research Data Centre (FDZ) of the German Federal Employment Agency (BA) at the Institute for Employment Research (IAB) in Ann Arbor, Michigan, USA; Cambridge, Massachusetts, USA; and Los Angeles, California, USA.

†The views expressed in this paper solely reflect those of the author and not necessarily those of the Federal Reserve Board, the Federal Reserve System as a whole, nor of anyone else associated with the Federal Reserve System.

1 Introduction

Since the mid-1970s Germany and other developed countries have experienced an increasing income inequality (Card et al., 2013; Lemieux, 2008) and a decreasing share of output paid as labor compensation (Karabarbounis and Neiman, 2014; Elsby et al., 2013). This paper documents these trends and a coincident rise in the proportion of German workers employed in labor contracts for which there is evidence of renegotiable pay. I consider these empirical observations in the context of a job ladder model in which firms may elect to employ under a non-renegotiable or a renegotiable wage contract (Doniger, 2015). I show that, in this model, as the share of firms electing to employ under renegotiable contracts increases labor share falls and inequality rises, especially in the lower tail of the wage distribution. Returning to the data, I find evidence that industries in which there is evidence of a larger increase in renegotiation labor share fell and inequality in the lower tail increased more rapidly.

The mechanism driving labor share and inequality variation in the model stems from the difference in how the considered labor contracts respond to future competition. In particular, how this difference leads to differentials in the amount of rent yielded to newly hired employees. Reducing the share of contracts that post wages increases firms ability to extract rents, particularly from workers lowest on the job ladder.

I find evidence of renegotiable pay by examining the labor market histories contained in the Sample of Integrated Labour Market Biographies (SIAB) provided by the the Research Data Centre of the German Federal Employment Agency at the Institute for Employment Research (IAB). These data contain a 2 percent random sample of German worker’s social security filings from 1975-2010. The universe covers all workers liable to social security, with the important exceptions of self-employed and public sector employees. Each record contains the start and end date of employment, average daily wage, and employer identifier as well as individual demographic characteristics and industry and occupation. A typical worker is registered with her employer from January 1 to December 31 each year. A minority of workers change employers and have two or more registered employment spells with different

employers including their respective starting and ending dates. A smaller minority *do not* change employers but are re-registered with a nominal raise with an existing employer within one year.

I show that year-on-year wage changes for workers who idiosyncratic raise dominate those of workers who with job-to-job transitions and that both dominate the distribution for workers who remain with the same employer and have no mid-year raise. In addition, while the probability of an idiosyncratic raises and a job-to-job transitions decline as a job-cycle progresses the probability of the former falls short of the later early on and the two converge with time. Both of these findings are in line with the job-ladder model in which only the better firms re-negotiate, as posited in this paper.

I exploit variation across industries and to identify a relation between rising incidence of re-registration, indicative of rising incidence of re-negotiable contracts, and the trends in labor share and inequality. To do so I supplement the SIAB data with national accounts data from the OECD and the EU-KLEMS project. Industries in which there is evidence of a larger increase in the share of renegotiable contracts exhibit a greater decline in labor share and greater increase in lower tail residual wage inequality.¹ All else equal, the observed change in the incidence of renegotiable contracts accounts for accounts for more than half the within industry decline in labor share and a smaller fraction of the increase in inequality.

This paper complements a host of theories have been put forward in order to explain these shifts: substitution of capital for labor, globalization, labor market fluidity, etc. and I test my model against these hypotheses and find that it is robust. In other words, increasing propensity for renegotiation is not simply a manifestation of coincident aggregate trends, for instance the decrease in unionization. Controlling for these trends, increasing renegotiation retains its predictive power with respect to labor share and inequality.

¹Wages are first cleaned of the effects of gender, education, age, industry and occupation

2 Institutional Changes and Aggregate Trends

Critical geopolitical events—the collapse of the Soviet Union and reunification—lead to large scale immigration to West Germany following 1990. Immigration likely contributed to the rise in unemployment during this period as well. Unemployment, in turn, instigated large scale labor market reform starting with the Employment Promotion Act of October 1996 and culminating with the Hartz reforms 2003-2005. The aim of these reforms was stabilization of the labor market through promotion of employment. Of particular interest for the present work, the Employment Promotion Act reduced restrictions of fixed contract employment while Hartz II promoted part time employment. In addition, these reforms reduced the generosity of non-employment benefits. Reunification likely also contributed to the decline in unionization as the wage distribution in the East fell short, and continues to fall short, of that in the West. These discrepancies have prompted a reorganization of union structure from industrial to plant level which has contributed to union decline.

Despite these radical changes in German labor market institutions, significant features of the trends in labor share and inequality remain to be accounted for.

2.1 Falling Labor Share

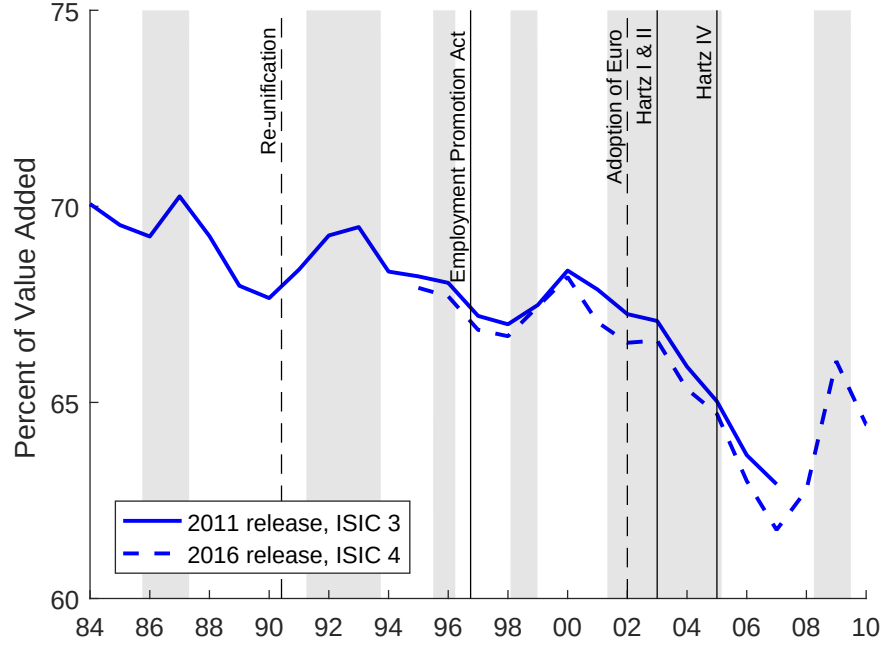
I follow the standard procedure and report labor share as the ratio of labor compensation (inclusive of proprietors income) to gross value added.² Data on labor share and value added are taken from the EU KLEMS Growth and Productivity Accounts.³

Figure 1 plots the share from 1984 until 2010. The solid line represents the share as reported in the EU KLEMS March 2011 release under the International Standard Industrial Classification (ISIC) revision 3. The dashed represents the share as reported in the December 2016 release under ISIC revision 4. From 1984 until 2010 labor share has exhibited a secular decline interrupted only during recessions, indicated by the gray areas. The share fell 7.3

²In the Appendix I document a parallel trend over this period an alternative measure—compensation of employees over gross value added—which is robust to errors in the imputation of proprietors income.

