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THE GERMAN LABOR MARKET MIRACLE REVISITED: RISK ELIMINATION IN WORKING TIME ACCOUNTS[†]

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Abstract

This paper contributes to analyses of sustainable enterprise with focus on quality of present and future employment, maintenance of human capital and constituting characteristics of institutional arrangements between the social partners. We add by proving that a specific option from the toolkit of flexible work schedules reduces unemployment risk over the business cycle, while providing mutual insurance of employers and employees. In labor market practice this option is known as working time accounts. Working time accounts are exceptionally widespread and well-institutionalized in Germany. We also introduce a risk elimination model of working time accounts and thus contribute to closing the jobs miracle research gap that has become evident since the global financial and economic crisis.

Keywords: German Labor Market Miracle, Working Time Accounts, Mutual Insurance, Stochastic Dominance Rules, Business Cycle

1. Introduction

The global financial and economic crisis 2008-09 has been characterized by a massive global downturn with lack of demand. The expression most frequently addressed to the global lack of demand phenomenon is the term *Great Recession* (Islam and Verick, 2011). The subsequent transmission of the output shock to labor demand, measured by responsiveness of employment and unemployment, was unexpectedly muted. The muted responsiveness phenomenon challenges, inter alia, Okun's Law, the fundamental empirical relation that is usually detected between output changes and unemployment changes, and points to labor market miracles associated with the Great Recession (Cazes and Verick, 2011; IMF, 2010; Elsby *et al.* 2010; Okun, 1962).

Several labor markets provided considerable shock absorption in terms of maintenance of human capital and jobs safeguarding. In addition, there is strong evidence for cross-country differences in the extent of the labor market miracle, with the *German labor market miracle* being exceptional (Burda and Hunt, 2011; ILO, 2011; OECD, 2010; Boysen-Hogrefe and Groll, 2010). Thus, the Great Recession can be studied as implementing a natural experiment in labor markets and workplace relations, disclosing considerable labor hoarding with retaining of job slots in firms and sustaining of household's disposable income (Carstensen, 2013).

These findings raised the question of supporting factors for labor market cushioning and sustainable enterprise effects. Especially the German labor market miracle is not finally resolved. This paper contributes to closing the labor market miracle research gap and adds to

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sustainable enterprise analysis with focus on quality of present and future employment, on maintenance of human capital over the cycle, and on the institutional arrangements between the social partners. It develops a theoretical model of adjusting labor input in response to demand fluctuations with the objective to filling the research gap concerning determinants of labor market cushioning and differences in the cushioning capacity.

Concerning employment cushioning effects, recent OECD research on labor market resilience, defined as the capacity to "weather economic downturns with limited social costs" (OECD, 2012a, p.57) is supportive of a distinctive role of well-defined institutions in the industrial relations surrounding. According to Gal *et al.* (2012), response heterogeneity is most important for differences in the downward adjustment dynamics and overall cushioning capacity of labor markets, while differences in industry structure and in the distribution of shocks across firms are less relevant. In other words, differences in the sensitivity of labor input to output shocks drive the jobs miracle. Using firm-level data and simulations, the OECD project also discloses the potential key role of collective and company-level wage bargaining in mitigating negative impacts of the Great Recession.

To our knowledge, a consistent theory of response heterogeneity and associated institutions has not yet been developed. This paper adds by proving that a specific option from the toolkit of flexible working-hours arrangements unambiguously lowers a worker's unemployment risk over the business cycle. In labor market and enterprise practice, this specific option has become known as working time accounts. Working time accounts are usually enacted as a firm-level institution with reciprocal obligations of employer and employees. Such accounts are negotiated and settled in collective or firm-level agreements. Every single working time account establishes a unique matching to an employee (one-to-one matching) and enables inter-temporal shifting of individual working time over the business cycle. Thus, working time accounts provide labor adjustment along the intensive margin, where the corresponding adjustment of hours worked might, for example, result from temporary shifts in demand or a preferences shift over the course of work-life balancing. By construction, working time accounts ensure that excess hours and also time-off in lieu are tracked in a time banking system, while salaries remain unchanged. From an institutional perspective, moreover, a settlement period is negotiated over which realized and standard hours on an individual time account obligatory equalize.

Our point of departure is threefold. First, we utilize the natural experiment property of the global financial and economic crisis and its aftermath, including the "labor market resilience" outcome (OECD, 2012a, p.57), with resilience most obvious in the German labor market. In other words, we start with the German labor market miracle.[1] Second, we inspect the correlation between sustainable jobs safeguarding through flexible work sharing in working time accounts as a mutual insurance device and a quick recovery. Methodologically speaking, we make use of the method of probability mass shifts and then evaluate outcomes based on stochastic dominance rules. Third, we re-assess the political debate, which tends to overemphasize the cushioning capability of short-time work.

The key contribution of this paper is to closing the existing labor market miracle explanation gap by introducing a probability mass shift approach at the enterprise-level that proves the key importance of working time accounts. We also provide an institutional arrangements guideline for business, unions and society to facilitating potential introduction of this sustainable adjustment practice.

The paper is organized as follows: Section 2 points out the empirical evidence of labor market cushioning and muted unemployment responsiveness in OECD countries during the Great Recession and initial recovery. With respect to the German labor market miracle, section 3 quantifies the relative importance of adjustment along the hours and productivity margin. Section 4 introduces the risk elimination model of working time accounts and elaborates the mutual insurance institution property. Interestingly, the jobs safeguarding access point will be the disposable income sustaining property of such accounts. Section 5 concludes and proposes

[1] Throughout the paper, the terms labor market miracle and jobs miracle are used interchangeable.

working time accounts as an employment and income stabilizing institution over the cycle with general cushioning effects.

2. Labor Market Cushioning during Great Recession and Recovery

This section provides an overview of the interplay between GDP changes and unemployment changes in the Great Recession and subsequent recovery. For the purpose of elucidating the existence of labor market miracles in general and of the German labor market miracle in particular, data from the following OECD sources enter the overview: Quarterly National Accounts Database, OECD Main Economic Indicators Database (MEI), and supplementary material in Annexes 2.A1 and 2.A2 of Chapter 2 of the 2012 OECD Employment Outlook (OECD, 2012b). For the sake of clarity, only countries with a total OECD-GDP share of at least 0.8 percent are included in the analysis, provided the availability of data.

One distinguishing feature of the Great Recession was an almost synchronized entry of affected economies into downturn, where the vast majority of peak dates is documented for 2008Q1-Q3 with associated trough dates from 2008Q4 to 2009Q2 (Spain: 2009Q4) and duration of crisis, measured by the number of quarters from peak date to trough date, ranging from one to five (Spain: seven).

Figure 1 reflects the broad evidence for muted labor market response among OECD countries and gives an overview of country-specific differences in average labor market adjustment to output shocks. With the exception of Spain, evidence of labor hoarding exists.

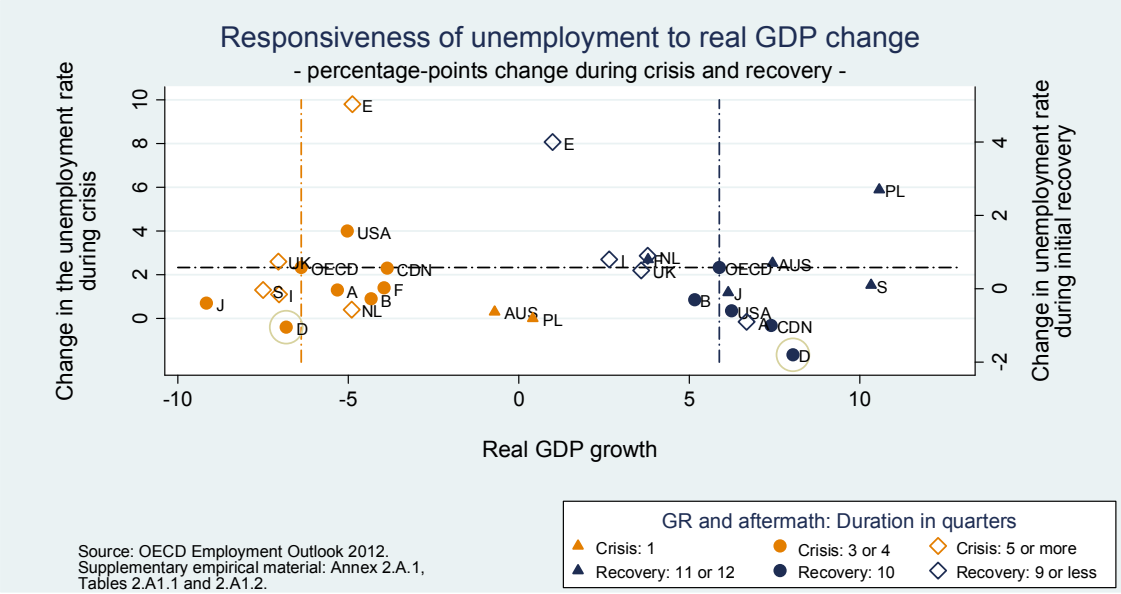

Figure 1. Labor market cushioning and the great recession: General evidence for a miracle

