Management Science

Publication details, including instructions for authors and subscription information:
http://pubsonline.informs.org

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To cite this article:
Douglas H. Frank (2014) Governance Institutions and Adaptation Costs: Evidence from the Fall of the Berlin Wall. Management Science 60(1):166-187. http://dx.doi.org/10.1287/mnsc.2013.1736

MANAGEMENT SCIENCE
Vol. 60, No. 1, January 2014, pp. 166–187
ISSN 0025-1909 (print) | ISSN 1526-5501 (online)

http://dx.doi.org/10.1287/mnsc.2013.1736

Governance Institutions and Adaptation Costs: Evidence from the Fall of the Berlin Wall

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This paper investigates how institutions governing the employment relationship influence firms' adaptation to environmental changes. After the Berlin Wall fell, migration from East Germany accounted for an abrupt increase in the supply of a key resource—labor—in the West. I study responses to this disruption among firms in the economically important machinery and equipment industry. I find that western firms adapted to migration by increasing employment *unless* they were affiliated with a works council, an institution that limits the firm's autonomy in managing its workforce. I also find evidence of institution-contingent responses to migration in two areas of firm strategy: vertical boundaries and the focus on exploration versus exploitation. The results suggest that "hybrid" (i.e., less hierarchical) governance institutions increase adaptation costs. The results also indicate that such adaptation costs have implications for multiple aspects of firm decision making that are nominally beyond the scope of those governance institutions.

Key words: adaptation; governance; institutions; labor markets; labor economics; organizations
History: Received November 11, 2011; accepted December 4, 2012, by Bruno Cassiman, business strategy.
Published online in *Articles in Advance* September 27, 2013.

1. Introduction

Adaptation is the "central problem of economic organization" (Williamson 1991, p. 278; see also Barnard 1938, March and Simon 1958). Questions of why, how, and how effectively organizations adapt to their environments are therefore fundamental to many theoretical perspectives in management and strategy (e.g., Cyert and March 1963, Lawrence and Lorsch 1967, Williamson 2005, Hannan and Freeman 1989, Teece and Pisano 1994). Firms' adaptive responses to changes in the environment are critically conditioned by governance institutions. For example, a central proposition of transaction cost economics is that "governance structures differ in their capacities to respond effectively to disturbances" (Williamson 1985, p. 56). Thus, different governance institutions impose different adaptation costs on organizations (Williamson 1991).

There is a growing body of literature that gives some insight into the comparative adaptation costs of different governance institutions, but no consensus has emerged. Some authors argue that more market-like institutions enhance adaptation (Sorenson and Sørensen 2001, Sorenson 2003, Gulati et al. 2005), whereas others argue that adaptation is facilitated by more firm-like institutions (Novak and Stern 2008, Weigelt and Sarkar 2012). Also, this literature generally studies adaptation on a single dimension: a focal transaction or relationship. But firms engage in many transactions, and the governance of any single one accounts for only a fraction of a firm's activity. Firms are inherently connected systems (Milgrom and Roberts 1995, Ichniowski et al. 1997), so this interconnectedness may affect adaptation (Levinthal 1997). Thus, the governance of any single transaction will affect the *relative* costs of adaptation on many other dimensions within the firm.[1] This implies that adaptation to disturbances, even unidimensional ones, will be multidimensional in nature. Furthermore, a firm's adaptive responses are likely to have spillover effects beyond its boundaries. For example, the decision of whether to make or buy an input affects demand for external suppliers of that input. However, the existing literature provides scant evidence on (a) how governance-related adaptation costs on one transactional dimension affect adaptation on other dimensions within the organization or (b) how these adaptations propagate through the market to other firms.

In this paper, I exploit a rare historical event to examine in detail how governance institutions mediate firms' adaptation to environmental shocks. After the Berlin Wall fell in 1989, hundreds of thousands

[1] The research that views adaptation from a learning perspective does sometimes acknowledge organizational interconnectedness (see, e.g., Sorenson 2003) but in a different way than conceived here. There, the main issue is that interconnectedness adds complexity to a single, broadly defined activity (e.g., meeting customer requirements); the question of how adaptation on one dimension spills over into other dimensions is not treated.

of East Germans migrated to West Germany. For the period 1991–1997, they increased the population of the average western labor market by 1%.[2] In contrast, from 1981 through 1988, the West German population had *decreased* by 0.3%. Migration thus made for an abrupt increase in the supply of a critical resource: labor. Moreover, only a few months before the Berlin Wall fell, West Germans were still expecting no change in political relations between East and West (Schmemann 1989) and so were implicitly expecting no change in labor supply dynamics.

I study how establishments in the West German machinery and equipment industry adapted along multiple dimensions—including employment, manufacturing boundaries, and strategy—to this unexpected influx of labor, paying particular attention to the mediating role of institutions that govern the employment relationship.[3] The machinery and equipment industry is one of the pillars of Germany's export-led economy, accounting for 17.5% of all exports (more than automobiles) and for more than 4% of all German employment.[4] In this industry, there are two main forms of governance: "firm" (employees contract individually with the firm and enter into an authority relationship with its managers) and "hybrid" (a legal institution is present that partially defines the terms of the relationship). Hybrid governance arises either from collective bargaining or from works councils. Collective bargaining defines minimum wages, working conditions, job grades, and the like; works councils give employees formal rights of participation in the enterprise's management.

My main findings are (i) migration caused establishments in this industry to increase employment; (ii) hybrid governance (in the form of a works council) suppressed the employment response, indicating higher adaptation costs for this institution; (iii) migration increased the probability of outsourcing among downstream producers with one specific form of hybrid governance (collective bargaining, no works councils), with apparent effects on upstream demand; and (iv) migration caused some establishments to adopt a more exploitation-oriented strategy (versus an exploration-oriented one), and the common thread among such establishments is the presence of a works council.

A crucial feature of the analysis is the use of *local labor markets*, which are discrete, "self-contained" regional markets with minimal commuter flows across their boundaries. I do not study responses in the West as a whole to unspecified "turbulence" in the 1990s. Instead, the analysis exploits measurable variation in the amount of migration received in 125 distinct western labor markets, both across markets within the same time period and within markets across time. To see why this is important, consider the generic question under study: What is the effect of attribute X (here, a governance institution) on some dimension of organizational change ΔY in response to an environmental shock ΔZ (here, migration)? As a problem of statistical inference, this amounts to finding the coefficients β_1 and β_2 in the regression $\Delta Y = \alpha + \beta_1 \Delta Z + \beta_2 X \Delta Z$. The question cannot be answered unless there is *variation* in ΔZ: different organizations must experience different degrees of environmental change. A study in which all organizations are exposed to a common shock (e.g., a regulatory change affecting an entire industry, a period of economic instability, etc.) is unable, by its very design, to show that observed organizational changes are related to any specific stimulus. This fact, in turn, makes it difficult to infer relative adaptation costs of different institutions or, more generally, to relate the empirical findings to any specific model or theory of adaptation. In contrast, the rich variation in migration to 125 markets over seven years allows meaningful inferences to be made.

A further empirical challenge is the fundamental endogeneity among strategy, performance, capabilities, and the environment (Henderson and Mitchell 1997). That is, for the estimates to be informative, the shock must be exogenous to unobserved determinants not only of the organization's response but also of its institutional affiliations. In particular, because migrants might have targeted a particular labor market based on unobservable determinants of organizations' performance and/or institutional affiliations, estimates based on observed migration flows might suffer from an omitted variables bias. To circumvent this problem, I introduce a novel method for isolating the factors that "push" migrants into each western labor market: I instrument migration flows using distance to and labor market conditions in the East German *sending* regions.[5] This approach enables consistent estimation of the organizations' adaptive responses to migration.

This paper makes several important contributions to our knowledge of governance and organizational

[2] "East Germany" ceased to exist in 1990, but I use it as a convenient shorthand for "the states of the former German Democratic Republic." Similarly, "West Germany" refers to the states of the Federal Republic of Germany before reunification.

[3] This industry corresponds roughly to the U.S. "machinery manufacturing" industry (NAICS 333). It includes most forms of capital equipment, except for electronics, optics, motor vehicles, ships, and aircraft.

[4] Figures, from the German Federal Statistics Agency, are for 2010.

[5] From the methodological standpoint, this paper is a migration experiment in the tradition of Card (1990). The use of migration *source* data to isolate destination-specific push factors is a novel refinement of the techniques used in that literature.

adaptation. First, the results indicate that hybrid governance of the employment relationship reduces organizational adaptability, especially when employees may view adaptation as a threat. This finding is consistent with predictions in Williamson (1991) that hybrid governance increases the costs of coordinated adaptation. Second, the results reveal a rich pattern of institution-contingent adaptation across multiple dimensions of firm decision making. Little research has explored how the governance of one transaction influences the firm's other strategic decisions—either in the context of adaptation or more generally. A rare exception is work on "governance inseparability" (Argyres and Liebeskind 1999), a theory proposing that firms are constrained to maintain the same governance form for a specific transaction over time and also to extend that form to contemporaneous transactions of the same type (e.g., offering the same contract to employees of the full-service and no-frills divisions of an airline). This paper contributes to that theory in two important respects. First, it illustrates that the governance of one transaction (labor) influences adaptation on a qualitatively different dimension (sourcing of inputs). Second, it highlights that the logic of institutional isomorphism underlying governance inseparability may not extend to qualitatively different transactions. For example, downstream establishments with more firm-like governance of the employment relationship (no works council) are able to adopt more market-like governance of product market transactions (outsourcing) in response to migration. This paper's final contribution is that, in identifying industry-level spillovers of firm-level adaptation, it answers the call for more research "that explicitly characterizes the continual, reciprocal nature of the interaction between the environment and the firms within it" (Henderson and Mitchell 1997, p. 6).

2. Theoretical Background

Adaptation can be defined as "a change in a significant attribute of the organization" in response to a changing environment (Levinthal 1997, p. 934). Responding to changes in the external environment is the essence of strategic management (Chakravarthy 1982). Some authors refine the definition of adaptation according to the magnitude of the environmental change (Miller and Friesen 1980, Meyer 1982). Such refinements are frequently associated with the "punctuated equilibrium" model (Tushman and Romanelli 1985) adopted from evolutionary biology, which proposes long periods of relative stasis punctuated by periods of "discontinuous" change. Examples of such "revolutionary periods" cited in the literature include the sociopolitical changes in 1989 in Eastern Europe (Meyer et al. 1990) and, specifically, Germany (Gersick 1991).