³For details of the data collection see [O'Mahony and Timmer \(2009\)](#).

Figure 1: Trends in Labor Share 1984-2010.

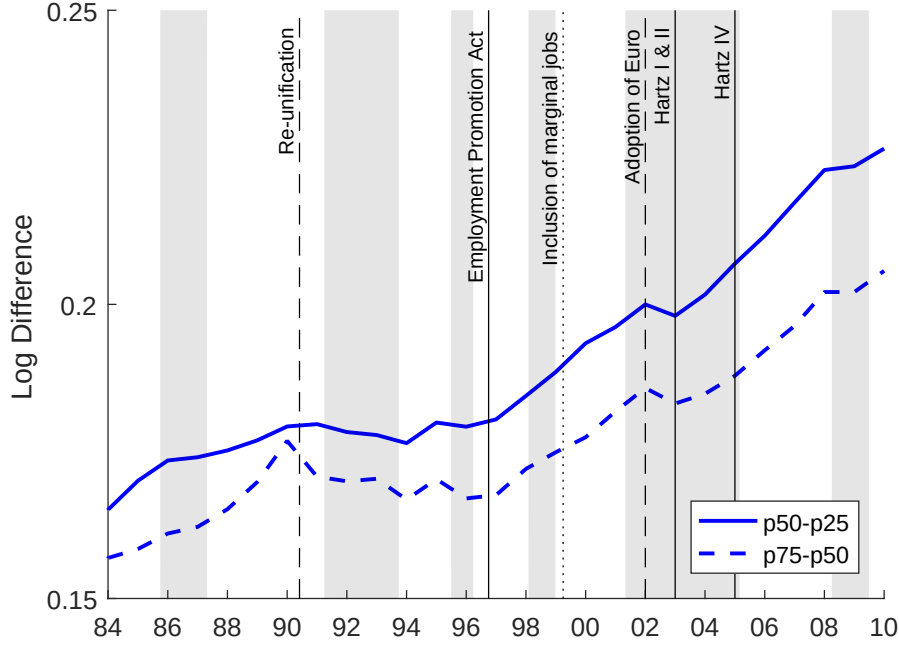


Note: The solid line represents the share as reported in the EU KLEMS March 2011 release under the International Standard Industrial Classification (ISIC) revision 3. The dashed represents the share as reported in the December 2016 release under ISIC revision 4. Vertical lines indicate important geopolitical events, and labor market reforms. Gray areas indicate indicate OECD based monthly recession dates as reported by the Federal Reserve Bank of St. Louis FRED.

percentage points from 1984 to 2008, likely in part due to severe economic distortions in the Euro area since the 2008 Great Recession, after which it has risen 1.6 percentage points for a total change over the horizon of 5.6 percentage points. Vertical bars in Figure 1 also plot key dates of geopolitical changes and reforms of labor market policy. Evolution of the labor share, however, seems to be largely independent of these.

In part this trend is due to sectoral changes that have resulted in industries with lower labor share accounting for a greater share of economic activity. Table A1 decomposes the headline labor share trend into components that account for (a) the shift in labor share with industries and (b) the share of economic activity accounted for by each industry. The analysis reveals that in the early part of the sample (1984-1995) the trend is accounted for by

Figure 2: Trends in Inequality 1975-2010.



Note: The solid line plots log difference between the 75th and the 50th percentile of imputed log wages while the dashed line plots the difference between the 50th and the 25th percentile. Vertical lines indicate important breaks in the data series, geopolitical events, and labor market reforms. Gray areas indicate OECD based monthly recession dates as reported by the Federal Reserve Bank of St. Louis FRED.

sectoral change. Indeed, on average, labor share within industries rose during this period. In the later period (1995-2010), however, the shift-share analysis reveals the opposite. Not only did labor share fall within nearly every sector but also the majority of the aggregate trend in the period is accounted for by these within industry changes. Of the 3.5 percentage point decline over this period, only 1.3 percentage points are accounted for by sectoral composition.

2.2 Rising Inequality

In order to assess the evolution of inequality, I take earnings data from the Sample of Integrated Labor Market Biographies (SIAB). The SIAB is a two percent random sample drawn from the Integrated Employment Biographies (IEB) of the Institute for Employment Research (IAB) of the German Federal Employment Agency. IEB contains records of all in-

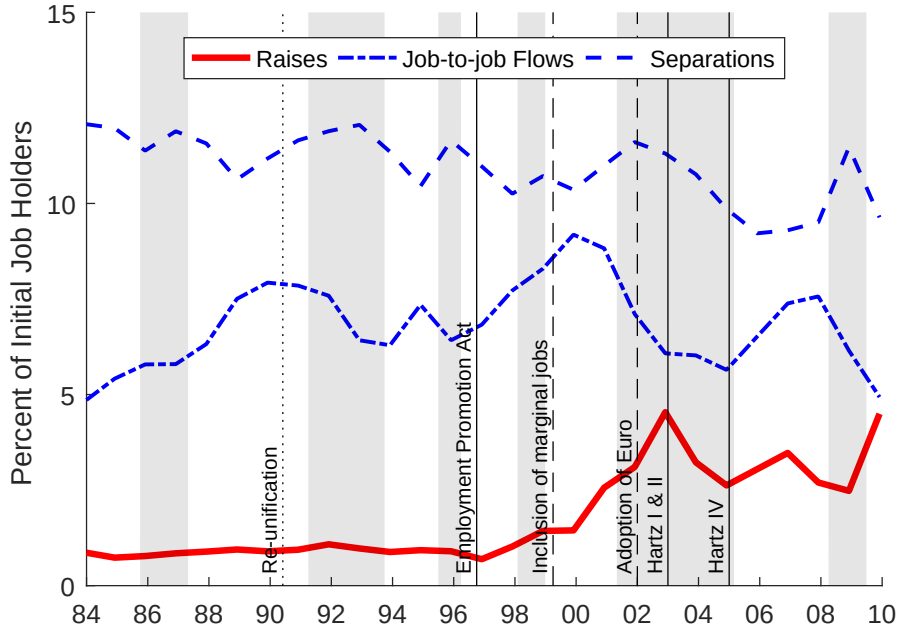
dividuals in Germany that have at least one of the following employment statuses: employed and subject to social security, marginal part-time employment, benefit receipt under German Social Code III or II, official registration as job-seeking at the German Federal Employment Agency, and planned participation in programs of active labor market policies. This data contains the exact beginning and ending date of each employment relationship, average daily wages during that relationship, basic job characteristics (occupation, industry, part-time or full-time status), and basic demographics (age, sex, education, German/non-German nationality). Importantly for the present work, the data also contain the exact starting and ending dates of each employment spell.

I focus on daily wages of full-time jobs of West German men age 20-60. I restrict to full-time workers to mitigate the impact that unobserved variation in hours worked might have on observed trends in inequality. I begin with the sample of full-time jobs in progress in the first week of January in each year 1975-2010. I aggregate multiple concurrent jobs with the same employer and broad occupation, taking the sum of daily wages for the concurrent period. From these data I record the average daily wage during an employment spell, characteristics of the employee (age, sex, education, occupation) and job (industry).

