Università degli Studi di Siena

Dipartimento di Economia Politica e Statistica

Dottorato di Ricerca in Economics

Ciclo XXVI

Coordinator: prof. Ugo Pagano

Three Essays on Lean Production

Settore Scientifico Disciplinare: SECS-P/12

Candidato: Enrico Cerrini

Tutor: prof. Michelangelo Vasta

Anno Accademico 2015/2016

Acknowledgment

This dissertation is not only the result of my work but also the result of feelings, ideas and behaviors that came up from people who I interviewed or I asked for advises. First of all, I want to deeply thank my supervisor prof. Michelangelo Vasta who supported my non-conventional research and guided me to do my best with his useful advises. I'm also grateful to the persons who supported my decision to enter the Ph.D program and who helped me to overcome those most difficult moments. Especially, I thank to my parents and all my family who encouraged me to continue to study and they provided me all the necessary support that allows me to complete my work. A special thanks to prof. Neri Salvadori, who was the first person that supported my idea to enter the Ph.D. program and advised me to join the Siena Department of Economics. I would also like to thank my friends who always help me relax when the program became too intensive, Andrea, Camilla, Daniele, Gabriele, Giacomo, Raffaele, Riccardo and Valerio.

I want to stress my appreciation to all the people who gave me ideas due to their abilities and their knowledge. In particular, director Ugo Pagano, prof. Giuseppe Berta, Samuel Bowles, Paolo di Martino and Nicola Meccheri as well as Paolo Borioni and Fabio Landini. The most largest group that I want to thank is composed by the people who helped me to find the sources and the interviewees. Those interviews were enormous work and it couldn't be possible if I hadn't met a lot of nice people who were curious about my work and didn't hesitate to help me. A special thanks to Silvia Velo, who helped me to find the contacts that I couldn't find by myself, to the Centro Storico Fiat, the Bohusläns Museum of Uddevalla, the Chalmers University of Göteborg, the Opel Eisenach work council, the UILM and FIOM Basilicata, which opened their archives and actively collaborated to the research.

Furthermore, I would like to thanks all the people who I interviewed and all the associations that helped me find the right contacts, in particular FIM Basilicata, IG-Metall Eisenach, IF-Metall, Sveriges Ingenjörer, Unionen and Volvo Verkstadsklubb Göteborg. Among these people, prof. Tomas Engström and Lars Medbo gave me great help to clarify the most important features of the Uddevalla Production System.

The final and the most important appreciations are for Hua, who not only was my girlfriend and then is my wife, but also a friend, a travel companion, a emotional anchorer and a great advisor. Without her, I would had stop at the first problem and the thesis would have never come out. She made me understand how to improve myself and how to communicate better with the large amount of people who I was contacting as well as she lighted my path with her bright eyes. Thanks a lot, my love.

CONTENTS

Introduction

In 1990, the best-seller *The Machine that Changed the World* (Womack et al.) introduced the term "Lean Production," which was then taken up in the scholarly literature, to indicate the production system that had been developed by the Japanese car company Toyota. The book defines as "Lean" a form of work organization that uses half or less than half of its resources, compared to the previously dominant model of work organization, known as Mass Production. Lean Production became the dominant model, though it was not characterized by any precise standards. In general, manufacturing companies declared their adoption of Lean Production after the introduction of teamwork and management practices based production on market requests that promised a continuous improvement in the efficiency of production.

Even Lean Production was not well-defined, *The Machine that Changed the World* considers the Japanese production system to be the best available model of work organization, all the alternatives being less efficient, and influential business scholars and managers agree on the superiority of the Toyota Production System (MacDuffie, 1995; Adler et al., 1998; Wickens, 1987; Ohno, 1988). On the other hand, other scholars have criticized Lean Production on the grounds that it is unhealthy for workers (Landsbergis et al., 1999; Parker, 2003). Moreover, certain Swedish and German scholars in engineering and sociology underline that different work organizations could have performed better in terms of productivity (Roth, 1997; Engström et al., 1995).

In this thesis we join this debate by looking at why the Japanese work organization model became the dominant one. The aim of the thesis is to show that Lean Production emerged due to very particular socio-economic conditions and did not possess the universal applicability once attributed to it. For this purpose, I study the adoption of Lean Production by comparing different countries, each characterized by different kinds of institutions. I divide these countries into two macro groups. The first group is composed of countries characterized by conflictual labor-management relations. Although Italy is used as the main example, the first group also includes the US, the UK, France, etc. The second group is characterized by those countries that are characterized by cooperative industrial relations because unions are extended co-management rights by national law. The second group includes Sweden and Germany.

Focusing on the first group, I show that conflictual industrial relations shaped a non-cooperative game between unions and management. Thus, I use a non-cooperative game model in order to stress how Lean Production became the dominant work organization in countries characterized by conflictual industrial relations. Focusing on the second group, I use a mix of history and theory in order to explain the rise of Lean Production in countries that were characterized by cooperative industrial relations because they were mandated by national law.

Returning to the first set of countries, I make use of historical sources to understand whether social conflicts can arise in lean environments, as strikes were uncommon in plants that adopted Lean Production.

Three different essays compose the chapters of the thesis. The **first chapter** introduces the shocks that caused the shift from Mass to Lean Production and explains why the Japanese model of work organization prevailed in Italy. The history of four representatives Italian firms—Fiat, Olivetti, Pirelli, and Benetton—shows that the decline in Mass Production may have been a consequence of the rise of two different forms of work organization: Lean Production and Flexible Specialization. During the 1970s, these companies were afflicted by social conflicts that caused heavy losses for management. In an effort to reduce the conflicts, some companies attempted to implement Flexible Specialization, which was a model of work organization based on artisanal tasks. It may have been used to sharply improve working conditions and provided the workers with greater job satisfaction in order to produce calmer industrial relations.

Our hypothesis is that Flexible Specialization would have become the dominant work organization if the conflicts had continued. We find that Lean Production prevailed because the conflicts calmed down due to certain socio-economic changes, which included the increased social welfare provisions by the government and an improvement in working conditions caused by the use of more modern machinery. Indeed, improving job satisfaction was a minor goal from the companies' point of view. In order to stress this point, we make use of an evolutionary game that explains how social conflicts influenced the passage from Mass to Lean Production by looking at the work organization as a result of interaction between two players: unions and management.

The **second chapter** analyzes how Lean Production arose in countries with peaceful industrial relations. For example, in Sweden and Germany, the unions were committed to cooperating with the companies in exchange for co-determination rights in management decisions. Our analysis stresses the importance of non-monetary incentives in the adoption of the new production system. Indeed, Lean Production implementation is usually characterized by a series of non-monetary incentives such as life employment and friendly labor management relationships based on direct contacts between lower managers and employees. On the one hand, the paper stresses that Lean Production could easily develop where these incentives were highly effective, such as in the former GDR. There, workers faced high unemployment rates, and the institutional setting, which they were used to, was characterized by a lack of communication between workers, unions, management.

These work incentives were unnecessary in Sweden due to the low unemployment rate and friendly work environments. Consequently, in order to provide non-monetary incentives, Volvo decided to provide workers with a work organization based on small workgroups working within a

long work cycle. Thus, the Swedish production system broke up the assembly line and sharply enlarged the workers' autonomy. On the basis of interviews with people involved in plant life, and archival research, in this chapter I analyze why the Swedish model of work organization was soon ruled out. I conclude that the Swedish production system was not implemented in the best way and most of the shortcomings could have been overcome if the management had not shut down the plant. The Swedish work organization was not necessarily less competitive than the traditional Lean Production, a fact underlined by numerous management scholars.

In the **third chapter,** I look further at countries characterized by conflictual labor-management relations. The aim of the chapter is to understand why social conflicts could arise in a lean environment, even though they were not common. By studying one of the main strikes in one of the most important European lean plants, I hope to aid in our understanding of some of the conditions that can contribute to the provocation of social conflict. The chapter shows that the factors that contribute to the expression of conflicts depend on the institutional setting in which the lean plants are embedded. This means that the use of Lean Production is insufficient by itself to enforce the social peace, and management needs to adjust to the factory's social environment if it wants to maintain peaceful industrial relations. The chapter looks at the rise in social conflicts through a series of interviews (18 in number) with workers, managers, and unionists, as well as archival research at the Fiat Historical Center and union archives.

I believe that the conditions that caused the passage from Mass to Lean Production could emerge again in the near or distant future. I believe Lean Production to be best understood as a way of responding to certain problems endemic to the social structure, and that it can be easily replaced by shocks in markets for certain commodities and technology. By stressing that Lean Production was not an unavoidable outcome, I suggest that there are useful ways in which companies may manage the passage between two different work organizations. Governments, companies, and unions may wish to engage in efforts to shape the new production system that will develop when Lean Production has become obsolete.

Lean Production versus Flexible Specialization: How Social Conflicts shaped Work Organization in Italian Factories (1969-89)

Enrico Cerrini[a]

[a]Dipartimento di Economia Politica e Statistica – Facoltà di Economia "Richard M. Goodwin"
Università degli Studi di Siena – Piazza San Francesco, 7 - 53100 Siena, Italy

Abstract

The dominant work organization after the Second World War was Mass Production, based on work rationalization and task specification. Between the 1980s and the 1990s, it was replaced by Lean Production, which was characterized by production flexibility. This model led to higher productivity due to several innovations, including a strong connection between the leading firm and its subcontractors, its use of team work, and a higher level of worker involvement, even though the tasks were still highly standardized. Some scholars, including Sabel and Piore (1984), had predicted that Mass Production would be replaced by a different work organization that would provide the workers with greater autonomy, which came to be called Flexible Specialization. In this chapter, I consider the reasons why Flexible Specialization did not become the dominant work organization. I approach this question first through an historic analysis of four Italian firms—Fiat, Olivetti, Pirelli, and Benetton—using a game-theoretical analysis that considers the various historic phases on the model of a game involving workers and entrepreneurs. I stress the key role of social conflict in the development of the two different models of work organization.

JEL Classification numbers: C73, J52, N64, O33

Keywords: Techno-Economic Paradigm, Work Organization, Social Conflicts, Evolutionary Game Theory

1. Introduction

During the 1970s, some Western manufacturing companies stopped using the rigid assembly line production model because the tasks seemed too simple, and repetitive and stressful for the workers. Trade unions, entrepreneurs, sociologists, and psychologists had been thinking about overcoming this problem. Entrepreneurs came up with various ideas in order to enrich the workers' jobs, including simultaneous work on multiple tasks, work on a complete sequence of the production process, more autonomous working methods, and greater worker involvement in the production process. In this paper, I discuss Flexible Specialization, a model of work organization that fulfils these requirements. During these years, another work organization model was being implemented in Japan, known as Lean Production. The Japanese model provided workers with only a small amount of control over production quality. Although the workers could provide ideas on how to improve productivity and could signal or repair some imperfections, their work was not more independent.

When these two work organization models were being implemented for the first time, scholars divided as to which of the two would become dominant (for Flexible Specialization, see Sabel and Piore, 1984; for Lean Production, see Belussi, 1992b; Coriat, 1991). Lean Production was credited as facilitating greater productivity (Womack et al., 1990), while some sociologists argued that the social environment of the 1980s impeded the success of Flexible Specialization. In this chapter I endeavor to explain why Lean Production rather than Flexible Specialization became the dominant work organization model.

To answer this question, we need to understand the previous production system, which was called Mass Production, and why it became obsolete. Before the 1970s, the market was absorbing almost all of the production of standardized goods, which meant that products needed little differentiation and demand adapted to supply. Entrepreneurs considered Taylorism as the best way to minimize labor costs. Taylorism stresses the importance of job rationalization, to be achieved by dividing the tasks among workers of different types. Job rationalization affected the occupational structure: factory workers needed to work on specific, standardized, and repetitive tasks, and a rigid hierarchy among workers with different qualifications was established. In this I consider Mass Production to be the form of work organization based on Taylorism.

Mass Production became obsolete not only because of its onerous working conditions but also due to a radical change in the market for goods. Mass Production started to decline during the first oil shock in 1973 (Freeman and Louça, 2001). The oil shock, as well as other sociological changes, contributed to an increase in demand volatility. The increment in households' well-being raised the demand for differentiated consumption. Households then started showing differences

among each other, stressing their tastes and their social statuses (Perez, 1986). At the same time, technical development enabled the production process to adapt to the demand volatility. The invention of the microprocessor in 1971 aided the production of equipment based on micro-electronics, making it easier to program. The low costs of programming made possible an increase in production flexibility. Thus, companies could easily vary the volume of production and the model of the goods. Thanks to the production flexibility, the supply could easily adapt to the demand.

This chapter is structured as follows. Section 2 describes the debate that arose in the 1980s about the future of the work organization inside the factories. Section 3 sketches a game theoretical model, in an effort to explain how economic changes may have affected the work organization. Section 4 discusses the history of four representative Italian firms: Fiat, Olivetti, Pirelli and Benetton. Section 5 matches the history and the model in order to understand why Lean Production became the predominant work organization. Section 6 draws some conclusions.

2. Literature Review

Some economists, those known as neo-Schumpeterians (Amin, 1994), consider economic history as a sequence of business cycles (Perez 1983, 1985, 1986; Freeman and Perez 1988; Freeman and Louça, 2001). Each business cycle is composed of three phases:

1. The upswing, when society reaches a harmonious complementarity among its economic, technological, and social forces, and so a particular form of growth stabilizes.
2. The peak, when prosperity is at its maximum and growth stops.
3. The downswing, when social structure decays and the conditions for creating a different structure arise.

Furthermore, each business cycle is characterized by a techno-economic paradigm, which is a way in which the economy and the technologies used within it are organized. Each paradigm has its own cost structure, which influences not only the economic structure but also other social aspects such as work organizations, customers' preferences and political goals. . Freeman and Perez (1988) consider the 1970s as a breaking point between two techno-economic paradigms, which they call a paradigm change. They consider this period as the peak of the Mass Production business cycle and the starting point of its decline. And, as underlined by neo-Schumpeterian scholars, management has to change the form of work organization each time the techno-economic paradigm changes. A new form of work organization emerges during the upswing new cycle, and is influenced by a number of social and political factors such as the balance of power between capital

and labor.

Perez (1985, 1986), suggested that one could only sketch certain characteristics of the dominant work organization that would emerge in the subsequent upswing. For example, workers' tasks would not be well-defined but different tasks would be shared among them, and the tasks formerly belonging to middle management would be taken over by computers, causing a decrement in the intermediate control levels. Ultimately, this meant that the form of work organization was driven by the competition between management and blue collar workers (Perez, 1985, 1986). One possible consequence of this would be an increase in the responsibilities of higher management. The decisional system would be more centralized and there would be greater differences in wages and responsibilities between workers and management. Another likely consequence would be an increase in the responsibilities of the blue collar workers. Thus, the workers would be more autonomous and the decisional system more decentralized.

Contrarily to neo-Schumpeterians, Flexible Specialization theorists (Amin, 1994) had a clearer idea of which production system would be dominant (Sabel and Piore, 1984; Hirst and Zeitlin, 1992). These theorists looked at economic history as involving a continual shift between two industrial organization: Mass Production and Flexible Specialization. They saw the crisis of the Mass Production system as coinciding with the rise of Flexible Specialization. Flexible Specialization is an organizational structure based on a neo-artisanal model of production. The achievement of production flexibility would be reached thanks to a system harmonizing the multi-purpose use of equipment, skilled workers, and relationships among firms. The workforce would benefited because workers would have stopped working on repetitive tasks and would have more qualified, responsible, and independent jobs as well as better relationships with management. There would be greater cooperation between workers and management, based on mutual trust.

The lacuna in the Flexible Specialization theory is simply that the 1980s were not characterized by Flexible Specialization, as work organization did not change radically, as many scholars had expected. Instead, most firms converged on a production structure that some scholars followed Womack et al. (1990) in speaking of Lean Production, which was also examined by Ohno (1988), Coriat (1991), Bonazzi (1993, 1997), and Volpato (1996), among others. Even if Lean Production increased the discretionary powers of both blue and white collar workers, semi-professional workers continued performing repetitive tasks. Consequently, Lean Production introduced a higher degree of collaboration between workers and management, without attaining the mutual trust required by Flexible Specialization.

This happened because production flexibility was pursued through a new relational system among the companies, their subcontractors, their suppliers, and the market. The big firms became companies coordinating a series of smaller firms easily able to update the production. Exploiting

cheap information, the leader firms could easily foresee market changes and ask subcontractors to update production in accordance with market requests. Consequently, although Flexible Specialization theorists predicted the emergence of an economy in which social forces would have pushed the organizational model towards a more decentralized decisional system, under Lean Production the centralized decisional system prevailed. Why did Flexible Specialization not become the dominant industrial organization?

There are two possible answers to this question. On the one hand, according to some sociologists, Flexible Specialization was incompatible with the prevailing labor relationships in the 1980s and could only arise in a society that is not divided between capital and labor (Freyssenet, 2012). Flexible Specialization could arise in an economy characterized by the free cooperation of individuals, which could shape social relationships in which highly skilled workers cooperate to produce high-quality products, as with the open-source computer software, which end users can modify for their own purposes (Giuri et al., 2010). On the other hand, some management scholars looked at Lean Production as a superior work organization that could already be universally applied (Womack et al., 1990), ruling out all other forms of work organization.

3. **Model**

3.1. **The setting**

We can use game theory to understand how Lean Production became the dominant work organization. To do this, we can suppose that the form of work organization arises from the interaction between two different groups: the entrepreneurs who own the means of production and the labor unions representing labor. Industrial production is based on two factors: the means of production provided by the entrepreneurs (E), and the labor provided by the workers (L). Different forms of industrial organizations have emerged historically according to combinations of E and L. Entrepreneurs have two choices: either they use some of their capital to provide their employees with social welfare, opting for the cooperative behavior $E^C \in E$; or they use capital to control the workers on the job, in the Non-Cooperative behavior $E^{NC} \in E$. We indicate the entrepreneurs' choice set as $S_e = \{E^C, E^{NC}\}$. For their part, labor unions also have two choices: either they encourage the workforce fight against the entrepreneurs and the capitalist society, opting for the Non-Cooperative behavior $L^{NC} \in L$; or they encourage employees to cooperate with the entrepreneurs in order to find agreement with them and to avoid excess tensions, which can be modeled as cooperative behavior $L^C \in L$. We indicate the labor unions' choice set as $S_l = \{L^C, L^{NC}\}$. This models enables to understand what happens when a group of entrepreneurs decide to

start the industrial production of certain commodities and to hire a certain number of workers., They must decide either to cooperate, providing their employees with social welfare, or not to cooperate, and instead engage in controlling the labor force. The hired workers unite in labor unions, each of which can decide non to cooperate, leading ultimately to stopping production, or to cooperate, facilitating production. This interaction generates our model, which is based on four assumptions.

First, we assume that cooperative entrepreneurs provide their workers not only with wage w, but also with social welfare, incurring a cost δ. We consider a cooperative policy as not only constituting an agreement between labor and management, but also as a way to establish mutual trust between these two sides.

Secondly, we assume that the labor unions are composed of workers, who belong to one of two different types.

1. Reciprocators, who are interested in their utility and they respond to entrepreneur behaviors. They make greater efforts when they meet Cooperative entrepreneurs independently of their unions. For example, they can reduce the degree of absenteeism. However, the greater effort performed by Reciprocators does not offset the benefits they obtained thanks to the social welfare provisions of the management.
2. Fighters, who do not have any faith in capitalist society, and who thus prefer to fight to establish a socialist society not dependent of entrepreneurial behavior. In the case of Non-Cooperative unions, the Fighters gain a benefit λ, representing the hope for a socialist society, and also obtain the concrete benefits from the company or government reaction such as higher wages and better pension schemes as well as more rights in the workplace. They are opposed by the entrepreneurs, and thus pay a cost ν representing the negative impact on them of the reactions of the entrepreneurs. We can think of λ representing the social welfare obtained by workers through strikes, through bargaining between unions and management, or government intervention. λ is lower in Cooperative firms than Non-Cooperative firms. This happens because the workers obtain greater advantages from strikes in Non-Cooperative firms, which do not on their own initiative provide the workers with social welfare.

We can indicate as λ^L the Fighters' benefits in Cooperative firm and as λ^H their benefits in Non-Cooperative firms. In the case of Non-Cooperative Unions, the firms tend to punish the Fighters with disciplinary actions that have a similar degree of intensity for Cooperative and Non-Cooperative firms; ν represents the number of disciplinary actions. We assume $\lambda^H > \nu > \lambda^L$. For the sake of simplicity and without a loss of generality, we assume that the Fighters do not gain anything in the case of Cooperative unions, because they believe that they cannot reach their goals. We also assume that, in the case of Cooperative unions, the Fighters tend to feel a degree of frustration that

offsets what they gain in winning increases in their wage. Strikes also inflict a cost μ the entrepreneurs, which represents the missing production costs; and it increases when the number of Fighters increases.

We can introduce the parameter φ as the reciprocator fraction of the whole worker population. It represents the workers who have not joined the most conflictual unions. Due to the above assumptions: $\mu'_{\varphi} < 0$.

Thirdly, we assume that, if the unions and entrepreneurs behave Cooperatively, the firms will enjoy higher profits Π^H, because the absenteeism rate is low and social peace can be used to develop better production strategies. When unions are-Non Cooperative and entrepreneurs Cooperative, the resulting non-cooperative environment does not increase the firms' profits. They firms enjoy higher profits only in the case where both management and unions are Cooperative, while in all the other cases they enjoy lower profits, $\Pi^{L,}$, where $\Pi^H > \Pi^L$.

Fourthly, we assume that the greater profits of a company in the case of Cooperative unions and entrepreneurs are sufficient not to gain higher profits, but also to repay the welfare costs. Thus, $\Pi^H - \Pi^L > \delta$.

3.2.**A simple game**

Thanks to the above assumptions, we can define a simple game, in which a firm composed of entrepreneurs and unions starts a process of industrial production. These two groups will have different payoffs according their behavior and that of their counterpart. The entrepreneurs' payoff π_e (E,L) is represented by the function:

$$\pi_e (E,L) = \Pi - \delta - \mu \tag{1}$$

The unions' payoff π_l (E,L) is represented by the function:

$$\pi_l (E,L) = \varphi*(w + \delta) + (1 - \varphi)*(\lambda - \nu) \tag{2}$$

The agents will choose their behavior so as maximizing their payoffs given the behavior of their counterpart. The entrepreneurs will select E = arg max π_e (E,L), given L; while unions will select L = arg max π_l (E,L), given E.

First we consider a simple game with only two players: one entrepreneur and one union. Each player can choose among two possible strategies in the simultaneous game, Cooperate or Non-

Cooperate. The strategy sets for the individual i are indicated by S_i ,while the set of strategy profiles is $S = S_e \times S_l$. The game is also characterized by the payoff function, given $x \in S$, where x_l is the strategy profile for the union and x_e the strategy profile for the entrepreneur. The payoff function is indicated by $\pi = (\pi_l(x_e, x_l), \pi_e(x_e,x_l))$. Given the number of players, the set of strategy profiles, and the payoff function, we can indicate the normal form of the game as: $\Gamma = \{2, \{S_i\}, \{\pi_i(x_e,x_l)\}\}$. The normal form of the game is showed in Table 1.

Table 1: **Payoff Matrix of our Game**

	Cooperative Unions $\{L^C\}$	Non Cooperative Unions $\{L^{NC}\}$
Cooperative Entrepreneurs $\{E^C\}$	$\Pi^H - \delta$ $\varphi^*(w + \delta)$	$\Pi^L - \delta - \mu$ $\varphi^*(w + \delta) + (1 - \varphi)^*(\lambda^L - \nu)$
Non Cooperative Entrepreneurs $\{E^{NC}\}$	Π^L φ^*w	$\Pi^L - \mu$ $\varphi^*w + (1-\varphi)^*(\lambda^H - \nu)$

The Game is characterized by four possible solutions: $\{E^C, L^C\}$, $\{E^C, L^{NC}\}$, $\{E^{NC}, L^C\}$, $\{E^{NC}, L^{NC}\}$. We want to find the Nash Equilibrium of the game.

Definition 1 (Mas-Colell, 1995). *A strategy profile* $x=(x_l,x_e)$ *constitutes a Nash Equilibrium of the game* $\Gamma = \{2, \{S_i\}, \{\pi_i(x_e,x_l)\}\}$ *if for every* $i = c,l$,

$$\pi_i(x_i,x_{-i}) \geq \pi_i(x'_i,x_{-i})$$

For all $x'_i \in S_i$.

Proposition 1. $\{E^{NC}, L^{NC}\}$ *is a Nash Equilibrium for the game* Γ. *The equilibrium holds because the entrepreneur and the union incur lower payoffs if they deviate from their strategy, because* $\varphi^*w + (1-\varphi)^*(\lambda^H-\nu) > \varphi^*w$, *and* $\Pi^L - \mu > \Pi^L - \delta - \mu$.

Proposition 2. $\{E^C, L^C\}$ *is a Nash Equilibrium for the game* Γ. *The equilibrium holds because the entrepreneur and union incur lower payoffs if they deviate from their strategy, because* $\varphi^*(w + \delta) > \varphi^*(w + \delta) + (1 - \varphi)^*(\lambda^L - \nu)$, *and* $\Pi^H - \Pi^L > \delta$.

Proposition 3. *When* $\varphi^*\delta > (1-\varphi)^*(\lambda^H - \nu)$, *the Nash Equilibrium* $\{E^C, L^C\}$ *is Pareto Superior to the Nash Equilibrium* $\{C^{NC}, L^{NC}\}$, *because in* $\{E^C, L^C\}$ *both the union and entrepreneur payoffs are greater than in* $\{E^{NC}, L^{NC}\}$, *so the Nash Equilibrium* $\{E^C, L^C\}$ *is payoff-dominant.*

The condition $\varphi*\delta > (1-\varphi)*(\lambda^H - \nu)$ means that the benefit for the reciprocators in the Nash Equilibrium $\{E^C, L^C\}$ offset the benefits for the fighters in $\{E^{NC}, L^{NC}\}$. We have a game where there are two Nash Equilibria and one is Pareto Superior, so we are analyzing an Assurance Game (Bowles, 2009).

Definition 2 (Bowles, 2009). *The Risk Dominant Strategy is a strategy that maximizes the expected payoffs of a player who attributes equal probabilities to the strategies open to the other player.*

Proposition 4. *When* $\Pi^H - \Pi^L < 2\delta$ *and* $2\nu < \lambda^H + \lambda^L$, *the Nash Equilibrium* $\{E^{NC}, L^{NC}\}$ *is a Risk-Dominant Equilibrium, while the Nash Equilibrium* $\{E^C, L^C\}$ *is not Risk-Dominant.*

The condition $\Pi^H - \Pi^L < 2\delta$ means that the difference between higher and lower profits is less than twice the welfare costs for the entrepreneur; while the condition $2\nu < \lambda^H + \lambda^L$ means that the Fighters' punishment cannot be higher than the average strike benefits.

All these conditions shape an Assurance Game, where both agents choose the Pareto Inferior outcome because they believe that the counterpart will not be Cooperative. Consequently, they prefer to play a strategy assuring them a higher expected payoff when they assign 0.5of the probability that the counterpart will be Cooperative. If the representative entrepreneur thinks that the workers have a natural inclination to fight, his behavior will be Non-Cooperative, and in our game will show a Coordination Failure, because the interaction leads to a result that is not Pareto optimal.

3.3 **Dynamics**

Now, we consider an economy involving more unions and more entrepreneurs. First, we calculate the payoffs for the Cooperative and Non-Cooperative entrepreneurs, relative to the behavior of their counterparts, where ω represents the Cooperative unions as a fraction on the union population as a whole.

$$E^C = \omega * (\Pi^H - \delta) + (1 - \omega) * [\Pi^L - \delta - \mu] \quad (3)$$

$$E^{NC} = \omega * (\Pi^L) + (1 - \omega) * [\Pi^L - \mu] \quad (4)$$

When $\omega = 0$, $E^C = \Pi^L - \delta - \mu$, and $E^{NC} = \Pi^L - \mu$, $E^{NC} > E^C$.