Notes: Orange-colored markers reflect labor market responses during crisis, with bullets depicting countries with average duration of downturn, triangles depicting a short crisis of just one quarter, and hollow-diamonds depicting sustained downturns of at least five quarters. Blue-colored markers are associated to labor market responses to recovery (from trough to latest available quarter in 2011), with bullets denoting countries with average duration of expansion, triangles depicting quick and sustaining recovery, and hollow-diamonds denoting delayed recovery. Sources: OECD (2012b), Tables 2.A1.1 and 2.A1.2, OECD Employment Outlook 2012, Chapter 2 (OECD, 2012a).

As can be seen in the left part of the figure, during crisis the enormous loss in real GDP was accompanied by merely moderate increases in unemployment (left y-axis: “Change in the unemployment rate during crisis”). As can be seen from the y-axis on the right-hand side, labeled as “Change in unemployment rate during initial recovery”, recovery is accompanied by muted – and potentially lagged – reduction of unemployment. Notice that the right y-axis has been rescaled such that the associated OECD-averages of percentage point change in

unemployment during crisis (2.3) and during recovery (0.6) both share the same horizontal line (black-colored dash-dot line, Figure 1).

The distinctive role of the German labor market during both crisis and recovery can be seen from the position of the D bullets relative their OECD-averages in crisis and recovery (the intersection of the dash-dot lines, respectively). While being severely affected by the decline in real GDP, Germany's labor market more than absorbed the output shock: Over the four quarters of crisis and in contrast to all other countries, Germany's unemployment rate slightly decreased, definitely contradicting Okun's relationship. The distinctive role of Germany's labor market continues during recovery, exhibiting considerable levels of job generation. Altogether, the German labor market miracle is relevant and a better understanding of the underlying factors might contribute important insights for potential lessons to be drawn in terms of appropriate labor market institutions aiming at quality of labor and maintenance of human capital.

3. Adjustment Practice in Germany: Variation of Annual Working Hours

In this section we inspect the relative importance of the different instruments within the menu of adjustment practices that have been utilized by German firms in the context of the global financial and economic crisis. In the subsequent calculation we make use of the following data sources and documentation of methods: IAB Establishment Panel Survey, Fuchs *et al.* (2012), IAB working time and volume of work tables, Bach and Koch (2003), Zapf (2012), WSI Works Council Survey; Zapf and Herzog-Stein (2011), Zapf and Brehmer (2010), Employer Survey on Operating Hours (ISO/sfs) and Carstensen (2013).

3.1. Germany's Labor Market Response: Dominance of Hours Adjustment

Figure 2 elucidates the labor market responses to the GDP shift during Great Recession and recovery, pointing out that the adjustment of labor input was driven by downward and upward adjustment in the number of hours worked. The initial point of departure of this paper, the virtual employment stability in the German labor market during crisis, is confirmed: At the aggregate level some negligible increase in the number of persons employed is documented (rise by 17,000 persons in employment, equivalent to employment growth by roughly 0.04 percent). Thus, labor-input adjustment in response to the negative demand shock (6.8 percent decline in real GDP) is concentrated in the intensive margin segment that varies average hours worked, with a documented decline in per capita annual working time by 43.6 hours, reflecting a fall by 3.1 percent, and accompanied by a labor hoarding effect of a 2.5 percentage shrinkage of hourly labor productivity.

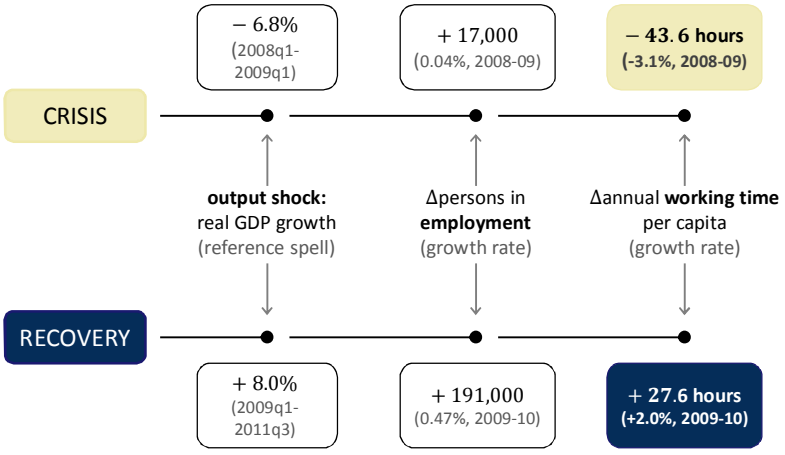

Figure 2. The response of the German labor market during crisis and recovery

Notes: Corresponding reference spells for crisis and recovery output shocks are denoted in parentheses, data source: OECD (2012b), Tables 2.A1.1 and 2.A1.2. Data sources for change in annual employment and working time: Fuchs *et al.* (2012), own calculations. Persons in employment are measured by number of employees.

The dominance of intensive margin adjustment at the working hours level remains during initial recovery. Initial recovery is accompanied by moderately rising employment (+191,000 persons, 2009-2010) at a growth rate of almost 0.5 percent, while average annual working time rose by almost 2 percent (+ 27.6 hours, 2009-2010). Hourly labor productivity co-moves with an increase by about 1.4 percent, indicating a reversal of the labor hoarding effect during recovery.

3.2. Variation of Average Annual Hours: Menu of Adjustment Practices

From the preceding figure it is evident that in order to understand the German labor market miracle we need to unravel the process of downward and upward flexibility of worked hours as well as the relative importance of the corresponding adjustment instruments in the menu of adjustment practices.

Figure 3 summarizes the percentage shares of related adjustment instruments in the hours adjustment menu in Germany and shows that the bulk of inter-annual flexibility of per capita working time in fact resulted from variation of four core instruments, accompanied by cycle-sensitive short-term absenteeism (CyABS). The core instruments are: (1) POVT: change in the extend of paid overtime work, (2) STW: variation of short-time work usage, (3) TWSH: introduction and termination of temporary work sharing arrangements at the company-level, and (4) WTA: rebalancing of working time accounts through hours withdrawal or hours accumulation in a time banking system (unique matches between individual worker and personal working time account).

While overtime work, short-time work, and work sharing (temporary part-time work) are well-known in labor market practice, this is not always true for working time accounts. Let us, therefore, introduce the following explanation from Burda and Hunt (2011, p.299) as a working definition: "The system of working time accounts *(Arbeitszeitkonten)* allows employers the freedom to increase hours above standard hours with no immediate payment, as long as hours are deduced at some future time with no cut in take-home pay, leaving hours at the standard when averaged over a window of time. The number of hours the employer owes the worker, which may be negative, is tracked in the worker's working time account."