An important drawback of the SIAB data is censoring of earnings data at the social security maximum: between 8% and 12% of full-time male's wages are censored in each year. I follow [Dustmann et al. \(2009\)](#) and [Card et al. \(2013\)](#) and stochastically impute the censored wages using a series of Tobit models fit separately by year, education level (five categories), age range (four 10-year ranges), industry, and occupation. I replace the censored wage values with a random draw from the upper tail of the appropriate conditional wage distribution using parameter values from these models.

Figure 2 plots the evolution of the range between the 75th and 50th and 50th and 25th percentiles of imputed log wages. The solid line plots log difference between the 75th and the 50th percentile of imputed log wages while the dashed line plots the difference between the 50th and the 25th percentile. Inequality rises comparatively more quickly in the period

Figure 3: Separation, Job-to-Job, and Raises 1975-2010.



Note: Separations are measured as job-leavers who do not have subsequent employment within 15 days. Job-to-job Flows are measured as job-leavers who do have subsequent employment within 15 days. Raises are measured as a mid-year nominal pay increase. Raises which are concurrent with more than 15% of employees within an industry are purged. Gray areas indicate OECD based monthly recession dates as reported by the Federal Reserve Bank of St. Louis FRED.

after the implementation of the Employment Protection Act in 1996.

2.3 Rising Evidence of Renegotiable Pay

Using the afore described sample from the SIAB, I record the fraction workers whose initial employment spell ends in job loss or job-to-job transition and the fraction who experience an idiosyncratic mid-year raise. Measurement of job-to-job transitions and idiosyncratic mid-year raise requires some discussion. A typical worker is registered with her employer from January 1 to December 31 each year. A small minority of workers change employers and have two or more registered employment spells with different employers. These data include the starting and ending dates with each employer. I record a job-to-job transition

if the start date of the new job exceeds the end date of the previous job by no more than 15 days. Another small minority *do not* change employers but are re-registered with an existing employer within one year, resulting in two or more registrations per year with the same employer. Focusing on idiosyncratic raises, I record a re-registration for each case in which the new registration is at nominal raise and which does not coincide with a nominal raise for more than 15% workers within the same industry.

Figure 3 plots the yearly incidence of job-to-job mobility and re-registrations for each year 1984-2010. The rate of job-to-job transitions fluctuates around 6.5 percent; peaking around 2000; and declining since this date. However, over the whole horizon the rate is relatively stable if not increasing. Separations exhibit a mild decline. In contrast, idiosyncratic raises increase in frequency over the horizon, with a marked acceleration after the mid-1990's.

In the following Section, 3, I present a model through the lens of which the rise in the incidence of idiosyncratic raises relative to the stable trend in job-to-job flows indicates a rise in the propensity for firms to employ under renegotiable contracts. I also show that this model predicts a fall in labor share and an increase in inequality, especially in the lower tail, when the propensity for employment under a renegotiable contract rises. I then provide evidence, in Section 4, that auxiliary predictions of the model regarding workers who receive raises are borne out in the data. Specifically, I detail the distribution of year-over-year pay gains for job stayers, workers with idiosyncratic raises, and job-to-job movers and the incidence of job-to-job transition and idiosyncratic raises over the job-cycle. These are all in line with the predictions of the model. Having argued that the measured idiosyncratic raises are indeed indicative of the posited model containing renegotiable contracts, I exploit cross-industry variation on labor share, inequality, and incidence of raises to show that a rising propensity for renegotiable contracts does indeed correlate with falling labor share and rising inequality in Section 5. The finding is robust to a variety of other accounts for the labor share and inequality trends.

3 A Job Ladder with Heterogenous Wage Contracts

Many theories have been put forth to explain rising inequality and falling labor share, jointly or independently: globalization, capital-labor substitution, skill-biased technical change, de-unionization, etc. In Section 5.1, I address several of these empirically. Here I recap the main features of a complementary theory based on a frictional model of the labor market in which employers may choose to hire workers under a non-negotiable or a re-negotiable wage contract. For a fully detailed exposition of the model see [Doniger \(2015\)](#).

The model assumes the basic structure of a random-search job ladder model à la. [Burdett and Mortensen \(1998\)](#). I augment this model with a choice of wage contracts. Firms may choose a non-negotiable wage contract, as in the posted-wage model of [Burdett and Mortensen \(1998\)](#), or a contract that can be re-negotiated as the worker's outside option evolves through further search, as in the sequential Bertrand auction of [Postel-Vinay and Robin \(2002\)](#). In [Doniger \(2015\)](#), I show that when the cost of maintaining a vacancy featuring a re-negotiable contracts exceeds that of a non-negotiable vacancy the equilibrium is segmented and only more productive firms re-negotiate.

I re-derive the key features of the model and present formal proof of segmentation in the Appendix. Here I provide intuition. Define non-negotiable wage offered by a firm with labor productivity p as $w^n(p)$ and the re-negotiable wage as $w^r(p, q)$ where q is the labor productivity of the worker's best-to-date outside option. In the Appendix, I show that these have the following properties:

$$(3.1) \quad \frac{dw^n(p)}{dp} > 0,$$

$$(3.2) \quad \frac{dw^r(q, p)}{dq} > 0,$$

$$(3.3) \quad \frac{dw^r(q, p)}{dp} < 0, \text{ and}$$

$$(3.4) \quad w^r(p, q) < w^n(q) \quad \forall q \leq \check{p} < p$$

where $\check{p}$ is the marginal product of labor such that the employer is indifferent between the two contract types given the relative costs of the associated vacancies.

(3.1) and (3.2) are intuitive. The first, (3.1), states that under a non-negotiable contract

wages are increasing in incumbent's productivity. [Burdett and Mortensen \(1998\)](#) and [Bontemps et al. \(2000\)](#) prove this in their wage-posting models which are nested in the present model.⁴ The intuition follows from noting that, conditional on selecting the nonnegotiable contract, a more productive firm is willing to pay more for an employee.⁵ The second, (3.2), states that under a renegotiable contract wages are increasing in a worker's best-to-date outside option. [Postel-Vinay and Robin \(2002\)](#) prove this in their sequential Bertrand auction which is also nested in the present model.⁶ The intuition follows by noting that a larger wage offer is required to beat out a more productive competing offer.

(3.3), which states that more productive employers employ workers at lower wages conditional on their best-to-date outside options, appears counterintuitive. However, by noting two things this can be made intuitive. First, the renegotiating employer offers a wage equal to the worker's current reservation given her current best-to-date outside offer. A lower wage offer would not be accepted and since the employer can renegotiate wages the prospect of future competition provides no incentive to offer a higher wage. Second, as in [Postel-Vinay and Robin \(2002\)](#), the option value of search is an amenity associated with the job offer and is thus priced into the wage contract. Since the option value stems from the expectation of future wages, and since a more productive employer will place higher wage bids in the future, employment in a high productivity firm now locks in a longer tail of the expected wage distribution. In other words, the option value of search is increasing in incumbent's productivity, conditional on the incumbent hiring under a renegotiable contract.

Finally, (3.4), which states that a firm which renegotiates can hire from a firm that does not at a wage cut, also appears counterintuitive. However, the logic also stems from comparing the option value of search in a nonnegotiable contract at a q -productivity employer to that in a renegotiable contract at a p -productivity employer. Since the renegotiating

⁴An economy identical to that considered by [Bontemps et al. \(2000\)](#) is recovered when the relative cost of maintaining a renegotiable vacancy is sufficiently large.