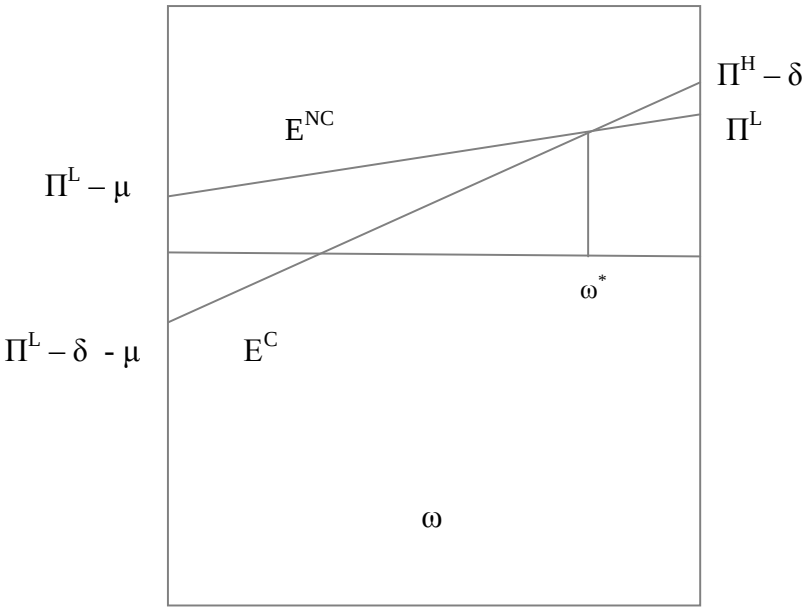
When $\omega = 1$, $E^C = \Pi^H - \delta$, and $E^{NC} = \Pi^L$, $E^{NC} > E^C$.

Entrepreneurs prefer to be Cooperative when the unions are Cooperative and to be Non-Cooperative when the unions are Non-Cooperative. We can calculate ω^* because it is the value equalizing the Cooperative and Non-Cooperative entrepreneur payoffs:

$$\omega^* = \delta/(\Pi^H - \Pi^L) \tag{5}$$

The value of ω^* decreases when the difference between the higher and lower firm profits increases and increases when the social welfare costs for the firm increase. Figure 1 shows how Cooperative entrepreneurs have a greater payoff than Non-Cooperative entrepreneurs when the fraction of Cooperative unions is larger than ω^*.

Figure 1: **Expected Payoffs for Group E, according to the Fraction of Unions' that are Cooperative, ω**



This model also enables us ascertain the payoffs for Cooperative and Non-Cooperative unions, relative to the counterpart. The fraction of Cooperative entrepreneurs out of the whole population entrepreneurs is ρ.

$$L^C = \rho*[\varphi*(w + \delta)] + (1 - \rho)*(\varphi*w) \tag{6}$$

$$L^{NC} = \rho*[\varphi*(w + \delta) + (1 - \varphi)*(\lambda^L - \nu)] + (1 - \rho)*[\varphi*w + (1-\varphi)*(\lambda^H - \nu)] \tag{7}$$

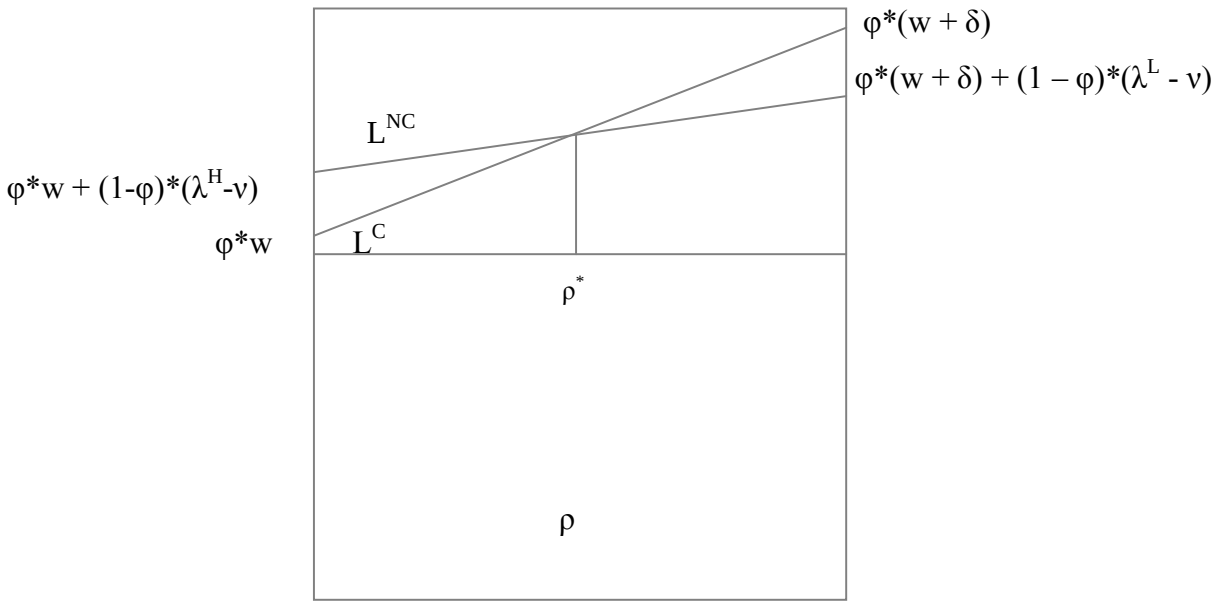
If $\rho = 0$, $L^C = \varphi^*w$, and $L^{NC} = \varphi^*w + (1-\varphi)^*(\lambda^H-\nu)$, $L^{NC} > L^C$.
If $\rho = 1$, $L^C = \varphi^*(w + \delta)$, and $L^{NC} = \varphi^*(w + \delta) + (1 - \varphi)^*(\lambda^L - \nu)$, $L^C > L^{NC}$.

As shown in Figure 2, unions also gauge their strategies based on those of their potential adversaries: they prefer to be Cooperative when the entrepreneurs are Cooperative, and to be Non-Cooperative when the entrepreneurs are Non-Cooperative. When the fraction of Cooperative entrepreneurs is ρ^*, Cooperative and Non-Cooperative unions obtain the same pay-offs. The proportion of Cooperative entrepreneurs equalizing the payoffs between Cooperative and Non-Cooperative unions is ρ^*.

$$\rho^* = (\lambda^H-\nu)/(\lambda^H-\lambda^L) \tag{8}$$

ρ^* is influenced positively by the strike benefits λ^H and λ^L, and negatively by the punishment level ν.

Figure 2: Expected Payoffs for Group L, according to the Fraction of Entrepreneurs who are Cooperative, ρ



We consider now the game replication wherein players update their behaviors after each period, which represents one round of the game. The entrepreneurs update their strategy according to the fraction of unions that are Cooperative ω, while the workers' update their behavior according to ρ, the fraction of entrepreneurs who are Cooperative. We can suppose that in each period a certain player knows with a certain probability $\sigma d\tau$ how other members of his population are

behaving, and that he can compare his payoff to that of the other player. We suppose that when an entrepreneur *a* is Non-Cooperative, he knows the behavior of other entrepreneurs and he compares his payoff to theirs, with the probability $\sigma d\tau$.

If the other entrepreneur is also Non-Cooperative, *a* will not update his strategy. However, if the other entrepreneur is Cooperative, *a* can decide how to behave according to his understanding of the Cooperative entrepreneur payoff. If the Cooperative entrepreneur payoff is lower than that of *a*, *a* will not change his strategy; but if the Cooperative entrepreneur payoff is higher than that of *a*, there is a probability ψ that *a* will change his strategy. If we are in period τ and there is a certain fraction ρ_τ of entrepreneurs who are Cooperative, the follow equation will tell us the expected fraction $\rho_{\tau+d\tau}$ of entrepreneurs who are Cooperative in the period $\tau+d\tau$.

$$\rho_{\tau+d\tau} = \rho_\tau + [\rho_\tau*(1- \rho_\tau)*\sigma d\tau*\chi^C*\psi*(E^C{}_\tau - E^{NC}{}_\tau)] - [\rho_\tau*(1- \rho_\tau)*\sigma d\tau*\chi^{NC}*\psi*(E^{NC}{}_\tau - E^C{}_\tau)] \qquad (9)$$

In this equation, χ^C and χ^{NC} are two binary functions, taking the value of 0 or 1 according to the value of $E^C{}_\tau - E^{NC}{}_\tau$. If $E^C{}_\tau - E^{NC}{}_\tau > 0$, χ^C will take the value 1, and χ^{NC} will take the value 0; otherwise, the contrary holds. The equation shows that the fraction of entrepreneurs who are expected to be Cooperative in the next period is based on the fraction ρ_τ in the previous period plus the fraction of entrepreneurs who turn Cooperative in the current period, in the case of $E^C{}_\tau - E^{NC}{}_\tau > 0$, or minus the fraction of entrepreneurs who turn Non-Cooperative in the current period, in case of $E^C{}_\tau - E^{NC}{}_\tau < 0$. The fraction of the entrepreneurs who turn Cooperative is a quantity given by the fraction of entrepreneurs who are Cooperative, multiplied by the Non-Cooperative entrepreneurs $\rho_\tau*(1- \rho_\tau)*\sigma d\tau$, and by the probability that the Non-Cooperative entrepreneurs will switch their behaviours, $\chi^C*\psi*(E^C{}_\tau - E^{NC}{}_\tau)$. The fraction of entrepreneurs who turn Non-Cooperative is a quantity given by the fraction of entrepreneurs who are Cooperative, multiplied by the Non-Cooperative entrepreneurs $\rho_\tau*(1- \rho_\tau)*\sigma d\tau$, and by the probability that the Cooperative entrepreneurs will switch their behaviours, $\chi^{NC}*\psi*(E^{NC}{}_\tau - E^C{}_\tau)$.

We write the same equation for the fraction of unions expected to be Cooperative in the next period $\omega_{\tau+d\tau}$

$$\omega_{\tau+d\tau} = \omega_\tau + [\omega_\tau*(1- \omega_\tau)*\sigma d\tau*\chi^C*\psi*(L^C{}_\tau - L^{NC}{}_\tau)] - [\omega_\tau*(1- \omega_\tau)*\sigma d\tau*\chi^{NC}*\psi*(L^{NC}{}_\tau - L^C{}_\tau)] \qquad (10)$$

The Cooperative and Non-Cooperative unions observe each other's payoffs and switch their strategy according to the differences between the payoffs. There will be different results according the fraction ω, of unions that are Cooperative.

If $\omega = 0$, all of the entrepreneurs are Non-Cooperative, and all of the unions are Non-

Cooperative. This is the Pareto Inferior Nash Equilibrium $\{E^{NC}, L^{NC}\}$.

If $0<\omega<\omega^*$, the entrepreneurs have higher payoffs if they are Non-Cooperative. If there are some Cooperative entrepreneurs, they will update their strategy. Consequently, the number of the Non-Cooperative entrepreneurs will decrease in the following period, and so the fraction ρ will decrease. The unions will have higher payoffs by being Non-Cooperative, so ω will decrease. Soon the economy will converge to $\{E^{NC}, L^{NC}\}$. If $\omega=\omega^*$, the result depends on the fraction ρ of entrepreneurs who are Cooperative:

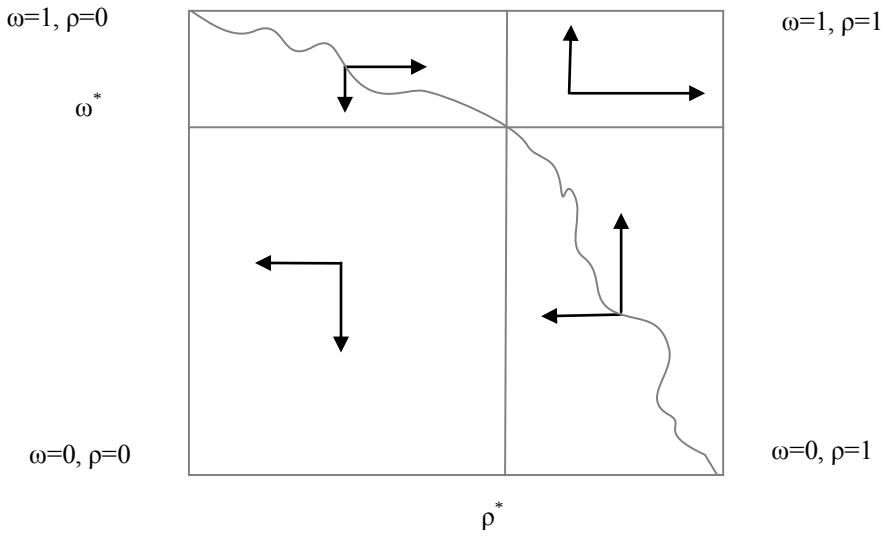
1. If $\rho=\rho^*$, the economy is stationary. The Cooperative and Non-Cooperative entrepreneurs obtain the same payoffs, and the Cooperative and Non-Cooperative unions also obtain the same payoffs. No one has an interest in change their strategy, and the Equilibrium will be $\{\rho^*, \omega^*\}$.
2. If $\rho<\rho^*$, few entrepreneurs will be Cooperative, and unions will obtain higher payoffs if they are Non-Cooperative, so that the fraction ω decreases and more entrepreneurs have an incentive to turn Non-Cooperative. The economy will end up in a state of Nash Equilibrium, $\{E^{NC}, L^{NC}\}$.
3. If $\rho>\rho^*$, the unions will enjoy greater payoffs if they are Cooperative, and the fraction ω increases, and the entrepreneurs have greater payoffs if they are Cooperative. This creates a mechanism ending up in $\{E^{C}, L^{C}\}$, the Pareto Superior Nash Equilibrium.
4. If $\omega^*<\omega<1$, the entrepreneurs will enjoy greater payoffs if they are Cooperative, so the unions have an incentive to be Cooperative, and the economy will end up in $\{E^{NC}, L^{NC}\}$. The same happens if $\omega=1$.

We can calculate how the fractions of Cooperative entrepreneurs and unions evolve over time, thanks to a system of differential equations. We take equations 9 and 10, and calculate the limit when $d\tau$ tends to zero; then we subtract the equations for the actual Cooperative unions and entrepreneur fractions. Assume $\sigma*\psi=1$ for the sake of simplicity, we then get:

$$\dot{\rho}_\tau = \rho_\tau*(1-\rho_\tau)*(E^{C}_\tau(\omega_\tau) - E^{NC}_\tau(\omega_\tau)) \tag{11}$$

$$\dot{\omega}_\tau = \omega_\tau*(1-\omega_\tau)*(L^{C}_\tau(\rho_\tau) - L^{NC}_\tau(\rho_\tau)) \tag{12}$$

Figure 3: **The dynamical system composed of equations (11) and (12)**



Note: the arrows show the out of equilibrium adjustments.

Definition 3 (Bowles 2009). *The Asymptotic Stability of a stationary state means that all sufficient perturbations in the population composition will result in changes leading back to the stationary state.*

Proposition 5. *The dynamic system is composed by equations (9) and (10), and is characterized by five Equilibria*: {ω=0, ρ=1}, {ω=1, ρ=0}, {ω=0, ρ=0}, {ω=1, ρ=1}, *and* $\{\omega=\omega^*, \rho=\rho^*\}$, *where* $\rho^* = (\lambda^H-\nu)/(\lambda^H-\lambda^L)$ *and* $\omega^* = \delta/(\Pi^H - \Pi^L)$. *Among these Equilibria*, {ω=0, ρ=1} *and* {ω=1, ρ=0} *are unstable*, $\{\omega=\omega^*, \rho=\rho^*\}$ *is stable but is a saddle, and* {ω=0, ρ=0}, {ω=1, ρ=1} *are asymptotically stable Equilibria*.

If the economy is in the area of the southwest of figure 3, the final Equilibrium will be $\{E^{NC}, L^{NC}\}$. If it is in the area of the northeast of figure 3, the economy will converge to $\{E^C, L^C\}$. In the other areas, we can define a locus that will bring the economy to an interior Equilibrium. This is a saddle because if there are small movements from this state, the updating process will bring the economy to one of the two Nash Equilibria. The interior Equilibrium is not able to self-adjust when contingent events happen. On the contrary, when the economy reaches one of the two Nash Equilibria, small movements cannot let the Equilibrium change. These two Equilibria represent the industrial organization conventions. Lastly, the two unstable Equilibria will never be reached, and even if the economy stands here, the updating process will bring it to different states.

Up to this point I analyzed a non-ergodic process dynamic, because the final result depends on the initial conditions. In this framework, if a process starts at a point below the locus that tends

to an interior Equilibrium, the process leads the economy to the Equilibrium $\{E^{NC}, L^{NC}\}$, so that the area at the southwest of Figure 3 is the basin of attraction for the Non-Cooperative convention. On the other hand, if a process starts above the locus that tends to the interior Equilibrium, the process will lead the economy to the Equilibrium $\{E^{C}, L^{C}\}$; thus, the area on the northeast of Figure 3 is the basin of attraction of the Cooperative convention. Nevertheless, a group of players from the same population can force the economy to realize the convention they consider best, and then the dynamic process is ergodic, meaning independent of the initial conditions.

Under these conditions, the players can choose to not behave according to their best response strategies, and they can then try to dislodge an Equilibrium by acting idiosyncratically. This means that the players can select their non-optimal response strategies in order to force their counterparts to change their behaviors. When the basin of attraction of one convention becomes larger, players who act idiosyncratically find it easier to reach that convention, even if the economy is in a state where the opposite convention is dominant. This happens because each player requires a lower fraction of idiosyncratic players to reach the most favorable convention. Another important thing that needs to be considered is the time necessary to shift a convention.

The expected waiting time until the process shifts from one convention to the other is called an *inertia*, which may be longer or shorter depending on the game characteristics (Young, 1998). When players interact with a small group of neighbors and base their decisions on relatively little information, the most profitable convention can quickly dislodge the less profitable one. In our case, a small group of entrepreneurs interacting through their employers' federation and basing their information mostly on the firm's profitability can quickly acquire the number of idiosyncratic responses necessary to dislodge the Non-Cooperative convention. An easier to realize convention is the stochastically stable state, defined as the state that occurs with non-negligible probability when the rate of idiosyncratic play is arbitrarily small (Bowles, 2009). In order to find the stochastically stable state we need to define the reduced resistance:

Definition 4 (Young, 1998). *The reduced resistance* r_{jk} *on the path from* E_j *to* E_k *, is the minimal number of individuals in a population adhering to the convention* E_j *that, should they idiosyncratically switch their strategy to k, would induce their best-responding partners to switch theirs. Then* $r_{10} = \min(1-\omega^*, 1-\rho^*)$ *and* $r_{01} = \min(\omega^*, \rho^*)$.

The Stochastically Stable Equilibrium is the convention with the most reduced resistance. We now possess the instruments to analyze which Equilibrium is stochastically stable. Studying the history of four representatives Italian firms, in what follows I will ascertain which conventions have been realized in each Equilibrium and which ones were stochastically stable.

4. **History**

4.1 **Fiat**

Fiat is a car company located in Turin, Italy. After the Second World War, relationships between workers and management were fragile because the close relationship of labor unions to the Italian Communist Party caused serious troubles for the management. The nature of the fight between workers and the company was not only economic but also political and ideological. Although the workers wanted to increase their decisional power in production, the CEO Vittorio Valletta was determined to maintain management's exclusive power in this regard. Valletta used tough methods to control the factories: he decided to fire Communist workers, to collect information about the political ideas of the employees, and to create departments that confine the most conflictual workers, often after they have been deskilled (Musso, 1999). Valletta was also convinced of the benefits of scientific management and scale economies, so he believed that Mass Production had to be applied through a rigorous task division.

Accordingly, Valletta thought that power should be entirely in the hands of the central management and the tasks of blue collars workers divided and simplified according to Taylorist principles (Musso, 1999). Valletta also expanded production (Berta, 1998), so the Mirafiori plant, one of Europe's largest, was expanded, while a new plant was planned for Rivalta, ten kilometers from Turin. Valletta's strategy was successful because the high demand in Italy for cars drove Fiat's growth. By the end of the 1960s, Fiat had become the largest European automobile company in the number of cars produced (Volpato, 1996). The company's continual expansion enabled the firm to attract more workers, and Fiat offered higher wages and a large company welfare program. At the same time, a new generation of peasants from the south migrated to the north due to poor working conditions in the countryside, looking for work in the factories (Sabel and Piore, 1984).

Most of the peasants arrived irregularly,[1] and so needed to hide from the police, while being able to find a job only through the black market. Consequently, Turin became overcrowded, a housing shortage development, and the conditions of the poorest in the working class became unsustainable. Bonazzi (1999) claims that highly skilled blue collar workers native to the Turin area wanted to fight to obtain better working conditions as well as to affirm their political and ideological views, but they were not strong enough to succeed. Consequently, when the conditions of the migrants became unsustainable, the highly skilled workers found in them partners in struggle.

1 A law that people need to certify that they have a job in order to change their residence was imposed. The law was abolished in 1961.

In 1969, workers tried to occupy the factories, demanding more rights, higher salaries, and better working conditions. This had the consequence that production became difficult and management was unable to run the factories. It tried to overcome these difficulties through bargaining. However, neither the unions nor management were willing to give any concessions to their counterparts (Magnabosco and Dealessandri, 1987). The 1970s were a critical period for Fiat because of this turmoil and the international oil crisis, which together squeezed the company's profits. In 1973, the labor unions demanded an enrichment of workers' tasks commensurate with their skills. Labor unions began to look for "a new way to build the car" by refusing standardized tasks.

Unluckily, Fiat was unable to implement profitable experiments in this context (Magnabosco and Delaessandri, 1987), and conflicts continued inside the factories. By the beginning of the 1980s the situation had become intolerable and the high level of labor conflict as well as the demand scarcity caused by the second oil shock pushed the firm to offer thousands of workers earlier retirement and redundancy funds. Although the unions' reaction was militant, this moment ended with the defeat of the labor unions, and labor-management relations subsequently calmed down. The new social environment enabled Fiat's management to experiment with production flexibility without meeting the workers' demands for more meaningful work. Bonazzi (1999) speaks about the advent of the highly automated factory, because work was based on new equipment that became available thanks to the technological breakthroughs in the microelectronics field.

In the new framework, the workers had to monitor the machines, and this made their jobs easier but also less skilled, while the factories became more neat and tidy. The automated and flexible machines did not fit with the organizational model of static production then in use, so the management decided that modern technologies should be combined with a higher involvement of human capital. To realize their goal of flexibility, Fiat established a kind of teamwork where the blue collar workers performed specific tasks and paid attention to production imperfections (Bonazzi, 1993). Factories were divided by *Unità Operative* (Operational Units), which were departments working on specific production processes (Volpato, 1996). A single *Unità Operativa* was divided into *Unità Tecnologiche Elementari* (Elementary Technological Units, UTE). Each UTE was responsible for checking the production quality and fixing contingent mistakes in order to provide the next UTE with a definite product.

Compared to the Mass Production paradigm, the new work organization based on UTE was characterized by better social relationships inside the factories. For example, there were more contacts between managers and workers, the firm asked the foremen to maintain good relationships with the workers, the workers had to notice production imperfections and try to solve them with the

help of the foremen (Bonazzi, 1996). Yet, despite these improvements, workers' tasks did not change radically compared to the previous paradigm. The final result was a decrease in the hierarchical character of the factory environment because the two levels of intermediate workers disappeared. Nevertheless, the blue collar workers benefited only partially from this change because their autonomy increased only partially, whereas the major part of the responsibility for decision-making was allocated to upper management.

4.2 **Olivetti**

Olivetti is located in the town of Ivrea, several kilometers from Turin. It was created as a factory producing typewriters, and contributed to the development of the valley surrounding Ivrea. Adriano Olivetti introduced scientific management in his factory before the Second World War. After the war, he focused his attention on the relationships between employees and managers. During these years, Olivetti became internationally successful, and was one of the world leaders in the manufacturing of typewriters. In 1959, Olivetti bought Underwood, which had been one of its main competitors. In 1964, the company produced the first commercial computer. The commercial success of the firm was accompanied by large social welfare provisions for its workers.

Adriano Olivetti provided various benefits for his workers: wages were higher than the Italian average, the company’s centers of psychology and social relationships monitored the workers, psychologists endeavored to solve problems related to the employees' lives, canteens, pre-school and kindergarten classes, and a large system of summer and winter camps for the children of workers were established. At the same time, the Italian entrepreneur stressed the importance of a good urban policy, on the grounds that cities should not become crowded or have empty depressed areas. Thus, Olivetti established a system of buses between the different areas of the valley and the factories, provided the workers with a housing system, and also established plants in the south of Italy. The Italian entrepreneur wanted to provide the same educational opportunities for everyone, and so a technical school was created for teenagers in the valley and scholarships were lavished on university students (Gallino, 2001).

In general, the Mass Production established by Olivetti was lighter compared to the usual standards for factories, and so sociologists spoke of a Humanitarian Taylorism. However, the Italian labor union closest to the Communist party did not approve the Olivetti policy. The Italian entrepreneur did not accept the unions' criticisms and in 1955 decided to create a company union that would allow workers to participate in factory decisions (Novara and Rozzi, 2005). The company’s social welfare policies were thus implemented against the will of the Communist workers. Yet, thanks to them, Adriano Olivetti helped to establish a social peace that had lasted

until his death in 1960. Later, during the social conflicts that characterized Italy in 1969, the Olivetti social environment remained peaceful because the management was able to meet the demands of the labor unions (Grijuela, 2005).

During this time, the Management and Psychology Center tried to satisfy the workers' requests for changing the work organization. Teamwork was established with the June 1973 labor-management agreement, the teams being called *Unità di Montaggio Integrato* (Integrated Assembly Units, UMI). Novara (1973) specifies the three motivations that induced Olivetti to adopt teamwork:

1. Market changes. Technology increased the competition between companies, so the production had to be differentiated and the assembly line needed to become more flexible in order to avoid its being obsolete each time customers' tastes change.
2. Work management. The Psychology Center discovered that repetitive assembly line work can cause high mental stress.
3. The Unions. Workers asked for higher wages and greater specialization of work.

The teamwork established by Olivetti was thought of as a system for increasing the wages and the satisfaction of employees, especially low-skilled workers. The core of each team was the self-repairing employee, who assembled a part of the product and solved problems arising from contingent mistakes (De Witt and Butera, 2010). The independence of blue collars workers generated confusion for white collar workers with regard to their role. Although the foremen had to concentrate on problem-solving tasks, their role was not easy to define. Consequently, the hierarchy decrement increased the autonomy of the blue collar workers, while at the same time the firm benefited from the production flexibility and the quality increment, thanks to the decline in the fault rate found on the tests. During this time, Olivetti recovered its profitability and competitiveness, after a period of financial distress resulting from the Underwood acquisition.

The Olivetti company's success is marked by the fact that it caught up with other companies in information technology, and in 1978 the Italian firm sold the world's first electronic typewriter (Novara and Rozzi, 2005). However, in 1978, Carlo de Benedetti, a manager who had worked for Fiat, became the CEO and changed the company's policies. De Benedetti gradually changed the strategy of Olivetti's management towards the workers, and the relationship between management and labor became weaker while the bargaining power of the labor unions decreased (Berta and Michelsons, 1989). The new plants established during the 1980s were highly automated. Consequently, they were able to achieve high production volumes and easily modify the goods produced to meet market requests, whereas the blue collar workers had less responsibility than

before and their working lives were more stressful than they had been under the previous teamwork organization.

4.3 **Pirelli**

Pirelli is a firm set in Milan specialized in the rubber sector, its production concentrated in tires and cables. After the Second World War, the relationships between management and labor unions at Pirelli were extremely tense because the labor union was closely linked to the Communist Party and was asking for greater participation in management decisions (Bolchini, 1967). The workers also wanted better working conditions, higher wages, and a system of social welfare. Although they obtained some benefits after three years of constant fighting, the 1948 demonstrations signaled a decline in strikes. The environment became more peaceful, and the 1950s and the 1960s were considered years of relative social peace because even though strikes were frequent, they did not reach the previous levels of intensity.