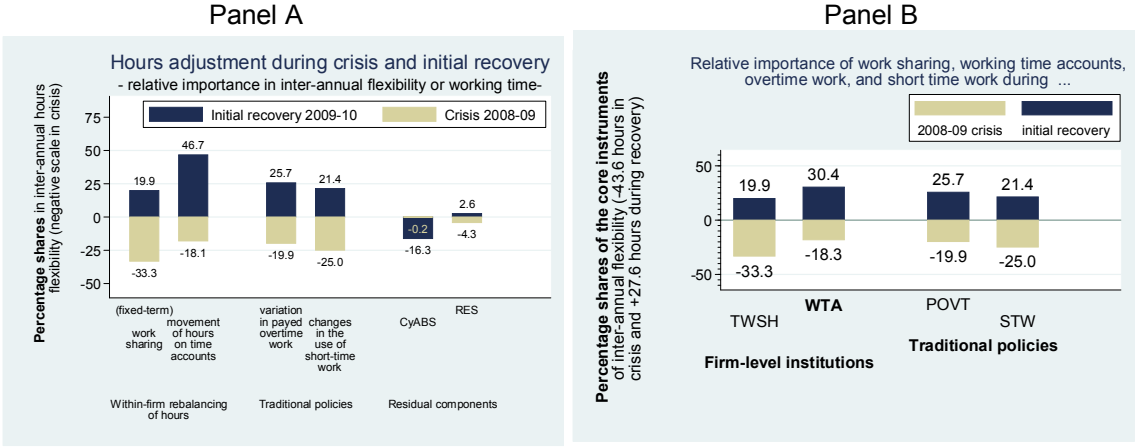

Figure 3. Instruments for labor market cushioning

Notes: Cycle-sensitive absenteeism (CyABS) reverted the expansive effect of upward adjustment of hours resulting from recovery by about 14 percent; presuming the existence of some substitutive relation: Corresponding "adjusted for inter-annual deviation in short-term absenteeism" effect of working time accounts is depicted by **WTA** in panel B. Data sources: IAB working time and volume of work tables (Bach and Koch, 2003) for methodology), Fuchs *et al.* (2012), own calculations.

Figure 3 consists of panels A and B: Panel A displays unadjusted percentage shares in the 43.6 hours decline in working time 2008-09 (stone-colored bars) as well as in the 27.6 hours increase of working time 2009-10 (blue-colored bars). We denote the left-hand side panel A as

unadjusted due to the property that it separately documents such labor hoarding and working hours effects that are imposed by inter-annual changes in the number of short-term sick-days (CyABS) and from structural reallocations of working time (RES), among the latter: changes in the ratio of part-time job slots. In contrast, panel B reports the same relative importance image but adjusted for inter-annual deviation in absenteeism and abstracting from RES. In particular, absenteeism-adjustment is operationalized by integrating rising short-term absenteeism during initial recovery into the withdrawal-of-hours-segment of movements on working time accounts. Finally, corresponding adjusted contribution of working time accounts is denoted by **WTA**.

As can be seen in panel A of Figure 3, during crisis about 96 percent of aggregate decline in hours per worker are "explained" by the four core instruments, with an almost zero-effect of absenteeism ($\text{CyABS} < -0.2$) and a minor impact of remaining influential factors ($\text{RES} = -4.3$). During initial recovery the latter effect declines to 2.6 percent of total changes in annual working time, equivalent to a 0.7 hours increase in annual working time from 2009-10.

With absenteeism-adjusted figures we recognize in panel B that the submenu of traditional policies (paid overtime plus short-time work) captures about 45 percent of the downsizing effect, whereas almost 52 percent of the corresponding 43.6 hours decline in working time are captured by the submenu of the two modern institutions – (i) temporary work sharing TWSH plus (ii) working time accounts systems **WTA** –, both institutionalized at the company-level. Tentatively speaking, traditional policies attain about 87% of the labor hoarding capacity of the firm-level institutions. The picture during recovery is fairly similar, with 47 percent of upward adjustment being associated to the traditional instruments submenu and almost 52 percent of it being imposed by the submenu of firm-level institutions. The corresponding capacity effect of traditional policies, relative the joint upward-flexibility-of-hours effect yielded by accumulation on working time accounts and temporary work sharing reversal, is 94 percent. In terms of over-the-cycle adjustment capacity of hours, mean aggregate contribution of working time accounts is roughly one quarter (24.4 percent), slightly exceeding over-the-cycle averages of short-time work (23.8 percent) and of paid overtime (22.8 percent).

To summarize, adjustment evidence is not supportive of the conjecture of a dominating effect of short-time work, which maintains in the political debate. In fact, the joint contribution of working time accounts and temporary work sharing arrangements dominates.

For assessing the potential link between TWSH and WTA recall that hours activities on working time accounts are equivalent to an extended, hence, generalized kind of work sharing: The term generalized addresses the constituting property of working-time banking schemes to embody coefficients of work sharing that exceed the value of one, compared to traditional work sharing that is associated to (temporary) part-time work schedules, i.e. restricted to sharing coefficients less than 1.

Notice that during crisis the internal weight ratio of **WTA** to TWSH amounted to 0.55 and roughly inverted to 1.53 during initial recovery. Cautiously speaking, under severe shocks these ratios might point to a tentative coherence between working time accounts adjustment and expansion on the one hand and between enacting of temporary work sharing in downturn on the other hand. Moreover, facing the global financial and economic crisis, a substantial fraction of companies introduced temporary work sharing agreements as supplementing exhausted contingencies of flexibility in working time accounts, subsequently permitting transition into working time accounts systems. Through the ex-post lens of the quick recovery, such TWSH schemes temporarily extended the length of the period or window of time within worked hours must average standard hours. Here, supporting evidence from the recent IAB Establishment Panel Survey reveals that 10 percent of working time accounts systems that existed by the end of 2011 have been introduced since 2009 (Ellguth *et al.* 2013, p.3) and is, thus, consistent with the suspicion of masked WTA activity in the guise of TWSH.

Altogether, Germany's labor market evidence is consistent with the hypothesis of a crucial contribution of working time accounts to labor market cushioning. In contrast to the majority of other economies, according time banking systems have been fully integrated as a labor market practice, which is utilized not only for adjustment purposes but often also as an institution of mutual (unemployment) insurance between employer and employee, thereby improving the quality of employment and maintaining specific human capital (Eurofound, 2012).

Correspondingly, Germany's industrial and workplace relations landscape is characterized by profound experience and a broad dissemination of WTA. Thus, labor economists have come to some consensus concerning a potential key role of working time accounts in the German labor market miracle (Carstensen, 2009 and 2013; Crimmann *et al.* 2010; Burda and Hunt, 2011).

In order to understand the intuition behind labor adjustment along the intensive margin including the general potential of eliminating risk, the next subsection summarizes emergence, coverage, institutional design and cushioning behavior of working time accounts since the first pilot schemes in the early 1990s.

3.3. Brief History of Working Time Accounts and Cushioning Capacity during GR

From the preceding figure it is evident that in order to understand the German labor market miracle we need to unravel the process of downward and upward flexibility of worked hours as well as the relative importance of the corresponding adjustment instruments in the menu of adjustment practices.

The history of working time accounts as a labor market institution began in the early 1990s as an extension of flexitime schemes beyond daily flexibility. Labor Economists attributed the term *Arbeitszeitkonten* to such elaborated flexitime schemes. EIRO network of the European Union subsequently adopted the direct translation, namely *working time accounts* and initially located working time accounts in the annualized hours sphere (Schulten, 1998; Kouzis and Kretsos, 2003).[2] Until today, international penetration rates of working time accounts are rather weak: "Flexitime schemes with the possibility to bank hours – so-called 'working time accounts' – are considered to be a form of flexibility that can meet the interest of both employers and employees. (…) working time accounts are generally still not commonly used. In the EU 27, only 6% of companies offer such … time accounts." (Eurofound, 2012, p.10).

In Germany, however, respective coverage is remarkably strong, with more than one third of firms operating working time accounts and more than any second employee being eligible to inter-temporal time transfers (Ellguth *et al.* 2013). Also, the overwhelming majority of WTA systems is well-designed and well-institutionalized with respect to contract sophistication and reliability of mutual obligations of contract partners (Groß and Schwarz (2010), Groß, 2010). If operated as a labor market institution of adjustment along the intensive a margin a given working time accounts system determines the rules for inter-temporal shifting of worked hours. Associated arrangements are usually part of collective agreements (sector- or industry-level) or are negotiated at the company-level between management and employee representatives. Typically treated in the same contract are accompanying components, among them job security commitments by employers like formal guarantees against involuntary layoff for a notable period of time (typically two years: *Tarifvertrag zur Beschäftigungssicherung*, see also Seifert and Massa-Wirth, 2005).