The terms revolutionary and discontinuous change might suggest discrete, short-lived events that upset an existing order. Indeed, formal analyses building on the punctuated equilibrium framework often make the simplifying assumption of an instantaneous environmental change (e.g., Levinthal 1997). In reality, however, a precipitating event may trigger further environmental changes that are distributed across time and space, just as an earthquake may trigger aftershocks and tidal waves. For example, the massive internal migration in Germany unleashed by the fall of the Berlin Wall lasted for years, surging, receding, and then accelerating again (Owen-Smith 1994).

Whether the shock is concentrated or distributed, the firm's response may be inhibited by adaptation costs that arise from a variety of sources: existing strategies, structures, ideologies, and slack resources (Meyer 1982); investments in specialized assets or cospecialized activities (Nickerson and Silverman 2003, Chan et al. 2007); image and identity (Dutton and Dukerich 1991, Fox-Wolfgramm et al. 1998); trust (Jeffries and Reed 2000); and the dynamics of political coalitions (Hannan and Freeman 1984). As these costs increase, the rate and extent of adaptation will generally decrease (Haveman 1992).

One important source of adaptation costs is institutions. Institutions "fix the confines of and impose form upon the activities of human beings" (Hamilton 1932, p. 84); they are "the humanly devised constraints that shape human interaction" (North 1990, p. 3). Thus, institutions limit the range of possible responses to a given environmental change. When a firm's preferred response is discouraged or prohibited by existing institutions (i.e., where the constraint binds), adaptation costs will be higher and adaptation incomplete. With respect to the governance of microeconomic transactions, Williamson (1991) has proposed three generic forms that differ in their adaptation costs: market, hybrid, and firm (or hierarchy). Although this taxonomy is most commonly applied to product market transactions, it is sufficiently flexible to encompass employment relationships as well (Nickerson and Silverman 2003, Williamson 2005).

In an employment relationship, a worker submits to a manager's authority (Simon 1951). Similarly, "authority rather than legal recourse" is a defining characteristic of hierarchical governance (Nickerson and Silverman 2003, p. 435). Thus, hybrid institutions governing the employment relationship can be further subdivided according to how much they limit a firm's authority over its workers. At the less limiting (and thus more firm-like) end of the scale are institutions such as minimum wage legislation, which specify minimally acceptable working conditions in narrowly defined areas. At the more limiting end of

the scale are institutions such as U.S.-style decentralized collective bargaining. This institution empowers an intermediary to represent workers on a range of issues, and the firm exercises its authority over workers only with that intermediary's consent. Governance of the workforce is much more clearly "shared" under this institution than under a minimum wage, which merely establishes a static constraint on the firm's otherwise autonomous decision making. Echoing the informal arguments in Williamson (1991), Tadelis and Williamson (2013) use a formal model to demonstrate that adaptation costs are lower in a hierarchy. Adaptation costs should therefore be highest for an institution resembling U.S.-style collective bargaining, lower for an institution resembling minimum wage legislation, and lower still for a firm operating in the absence of either institution.

Research on institutions and adaptation can be divided into two broad categories, depending on whether the institutions are conceptualized as (a) part of the environment to which the firm is adapting or (b) mediating factors in the firm's adaptation to change elsewhere in the environment. A good example of the former is Siegel and Larson (2009), who show how some overseas subsidiaries of the Lincoln Electric Company improved their performance by adapting their human resource practices to local labor market institutions.[6] Research of this type essentially explores the "fit" between specific business practices and the institutional environment, and it offers important insight into how institutions influence the choice and effectiveness of different business strategies. However, such research is less informative about the adaptation costs described by Williamson (1991), which are clearly in category (b)—institutions influencing adaptation to "disturbances." This view of adaptation is also reflected in Nickerson and Silverman (2003, discussed earlier) and is the one taken in this paper.

Finally, scholars beginning with March (1991) have described organizational adaptation as being decomposable into exploration and exploitation, and they have attempted to characterize the boundary conditions influencing the value of each type of adaptation.[7] Much of this work focuses on the role of environmental uncertainty (see, e.g., Rowley et al. 2000, Lin et al. 2007, Posen and Levinthal 2012), and the research is divided on the question of whether environmental change should lead to more or less exploration. This paper provides some additional evidence on that question and explores the possible mediating role of institutions.

3. Empirical Setting

3.1. Migration

On November 9, 1989, the Berlin Wall was breached and East Germans began streaming westward. In the four years from 1989 to 1992, 870,000 of them (10% of the East German labor force) migrated to the West. Thereafter, domestic migration stabilized at an annual rate of about 140,000–180,000 (Owen-Smith 1994, p. 266). This migration conforms well to the punctuated equilibrium framework discussed previously because it (a) was entirely unexpected, (b) upset the established order, and (c) threatened the existing population. Regarding (a), as recently as 1988, both major West German political parties had issued statements that revealed increasing pessimism about prospects for reunification (Marsh 1988a, b). Elite opinion mirrored popular opinion; less than six months before the Berlin Wall fell, a poll revealed that more than two-thirds of West Germans believed that it would still be standing in the year 2000 (Schmemann 1989). Regarding (b), migration significantly altered West German population trends. For the period 1990–1997, East German migration increased the population of the average West German labor market by 1%. In contrast, from 1981 to 1988, the West German population had *decreased* by 0.3%.[8] Finally, regarding (c), multiple sources indicate that West German workers viewed East German migrants as a threat to their job security and standard of living. For example, in early 1984, East Germany had exceptionally allowed 13,000 citizens to migrate to West Germany. This was equivalent to only 1.5% of the total migration during the first three years after the Berlin Wall fell, but it was of sufficient concern to merit a major cover story on the migration "wave" under the headline, "They're Taking Our Jobs Away" (*Der Spiegel* 1984). After 1989, during the true migration wave, West German labor unions were eager to extend West German wage agreements to the East, precisely to "prevent competition and a decline of working standards in the West" (Goedicke 2006, p. 58).

3.2. Governance Institutions

I study two institutions governing the employment relationship: collective bargaining and works councils.[9] Appendix A briefly sketches their historical origins, and Table 1 summarizes their key features.

[6] Other examples involving labor market institutions include Schneper and Guillén (2004), Capron and Guillén (2009), and Carney et al. (2011).

[7] Gupta et al. (2006) discuss the extent to which exploration and exploitation are mutually exclusive or orthogonal concepts.

[8] Because East Germans began migrating west immediately after the Berlin Wall fell in late 1989, 1988 is the last year in which West German population figures are not influenced by East German migration.

[9] This section draws heavily on Berghahn and Karsten (1987).

Table 1 Overview of Institutions

	Collective bargaining	Works councils
Legal basis (year first enacted):	Collective Agreement Act (1949)	Works Constitution Act (1952)
Locus of governance:	Industry	Plant
Employers' intermediary:	Employers' association	None
Workers' intermediary:	Labor union	Works council
How affiliation initiated:	Employer joins employers' association	At employees' option in establishments of at least five regular employee
Key features:	Single agreement binding on all members of an industry employers' association in the bargaining territory (roughly corresponding to a state) Agreement establishes job classifications, minimum wages, working hours restrictions, and the like "Wage drift": many member firms go beyond agreement's terms	Employer must inform, consult with, and/or obtain consent of works council on matters affecting employees (e.g., job classifications, transfers, restructurings) Works council ensures that employer abides by all agreements that affect employees (e.g., health and safety rules, collective bargaining agreements) Bargaining between employer and works council over elements of the collective agreement forbidden

Because these institutions limit the firm's autonomy in dealing with its workforce, they correspond to hybrid governance of the employment relationship, as defined previously. It should be emphasized that these two governance institutions are formally independent of one another and are not universal. Hence, there are four possible governance regimes: firm governance (neither institution is present) and three different hybrid governance regimes (collective bargaining, works council, or both).

Collective bargaining in Germany is highly centralized. Industry agreements are set in a *single* negotiation between one labor union and one employers' association for *all* firms and employees in a geographic territory roughly corresponding to a federal state. The primary function of these agreements is to define job classifications, pay formulas, and restrictions on working hours. A collective agreement signed by the employers' association is binding on all affiliated firms, regardless of how many union members they employ. Firms can avoid a collective-bargaining agreement only by renouncing membership in the employers' association. However, the firm remains bound by any extant contract until it expires and sometimes even longer (Berthold et al. 2003), and the firm is forbidden under the Works Constitution Act (Federal Republic of Germany 1972) from negotiating collectively with its workforce. Therefore, the benefits of exit can be realized only in the long term and even then they are unclear, whereas the costs of leaving the employer's association are immediate and more evident. Not only does the association provide expertise and leverage in wage negotiations, it also provides several forms of insurance against industrial action.[10]

Collective bargaining can thus be viewed as establishing industry-specific minimum wages and working conditions for all firms in the employers' association. The centralized nature of wage bargaining leads unions to orient their demands toward the median firm's willingness to pay. Otherwise, a majority of the employers' association's members would oppose the agreement. This leaves scope for individual member firms to offer even better employment terms, as many do. One consequence is the phenomenon of "wage drift," whereby employment terms at the plant level are decoupled from those established via collective bargaining.

Works councils are elected, participatory bodies at the establishment level, and their legal foundation is the Works Constitution Act.[11] Employees in establishments regularly employing at least five people are entitled to establish a works council, although this right is not exercised in about half of the eligible establishments (Addison et al. 2004). The works council represents all nonexecutive employees, whether or not they are union members. Its chief duties include (a) ensuring that the employer honors all laws, safety standards, contracts, and other agreements affecting the workers and (b) negotiating with the employer to resolve issues raised by workers (Section 80). Technically, the Works Constitution Act forbids the works council from negotiating over wages or anything else covered by the industry's collective bargaining agreement, even if the employer is not bound by it (Article 77). However, discussions in Berghahn and Karsten (1987) and Berthold et al. (2003) indicate that this provision is difficult to enforce.

The broad intent of the Works Constitution Act is to guarantee workers' rights of "codetermination"—that is, participation in the management of the

[10] For example, it administers an insurance fund that covers members' fixed costs during a strike. In addition, members pledge not to take advantage of another member firm if its business is interrupted by a labor dispute.

[11] The Works Constitution Act was revised in 2001. All references in this paper are to the 1972 version, which was in force during the time period under the study.

enterprise. These rights are substantial, especially in personnel matters. The works council can block any hiring, classification, reclassification, or transfer that would disadvantage a worker and is not justified for operational reasons (Section 99).[12] Furthermore, it can block dismissals on fairly broad grounds and may, with the employers' agreement, be given veto rights over dismissals generally (Section 102). Finally, the works council must be informed in advance of any significant restructuring of the establishment or its work practices, and the employer is obligated to reach an agreement with the works council over measures to soften the impact on employees (Sections 111 and 112).