⁵That this carries through to the segmented equilibrium follows from noting that labor flows are constrained efficient under segmentation. This is discussed in the Appendix.

⁶An economy identical to [Postel-Vinay and Robin \(2002\)](#) is recovered when the relative cost of maintaining a renegotiable contract falls below zero.

employer will increase the wage offer in an attempt to retain the worker the renegotiating employer offers a larger option value of search. As in the logic of (3.3) this is priced into the wage that induces transition from the q -productivity firm to the p -productivity firm and results in the noted wage cut.

Finally, noting that labor flows are constrained efficient under segmentation, properties (3.1)-(3.4) are all that is required to prove that segmentation is a Nash-equilibrium of the game. The Doniger (2015) and Appendix also show that when the job ladder is sufficiently short—the hazard of on-the-job offer arrival is not too much larger than that of separation—there is a one-to-one mapping between the relative cost of negotiable and non-negotiable vacancies and the share of employers that do not negotiate.

The Doniger (2015) model of contract heterogeneity has two aggregate implications important for the present project:

Proposition 1. *Increasing the share of employers offering the re-negotiable contract reduces labor share.*

Proposition 2. *Increasing the share of employers offering the re-negotiable contract increases lower tail inequality.*

Proofs can be found in the Appendix and in Doniger (2015). Here I provide intuition.

To gain intuition for Proposition 1, note three forces that act upon the compensation of employees. First, some marginal employer switches from the non-negotiable contract to the renegotiable contract. From (3.4) we know that this employer reduces its average wage bill. Second, countervailing this force, wages necessary to higher from this marginal firm increase. These first two items offset perfectly. Third, renegotiating firms yield no rent at hiring, since they can adjust in the face of future competition, while non-negotiating firms offer wages above the history dependent reservation wage since they cannot adjust later to ward off future competition. Indeed, nonnegotiable wages are optimally set to balance the lost rent against the hazard of attrition (Burdett and Mortensen, 1998; Bontemps et al.,

2000). As the share of re-negotiating employers rises the result is that the rent yielded at hiring falls.⁷

To gain intuition for Proposition 2 note that a worker currently unemployed or employed in a nonnegotiable contract captures rent only when she meets another employer who *does not* negotiate. Thus, the wage offer that a worker in such a position is willing to accept from an employer that *does* renegotiate is declining in the share of renegotiable employers. Further, in the Appendix I show that the decline is largest when the workers best-to-date outside option is worst. This gives the result.

4 Idiosyncratic Raises in the Lens of the Model

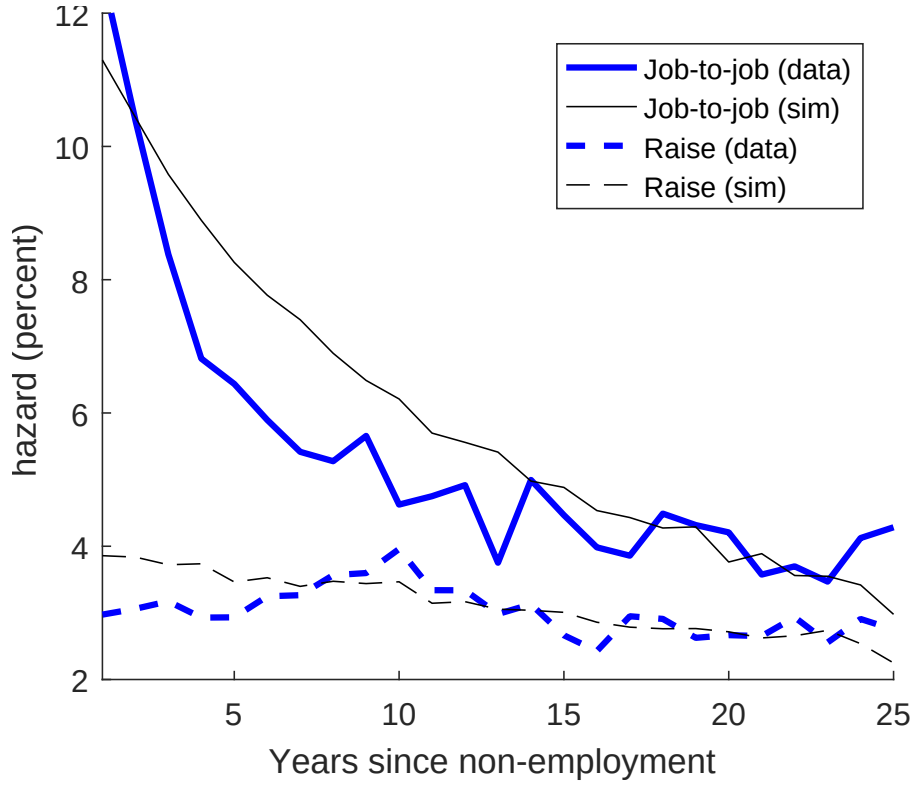
In Section 2, I showed that the incidence of idiosyncratic raises is rising rapidly since the late 1990's. This section begins by investigating the properties of idiosyncratic raises identified in the SIAB data vis à vis the models predictions. Overall, the data are in line with model predictions. I then discuss how incidence of raises can be used to infer incidence of renegotiable contracts.

Raises in the Data and in the Model

The model described in the previous section exhibits a job-ladder. As such job-to-job transitions are predicted to decline as a job-cycle—the time since a worker's last unemployment spell—continues. Job-to-job transitions occur whenever a worker draws a new employer that is better than any previously sampled during the job-cycle. The job-ladder similarly regulates the quality of a worker's best to date outside option.

⁷Indeed, it falls to zero as the game Approaches Postel-Vinay and Robin (2002) making that game subject to the Diamond (1971) Paradox. Doniger (2015) discusses how contract heterogeneity serves to break the Diamond (1971) Paradox, restoring a relation between wage dispersion and search incentives. The problem of the Diamond (1971) Paradox could also be alleviated by introducing bargaining power on the part of workers as in Cahuc et al. (2006). As compared to Cahuc et al. (2006) which offers a reduced form incentive for search on the part of the unemployed, the Doniger (2015) model provides a microfounded incentive that leaves observable tracks in the data: the incidence of raises relative to job-to-job transitions.

Figure 4: Job-to-job transitions and Raises over the Job-Cycle.



Note: These data reflect 2006. This year was chosen as a representative year that did not coincide with implementation of any of the Hartz reforms. The data features, decreasing hazards and convergence, are representative; however, figures reflecting other years are pending data disclosure.

The best-to-date outside option evolves according to the second best employer sampled during a job-cycle. Were all contracts renegotiable this would imply that the hazard of a raise be nearly identical to that of job-to-job transition. On the other hand, were all contracts to be non-renegotiable the hazard of a raise would be nil regardless of duration of job-cycle. In the intermediate case, the hazard of a raise falls short of that of a job-to-job transition early in the job-cycle when many workers are employed in the less productive firms that do not renegotiate. As the job-cycle progresses, however, workers climb the ladder and the probability that an incumbent renegotiates rises toward one. Thus, the model predicts that the hazard of job-to-job transition and of a raise converge.

Figure 4 plots the empirical job-to-job transition hazard and idiosyncratic wage hazard

against the same hazards implied by a loosely calibrated model in which 80 percent of firms do not renegotiate.⁸ As predicted by the model the hazard of an idiosyncratic raise falls short of a job-to-job transition early in the job-cycle and the hazards converge over time.