Figure 4 reports long standing experience and increasing incidence of working time accounts in Germany, it displays constituting characteristics and prevailing institutional arrangements of WTA systems. Moreover, the amount of realized shock absorption during the Great Recession is documented.

Increasing coverage and broad dissemination of WTA arrangements in German firms can be depicted from panel A of Figure 4. At emergence of the global financial and economic crisis almost one third of all companies were running a firm-level system of hours flexibility through inter-temporal transfers in working time accounts. Since prevalence of WTA rises with firm size, more than every second employee has been covered by a WTA contract at that time. Share of participating firms and of covered workers continued to rise in the aftermath of crisis: In 2011 34 percent of firms and 54 percent of employees were covered, consistent with the observation that every tenth WTA system that existed by the end of 2011 had been introduced since 2009 (cf. Ellguth *et al.*, 2013).

[2] In the literature, working hours accounts and time-saving accounts appear as interchangeable terms.

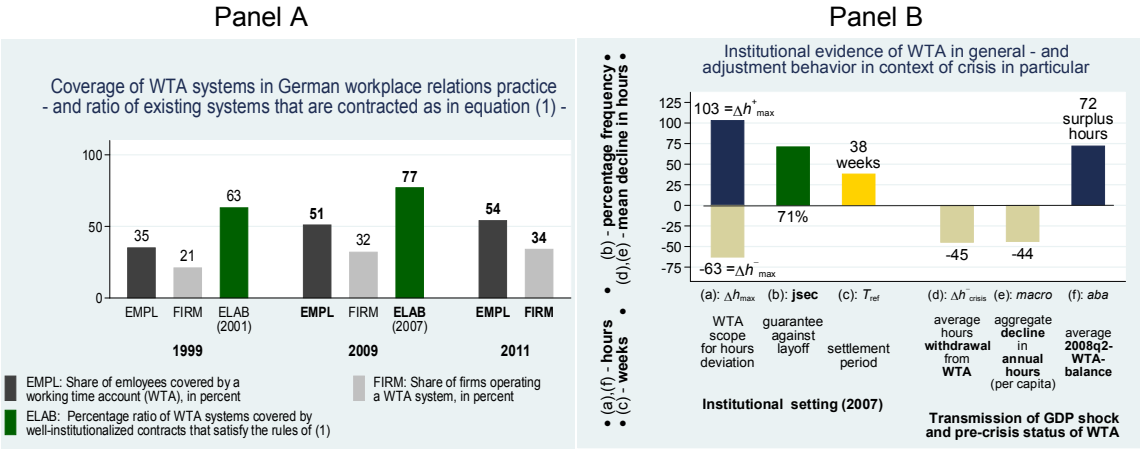

Figure 4. Dissemination of working time accounts - institutional design and cushioning behavior

Notes: Note that WTA are typically settled as firm-specific or collective agreements, often in so called PECs (pacts for employment and competitiveness, Seifert and Massa-Wirth, 2005). Coverage data (2011) taken from Ellguth *et al.*, (2013, 3). Date sources: ISO/sfs Employer Survey on Operating Hours (bars (a)-(c)), IAB Establishment Panel Survey and WSI Works Council Survey (bars (d), (f)), IAB working time and volume of work tables (bar (e)). See also Zapf (2012), Zapf and Brehmer (2010), Groß (2010), Groß and Schwarz (2010). Notice that reported averages do not reflect the variety of existing systems.

While it is useful and important to know the overall WTA coverage, with respect to the unprecedented labor market cushioning effect it is also crucial to inspect the constituting characteristics of existing WTA arrangements in terms of inter-temporal transfer allowance, time corridors over which individual hours and standard hours obligatory equalize, and incidence of no-layoff clauses. A first impression of such properties is given by the green-colored ELAB-bars in Figure 4 (panel A), which reflect the ratio of well-ruled and well-institutionalized WTA systems among all operated WTA arrangements over time. This ratio is remarkably high and, moreover, growing over time. In 2001 nearly two-thirds of all existing WTA arrangements were based on sophisticated contracts, while in the crisis year 2008-09 at least 77 percent of systems were ruled in sophisticated contracts, equating a 14 percentage point increase in contract elaboration incidence in just six years.

The term sophisticated is not chosen arbitrarily. The standard reference Seifert and Massa-Wirth (2005) determines an existing WTA system as sophisticated if following elements are explicitly stated and well-defined in the associated contract:[3] (i) an upper bound for hours surpluses, i.e. the maximum amount of excess hours to be collected by an employee: Δh^{+}_{max}, (ii) a lower bound for hours deficits, i.e. the maximum amount of hours that an employee at most owes the firm: Δh^{-}_{max}, (iii) the settlement period, i.e. the length of the window of time over which individually worked hours and standard hours obligatory equalize: T_{ref}.[4] From the institutional economics perspective WTA systems can be distinguished according to whether (iv) a contract provides job security for treated employees or not. Let indicator **jsec** capture the distinguishing property of providing (private) insurance against unemployment.

The green bars in panel B of Figure 4 inform about this distinguishing property: These capture the 2001 and 2007 percentage shares of WTA contracts providing such a formal guarantee against involuntary layoffs. In addition to revealing the aggregate propensity of insuring employees against job loss, panel B informs about the empirical averages concerning the other constituting elements (i), (ii), and (iii) of working time accounts in Germany in bars (a) and (c): For upper and lower bounds, institutional practice allows an average upward scope for

[3] For corresponding proofs of renegotiation-proofness of sophisticated working time accounts see Carstensen (2013).

[4] The window of time T_{ref} is synonymously denoted as settlement period (Carstensen, 2013, 20), alternatively as time account's compensation period (Seifert, 2004, 2), or as reference period (Carstensen, 2009, 2).

flexibility of about three working weeks (full-time equivalent) as well as an average downward flexibility scope of almost two working weeks (provided the pre-adjustment balance of that account had been zero). Expressed in the number of hours, the average working time account limits the maximum time deficit allowed for an employee to 63 working hours, while cumulated surpluses, i.e. the sum of time credits, of an employee are restricted to 103 hours (the (a)-bar in the figure). According to the overall philosophy of working time accounts, the marginal cost associated to inter-temporal hours shift on a working time account is zero, with a mean contracted settlement period of 38 weeks (the yellow (c)-bar). Notice that the unemployment insurance motive is indeed strong: 71 percent of working time accounts that existed in 2007 embodied reciprocal insurance with formal guarantees against layoffs in exchange for inter-temporal hours flexibility (the green (b)-bar, as mentioned).

Notice also that the representative employee in Germany covered by a WTA scheme went into crisis with a surplus of 72 hours on his/her account, equating a time-buffer of at least two working weeks (full-time equivalent, (f)-bar in the figure). With the severe GDP drop during crisis this time-buffer was exploited to a large extend, supporting the joint objective of firms and employees of mitigating negative employment effects resulting from the shock, eventually enabling labor hoarding without implementing short-time work schedules. The corresponding cushioning capacity can be seen in the right-hand side of panel B in Figure 4: The decline in annual working time per capita as imposed by drawing down WTA balances is measured by $\Delta h^{-}_{crisis} = 45$ (reported by the (d)-bar). In other words, the average hours withdrawal from an existing time account during crisis amounted to 45 hours. Despite being merely anecdotal evidence, these 45 hours fairly coincide with the 44 hours decline in average annual working time that is measured at the aggregate level (reported by the (e)-bar, calculations based on IAB working time and volume of work tables). We suspect this almost coincidence to pointing out a more general mechanism behind the common strategy of jobs safeguarding and human capital maintenance during the global financial and economic crisis. This mechanism is expected to link macro-level labor market policies and micro-level institutions. At the moment, we leave the detailed analysis of the latter issue to future research.