Yet, while its social environment during the 1960s was peaceful, Milan suffered the same problems as Turin due to its high levels of immigration from the south. By 1969, the situation had suddenly become ungovernable (Bolchini, 1984). Since management was not ready to face a new series of conflicts, the labor unions were able to obtain large benefits. After several years of conflict, the company's owner Leopoldo Pirelli decided to hire new managers, who tried to reach an agreement with the unions in 1973, because they wanted to secure the workers' agreement at a difficult moment for the rubber market.

Although the first agreement did not yield important results, the situation changed thanks to a second agreement in 1976, after which the atmosphere became more cooperative. Teamwork was established in 1977 based on the 1976 agreement. The introduction of teamwork led to salary increases, and workers enjoyed greater autonomy in their tasks, could obtain qualifications enabling them to advance to more highly skilled roles, while the foremen felt dissatisfied as their roles were emptied out. In 1979, an analysis of the work organization system involved positive conclusions, but also indicated that teams needed to put more effort into application of the teamwork model. This was extended in 1981 to include all subdivisions involved in tire production.

4.4 **Benetton**

Benetton is a fashion label set in the Treviso province, near Venice. The company started its activity in 1965, producing sweaters, and was still a small firm when large-scale social conflicts arose in Italy in 1969. As the area where the firm's operations were situated was not affected by

high immigration levels, the fashion firm did not suffer the tensions that characterized Fiat and Pirelli. At the same time, the management understood that a large market segment was unexplored and the company grew by meeting the demand of young people for fashion sweaters (Favero, 2005). Many young people desired clothes that were more colorful than those worn by earlier generations, and recognizing this, Benetton was able to penetrate a mass market in the fashion sector.

Thanks to its market strategy, Benetton became the biggest fashion firm in Italy in less than ten years (Belussi, 1992a). Benetton owned the shops where the clothes were sold, which offered its products exclusively. This enabled production to be planned in an efficient way because the factories produced on the base of what was being sold by the shops. This meant that the production could be rationalized and standardized on the basis of what the customers bought. Another peculiarity of the Benetton production system was that when the company was expanding, the fashion firm did not directly hire huge part of its workforce by themselves. This was because Benetton did not want to incur the risks caused by production concentration, while the Italian social environment was characterized by social conflicts.

The Benetton production system was also influenced by the law called *Statuto dei Lavoratori* (Statute on Workers), which conferred more rights upon workers who worked in big companies. In response, Benetton created a large system of small subcontractor firms in order to avoid having to provide its workers with the large benefits to which they would otherwise have been entitled by law. The subcontractor firms agreed to produce only for Benetton, and as consequence its employment level did not change much in the 1970s, even though sales increased dramatically during the same years (Belussi, 1992a). Its use of a system of subcontractor firms enabled the fashion firm to reach production flexibility (Favero, 2005). Each subcontractor was responsible for a different stage in the production process, while the assembly line remained standardized because the company did not need a flexible assembly line.

Accordingly, Benetton developed a kind of Mass Production that could be renewed continually, because its work organization reproduced Taylorist principles among its subcontractors. More specifically, production was controlled by the fashion firm in a hierarchical way, because Benetton controlled the work of the galaxy of small firms that it surrounded itself with. Thus, decisional activities were allocated mostly to the leading firm, and the autonomy of the subcontractors was small. Moreover, thanks to its IT utilization, the leading firm knew immediately which kinds of clothes were being sold more and it would communicate immediately to the subcontractors information on which kinds of products to produce. Due to these innovations, the company worked on the basis of half-programs, which meant that one part of the production process had already been set before the fashion season started, while another part would be set on the base

of what the market was asking for.

5. The Model in History

5.1 Upswing

I will describe the history of the four representative Italian firms from a neo-Schumpeterian point of view in this Section. We can use the game theoretical model sketched in Section 3 to understand how Lean Production became the dominant model of work organization. Thus, during the 1950s and 1960s the business cycle was in an upswing phase and the two Nash Equilibria were characterized by Mass Production. According to the analysis I provided in Section 4, the Equilibrium $\{E^C, L^C\}$ was characterized by a kind of Mass Production aimed at satisfying the needs of workers which can be called "Humanitarian Taylorism." The Equilibrium $\{E^{NC}, L^{NC}\}$, however, was characterized by the conventions of Mass Production. We can suppose that most of the entrepreneurs selected the second convention because the "Humanitarian Taylorism" basin of attraction was smaller than that of "Mass Production."

This was due to the high costs for entrepreneurs of providing workers with social welfare and the differences, though they were few, in profitability between the Cooperative and Non-Cooperative firms. The theoretical model reveals that the entrepreneurs needed a high fraction of Cooperative unions to turn Cooperative themselves, but found this difficult due to the high proportion of fighters in the population of workers. Even though labor-management relations were stable in those years, companies were frightened by the huge number of workers who were ready to fight in an effort to establish a socialist society. The Humanitarian Taylorist model was rarely seen in practice, because management was afraid that workers would turned fighters and drive downward the company's profitability towards the worst case scenarios characterized by $\{E^C, L^{NC}\}$.

Proposition 6. *During the business cycle upswing,* $r_{10} = 1 - \omega^*$ *and* $r_{01} = 1 - \rho^*$, *but* $1 - \rho^* > 1 - \omega^*$, *so the reduced resistance in the path from* $\{E^C, L^C\}$ to $\{E^{NC}, L^{NC}\}$ *was lower than that of the opposite path. It was easier to reach the Mass Production convention starting from that of Humanitarian Taylorism, rather than the contrary.* $\{E^{NC}, L^{NC}\}$ *represents the Stochastically Stable Equilibrium characterizing the business cycle upswing.*

5.2 Peak

According to neo-Schumpeterian theory, the early 1970s corresponded to a business cycle

peak and the starting point of its decline. The changes in the 1970s decreased the profits of firms using the Mass Production model, and so the characteristics of the game changed. The change in the players' payoff structure was possible because the model being followed was influenced by technological and market changes, which are easier to adapt to than other changes such as cultural ones (Young, 1998). The firms needed to adapt to the new technologies and the new market structure because the new technologies influenced the lives of commodities and the demands structure. Thus, firms needed a flexible production system that could enable changes in production of goods to be made easily. The firms also needed to face a moment of tough social conflicts.

In this context, as seen in Section 4, the firms that were applying "Humanitarian Taylorism" did not suffer on account of the labor turmoil, thanks to a good relationship between workers and management, and so they were able to focus their attention on achieving production flexibility. At the beginning of the 1970s, microelectronics technology was not mature enough to make possible production flexibility by itself. Thus, firms needed to use a combination of technology and human capital to achieve greater flexibility in order in turn to satisfy the market requests. Cooperative entrepreneurs were able to ask workers to perform in a more skilled and responsible manner involving more difficult tasks. Consequently, the Flexible Specialization model replaced that of "Humanitarian Taylorism" at the Nash Equilibrium $\{E^C, L^C\}$.

Although Flexible Specialization required radically changing the assembly line by installing new machinery, these costs were offset by the higher profits made possible by production flexibility. The investments in production flexibility increased workers' benefits thanks to the greater job satisfaction made possible by teamwork. We can assume that the increment in δ was higher than the increment in Π^H, with $\Delta\Pi^H > \Delta\delta$. On the other hand, the firms that were still using the Mass Production model suffered problems from both the market and workers' sides. Due to the contemporary social distress, most of the workers turned from being Reciprocators to being Fighters. Consequently, the fraction φ decreased while the strike cost μ increased and profits Π^L decreased, because the Non-Cooperative firms were unable to adapt themselves to the new market requests. The government intervention favored the workers' rights and established a stronger state system of social welfare, which meant also that strike benefits in Non-Cooperative firms λ^H increased.

In order to confront these changes, most Non-Cooperative entrepreneurs tried to end the turmoil by bargaining with the unions, firing the most combative workers, and decentralizing production from large factories in major cities to smaller factories located in the countryside. This meant that the reactions of Non-Cooperative entrepreneurs tended to increase the punishments, ν, for militant workers. Given these assumptions, the two Nash Equilibria were preserved, but the conditions of the firms using the Mass Production model became unsustainable. As summarized in

Table 2, the new interior Equilibrium $\{\omega^*,\rho^*\}$ was characterized by higher λ^H, ν, Π^H, and δ, as well as lower Π^L. ρ^* decreased to a moderate degree, while ω^* shrank significantly, as $\Delta\Pi^H > \Delta\delta$. Consequently, the basin of attraction of $\{E^C, L^C\}$ grew at the business cycle peak due to the shocks affecting the market and improvements in labor-management relations.

Proposition 7. *During the business cycle peak, it is not clear which reduced resistance was lower. It is not clear whether it was easier to switch from the Mass Production model to that of Flexible Specialization, or vice versa. The business cycle upswing represented a moment of uncertainty when it was not clear what was the Stochastically Stable Equilibrium.*

Table 2: **Historical changes in the variables affecting firm costs**

Variables	*Upswing*	*Peak*	*Downswing*
Cooperative Firms' Profits	Π^H	$\uparrow\uparrow\Delta\Pi^H$	$\downarrow\Delta\Pi^H$
Non-Cooperative Firms' Profits	Π^L	$\downarrow\Delta\Pi^L$	$\uparrow\uparrow\Delta\Pi^L$
Strike Costs for Firms	μ	$\uparrow\Delta\mu$	$\downarrow\Delta\mu$
Fraction of Reciprocators	φ	$\downarrow\downarrow\Delta\varphi$	$\uparrow\uparrow\Delta\varphi$
Welfare Costs for Cooperative Firms	δ	$\uparrow\Delta\delta$	$\uparrow\Delta\delta$
Strike Benefits for Workers at Non-Cooperative Firms	λ^H	$\uparrow\Delta\lambda^H$	$\downarrow\Delta\lambda^H$
Strike Benefits for Workers at Cooperative Firms	λ^L	λ^L	λ^L
Costs of Repression of Worker Militancy	ν	$\uparrow\Delta\nu$	$\downarrow\Delta\nu$
Workers' Wages	w	W	$\downarrow\Delta$w

5.3 **The Downswing of the 1980s**

We can consider the beginning of the 1980s as a time of business cycle downswing, as well as one when microelectronics technology matured, and many changes happened in Italian society. As shown in Section 4, firms could exploit the benefits of the new information system, so that working conditions in the Equilibrium $\{E^{NC}, L^{NC}\}$ became less difficult thanks to the new equipment, and social distress also lessened as a consequence. Thanks to these innovations, the proportion of Fighters decreased dramatically and the firms that faced Equilibrium $\{E^{NC}, L^{NC}\}$ were

able to make use of microelectronics to increase production flexibility. The decrement of Fighters in the population of workers meant greater social peace, which favored a new production organization based on an intense use of information technology and robots.

In this context, the Non-Cooperative firms were able to achieve high production flexibility levels without needing to implement an environment of mutual trust. If in the Mass Production paradigm the Non-Cooperative entrepreneurs provided workers with higher wages, in the new paradigm collaboration was implemented thanks to a less authoritarian management, as well as certain improvements in the workplace. The Lean Production model was implemented at the Equilibrium $\{E^{NC}, L^{NC}\}$. The firms that adopted this model could benefit from a market advantage thanks to the utilization of microelectronics, and their profits, Π^{L}, increased. At the same time, wages decreased as industrial development slowed down, as this meant that entrepreneurs did not need to pay higher wages in order to attract workers.

In contrast, Cooperative entrepreneurs needed to engage in greater efforts to provide workers with a welfare system. On the one hand, the welfare system provided by the government covered a huge part of the welfare provided by the Cooperative entrepreneurs, and so they needed to make great efforts to avoid redundancies in their welfare system, and δ increased. On the other hand, the state no longer needed to intervene to calm relationships between workers and management, and this meant that workers could expect few benefits from Fighting behavior. Thus, λ^{H} returned to its initial value, as did ν. The change in the variables is summarized in Table 2. These differences influenced the interior Equilibrium $\{\omega^{*}, \rho^{*}\}$, which was affected by an increase in both ω^{*} and ρ^{*}, increasing in turn the basin of attraction of the Lean Production model.

Proposition 8. *During the business cycle downswing,* $r_{10} = 1 - \omega^{*}$ *and* $r_{01} = 1 - \rho^{*}$, *but* $1 - \rho^{*} > 1 - \omega^{*}$, *so the reduced resistance of the path going from* $\{E^{C}, L^{C}\}$ to $\{E^{NC}, L^{NC}\}$ was *lower than that of the opposite path. It was easier to shift to Lean Production from Flexible Specialization, than vice-versa.* $\{E^{NC}, L^{NC}\}$ *was the Stochastically Stable Equilibrium characterizing the business cycle downswing.*

6. Conclusions

My findings largely agree with those of Freyssenet (2012) in recognizing that Flexible Specialization failed to become the dominant model of work organization due to the social environment that characterized the 1980s. Lean Production thus became the dominant model not because it was superior to all of the other production systems, but because the Japanese work organization model proved superior in the fact of certain social conditions at the time, including the

ending of the social conflicts that in Italy had characterized most of the previous decade. These findings of the ways in which the social environment shaped the model of factory work organization constitute a novel contribution to the scholarly literature on the latter. The process can be summarized as follows:

Italian firms grew during the cycle upswing of the 1950s and 1960s, and the international success of Olivetti suggest that its model of "Humanitarian Taylorism" was more profitable than the Mass Production model that had been standard until then. However, this model was not applied by many firms, because the entrepreneurs who implemented it risked facing the consequences of Non-Cooperative behavior on the part of unions. In the later part of the cycle upswing, a season of great labor conflict began. The Non-Cooperative entrepreneurs then tried to restore the social peace through bargaining but without establishing a Cooperative policy. This was because those entrepreneurs who might otherwise have been Cooperative faced a worst-case scenario, $\{E^C, L^{NC}\}$.

Nonetheless, some companies, such as Pirelli, decided to behave Cooperatively even though the workers were behaving Non-Cooperatively. Pirelli started to act idiosyncratically, playing a non-best response strategy in the hope of influencing unions to change their behavior to a more Cooperative one. At the beginning, Pirelli had to face the worst-case Equilibrium $\{E^C, L^{NC}\}$, but after a few years, social peace was restored and Pirelli could attain the best-case Equilibrium $\{E^C, L^C\}$. Later, firms increased their flexibility thanks to the employment of the Flexible Specialization model. We can suppose that the behavior of firms such as Pirelli and Olivetti increased the number of idiosyncratic moves, leading the Flexible Specialization to become the basin of attraction. This is the status observed by Sabel and Piore (1984) in their book, *The Second Industrial Divide*.

During the downswing of the business cycle in the 1980s, there were many changes in the society, the new technologies were more mature, and the conflicts at the Equilibrium $\{E^{NC}, L^{NC}\}$ calmed down. Consequently, firms like Benetton were able to increase profitability by adopting the Lean Production model rather than that of Flexible Specialization. The Lean Production basin of attraction became larger and consequently a majority of manufacturing companies, including Fiat and Olivetti, applied the Japanese model industrial organization.

It seems reasonable to assume that this analysis of the Italian case can be assumed to hold broadly for advanced industrialized countries in which industrial relationships are based upon on the conflict between capital and labor, for example, the UK and the US. It may not be applicable for socialist countries or capitalist countries that based their industrial relationships on cooperation between capital and labor, such as Germany and Sweden. Further research is needed to understand work organization in countries of this second type.

7. Appendix

Proof of Proposition 4:

If the entrepreneur supposes that the union will play Cooperative or Non-Cooperative with equal probabilities, the expected payoffs will be:

$E^C = ½(\Pi^H – \delta) + ½(\Pi^L – \delta - \mu)$

$E^{NC} = ½(\Pi^L) + ½(\Pi^L - \mu)$

E^{NC} is the risk dominant strategy for the entrepreneur if $½(\Pi^L) + ½(\Pi^L - \mu) > ½(\Pi^H – \delta) + ½(\Pi^L – \delta - \mu)$. This happens if $\Pi^H – \Pi^L > 2\delta$.

If the union supposes that the entrepreneur will play Cooperative or Non-Cooperative with equal probabilities, the expected payoffs will be:

$L^C = ½(\varphi*(w^H + \delta)) + ½(\varphi*w^H)$

$L^{NC} = ½(\varphi*(w^H + \delta) + (1 – \varphi)*(\lambda^H - \nu)) + ½(\varphi*w^H + (1-\varphi)*(\lambda^L-\nu))$

L^{NC} = is the risk dominant strategy for the union if $½(\varphi*(w^H + \delta) + (1 – \varphi)*(\lambda^H - \nu)) + ½ (\varphi*w^H + (1-\varphi)*(\lambda^L-\nu)) > ½(\varphi*(w^H + \delta)) + ½ (\varphi*w^H)$. This happens when $2\nu < \lambda^H + \lambda^L$.

Proof of Proposition 5:

Solving the system composed by equations (9) and (10), we can find the Equilibrium point considering $\dot{\rho}_\tau = 0$, $\dot{\omega}_\tau = 0$. We can also study the asymptotic stability of each Equilibrium by analysing the Jacobian Matrix *J* associated with the system composed by equations (9) and (10):

- At {0, 0}, the $Tr(J) = – \delta – \lambda^H + \nu < 0$, and $Det(J) = -\delta*(-\lambda^H + \nu) > 0$.

The Equilibrium {0, 0} is asymptotically stable.

- At {0, 1}, the $Tr(J) = \Pi^H - \Pi^L – \delta + \lambda^H - \nu > 0$, and $Det(J) = (\Pi^H - \Pi^L – \delta)*(\lambda^H -\nu) > 0$.

The Equilibrium {0, 1} is unstable.

- At {1, 0}, the $Tr(J) = \delta - \lambda^L + \nu > 0$, and $Det(J) = \delta*[-\lambda^L + \nu]>0$.

The Equilibrium {1, 0} is unstable.

- At {1, 1}, the $Tr(J) = -\Pi^H + \Pi^L + \delta + \lambda^L + \nu - 2\lambda^H < 0$, and $Det(J) = (-\Pi^H + \Pi^L +\delta)*(\lambda^L + \nu – 2\lambda^H) > 0$.

The Equilibrium {1, 1} is asymptotically stable.

- At $\{\omega^*, \rho^*\}$, the $Tr(J) = 0$, and $Det(J) = - \omega^**(1-\omega^*)*(– \lambda^H + \nu)*\rho^**(1- \rho^*)(-\delta) <0$.

The Equilibrium $\{\omega^*, \rho^*\}$ is a saddle.

Are There Alternatives to the Toyota Production System?
The Role of Work Incentives in Two Auto Plants, 1985-2005

Enrico Cerrini[a]

[a]Dipartimento di Economia Politica e Statistica – Facoltà di Economia "Richard M. Goodwin," Università degli Studi di Siena, Siena, Italy

Abstract

The scholarly literature suggests that the Toyota Production System, which is based on the assembly line, is a form of work organization that is broadly applicable anywhere. Some other scholars have suggested that work organization should be based on the national or regional institutions that regulate the plant environment. For example, the Swedish Volvo Uddevalla plant had a work organization that depended on the national turnover rate, which was higher than that in other Western countries. This paper compares the Uddevalla Production System with the Toyota Production System, which was adopted in the Opel Eisenach plant, located in the former GDR. Although the Uddevalla plant was shut down after the start-up phase, whereas Opel Eisenach was highly productive, in this paper I show that TPS is in fact not universally valid. The paper employs new sources based on labor/management agreements, other factory documents, and a series of 21 interviews with workers, unionists, and managers. On one hand, I show that the Uddevalla Production System could have survived had it followed its optimal path of development, while, on the other hand, the Opel Eisenach plant was highly productive due to regionally specific features such as the poor work norms in the GDR era and the high unemployment rate.

JEL Classification Numbers: J08, L62, N64, P12

Keywords: Lean Production, Sweden, Germany, Institutions

1. **Introduction**

In the 1970s and 1980s car companies shifted their model of work organization from Mass to Lean Production. Lean Production, hereafter LP, which was developed in Japan after the second world war (Coriat, 1991; Ohno, 1993; Womack et al., 1990), makes possible higher flexibility and lower costs compared to Mass Production. As pointed out by Westney (1989) and Berggren (1993), the ability of LP to decrease production costs pushed many scholars and managers to believing that LP could be valid universally. Consequently, the success or failure of a facility would depend on the management's ability to adhere to the universal LP model. This paper challenges the idea of the universality of LP by analyzing work incentives in two different plants operating in two different institutional settings.

This paper defines LP as a form of work organization that adopts at least three main management practices: "just in time," which states that production should be based on market requests; total quality management, which states that the assembly line should guarantee a continuous improvement in production quality (Shah and Ward, 2007), and teamwork. Each team has the duty to provide the next one with a product without mistakes, and team members may suggest ideas for improving quality and productivity. On the other hand, we may consider that management provides workers with incentives to work in order to induce them to provide the company with greater effort as well as to decrease the labor turnover rate. In this paper, I show that work incentives must fit with those features of factory life that regulate it, such as workforce expectations, the national labor laws, and the unemployment rate. This means that work organization cannot be universally valid, but must adapt its work incentives to the relevant national or regional institutions such as unemployment and labor turnover rates as well as work norms.

The paper analyses work incentives in two Western countries that are characterized by cooperative industrial relations and difficulties in implementing LP: Germany and Sweden. In 2000 the main Swedish plant, Volvo Torslanda, produced 40 cars per employee. In contrast, Nissan Sunderland, which is the most productive European plant, produced 101 cars per employee.[1] Before 1999, the only highly productive German car plant had been Opel Eisenach, which is located in the former GDR, it adopts a standard form of LP, it was the most productive European facility in 1995 (Wergin, 2003) and it produced 81 cars per employee in 2000.[2] According to the scholarly literature, Opel Eisenach's high productivity levels were caused by the ability of the managers to import LP into the former GDR by transplanting what the company had learned from the Japanese

1 Anon., "Nissan's Sunderland plant sets new European productivity standards," *PR Newswire*, http://www.prnewswire.co.uk/news-releases/nissans-sunderland-car-plant-sets-new-european-productivity-standards-154794285.html [last access, October 23, 2014].

2 Ibid.

car manufacturer Toyota (Jürgens, 1998).

Swedish companies developed a special kind of LP that some scholars have called Reflective Production (Ellegård et al., 1992). In 1988, when the Uddevalla factory was built, Volvo Cars eliminated its assembly line. Contrarily to the standard LP, which is based on the assembly line, Volvo established a work organization based on a parallel product flow assembly system featuring small workgroups working with a long work cycle time. Autonomous teams assembled cars in work stations and teams operated independently of each other; blue collar workers performed artisanal tasks, and each worker could learn how to assembly a whole car. I shall refer to the Swedish use of LP as the Uddevalla Production System,[3] hereafter UPS, contrastingly with the Japanese version of LP, which is called the Toyota Production System, hereafter TPS, from the name of the company that developed it.

The main difference between the two production systems is the work cycle time, which is between one and two minutes length in TPS and at least 2 hours in UPS. TPS is the form of LP that has been globally applied, whereas UPS is specific to Sweden. In 1993, Volvo Uddevalla was shut down. The available data for UPS on quality and productivity were high but not as high as expected by the management as well as labor turnover data were low but not as low as expected by the Swedish company. (Berggren, 1995). Scholars have different opinions about why the plant was shut down. Scholars who are appreciative of TPS tend to stress that UPS was not competitive (Womack et al., 1990), while those who support UPS typically underline the lack of management knowledge (Blomquist et al., 2013) and lack of support from engineers and the metal workers' union (Hancké and Rubinstein, 1995).

The paper is structured as follows: section 2 describes the Volvo and Opel companies in the international context, and Section 3 presents a literature review. Section 4 introduces the features of the labor market in the former GDR and Sweden, and Section 5 describes the sources I have used to reconstruct the history of the facilities. Section 6 introduces the incentive scheme adopted by the Opel and Volvo managers, and section 7 analyses the historical sources in order to assess the benefits and shortcomings of the Opel and Volvo incentive schemes. Section 8 presents some conclusions.

2. Volvo and Opel in the Automotive Sector Scenario

Volvo and Opel are car companies that operate in different markets. Opel is a German firm based in Rüsselsheim, which is a city located in the Hessen *Land* (state) in the neighborhood of Frankfurt. It was founded in 1895 by Adam Opel and was acquired by General Motors in 1929. GM

3 Volvo did not develop a homogeneous production system for use in all its plants.

is an international giant and formerly the world's biggest car company, as shown in Table 1. Opel produces small cars for the European market and is the biggest GM sub-company in Europe. It has production levels similar to those of the other main European car producers, as shown in Table 1. Between the 1950s and 1960s, the Rüsselsheim plant became the largest West German industrial building[4] and Opel built a new factory in Bochum, which employed 20,000 workers.[5]

By contrast, Volvo is of small dimensions at the international level, even if it was once the biggest Swedish private company.[6] As shown in Figure 1 and Table 1, until 1993 Volvo had smaller dimensions compared to the main European carmakers, but similar dimensions compared to its main European competitors. The company's growth was pulled by the export of high-quality, family-oriented, and safe products, and consequently the Swedish company has targeted an upper market segment compared to Opel. During the 1980s, Volvo became the most profitable car company in the world (Berggren, 1992). Volvo's headquarters are located in Torslanda, a town near Göteborg, the second largest Swedish city. The Volvo Torslanda plant was built in 1964 and was the largest Swedish workplace, which could employ up to 11,000 workers.[7]

Volvo Torslanda adopted a system of mass production as its work organization, and this meant that each worker was performing repetitive tasks that caused work strain injuries, stress, and alienation as well as wildcat strikes, high absenteeism, and labor turnover rates that decreased the company's productivity (Berggren, 1993). Consequently, Volvo built a new plant in Kalmar in order to minimize worker distress on the assembly line[8] thanks to the first use of teamwork organization in European car production (Berggren, 1992). Built in 1974, the plant employed around 600 workers and it reached a full production of 30,000 cars per year.[9] The final layout of the Kalmar plant was characterized by teams that each assembled one part of the car, a sequence of 27 work stations, and a cycle time of between 15 and 40 minutes (Sandberg, T., 1995).

Though the West German manufacturing sector was affected by wildcat strikes, Opel's management did not pursue the same strategy as Volvo. West Germany's government and its labor unions both asked for work humanization programs that were usually opposed by managers (Roth, 1997). The management policy changed when mass production became obsolete and Opel pursued TPS at the beginning of the 1980s. During this time, Japanese competition and the demand

4 Anon. "Rüsselsheim plant. Facts and figures", http://media.opel.it/media/intl/en/opel/company_opel/plants/ruesselsheim.brand_opel.html [last access, February 23, 2015].

5 Anon, "Adam Opel AG Werk Bochum I", http://de.wikipedia.org/wiki/Adam_Opel_AG_Werk_Bochum_I#cite_note-5 [last access, February 23, 2015].

6 See http://fortune.com/global500/1997/ [last access, August 17, 2015].

7 Anon., "50 year anniversary for Volvo Torslanda plant" http://news.volvogroup.com/2014/04/24/50-year-anniversary-for-volvo-torslanda-plant/ [last access, December 4, 2014].

8 Anon, *The Volvo Group of Companies*, 1974. http://www.volvoclub.org.uk/pdf/VolvoGroupOfCompanies1974.pdf [last access, December 4, 2014].

9 Ibid.

volatility caused by the second oil shock pushed GM to adopt LP. To implement TPS, GM set up a joint venture with Toyota (Duerr et al., 2005). This joint venture resulted in the building of the New United Motor Manufacturing, Inc. (NUMMI) plant, in Fremont, California. NUMMI workers were performing in cycle times of around 60 seconds and they were grouped in small teams linked by the assembly line (Adler et al, 1998; Adler, 1999).