Table 1: Labor flows, pay changes, and year/year wage growth.

(2006)		year-over-year % real pay change						
% of workers experience		average	median	share less than or equal to				
				-0.1	-0.05	0	0.05	0.1
Job staying	84.30	0.01	0.00	0.07	0.16	0.54	0.80	0.91
Job-to-job move	6.25	0.07	0.03	0.16	0.23	0.40	0.54	0.65
Mid-year raise	2.86	0.09	0.06	0.03	0.06	0.19	0.42	0.65
Separation	9.44							
N 326,420								

The model also makes predictions for the distribution of pay changes following job-to-job mobility, raises, and continued employment with neither. In a given interval of time, if neither job-to-job mobility nor competition between prospective employers occur a worker's wage should remain unchanged. Following job-to-job mobility a worker may experience either pay gain or a pay cut. The pay gain arises if both the new incumbent and the past incumbent renegotiate and the productivity of the past incumbent does not fall too short of that of the new incumbent. However, if the past incumbent either does not renegotiate or renegotiates but is sufficiently less productive than the new incumbent then the option value of search from within the new incumbent is large enough that the new incumbent can hire the worker at a pay cut. Similar features are present in the nested [Postel-Vinay and Robin \(2002\)](#) model. When some, but not all, firms renegotiate, competition between employers leads to on-the-job raises in the model. These skew more positively than pay changes following job-to-job moves.

Table 1 records year-over-year real pay changes conditional on the evolution of labor

⁸The on-the-job offer arrival hazard is set to 0.25 and the separation hazard to 0.07 implying just over seven job offers per employment cycle.

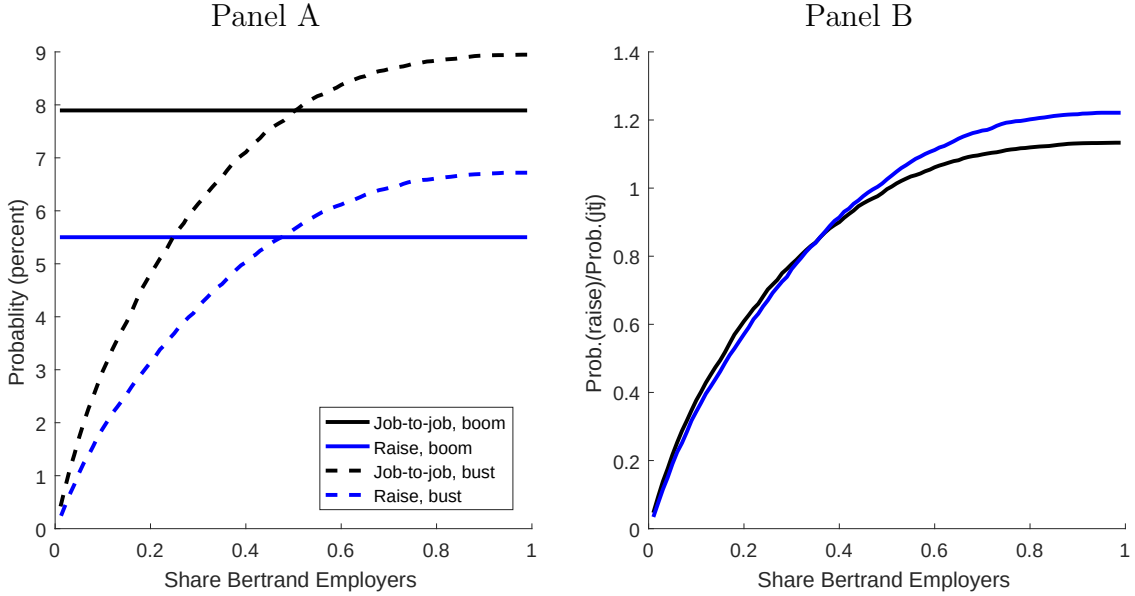
market history during that year. Workers who remained with their incumbent during the entire year account for 84.3 percent of the sample. These workers received very small pay changes on average and the distribution of pay changes is tightly grouped around zero. This is largely in line with model predictions. Workers who moved job to job received a median pay change of 7 percent while the distribution of these pay changes was considerably more disperse: 16 percent of job-to-job movers receive a pay cut in excess of 10 percent while 35 percent receive a pay gain in excess of 10 percent. For workers who receive an idiosyncratic mid-year pay increase the median year-over-year pay gain was 9 percent. Again outcomes were disperse with 3 percent receiving a pay cut in excess of 10 percent and 35 percent receiving a pay gain in excess of 10 percent. These relationship between these distributions is broadly in line with the predictions of the model. Job-stayers exhibit the least dispersion while pay changes for workers who receive raises with their incumbents dominate those for workers who move job-to-job.

Inferring the Share of Renegotiable Contracts

Turning now to inference of the share of renegotiable contracts. Figure 5 Panel A illustrates the steady state probability of a job-to-job transition and a raise in the model as the share of firms utilizing the renegotiable contract rises from nil to unity. As discussed in the Appendix, the allocation of labor is constrained efficient under all compositions of contract types. Thus, the probability of observing a job to job transition (solid lines) depends only on the model hazards and is independent of the fraction of employers utilizing the renegotiable contract. In contrast the probability of observing a raise is increasing, not surprisingly, in the fraction of firms which renegotiate.

Panel A illustrates these hazards under a high probability of on-the-job offer arrival and low probability of separation as would be the case in an expansion (black) and a low probability of offer arrival and high probability of separation as would be the case in a contraction (blue). In the contraction simulation both job-to-job transition and raise probabilities fall

Figure 5: Inference. pos



short of the expansion. However, these scale approximately proportionately—a drop in the job-to-job transition probability of half coincides with a job in the raise probability of about half—when the share of firms that renegotiate is not too large. This is illustrated in Panel B. In the aggregate data presented in Section 2 the ratio fluctuates between 0.1 and 0.6, well within the region in which the mapping from the ratio of these to the share of firms which renegotiate is approximately acyclical.⁹

5 Exploiting Heterogeneity Across Industries

Germany’s declining labor share and rising inequality follow patterns similar to the United States, but at some delay. Similar to the findings of [Elsby et al. \(2013\)](#) the falling labor share in the earlier period is accounted for largely by sectoral composition. Indeed within sectors labor share is gowning. In the later period labor share falls in most industries, with the notable exception of ”Professional and Business. The pattern in Germany lags the U.S.

⁹In 2003 and 2010 the ratio rises to .75 and .9 respectively. These are still within the range of approximate acyclicity of the mapping. In what follows I test the robustness of conclusions to exclusion of these years.

by about a decade. Similarly, as [Dustmann et al. \(2009\)](#) has already noted, inequality rose in the lower tail in the 1990's a decade after the corresponding pattern in the U.S.. For these reasons I restrict attention in this section to the post-1995 period.¹⁰

I now turn to exploiting heterogeneity across industries in order to explore the relationship between trends in the incidence of re-negotiable contracts and in labor share and inequality in the later period: 1995-2010. To test the hypothesis that an increase in the share of firms selecting renegotiable contracts implies a decrease in labor share and an increase in lower tail inequality I run the following reduced form regression:

$$LHS_{i,t} = \beta_1 \{share\ renegotiable_{i,t}\} + \{competing\ theories_{i,t}\} \times \beta \\ + year\ fixed\ effects + industry\ fixed\ effects + \varepsilon_{i,t}$$

where $LHS_{i,t} = \{Labor\ Share, \ln(p50) - \ln(p10)\}$ at the industry $\times$ year level, $\{share\ renegotiable_{i,t}\}$ is the ratio of idiosyncratic raises to job-to-job transitions in an industry $\times$ year, and $\{competing\ theories_{i,t}\}$ is a vector of measures related to the alternative hypotheses discussed below, also measured at the industry $\times$ year. Regressions are weighted according to the average value added when the left hand side is labor share and average employment at the industry level left hand side measures inequality. Regressions are clustered at the industry level. I consider the 33 broad industries in the ISIC4 classification. Data on labor share are taken from the EUKLEMS.