Anecdotal reports indicate that works councils can use the machinery of the Works Constitution Act to contest hiring that threatens incumbents. One source recounts some 20 cases, in the state of North Rhine-Westphalia, where works councils used their statutory veto powers to force employers to pay temporary workers at the same rate as regular employees (*Der Tagesspiegel* 2007). In another case, a works council vetoed a German shipping company's plans to hire six Filipino sailors at wages below those in the German employment contract (European Court of Justice 1993, Wishlade 1997). The case ultimately went to the European Court of Justice, where the Advocate General sided with the works council but the judges ruled against it.[13] The entire process lasted approximately three years.

4. Empirical Analysis

4.1. Hypotheses

The central hypothesis tested in this paper is that the employment response to migration will be smaller in establishments with works councils or collective bargaining as a result of the higher adaptation costs that these governance institutions impose. To clarify the logic behind this hypothesis and develop additional implications, I present a simple model of an imperfectly competitive industry. The derivations are omitted to save space.[14]

There are two firms, i and j, with marginal cost c_i and c_j, respectively. Firm i's demand is given by $q_i = a - p_i + bp_j$ for $b < 1$. In other words, firm i's quantity sold is decreasing in its own price but increasing in its rival's price, and the own price effect is greater than the rival price effect. Firm j's demand is defined analogously. Consider a labor supply increase that may allow firms to reduce their marginal costs. In a frictionless labor market, this reduction would be effected through a lower market wage. In an imperfectly competitive labor market, such as Germany's, the adjustment would not be as straightforward but would have qualitatively the same result. For example, the increased labor supply would diminish incumbent employees' outside options, allowing the firm to negotiate more favorable employment terms. In either market type, there are two key consequences of a labor supply increase: (i) it produces downward pressure on incumbents' employment terms; (ii) all else equal, the firm's hiring response is in direct proportion to its ability to adjust those terms in its favor.[15]

A governance institution that protects workers' interests will impose high adaptation costs in response to increasing labor supply. Assume that such an institution affects firm i only; this means that firm i cannot adapt (its marginal cost remains the same), but firm j can (its marginal cost falls).[16] In the new equilibrium, the relative change in output (firm j minus firm i) is given by $\Delta c_j(\partial q_j^*/\partial c_j - \partial q_i^*/\partial c_j) = -\Delta c_j(b+1)/(b+2)$. Since $b > 0$ and $\Delta c_j < 0$, it follows that firm j's output increases relative to firm i's. This same relation will hold for employment. (If the labor cost relative to other inputs is constant or decreasing, then an increase in output entails an increase in the consumption of labor.) Thus, the employment response to migration will be smaller in establishments with works councils or collective bargaining.

Collective bargaining and works councils should, however, have different effects. First, recall that collective bargaining in Germany is highly centralized. The agreement is a "template" negotiated by the employers' association on behalf of thousands of members spanning an entire bargaining territory. The firm does not negotiate with the union, so it has substantial flexibility to adjust employment terms as long as they remain above the agreement's thresholds. In this sense, the collective bargaining agreement more closely resembles minimum wage laws

[12] In this and other cases where the works council can withhold its consent, the employer has redress to the Labor Court or arbitration.

[13] The Advocates General are court appointees whose role is to provide the judges with impartial opinions on pending cases (European Union 2007). Thus, the outcome can be viewed as a split decision, and other employers would have wondered about their chances of success in similar cases.

[14] The model is a variant of an example in Gibbons (1992, p. 21). The results presented here are simple manipulations of the equilibrium outcomes derived there, and readers are referred to that work for additional details.

[15] Note that the model's implications are the same if the decline in wages or employment terms more generally is relative (e.g., a reduced rate of improvement) rather than absolute.

[16] This assumption simplifies the discussion without affecting the results. The essential assumption is that firm j's marginal cost falls more than firm i's.

than it does decentralized U.S.-style collective bargaining. Works councils, on the other hand, do resemble U.S.-style unions in that, for a broad range of issues, the firm exercises authority over its employees only with the works council's consent. Because collective bargaining is thus the more firm-like of the two governance institutions, it should be associated with lower adaptation costs and with a larger response of employment to migration. Furthermore, the wage drift phenomenon discussed previously means that the collective bargaining agreement will not be a binding constraint on all firms. That flexibility effectively blurs the distinction between collective bargaining and firm governance (neither collective bargaining nor works council), so the effects of collective bargaining are likely to be muted in the empirical analysis. Finally, the effect of a collective bargaining agreement may well depend on whether or not a works council is present, given that one function of the latter is to oversee the implementation of the former. The agreement might therefore give works councils additional leverage over employers. If so, we should see the highest adaptation costs (and smallest employment response) among establishments with both governance institutions.

The model presented here has implications that extend beyond the labor transaction. To see this, first note that firm i's equilibrium price is given by $p_i^* = [a(2+b) + 2c_i + bc_j]/(4-b^2)$, and firm j's similarly. Therefore, if firm j's marginal cost c_j decreases, then *both* firms' prices decline—a result with implications for firms' vertical boundaries. Suppose firms i and j together constitute the upstream segment of the industry (producing components but not fully functioning machines). Then migration reduces average prices of this segment's products, which in turn affects the make-versus-buy decision for certain downstream firms because they will evaluate the cost of in-house components production against the new, lower prices of upstream suppliers. Downstream firms' *incentives* to outsource will depend on how much their own labor costs can change relative to those in the upstream segment, while their *ability* to outsource will depend on the presence of internal constraints on restructuring. The propensity to outsource should therefore be highest among firms with collective bargaining agreements (which limit how far employment terms can be adjusted in the firm's favor) but without works councils (which increase restructuring costs).

As a final implication of the model, observe that outsourcing by downstream firms would be a positive demand shock to upstream firms (increasing a in the demand equation previously discussed). Unlike an increase in labor supply, a demand shock puts no downward pressure on wages or employment terms and so entails few (if any) adaptation costs related to the governance institutions studied here. Ceteris paribus, then, upstream firms will exhibit a greater employment response to migration than will downstream firms. Among upstream firms, those with the lowest adaptation costs (i.e., no institutions) will be the most responsive.

Finally, the empirical analysis will examine the degree to which institutions influence the choice of exploration versus exploitation in response to environmental change. As noted by March (1991), exploration implies experimentation and novelty, whereas exploitation implies refinement and extension of known ways of doing things. The most significant aspect of collective bargaining is to establish a floor on wages. Because neither exploration nor exploitation seems more likely to cause this constraint to bind, we should expect collective bargaining to have no effect on these responses. In contrast, the works council makes restructuring, worker reassignments, and worker reclassifications more costly. Yet such changes are more likely when the organization is experimenting with new routines, so we should expect works councils to be associated with *less* exploration and *more* exploitation.

4.2. Estimation

The empirical analysis is based on the following reduced-form equation:

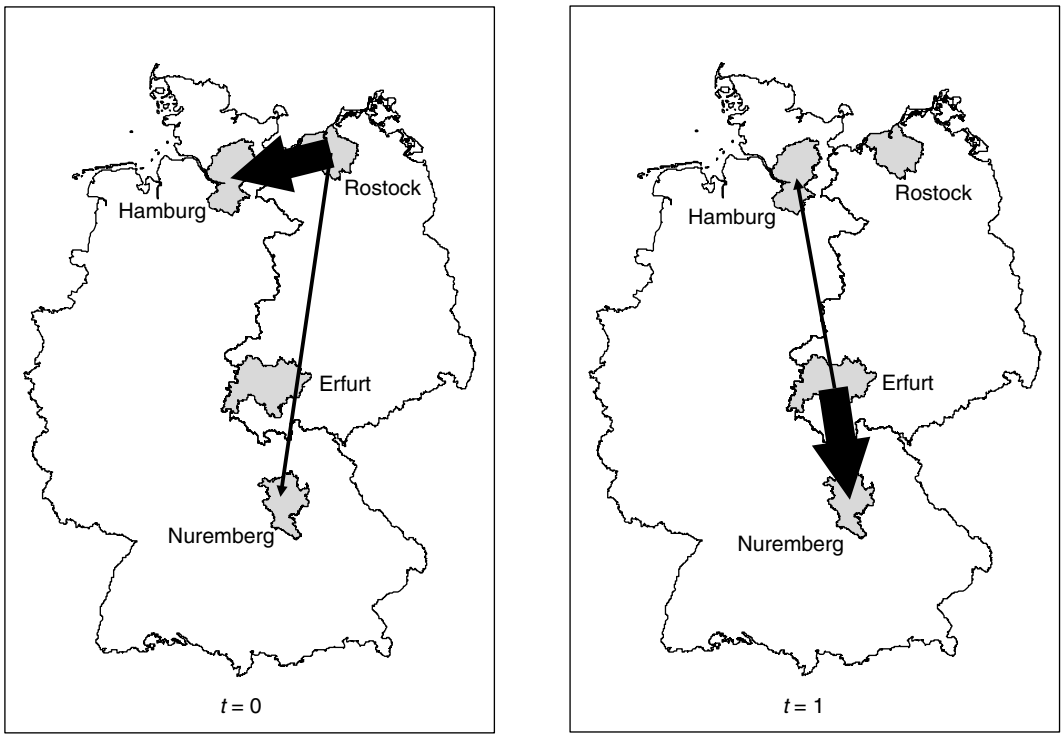
$$\Delta y_{it} = \beta_0 + \beta_1 m_{wt} + \beta_2 I_i m_{wt} + \beta_3 \Delta \mathbf{x}_{it} + \Delta \epsilon_{it}. \quad (1)$$

The index i denotes an organization, and w denotes a West German local labor market.[17] The quantity m_{wt} is the net migration from East Germany divided by the total population at time $t-1$, and the quantity y_{wt} is an organizational response. In the first set of analyses, y_{it} will be log employment; in later analyses, it will represent other strategic choices or outcomes (e.g., sales, manufacturing scope, and strategic focus). The variable I_i is an indicator for organization i's institutional affiliation (to be defined later), $\mathbf{x}_{it}$ is a vector of controls, and ϵ_{it} is an error term.

Estimating β_1 and β_2, the main coefficients of interest in Equation (1), is complicated by possible correlation between m_{wt} and $\Delta\epsilon_{it}$. For example, if East German migrants tend to go to western regions where demand for labor is growing due to factors that are not observable in the data, then the estimates $\hat{\beta}_1$ and $\hat{\beta}_2$ will not accurately measure organizations' employment responses. To address this issue, I construct instruments for m_{wt} that capture the exogenous forces "pushing" migrants into labor market w. These instruments are motivated by the observation

[17] Because organizations do not change labor markets in my data, the w subscript for organization-level variables would be redundant.