In sum, through the lens of the great diffusion of working time accounts in Germany and the degree of sophistication, the overwhelming shocks mitigating capability of the labor market during the Great Recession appears logical. Since, by construction, WTA contracts moderate extensive margin adjustment of labor, they mitigate loss of human capital resulting from cyclical fluctuations. Cyclically speaking, downturn and recession go hand in hand with withdrawal of time credits and accumulation of time deficits, while during expansion we expect the accumulation of surplus hours and time credits on working time accounts. Notice that due to the property of perpetuating disposable income embodied in WTA systems, firms running such a system are basically enabled to accumulate liquidity during expansion that might be used in downturn. Descriptive evidence for this chain is rather striking (Figure 4).

Concerning the evolution of working time accounts as a micro-level institution it is worth mentioning that from the very beginning WTA systems in Germany have been mutually set up by the social partners, even in their early experimental stages. Working time accounts have been “invented” in a period of greater decentralization of decision-making and responsibility with gradual erosion of centralized bargaining arrangements. Being part of this historical development, WTA arrangements were negotiated and stipulated as integrated company-level contracts that in turn for internal hours flexibility provided private insurance against involuntary unemployment (Carstensen, 2000). Associated working time account systems internalized (re)allocative shocks, thereby promoting the quality of present and future employment and contributing to sustainable enterprises.

3.4. Maintenance of Human Capital over the Cycle

Growing diffusion of multitasking and versatile work over the past decades with an increasing amalgamation of occupational classifications and demarcation crucially altered information processing capacity of centralized and sector-level bargaining with important consequences for the efficiency cost of negotiations (Lindbeck and Snower 2001). In line with reorganization of

work, the German industrial and workplace relations system gradually decentralized collective bargaining, where collective settlements have been increasingly supplemented by firm-based contents, among them specific fringe benefits, additional (efficiency) wage instruments, and customized further training. A very essential content of the structured decentralization process are so called company-level *pacts for employment* into which working time accounts contracts are often integrated.[5] Such settlements provide the contractual basis for firm-specific combinations of inter-temporal transfers of working time (resulting from demand fluctuation) with formal guarantees against layoff (due to operational reasons) and plant closure.

While basic pay is still predominantly determined in collective bargaining at the industry- or sector-level between unions and employer's associations, issues like working hours and organization of work schedules have yielded importance over time as integral part of decentralized bargaining within the idiosyncratic context at the company-level. Decentralized bargaining over working hours (adjustment) patterns goes hand in hand with strengthened involvement of employees and their representatives in communication and decision-making processes. In fact, inter-temporal hours flexibility in working time accounts and a well-institutionalized system of information and communication channels define a key complementary subsystem of balanced packages of human resource management instruments. Moreover, by applying methods of supermodular optimization it can be shown that hours flexibility and transparency yield the strongest efficiency gain and should be, therefore, considered as the initial subsystem within a holistic reorganization process (Carstensen, 2003).

However, as long as shocks move within "well-behaved" bands of deviation with minor amplitudes and negligible scarcity of qualified human/knowledge capital, the task of identifying the modern firm with versatile labor and superior shocks mitigating behavior is almost hypothetical. Even worse, during expansion the associated cushioning capacity is rather misspecified as omitted hiring or as jobless growth. During normal downturn decreases in random separation might be misinterpreted as job reallocation inertia. Unless extraordinary developments affect output markets, the full potential of working time accounts is hardly recognizable. Consequently, the majority of international labor economists were not aware of the general risk eliminating potential of working time accounts, of their relevance as a company-level labor market institution, and of enabling factors such as being enacted beforehand crisis.

Here, the natural experiment imposed by the global financial and economic crisis definitely changed the setting: The formerly hypothetical debate turned into real, implementing the two hollow-circled observations for Germany during recession and recovery as in Figure 1 (orange-bullet/blue-bullet D marker, respectively). Muted-hiring-behavior and jobless-growth interpretation were then replaced by jobs-safeguarding and missing-unemployment-increase interpretation of the unprecedented evidence of labor market resilience.

Determinants of shocks mitigating behavior over the cycle and the relation between inter-temporal shifting of worked hours and labor market risk elimination are developed in the next section that also introduces our theoretical explanation for disclosing the German labor market miracle.

4. The Risk Elimination Model of Working Time Accounts

This section draws attention to the stochastic properties of inter-temporal shifting of hours with respect to the distinctive role of muting risk. The objective is to provide a testable theoretical approach of adjusting labor input in response to demand fluctuations, thereby filling the research gap of the German labor market miracle and associated determinants of differences in labor market cushioning capacity. The organization of the section is as follows: First and with strong reference to workplace relations practice, the basic institutional setting of working time

[5] Under the impression of the general labor market objectives and reforms proposed by the Social-Democratic/Green government in the late 1990s, empirical IR literature associated the term pacts for employment and competitiveness (Sisson (2001), Seifert and Massa-Wirth, 2005). Using data from the IAB Establishment Panel Survey, corresponding employment effects and impact on employment growth are studied in Bellmann *et al.* (2008), while employment changes during crisis 2008-09 are addressed in Bellmann and Gerner (2012).

accounts is illustrated. Second, our risk elimination through inter-temporal hours transfers model is explored. Finally, the probability mass shift interpretation of the risk elimination result follows.

As could be seen in both Figures 3 and 4, during recession working time has been transferred to future periods or accumulated surpluses from the past have been drawn down, imposing phasing-down of accounts. During recovery a substantial ratio of postponed and deducted working time was retrieved and withdrawal of hours has been reversed. The associated inter-temporal reallocation of working time effectively internalized deviations in output demand. Following the institutional settings, associated activities on WTA connect recession and recovery and, consequently, imply reciprocal risk elimination for workers and firms. Over the cycle and within the scope for hours deviation, WTA instantaneously internalize allocative shocks like random fluctuations in demand. As a result, relevant part of cyclical variation of employment and of disposable incomes is absorbed.

4.1. Working Time Accounts as a Reciprocal Labor Market Institution

In Germany, collective and company-level bargaining experiences with working time accounts are rich and long lasting. WTA systems are firmly integrated into workplace and industrial relations practice. Associated agreements are set up as comprehensive reciprocal institutions with mutual obligations of covered agents, namely employers and employees. Such sector- or company-level contracts insure workers against involuntary unemployment in turn for granting the employer the option of inter-temporally shifting working time.[6]

The distinguishing property of working time banking is the tracking of worked hours (deviations) in an individualized statement of account: the working time account WTA. Suppose that any single WTA denotes the following elements:

- Identifier of associated employee i (one-to-one matching).
- Remuneration package of employee ($\boldsymbol{w_i}$).
- Contracted vector of standard hours ($\boldsymbol{h_{st}}$).
- Settlement period (T_{ref}).
- Contracted distribution of working time deviations ($\boldsymbol{\Delta_t^-}, \boldsymbol{\Delta_t^+}$) that also includes the overall scope for flexibility, the latter written as: $\Delta h_{max} = \{\Delta h_{max}^-, \Delta h_{max}^+\}$.
- Current WTA balance (aba_i).
- Enforceable guarantee against involuntary layoff, measured as indicator vector ($\mathbf{jsec}$).

Formally, the working time account WTA for a particular individual writes as:

(1) $\quad \mathrm{WTA}_i := \{\boldsymbol{w_i},\ \boldsymbol{h_{st}}, T_{\mathrm{ref}}, (\boldsymbol{\Delta_t^-}, \boldsymbol{\Delta_t^+}), \mathrm{aba}_i, \mathbf{jsec}\},$

where remuneration vector $\boldsymbol{w_i} = (w_{i,fixed}, w_{i,variable})$ comprises fixed and possible variable/bonus components**.** The reference spells in the contracted vector of standard hours run from short-termed daily reference to long-termed annual or longer reference periods: $\boldsymbol{h_{st}} = (h_{st}^d, h_{st}^w, h_{st}^m, h_{st}^a, \cdots)$, provided the restrictions as imposed by Hours of Work Acts are satisfied. Settlement period T_{ref} defines the maximum window of time for worked hours and standard hours to equalize and is usually denoted in weeks. Like standard hours, downward adjustment capacity draws on a well-defined order of reference spells, with a strictly binding overall upper limit for deficit hours. The corresponding vector of realized hours deficits is written as $\boldsymbol{\Delta_t^-}$**,** with the strictly binding bound for cumulated hours the employee might owe the firm being displayed by Δh_{max}^-. Correspondingly, upward adjustment capacity $\boldsymbol{\Delta_t^+}$ is bounded from above, where the maximum number of cumulated surpluses is denoted as Δh_{max}^+. Taken together, Δh_{max}^+ and Δh_{max}^- determine the WTA's scope for hours deviations, which we already know from Figure 4 (the (a)-bar).