NUMMI was the first Japanese transplant in North America. Later, Ford and Chrysler also adopted LP and some Japanese firms set up facilities in North America. Womack et al. (1990) stress that these plants had excellent results in terms of productivity, quality, and absenteeism. Due to the good productivity results of the North American transplants, LP became a management fashion in many Western countries. GM was the first company to establish LP in Germany. The use of teamwork was introduced by Opel as a result of a labor agreement signed in April 1991. However, according to scholars and union leaders, the introduction of LP in the old Opel plants faced serious resistances (Murakami, 1995).[10]

Opel was not the only German company that attempted to introduce LP. For instance, Ford established LP in Saarlouis and Mercedes in Rastatt. LP then spread to foreign factories owned by German firms, such as SEAT Martorell, which is controlled by VW, and Opel Zaragoza. As shown in Table 2, the Spanish plants achieved better productivity results than most of the German facilities. And, while Ford Saarlouis reached the same productivity levels as Opel Eisenach, it is worth noting that the Ford plant only began to be highly productive in 1999. Another greenfield plant, which means that was newly built, was established by VW in the former GDR, in the city of Zwickau (Jürgens, 1998). Unlike Opel Eisenach, VW Zwickau employs 7,000 workers, and it produced only 30 cars per employee in 2012.[11]

10 Interview with Ralf Giesing, Franz Klaus, and Harald Lieske.

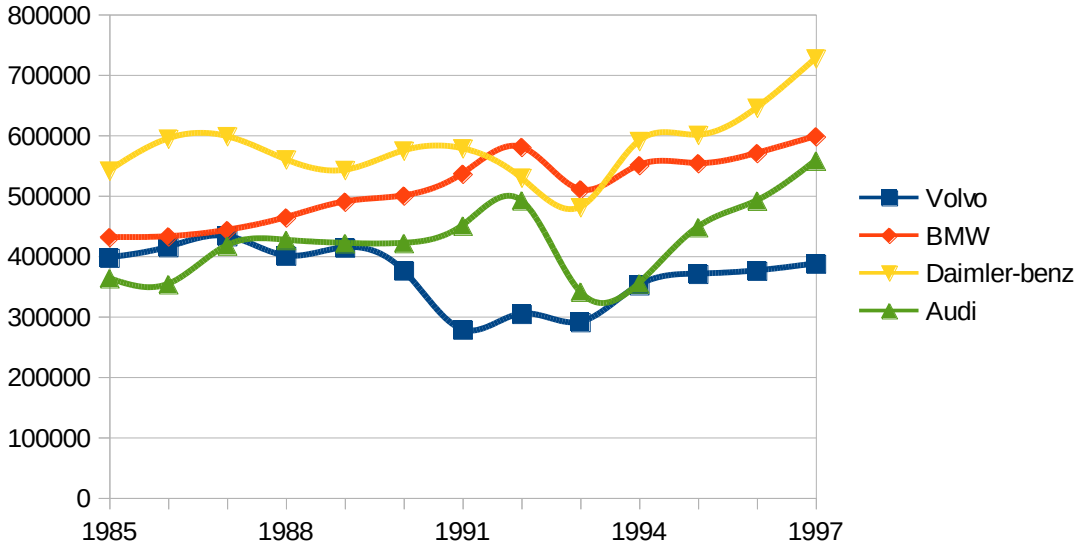
11 The data for VW Zwickau plant comes from Volkswagen News, "Die Volkswagen Sachsen GmbH," http://www.volkswagen-sachsen.de/documents/pressemitteilungen/allgemeines/Die_Volkswagen_Sachsen_GmbH.pdf [last access, October 23, 2014].

Table 1. **Passenger Cars produced by the main World Motor Companies (1986-2011)**

Company	*Country*	*1986*	*1991*	*1996*	*2001*	*2006*	*2011*
AWE	GDR	74	7				
BMW	GER	432	931	1095	947	1367	1738
Chrysler	USA	(1,170)	528	971	1104[A]	748	502
Daewoo	KOR		241	623	469	757[B]	
Daimler-Benz	GER	594	575	641	2392[A]	1275	1443
FIAT	ITA	(1,652)	1811	2230	1929	1756	1741
Ford	USA	(1,809)	3002	3637	3699[C]	3957[C]	3094
GM[D]	USA	(4,351)	4770	5139	4663	5780[B]	6494[B]
Honda	JPN	(1,025)	1781	1832	2608	3550	2886
Hyundai – Kia	KOR		901	1600	2087	3190	6118
Mazda	JPN	(811)	1155	695	780	1009	1104
Mitsubishi	JPN	(579)	1074	948	1242	1009	1017
Nissan	JPN	(1,769)	2203	2025	1967	2512	3581
Opel - Vauxhall[D]	GER		1620	1771	1942	1862	1224
PSA	FRA	1,707	2171	2100	2710	2961	3161
Renault	FRA	1,754	1624	1862	2070	2137	2443
Suzuki	JPN	(300)	531	946	1162	2004	2337
Toyota-Daihatsu	JPN	(2,826)	3589	3594	5021	7705	6794
Trabant	GDR	143	20				
Volkswagen	GER	2423	2700	3803	4881	5430	8157
Volvo	SWE	414	261	373	419[C]	427[C]	462
Total			30900	34973	40853	49918	59897

Note: Production of Passenger Cars in thousands of units. The numbers in parenthesis represent production in the countries where the companies' headquarters are set.
Sources: FIOM Piemonte, "FIAT Auto negli anni '90: Occupazione, Produzioni, e Mercato" [FIAT Auto in the 90s. Employment, production and market] 26/27 February, 1998, http://www.fiompiemonte.it/Storico/fiompie/tutfiat/fiat90_01.htm. [last access, February 24, 2015]; www.oica.net [last access, March 9, 2015]; Japan Automobile Manufacturers Association, "Motor Vehicles Statistics of Japan," 2011; Anon., "U.S. Automobile Production Figures," http://en.wikipedia.org/wiki/U.S._Automobile_Production_Figures [last access, April 7, 2015]. Anon., Automobilwerk Eisenach, http://de.wikipedia.org/wiki/Automobilwerk_Eisenach [last access, February 24, 2015]; on the Trabant, see http://trabitechnik.com/?page=35 [last access, February 24, 2015]; Volkswagen Aktiengesellschaft, "Volkswagen Chronik: Der Weg zum global player," 2008; Wolfsburg; Daimler-Benz Annual Report; Freyssenet (2007).
[A] For the year 2001, Daimler-Benz production includes Chrysler.
[B] For the years 2006 and 2011, GM Production includes Daewoo.
[C] For the years 2001 and 2006, Ford Production includes Volvo.
[D] In each case here, GM production includes Opel.

Figure 1: **Passenger Cars Produced by European Makers Operating in the Upper Market Segment (1985-1997)**



Note: The numbers refer to thousands of cars produced.

Sources: Daimler-Benz. See Daimler-Benz Annual Reports (1986-1997); others, see FIOM Piemonte, "FIAT Auto negli anni '90. Occupazione, produzioni e mercato" [FIAT Auto in the 90s. Employment, production and market] 26/27 Februray, 1998, http://www.fiompiemonte.it/Storico/fiompie/tutfiat/fiat90_01.htm. [last access, February 24, 2015].

Opel decided to set up a plant in Eisenach, because Opel was cooperating with the GDR car company Automobilwerk Eisenach (AWE), which was located in Eisenach, in the Thüringen *Land*. The AWE factory was producing the Wartburg cars, and was considered highly inefficient,[12] employing a maximum of 8,000 employees.[13] Its production fully concentrated in Eisenach, AWE was the second largest car manufacturer in East Germany, and its dimensions were small compared to competing international firms, as shown in Table 1. It was closed in 1991 by the *Treuhandanstalt* (Trust agency), the German national trust agency responsible for privatizing former GDR public firms.[14] After the AWE closure, Opel established in Eisenach a plant that adopted TPS. Opel Eisenach is a complete factory with assembly, paint shop, and body shop departments, and it employs 2000 workers.

12 See Phil Scott, "The last of the dinosaurs," *The Sun Herald* (Sydney, Australia), May 8, 1990.
13 See Alan Ferguson, "German city says a sad goodbye to humble Wartburg," *Toronto Star*, October 5, 1991.
14 Ibid.

Table 2: **Productivity in the Main European Plants**

Manufacturer	*Plant*	*Country*	*1997*	*1998*	*1999*	*2000*	*Ranking*
Nissan	Sunderland	UK	98	105	94	101	1
Toyota	Burnaston	UK	58	72	81	86	2
Ford	Saarlouis	Germany	59	59	77	81	3
GM	Eisenach	Germany	76	76	82	81	4
Ford	Valencia	Spain	57	58	73	77	5
GM	Antwerp	Belgium	n/a	n/a	63	77	6
Renault	Valladolid	Spain	59	64	71	77	7
FIAT	Melfi	Italy	70	73	70	76	8
SEAT	Martorell	Spain	69	69	66	71	11
GM	Zaragoza	Spain	67	67	69	62	16
GM	Bochum	Germany	n/a	n/a	n/a	62	17
Daimler	Rastatt	Germany	n/a	n/a	48	53	28
VW	Wolfsburg	Germany	39	42	50	46	31
Volvo	Ghent	Belgium	n/a	n/a	n/a	45	32
Volvo	Born	Netherlands	36	50	n/a	40	35
Volvo	Torslanda	Sweden	n/a	n/a	n/a	40	36
GM	Rüsselsheim	Germany	n/a	n/a	n/a	34	40
VW	Emden	Germany	28	37	29	27	44

Note: Productivity is calculated on the basis of the number of vehicles produced by each employee.

Source: Anon., "Nissan's Sunderland plant sets new European productivity standards," *PR Newswire*, http://www.prnewswire.co.uk/news-releases/nissans-sunderland-car-plant-sets-new-european-productivity-standards-154794285.html [last access, October 23, 2014].

Uddevalla's history is slightly different than that of Eisenach. In Sweden, in 1984, Volvo's management decided to develop a work organization based on long work-time cycle in a building located next to the Torslanda factory. The project was soon stopped, but the ideas it was were partially implemented in the later Uddevalla factory,[15] which was located in the Bohüslans Region, 90 km from Göteborg. The Uddevalla plant was a further step compared to Kalmar, because the Uddevalla layout was characterized by the absence of an assembly line. Thus, cars were built on one or two stations, the minimum time cycle required to perform the workers' tasks was two hours, and employees had the opportunity to learn how to assembly a whole car. Volvo Uddevalla was an assembly plant, it hired around 1000 employees and its expected production was 40,000 cars per year. In 1991, Volvo was highly influenced by the crises that affected the car market at the beginning of the 1990s. As shown in Figure 1, the Swedish company lost part of its market share to

15 Interview with Björn Mattson. Conversation with Tomas Engström.

its main competitors. During this time, TPS was applied in the Torslanda factory,[16] whereas the Uddevalla and Kalmar plants were shut down. As shown in Table 2, Torslanda productivity results were lower than those at the main European facilities.

3. The Application of Lean Production in Sweden and Germany: The Established View

In 1990, the appearance of the book *The Machine that Changed the World* (Womack et al., 1990) heavily influenced the debate about LP. The authors argue that TPS is the best possible work organization because it increases productivity, production flexibility, product quality, and job satisfaction. All of the other work organizations should be ruled out. According to the authors, the Volvo Uddevalla plant expressed a nostalgia for an artisanal mode of production without any practical utility.[17] Berggren (1993) notes that scholars appreciative of Toyota's virtues present TPS as a "best practice" that can be universally applied. Westney (1989) notices that Western Multinational Companies stopped modelling its work organization on Institutions.

At the same time, some scholars, conscious of the uniqueness of the UPS work organization, believe that it can offer results superior to those of TPS. UPS was developed in response to the physical constraints of the Uddevalla building (Engström et al., 1998), Sweden's low wage differentials, the importance placed by its unions on the quality of work (Sandberg, Å., 1995), the dominance of cooperative industrial relations (Freyssenet, 1998a), and an exceptionally low unemployment rate (Blomquist et al., 2013). A debate arose between proponents of the different views. On the one hand, scholars more appreciative of TPS argue that UPS only improves job satisfaction, but not productivity, quality, and ergonomics (Adler and Cole, 1995). Moreover, they argue that organizational learning is more effective in the more traditional Lean plants because their standardized tasks help workers better understand their specific tasks.

On the other hand, managers, pedagogues, and sociologists appreciative of the Swedish model argue that UPS improves organizational learning because a long cycle time help workers to understand their tasks better. Moreover, it increments flexibility because the production can easily change according to market demands (Berggren, 2000; Ellegård, 1995; Nilsson, 1995). The literature that claims the superiority of UPS is inspired by the work of Wild (1975). These scholars follow him in arguing that teamwork based on work stations can improve factory results because it is easier to coordinate small workgroups rather than a large number of employees on the line.[18]

16 Interview with Glenn Bergstrom.
17 Steven Prokesh, "Edges Fray on Volvo's Brave New Humanistic World," *New York Times*, July 7, 1991.
18 Wild (1975) argues that the costs were reduced thanks to a large time cycle and "Balance Loss," "Division of Labor Loss," and "System Loss." See also Jonsson et al. (2004) and Blomquist et al. (2013).

According to them, the main reasons why Uddevalla plant was shut down are that the managers who were working in the UPS plants did not fully understand the new production system; that they felt threatened by the change in the balance of power due to the greater responsibilities of the workers; companies preferred to have homogeneous work organizations,; and the Swedish unemployment rate suddenly increased (Blomquist et al, 2013). Moreover, Hancké and Rubinstein (1995) point out that one of the main reason why Volvo Uddevalla was closed was the lack of support by the central metal union.

Even though German managers did not develop a work organization that introduced a new production system, such as Volvo Uddevalla, a scholarly debate about LP also arose in Germany (Benders and Van Bijsterveld, 2000). German management scholars consider TPS the only work organization possible to be applied because other work organizations do not reach similar productivity levels (Springer, 1999) and some sociologists underline that the Japanese path is the one that can be easily applied by German managers because TPS matches the German classical training system (Jürgens, 1995). Other sociologists claim the superiority of the traditional German system by pointing out that West German production data were higher than Japanese's if adjusted to the working time (Roth, 1997) and managers cannot easily implement TPS due to institutional constraints (Streeck, 1996). Most scholars, however, explain the German difficulties in applying TPS through the unwillingness of workers and lower-level managers to fully accept the new work organization. For example, Murakami (1999) underlines that Opel Rüsselsheim's teamwork diverged from TPS because the work council sought to implement a democratic model of teamwork. In general, union leaders such as Pessa and Sartirano (1993) as well as sociologists and management scholars like Cersosimo (1994) and Duerr et al. (2005) stress that in old facilities management encounters resistances when it attempts to introduce LP.

Due to the resistances to developing TPS in old plants, Opel's management decided to establish TPS in greenfield environments by investing in the Eastern territories after the German reunification. The consensus in the literature is that Opel Eisenach was the most successful car plant in the former GDR. The literature in sociology and management stresses that Opel Eisenach reached high productivity levels due to the TPS adoption, a high level of cooperation between management and unions, strong worker skills, management efforts directed at improving work organization design, and GM's ability to reproduce what it had learned from its North American transplants (Haasen, 1996; Inkpen, 2008; Jürgens, 1998). However, the sociologist Bruno Cattero points out that the Opel Eisenach labor agreement worsened working conditions in comparison to the West German car plants (Cattero, 1994).

In summary, the scholarly literature largely agrees that TPS is a "best practice" that is broadly applicable, and thus Opel Eisenach's success was caused by its management's ability to

adhere to TPS. Thus, Uddevalla was shut down because it had not implemented TPS. Other sociologists, however, and engineers appreciative of the virtues of Volvo Uddevalla believed that UPS promised better results because it could fit with some Swedish labor market features, such as high labor turnover rate, whereas TPS couldn't.

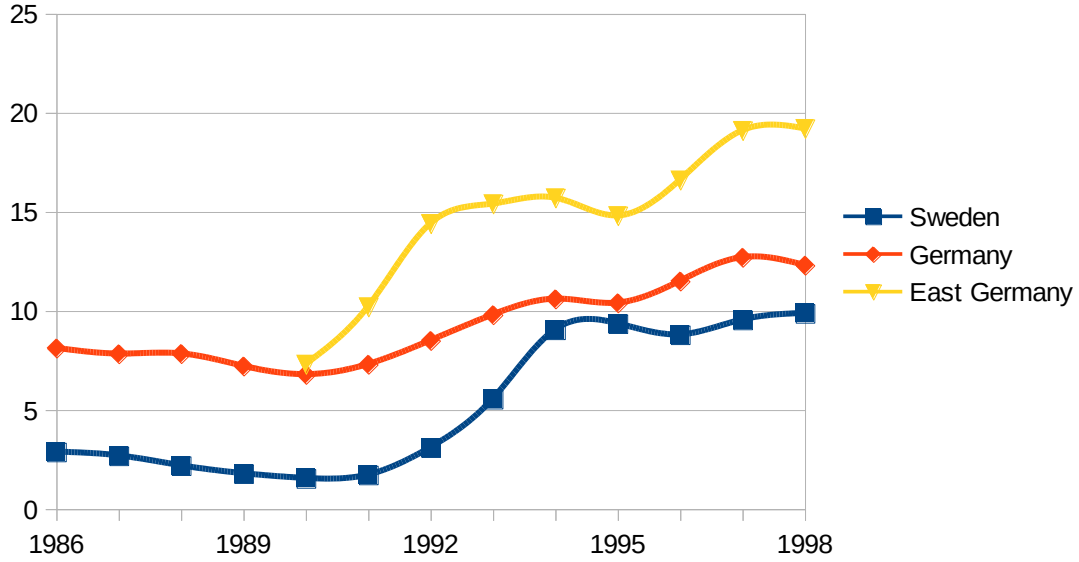
4. Swedish and GDR Labor Market Features

By analyzing the Swedish and GDR labor market features, we can ascertain why the two countries developed different kinds of LP. In particular, the standard work incentive scheme, which was developed by Japanese companies, was highly effective in the former GDR, whereas it was unnecessary in Sweden. The two labor markets were different in terms of workforce skills, unemployment, wage differentials, and industrial relations. In general, Swedish workers were richer than their East German counterparts in terms of GDP per capita[19] and purchasing power.[20] Furthermore, Swedish employees were more likely to find a job, but were less skilled than their East German counterparts. Sweden had a lower unemployment rate, higher unemployment benefits, and lower wage differentials than East Germany. Lastly, Swedish workers enjoyed more congenial work norms than those in the GDR. I understand as work norms the informal understandings that govern management behavior in the factory, as well as explicit rules that govern industrial and social relations in the workplace.

19 The Swedish GDP per capita was USD 15,700, whereas the GDR's GDP per capita was USD 9,679. See *1990 World Fact Book of the United States Central Intelligence Agency.*

20 Swedish workers could buy 10 kilos of flour with one hour's wage, while the East German worker could buy only 6.

Figure 2: **Unemployment Rates in Sweden, Germany, East Germany (1986-1998)**



Note: "Germany" refers to West Germany before 1991 and to the reunified Germany after 1991.

Sources: http://www.econstats.com/weo/V027.htm [last access, January 26, 2015];

Bundesagentur für Arbeit, "Arbeitsmarkt in Zahlen"

http://www.khd-research.net/Docs/BAfA_Arbeitslose_1991-2007.pdf [last access, January 15, 2015]

Among these differences, the main peculiarity of the Swedish labor market is that it provides each worker with the possibility of find a new job as soon as an employee has lost his previous one. This peculiarity is the result of a series of features: an educational system based on lifelong learning, work organization based on standardized tasks, active labor market policies (Bruhn et al., 2013), a low unemployment rate, and high unemployment benefits.[21] The low unemployment rate causes workforce shortage from the companies' point of view as well as the standardization of tasks shapes low skilled workforce that can be easily retrained thanks to the active labor market policies. As a consequence, the Swedish labor market is characterized by a workforce that allows for frequent shifts in jobs. Accordingly, workers wind up having few responsibilities on the shop floor and knowledge on the production process is entirely allocated to the engineers.

Contrariwise, as underlined by our interviews with AWE workers and by Frege (2002), in the GDR the tasks performed by blue collars were not highly standardized, the work pace was slow, and the workers tended to have strong feelings of solidarity for their colleagues.[22] The GDR labor market was influenced by an educational system based on vocational training, which was used to certify employees' specific skills. Thus, East German workers had a level of skill that pertaining not to mere standardized tasks. Consequently, East German managers developed a different work

21 The government paid 90% of a worker's salary at its more recent level as unemployment insurance. See Holmlund (2006).

22 Interviews with Uwe Künhast, Harald Lieske, Thomas Ortloff, and Reinhard Schäfer.

organization that allowed blue collar workers to work in teams in order to perform tasks that required higher autonomy. The teams were called *Arbeitsbrigade* or work brigade (Jürgens, 1998). Another feature that helped workers in Sweden to more easily shift jobs that those in the former GDR was the unemployment rate.

As shown in Figure 2, Sweden was characterized by a low unemployment rate, whereas in Germany the Eastern territories had been facing a high unemployment rate since the reunification. In July 1990, the first step of reunification was the establishment of a currency union. Three months before the political reunification, the Western *Deutschmark* was introduced as the GDR's currency at the exchange rate of one-to-one. Due to the currency union, the GDR salaries sharply increased[23] and production declined because workers' wages became unsustainable for the GDR firms, while customers preferred buying Western products. In December 1990, the production of machinery and transportation equipment dropped 40%, compared to the previous May (Akerlof et al., 1991). The agency that privatized the East German firms was unprofitable due to the higher cost of labor. Therefore, most of the companies were liquidated, as had happened to AWE.[24] The unemployment rate rose from the 1.6% of June 1990 to 8.9 % in February 1991 (Akerlof et al., 1991).

Referring to the job norms, we can infer that GDR work norms were poor because its unions were subordinate to the Communist Party and the law did not guarantee any effective means of workers' representation on the shop floor (Frege, 2002). Accordingly, Opel unionists who had been working at AWE have pointed out that GDR employees believed that there was poor communication between managers, unions, and employees.[25] After the reunification, East Germany inherited the Federal Republic's bargaining features. The new labor law established a right of co-determination in the management decisions, which guarantees union members the possibility of a seat on the supervisory board (Müller-Jentsch, 1995). The central bargaining between the national unions and national entrepreneurs' association established that in 1995 East German salaries would reach parity with the West, and it increased the work week from 35.2 hours to 40.[26] The work organization was the result of bargaining between plant or company management and work councils.[27] These councils are elected by the whole workforce and are supposed to be independent of the unions.

In contrast to the GDR job norms, the Swedish metal union plays an active role because it participates in the companies' administrative boards and it represents almost the entire workforce

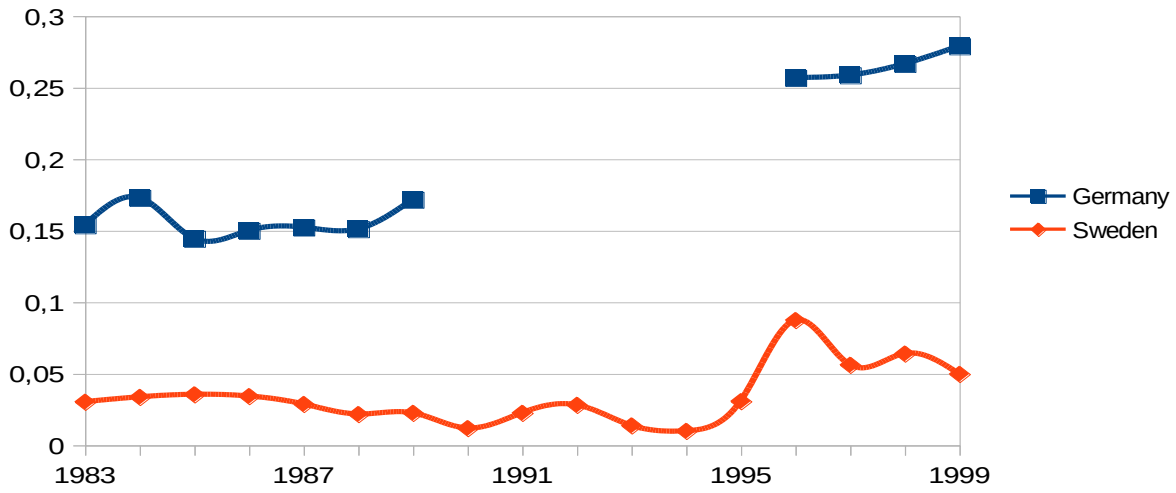
23 In 1990 an East German workers could buy 6 kilos of flour with one hour's wage, whereas in 1991, an East German workers could buy 7.7 kilos of flour with one hour's wage. See ILO Laborsta.
24 Tony Allen-Mills, "Workers pay the price of a united Germany," *The Sunday Times* (London), March 31,1991.
25 Interview with Harald Lieske and Reinhard Schäfer.
26 *1990 World Fact Book of the United States Central Intelligence Agency.*
27 See the Opel Eisenach Labor/management agreement: "Opel Eisenach Betriebsvereinbarung," n. 11 (Labor/ management agreement signed August 3, 1992).

(Bruhn et al., 2013). Swedish law does not guarantee to workers work councils, and the plant management bargains with union representatives selected by their members. The metal union carries on industrial relations based on the solidarity wage policy. According to this policy, workers who are performing the same jobs receive the same wage, independently of the companies' profitability.[28] Consequently, workers are paid different wages only if they have different skills or different working conditions (Edin and Holmlund, 1993). This is possible because the bargaining system is highly centralized, and so some features, such as wage, working time, and work organization are regulated by the national or company bargaining.[29]

A consequence of the solidarity wage policy was that the Swedish automotive salaries could not attract young employees. Young workers preferred to avoid working on the standardized tasks that characterized Mass Production, so they often refused jobs in the automotive industry (Berggren, 1992). Consequently, Sweden suffered from a high labor turnover rate, which is defined as the ratio between annual job separations and the level of employment (Schlicht, 1978). Workers were not afraid to lose their jobs, because they could easily find a new one that paid a similar wage. Consequently, the Swedish manufacturing sector suffered an average turnover rate of 22% per year over the period 1968-1988, while the lay-off rate was 2% (Skans et al., 2009). As shown in Figure 3, the reunified Germany had higher wage differentials compared to Sweden, so the problems related to the high labor turnover rate did not arise.

28 Interview with Glenn Bergstrom.
29 About Swedish bargaining institutions, see Brulin (1995).

Figure 3: **Solidarity Wage Policy (1983-1999)**



Note: The index represents the increment in the wage of a worker in the transport sector, compared to the average wage in the manufacturing sector. Increment = (Wage in the transport sector – Average Wage in the Whole Manufacturing Sector)/Average Wage in the Manufacturing sector). Germany refers to West Germany until 1990.
Source: ILO Laborsta, http://laborsta.ilo.org/ [last access, October 23, 2014]

While Sweden and East Germany faced completely different economic problems during the transition from Mass Production to LP, both companies needed to motivate their workforce. The Swedish managers faced problems related to labor turnover. In contrast, the main goal of the German managers was to squeeze production costs in order to offset the high labor costs.

5. Sources

I reconstructed the history of the two plants thanks to a series of interviews with blue and white collar workers, managers, and unionists, who participated in the factories' life or followed closely the plants' development. A list of the people interviewed is presented in Table A1 in the Appendix. These interviews are accompanied by the documents provided by the Opel Eisenach work council, such as labor management agreements and surveys on working conditions. Another source on the Eiseanch plant is represented by the historical on-line archive of the German newspaper *Die Zeit*.

Regarding the Uddevalla case, documents were provided by the Chalmers University of Technology in Göteborg and the Archive of the Bohüslans Museum in Uddevalla. Furthermore, Chalmers University provided the work instructions that a worker should have followed in order to assembly the cars, along with other documents, which are important for understand the engineering development of the plant. The Archive of the Bohüslans Museum provided Volvo its Red and Blue

Books, which explained to the Volvo Group the first Uddevalla. The Red Book represents the preliminary project, whereas the Blue Book represents an advanced stage of the project. Other original sources were found in the same archive, including the complete collection of *Kärran*, the plant magazine written by workers, union leaders, and managers.

6. **The Theory of Work Incentives**

As we have seen in Section 4, Opel and Volvo needed to motivate their workforces. While the German management attempted to increase workers' efforts on the shop floor, the Swedish management attempted to reduce labor turnover. Volvo and Opel could not increase wages in order to motivate their workers, because the salaries and the working times were regulated by bargaining at the national level. Thus, managers implemented non-monetary incentives. The basis of wages was set by the notion of fair wage. According to fair wage theorists, workers can be motivated by salaries that they perceive as fair. The fair wage can be defined as the set of monetary and psychological rewards that influence the workers' perception to be fairly treated.