Figure 1 Illustration of the Study's Identification Strategy



Notes. At $t = 0$, a large shock to Rostock produces a large flow of migrants to nearby Hamburg but a comparatively small flow of migrants to more-distant Nuremberg. At $t = 1$, a large shock to Erfurt produces a large flow of migrants to Nuremberg but a comparatively small flow to Hamburg. Eastern shocks interacted with distance are therefore instruments for the push component of migration received by each western labor market.

that western labor markets that are closer to eastern regions with weak labor demand should receive more migrants. The reason is that weak labor demand stimulates search for employment opportunities in the West, and migrants will prefer moving to the regions nearest their homes.[18] Figure 1 illustrates the identification strategy. At $t = 0$, a large "shock" (i.e., a decline in the quantity or quality of available jobs) in Rostock produces a large flow of migrants to Hamburg (187 km), but a comparatively small flow of migrants to Nuremberg (628 km). At $t = 1$, a large shock in Erfurt produces a large flow of migrants to Nuremberg (228 km), but a comparatively small flow to Hamburg (398 km). Shocks in the east that vary across region and time interact with distance to produce cross-sectional and longitudinal variation in the amount of migration going to western labor markets. Appendix B develops this intuition more formally and discusses the empirical strategy's identifying assumptions.

The specification in Equation (1) is in first differences (the migration variable m_{wt} is equivalent to $\Delta mpop_{wt}$, where $mpop_{wt}$ denotes the migrant population in labor market w at time t).[19] This is the most intuitive way of describing the regression. However, I have an unbalanced panel. The first-differences estimator is ill equipped to handle establishments with gaps in their data, because there can be no first difference when the preceding year's observation is missing. Hence, I use the fixed-effects analogue of Equation (1),

$$\tilde{y}_{it} = \beta_0 + \beta_1 \widetilde{mpop}_{wt} + \beta_2 I_i \widetilde{mpop}_{wt} + \beta_3 \tilde{\mathbf{x}}_{it} + \tilde{\epsilon}_{it}; \qquad (2)$$

here the tilde denotes the "within" transformation, which for $mpop_{wt}$ is $\widetilde{mpop}_{wt} = mpop_{wt} - (1/T)\sum_{s=1}^{T} mpop_{ws}$. Note that Equation (2), therefore, contains a variable, $mpop_{wt}$, that I do not observe. In other words, I observe only migrant flows, not stocks. However, we can also express the migrant population as $mpop_{wt} = mpop_{w,1990} + M_{wt}$, where $M_{wt} = \sum_{s=1991}^{t} m_{ws}$

[18] "Gravity" models, which specify an inverse relationship between distance and migration, have long been used in urban and population economics. Greenwood (1975, p. 398) notes that distance serves as a proxy for "transportation and psychic costs of movement, as well as for the availability of information."

[19] Note that this equivalence may not hold in the data due to unobserved out-migration of East Germans. Yet all that is required for the analysis is that such population movements be uncorrelated with the instruments, and evidence presented in Frank (2011) suggests that this is the case.

Table 2 Summary Statistics

	N	Mean	SD	Min	Max
		West German regions			
Area (km^2)	125	1,482.1	944.1	323.3	5,085.8
Population (*1990*)	125	411,843	533,069	62,008	2,773,988
Distance to border (km)	125	277.4	80.4	107.5	484.4
Net in-migration 1991–1997 (*% of 1990 pop.*)	125	0.950	0.554	−0.107	3.07
		East German regions			
Area (km^2)	25	4,308.9	2,885.4	225.8	12,095.0
Population (*1991*)	25	580,393	314,445	125,476	1,269,417
Net out-migration 1991–1997	25	17,237	10,872	2,649	50,027
Net out-migration (*% of 1991 pop.*)	25	3.14	1.729239	0.505	9.71
		Instruments			
Out-migration/population × 1,000	28,175	0.0287	0.0811	−1.29	2.93
Unemployment rate (%)	175	15.9	3.42	7.3	23.4
Unemployed persons per full-time vacancy	175	37.8	25.0	11.4	154.4
Unemployed persons per permanent vacancy	175	49.4	28.8	17.2	211.3
Ratio of part-time vacancies to all vacancies	175	0.157	0.106	0.0169	0.577
Ratio of temporary vacancies to all vacancies	175	0.358	0.144	0.032	0.649
Fraction of employed in subsidized jobs	175	0.0376	0.0163	0.0117	0.0893
		West German establishments: Time-invariant			
Union only	1,487	0.176	0.381	0	1
Works council only	1,487	0.121	0.326	0	1
Union and works council	1,487	0.458	0.498	0	1
Downstream producer	1,878	0.449	0.498	0	1
		West German establishments: Time-varying			
Natural log of employment	7,254	4.32	1.09	1.61	8.861
Natural log of sales (million DM)	6,996	2.70	1.25	−0.0511	7.17
Outsourcing	3,861	0.629	0.483	0	1
Intermediate sales (%)	5,036	31.4	36.7	0	100
Sales/Marketing strategy (rank)	4,004	1.816	0.967	1	4
Diversification strategy (rank)	4,004	3.572	0.788	1	4
Product exploration	4,004	5.884	1.095	3	7
Market exploration	4,004	5.872	1.072	3	7
Level of technology	1,561	2.780	0.783	1	4
Work groups in use	1,832	0.452	0.498	0	1
Work groups planned	1,832	0.048	0.214	0	1

(i.e., the cumulative net migration into labor market w since 1990). Because the within transformation cancels out the constant, $mpop_{w,1990}$, Equation (2) is equivalent to

$$\tilde{y}_{it} = \beta_0 + \beta_1 \tilde{M}_{wt} + \beta_2 I_i \tilde{M}_{wt} + \beta_3 \tilde{\mathbf{x}}_{it} + \tilde{\epsilon}_{it}. \qquad (3)$$

This is the equation that I estimate.

5. Data

The analysis combines multiple data sources: county-level migration flows, information from the West German establishments, definitions of the East and West German regions, and instruments for migration. I discuss each of these in turn. Summary statistics are given in Table 2.

5.1. Establishment Data: The NIFA Panel

The NIFA panel comes from the annual survey of establishments in the German machinery and equipment industry conducted during 1991–1998 by researchers at the Ruhr University Bochum.[20] The data set was distributed by the Central Archive for Empirical Social Science Research at the University of Cologne. The mean number of establishments was 1,304 per year and ranged from a high of 1,642 in the first year to a low of 1,038 in the last year.[21] Some

[20] The study's purpose was to examine the use of advanced technologies and work practices in manufacturing. (NIFA is the German acronym for "New Information Technologies and Flexible Work Systems.")

[21] Note that the actual NIFA data set is larger. These figures reflect only those establishments giving at least two usable observations for at least one of the variables of interest.

questions were not asked annually; their survey years are indicated in parentheses after the variable name.

5.1.1. Labor-Related Data.

Employment: Number of employees (excluding trainees) in the establishment at the start of the year.[22]

Union (1994–1996): Answer to the question, "Is your firm bound by a collective bargaining agreement?"

Works council (1994, 1996): Answer to the question, "Does your firm have a works council?"

As one might expect, the labor market institutions are "sticky": only 3.8% of the establishments in the sample report a change in the works council (the overwhelming majority are additions), and only 6.4% report a change in collective bargaining status. I treat both variables as fixed firm characteristics, using the earliest reported value, for two reasons. First, the thought experiment in this study is, "What institutional choices had these organizations made before reunification?" The data do not permit me to answer this question with certainty. However, because these institutions are so sticky, choosing the earliest observed affiliations is a reasonable approximation to the true affiliations a few years earlier. Second, because these variables are not observed in all years, it is necessary in any case to impute values for the other years. A different imputation rule than the one chosen would be arbitrary (particularly for years in between observed changes) and so would be further removed from the thought experiment motivating the analysis.

Table 2 shows that 64% of establishments in my sample had a collective bargaining agreement when first observed. Works councils were present in 58%. I observe that 18% of establishments had only collective bargaining, 12% had only works councils, and 46% had both. So even though there is strong correlation in the incidence of these two institutions, there is sufficient variation in the data to estimate the effects of each separately.

5.1.2. Other Operational Data.

Sales: Establishment sales in the previous year in millions of deutsche marks (DM).

Intermediate sales: Share of sales going as input to industrial customers.

Outsourcing (1995–1998): Answer to the question, "In [the previous year], did your establishment contract out manufacturing orders (e.g., to unaffiliated establishments) that had formerly been performed in-house?"

Position in the production chain (1995–1998): Establishments are classified in accordance with their responses to this question: "Our establishment is primarily a manufacturer of (a) individual parts, (b) modules, (c) machines, (d) machine systems, (e) other." Multiple responses were allowed. I exclude establishments that answered only (e).[23] I define establishments answering (c) or (d) as *downstream* and all others as *upstream*.[24] As with the labor market institutions, I treat these classifications as fixed firm characteristics and take the earliest observed value.

Strategy (1991, 1994, 1995, 1997, 1998): Managers ranked the importance, from 1 (most important) to 4 (least important), of each of four strategies corresponding to the quadrants of an Ansoff matrix (Ansoff 1957): "sales and marketing" (focus on current products and current markets), "diversification" (focus on new products and new markets), "market expansion" (focus on current products and new markets), and "new products" (focus on new products and current markets). I interpret the two extreme quadrants (existing/existing and new/new) as a focus on exploitation and exploration, respectively. I also define a *market exploration* variable as the sum of the rankings for the two strategies involving new markets (diversification and market expansion) and a *product exploration* variable as the sum of the rankings for the two strategies involving new products (diversification and new products).

Branch of industry: Subindustry code (11 possible values) defined by the German Engineering Federation and assigned by the Federal Employment Agency. To control for the effects of changing demand on my dependent variables, I use subindustry-year indicators in all regressions.