[6] The idea of mutual insurance in working time accounts systems was introduced in Carstensen (2000).

Further, current WTA balance aba_i displays the actual number of surplus hours or deficits hours, respectively, as existent on the individual working time account WTA_i. Any positive value $\mathrm{aba}_i > 0$ indicates a time credit granted by employee i to the firm, while a negative $\mathrm{aba}_i < 0$ points out that, in contrast, worker i owes the employer working time. With – on average – accurate market expectations expected value of aba_i is, of course, zero. Finally, jobs safeguarding appears as indicator variable **jsec**, with $\mathbf{jsec} = 1$ documenting that a formal and enforceable guarantee against involuntary layoff is part of the working time account contract, eventually implementing (reciprocal) private unemployment insurance.[7]

4.2. Risk Elimination by Inter-temporal Hours Transfers

An appropriate context for assessing the mutual insurance capability of well-defined shifting of working time between periods in the above WTA is the stochastic environment of mean preserving decreases in risk. The associated analysis is that of second order stochastic dominance (Hadar and Russel, 1969; Hanoch and Levy, 1969; and Rothschild and Stiglitz, 1970; for surveys: Levy, 1992 and 2006; Eeckhoudt *et al.* 2005). Technically speaking, working time accounts introduce probability mass shifts on the risky prospects of, for example, employment or disposable income without altering the target function's average.[8]

We recapitulate the main definitions of stochastic dominance. Notice that mean preserving decrease in risk and second order stochastic dominance are equivalent.

DEFINITION 1 (stochastic dominance). For any two random variables X and Y with support Z and associated distribution functions $F(x)$ and $G(y)$ we say that X stochastically dominates Y in the

(a) first order sense, written as $X \succ_{FSD} Y$, iff
1. $F(t) \leq G(t)$, for all $t \in Z$, and
2. strict inequality holds for at least one t.

(b) second order sense, written as $X \succ_{SSD} Y$, iff
1. $\int_{z_{min}}^{z} [G(t) - F(t)]dt \geq 0$, for all $z \in Z$, and
2. strict inequality holds for at least one z.

Next we will show that according to its unique nature the inter-temporal transfer of hours in working time accounts exactly matches the definition of second order stochastic dominance and such hours transfer will therefore be strictly preferred by all risk-averse agents.

Suppose random fluctuations in demand. Draw attention to differences in company-level policies of labor input adjustment, in particular to the sensitivity of jobs and disposable income to the output shock. Let us consider the following three distinctive transmission patterns of the output shock to labor:

- The individual employment relation is sustained. An employee is remunerated dependent on output under the individual performance related payment system of piece rate pay: Output and disposable income vary with the shock, while jobs are stable.
- The individual employment relation is sustained, where employees are covered by a working time accounts contract including a remuneration system that

[7] Recall that in recent industrial and workplace relations practice WTA arrangements typically embody formal job guarantees: In 2007, 71 percent of arrangements in Germany exhibited a value $\mathbf{jsec} = 1$ for the employment insurance indicator variable. Obviously, strong incidence and incentives for private unemployment insurance do exist.

[8] A more detailed definition and discussion of working time accounts as well as the extensive proof of the subsequent results can be found in Carstensen (2013) who, moreover, provides the proof that working time accounts as a mutual insurance device are self-enforcing and establish a renegotiation-proof (internal) labor market institution.

sustains disposable income within the WTA's scope for hours deviations: Worked hours vary with the demand shock, while jobs and disposable income stay the same.

- Dependent on the shock, employment relations are separated or new workers are hired with, for simplicity, EPL being either not effective or of minor relevance: At the aggregate level, propensity of layoff and hiring varies with the shock, thus, implementing a correspondence of employment adjustment at the extensive margin. Disposable income varies accordingly over the cycle.

For the three stylized adjustment patterns we write, respectively:

- *Output-driven inter-temporal adjustment of remuneration* (PRP).
- *Output-driven inter-temporal transfer of working hours* (WTA).
- *Output-driven inter-temporal labor turnover* (SEPA).

With *output-driven adjustment of remuneration* (PRP) adjustment of labor input occurs by output alignment of remuneration. With shrinking demand piece rate pay implies downward adjustment of remuneration, while expansion of demand is accompanied by an increase in remuneration and, accordingly, in disposable income. Let Y_1 capture the random distribution of disposable income that is associated to PRP adjustment, and let $G_1(y)$ capture the respective cumulated distribution function.

With *output-driven labor turnover* (SEPA) adjustment of labor input takes place through adapting employment by immediate separation and hiring. Write the random distribution of employment adjustment SEPA that is associated to such separation and hiring behavior as Y_2 for the random variable itself and as $G_2(y)$ for the corresponding cumulated distribution function.

With *inter-temporal transfer of working hours* (WTA), however, a contraction in labor input is imposed by temporarily working fewer hours, whereas employees work longer hours in times of expansive shocks, consequently implying temporary contraction and extension of labor input along the intensive margin. Associated hours movements, i.e. deviations, are tracked over time in the individual working time account. Notice that remuneration does not change in response to hours deviations. Since mean working time is held constant over the settlement period, inter-temporal substitution of working longer hours and time-off in lieu is enabled, and within the contracted scope of hours flexibility of a working time account the number of workers is stable, despite the output shock. Let us denote the random variable of employment adjustment outcomes under the WTA scheme as X_2 for the random variable itself and as $F_2(x)$ for the associated distribution function. Further, we write X_1 for the random variable of changes in disposable income imposed by WTA adjustment and $F_1(x)$ for the corresponding distribution function. As long as the hours impact of random demand fluctuation realizes within interval $\{\boldsymbol{\Delta_t^-}, \boldsymbol{\Delta_t^+}\}$, neither disposable income is affected nor is employment: Hence, with working time accounts the number of employees as well as individual disposable income are sustained at their expected value, eventually alleviating ups and downs in random job destruction and creation.

Given these preliminaries, X_j and Y_j, with $j = 1,2$, exactly meet Definition 1 in terms of second order dominance and, further, establish the risk eliminating property of working time accounts. Subsequent Proposition 1 covers this critical property of inter-temporal transfer in working time accounts, stating that WTA automatically internalize reallocative shocks, thereby eliminating adverse effects of fluctuation in demand or output shocks. For simplicity, let us work with symmetrical shocks and one month as reference period. Moreover, suppose interval $\{\boldsymbol{\Delta_t^-}, \boldsymbol{\Delta_t^+}\} = \{-\delta h_m, +\delta h_m\}$ as flexibility allowance of hours, hence, the contracted WTA's overall scope for flexibility.

PROPOSITION 1 (risk elimination). Fix symmetric random variable X_j and let X_j stochastically dominate symmetric random variable Y_j in the second order sense: $X_j \succ_{SSD} Y_j$. In particular, suppose that X_j has been generated from Y_j by a mean preserving decrease in risk, which

has been imposed by a shift of probability mass from tail regions T_k of Y_j, with $k = l, r$, to its center region I. Then, fix T_l as left-tail region of Y_j and T_r as right-tail region of Y_j such that: $T_l := \left[E[Y_j] - \delta_j, E[Y_j]\right]$, $T_r := \left[E[Y_j], E[Y_j] + \delta_j\right]$, $\delta_j > 0$, and $j = 1,2$. Further, fix point interval $I = \{E[Y_j]\}$ as the center region to which both tail-areas T_l and T_r are transferred, where transfer occurs through completely eliminating either associated tail probability mass by collapsing it to the mean.