The idea of fair wage includes the psychological and sociological aspects of the work. For example, Akerlof (1982) stresses the variables that induce a worker to perceive his or her wage as fair. The amount of wage paid by a company to an employee can partially increment the fair wage. Other variables that influence fair wage are: the work norms, the unemployment rate, and the wage and work norms that are provided by the companies that hire the set of people who can interact with workers outside the plant, such as neighbors, relatives, and friends. Furthermore, workers not only look at the current values of these variables but compare current with former values. It is worth considering how these variables influenced the life of Volvo Uddevalla and Opel Eisenach in order to understand the work incentives developed by managers.

As we have seen in previous sections, the GDR work norms were poor and the unemployment rate high. Thus, Opel Eisenach's workers would have increased their fair wage if the work norms had improved compared to the GDR era, and the company would have provided them with stable employment because it would have been difficult to find a new job once they had been fired. The standard TPS work incentives are based on a friendly work environment thanks to direct contact between blue collar workers and managers, cooperative industrial relations, and lifetime employment. The Opel Eisenach managers replicated the Japanese system. Scholars and interviewees agree on the management attempt to establish a friendly workplace. For example, Opel improved the work environment thanks to better food in the canteen and well-lighted workplaces.[30]

Moreover, Opel guaranteed direct and friendly relationships among blue collar workers,

30 Interview with Reinhard Schäfer.

team leaders, and lower managers. The lower managers were called *Bereichsingenieuren* (Area Engineers) and they were responsible for coordinating five teams and issuing disciplinary sanctions. The labor management agreements clarified the role of the lower managers that were committed to taking care of the needs of all of the workers in their area.[31] Each team was composed of four or five members and managed by a team leader, who served as a mediator between workers and lower managers. Team leaders performed some offline tasks such as the holiday planning[32] and they were also committed to maintaining good relationships with team members. It is worth noting that some labor agreements in the automotive sector do not specify the tasks of team leaders and lower managers.[33]

Regarding industrial relations, Opel attempted to demonstrate a radical break with the previous system by establishing more egalitarian relationships (Jürgens, 1998). As a result, managers decided to respect the unions and a sign of the new environment was the lack of separation between work council and management offices.[34] It is worth noticing that the better industrial relations were important not only because the workers could recognize the work norms as fair but also because the work council could play an active role in the LP implementation. For example, Harald Lieske, the Opel Eisenach work council chairman, actively supported the LP introduction because he believed that it would increase productivity and job satisfaction.[35] Consequently, the Eisenach work council, which represented the link between managers and workers, induced the company's workers to accept the new work organization.[36]

The last incentive established by Opel was lifetime employment. This served as an incentive that was highly effective in Opel Eisenach because the Eastern *Länder* were affected by a high unemployment rate, as shown in previous sections. However, the unemployment rate was low in Sweden, so life employment could not be considered as an effective incentive in the Volvo Uddevalla case. Furthermore, the Volvo's work norms were perceived by the workers as fair. As stressed by all of our interviewees, the metal union could influence the management decisions and Volvo management had direct and friendly relationships with its employees. For example, Volvo CEO Pehr Gyllenhammar, after listening to workers on the shop floor, and he asked to the managers to solve the employees' problems as soon as possible.[37]

This meant that Volvo's management could not improve the fair wage by intervening in

31 "Opel Eisenach Betriebsvereinbarung," n. 11 (labour/management agreement, signed August 3, 1992).
32 Torsten Oltmanns, "Revolution im Osten," *Die Zeit*, September 25, 1992.
33 See the FIAT Melfi labor/management agreement, signed June 11, 1993.
34 Interviews with Harald Lieske and Reinhard Schäfer.
35 Interview with Harald Lieske.
36 It is worth noting that management was able to exploit the union's weakness in order to find an agreement that established a kind of LP that was close to the company's ideas. Eisenach's metal workers' union was weak, because Eisenach's unionisation rate was only 35%, whereas Opel's was 75%. See interviews with union leaders in Rüsselsheim Franz Klaus and in Eisenach Reinhard Schäfer.
37 Interview with Björn Mattsson.

industrial relations, or making changes to the wage rate or life employment. Volvo could only change the working conditions, which were considered stressful by many of its workers. Thus, Volvo's CEO decided to increase the job satisfaction of its workers through an extensively long work cycle time (Berggren, 1995; Boglind, 2013). Thus, Volvo established a project team that involved management, unions, and engineers from the Chalmers University of Technology. The project team decided the length of the time cycle during the Volvo Uddevalla planning phase. Some management and union representatives thought that the maximum cycle time, which can be learned by the employees, is around 20 minutes. Nevertheless, the project team understood that it was possible to widens the cycle time up to 2 hours (Engström et al, 1998).

The first consequence of the extensive cycle time was that the assembly line was ruled out and cars were assembled at workstations (Ellegård, 1995). Teams composed of eight blue collars assembled the whole car on one or two workstations. In addition to assembly tasks, team members were also involved in personnel issues because they contributed to organize holiday plans. Each team was at least 40% female, and one-fourth of the workforce had to be younger than 25 and one-fourth older than 45 (Follis et al., 1991). Each team was supervised by a team leader elected by the team members. The lowest management figure was the product shop leader, who was responsible for coordinating eight teams (Sandberg, Å., 1995). The second consequence was that the work instructions had to be adapted to the new cycle time. Thus, the project team developed work instructions that could explain to the blue collar workers the internal logic of the work process (Engström and Medbo, 1992). The new work instructions provided blue collar workers with greater autonomy and understanding of the product structure (Ellegård et al., 1992). For example, they were encouraged to find new ways to assembly the components.

Yet, even though increasing worker autonomy was Uddevalla's main goal, industrial relations could not be neglected. Implementing a work organization that provided the workers with a greater knowledge of the production process implied the existence of mutual trust between management and employees. For example, the Blue Book stressed that the work environment should improve the physical and psychological conditions of both blue- and white-collar workers.[38] In compliance with the Volvo tradition, management was confident that its workers could learn the tasks required by the new work organization, and, according to the white collar union leader Benny Frick, the employees reciprocated by developing the team spirit necessary to fulfill their tasks.[39] The company magazine *Kärran* helped the workers develop feelings of solidarity by promoting various recreational activities and introducing to workers new colleagues.

While these efforts contributed to the workers' sense of autonomy and to more cooperative

38 Sven Date, "Blå Bok," June 1986, Bohüslans Museum Archive.
39 Interview with Benny Frick.

industrial relations, the Swedish incentive scheme was characterized by a problem in the short run. The problem is underlined in the scholarly literature about labor turnover (Schlicht, 1978) as well as the interview with Benny Frick. When the workers' skills increase, the training and turnover costs do also. The Uddevalla workers were trained for four months in a separate workshop before they started working at the workstations (Follis et al., 1991). In contrast, TPS workers are trained off the line for several weeks before they start working on the line.[40] This means that the Volvo incentive scheme could have reduced the labor turnover rate and, consequently, the number of workers who needed to be trained, but it increased the labor turnover costs for each worker who had to be trained. The second effect may have offset the benefits caused by the lower turnover rate.

In order to overcome this problem, the training activities were performed by the Uddevalla employees with the highest level of skills. These workers were identified as those able to assembly an entire car. These peculiar workers could ask for a certificate of "Master," which would have allowed them to train the new entrants (Follis et al., 1991). If more workers had been able to train the new workers, the training process would have been self-sustainable and the training costs would have decreased. The incentive scheme proposed by the project team could have minimized costs as most of the blue collars would have learned how to assembly the whole car. Thus, the company motivated its employees to learn the whole assembly process by creating a wage system that provided the workers with extra pay for each additional quarter of car mastered in assembly (Ellegård, 1995).

7. The Results of Work Incentives

As we saw in the previous section, the incentive scheme established by Opel fit the former GDR institutions because it improved work norms and guaranteed life employment in an area characterized by high unemployment. This had the consequence that the plant had good results in terms of productivity, industrial, and social relations. As mentioned earlier, Opel Eisenach was the most productive European plant in 1995 and the fourth most productive in 2000. In terms of social relations, TPS was able to exploit the feelings of solidarity that had been promoted during the GDR era, because team members cooperated with each other inside the plant and socialized together outside it. According to certain union leaders, team leaders and Area Engineers would help those who had difficulties in performing their on-line tasks.[41] Moreover, managers and unionists pointed

40 For example, FIAT Melfi's training of its workers took place over just two weeks off the line, with workers joining the assembly line afterwards. See interview with Melfi union representatives Antonio D'Andrea and Vittorio Verrascina.

41 Interviews with Thomas Gimm and Reinhard Schäfer.

out that some lower managers never issued a disciplinary sanction in their entire career.[42]

As pointed out by both managers and union leaders, industrial relations were considered smooth because strikes affected the Eisenach plant less than other plants in West and East Germany.[43] Workers appreciated the new work organization because they were proud to produce high-quality cars, as was stressed in all the interviews I conducted. The surveys undertaken by the Eisenach work council confirm that the factory environment was conserved by workers as better than that in other Lean plants. The results of the survey undertaken by the Eisenach work council depict an environment that is more cooperative than other European Lean plants, such as FIAT Melfi, where the 75% of the interviewees evaluated the working conditions as "bad."[44] At Opel Eiseanch, only the 20% of the interviewees evaluated the factory environment as "bad." Some survey results can be seen in Figure A1 in the Appendix. These results are consistent with the scholarly literature.

What the interviews add to the academic literature is that the work environment deteriorated somewhat during these years. Today, Opel Eisenach has lost some of the features that made it unique, and the productivity level didn't further increment.[45] While each of the interviewees mentioned a particular problem of concern to him, all agreed about the difficulties that the factory was incurring. For example, all of the workers and union leaders agree that many of the blue collar workers were physically and psychologically too old to perform the TPS tasks.[46] Psychologically, the work council chairman Harald Lieske suggests that teamwork requires fresh ideas and a constant effort to implement them. Blue collar workers tend to continue working in the same way as they grow older.[47] As the union leader Gerd Krauß stresses in my interview with him, certain policies worsened this problem. In particular, GM usually changes plant upper managers every three years. According to Krauß, this policy lowers the sense of a shared commitment between workers and managers and leads the latter to being more interested in improving productivity results than encouraging the worker's contributions.

Physically, most workers cannot bear the fast TPS work rhythms. During my factory visit, I observed that older workers were unable to keep up with the assembly line. Because of this, Opel installed special machinery that allowed workers to sit while performing their jobs. This increased

42 Interviews with Ralf Giesing, Thomas Gimm, and Reinhard Schäfer. We may assume that in other LP plants, such as FIAT Melfi, disciplinary sanctions were very common.

43 Interviews with Ralf Giesing and Reinhard Schäfer.

44 Inquiry about Working Conditions: Results from a questionnaire distributed to young workers at FIAT SATA by FIOM CGIL Potenza, Julys/September 1999.

45 In 2000 Opel Eisenach hired 1,971 employees and produced 145,200 cars. In 2013 Opel Eisenach hired 1,360 employees and produced 103,000 cars. See Anon., "Nissan's Sunderland plant sets new European productivity standards," PR Newswire; and Anon. "Opel Facts and Figures 2013", http://media.gm.com/media/intl/en/opel/company_opel/ebook.brand_opel.html#36/z [last access January 30, 2015].

46 Interviews with Gerd Krauß, Uwe Künhast, Harald Lieske, Jens Möncher, Thomas Ortloff, and Reinhard Schäfer.

47 Interview with Harald Lieske.

the plant's costs. Also, according to the union leader Reinhard Schäfer, the ageing of the workers made the job of the team leaders more difficult. Twenty years ago, the team leaders could easily perform off-line activities, such as developing a holiday plan. As workers became older, team leaders, mostly those working on the line, would help out those team members who could not keep up with the work pace.[48] Lower and upper managers pointed out other problems. According to the human resource manager Ralf Giesing, the work council slowly became less independent from the metal union, and this negatively affected the TPS implementation.[49] Lower manager Thomas Gimm underlines that social conditions in the factory have changed since 1994. More specifically, the solidarity feelings that were at the base of the teamwork vanished and young people are not accustomed to work together.[50] The ageing of its workers meant that the life employment incentive had a negative effect for Opel Eisenach on its productivity and production costs.

The ageing of the workforce at the Uddevalla plant could not have affected the plant's productivity, because the teams were designed partly so as to include the older workers. Nonetheless, as we have seen in Section 6, the Uddevalla incentive scheme might have performed well in the medium term since it enabled older employees to teach the new entrants. In fact, UPS performed more poorly than TPS during the start-up phase due to difficulties in finding the right workforce that would be up to the demanding assembly work. Consequently, when the factory had overcome the problems of the start-up phase, the productivity results would have been improved. And indeed, an improvement in the Uddevalla performances is indicated by the data collected by the Swedish academics.

The initial turnover rate was high because the plant management encountered difficulties in recruiting workers with experience in long work cycles. Later, the turnover rate dropped. The productivity reached the Torslanda level in 1991 (Adler and Cole, 1995), and the time to assembly the cars had halved by 1992. Quality also improved with time. Uddevalla was also more flexible than Torslanda because it was easier and less costly to shift to the car model that it had chosen to produce (Berggren, 1995). Some data are shown in Table A4 in the Appendix.

Although production improved with time, the factory was shut down. Interviews and scholarly literature both show that the 1992 crisis was the main reason the Uddevalla plant was shut down. The number of cars sold in the Swedish car market dropped from 344,000 in 1988 to 155,000 in 1992 (Berggren, 1995), and the unemployment rate suddenly became high. In response to these changes, the management preferred to close the small and incomplete Uddevalla and Kalmar plants rather than close one line in Torslanda. Union leaders from Torslanda and Uddevalla stressed that the metal workers' union had given its consent to the management decisions because it understood

48 Interviews with Uwe Künhast, Jens Möncher, and Reinhard Schäfer.
49 Interview with Ralf Giesing.
50 Interview with Thomas Gimm.

the serious problems that were faced by the company. For example, the metal union leaders believed that the Torslanda plant would have lower costs thanks to its use of scale economies.[51] My interviews and archival researches stress that the 1992 crisis and the lack of support from the metal workers' union form only part of the history of Uddevalla.

Various sources point to certain shortcomings that inhibited optimal plant development. On the one hand, the production scheme was less than optimal, due to a lack of cooperation between the project team and Volvo's engineers. On the others hand, the work incentives designed by the project team had certain shortcomings. Regarding the first shortcoming, although the engineers interviewed had a generally positive evaluation of UPS,[52] some project team members underline a lack of trust between academics participating in the Uddevalla planning, the metal workers' unions, Volvo engineers, and top management. In particular, project team members stress that Volvo's engineers doubted the efficiency of UPS.[53] In 1993, these problems, which were having an effect on the power relations in Volvo's factories, became evident when the CEO, who was the company's main supporter of UPS, resigned because Volvo's top managers and engineers had challenged his decision to merge the company with the French automaker Renault (Boglind, 2013). There was also a failure of cooperation that could be seen in the company's marketing and production flow as well as its manufacturing process.

First, from a marketing point of view, Berggren (1995) underlines that the car model produced by Volvo Uddevalla was eight years old. The management had not developed a car model that could be produced in the Uddevalla factory. As the Volvo academic specialist Boglind has noted, a new car model might have increased the company's profits because it could have been easily advertised in such a way as to appeal to politically liberal consumers on the grounds that the car was manufactured in a humanistic way.[54] Second, from a manufacturing point of view, Volvo's Product and Process Department provided the Uddevalla workers with standard instructions valid for all of the company's plants. These work instructions, which were called Process and Control Instructions, did not explain how the components were interrelated, although knowledge of this is necessary if one is to follow a cycle time of two hours (Engström et al., 2001). However, the project team did develop proper work instructions in recognition of this.

From a production point of view, the scheduling system should have been changed. In the case of an assembly line factory design, the activities of all of the on-line workers are coordinated so as to produce a predetermined number of cars per day. In contrast, a work organization based on workstations enables different teams to have different rhythms and knowledge. Thus, according to

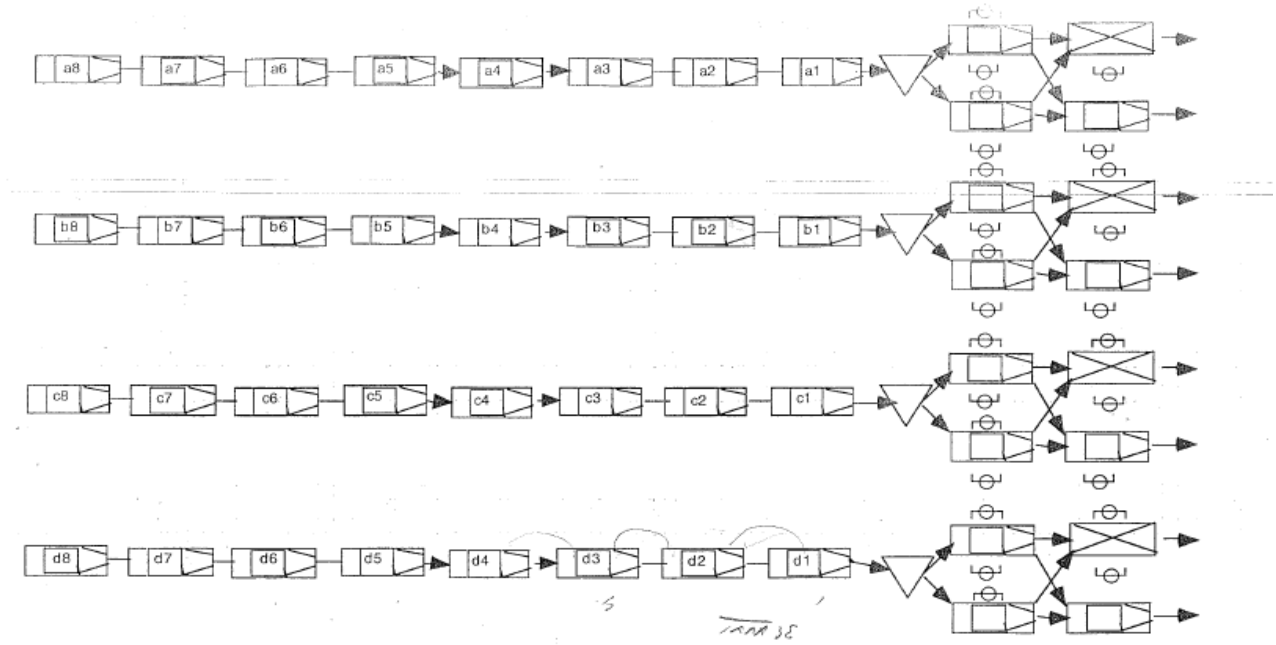
51 Interviews with Glenn Bergstrom, Olle Ludvigsson, and Mattias Jonsson.
52 Interviews with Olle Ludvigsson and Magnus Sundemo.
53 Interviews with Anders Boglind and Björn Mattsson; conversation with Tomas Engström and Lars Medbo.
54 Interview with Anders Boglind.

engineers at Chalmers University, UPS allows each team to decide which car model to produce.[55] Accordingly, the Chalmers engineers proposed a decentralization of production at the team level thanks to a buffer that would have collected and distributed the car components according to the car models required by the teams, as shown in Figures 4 and 5 (Engström and Medbo, 1992). This was never done in Uddevalla and, according to the project team, sometimes the cars being assembled did not match the knowledge and the rhythms of the teams.[56]

At the same time, the plant development was not optimal due to certain shortcomings in the incentive scheme. According to the academic specialist Anders Boglind, the project team attempted to include too many features in its work humanization program.[57] This is confirmed by two pieces of data, involving the turnover rate and the number of employees who were able to assembly a whole car. In 1991, the turnover rate was around 6%, and so was similar to that in other Lean plants, which had lower training costs (Adler and Cole, 1995). Thus, it was lower compared to the other Swedish plants, but not as low as expected. The turnover rate did not drop merely due to the mismatch between the Swedish labor market and Volvo's decision to build heterogeneous teams. Indeed, many young men and women could have left the plant due to the long military and parental leaves established by Swedish law.[58] As stressed by the interview with Benny Frick, the turnover rate negatively affected the plant life because each time a worker left the company, another one had to be hired or someone retrained in his place.[59]

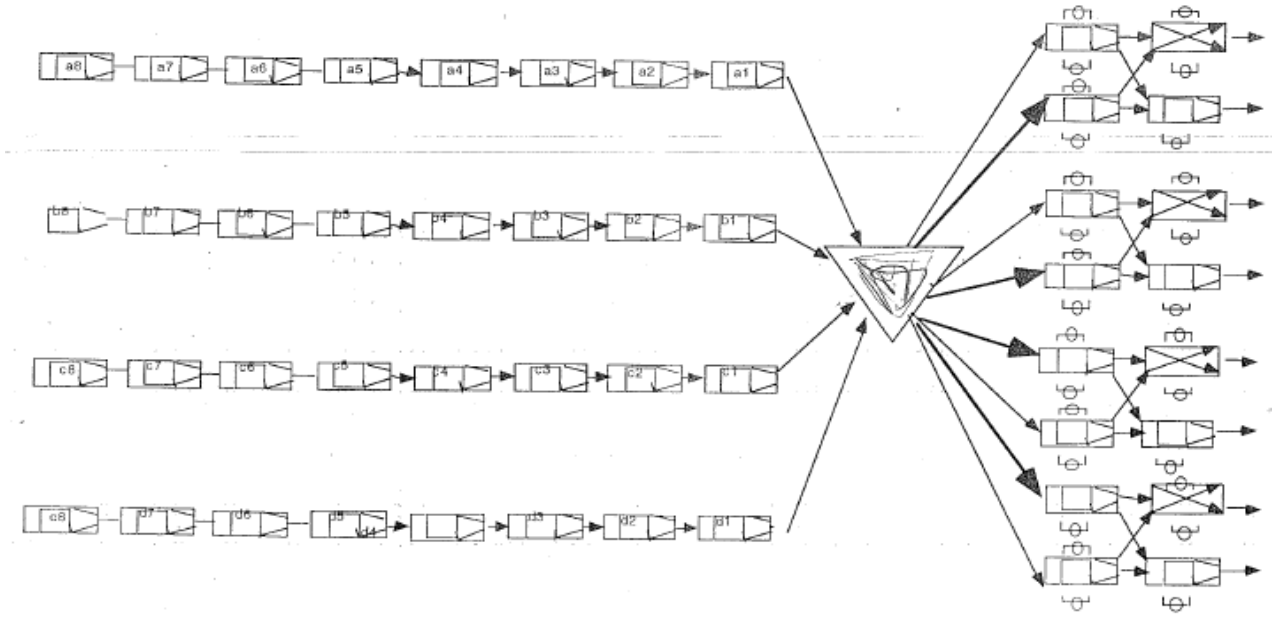
55 Conversation with Tomas Engström and Lars Medbo.
56 Ibid.
57 Interview with Anders Boglind.
58 Conversation with Lars Medbo.
59 Interview with Benny Frick.

Figure 4: **Schematization of the product flow structure as it was adopted**



Note: a1, b1, c1, and d1 represent the different car models. In this framework, the production schedule is designed by the central management, which assigns to each team a certain type of car. The triangles represent the buffers for each team. Picture from Chalmers University.

Figure 5: **Schematization of the optimal product flow structure**



Note: Car models a1, b1, c1, and d1 were chosen by the teams according to their own abilities and the time need for assembly. The large triangle represents the buffer that allowed each team to choose which car model to assemble. Picture from Chalmers University.

At the same time, if more employees had been able to train the new entrants, it would have been easier to replace the workers who left the company. Unfortunately, in 1990 only 12 workers were awarded the diploma certifying their skills (Follis et.al., 1991). In 1992, 25% of the workforce received the diploma, with only one woman among them,[60] even the project team had observed that their women workers were better than the men in building a whole car. Tomas Engström, professor at Chalmers University who participated to the factory planning and studied the factory environment argues that the reward offered the workers should have been job satisfaction rather than monetary compensation, and that monetary incentives to obtain the diploma were not enough to induce the workers to certify their skills.[61] This meant that the costs of training new entrants were too high because only some of them could be trained by their colleagues. Consequently, Volvo Uddevalla did not follow a path of optimal development. Thus, when the market crises hit Volvo, Uddevalla was in a weaker position compared to Torslanda, and management and the metal workers' union together agreed to shut down the plant.

8. **Conclusions**

This paper challenges the established view of Lean Production, because it shows that TPS is not a universally applicable form of work organization. The evidence for this statement can be found in three main areas. First of all, I have shown that the incentive scheme provided by the Opel management exactly matched certain GDR labor market features, including poor work norms and a high unemployment rate. Thus, Opel Eisenach's success in terms of productivity cannot be explained only by its ability to implement TPS.

Secondly, although UPS was a work organization created to overcome the problems caused by the high labor turnover rate in Sweden, other problems were encountered during its start-up phase. On one hand, the lack of cooperation between Volvo's engineers and its project team damaged the system implementation. On the other hand, parental and military leaves affected the turnover rate because the factory employed a significant number of women and youths. The problem could have been solved if the workforce had been able to train the new entrants, but the monetary incentives offered were not high enough to motivate the employees to seek further training. Consequently, the Volvo Uddevalla plant was shut down not because it had not adopted TPS, but because of serious problems in the planning and start-up phases that could have been solved during the later development.

60 Conversation with Thomas Engström.
61 Ibid.

Lastly, this paper hints that UPS could have had a far greater effect in the medium term that TPS, because the Opel Eisenach environment had deteriorated due to the workers' ageing. However, the Swedish plant was designed to adapt to the ageing of its workforce, because each team would employ a certain percentage of older workers. Thus, we can suppose that the factory productivity results would have challenged the TPS results in the medium term. Unfortunately, this proposition cannot be tested due to the rapid decision to shut down the Uddevalla plant.

9. **Appendix**

Table A1: **List of Persons Interviewed**

	Place	*Date*	*Role*	*Minutes*
Lieske Harald	Eisenach	07/10/13	Worker in AWE and later in Opel Eisenach plant. Work Council chairman from 1993 to 2013.	64
Schäfer Reinhard	Eisenach	08/10/13	Worker in AWE and later in Opel Eisenach plant. Work Council member. IG-Metall chairman at Opel Eisenach.	45
Giesing Ralf	Eisenach	08/10/13	Human Resource Manager in Opel Eiseanch plant since the beginning.	25
Iffland Gerhard	Eisenach	09/10/13	Worker in Opel Eisenach plant since the beginning. Currently First Line Manager.	21
Ortloff Thomas	Eisenach	09/10/13	Worker in AWE and later in Opel Eisenach plant. Work Council member.	35
Krauß Gerd	Eisenach	09/10/13	Worker in AWE and later in Opel Eisenach plant. Work Council member.	37
Möncher Jens	Eisenach	09/10/13	Worker in Opel Eisenach plant since the beginning. IG-Metall Shop Steward.	34
Künhast Uwe	Eisenach	09/10/13	Worker in AWE and later in Opel Eisenach plant.	23
Gimm Thomas	Eisenach	09/10/13	Worker in Opel Eiseanch plant since the beginning. Currently First Line Manager.	24
Laubach Uwe	Eisenach	11/10/13	Current First Delegate IG Metall Eisenach.	70
Jonsson Mattias	Göteborg	11/04/14	Blue Collar Worker in Volvo Uddevalla plant since 1995. Chairman of IF-Metall Union in Uddevalla from 1998 to 2002. Member of the Swedish Parliament since 2010.	73
Boglind Anders	Göteborg	11/04/14	Academic Specialist in Volvo Car Corporation, he was hired full-time since 1989. He worked in different management positions.	91
Frick Benny	Uddevalla	15/04/14	White Collar Worker in Volvo Uddevalla since 1986. Chairman of SIF union.	109
Karlsson Anne	Uddevalla	15/04/14	Blue Collar Worker in Volvo Uddevalla since 1996. Chairman of IF-Metall union from 1996 to 1998	57
Granath Åke	Uddevalla	15/04/14	Blue Collar worker in Volvo Uddevalla since 1998. Chairman of IF-Metall union	39

			from 2003 to 2008.	
Bergstrom Glenn	Torslanda	16/04/14	Blue Collar worker in Volvo Torslanda since 1974. Union full-time officer since 1992. Member of the Volvo Board of Administration since 2009.	111
Mattsson Björn	Torslanda	17/04/14	Test Driver in Volvo Torslanda since 1982. He was involved in the project to rebuild Torslanda from the Metall side.	60
Fortgens Walter	Phone	21/04/14	Volvo Uddevalla CEO since 2000.	35
Sundemo Magnus	Phone	24/09/14	Chairman of the Academic Union in Volvo in the periods 1992-1995 and 2007-2014.	9
Klaus Franz	Phone	30/09/14	Member of the bargaining over Lean Production in the Western Opel plant (1988). Chairman of the Opel European Work Council, 2002-2014.	31
Ludvigsson Olle	Phone	08/10/14	Chairman of the IF-Metall union at Volvo 1991-2003.	10

Table A2: **Draft List of Interview Questions for Eisenach Workers**

1) Where do you live? When did you start to work at Opel Eisenach?
2) Did you receive any training before coming to work at Eisenach?
3) How would you evaluate the training?
4) Which tasks did you perform at the workplace?
5) How much did you generally need to perform a given task? Did the time cycle change over the years?
6) Did you normally rotate the tasks with your colleagues?
7) How would you evaluate the job rotation experiment?
8) Except for your main tasks, did you need to perform other activities?