5.2. Geography

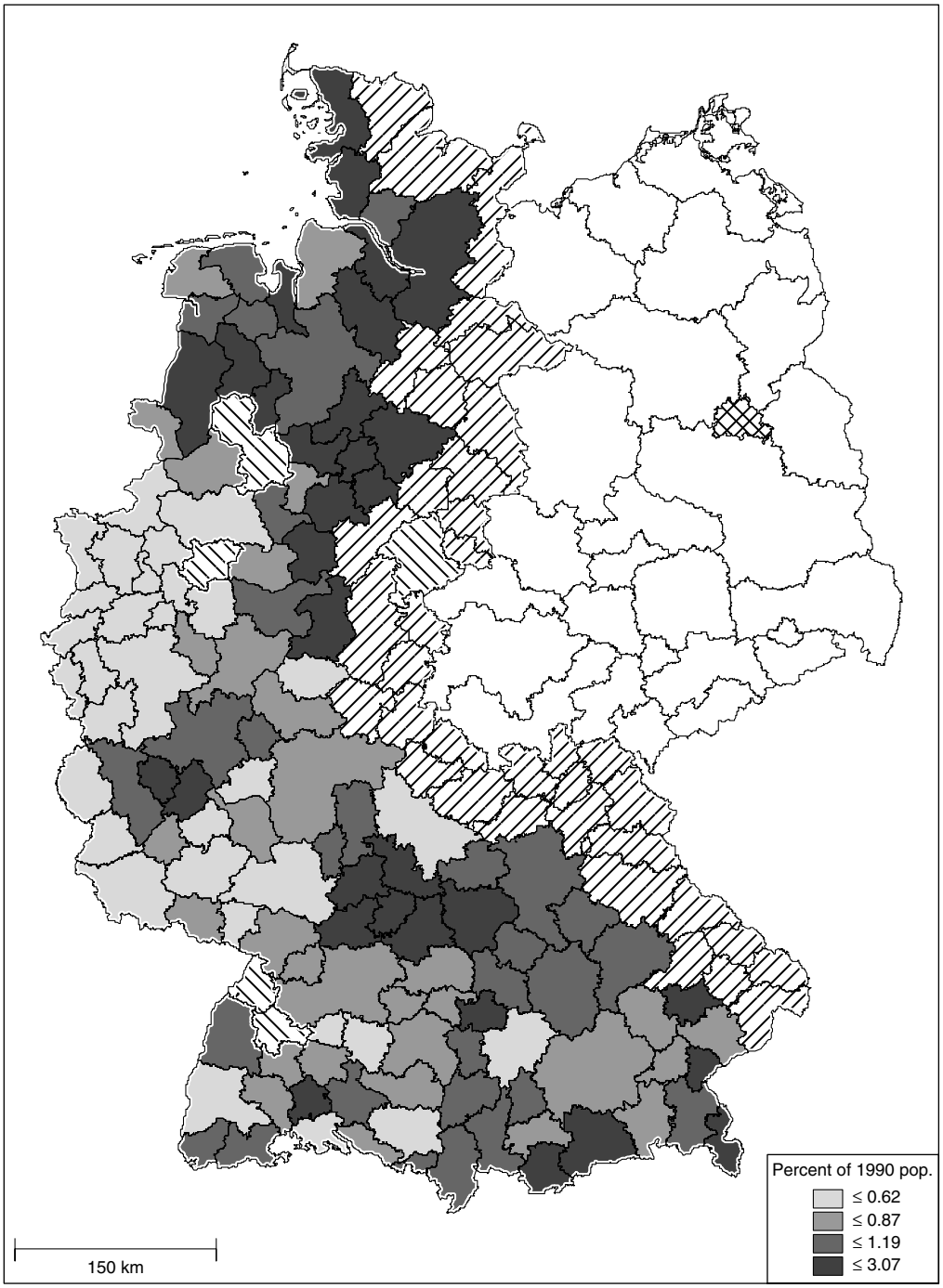
The analysis revolves around two main geographic units: the West German regions receiving migrants and the East German regions sending them. See Figure 2 for an illustration. In the West, I study 125 local labor markets (shaded regions in the figure) using the definition in Eckey and Klemmer (1991). Each such market is an agglomeration of counties with minimal commuter flows across its boundary. As a relatively self-contained labor market, it is preferred to the county or state for studying migration's impact. In the East, I study 25 distinct regions based on the 35 "employment office districts" of the German Federal Employment Agency (white regions in Figure 2). These are the units for which the agency reports its

[22] I drop establishments in which employment falls below five at any point because the Works Constitution Act's key provisions apply only to establishments with at least five regular employees.

[23] The establishments are excluded only from specifications including this variable.

[24] This categorization accords well with the *intermediate sales* variable, where the average is 51% for upstream firms and 22% for downstream firms. As with the institution indicators, the classification is based on the first observation for the establishment.

Figure 2 Regions Used in the Analysis



Notes. Shading denotes cumulative migration received by each labor market during the study period as a percentage of its 1990 population. Hatched regions are dropped from the analysis for reasons discussed in the text. East German regions are in white; Berlin (dropped from the analysis) is the cross-hatched region.

labor market indicators, which are the instruments for westbound migration. Because the eastern regions are administrative districts rather than labor markets in the Eckey and Klemmer (1991) sense, I reserve the term "labor market" for the western regions.

Excluded from the regressions are 37 western labor markets that significantly overlap the Zonal Border Area (ZBA)—a strip of West German land within approximately 40 km of the former eastern border (the regions with "southwest" to "northeast" diagonal hatching in Figure 2).[25] The ZBA labor markets

[25] See Redding and Sturm (2008) for a discussion of the border region and its economic development.

are unrepresentative of the rest of West Germany for two reasons: (a) active government subsidy programs, dating from the prereunification period, intended to stimulate labor demand in this then-isolated part of Germany (Federal Republic of Germany 1990); and (b) their location within commuting distance of many East German population centers.[26] Because my data do not include commuters, observed migration will not accurately measure the increase to the ZBA's labor supply. Hence, any estimates of the migration's impact on ZBA labor markets are likely to be inaccurate.[27]

5.3. Migration

Migration data come from the county-level migration matrix provided by the German Federal Statistics Office for the years 1991–1997. All residents of Germany, whether citizens or not, are required by law to register their address with the local authorities; these registrations constitute the basis for the migration data. The data, therefore, can be viewed as a census, rather than a sample, of internal migration in Germany. As the name suggests, the matrix provides annual migration flows between all county pairs in Germany. East German states were included in the matrix for the first time in 1991.

I exclude Berlin (the cross-hatched region in Figure 2) as a source of East German migration (doing so does not substantially affect the results). Politically, Berlin was simultaneously part of both West and East Germany before reunification, so it is hard to establish the extent to which migration between Berlin and West Germany constitutes East–West migration. I also eliminate western labor markets containing admissions centers for "resettlers"—ethnic Germans whose ancestors had emigrated to Eastern Europe centuries earlier.[28] Between 1987 and 2001, more than 2.8 million resettlers returned to Germany through a handful of admission centers. Upon arrival, they were registered as residents of the center's town.[29] Once their ancestry claims were verified, they were reassigned to other parts of Germany (including East Germany) according to predetermined quotas—a process that creates artificially large eastbound flows in the migration data and therefore renders it unusable for the labor markets with admissions centers (the northwest to southeast diagonal hatching in Figure 2).[30]

Figure 2 illustrates the migration received by each labor market as a percentage of its 1990 population. The negative correlation between distance to the border and migration is faintly visible. However, because the labor markets had different baseline populations, even some distant regions experienced large relative shocks. The average western labor market studied here grew by 1% for 1990–1997, although growth ranged as high as 3.07% (see Table 2).

5.4. Instrumental Variables

As previously discussed, I construct instruments for endogenous migration from annual indicators of labor market conditions in the East German regions sending migrants. The German Federal Employment Agency provided this data at the level of the employment office district. I use two sets of indicators, as follows.

1. *Indicators of the* quantity *of available jobs*: unemployment rate, unemployed persons per full-time vacancy,[31] and unemployed persons per permanent vacancy.[32]

2. *Indicators of the* quality *of available jobs*: ratio of part-time vacancies to all vacancies, ratio of temporary vacancies to all vacancies, and share of employed persons in government-subsidized "make-work" jobs.

Summary statistics for these variables are given in Table 2. The procedure for generating the instruments is detailed in Appendix B. Its essential action is to generate, via ordinary least squares (OLS) regression, two instruments that summarize the migration push forces (the just-described variables interacted with distance) acting on each western labor market in each year. It is important to emphasize that this procedure is not the first stage of a two-stage regression;

[26] Several populous western labor markets, such as Hamburg and Frankfurt, have catchment areas with subsidy-eligible communities at their fringes. The impact of the subsidy program is unlikely to be significant for such labor markets, so I retain any nominally subsidy-eligible labor market (a) that does not have a common land border with East Germany and (b) with major city or cities (100,000 inhabitants or more) that were not eligible for the subsidy program. The results are not materially affected if I instead eliminate all such labor markets.

[27] Commuters are of little concern for the remaining western labor markets. First, all their major population centers are more than 100 km from the nearest East German population center. Second, each such labor market is buffered by at least one excluded western labor market with which it has (by definition) minimal commuter flows. Therefore, any impact of commuter flows spanning this buffer zone is probably small.

[28] The information on resettlers comes from Glitz (2012), except where otherwise noted. I refer the reader to that paper for a more detailed discussion of the institutional framework related to resettlers.

[29] The author's private communication (via telephone call in 2005) with an official of the involved agency.

[30] The reassignment process to other counties within West Germany is pure background noise because it was based on administrative formulas that are uncorrelated with either business conditions at the destination or its distance to any eastern region. Note that only the lack of correlation with distance is required for the estimation strategy because it means that this influence is uncorrelated with the instruments.

[31] Vacancies registered with the agency.

[32] "Permanent" refers to an open-ended (i.e., not a fixed-term) employment contract.

it is instead a preliminary, "instrument-generating" regression.

6. Results

6.1. Instrument-Generating Regressions

Table 3 presents the results of the instrument-generating regressions described in §A.2. Because the purpose of this paper is to examine the consequences rather than the causes of migration, the discussion of Table 3 will be brief. First, the indicators for the *quality* of available jobs (panel B) are generally stronger predictors of migration than are the indicators for the *quantity* of jobs (panel A). The explanatory variables are jointly significant in each panel, as indicated by the F statistics. The signs of the coefficients that are precisely estimated generally match the intuition that poor labor market conditions in East German induced people to leave. The main exception is the ratio of part-time vacancies to all vacancies, which has a negative effect on out-migration. The estimates also match the intuition that these effects should attenuate with distance (distance interaction coefficients have opposite signs of the main effects) and should exhibit diminishing returns (squared terms have opposite signs of the main effects).