Then, X_j eliminates risk from Y_j and will be preferred by any risk-averse agent. In particular, comparing adjustment prospect *Output-driven inter-temporal transfer of working hours* (WTA: X_2), on the one hand, with prospect *Output-driven inter-temporal labor turnover* (SEPA: Y_2), one the other hand, reveals that well-defined hours adjustment in working time accounts eliminates unemployment risk of covered employees, since distribution function $F_2(x)$ satisfies the condition of second order dominating $G_2(y)$, where the latter is related to policy Y_2 of shock- and cycle-sensitive labor adjustment along the extensive margin.

Risk elimination capacity of working time accounts is not restricted to exposure of workers to unemployment risk but generalizes to insuring individual disposable income over the cycle. Consequently, adjustment of labour input by *Output-driven inter-temporal transfer of working hours* (WTA: X_1) eliminates risk on disposable income of covered employees in comparison to adjustment policy *Output-driven inter-temporal adjustment of remuneration* (PRP: Y_1), eventually implying that risk averse agents strictly prefer working time accounts as a mutual insurance device to competing institutions of flexibility such as piece rate pay compensation systems, integrated patterns of overtime work-short-time work sequences, and systems of (temporary) part-time work or temporary help services.

Proof. Proving the risk eliminating property of working time accounts is straightforward from the set-up of WTA_i in (1) together with the notion of second order stochastic dominance (Definition 1). Figure 5 graphically reinforces the proof of disposable income insurance, while Figure 6 displays the unemployment insurance contents. Both figures, for simplicity of exposition, refer to standard normally distributed outcomes of firm's adjustment behavior to short term shocks – as faced by the individual employee (changes in disposable income, Figure 5) and by the workforce at the aggregate level (propensity of employment status changes, Figure 6). Moreover, the flexibility allowance for inter-temporal working time transfers, given by $|\delta h_m|$, enforces employment and disposable income insurance over precisely interval $T = [T_l, T_r]$ of output shocks, with $T = (-\delta_j, +\delta_j) = \left(-\sigma_{y_j}, +\sigma_{y_j}\right), j = 1,2$, on the support of the respective employment and disposable adjustment domain.[9]

As can be seen in Figure 5 the conditions for second order stochastic dominance of X_1 are satisfied, meaning that the labor market adjustment institution working time accounts stochastically dominates the (originating) intensive margin adjustment institution of performance related payment. Notice that cumulative distribution function $F_1(x)$ depicts cumulated density of disposable income adjustment under WTA (blue colored curve), whereas $G_1(y)$ plots cumulated density of respective adjustment outcomes under straight output based pay PRP (dashed curve, orange-colored). Notice that outside the scope-of-flexibility interval $(E[Y_1] - \delta_1, E[Y_1] + \delta_1)$ both distributions $F_1(x)$ and $G_1(y)$ do not differ:

(2) $\int_{z_{min}}^{z} [G_1(t) - F_1(t)]dt \geq 0$, for all $z \in \mathbb{R}$ and

(3) strict inequality holds for interval $z \in (E[Y_1] - \delta_1, E[Y_1] + \delta_1)$.

[9] In our illustrations, we let the WTA scope of hours deviations implement disposable income and unemployment insurance within the one-standard-deviation shock interval. Outside this interval, also employees covered by working time accounts face unemployment risk, provided all surpluses in the account are drawn down to zero.

Property (2) is straightforward and property (3) is evident if we inspect the difference $G_1(y) - F_1(x)$ over the WTA-scope-for-hours-deviation interval $(E[Y_1] - \delta_1, E[Y_1] + \delta_1)$. $G_1(y) - F_1(x)$ is non-negative over the entire support, increases to its maximum $(.841 - .159)$ at point $E[Y_1]$, and then decreases until $G_1(y)$ and $F_1(x)$ equalize again. Graphically, the area under the reference probability density function $g_1(y)$ (dotted curve) is cut and completely relocated to the expected value, here representing stable disposable income.

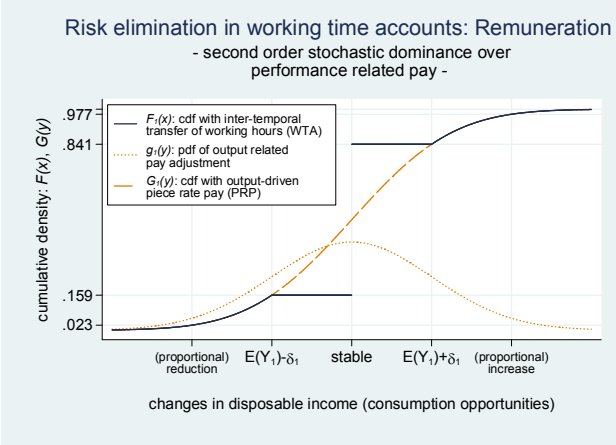

Figure 5. Risk elimination through inter-temporal hours transfer in working time accounts: disposable income stabilization

Notes: Reference distribution is the adjustment policy of output-driven inter-temporal adjustment of remuneration (PRP, piece rates as performance related payment), written as $g_1(x)$. Effects on disposable income of adjustment by inter-temporal transfer of working hours are expressed by distribution $F_1(x)$. $F_1(x)$ differs from $G_1(y)$ by collapsing cumulated probability of interval $[E[Y_1] - \delta_1, E[Y_1] + \delta_1]$ to the expected disposable income (introducing consumption smoothing). Collapsing of probability mass is enabled by inter-temporal substitution of working longer hours and time-off in lieu in working time accounts.

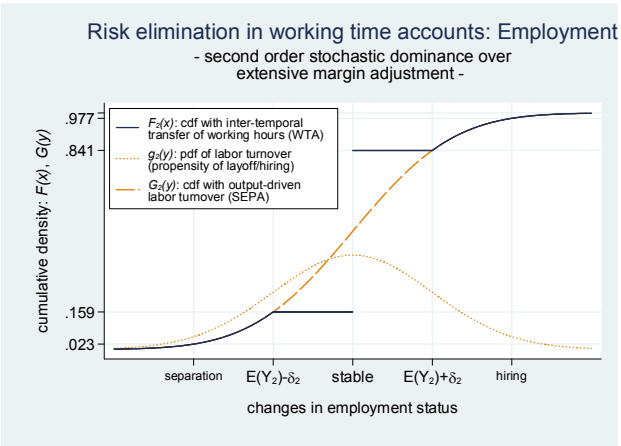

Figure 6. Risk elimination through inter-temporal hours transfer in working time accounts: Employment stabilization

Notes: Reference distribution is the adjustment policy of output-driven labor turnover (SEPA, extensive margin adjustment), written as $g_2(x)$. Effects on employment status of adjustment by inter-temporal transfer of working hours are expressed by distribution $F_2(x)$. $F_2(x)$ differs from $G_2(y)$ by collapsing cumulated probability of interval $[E[Y_2] - \delta_2, E[Y_2] + \delta_2]$ to the expected value, i.e. a constant employment status (retaining of jobs for job holders). Collapsing of probability mass is enabled by inter-temporal substitution of working longer hours and time-off in lieu in working time accounts.

The proof of private unemployment insurance with working time accounts is exactly the same as known from equations (2) and (3). We just need to substitute subscript 1 by subscript 2, denoting that we now compare WTA adjustment policy (X_2) with SEPA adjustment policy (Y_2).

In sum, each X_j internalizes risk from its Y_j counterpart, ultimately establishing risk elimination in working time accounts. Very interestingly, working time accounts eliminate risk on disposable income as well as on employment. Thus, unravelling of the German labor market miracle roots in detecting the stable disposable income property or working time accounts.

4.3. The Probability Mass Shift Interpretation of Working Time Accounts

Risk elimination on a random variable is closely related to shifting probability mass from tail regions of the associated probability distribution function to the center region of that probability function with important impact on the shape of the post-shift distribution function. The kinks in Figures 5 and 6 display the corresponding shape effects of shifting probability mass in working time accounts. The probability mass shift interpretation of mutual insurance in working time accounts facilitates an intuitive access to the key effects of risk elimination generated by inter-temporal transfer of worked hours.