9) How would you evaluate the work team experience? What in your experience were the positive sides and which the negative sides?
10) Which policies helped the company to build a team spirit? How do you evaluate these policies?
11) Could you stop the assembly line?
12) What would generally happen when you found a mistake in the production process?
13) Could you consider your work as being autonomous? Which characteristics of your job made you feel more autonomous and which made you feel more constrained?
14) Did you expect a different kind of job after the training?
15) In your impression, how did your job at Eisenach change compared to your job at Rüsselsheim in the 1970s?
16) In your impression, how did your job at Opel change compared to the job at Wartburg?

17) What were the tasks of the team leader?
18) Which of his tasks did he seem to perform most?
19) What were the relationships between the team leader and other workers?
20) Were the team leaders appointed by the management or elected by the team?
21) Which system of team leader selection did you prefer?
22) Do you think all of the other workers were able to perform the tasks assigned them by the team leader?

23) What were the tasks of the area engineers?
24) Among the tasks of the area engineer, which ones was he most involved in performing?
25) What, generally, was the character of the relationships between the workers and area engineers?
26) What, generally, was the character of the relationships between the team leaders and area engineers?

27) How would you evaluate labor/management relations in the Eisenach factory?
28) What were the work council's tasks?
29) How would you evaluate the role of the work council in Eisenach?
30) Did you participate in any strike involving specific matters at Eisenach?
31) What do you think were the conditions that caused the strikes in 1993 affecting all of former East Germany?
32) In your impression, when was the moment of heaviest tension between management and workers while you were working there?
33) How would you evaluate the role of the IG-Metall?
34) In your opinion, which are the good sides of working at Eisenach? What do you think could be improved? How?

Table A3: **Draft of the interview question list for Uddevalla workers**

1) Did you receive any training before going to work at Volvo Uddevalla?
2) How would you evaluate the training?
3) What did you study previously? When did you start working at Volvo Uddevalla?
4) Was the training different from the standard training of Swedish metalworkers?

5) Which tasks did you perform at the workplace?
6) How much time did you generally need to perform a given task? Did the time cycle change over the years?
7) Did you normally rotate tasks with your colleagues?
8) Apart from your main tasks, did you need to perform other activities?
9) How would you evaluate the teamwork experience?
10) Which policies helped the company build a team spirit?
11) What, generally, would happen when you found a mistake in the production process?
12) What, generally, would happen when a worker make a mistake?
13) Did it seem to you that your job included some white collar tasks?
14) What were the main differences between the workers' tasks in the parallel work flow system in 1989 and the semi-parallel work system in 1995?

15) What were the tasks of the team leader?
16) What were the relationships between the team leader and other workers?
17) Were the team leaders appointed by the management or elected by the team?

18) What were the tasks of the product shop leaders?
19) What were the relationships between workers and product shop leaders?
20) What were the relationships between team leaders and product shop leaders?
21) How would you evaluate the labor/management relations at Volvo Uddevalla?
22) Did it seem to you that there was mutual trust between workers and management?
23) Were the unions able to influence management decisions? How?
24) What was your role in the union? How was the union structured inside the plant?
25) How was generic bargaining between unions and management at Volvo performed?
26) Which topics were more stressed by the unions during the bargaining?
27) Were strikes usually called by the union, as opposed to being wildcat? If so, why do you think that was?
28) What were the relationships of the different unions with one another?
29) How did your unions evaluate the new work organization at Uddevalla?
30) Did the role of the unions change in order to adapt to the new Uddevalla work organization? If, so how?
31) How did the management evaluate the new work organization at Uddevalla?
32) Why was an assembly line eventually introduced?
33) In your opinion, what were the positive sides of working of the Uddevalla experience? What do you think could be improved? How?

Table A4: **Plant Performance and Workforce Characteristics in 1989**

	Japanese in Japan	*Japanese in North America*	*Americans in North America*	*All Europe*
Productivity (hours/vehicle)	16.8	21.2	25.1	36.2
Quality (Assembly Defects/100 Vehicles)	60.0	65.0	82.3	97.0
% of Workforce in Teams	69.3	71.3	17.3	0.6
Job Rotation (0 = none, 4 = frequent)	3.0	2.7	0.9	1.9
Suggestions/Employee	61.6	1.4	0.4	0.4
Training of New Production Workers (hours)	380.3	370.0	46.4	173.3
Absenteeism	5.0	4.8	11.7	12.1

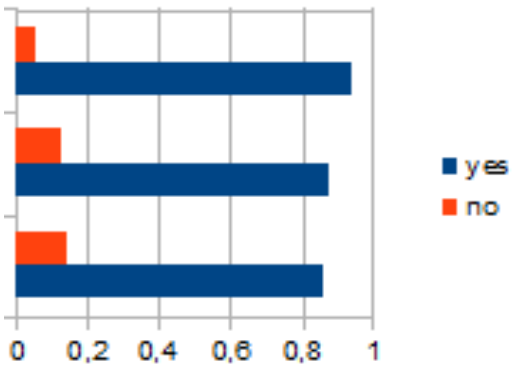
Source: Womack et al. (1990)

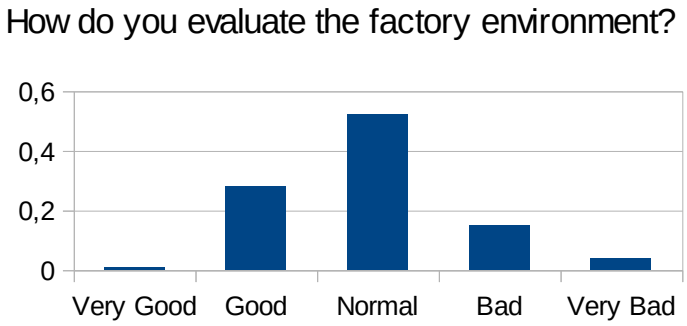
Figures A1. **Survey of Shop Stewards and Work Councils at Opel Eisenach, March 1997**

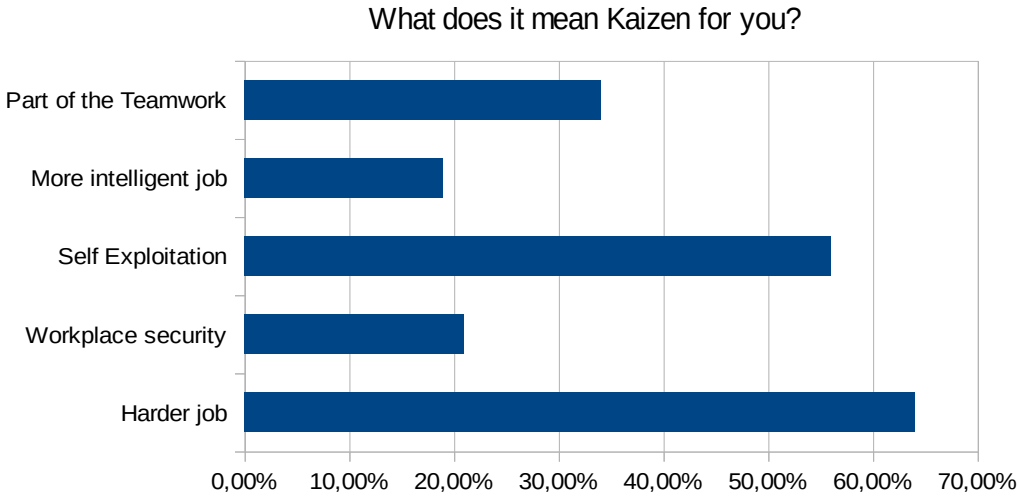
Do you want to participate in industrial actions inside the formal bargaining process?

Do you want to participate in industrial actions outside the formal bargaining process?

Does Eisenach penalize you when you express your opinion?







Note: 270 workers surveyed

Table A5: **Volvo Uddevalla Results**

	Results
Productivity	Reached the Torslanda level in 1991. From 70 hours to assembling one car in 1990 to 36 hours in 1992.
Learning	Whole car assemblers built complete cars in 10 hours.
Improvement Suggestions	Very good environment for making suggestions for improvement
Absenteeism	Absenteeism was lower than in the Torslanda plant, but the difference was not high. Average of Sick Leave absences about 12% in 1990.
Turnover Rate	During the first year, the labor turnover was very high. In 1991 it was 6%, and in 1992, 4%. Turnover rate was similar to that of the NUMMI plant in the US.
Quality	The Quality results were not stable during the early years. In 1992, the Volvo Uddevalla plant received 124 complaints for every 100 cars produced. The same year, Torslanda received 144 complaints, while the average for European cars sold in US was 158. In 1993, the car model that was assembled at Volvo Uddevalla received 87 complaints.
Flexibility (Machinery)	25% less tooling cost per car than at Torslanda
Flexibility (Personnel)	The training costs, when the car model was changed, were 60% lower than at Torslanda

Sources: Berggren (1995), Adler and Cole (1995).

How Can Lean Production Cause Social Conflicts?
The Role of Institutions in the Fiat Melfi Case (1989-2004)

Enrico Cerrini[a]

[a]Dipartimento di Economia Politica e Statistica – Facoltà di Economia "Richard M. Goodwin"
Università degli Studi di Siena – Piazza San Francesco, 7 - 53100 Siena, Italy

Abstract

The scholarly literature usually associates Lean Production with high productivity, difficult working conditions, and a low rate of social conflicts in the facilities that have applied this model of work organization. In some cases, social conflicts arose that caused heavy losses to company profits. One of these cases was that of the Fiat Melfi plant, which was the site of the most important attempt to transplant the Japanese model of Lean Production to Italy. The Melfi plant, which opened in 1993, had a high level of productivity, but social problems developed and the facility was affected by one of the most important social conflicts to emerge in Italy since the 1970s. In this chapter, I explore why social conflicts arose in a Lean environment. I answer this question by studying the history of the Fiat Melfi plant through a series of interviews with workers, union leaders, and managers, as well as through a study of original Fiat publications. The results of this analysis show that the Lean Production model implemented by Fiat had four shortcomings that were consequences of characteristics of the Italian situation, Italy's labor unions, and Fiat itself.

JEL Classification numbers: J53, L62, N64, P12
Keywords: Lean Production, Social Conflicts, Institutional Failure

1. **Introduction**

Lean Production is a model of work organization that was introduced in Western factories during the first half of the 1980s. After its introduction, the strike rate dropped and industrial relations became quieter. In this chapter, I will explore the relationships between social conflicts and Lean Production, which are not adequately explained in the extant scholarly literature. For example, the academic management literature that is appreciative of Lean Production does not explain social conflicts because it stresses the idea that lean plants are characterized by better industrial relations due to higher levels of worker involvement (Womack et al., 1990; MacDuffie, 1995; Adler, 1999). Moreover, some of the works in sociology stress that certain typical Lean Production features, such as teamwork, can sharply increase management surveillance of the workforce (Sewell, 1998). However, management scholars who are critical of Lean Production observe that it can cause tensions due to the unions becoming disillusioned when management fails to deliver on its promises (Berggren, 1993).

In general, mainstream academic literature on Lean Production has not been interested in social conflicts. Management literature, for its part, usually suggests that social conflicts became unnecessary, whereas much of the sociological literature stresses that Lean Production establishes a form of social control that can prevent the clear expression of social conflicts. Nonetheless, history shows that social conflicts are possible in a lean environment even if they are not common. There have been only two strikes in lean environments in the automotive sector. The first strike occurred in Canadian Automotive Manufacturing Inc. (CAMI), a Canadian plant in Ontario; the second occurred in Fiat Melfi, which is located in southern Italy. I focus on the Fiat Melfi case in order to explore the conditions that are necessary to create conflicts between blue collars and management in this work environment.

I chose to analyze the Fiat Melfi case because of certain peculiarities: Fiat Melfi was built to implement Lean Production, making it a greenfield environment; it is one of the largest world automotive facilities built after 1980; Fiat was the biggest Italian private company at that time;[1] and its management considered the facility a success in term of productivity. Furthermore, the Italian case is unique because Fiat Melfi was built in an area that lacked any industrial traditions. In Western countries, all of the other greenfield environments were located in areas that had already been industrialized. In order to understand the strikes that affected the Melfi facility, I will focus on Fiat's history, which was characterized by conflictual industrial relations.

Throughout the 1970s, Fiat suffered from social conflicts and turmoil that sometimes paralyzed

1 Anon, 1995, "Fortune Global 500", http://fortune.com/global500/1995 [last access, April 7, 2015]

its plants' activities. By the beginning of the 1980s, the social conflicts had calmed down due to the changes in Italian society, and Fiat also benefited from a market recovery. At the end of the 1980s, the favorable market conditions pushed the Fiat management to build a new factory in Melfi, a town in the Basilicata region of southern Italy. Plant operations started in 1993, and Fiat decided to adopt the model of Lean Production in the new factory. Additionally, Fiat established a series of joint committees intended to allow for union participation in management decisions as well as to prevent conflicts. The plant's first years were characterized by huge successes in terms of productivity, quality, and industrial relations. However, in 2004 a massive strike hit the Melfi plant during a moment of relatively peaceful labor management relationships in Europe.

The chapter is organized as follows: Section 2 describes some of the literature on Lean Production, focusing on the relationship of Lean Production to social conflicts and its impact in the Fiat case; Section 3 introduces the global context that characterized the birth of Fiat Melfi; Section 4 describes Fiat's bargaining history; Section 5 presents the original sources used to reconstruct the plant's history; Section 6 introduces Italian bargaining institutions, which are composed by national law and by negotiang bodies such as trade unions and employers' federations; Section 7 presents the conflict prevention scheme elaborated by Fiat; Section 8 explains how the conflicts started; and Section 9 concludes.

2. Literature Review

Most scholarly literature on Lean Production in management science suggests that Lean Production can improve plant productivity, especially in the automotive sector (Wickens, 1987; Womack et al., 1990). These scholars also predicted that if workers were to obtain better working conditions thanks to industrial actions, plant productivity would be negatively affected (Adler, 1998). The new model of work organization was called Lean Production because it reduced production waste by using fewer resources to reach the same output levels as in the previous model of work organization, known as Mass Production. In this chapter, I define Lean Production as a model of work organization that adopts three management practices: "just-in-time," according to which production should be based on market requests; total quality management, from whose perspective the assembly line should guarantee a continual improvement of production; and teamwork (Shah and Ward, 2007).

On the one hand, management literature appreciative of Lean Production stresses that the new Human Resources Management system will improve working conditions (MacDuffie, 1995), especially if management applies it correctly (Conti et al., 2006) and workers are actively involved in the work

organization (Adler, 1999). Thus, lean plants were assumed to operate in the best possible circumstances, leaving no reasons for workers to strike. Another academic stream composed of economists, sociologists, and psychologists, believed that the new model of work organization might cause work intensification, which could increase cardiovascular diseases, musculoskeletal disorders (Landsbergis et al., 1999), job stress (Parker and Slaughter, 1990), and psychological distress (Parker, 2003). According to these scholars, the effects of Lean Production on workers' health could offset the initial productivity advantages.

Although the latter stream of literature on Lean Production looked at the strikes in a favorable way, these scholars did not make any predictions about the possibility of industrial actions. Few hints about the relationship between Lean Production and strikes are sketched by Berggren (1993) in his analysis of the strikes at the Canadian plant CAMI and the strike threat at the US Mazda facility Flat Rock. He draws the conclusion that these tensions were caused by the unions' mistrust in management's promises. One geographer pointed out that when production is based on market requests, the strike instrument is empowered; then, if a plant or department does not provide the other plants with the pieces necessary for production, the whole system can be stopped (Herod, 2000). But then, if Lean Production made the strike a more powerful instrument, why did few strikes arise in factories that used it?

Two different streams of sociological thought have attempted to answer this question. One refers to the ideas of Marx, and the other to those of Michel Foucault. Foucauldian sociologists argue that workers' resistance on the shop floor tend now to be individual rather than collective because the social structure has changed and the new model of work organization encourages a direct approach between management and workers, allowing management to overcome the power of unions. On the one hand, workers do not achieve class consciousness, while on the other, the control mechanisms of management over workers are so strong as to impede conflicts (Sewell, 1998, 2001). Contrariwise, Marxian sociologists argue that underneath the apparent peace, there exists the basis of a new collectivism based on workers' class consciousness. For example, blue collars could help each other when they are unable to keep up with the assembly line or when they feel threatened by management (Stephenson and Stewart, 2001). This means that industrial actions can arise in some cases (Thompson and Ackroyd, 1995; Martinez and Stewart, 1997).

When the Fiat Melfi plant opened, Italian sociologists debated the relationship between workers and management in the *Fabbrica Integrata* (Computer Integrated Manufacturing) model, which was the Fiat Lean Production protocol:

1. Some sociologists looked at *Fabbrica Integrata* as involving a gift exchange between workers

and management, because the workers paid greater attention to quality in exchange for less effort being needed thanks to the use of automation (Bonazzi, 1993).

2. Foucauldian sociologists looked at the Melfi plant as a huge mechanism of control for management to use with workers (Cavazzani et al., 2001).
3. Other scholars pointed out that Lean Production was a complex mechanism. They suggested that Fiat carefully institute industrial democracy in order to avoid conflicts (Guidi, 1996) and solve the conflict between workers' desire for greater job involvement and productivity requirements (Cerruti, and Rieser, 1991; Cerruti, 1994).

3. The Global Scenario in the Automotive Sector since the 1980s

After the Second World War, US motor vehicle production continually increased; the demand for cars was apparently unlimited. In 1973, the first oil crash gave rise to the first market crisis in the automotive sector, and demand became more volatile. In 1979, the Iranian Revolution caused a second market crisis in the automotive sector due to the sharp increase in oil prices. The dominant model of work organization, Mass Production, became obsolete because the old production system was unable to adapt to demand volatility. It also suffered from competition with Japan. As shown in Figure 1, Japanese motor vehicle production overcame US production in 1980. These events drove US car companies to study Toyota's work organization model. The US government even imposed restrictions on Japanese imports. GM and Toyota, two of the world's biggest car manufacturers,[2] led the change by establishing a joint venture.

Toyota and GM built a joint plant in California to overcome their respective problems: GM could study the Japanese Lean Production model, and Toyota could sell its cars in the US (Duerr et al., 2005). This joint venture became the most influential Japanese transplant; called New United Motor Manufacturing Inc. (NUMMI), it was considered a successful experiment in terms of productivity, flexibility, working conditions, and industrial relations (Adler et al, 1998; Adler, 1999). Table 2 shows the successful experience of the Japanese North American transplants in terms of productivity, quality, and absenteeism. Western firms began to adopt Lean Production in order to catch up with their Japanese counterparts. Due to resistance to changing the model of work organization in existing plants, automotive companies often exploited market recoveries to build new plants. In the new plants, European and North American companies introduced the Lean Production features that they thought

2 In 1995, GM ranked as the fifth largest company in the world (first among car manufacturers), and Toyota as the eleventh (third among car manufacturers). Anon., 1995, "Fortune Global 500."

could improve workers' skills and allow them to participate in production and quality improvement.

Table 1. **Passenger Cars Produced by Major Motor Companies (1986-2011)**

Company	*Country*	*1986*	*1991*	*1996*	*2001*	*2006*	*2011*
BMW	GER	432	931	1,095	947	1,367	1,738
Chrysler	USA	(1,170)	528	971	1,104[A]	748	502
Daewoo	KOR		241	623	469	757[B]	
Daimler-Benz	GER	594	575	641	2,392[A]	1,275	1,443
FIAT	ITA	(1,652)	1,811	2,230	1,929	1,756	1,741
Ford	USA	(1,809)	3,002	3,637	3,699[C]	3,957[C]	3,094
GM[D]	USA	(4,351)	4,770	5,139	4,663	5,780[B]	6,494[B]
Opel - Vauxhall[D]	GER		1,620	1,771	1,942	1,862	1,224
Honda	JPN	(1,025)	1,781	1,832	2,608	3,550	2,886
Hyundai – Kia	KOR		901	1,600	2,087	3,190	6,118
Mazda	JPN	(811)	1,155	695	780	1,009	1,104
Mitsubishi	JPN	(579)	1,074	948	1,242	1,009	1,017
Nissan	JPN	(1,769)	2,203	2,025	1,967	2,512	3,581
PSA	FRA	1,707	2,171	2,100	2,710	2,961	3,161
Renault	FRA	1,754	1,624	1,862	2,070	2,137	2,443
Suzuki	JPN	(300)	531	946	1,162	2,004	2,337
Toyota-Daihatsu	JPN	(2,826)	3,984	3,985	5,021	7,705	6,794
Volkswagen	GER	2,423	2,700	3,803	4,881	5,430	8,157
Volvo	SWE	414	261	373	419[C]	427[C]	462
Total			30,900	34,973	40,853	49,918	59,897

Note: Production of passenger cars and light commercial vehicles in thousands of units. The numbers in parentheses represent production in the countries where the companies' headquarters are located.

Sources: FIOM Piemonte, "FIAT Auto negli anni '90: Occupazione, produzioni e mercato," [FIAT Auto in the 90s. Employment, production and market], February 26-27, 1998, http://www.fiompiemonte.it/Storico/fiompie/tutfiat/fiat90_01.htm [last access, February 24, 2015]; www.oica.net [last accessed March 9, 2015]; Japan Automobile Manufacturers Association, "Motor Vehicle Statistics of Japan," 2011; Anon., "US Automobile Production Figures," http://en.wikipedia.org/wiki/U.S._Automobile_Production_Figures [last access, April 7, 2015]; Volkswagen Aktiengesellschaft, 2008, "Volkswagen Chronik: Der Weg zum global Player," Wolfsburg: Daimler-Benz Annual Report; Freyssenet (2007).

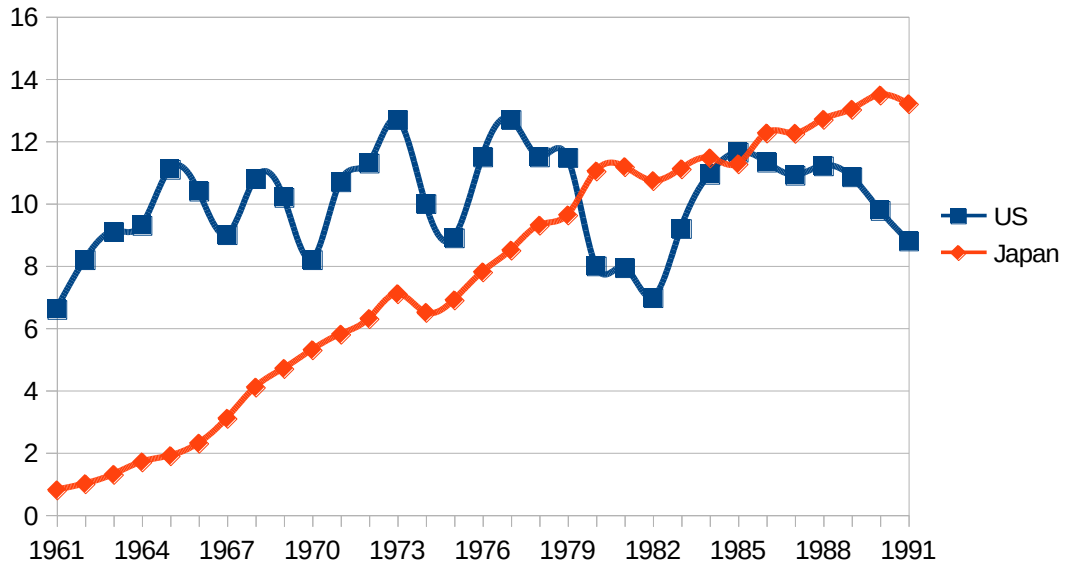
A In 2001, Daimler-Benz production included Chrysler.

B In 2006 and 2011, GM production included Daewoo.

C In 2001 and 2006, Ford production included Volvo.

D GM production includes Opel.

Figure 1: **Motor Vehicles Produced in the US and Japan (1961-1990)**



Note: Numbers refer to millions of passenger cars, light commercial vehicles, minibuses, trucks, buses, and coaches produced each year. Source: Michigan Statistical Abstract 1996, Ann Arbor, MI: University of Michigan Press.

Table 2: **Plant Performances and Work Force Characteristics in 1989**

	Japanese in Japan	*Japanese in North America*	*American in North America*	*Europe*
Productivity (hours/vehicle)	16.8	21.2	25.1	36.2
Quality (Assembly Defects/100 Vehicles)	60.0	65.0	82.3	97.0
% of Workforce in Teams	69.3	71.3	17.3	0.6
Job Rotation (0 = none, 4 = frequent)	3.0	2.7	0.9	1.9
Suggestions/Employee	61.6	1.4	0.4	0.4
Number of Job Classes	11.9	8.7	67.1	14.8
Training of New Production Workers (hours)	380.3	370.0	46.4	173.3
Absenteeism	5.0	4.8	11.7	12.1

Source: Womack et al. (1990)

In Europe, the first Japanese transplant was Nissan Sunderland, which was built in 1984 in the UK. At the end of the 1980s, Mediterranean countries started to show interest in Japanese models of work organization and the Fiat *Fabbrica Integrata*, based on North American transplants, was created (Camuffo and Miceli, 1997). Opel was the first German company to adopt the Japanese model of work organization, but the initial results were not satisfactory. After German reunification, Opel managers opened the Eisenach factory in the former GDR, and it became one of the most productive European plants (Jürgens, 1998). Swedish Lean Production development started in 1993 after the previous model of work organization, which was based on workstations and autonomous teams, was abandoned.[3]

The Melfi plant was the most important attempt to establish Lean Production in an Italian factory. This attempt was made by the biggest Italian private firm, and it was peculiar because the greenfield plant was built in an area where there was no industrial culture. Many greenfield transplants had been located in areas that were host to an obsolete car plant, such as NUMMI, VW Zwickau, and Opel Eisenach. Fiat Melfi was also the one of the largest plants to adopt Lean Production between the 1980s and the beginning of the 1990s. It is worth noting that the VW plant in Zwickau never reached

3 Interview with Glenn Bergstrom (full time union officer at Volvo since 1992, member of the Volvo Board of Administration since 2009).

satisfactory productivity levels, while Fiat Melfi was the eighth most productive European plant in 2000 and the third most productive in 1997.[4] Table 3 lists the European facilities that opened between 1980 and 1995.

Lean plants were rarely affected by strikes, as shown in Tables 3 and 4. Only four North American facilities were unionized; in some cases, workers were not interested in the union,[5] while some unionized factories were regulated by no-strike deals, such as Diamond Star (Berggren, 1993). Some factories experienced only a few strike threats, such as Mazda Flat Rock at the beginning of the 1990s and Nissan Sunderland in 2003.[6] The strikes were not always related to working conditions. For example, the Opel Eisenach and VW Zwickau plants suffered strikes in 1993, when the former GDR workers asked for the same wages being paid to their West German counterparts.[7] Spanish Martorell workers struck in 2005 to stop wage cuts planned by Seat.[8] The only two relevant conflicts that affected lean plants were the CAMI strike in 1992 and the Fiat Melfi strike in 2004.[9] The Fiat Melfi case allows for the study of a factory that was larger, more productive, and more important from the company's point of view than the Canadian plant.