Table 3 Instrument-Generating Regressions

Panel A. Indicators of quantity of available jobs	
Unemployment rate	0.194
	(0.246)
Unemployed persons per full-time vacancy (*UPFTV*)	0.0207
	(0.131)
Unemployed persons per permanent vacancy (*UPPV*)	0.263*
	(0.151)
Unemployment rate squared	−0.188
	(0.212)
UPFTV squared	−0.0441
	(0.0322)
UPPV squared	0.000380
	(0.0245)
Unemployment rate × *Log distance*	−0.0340
	(0.0402)
Unemployment rate squared × *Log distance*	0.0318
	(0.0343)
UPFTV × *Log distance*	−0.00221
	(0.0205)
UPFTV squared × *Log distance*	0.00627
	(0.00501)
UPPV × *Log distance*	−0.0409*
	(0.0228)
UPPV squared × *Log distance*	0.000424
	(0.00380)
Constant	0.0149
	(0.0798)
Observations	28,175
R^2	0.0478
F	16.32
Panel B. Indicators of quality of available jobs	
Part-time ratio (*part-time vacancies to all vacancies*)	−0.574**
	(0.214)
Temporary ratio (*temporary vacancies to all vacancies*)	0.536*
	(0.275)
Make-work ratio (*fraction of employed in subsidized jobs*)	0.137
	(0.244)
Part-time ratio squared	0.296**
	(0.112)
Temporary ratio squared	−0.183
	(0.109)
Make-work ratio squared	−0.0336
	(0.101)
Part-time ratio × *Distance*	0.0775**
	(0.0336)
Part-time ratio squared × *Distance*	−0.0414**
	(0.0177)
Temporary ratio × *Distance*	−0.0877*
	(0.0446)
Temporary ratio squared × *Distance*	0.0303*
	(0.0174)
Make-work ratio × *Distance*	−0.0199
	(0.0364)
Make-work ratio squared × *Distance*	0.00500
	(0.0150)
Constant	0.0572**
	(0.0231)
Observations	28,175
R^2	0.0605
F	24.64

Notes. The unit of analysis is an East German employment office district and West German labor market pair, observed in each of seven years. The dependent variable is the net migration to the west per thousand population in the East German district.

*Significant at 10%; **significant at 5%.

6.2. Effects of Migration on Employment

Table 4 presents the effects of migration on log employment. The independent variable is the cumulative migration measured as a percentage of 1990 population. Recall that, in the fixed-effects specification, cumulative migration is equivalent to migrant population. Therefore, coefficients on the cumulative migration terms are interpreted as the marginal effect of a 1% increment to 1990 population caused by migration.[33]

Results for the baseline specification—log employment versus migration—appear in column (1) (OLS)

[33] The estimates, therefore, superficially resemble demand elasticities but should not be interpreted as such; the reason is that migration is a shock to the entire labor market population, whereas the employment variable is for a single industry that accounts for only about 4% of employment.

Table 4 Effect of Migration on Employment

	(1) OLS	(2) GMM	(3) GMM	(4) GMM	(5) GMM	(6) GMM
Migrants per 100 population	0.131***	0.223***	0.433***	0.537**	0.407***	0.450***
	(0.0430)	(0.0770)	(0.0937)	(0.229)	(0.108)	(0.0940)
Migrants × Collective bargaining			−0.0292	−0.0189	−0.0297	−0.0361
			(0.0730)	(0.0732)	(0.0731)	(0.0729)
Migrants × Works council			−0.298***	−0.250***	−0.296***	−0.300***
			(0.0592)	(0.0842)	(0.0620)	(0.0592)
Migrants × Log avg. estab. employment				−0.0282		
				(0.0428)		
Technology level 2				−0.0118		
				(0.0361)		
Technology level 3				−0.0477		
				(0.0393)		
Technology level 4				−0.120***		
				(0.0460)		
Work groups in use				0.0185*		
				(0.00958)		
Work groups planned				0.0326***		
				(0.0121)		
Migrants × Above-median distance to border					0.104	
					(0.0740)	
Migrants × Northern state					0.0563	
					(0.1616)	
Instruments	None	Full	Full	Full	Full	Partial
Observations	7,254	7,254	6,363	5,133	6,363	6,363
Clusters	1,878	1,878	1,487	1,369	1,487	1,487
R^2	0.0656					
Kleibergen–Paap *rk F*		51.9	16.2	10.4	9.0	17.2
p-value of Hansen's *J*		0.963	0.426	0.271	0.630	0.441

Notes. The dependent variable is the log of establishment employment. The reported coefficients are from fixed-effects regressions, all of which include year, year-state, and year-subindustry effects. Robust standard errors (in parentheses) are clustered on establishments.

*Significant at 10%; **significant at 5%; ***significant at 1%.

and column (2) (generalized method of moments (GMM)) of Table 4. A comparison shows that the OLS estimates appear to be biased downward, indicating that migrants tended to choose labor markets where employment in this industry was declining. Although counterintuitive, a similar bias has been found in Germany by Pischke and Velling (1997) and Frank (2011).[34] Column (2) of Table 4 shows that eastern migration had a significant positive effect (22% growth) on employment across all establishments. However, this large effect must be interpreted against a background of declining employment; the overall within-establishment employment trend in the sample is negative—even net of the positive migration effects.

[34] These studies examine employment outcomes across all industries, not just the one studied here. Such a downward bias may be evident if migrants tend to go to areas where other migrants congregate, housing is inexpensive, services for the marginalized or unemployed are widely available, and so forth. All these factors may be correlated with weak labor demand.

Column (3) of Table 4 introduces indicators for collective bargaining (union) and works councils. The point estimates show that both are associated with a reduced employment response to migration, which is consistent with the hypothesis that these governance institutions have higher adaptation costs. The point estimate for collective bargaining is smaller in magnitude than the one for works councils (as predicted); however, it is not significant at conventional levels, so the employment response for collective bargaining is statistically indistinguishable from that for firm governance (i.e., when neither works council nor collective bargaining is present). As discussed earlier, the wage drift phenomenon could blur the distinction between hybrid (collective bargaining) and firm governance because the collective agreement imposes no real constraint on firms that offer more generous terms.

Columns (4)–(6) of Table 4 contain robustness tests. Column (4) tests two alternative hypotheses. The first is that the works council effect is actually a size effect. Because works councils tend to be found

Table 5 Indicators of Overstaffing

	Obs.	No works council	Works council	*p*-value difference
Overtime in use (yes/no)	885	0.819	0.810	0.740
Saturday hours in use (yes/no)	885	0.557	0.597	0.236
Personnel utlization rate (%)	880	94.6	95.7	0.133

Note. Data for the year 1990, surveyed in 1991.

at larger firms (see, e.g., Addison et al. 1997), column (3) could merely indicate that larger organizations grow more slowly when the labor supply increases. However, the results in column (3) are qualitatively unchanged by the inclusion in column (4) of a separate interaction between migration and the log of average establishment employment. The other hypothesis tested in column (4) is that employment growth is driven by different patterns of technological change across regions. First, it should be noted that, unless these changes are correlated with the instruments (distance to each of 25 East German regions interacted with labor market conditions there), they are pure random noise with respect to estimating the effect of migration on employment. Second, column (4) incorporates three establishment-level technology indicators: management's overall assessment of how technologically advanced the operations are (a four-point scale) and indicators for whether self-directed work groups are in use or planned. The latter are motivated by research indicating that such groups tend to accompany other technological changes as part of a bundle of "advanced work practices" (Ichniowski et al. 1997). Including these technology controls does not qualitatively change the results reported in column (3).[35] Another alternative hypothesis is that firms with works councils were overstaffed before migration began and so should have been reducing employment during this period. Table 5 tests this hypothesis by examining three different indicators of overstaffing, measured at the start of the study time frame: the incidence of overtime work, the incidence of Saturday working hours, and the personnel utilization rate. If establishments with works councils were bloated, then they should display systematically lower values for all three measures. In fact, there is no significant difference in any of the measures.

Returning to Table 4, columns (5) and (6) test the robustness of the instrumental variables estimation strategy. The strategy is valid under the assumption that unobserved determinants of an organization's outcomes (here, employment) are uncorrelated with the organization's distance to the East German border. This assumption could be violated if either (a) the labor market shocks in the East that drive out-migration are correlated with unobserved factors in the West that drive the dependent variable in Table 4 or (b) unobservable determinants of performance outcomes in West German establishments have systematic spatial patterns. For example, there is usually a strong north–south divide in German employment outcomes. So if southern states happen to be closer to eastern German regions that send more or fewer migrants, then a correlation could be induced between instruments and unobservables. Column (5) of Table 4 introduces two geographic indicators to the specification in column (3): whether the organization is above or below the median distance to the East German border and whether it is in a northern (Schleswig–Holstein, Hamburg, Bremen, Lower Saxony, or North Rhine–Westphalia) or southern (Hessia, Rheinland–Palatinate, Saarland, Baden–Württemberg, or Bavaria) state. Together, these indicators effectively divide West Germany into four quadrants. If either one of the hypotheses (a) or (b) were true, then one or both of the interactions of these indicators with the migration variable would be significant, yet neither is. A further test of hypothesis (a) is contained in column (6), which replicates column (3) but omits the East German regions closest to the border from the regressions that generate the instruments. If unobservables are correlated across the border, then we should see a qualitative difference in the estimates so obtained, yet we do not.

6.3. Broader Effects of Migration

Table 6 explores the remaining implications of the model sketched previously. The hypotheses involve three dimensions along which establishments may differ: upstream versus downstream, collective bargaining versus none, and works council versus none. For clarity of exposition and ease of comparison across specifications, I report the marginal effects for each of the eight possible categories (the sum of the coefficients for the migration variable and its interaction with that category) rather than the underlying regression coefficients. Column (1) of Table 6 provides some slight evidence in favor of the hypothesis that collective bargaining intensifies the works council's negative effect on the firm's employment response. Among upstream establishments, the effect of migration on employment is smallest when both institutions are present. However, the difference with respect to the next-smallest coefficient is not statistically significant. Among downstream establishments, the evidence is even less conclusive because the employment response to migration is statistically indistinguishable

[35] Because these variables are not reported in all years, including them involves a substantial loss of data and statistical power. Hence, they are not included in subsequent specifications.