Table 2 columns I and IV present the main result. An increase in the share of renegotiable contracts predicts a decrease the labor share and an increase in lower tail inequality. All else equal, if the share of renegotiable contracts rose from the level observed in 1995 to that observed in 2010 the labor share would have fallen by 1.3 percent; more than half of the within industry variation! Similarly, the change in the implied incidence of renegotiable contracts contributes 0.4 percentage points to the 9 percent increase in lower tail residual

¹⁰In addition, key covariances used to check robustness of the conclusions exist only for the post-1995 period.

inequality.¹¹

Table 2: Main Table.

<i>Dependent Variable:</i>	Labor Share ^a			p50-p10 ^b		
	I	II	III	IV	V	VI
Share Renegotiable	-0.047** (0.020)	-0.048*** (0.016)	-0.039** (0.017)	0.015** (0.005)	0.014** (0.006)	-0.013** (0.005)
Union Density		0.235 (0.164)	0.231 (0.167)		-0.080 (0.063)	-0.082 (0.069)
Import Exposure			-0.010 (0.166)			-0.024 (0.098)
Cap.-Lab. Subs.			-0.000 (0.000)			-0.000 (0.000)
Dynamism			-0.167* (0.091)			0.014 (0.056)
Match Quality			-0.005 (0.010)			-0.008 (0.010)
FE (Year and Industry)	X	X	X	X	X	X
Observations	528	528	528	528	528	528
R-squared (within)	0.190	0.243	0.263	0.684	0.696	0.700

5.1 Robustness to Alternative Explanations

Are these correlations robust to competing explanations? Here I test against a host of competing theories. In sum, I find that inclusion of competing theories strengthens the main result.

Declining Unionization

The primary alternative hypotheses is declining unionization in Germany over this period: the fraction of workers employed outside of a sectoral agreement rose from 27 percent in 1995 to 44 percent in 2007 (Card et al., 2013). Unionization may increase workers' share of the surplus by increasing their bargaining power, for example ? finds a 20 percent union

¹¹Results are robust to the exclusion of Mining and Quarrying and to the exclusion of 2003 and 2010 which may have spurious idiosyncratic raise probabilities.

wage premium in U.S. data. Unionization may also compress wage schedules workers bargain collectively (?). In the United States ? finds a union wage premium around 20 percent.

In regressions II and V, I control for the share of employment in an industry which is governed by a union agreement. I obtain an estimate of this share using the IAB Establishment Panel. These data are a representative employer survey at individual establishments conducted each year since 1993 in West Germany (and each year since 1996 in East Germany). From the survey questions weather or not a union exists at an establishment can be inferred along with the establishments total employment. These data can not be directly linked to the SIAB data even at the industry by year level; however, I impute The estimated share of employees in an industry employed in a unionized establishment as the best fit quadratic in time. Higher order time trends do not improve the fit substantially.

Columns II and V show that union density is not a significant predictor of labor share and inequality.¹²

Table A2 shows that while both the share renegotiable and unionization trend together over the sample period decreased unionization does not predict a decrease in the share of renegotiable contracts once a flexible time trend is accounted for: renegotiability is not simply a symptom of declining unionization.

Table 3: Renegotiability and Union Density.

	<i>Share Renegotiable</i>	
Union Density	-2.340***	-0.142
	(0.211)	(0.941)
Year FE		X
Industry FE (Year and Industry)	X	X
Observations	528	528
R-squared (within)	0.380	0.725

¹²An inaccurate regression including the share of unionized establishments yield wildly different results. The key to understanding the divergence is to note that non-union establishments are predominantly and increasingly predominantly small. Thus, while the share of unionized establishments has declined rapidly (in some industries) the share of employment governed by union wage agreements has been comparatively stable.

Controlling for unionization in the mainline regression (II) hardly effects the coefficient on the share of renegotiable contracts. Meanwhile, while the coefficient on the share renegotiable becomes statistically indistinguishable from zero in specification (V) controlling for overall wage flexibility in the industry, as discussed below, in specification (VI) returns the mainline result.

Import Exposure

As suggested by [Elsby et al. \(2013\)](#), import penetration could depress labor’s share of domestic value added if labor and imported intermediates are more substitutable than capital and imported intermediates. Evidence is more mixed regarding the impact of trade on inequality (?).

I construct import exposure using the annual input-output matrices available from the OECD Structural Analysis (STAN) database. These are available from 1995-2011. Following [Elsby et al. \(2013\)](#), import exposure is expressed as the percentage increase in value added need to satisfy German final demand if Germany would produce all its imports domestically.¹³ In specifications (III) and (VI) import exposure appears to have no impact on labor share or inequality in Germany.

5.1.1 Capital Labor Substitutability

Alternatively, it is possible that industries which tend to invest in equipment types whose prices increase more slowly see more rapidly decreasing labor share and more rapidly increasing inequality. If the decline in labor share is due to workers being replaced by machines then one would expect larger declines in labor share in industries where equipment prices rise less rapidly. In the case of skill biased technical change we would expect lower equipment prices to displace workers performing routine jobs.

I compute the price of equipment and software in an ISIC 4 industry in each year from

¹³In terms of input-output terminology and following [Elsby et al. \(2013\)](#), the measure of import exposure is the percentage difference between total domestic requirements and total requirements for an industry.

1995-2010. Data on equipment price inflation are taken from the Haver Analytics series on Gross Fixed Capital Formation by Economic Sector. Haver reports these from the German Federal Statistics office. In specifications (III) and (VI) equipment price also appears to have no impact on labor share or inequality in Germany.

5.1.2 Match Quality and Declining Labor Market Fluidity

In a job ladder model worker's continued exposure to employment opportunities leads to increasingly good matches over time as workers reallocate toward better prospects. [Davis and Haltiwanger \(2014\)](#) observe that fluidity has declined in the United States and suggest that this may contribute to trending inequality and labor share. [Figure 3](#) illustrates a relatively stable job-to-job mobility rate in Germany, thus this story is unlikely to fit for that country.

I measure labor market fluidity as the expected number of job offers per employment spell using data from the SIAB. In particular, I calculate the average number of job-to-job transitions¹⁴ and the average number of job-to-nonemployment separations for workers who were employed starting from January first of each year. I proxy the expected number of job offers per employment spell as the ratio of job-to-job transitions to job-to-nonemployment transitions in each year.¹⁵ Again, in specifications (III) and (VI) labor market fluidity appears to have no impact on labor share or inequality in Germany.