4 Anon., "Nissan's Sunderland car plant sets new European productivity standards," *PR Newswire*.

5 "UAW and Why Honda and Toyota Workers Are Not Interested," *Automotive News*, March 27, 2007, http://www.automotive.com/news/uaw-and-why-honda-and-toyota-workers-are-not-interested-1478/ [last access, October 24, 2014].

6 Gow David, "Nissan's First Strike Dangerously Close, *The Guardian*, January 21, 2003, http://www.theguardian.com/business/2003/jan/21/motoring.carindustry [last access, October 24, 2014].

7 Interviews with Uwe Laubach (IG-Metall First Delegate at Eisenach), October 11, 2013, Harald Lieske (Work Council Chairman at Opel Eisenach, October 7, 2013.

8 Daniel O'Rourke and Paul Mitchell, "Spain: Auto Unions Agreed Redundancies at SEAT," *World Socialist Web Site*, December 28, 2005, http://www.wsws.org/en/articles/2005/12/seat-d28.html [last access, October 24, 2014].

9 About the CAMI strikes, see *Toronto Star* between September 14 and October 19, 1992. On the Fiat Melfi strikes, see the book: VV.AA., *La primavera di Melfi: Cronaca di una lotta operaia*, Milan: Edizioni Punto Rosso, 2004.

Table 3: Major **European Lean Plants**

Company	*Location*	*Start*	*Production*	*Employees*	*Productivity*	*Strikes*
Nissan	Sunderland, UK	1984	330,000	4,600	101	No Strike Deal Strike Threat January 2003
Toyota	Burnaston, UK	1989	170,000	2,800	86	No Strike Deal
Opel	Eisenach, FRG	1993	145,000	1,800	81	Strikes in 1993 and 2003 for East and West German parity
Fiat	Melfi, Italy	1993	364,000	5,300	76	Strikes since 1996, 3 weeks of strike in April 2004
Renault	Novo Mesto, Slovenia	1988	122,000	2,000	73	
Seat	Martorell, Spain	1993	516,000	8,400	71	Some strikes in 2002, 2004, 2005, each lasting a few days
Opel	Zaragoza, Spain	1982	373,000	8,700	62	35 days of strike between 1982-1988 Only national strikes after LP implementation
Honda	Swindon, UK	1985	74,000	2,600	55	No Strike Deal
Daimler	Rastatt, FRG	1992	200,000	4,700	53	Two Regional strikes in 2002 and 2007
VW*	Zwickau, FRG	1990	230,000	7,000		Strikes in 1993 and 2003 for East and West German parity

Note: Productivity is calculated on the base of the vehicles produced by each worker. Productivity, employees, and production are for the year 2000. The information on strikes is drawn from major world publications found in the Lexis/Nexis archive and conversations with union leaders who were working in the plants.

*Production and employees for 2012. Source: Volkswagen News, "Die Volkswagen Sachsen GmbH," http://www.volkswagen-sachsen.de/documents/pressemitteilungen/allgemeines/Die_Volkswagen_Sachsen_GmbH.pdf [last access, October 23, 2014].

Sources: Anon., "Nissan's Sunderland plant sets new European productivity standards.",

Table 4: **Strike Rates in Manufacturing Companies by Country (1980-2008)**

	1980-1984	*1985-1989*	*1990-1994*	*1995-1999*	*2000-2005*	*2005-2008*
UK	0.08	0.03	0.01	0	0	0
US	0.01	0	0	0.01	0	0
Canada	0.04	0.02	0.01	0.01	0	0.01
Germany	0.02	0.01	0.01	0.01	0.02	0.01
Sweden	0.11	0.02	0	0	0	0
Spain		0.21	0.15	0.07	0.06	0.05
Italy	1.04	0.42	0.3	0.11	0.08	0.08

Note: The Strike Rate is calculated by dividing the number of workers on strike in the manufacturing sector by the total amount of employees in the manufacturing sector. Sources: ILO Laborsta, http://laborsta.ilo.org [last access, October 23, 2014].

4. How Fiat Adopted Lean Production

Fiat's history played a pivotal role in the way the Italian company adopted Lean Production. After the Second World War, Fiat CEO Vittorio Valletta introduced Taylor production principles: workers' tasks were divided and standardized, power was executed by central management, and everyone else performed his job according to his position in the hierarchy (Musso, 2002). Valletta also thought that Fiat should grow to exploit economies of scale (Berta, 1998). During the Italian economic boom (1958-1963), the biggest plant in Turin was expanded and another plant was built in the neighborhood. Italy's high demand for small cars pushed Fiat's growth, and by the end of the 1960s, Fiat had become the largest European car company in terms of the number of cars produced (Volpato, 1996).

Inside the Fiat plants, there were four unions involved in industrial relations. Federazione Impiegati Operai Metallurgici–Confederazione Generale Italiana del Lavoro (FIOM-CGIL) was inspired by Communist and Socialist values; it was the most conflictual labor union and it was interested not only in the improvement of working conditions, but also in the promotion of its political values. Federazione Italiana Metalmeccanici–Confederazione Italiana Sindacato Lavoratori (FIM-CISL) was inspired by Catholic values and Unione Italiana Lavoratori Metalmeccanici–Unione Italiana del Lavoro (UILM-UIL) by social democratic values. These unions exhibited more cooperative behavior with management and were more interested in working conditions than in political ideas. Some workers belonging to the Catholic FIM union separated and established the Fiat company union,

which later would be called Federazione Italiana Sindacati Metalmeccanici e Industrie Collegate (FISMIC). After the Second World War, Fiat workers were more interested in salary improvement than in political ideas. Thus, FIM, UILM, and FISMIC had the greatest influence on the election of the *Commissione Interna* (Internal Commission), which functioned as the board of union representatives.[10]

Conditions changed in 1969 with the onset of sharp social conflicts. Due to a high level immigration from the countryside, cities became overcrowded and the demand for housing increased (Sabel and Piore, 1984). Immigrants became stressed by living conditions in Turin and by working conditions in the factories, and this was one of the aggravating factors in the nascent social conflicts. Even when management was able to negotiate agreements with the trade unions to restore production, they could not stop the turmoil (Dealessandri and Magnabosco, 1987). Later, at the beginning of the 1980s, due in part to changes in the social structure, the conflicts ended. The firm decentralized, moving production to small plants in the countryside, which decreased the housing pressure in the big cities. The government provided the working class with social welfare, while the introduction of robots working on assembly lines simplified many tasks. The social peace that then emerged was the result of a new social structure rather than reciprocal trust between management and workers.

At the same time, the market demanded a broader variety of supply, leading the management to introduce production flexibility. Followed a technological strategy in order to realize production flexibility at the beginning of the 1980s, Fiat's factories became highly automated (Volpato, 1996). After several years, management discovered that the machines were frequently out of order and required time to be repaired.[11] Fiat CEO Cesare Romiti later admitted that production needed human creativity to be improved.[12] The desire to take account of human creativity generated the work organization called *Fabbrica Integrata*, which made use of a kind of Lean Production. The new model of work organization should have changed Fiat's industrial relations through greater involvement of unions in company decisions (Fiat Auto, 1994). However, Lean Production failed to provide the firm with the expected results because the new model of work organization encountered resistance when it was implemented in the traditional Mass Production plants (Pessa and Sartirano, 1993; Damiano and Pessa, 2003).

Due to this resistance to adopting Lean Production in the old plants, Fiat decided to employ the Japanese model of work organization in its new facilities. When the Fiat management decided to produce a new car model (which later became the *Punto*), some managers thought it would be cheaper

10 The results of the election for the *Commissione Interna* can be found in Anon., *Le Commissioni Interne*, http://www.mirafiori-accordielotte.org/rappresentanza/commissioni-interne/ [last access, October 24, 2014].
11 Interviews with Leonardo Burmo and Piero Pessa.
12 Interview with Cesare Romiti by Paolo Guzzanti, December 12, 1992, "Io, l'Avvocato e la Fiat," *La Stampa*

to build a new plant than to change the assembly lines in the old plants (Donzelli et al., 1994). Management decided to use the opportunity to introduce the *Fabbrica Integrata* model of work organization in a plant that had never used Mass Production and at a location, Melfi, where the workforce was young and highly skilled (Cersosimo, 1994). Some years after the factory opened in 1993, two major sociological studies underlined its characteristics.

The first study pointed out problems faced by workers on the shop floor, including the fast work rhythms, difficult working conditions, and clientelism in the teams (Rieser, 1997). Another study, by researchers at the University of Salerno, described three kinds of workers (Cotesta et al., 2000):

1. Integrated workers who agree with managerial behavior.
2. Ritualist workers who perceive themselves as unrelated to the factory environment.
3. Fighter workers who distrust management when it does not implement features such as those of Lean Production that can improve working conditions. These workers are ready to fight to obtain their rights.

5. Sources

An historical overview will provide more information on the context and causes of the conflict. Lean Production was transplanted differently according to the culture of each company or country. These differences increased or decreased strike episodes.[13] Lewchuck, Stewart, and Yates (2001) concluded that Lean Production implementation was path-dependent, and so was influenced by the histories of the company and the country where it was located. The institutions that regulated plant life were major factors in whether or not Lean Production led to industrial actions. A collection of 17 interviews with union members, other workers, and managers who worked in the plant or participated in plant planning and bargaining provides insight into the history of the Fiat Melfi plant. The list of interviewees is presented in Table A2 in the Appendix.

The interviews are accompanied by information gathered from magazines addressed to the Fiat Group and Fiat Auto executives (Fiat Quadri and Fiat Auto Quadri), which were provided by the Fiat Historical Center (Centro Storico Fiat)..The archives of UILM and FIOM provided documents and materials from the unions as well as a partial collection of memos by the joint committees. Another important source is the collection of labor management agreements; some of them were provided by the Trade Union FIM Potenza, while others were found on the web page http://www.mirafiori-

13 Among the Big Three, Chrysler had the lightest working conditions and GM the hardest. GM was affected by more strikes than Chrysler and Ford together. See Lewchuk et al. (2001).

accordielotte.org/ and on the CD attached to the book *Dopo Lunghe e Cordiali Discussioni* (After Long and Cordial Discussions), by Cesare Damiano and Piero Pessa. Lastly, other sources include the original documents contained in the VV.AA.'s book *La primavera di Melfi: Cronaca di una lotta Operaia* (The Springtime of Melfi: Chronicle of a Workers' Struggle), and the online archives of the newspapers *La Stampa* and *L'Unità*.

6. Italian Bargaining Institutions

The Italian bargaining system is based on bargaining between unions and management. The Italian Constitution explicitly acknowledges the co-determination right of workers, and stresses that the law can regulate conflicts between the two parties (Giugni, 2006); these possibilities have never been applied because management and unions prefer to bargain rather than implement a workers' participation scheme. Italian law adjusted to this situation by allowing the parties to reach agreements through collective bargaining. On the one hand, a national collective agreement is the result of bargaining between the major unions and entrepreneurs. The national agreement sets the minimum standard working conditions. On the other hand, bargaining between labor and management generates decentralized agreements that can be applied to the entire firm or to a specific plant. A decentralized agreement improves working conditions beyond the minimum standards required by the national agreement (Giugni, 2006).

Even though bargaining is the main union instrument, representation on the shop floor remains important. Until 1970, the board of union representation was called *Commissione Interna*, which was intended to be a work council elected by the whole workforce (Regalia, 1995). In 1970, due to social conflicts that were affecting the entire Italian industrial sector, the parliament passed a law called *Statuto dei Lavoratori* (Statute on Workers), which not only guarantees the rights of union activism, but also formally acknowledges union representatives, whose activities are regulated by bargaining. The 1993 agreement establishes that at least two-thirds of these representatives must be elected by the whole workforce.[14]

According to the 1993 agreement, the union representatives were responsible for bargaining on behalf of workers and solving concrete problems on the shop floor instead of promoting political beliefs. However, the activities of union representatives were often influenced by the political beliefs of

14 The agreements about union representatives can be found on the FIOM site at http://fiomgd.altervista.org/blog/wp-content/uploads/2012/10/normative-rsu.pdf [last access, November 5, 2014].

their national unions.[15] This was directly related to the division of the unions that became manifest when an agreement lowered the wage indexed to the inflation rate. In 1984, this agreement was signed by CISL and UIL, but not by CGIL. In 1985, the unions stopped signing agreements as a single union and started stressing their ideological differences.[16] CISL and UIL behaved more cooperatively with management, while CGIL was more conflictual. During the 1990s, other conflictual unions emerged, including Comitati di Base della Scuola (COBAS), Unione Generale del Lavoro (UGL), and Federazione Autonoma Italiana Lavoratori Metalmeccanici e Servizi (FAILMS) .

In general, Italian law failed to provide unions with the co-management power they enjoyed in Sweden and Germany (Brulin, 1995; Müller-Jentsch, 1995). Neither did the law give management the ability to override unions; the right to strike was never weakened as it was in the US and the UK (Garrahan and Stewart, 1992; Berggren, 1993). Italian institutions shaped an informal industrial system, allowing unions and managers to influence each other on the base of their contingent bargaining power. Unions could constantly flex their bargaining power by striking, while to increase their power they sought to create a workers' class consciousness establishes solidarity among blue collar workers.

7. Where did the Conflicts arise?

The Italian bargaining institutions set the conditions that shaped the decentralized Melfi agreement, which was signed by the managers and unions in 1993. Two main problems characterized the bargaining. First, as stated by FIOM unionists, the main problem was that Fiat refused to bargain about work organisation,[17] pointing out that the other European unions could not do so (Annibaldi and Berta, 1994). Thus, the Fiat Melfi labour management agreement set the salaries, the shift system, and the joint committees' structure but did not mention any of the tasks of the workers and lower managers.[18] This problem becomes more evident if we look at other European countries such as the UK, Sweden, Germany, and Spain.

For example, in the UK the unions could not bargain about the mode of work organization because the Japanese management autonomously decided the work organization in its transplants (Garrahan and Stewart, 1992). On the other hand, Swedish unions actively participated in the

15 Interview with Enrico Ceccotti, and conversation with Ringo Anselmi (FIOM Vice-Secretary for Emilia-Romagna, 1989-1992, and FIOM Secretary for Tuscany, 1992-1996).

16 The Labor Management Agreement signed November 11, 1985 was the last one signed by FLM, the union organization composed of FIM, FIOM and UILM.

17 Interviews with Enrico Ceccotti and Piero Pessa, conversation with Ringo Anselmi.

18 Fiat Melfi labour management agreement, June 11, 1993, signed by EMA, SATA, FIM, FIOM, UILM, FISMIC.

development of the new work organization,[19] and the German and Spanish work councils were able bargain about work organization. The Opel Eisenach labour management agreements specified the tasks and behaviours of workers, team leaders, and lower managers.[20] The Opel Zaragoza work council proposed implementing Lean Production in lieu of the previous work organisation, which seemed to be causing many social conflicts.[21]

The second main bargaining problem was that the best countries in which to build a new plant would have been Spain and Portugal, due to their national labour laws and monetary incentives.[22] Consequently, the management asked the unions to accept the maximum plant exploitation in order to minimize_the costs.[23] For this reason, the preliminary agreement established the introduction of the night shift in the Fiat Melfi plant, although it not been introduced in any other Fiat factory.[24] A later agreement established salary conditions that were worse that those in the national Fiat agreement but better compared than in the national metalworking sector agreement.[25] Although the FIM and FISMIC unionists stated that they were satisfied with the bargaining,[26] the FIOM unionists found that they were forced to accept worse working conditions under the threat of investment abroad.[27]

Consequently, due to the impossibility of bargaining over the work organization, the collective agreement could only partially influence the conflict prevention scheme. This was based on workers' participation in management decisions because Fiat managers were aware that a form of work organization based on production quality would require cooperative industrial relations that could overcome the tensions described in the previous sections. Total Quality Management was associated with a higher level of workers' involvement because in meant that the workers should check the quality, stop the assembly line, and suggest or implement improvements.[28] It was therefore thought that the workers' greater level of responsibility should be accompanied by cooperative industrial relations that could establish an environment of trust inside the plants (Fiat Auto, 1994).

Starting from these bases, Fiat developed a conflict prevention system that was organized in a

---

19 Interview with Björn Mattson (former union leader and later manufacturing engineer at Volvo), April 17, 2014.
20 Opel Eisenach *Betriebsvereinbarung* n. 11 (labour-management agreement signed August 3,1992).
21 Conversation with Fernando Bolea Rubio (Opel Zaragoza Work Council Chairman, 1982-2011).
22 Interviews with Giuseppe Cavalitto and Cosmano Spagnolo.
23 Interview with Cosmano Spagnolo. Michele Figurati, "Flessibilità e utilizzo degli impianti," in *Fiat Auto Quadri*, Periodico bimestrale, vol. 1, no.1 (1991), Fiat Historical Center.
24 Fiat Melfi preliminary agreement, December 18, 1990, signed by the Fiat and Torino Industrial unions FIM, UILM, FIOM, FISMIC.
25 Interviews with Cosmano Spagnolo and Giuseppe Cavalitto; Fiat Melfi labor-management agreement, June 11, 1993, signed by FMA, SATA, FIM, FIOM, UILM, and FISMIC
26 Interviews with Giuseppe Cavalitto and Cosmano Spagnolo.
27 Interviews with Enrico Ceccotti and Piero Pessa.
28 Interview with Maurizio Magnabosco; Giovanni Nespolo, "Si scrive team si legge qualità," in *Fiat Quadri*, Periodico mensile del Gruppo Fiat, vol. 21, no. 3, (1992), Fiat Historical Center.

hierarchy that started from the workers' teams called *Unità Tecnologica Elementare* (Elementary Technological Unit, UTE) and ended up with the joint committees. The UTE social relations were based on a direct relationship between the *Capo* UTE (UTE Chief), which represented the lowest management level, and workers, with the help of intermediate figures such as the *Conduttori di Processi Integrati* (Integrated Process Drivers, CPI). On the one hand, the UTE Chief managed all the technical and human resources in order to guarantee the goals he set, so he needed to develop a new relational system in collaboration with his staff, planning the UTE's activities and training workers.[29] Thus, the UTE Chief needed to keep stable the social relations in his UTE, rather than control how the workers were performing their jobs. On the other hand, the CPI were workers who operated on the line and performed tasks of coordination.

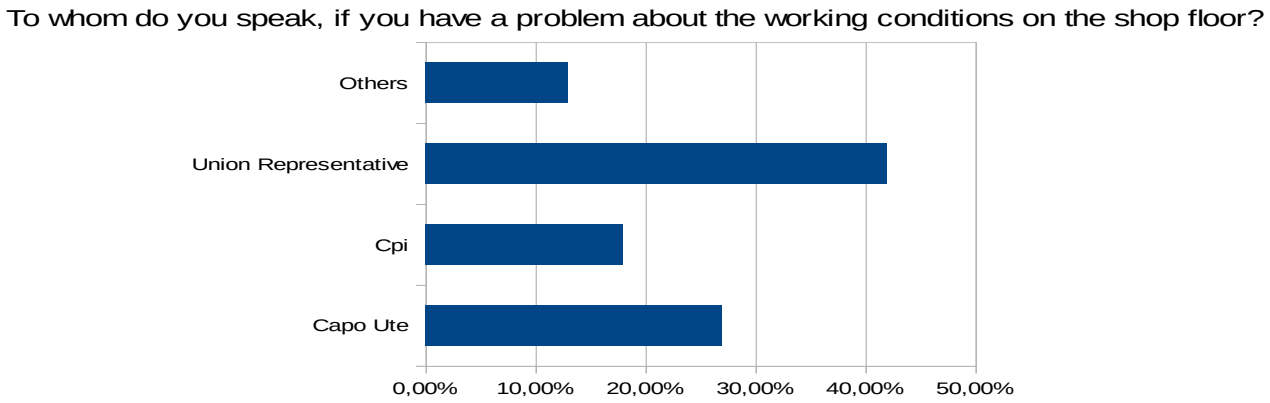
The UTE Chief should have motivated the workers on the job, in order to increase their job satisfaction and improve production quality. If the UTE Chief were unable to motivate the workers, they might have not paid enough attention to their work and the quality would have decreased. Whereas if the UTE Chief concentrated his efforts on the productivity results, he would not need to motivate the workforce because the productivity results would depend not on the workers' attention but on their ability to follow the assembly line speed. At the same time, when a controversy arose between a worker and the management, the UTE Chief was responsible to solve it. If the UTE Chief did not have the right knowledge or enough power to solve the controversy, the workers could speak to the union representative or his counterpart, the *Responsabili del Personale di Officina* (Workshop Personnel Managers, REPO), managerial figures who had the function of arbitrators.[30] Figure 2 show that workers would speak about their on-line problems to all the figures who had been responsible for this in the conflict prevention scheme.

The union representatives could have tried to solve the controversy informally through direct bargaining with the REPO or the UTE Chief (Fortunato, 2007). Otherwise, the union representatives could have chosen to bring the controversy to the proper joint committee, which was composed of the managers, REPO and the union delegates for each union that signed the Melfi agreement. After the union representatives and REPO collected information thanks to informal colloquia with the UTE workers, the management could have chosen to call the joint committees (Pero, 1996). They were the only instrument regulated by the Melfi agreement, and their deliberative power was dependent on all the parties agreeing on the decision. If the controversy was not solved in the proper joint committee,

29 Maurizio Magnabosco, interviewed by Giulio Cesare della Morte and Pier Giorgio Lazzarin, "La fabbrica integrata" in *Fiat Quadri*, Periodico mensile del Gruppo Fiat, vol. 20, no. 4, (1991), Fiat Historical Center.
30 Ibid.

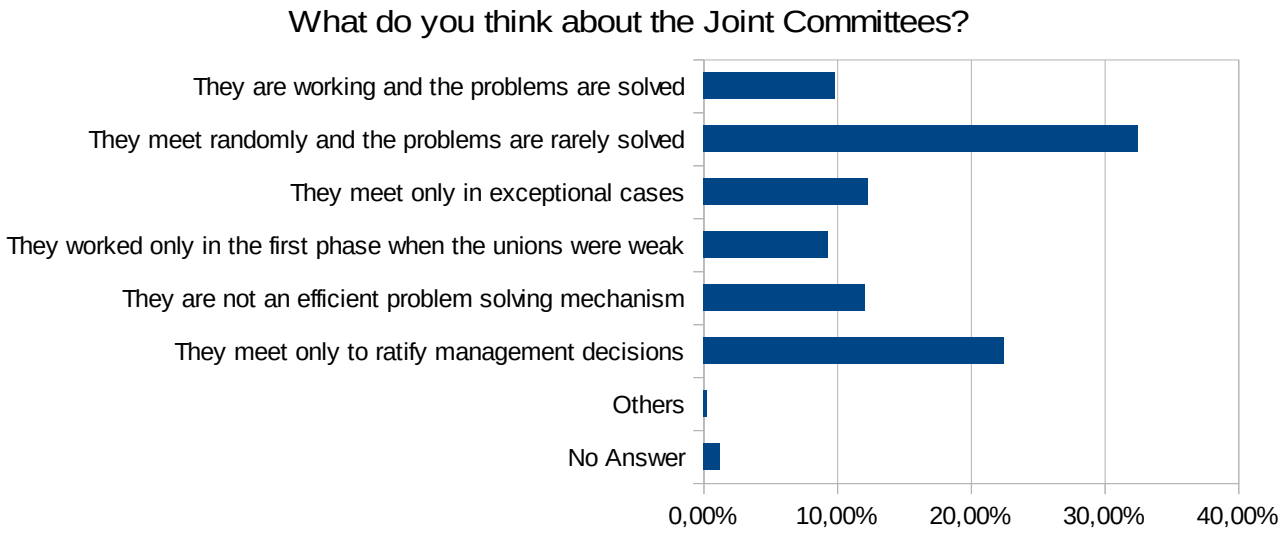
the parties had to meet in the conflict prevention committee before calling a unilateral actions such as a strike.[31] The list of the joint committees can be find in table A6 in the Appendix.

Figure 2



Source: Inquiry into Working Conditions. Results from a questionnaire distributed to young workers at Fiat Sata by FIOM-CGIL Potenza, July-September 1999.

Figure 3



Source: Fortunato (2007).

In summary, the Melfi agreement did not overcome the problems of the national bargaining. This was because, on the one hand, Fiat refused to bargain with the work organisation, so the activities of figures such as the UTE Chief, CPI, and REPO were not regulated by the labour agreements; while,

31 Labor-management agreement, June 11, 1993, signed by FMA, SATA, FIM, FIOM, UILM, and FISMIC.

on the other hand, the joint committees were a weak instrument because their activity lacked clear regulation; for example, neither calendars nor punishment mechanisms were defined by the Melfi agreement. As shown in figure 3, the workers' perception of the joint committees was negative because only the 10% perceived this instrument as "efficient." Furthermore, figures 4 and 5 show that the inefficiency of the participation scheme caused problems on the shop floor. Though it may be that the workers' answers were biased, it is worth noting that in Fiat Melfi around 75% of the workers evaluated the working conditions as "bad," whereas, in a similar survey, only 20% of the Opel Eisenach workers so evaluated their factory environment.[32]

Figure 4

Source: Inquiry into Working Conditions. Results from a questionnaire distributed to young workers at Fiat Sata by FIOM-CGIL Potenza, July-September 1999.

32 Survey by Shop Stewards and Work Council of Opel Eisenach, of 270 workers. March 1997, Opel Eisenach Work Council Archive.

Figure 5

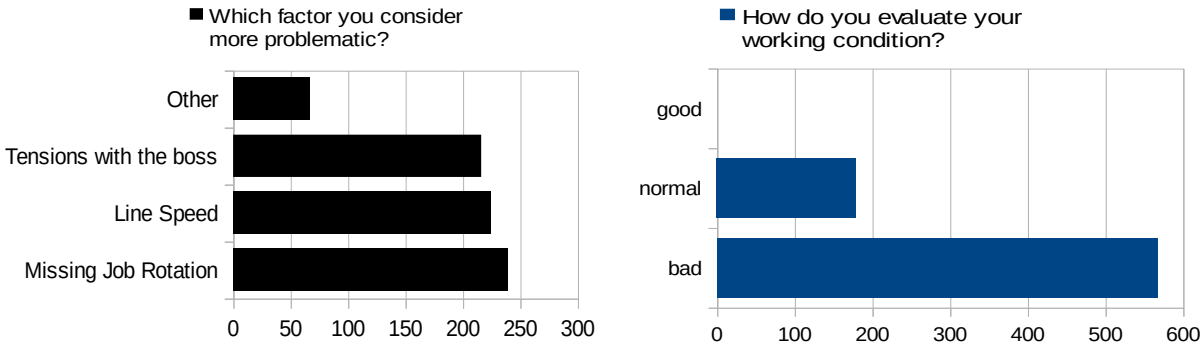


Figure 5a Figure 5b

Source: Inquiry into Working Conditions. Results from a questionnaire distributed to young workers at Fiat Sata by FIOM-CGIL Potenza, July-September 1999.

8. Why did the Conflict Arise?

It is worth analysing the prevention system described in Section 7 from its basis in the UTE. Although the *Fabbrica Integrata* principles stressed that the UTE Chiefs should motivate the workforce and manage the factory's human resources,[33] as underlined by our interviews with workers and union representatives, most of the UTE Chiefs were seen as bosses who merely controlled the workers' tasks.[34] Only a part of the workforce understood the UTE Chiefs role as the one prescribed by the *Fabbrica Integrata*.[35] This was a consequence of three management choices: the UTE size, the allocation of the UTE Chief's tasks, and the mass hiring.

1. The UTEs were larger compared to the Japanese teams,[36] and the UTE Chief was not committed to keep the same relationships with all the workers in his UTE, so he could have treated each worker differently. Contrariwise, the German *Bereichsingenieur* (Area Engineer), who performed an equivalent role in the Opel Eisenach plant, was committed to knowing the needs of all of the workers' on the shop floor.[37]
2. The UTE Chief was in charge of issuing disciplinary sanctions as well as scheduling the job

33 Giovanni Nespolo, "Si scrive team si legge qualità," in *Fiat Quadri*, Periodico mensile del Gruppo Fiat, vol. 21, no. 3 (1992). Maurizio Magnabosco interviewed by Giulio Cesare della Morte and Pier Giorgio Lazzarin, "La fabbrica integrata", in *Fiat Quadri*, Periodico mensile del Gruppo Fiat, vol. 20, no. 4, (1991). Anon., "Caro Capo UTE volevo dirti...", in *Fiat Auto Quadri*, Periodico Bimestrale druppo Fiat, vol. 2, no.5 (1994), Fiat Historical Center.