Table 6 Effects of Migration–Detail

	(1) Log employment	(2) Log sales	(3) Outsourcing	(4) Intermediate sales
Upstream and no union and no works council	0.698***	0.661***	−0.262	12.582
	(0.13)	(0.15)	(0.52)	(18.71)
Upstream and no union and works council	0.276***	0.337	−0.266	−27.930
	(0.09)	(0.25)	(0.36)	(27.76)
Upstream and union and no works council	0.445***	0.563***	0.422	14.695
	(0.12)	(0.18)	(0.37)	(11.63)
Upstream and union and works council	0.265*	0.398**	−0.481	−0.500
	(0.14)	(0.19)	(0.55)	(20.96)
Downstream and no union and no works council	0.298***	0.155	0.104	15.225
	(0.10)	(0.14)	(0.56)	(15.35)
Downstream and no union and works council	0.090	−0.039	0.043	−23.722
	(0.15)	(0.19)	(0.49)	(18.40)
Downstream and union and no works council	0.427***	0.283**	0.872*	−28.688**
	(0.09)	(0.13)	(0.52)	(14.50)
Downstream and union and works council	0.126	0.121	−0.002	0.135
	(0.09)	(0.11)	(0.37)	(13.32)
Observations	5,535	5,335	2,971	4,114
Clusters	1,230	1,202	970	1,193
Kleibergen–Paap *rk F*	6.10	6.31	6.64	5.98
p-value of Hansen's *J*	0.139	0.663	0.647	0.797

Notes. The reported coefficients are for marginal effects from fixed-effects regressions, all of which include year, year-state, and year-subindustry effects. Robust standard errors (in parentheses) are clustered on establishments.

*Significant at 10%; **significant at 5%; ***significant at 1%.

from zero for two categories of establishments: union/works council and no union/works council. Column (1) of Table 6 provides stronger support for the hypothesis that upstream establishments grew more in response to migration than did downstream firms. In each of the four possible comparisons between upstream and downstream (holding the institutional affiliations constant), the upstream point estimate is larger. In two out of four cases (establishments without collective bargaining agreements), the difference is statistically significant at $p = 0.10$ or better. The largest and most significant employment effect is seen in upstream firms without collective bargaining agreements or works councils, consistent with earlier predictions that the net employment response would be largest among firms with the lowest adaptation costs.

According to the model, predictions about relative changes in employment exactly mirror predictions about relative changes in the quantity of output. An analogous relationship between employment and sales revenues does not hold because prices and quantities move in opposite directions. However, the data do not contain production quantities, so column (2) of Table 6 reports results for the effect of migration on sales revenues. These results broadly mirror the employment results in column (1) of Table 6. In particular, upstream establishments without works councils display the greatest response of sales to migration.

The model's prediction of increased production among upstream producers is linked to the prediction that some downstream producers will respond to migration by substituting purchased components for in-house production. Specifically, it was hypothesized that the leading candidates for such a change in manufacturing scope were downstream establishments with collective bargaining agreements (which limit downward wage flexibility) and without works councils (which reduce the firm's autonomy in restructuring itself). Columns (3) and (4) of Table 6 lend support to this hypothesis. Column (3) shows that migration increased the propensity of establishments with collective bargaining but without works councils to outsource manufacturing work that had formerly been performed in-house.[36] Column (4) shows that migration led to a reduction among these same establishments in the share of sales classified as intermediate goods. Both results amount to a change in these organizations' vertical boundaries. Note that, as measured here, the propensity to outsource depends on relative changes in labor costs of buyers and suppliers as a function of migration. Thus, the data actually bias against finding a link between migration and

[36] The dependent variable is a qualitative one, which usually dictates that a logistic or probit regression be performed. However, I wish to use instrumental variables and fixed-effects techniques simultaneously. Standard methods to use instruments with qualitative dependent variables depend on properties of the normal distribution, whereas methods to control for fixed effects with qualitative dependent variables depend on properties of the logistic distribution. The GMM method is used instead because it does not suffer from this incompatibility.

outsourcing, to the extent that outsourcing activity crosses labor market boundaries. This is because the regression compares the outsourcing decision with migration in the *same* labor market. The outsourcing variable tells only if outsourcing occurred, not where production went. To the extent that downstream establishments purchase inputs from suppliers in *other* labor markets, no effect of migration on outsourcing propensity will be observed unless migration patterns are correlated across the two markets. These remarks suggest that the estimates presented here are probably conservative.

The results in Table 6 indicate that the institutions governing the employment relationship influence adaptation in a multilayered way. Labor market institutions mediate the adaptive employment response to an external disruption in the labor market. Yet, as discussed in §4.1, heterogeneity in adaptive responses (brought about by heterogeneity in the institutions) yields heterogeneity in firms' competitiveness (i.e., their marginal costs), which in turn changes the economics of in-house production versus outsourcing in an institutionally contingent way.

Finally, Table 7 displays results concerning the effect of migration on establishments' choice of exploration- versus exploitation-oriented strategies. The literature is divided on whether environmental change should lead to more of one or the other, and it is silent on whether (or how) governance institutions mediate this response. Because the dependent variables are ordinal importance rankings, with smaller values corresponding to greater importance, a negative coefficient is interpreted as an *increase* in that strategy's importance. Column (1) of Table 7 reports results for the sales and marketing strategy. Recall that, of the Ansoff matrix quadrants about which respondents were queried, this one is the most clearly exploitation because it involves focus on existing customers and existing products. Three establishment types show an increase in the importance of exploitation in response to migration; the largest and most statistically significant effects are for establishments with works councils. In contrast, there is no effect of migration on the diversification strategy (new markets and customers, i.e., exploration). We might expect to see that an increase in exploitation is accompanied by a decrease in exploration. However, the summary statistics show that the exploration strategy has a low average rank across all respondents and a low variance compared with the exploitation strategy. These figures indicate that increased emphasis on exploitation was not at the expense of a pure exploration strategy but rather at the expense of other, intermediate strategies. Therefore, columns (3) and (4) of Table 7 report measures incorporating information from these intermediate strategies: market exploration (a strategy featuring new products) and product exploration (a strategy featuring new markets). Column (3) shows a decrease in the importance of market exploration in establishments with works councils. Column (4) shows no change in the importance of product exploration.

In summary, Table 7 provides tentative support for two conclusions. First, it reinforces the conclusion that institutions governing the employment relationship affect adaptation to an external shock, not only in the dimension of labor policy but also in the dimension of strategy. Table 6 showed this with respect to the strategic choice concerning the firm's vertical boundaries. The results in Table 7 also indicate an effect on the strategic choice of whether to focus

Table 7 Effect of Migration on Strategy

	(1) Sales/marketing	(2) Diversification	(3) Market exploration	(4) Product exploration
No union and no works council	−0.556*	−0.053	0.476	0.007
	(0.33)	(0.29)	(0.33)	(0.41)
No union and works council	−0.932**	0.510	1.202***	0.199
	(0.40)	(0.36)	(0.43)	(0.47)
Union and no works council	−0.290	0.329	0.449	0.274
	(0.33)	(0.25)	(0.40)	(0.44)
Union and works council	−0.655**	0.286	0.567*	0.345
	(0.32)	(0.26)	(0.32)	(0.41)
Observations	3,032	3,032	3,032	3,032
Clusters	1,077	1,077	1,077	1,077
Kleibergen–Paap *rk F*	12.4	12.4	12.4	12.4
p-value of Hansen's *J*	0.634	0.185	0.456	0.728

Notes. The dependent variable is the ordinal importance ranking of each of the indicated strategies (hence, a negative coefficient corresponds to an *increase* in importance). The reported coefficients are for marginal effects—of migration (migrants per 100 population, as in Table 4) on each category of establishment—from fixed-effects instrumental variables (GMM) regressions, all of which include year, year-state, and year-subindustry effects. Robust standard errors (in parentheses) are clustered on establishments.

*Significant at 10%; **significant at 5%; ***significant at 1%.

on exploration or exploitation. Second, the works council is, as predicted, associated with an increased emphasis on exploitation (incremental improvements to the known) and a reduced emphasis on exploration (experimentation with the unknown).

7. Discussion and Conclusions

This paper's objective was to study how governance institutions influence adaptation costs. Combining a simple model of an imperfectly competitive industry and existing theories that adaptation costs are lower in a hierarchy, I developed a set of testable hypotheses about how firms' adaptation to an increase in their labor supply will be mediated by institutions governing the employment relationship. The empirical analysis focused on two such institutions in Germany—(centralized) collective bargaining and works councils—and on the labor supply increase that was triggered by the fall of the Berlin Wall, a "revolutionary period" that upset the established equilibrium and created pressure for change. West German firms entered the 1990s with labor governance institutions that were adapted to the old world of a shrinking population but possibly maladapted to the new world in which labor was plentifully available.

One approach to inferring adaptation costs is to ask, "Which institutions tend to be found in more turbulent environments and which tend to be found in relatively stable ones?" In this paper, I have taken a more dynamic approach and instead ask, "How do institutions mediate firms' responses to an identifiable and measurable environmental change?" By exploiting the concept of a local labor market and introducing a novel strategy to control for the endogeneity of migration into each western locality, the analysis shows a clear causal relationship between the stimulus of population inflows and firms' adaptive responses. These institutionally mediated responses are multilayered yet consistent with the model's predictions.

This paper's central result is that employment growth is less responsive to migration in the presence of a works council, consistent with higher adaptation costs for that less hierarchical (less firm-like) governance institution. Results for collective bargaining are directionally similar but of substantially reduced magnitude and significance, probably due to a combination of factors. First, collective bargaining as practiced in Germany implies a comparatively small reduction in the firm's authority over its workers, so this institution is more firm-like than is the works council. Second, many firms with collective-bargaining agreements pay above the contractual minimum; for them, the agreement is less binding and so, in a large sample, the adaptation costs will be smaller on average.

Scholars have long attributed distinct rent-seeking and employee-participation roles to labor market institutions that secure workers' rights to collective representation (see, e.g., Freeman and Medoff 1984). The German context presents a unique opportunity in that, by law, these two roles are assigned to separate institutions (rent seeking to collective bargaining and employee participation to works councils), whereas in most other countries, the roles are combined in a single institution. One irony of this study's results is to highlight the practical challenge of achieving true separation between the two roles. This is the question asked in Freeman and Lazear (1994): How can meaningful participation rights be conferred without simultaneously giving workers leverage to extract rents? In the present study the works council, by limiting the employment response to a supply shock, appears to behave like a rent-seeking institution.

However, these results should not be viewed as an indictment of worker participation generally. It is interesting to note that the Lincoln Electric Company, the subject of Siegel and Larson (2009) and of a popular business school case study, has an "advisory board" whose role and privileges closely resemble those of a works council (Fast and Berg 1983, Jones 2010). An important difference is the absence of a legal mandate. The advisory board effectively rests on a relational contract (Poppo and Zenger 2002) between management and workers, and either side can easily withdraw its cooperation in response to perceived exploitation by the other. Yet it has also been argued (Williamson 1985, Hogan 2001) that labor market institutions similar to those studied here actually reinforce relational contracts. Such contracts are subject to reneging/commitment problems (Gibbons 2005) and are hence not always viable, so some formal institutional structures (such as legal mandates) may be needed for commitments to be credible.