5.1.3 Wage Flexibility

A hypotheses related to labor market fluidity relates to wage flexibility: perhaps labor share falls and inequality rises simply because firms have gained the power to offer more targeted wage contracts. These contracts could reward worker differentials more specifically and could

¹⁴defined as moving from one employer to the next with an intervening spell of non-employment lasting fewer than 15 days

¹⁵THIS IS BIASED I SHOULD ADJUST FOR THE FACT THAT SOME OFFERS MAY BE REJECTED AND THAT THIS MAY BE MORE LIKELY DURING AN EXPANSION or replace this with the [Hagedorn and Manovskii \(2013\)](#) measure.

respond to cyclical fluctuations more rapidly.

I measure wage flexibility as the ratio of the probability of an idiosyncratic pay *change* to the probability of a job-to-job transition both calculated in the SIAB data. Specifications (III) and (VI) show that wage flexibility has little predictive power for labor share and predicts an increase in inequality. Importantly, after controlling for overall wage flexibility the share of renegotiable contracts is once again a statistically significant predictor of inequality: deunionization increases wage flexibility but does not predict increases in upward revisions.¹⁶

6 Conclusion

¹⁶I also test that the share renegotiable does not simply correlate with increasing value added at the industry level.

References

- Bontemps, C., J.-M. Robin, and G. J. van den Berg (2000, May). Equilibrium Search with Continuous Productivity Dispersion: Theory and Nonparametric Estimation. *International Economic Review* 41(2), 305–58.
- Burdett, K. and D. T. Mortensen (1998, May). Wage Differentials, Employer Size, and Unemployment. *International Economic Review* 39(2), 257–73.
- Cahuc, P., F. Postel-Vinay, and J.-M. Robin (2006, March). Wage Bargaining with On-the-Job Search: Theory and Evidence. *Econometrica* 74(2), 323–64.
- Card, D., J. Heining, and P. Kline (2013). Workplace Heterogeneity and the Rise of West German Wage Inequality. *The Quarterly Journal of Economics* 128(3), 967–1015.
- Davis, S. J. and J. Haltiwanger (2014, September). Labor market fluidity and economic performance. Working Paper 20479, National Bureau of Economic Research.
- Diamond, P. A. (1971, June). A Model of Price Adjustment. *Journal of Economic Theory* 3(2), 156–68.
- Doniger, C. L. (2015). Wage Dispersion with Heterogeneous Wage Contracts. Finance and Economics Discussion Series 2015-02.
- Dustmann, C., J. Ludsteck, and U. Schnberg (2009). Revisiting the german wage structure. *The Quarterly Journal of Economics* 124(2), 843–881.
- Elsby, M., B. Hobijn, and A. Şahin (2013). The Decline of the U.S. Labor Share. *Brookings Papers on Economic Activity* 47(2 (Fall)), 1–63.
- Hagedorn, M. and I. Manovskii (2013, April). Job selection and wages over the business cycle. *American Economic Review* 103(2), 771–803.
- Karabarbounis, L. and B. Neiman (2014). The global decline of the labor share. *The Quarterly Journal of Economics* 129(1), 61–103.
- Lemieux, T. (2008, January). The changing nature of wage inequality. *Journal of Population Economics* 21(1), 21–48.
- O’Mahony, M. and M. P. Timmer (2009, June). Output, Input and Productivity Measures at the Industry Level: the EU KLEMS Database. *Economic Journal* 119(538), F374–F403.
- Postel-Vinay, F. and J.-M. Robin (2002, November). The Distribution of Earnings in an Equilibrium Search Model with State-Dependent Offers and Counteroffers. *International Economic Review* 43(4), 989–1016.

A Structural Model

I consider a structural model of the labor market in which 1) homogenous workers and heterogeneous firms are brought together by pairwise random search, 2) offers arrive both on- and off-the-job with exogenous Poisson probabilities λ_0 and λ_2 and separation occurs at exogenous Poisson probability δ , 3) firms may choose between making employment offers that are non-negotiable, as in [Burdett and Mortensen \(1998\)](#), or re-negotiable as the employee's outside options evolve on the job, as in [Postel-Vinay and Robin \(2002\)](#). In [?](#), I show that when maintaining a vacancy featuring a re-negotiable offer is costly relative to a non-negotiable offer vacancy the equilibrium is such that only more productive firms select the re-negotiable offer.

With that established it is straightforward to derive wage schedules under each contract type:

$$\begin{aligned}
 w^n(p) &= p - [1 + \kappa_1 \bar{\Gamma}(p)]^2 \int_{\underline{w}}^p [1 + \kappa_1 \bar{\Gamma}(x)]^{-2} dx && \text{for } p < \check{p} \\
 w^r(q, p) &= w^n(q) - k_1 \bar{\Gamma}(\check{p}) \left[\check{p} - w^n(q) - \int_q^{\check{p}} \frac{k_1 [\Gamma(\check{p}) - \Gamma(x)]}{1 + k_1 [\Gamma(\check{p}) - \Gamma(x)]} \frac{dw^n(x)}{dx} \right] \\
 &\quad - k_1 \int_{\check{p}}^p \bar{\Gamma}(x) dx && \text{for } q \leq \check{p} \leq p \\
 w^r(q, p) &= q - k_1 \int_q^p \bar{\Gamma}(x) dx && \text{for } \check{p} < q \leq p.
 \end{aligned}$$

where p is the incumbent employer's productivity, q is the productivity of the best-to-date outside offer, k_1 is the ratio of the arrival rate of offers on-the-job to the separation rate, Γ is the distribution of employer types, $\underline{w}$ is the reservation wage of a worker to take employment in a non-negotiable contract, and $\check{p}$ is the least productive employer utilizing the re-negotiable contract. It is also straightforward to derive the labor supply to a p -productivity firm:

$$\ell(p) = \frac{1 + k_1}{1 + k_1 [1 - \Gamma(p)]} \frac{M - U}{N}$$

where M , U , and N are the mass of workers, unemployed workers, and firms respectively.

(3.1)-(3.4) follow.

A.1 Proof: An Increase in the Share Renegotiable decreases Labor Share.

$$\begin{aligned}
total\ wages &= \int_{\underline{p}}^{\check{p}} w^n(p) \ell(p) d\Gamma(p) \\
&\quad + \int_{\check{p}}^{\bar{p}} \left[w^r(\underline{p}, p) \ell(\underline{p}) + \int_{\underline{p}}^{\check{p}} w^r(q, p) d\ell(q) + \int_{\check{p}}^p w^r(q, p) d\ell(q) \right] d\Gamma(p) \\
&= \int_{\underline{p}}^{\check{p}} w^n(p) \ell(p) d\Gamma(p) \\
&\quad + \int_{\check{p}}^{\bar{p}} \left[w^r(\check{p}, p) \ell(\check{p}) - \int_{\underline{p}}^{\check{p}} \ell(q) \frac{1 + k_1 \bar{\Gamma}(q)}{1 + k_1 [\Gamma(\check{p}) - \Gamma(q)]} \frac{dw^n(q)}{dq} \right. \\
&\quad \left. + p\ell(p) - w^r(\check{p}, p) \ell(\check{p}) - \int_{\check{p}}^p \ell(q) (1 + k_1 \bar{\Gamma}(q)) dx \right] d\Gamma(p)
\end{aligned}$$