Figure 7 illustrates the intuition of mitigating risk by imposing a shift of probability mass. Based on the three adjustment patterns introduced in 4.2. (PRP, WTA, and SEPA) it elucidates the dispersion reducing effect of a probability mass shift to the center. For ease of illustration we work with a discrete uniform distribution of five equally likely (output) outcomes to display a stylized business cycle and suppose any two outcomes being equidistant from each other.

Panel A in Figure 7 displays the risk eliminating effect on both employment and disposable income of working time accounts as a reciprocal insurance device. It can easily be seen that inter-temporal shifting of individual working time over the business cycle, first, absorbs risk in terms of uncertainty in disposable income: The individual remuneration path under piece-rate pay scheme PRP in panel B (left-hand side, bottom part of the figure) displays the transmission of output risk to disposable income, where the light grey bars depict such income risk realizations that are insured in working time accounts: In terms of the probability mass shift interpretation, the associated 40 percent of total probability would have been shifted to the green bar, eventually adding up to a post-shift relative frequency of 60 percent of the expected value, provided WTA had been in use.

Second, time transfers that are organized in working time accounts absorb unemployment risk in terms of the aggregate propensity of random job loss under the strict extensive margin adjustment strategy SEPA. Here, panel C (right-hand side, bottom part of the figure) illustrates the transmission of output shocks to increased unemployment risks imposed by job destruction and job creation resulting from a straight hiring and separation strategy of the firm. Through the lens of the probability mass shift approach, adjustment scheme SEPA determines a dispersion increasing effect with respect to the flexibility of hours pattern under the alternative adjustment strategy WTA.

To summarize, the jobs and consumption stabilizing effect of working time accounts is likely a key element in explaining response heterogeneity of labor input to the global financial and economic crisis and in the extent of cross-country differences in the jobs miracle.

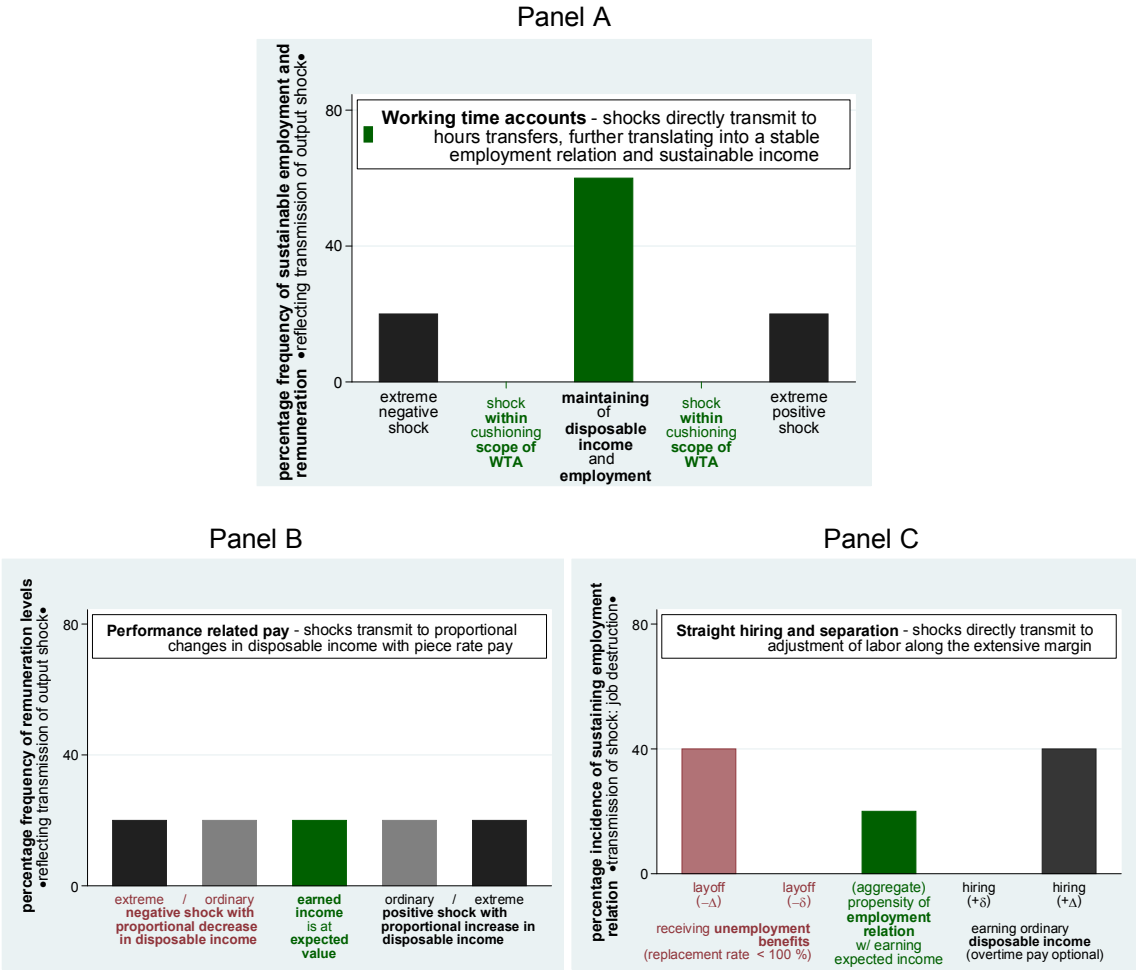

Figure 7. Comparative probability mass shift interpretation of adjustment institutions

Notes: Mutual insurance of disposable income and employment relation in working time accounts systems (top panel A, cf. adjustment prospect *inter-temporal transfer of working hours*, WTA). Employment insurance at expense of stable income with performance related pay systems (bottom panel B: *inter-temporal adjustment of remuneration,* PRP). Hardly cushioned transmission of output shocks to employment and to disposable income is associated to extensive margin adjustment (bottom panel C, cf. adjustment prospect *inter-temporal labor turnover*, SEPA).

5. Conclusion

The point of departure of this paper has been the muted labor market response to the severe output shocks during the Great Recession, to some extend characterized by substantial shock absorption in terms of jobs safeguarding or retaining of human capital and of disposable income. In this respect, we studied the global financial and economic crisis as implementing a natural experiment in labor markets and workplace relations, disclosing considerable labor hoarding with retaining of job slots in firms and sustaining of household's disposable income. In particular, this paper addressed the exceptional performance of Germany's labor market and presented an approach to unravel the so called German labor market miracle.

The major contribution of this paper is to detecting and explaining the risk eliminating effect that is inherent in inter-temporal transfer of worked hours in working time accounts. Based on a stochastic dominance model of probability mass shift, we were able to show that working time accounts establish a mutual insurance device between employers and employees. For employees, coverage by a working time accounts system provides both, insurance of disposable income and private unemployment insurance. For firms, such a system provides smoothing of labor cost. Moreover, working time accounts improve the quality of present and

future employment relations, supporting sustainable enterprises and availability of human capital. In Germany, working time accounts are well disseminated and sophisticated institutional arrangements between the social partners are pretty standard.

The key contribution of this paper helped to closing the jobs miracle research gap that has become evident since the global financial and economic crisis, where we revisited the labor market miracle from a disposable income perspective. Interestingly, the appropriate access point to *disclosing the sustaining jobs miracle* is exactly the *sustaining disposable income at work property* that is implemented by working time accounts by construction. Given the revisiting access to the German labor market miracle, the rather unprecedented development of employment and disposable income in Germany prior to, during and in the aftermath of the world crisis has become clear and also fairly predictable.

We conclude with the interpretation that the fact that inter-temporal transfer of worked hours has been enacted beforehand crisis - i.e. the profound experience of working time accounts as a mutual insurance device in Germany's industrial and workplace relations system - crucially contributed as context factor to the success of the employment stabilizing and even job generating effect during the Great Recession and its aftermath. Thus, employment and income stabilizing over the business cycle through mutual insurance in working time accounts points to an institution that might be promising for other economies and labor markets as well, in particular under conditions of growing scarcity of qualified labor.

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