This paper's second set of findings demonstrates more nuanced effects of institutions on adaptation. Upstream producers of machine components, especially those with the most firm-like governance, grow the most in response to migration. Furthermore, the results indicate that migration spurred one class of downstream firms—those with collective bargaining agreements (which put a floor on wage adjustments) but without works councils (which increase the costs of restructuring)—to reduce their own in-house components production and engage in more outsourcing. This finding brings to mind Peteraf and Reed (2007, p. 1106), who observe that "when managers find that their discretion is limited in one arena, they adapt by exercising their discretion in a less constrained arena." The results are also a within-country analogue to those reported in Witt and Lewin (2007), who find that outward foreign direct investment is an "escape

route" around restrictive home-country institutions. Finally, these findings suggest that, because different institutional affiliations lead to different degrees of adaptation, a common external disruption will change firms' relative competitiveness. As modeled here, the effect is on unit production costs, but the implications are more general and suggest a mechanism by which institutions influence the dynamic process of changes in competitive advantage.

The paper's third set of results suggests that institutions influence the choice of exploration versus exploitation as an adaptive response to environmental change. Although the effects are isolated, whenever responses are observed there is a consistent pattern: the works council is associated with less emphasis on exploration and more emphasis on exploitation. Coupled with the evidence of institutionally contingent patterns of outsourcing (change in strategy concerning the firm's vertical scope), these results indicate that governance institutions affect firms' strategic choices, and they add an institutional dimension to recent work on strategic divergence (Lee 2003, Almirall and Casadesus-Masanell 2010).

Finally, although much of the research on institutions relies on *between*-country comparisons, this paper illustrates a complementary role for *within*-country analysis. German labor relations may seem to be a monolith, but this paper shows there is within-country variation in institutional configurations that affects strategic decision making and performance. Within the United States, there is also local variation in institutions—such as tax policy, environmental regulation, and right-to-work laws—that shape the competitive advantage of regions and firms. Furthermore, as in the present study, within a given country, firms often freely choose (or at least have some control over) their institutional affiliations. Walmart is famously hostile to labor unions, for example, whereas Costco voluntarily entered into a relationship with a unionized work force when it merged with Price Club. This paper highlights how similar choices can produce path dependence as subsequent environmental disturbances arrive.

Acknowledgments

The author thanks Bruno Cassiman (the department editor), Raquel Bernal, Matthew Bidwell, Leemore Dafny, Douglas Frank Sr., Javier Gimeno, Shane Greenstein, Peter Hayes, Tom Hubbard, Ben Jones, Feng Lu, Paul Oyer, Scott Schaefer, Jordan Siegel, Jasjit Singh, Scott Stern, Chris Taber, Kathleen Thelen, Bart Vanneste, Balagopal Vissa, Winai Wongsurawat, and the three anonymous referees for helpful comments and suggestions. This paper would not have been possible without the cooperation of Ulrich Widmaier at the Ruhr University Bochum and Diana Schumann at the Society for Innovative Employment Promotion (Gesellschaft für Innovative Beschäftigungsförderung). The staff at the German Federal Statistics Office (Statistisiches Bundesamt), the German Federal Employment Agency (Bundesagentur für Arbeit) and its research arm, the Institute for Employment Research (Institut für Arbeitsmarkt- und Berufsforschung), were extraordinarily helpful, especially Christina Wübbeke. Finally, the author gratefully acknowledges the hospitality of the German Engineering Federation (Verband Deutscher Maschinen- und Anlagenbau) and the firms Desco Maschinenfabrik, Karl Mayer Textilmaschinenfabrik, MW Hydraulik, and Reis Robotics during the early stages of researching this project. The conclusions drawn in this paper in no way represent the opinions of any of the aforementioned institutions.

Appendix A. Labor Market Institutions: Historical Origins

German industrial relations are founded on the principle of codetermination, which asserts that "the freedom of entrepreneurs within a liberal economic order also requires obligations to prevent social ills" (Jackson 2001, p. 149). Codetermination has diverse and deep-rooted intellectual foundations, ranging from Hegelian philosophy to the democratic ideals of the 1848 Frankfurt National Assembly to Catholic social teaching (Jackson 2001, Lehmbruck 2001). Among the many features of the modern system that distinguish it from U.S. labor relations, two are notable. The first is that the government's intervention amounts to establishing flexible frameworks that structure the interactions of interest groups rather than ad hoc rules prescribing specific outcomes (Thelen 1991). The second and related feature is that interest group interactions take place through designated intermediate associations. The government's reliance on these can be traced back to late 19th-century policies of "bureaucratic liberalism" (Lehmbruck 2001). On one side are German employers' associations, which are the descendants of the industry "peak associations," which the Bismarck government encouraged in conjunction with its protectionist trade policy. On the other side are two institutions representing workers. First are the labor unions. These were first legalized in 1869, but they did not become widespread until after the turn of the 20th century (Jackson 2001). Banned under Hitler, they were reconstituted after World War II. Postwar union leaders emphasized unity and centralization in the belief that the movement's prewar weakness had been due to its "internal fragmentation" and "ideological cleavages" (Thelen 1991, p. 71). The second institution representing workers is the works council, which originated in the worker committees established by the 1891 Industrial Code Amendment. Although these councils began with only limited consultation rights, successive legislation in 1916, 1920, and 1922 expanded their powers. Abolished under the Nazi regime, they were reestablished under the 1952 Works Constitution Act, which was revised in 1972 (Jackson 2001).

Appendix B. Statistical Appendix

B.1. Identification

Observe that migration into western region w can be decomposed as $m_{wt} = \sum_e m_{ewt}$, where e indexes an East German region. Let u_{et} be an indicator of the quantity or

quality of available jobs in region e at time t, and let d_{ew} be the distance between regions e and w. The push component of m_{ewt}, described in the discussion of Figure 1, is the part that is explained by $d_{ew}u_{et}$; call this $\hat{z}_{ewt} \equiv E[m_{ewt} \mid d_{ew}u_{et}]$, which can be obtained through linear regression. Total push migration into region w, $\hat{z}_{wt} \equiv \sum_e \hat{z}_{ewt}$, is then an instrument for m_{wt} in a standard two-stage estimation of Equation (1).[37]

The identifying assumption is $E[d_{ew}\Delta\epsilon_{wt} \mid \Delta\mathbf{x}_{wt}] = 0$ for all e and t. In other words, the unobserved determinants of outcomes in a West German labor market are conditionally uncorrelated with its distance from any East German region. To understand why this assumption is valid despite the integration of the East and West German economies, note that East–West linkages alone are not enough to contaminate the instruments because the identifying assumption is an assumption at the lower level of individual labor markets. To see this clearly, suppose that u_e (labor-market conditions in East German region e) are correlated with ϵ_w (unobservable shocks to organizational outcomes in West German region w). The model is correctly identified if $E[(d_{ew}u_{et})\Delta\epsilon_{wt} \mid \Delta x_{wt}] = 0$, that is, if the push factors used to predict migration (the product $d_{ew}u_{et}$) are conditionally uncorrelated with the unobserved determinants of outcomes in the western labor market. Yet this follows from the identifying assumption and the law of iterated expectations. Therefore, the instruments remain valid *even in the presence of East–West correlations* provided these correlations have no spatial pattern *at the local labor market level*. Frank (2011) contains an expanded discussion of this subject and explains why, for example, the substantial capital flows from West to East Germany are compatible with the assumptions of this analysis. Interested readers are referred to that paper for more details.

Economic linkages that display no pattern of spatial correlation at the disaggregated level at which migration flows are measured do not invalidate the identifying assumptions. However, there still might be some problematic linkages that do display spatial patterns. Examples include labor demand shocks that are correlated across neighboring regions as well as systematic spatial patterns of labor-market shocks in West Germany. I perform robustness tests for these possibilities in the analysis.

B.2. Instrument Construction

To create the instruments, I first perform regressions of the following form:

$$\frac{m_{ewt}}{pop_{et}} = \alpha_0 + \boldsymbol{\alpha}_1\Gamma_{ewt} + \nu_{ewt}, \tag{B1}$$

where m_{ewt} is the net migration from East region e to western labor market w, pop_{et} is eastern region e's population, Γ_{ewt} is the vector of instruments, and ν_{ewt} is an error term.[38] The instrument vector Γ_{ewt} contains (a) each of the labor market indicators described previously, (b) each indicator's square, and (c) separate interactions of (a) and (b) with the (logged) distance between regions e and w.[39] Each of the elements in Γ_{ewt} is expressed relative to the East German average for that year. Because the labor market indicators are therefore all scale free, I normalize the dependent variable (migration) by region e's population. I perform two regressions, one for each set of indicators.[40] From each regression, I obtain a separate instrument $\hat{z}_{wt}$ for m_{wt} (net migration into western labor market w from all East German sources) as follows:

$$\hat{z}_{wt} \equiv \sum_i \left(\frac{\hat{m}_{ewt}}{pop_{et}}\right) pop_{et}. \tag{B2}$$

Note that the regressions used to generate $\hat{z}_{wt}$ are *not* first-stage regressions; in other words, $\hat{z}_{wt}$ appears as an instrument (transformed in a manner analogous to m_{wt} in the construction of $\tilde{M}_{wt}$ in Equation (3))—not an estimated regressor—in the standard two-stage methods applied in the main analysis.

[37] In practice, I use two different vectors of labor market indicators to generate instruments $\hat{z}_{jt,1}$ and $\hat{z}_{jt,2}$. The reader may wonder why I do not enter the data that is summarized in the instruments directly into the two-stage regression. Apart from the fact that the regressions producing $\hat{z}$ closely match the intuition of how the push factors operate, there is a practical reason: entering all the eastern labor market data directly as instruments in the two-stage estimation would involve hundreds of instrumental variables.

[38] The population numbers come from county-level data provided by the German Federal Statistics Office.

[39] The distance between two regions is measured as the driving distance between the county seats (Kreishauptstädte) of the largest constituent counties. I obtained this data from http://www.mapquest.de in April and May 2005.

[40] I retain the labor markets of the Zonal Border Area for these regressions. Note that the foregoing concerns about the ZBA mainly involved *internal* characteristics—unobservable determinants of labor demand associated with the subsidy program. The ZBA was still an important destination for eastern migrants and is therefore useful in estimating the average weights (the regression coefficients in Equation (B1)) on the *external* factors that are used to construct the instruments. Secondary concerns about the influence of unobserved commuters to the ZBA on these weighting factors are mitigated by robustness tests (described in the text) in which the eastern regions bordering the ZBA are omitted from the regression described by Equation (B1).

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