Since integrating by parts yields:

$$\begin{aligned}
\int_{\underline{p}}^{\check{p}} w^r(q, p) d\ell(q) &= w^r(\check{p}, p) \ell(\check{p}) - w^r(\underline{p}, p) \ell(p) - \int_{\underline{p}}^{\check{p}} \ell(q) \frac{1 + k_1 \bar{\Gamma}(q)}{1 + k_1 [\Gamma(\check{p}) - \Gamma(q)]} \frac{dw^n(q)}{dq}, \text{ and} \\
\int_{\check{p}}^p w^r(q, p) d\ell(q) &= p\ell(p) - w^r(\check{p}, p) \ell(\check{p}) - \int_{\check{p}}^p \ell(q) (1 + k_1 \bar{\Gamma}(q)) dx
\end{aligned}$$

Differentiating:

$$\begin{aligned}
\frac{d(\text{total wages})}{d\check{p}} &= [w^n(\check{p}) - w^r(\check{p}, \check{p})] \ell(\check{p}) d\Gamma(p) \\
&+ d\Gamma(\check{p}) \int_{\underline{p}}^{\text{checkp}} \ell(q) \frac{1 + k_1 \bar{\Gamma}(q)}{1 + k_1 [\Gamma(\check{p}) - \Gamma(q)]} \frac{dw^n(q)}{dq} \\
&+ \int_{\check{p}}^{\bar{p}} \left[\frac{d\ell(\check{p})}{d\check{p}} [w^r(\check{p}, p) - w^r(\check{p}, p)] + \ell(q) \left[\frac{dw^r(\check{p}, p)}{d\check{p}} - \frac{dw^r(\check{p}, p)}{d\check{p}} \right] \right. \\
&- (1 + k_1 \bar{\Gamma}(\check{p})) \ell(\check{p}) \left[\frac{dw^n(\check{p})}{d\check{p}} - 1 \right] \\
&\left. + k_1 d\Gamma(\check{p}) \int_{\bar{p}}^{\check{p}} \ell(q) \frac{1 + k_1 \bar{\Gamma}(q)}{(1 + k_1 [\Gamma(\check{p}) - \Gamma(q)])^2} \frac{dw^n(q)}{dq} \right] d\Gamma(p) \\
&= (1 + k_1) d\Gamma(\check{p}) \int_{\bar{p}}^{\check{p}} \frac{1}{(1 + k_1 [\Gamma(\check{p}) - \Gamma(q)])^2} \frac{dw^n(q)}{dq} \\
&> 0
\end{aligned}$$

Noting that:

$$\begin{aligned}
w^r(\check{p}, p) - w^r(\check{p}, p) &= (w^n(\check{p}) - \check{p})[1 + k_1 \bar{\Gamma}(\check{p})], \text{ and} \\
\frac{d\ell(\check{q})}{d\check{q}} &= \ell(q) \frac{2k_1 d\Gamma(q)}{1 + k_1 \bar{\Gamma}(q)}
\end{aligned}$$

A.2 Proof: An Increase in the Share Renegotiable increases Lower Tail Inequality.

First note that the lowest wage is paid by the most productive firm: $\underline{w} = w^r(\underline{p}, \bar{p})$. Now note that $\frac{dw^r(q, \bar{p})}{d\bar{p}} < 0$ for all $q < \hat{p}$ and $\frac{dw^r(q, \bar{p})^2}{dq d\bar{p}} > 0$.

B Auxiliary Tables

Table A1: Shift-Share Analysis of Changes in Labor Share .

	Share of Value Added			Labor Share			Shift-share	
	1985	1995	change	1984	1995	change	shift	share
TOTAL	100.0	100.0	0.0	70.6	68.2	-2.4	1.4	-3.6
Agri., Forest., Fish.	2.1	1.3	-0.9	136.1	116.2	-19.9	-0.3	-1.1
Mining & Quarrying	1.4	0.6	-0.9	66.1	83.9	17.8	0.2	-0.6
Manufacturing	28.2	22.6	-5.5	76.1	80.3	4.2	1.1	-4.3
Utilities	2.8	2.2	-0.7	40.8	45.0	4.2	0.1	-0.3
Construction	6.5	6.8	0.3	82.3	80.3	-2.0	-0.1	0.2
Trade	10.2	10.9	0.7	86.8	84.9	-1.9	-0.2	0.6
Transport. & Storage	6.1	5.7	-0.5	72.2	70.6	-1.6	-0.1	-0.4
Leisure & Hospitality	1.3	1.4	0.1	113.6	126.8	13.2	0.2	0.1
Info. & Comm.	2.5	2.4	-0.1	52.1	50.7	-1.4	0.0	0.0
Fin. & Ins.	4.5	4.6	0.1	65.3	70.9	5.5	0.3	0.1
Real Estate	15.4	21.8	6.4	23.7	24.8	1.1	0.2	1.5
Pub. Admin.	7.3	6.7	-0.5	85.0	84.5	-0.5	0.0	-0.5
Education	4.5	4.3	-0.2	90.6	95.8	5.2	0.2	-0.2
Health & SocialWork	5.2	6.3	1.1	79.3	79.3	-0.1	0.0	0.8
Other Service	4.0	4.6	0.5	61.8	62.6	0.8	0.0	0.3
	1995	2010	change	1995	2010	change	shift	share
TOTAL	100.0	100.0	0.0	67.9	64.4	-3.5	-2.1	-1.3
Agri., Forest., Fish.	1.0	0.7	-0.3	131.5	97.7	-33.9	-0.3	-0.4
Mining & Quarrying	0.6	0.2	-0.3	82.3	78.2	-4.1	0.0	-0.3
Manufacturing	22.8	22.2	-0.6	73.3	65.6	-7.7	-1.7	-0.4
Utilities	2.8	3.4	0.7	48.0	32.2	-15.7	-0.5	0.3
Construction	6.8	4.3	-2.5	88.6	91.2	2.5	0.1	-2.3
Trade	10.3	9.9	-0.4	83.5	79.1	-4.4	-0.4	-0.3
Transport. & Storage	4.0	4.6	0.6	84.8	62.3	-22.5	-1.0	0.4
Leisure & Hospitality	1.5	1.4	-0.1	111.7	101.1	-10.6	-0.2	-0.1
Info. & Comm.	3.8	4.5	0.6	56.9	63.2	6.2	0.3	0.4
Fin. & Ins.	4.7	4.6	-0.1	75.0	71.4	-3.7	-0.2	-0.1
Real Estate	10.9	11.5	0.6	5.7	5.4	-0.3	0.0	0.0
Prof. & Business	9.6	10.6	1.0	45.2	65.6	20.4	2.1	0.6
Pub. Admin.	6.8	6.3	-0.5	81.8	81.3	-0.5	0.0	-0.4
Education	4.3	4.5	0.2	88.9	90.6	1.6	0.1	0.2
Health & SocialWork	5.9	7.1	1.2	89.7	84.5	-5.2	-0.3	1.0
Arts & Rec.	1.2	1.3	0.1	65.8	66.6	0.8	0.0	0.1
Other Service	2.6	2.6	-0.1	72.4	72.6	0.2	0.0	-0.1

Table A2: Unionization and renegotiation.

<i>Dependent Variable:</i>	Share renegotiable	
	I	II
Union Density	-2.34 (0.21)	-0.93 (0.72)
Year FE		X
Industry FE	X	X
R-squared (between)	0.380	0.736