34 Interviews with Rocco Aquino, Antonio D'Andrea, Giovanni Zoppi.

35 Interview with Marco Lomio

36 The Fiat management chose to removed two hierarchical levels, rather than one, as in the North-American transplants, so the team leader figure was not introduced. See interview with Maurizio Magnabosco.

37 We can compare the Fiat labour-management agreement, June 11, 1993, signed by FMA, SATA, FIM, FIOM, UILM, and FISMIC, with Opel Eisenach *Betriebsvereinbarung*, n.11 (labour-management agreement, signed August 3, 1992).

rotation, the leave permits, and the holiday plan. Contrariwise, at Opel Eisenach even if the disciplinary sanctions were issued by the *Bereichsingenieur*, the job rotation and the holiday plan were scheduled by the team with the help of the team leader.[38]

3. Fiat Manager Cesare Annibaldi admitted that one of the company's biggest mistakes was the mass hiring at the time of the factory's opening, which led to tough competition among workers, and for CPIs and UTE Chiefs intent on pursuing their careers, because most of the positions in the hierarchy were already filled.[39]

These three Fiat choices led to a lack of uniform relationships, and to unfairness and clientelism inside some UTEs. Thus, the UTE Chief could use such instruments as job rotation, leave permits, and disciplinary sanctions to punish some workers and benefit others, as analysed by some sociologists (Rieser, 1997). Furthermore, the tough competition pushed the UTE Chiefs to compete on productivity results because those data were easier to check than quality results. As pointed out by many workers, when they found a mistake they just wrote it on a check list and the car would be recovered at the end of the line.[40] Consequently, tensions arose and there could sometimes be tough episodes between workers and the UTE Chief.

For example, in 1999 a UTE Chief threatened a worker who had signalled an anomaly in the machinery.[41] The management agreed to call the conflict prevention committee,[42] and the problem was solved peacefully.[43] Later, the relationships inside the UTEs worsened and disciplinary sanctions multiplied, as has been denounced by FIOM and UILM since 2001.[44] Thus, in case of controversy, both sides behaved differently. In 2003, one FIOM Representative was fired for misbehaviour and FIOM reacted by both asking for a meeting of the conflict prevention committee,[45] and calling for a one-hour strike of the whole Fiat Group.[46] The conflict was not solved through the participation scheme, the parties went to court to solve the controversy, and the matter was also treated by the national

38 Ibid.
39 Interview with Cesare Annibaldi.
40 Interviews with Rocco Aquino, Giuseppe Cillis, Giovanni Zoppi.
41 Pepino Doino (FIOM representative), letter to Giuseppe Cillis (FIOM Provincial Secretary), July 21, 1999, FIOM Basilicata Archive.
42 Public Announcement by FIM, UILM, and FISMIC, July 21, 1999. Fiat SATA S.p.A., letter to the members of the Conflict Prevention Committee, July 27, 1999, FIOM Basilicata Archive.
43 Public notice by Uilm, July 31, 1999, FIOM Basilicata Archive.
44 Interviews with Giuseppe Cillis, Emanuele De Nicola, Carmine Vaccaro. FIOM union representatives, letter to the other union representatives, May 19, 2003, FIOM Basilicata Archive. UILM representatives, letter to the Fiat SATA Management, February 23, 2002, UILM Basilicata Archive.
45 Rocco Aquino, letter to the official responsible for industrial relations at Fiat SATA, February 10, 2003, FIOM Basilicata Archive.
46 Fiom Notizie, vol. 9, no. 1 (2003), FIOM Basilicata Archive.

parliament.[47]

After the UTE, the second level in the conflict prevention scheme was the union representation. In the Melfi area, which lacked of any industrial tradition, the inexperienced unionists called on the help of researchers in order to negotiate with the factory management regarding most serious problems. For example, FIOM elaborated a new shift system after an inquiry into the Fiat Melfi working conditions promoted by the sociological magazine *Finesecolo*;[48] while UILM proposed a new participation scheme based on studies by management scholars as well as union leaders.[49] The different types of knowledge used here pointed to the political differences between the two unions, as discussed in section 4. In this case, FIOM attempted to increase working class consciousness, whereas UILM attempted to establish a clearer participation scheme.

FIOM was sceptical about the participation scheme proposed by Fiat, and concentrated its union activity on working conditions.[50] In particular, FIOM constantly stressed the necessity to overcome the shift system called *Doppia Battuta* (double time), which was considered stressful because under this schema the workers could work as many as twelve nights consecutively.[51] Due to scepticism about the participation scheme, FIOM held that the working conditions could be improved thanks to the development of sufficient working class consciousness, which could increase FIOM's bargaining power. Thus, one of FIOM's main goals became the creation of a working class sentiment.[52] On the other hand, even though UILM always pointed out the necessity of overcoming the *Doppia Battuta* system, it mainly just elaborated a proposal to change the work of the joint committees in order to improve the participation scheme.[53] This was because UILM believed that participation could improve working conditions more than actions that focused workers' attention on a specific problem.

Consequently, the unions behaved differently when controversies arose. It is worth noting what happened during the first strike for the improvement of working conditions, which was archived in the FIOM offices as "*Caso Foggetta*." In 1998, the union representatives denounced a series of safety

47 Italian Senate, 14th Legislature, Act no. 4-03896, February 13, 2003, session no. 333; and Act no. 4-09786, December 5, 2005, session no. 915.

48 Giuseppe Cillis, letter to the FIOM-CGIL national offices, September 24, 1997.

49 The material on the Progetto Leonardo that analyses the European Joint Committees was found in the UILM archive together with the UILM proposal for a new participation scheme. See Pero (1996) and Uilm Public Notice, March 1, 2000, UILM Basilicata Archive.

50 Giuseppe Cillis, Introductive Report to "Inquiry into Working Conditions: Results from a questionnaire distributed to young workers at Fiat SATA by FIOM-CGIL Potenza," July-September 1999, FIOM Basilicata Archive.

51 The FIOM public notices mainly asked for the abolition of *Doppia Battuta*. See, e.g., Public Notice February 28, 2000 and January 26, 1998, FIOM Basilicata Archive.

52 Giuseppe Cillis, Introductory Report to "Inquiry about Working Conditions: Results from a questionnaire distributed to young workers at Fiat SATA by FIOM-CGIL Potenza," July-September 1999, FIOM Basilicata Archive.

53 Uilm Public Notice, February 16, 2000, March 1, 2000, UILM Basilicata Archive.

problems in different UTEs, and these were discussed in the Environment and Safety Committee.[54] When another episode affected the plant safety, FIOM called a strike in order to again invoke the environment and safety committee.[55] The other unions accused FIOM of refusing to discuss the problem in the conflict prevention committee before calling the strike.[56] The management imputed the safety fault to FIOM official Francesco Foggetta.[57] Finally, the more cooperative unions accused FIOM of not following the participation scheme,[58] while FIOM accused the other unions of attacking the right to strike in the plant,[59] and the management of discriminating against FIOM members.[60]

The joint committees formed the third level of the conflict prevention scheme. This approach suffered from a lack of formal procedures, so UILM asked the unions to schedule them and suggested a punishment mechanism in case of misbehaviour.[61] The informal mechanism at the basis of the joint committees' work required complete trust among all the parts involved. Due to the lack of trust between FIOM and Fiat, which was caused by misbehaviour of both management and union, historical conflicts, and misunderstandings,[62] the joint committees found it difficult to operate. From reading the joint committee memos, one can understand the causes of the successes and failures of the participation scheme. Although joint committees were called more often than in other Fiat plants (Pero, 1996), they were called even more often after a meeting of the conflict prevention committee in 1998.

Management and unions called ten different committee meetings in one next month. Three months later, the parties met in a Consulting Committee and agreed that the joint committees' work had solved some of the problems on the shop floor (with the exception of FIOM, which evaluated the work as not satisfactory). Due to this positive evaluation, when management changed the car model produced in the plant at the beginning of 1999, the cooperative unions asked to be involved in the production change.[63] Consequently, in 1999 the *Fabbrica Integrata* committee met at least 8 times in the assembly department. Most of these meetings concentrated on the possibility of solving problems related to the

54 Memo of the Environment and Safety Committee, February 17, 1998; FIM, UILM, and FISMIC Public Notice, March 18, 1998; FIOM representatives, letter to the other Union Representatives, February 18, 1998; FIOM Representatives Public Notice, February 25, 1998, FIOM Basilicata Archive.

55 Anon., "Fiat di Melfi: Sciopero all'area montaggio," *L'Unità*, March 14, 1998.

56 FIM, UILM, and FISMIC Public Notice, March 14, 1998, FIOM Basilicata Archive.

57 Fiat SATA Management, letter to Francesco Foggetta, March 14, 1998, FIOM Basilicata Archive.

58 FIM, UILM, and FISMIC Public Notice, March 18, 1998; FIM, UILM, and FISMIC Public Notice March 14, 1998, FIOM Basilicata Archive.

59 Giovanni Cazzato (CGIL Basilicata Regional Secretary), Public Notice March 18, 1998, FIOM Basilicata Archive.

60 Letter from Foggetta Francesco to Fiat SATA Management, March 17, 1998, FIOM Basilicata Archive.

61 UILM Public Notice, March 1, 2000, UILM Basilicata Archive.

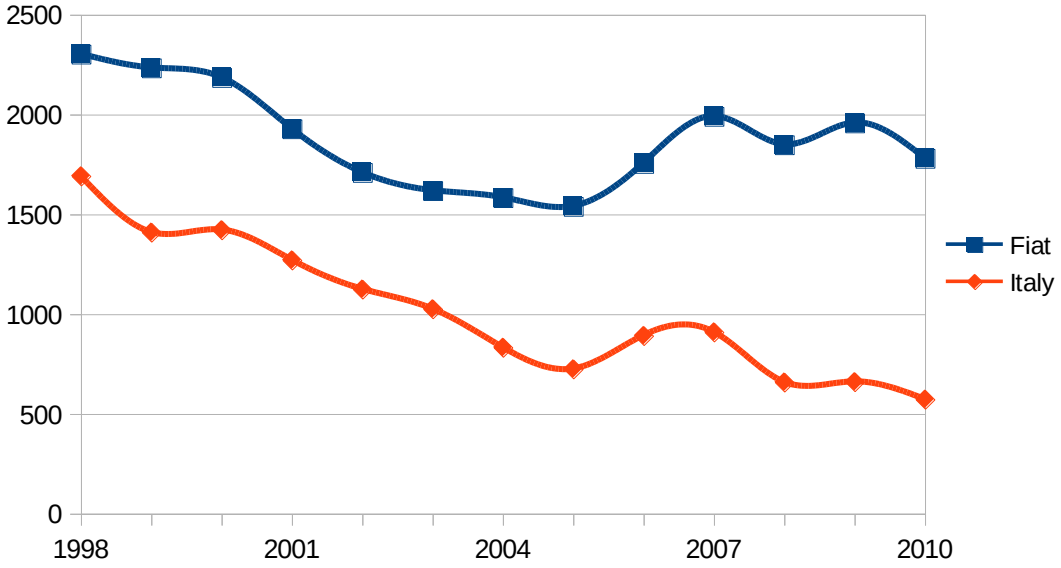
62 Concerning misunderstandings, it is worth noting that Fiat was forced by regional politicians to hire its workforce from areas far from the plant. FIOM believed that this was intended to keep workers far from each other and impede the development of a working class consciousness. Interviews with Cesare Annibaldi and Antonio D'Andrea.

63 Memo of Consulting Committee, April 23, 1999, UILM Basilicata Archive. It is worth noting that FIOM stressed that it did not attend the meeting due to the participation scheme being an objective impossibility.

new production model.[64] The joint committees met often in order to verify whether or not those problems had been solved and the parties felt satisfied.[65]

While the joint committees were able to solve some of the factory problems thanks to the actions of the more cooperative unions, FIOM continued to be sceptical about the participation scheme. Later, FIOM participated less in the *Fabbrica Integrata* committees; in 2001, its representatives failed to attend most of the meetings documented in the archives.[66] FIOM and UILM stopped collecting joint committee memos in 2002. Later, joint committees were called less and less often and lost their relevance. This resulted in the conflict prevention scheme failing to play any role during the 2004 strike as described in the VV.AA.'s book *La Primavera di Melfi: Cronaca di una Lotta Operaia*.

Figure 6: **Passenger Cars Produced by Fiat and in Italy (1998-2010)**



Note: the numbers refer to thousands of passenger cars produced each year. Source: www.oica.net.

Managerial behaviour completes the picture of factory life. Several years after the plant's

64 Memos of the Fabbrica Integrata committee – Assembly Department, May 20, 1999, July 14, 1999, September 6, 1999, September 15, 1999, September 25, 1999, October 9, 1999, November 3, 1999, December 2, 1999, UILM Basilicata Archive. Paint Shop Department, February 24, 2001, March 31, 2001, May 17, 2001, June 29, 2001, October 13, 2001, October 26, 2001, November 10, 2001. Steel Body Work Department, January 23, /2001, March 2, 2001, July 5, 2001, October 13, 2001. Assembly Department, January 25, 2001, March 30, 2001, April 12, 2001, July 7, 2001, July 11, 2001, October 13, 2001, October 19, 2001, October 26, 2001. Memos of the Environment and Safety Committee – Paint Shop Department, March 31, 2001, June 1, 2001. Assembly Department, February 3, 2001, Fiat Melfi Archive.

65 Memos of the Fabbrica Integrata Committee – Assembling Department, February 14, 2000, July 6, 2000, UILM Basilicata Archive.

66 Memos of the Fabbrica Integrata Committee – Assembly Department, March 2, 2001, March 12, 2001, April 20, 2001, April 27, 2001, September 1, 2001, UILM Basilicata Archive.

opening, management began showing productivity results to competitors, causing the Melfi facility to concentrate on productivity and sacrifice quality.[67] This led management to cease following the participation strategy. Among the main causes of this behaviour were the market crises. In 1998, Fiat was the world's fifth largest car producer, but by 2004, it was in twelfth place.[68] During the market crisis, Melfi lost Fiat's attention with the rise of a new set of managers; they had not experienced the social tensions of the 1970s, and so were less interested in the participation scheme (Berta, 2006). Consequently, as was pointed out in the interviews with managers and more cooperative unions, Fiat's management treated the Melfi plant in the same way it treated its other plants; this behaviour frustrated workers because they received a lower wage compared to workers in Fiat's other plants.[69]

9. **Conclusions**

In discussing the relationships between Lean Production and social conflicts, I have identified the conditions in which social conflicts can arise in a Lean environment. Neither FIOM nor FIAT strictly adhered to the conflict prevention scheme. This led to tensions, to parties going to court in an attempt to solve conflicts, and a failure to solve the underlying problems of factory life. However, there are also four shortcomings that contributed to the misbehaviour of both management and unions: lack of union involvement during the planning phase; ideological division among the unions; power relations based on contingent bargaining power; and lack of enforcement mechanisms.

Fiat did not involve the unions when the new model of work organization was developed. In contrast, in factories where unions did have a voice in creating the new model of work organisation, no strike related to working conditions occurred. Behind the management behaviour lies the historical tensions that characterized Fiat's industrial relations. It seems that the involvement of unions in the planning stage represented a clear sign of trust and a radical break with the past. Thus, if the management had chosen to involve the unions, the unions would likely have reciprocated by establishing peaceful industrial relations. Secondly, the unions were ideologically divided. The conflict prevention scheme established that the joint committees could have deliberative power only if the decisions were unanimous. Unluckily, in the Melfi case it was almost impossible to reach any effective decisions due to the ideological division between cooperative and conflictual unions. This ideological division is a peculiar characteristic of Italian bargaining.

67 Interview with Cesare Annibaldi.
68 Data from OICA. 1998. Data: http://www.oica.net/wp-content/uploads/2007/06/cl98cons2.pdf. 2004. Data: http://www.oica.net/wp-content/uploads/2007/06/worldranking.pdf [last access, October 24, 2014].
69 Interviews with Giuseppe Cavalitto, Maurizio Magnabosco, and Cosmano Spagnolo.

Thirdly, power relations between unions and management depended on contingent bargaining power. In countries such as the US and the UK, the management could override the unions, and some unions signed no-strike pledges and some factories were not unionised. In Sweden and Germany, the law establishes clear duties and responsibilities for management and unions. It acknowledges the power of unions while limiting the ability of management and unions to undertake unilateral actions, such as strikes or massive lay-offs. In Italy, the power dynamics between labour and management are based on the contingent bargaining power of the respective parties, with that of the unions dependent on the consensus of workers. Strikes can be interpreted as a method adopted by unions to show their power and strengthen their consensus by building a working class consciousness. Lastly, the conflict prevention scheme established by Fiat lacked any enforcement mechanisms. For example, there were no clear punishments for contingent misbehaviours, which allowed parties to avoid adhering to the conflict prevention scheme without fear of reprisal.

The first three shortcomings are direct consequences of the institutions that regulated the Italian bargaining system, the Fiat management, and the unions' traditions. Countries characterized by different institutional pressures have never experienced turbulent industrial relationships in the Lean plants. It is likely that different responses on the part of Italian law, Italian unions, and Fiat managers could have avoided at least one of these shortcomings, and there would have been no strikes at Fiat Melfi. The Melfi strike can therefore be defined as a result of massive institutional failure.

10. **Appendix**

Table A1: **Union Representatives Elected in Fiat Melfi**

Union	*1995*	*1998*	*2001*	*2004*	*2007*
FIM	20	18	14	9	13
FISMIC	20	14	9	8	9
FIOM	17	16	14	14	12
UILM	11	14	12	11	17
FAILMS	0	0	2	6	3
UGL	0	6	6	6	5
COBAS	0	0	3	0	1
Others	0	0	0	2	0
Sum of Cooperative Unions (FIM,UILM and FISMIC)	51	46	35	28	39
Sum of Conflictual Unions (FIOM, UGL, FAILMS and COBAS)	17	22	25	26	21
Total	68	68	60	56	60

Source: Fortunato (2007)

Table A2: **List of People Interviewed**

	Place	*Date*	*Role*	*Minutes*
Ceccotti Enrico	Piombino	05/09/13	Former member of Ufficio Sindacale FIOM, he signed the Melfi Agreement, 11/06/93	25
Annibaldi Cesare	Turin	09/09/13	Former Fiat External Relations Manager	59
Magnabosco Maurizio	Turin	09/09/13	Former Fiat Auto Personnel Manager	63
Spagnolo Cosmano	Rome	16/09/13	Former member of Ufficio Sindacale FIM, he signed the Melfi Agreement, 11/06/93	38
D'Andrea Antonio	Potenza	18/09/13	Worker in Fiat Melfi since 1995, paint shop department, FIOM Representative	20
D'Andrea Angelo	Potenza	18/09/13	Worker in Fiat Melfi since 1995, assembling department, FIOM Representative	29
Aquino Rocco	Potenza	19/09/13	Worker in Fiat Melfi since 1995, paint shop department, FIOM Representative	16
Cillis Giuseppe	Potenza	19/09/13	Tecnologo in Fiat Melfi since 1992, Fiom Basilicata Secretary (2004-2010)	50
Lomio Marco	Rionero in Vulture	20/09/13	Worker in Fiat Melfi since 1994, trial department, UILM Representative	37
Zoppi Giovanni	Rionero in Vulture	20/09/13	Worker in Fiat Melfi since 1995, steel body work department	16
Verrascina Vittorio	Melfi	23/09/13	Worker in Fiat Melfi since 1994, Assembling department, FIM Representative	54
Burmo Leonardo	Melfi	23/09/13	Former FIM Member Responsible for Cassino and Termoli plants, FIM Basilicata Secretary	64
De Nicola Emanuele	Potenza	25/09/13	Maintenance Technician in Fiat Melfi since 1993, former FIOM Representative, FIOM Regional Secretary since 2010	66
Cavalitto Giuseppe	Turin	24/10/13	Former FISMIC National secretary, he signed the Melfi Agreement, 11/06/93	57
Pessa Piero	Turin	24/10/13	Former FIOM representative in Mirafiori plant, Ufficio Sindacale FIOM, he participated in the Progetto Force, which consisted of the analysis of several European automotive plants	87
Vaccaro Carmine	Rome	06/12/13	CPI in Fiat Melfi Plant since 1992, UIL Basilicata Secretary since 2009	57

Table A3: **Draft of Interview Questions for Melfi Workers**

1) Where do you live?
2) When did you start to work in Fiat Melfi?
3) Did you receive some training before working in Melfi?
4) How long was the training?
5) How do you evaluate the training?

6) What was your position after you started to work in Melfi?
7) Did you have other positions?
8) Which tasks did you perform in the workplace?
9) How long did you need to perform one task? Did the time cycle change over the years?
10) Did you normally rotate the tasks with your colleagues?
11) How do you evaluate the job rotation experiment?
12) Except your main tasks, did you need to perform other activities?
13) Did you perform maintenance activities?

14) Do you evaluate your job polyvalent or autonomous?
15) Could you stop the assembly line?
16) Could the management change the assembly line speed?
17) Did you participate in the technological team meetings? What were its duties? How do you evaluate this experience?
18) Did you expect a different kind of job after the training?
19) In your opinion, how did your job in Melfi change compared to the job in Turin during the 1970s?

20) What were the tasks of the CPI?
21) What were the relationships between the CPI and the other workers?
22) Do you think that the CPI was performing a more autonomous job compared the other on-line workers?
23) Do you think all the other workers were able to perform the CPI's tasks?

24) What were the tasks of the *UTE Chief*?
25) Among all his tasks, which were the tasks performed more by the *UTE Chief*? Why?
26) What were the relationships between workers and the *UTE Chief?*

27) How do you evaluate the labor management relationships in the Melfi factory?
28) In your opinion, did the company try to involve the workers in management decisions?
29) How do you evaluate the role of the joint committees?
30) In your opinion, what were the causes of the strikes that affected the company for three weeks?
31) In your opinion, what are the good sides to working in Melfi? What do you think can be improved? How?

Table A4: **Draft of the Interview Questions for Union Members Who Participated in Planning the Melfi Strike**

1) Between the 80s and 90s, how did your union look at Lean Production? Was it considered an opportunity or a threat?
2) How did you union look at Volvo Reflective Production?
3) Which work organization did your union take more into consideration?
4) How do you evaluate the relationship between Fiat and your union during that time?

5) How did your union evaluate the Lean Production model adopted by Fiat? Did your union think that this model would change union activities?
6) In your opinion, which working conditions changed thanks to the UTE's implementation?
7) In your opinion, which factors influenced the Melfi location choice?
8) How do you evaluate the bargaining between Fiat and the unions during the planning phase? Did the company try to cooperate?
9) What were the main union successes during the planning phase?

10) Which Melfi features did you believe could increase workers' participation in factory life?
11) Which Melfi features did you believe could decrease workers' participation?
12) What do you think about the UTE Chief figure? What were his tasks in theory and in practice?
13) In your opinion, did plant life adhere to the initial agreement?
14) In your opinion, what were the causes of the strikes that affected the company for three weeks?

15) In your opinion, which are the good sides of the Fiat Melfi plant? What do you think can be improved? How?

Table A5: **Draft of Interview Questions For Fiat Managers**

1) Why did Fiat adopt the Lean Production model?
2) Which Lean Production characteristics were more important for Fiat?
3) Why was an American edition of the Lean Production model used? Why was a joint-venture with a Japanese company as GM not chosen?
4) Which were the most important teamwork features? Why was the little Japanese team composed of 7-10 members not implemented?
5) How did Fiat management evaluate the Swedish Reflective Production model?

6) How do you evaluate Lean Production implementation in the Melfi plant?
7) How was the workers' training carried out?
8) Why did the Lean Production model abolish the division between who thinks and who works? How? How do you evaluate the workers' autonomy?
9) What were the workers' tasks in theory and practice?
10) Could the workers stop the assembly line?

11) What were the CPI's tasks?
12) What were the UTE Chief's tasks? Did he concentrate more on the UTE's management or the workers' supervision?
13) How do you evaluate the UTE Chief figure?
14) How do you evaluate the relationship between workers and UTE Chiefs?

15) How do you evaluate the labour management relationships in Fiat during that time?
16) How do you evaluate the joint committees' work?
17) In your opinion, what were the causes of the strikes that affected the company for three weeks?

18) In your opinion, what are the good sides of the Fiat Melfi plant? What do you think can be improved? How?

Table A6: **Joint Committees' Activity**

Name of the Committees	*Management Members*	*Union Members*	*Goals*
Consulting	4	4	Industrial Relations and company development perspectives
Equal Opportunities	3	4	Study of positive actions
Conflict Prevention	3	4	Find joint solution about conflicts started in the other committees
Prize Check	6	8	Check the productivity data that can influence the salary prize
Professional Learning	4	4	Check the need for knowledge and propose training activities
Company Services	4	8	Check company services and promote cultural activities
Health Services	3	4	Organization of the health services in the plant
Environment and Safety	6	4	Study activities to sensitize workers to the safety and injury prevention
Fabbrica Integrata	6	4	Monitor the production optimization and all production problems

Source: Pero (1996)

Conclusions

In this dissertation thesis, I set out to explain the advent of Lean Production in Western countries during the 1980s. In particular, I showed how Lean Production ruled out alternative forms of work organization in two different types of countries: those, such as Italy, that suffered conflictual labor management relations, and others that enjoyed cooperative industrial relations, such as Germany and Sweden. I aimed to answer the question whether Lean Production was an unavoidable outcome, as stressed by management literature appreciative of the Japanese model, or just one possibility among others, as suggested by a numerous sociologists, engineers, and economists. Thus, was Lean Production the best form of work organization possible, as some maintained?

I will now summarize the findings of each chapter and explain how they bear upon the scholarly debate and what questions are worth taking up in future research. The first chapter analyzes Italian industrial history in order to understand why in Italy Lean Production, rather than Flexible Specialization, became the dominant form of work organization. I show that the emergence of Lean Production was made possible by the ending, at the beginning of the 1980s, of the severe social conflicts of the previous decade. If the high rate of strikes and labor turmoil generally had continued, Italian firms would likely have sought to implement a form of work organization that could promote industrial tranquility by incrementing workers' skills and welfare. Instead, social conflicts were attenuated thanks to other factors, such as the introduction of highly automated machines on the shop floor, that eased workers' tasks, along with an increment in the social welfare provisions by the government.

The second chapter focuses on countries characterized by cooperative industrial relations. I analyze in the case of Sweden one of the most important applications of Flexible Specialization, and in the case of the former GDR, one of the most important implementations of Lean Production. I find that the reason why the German plant enjoyed high productivity, while the Swedish plant was soon shut down, lie in the different strengths of the work incentives in the two plants. For example, lifetime employment was a very effective incentive in the East German social context, which was characterized by high unemployment rates. On the contrary, in Sweden the increment in workers' skills increased training costs, which could only have been lowered if the most experienced workers had trained the new entrants. Unfortunately, however, the most experienced workers had few incentives to do that, and largely for this reason, the plant failed to reach its optimal development before having to be shut down.

In the third chapter I focus on the factory of Melfi, which was the site of the main attempt to implement Lean Production in an Italian plant. I ask whether there can be social conflicts in a Lean environment, as strikes have rarely affected Lean plants. I find that the emergence of social conflicts depends not only on the form of work organization adopted by the management, but also on the institutions that regulate factory life, such as bargaining activities and the structure of the unions, as well as the history of the company.

This means that Lean Production could not be considered the work organization guaranteeing the highest productivity as well as the most peaceful industrial relations. In this I disagree with the conclusions of the best-selling book, The Machine that Changed the World (Womack et al., 1990), and with most of the scholarly management literature, such as MacDuffie (1995) and Adler (1998). Instead, my findings agree with those of the scholars who have argued that the form of work organization adopted in a factory is principally driven by the firm's history (Lewchuck et al., 2001), the balance of power between capital and labor (Freyssenet, 2012), and management interests (Blomquist et al., 2013). Lean Production was, then, one of the possible paths that could be taken, and it did assure higher productivity in the particular framework of the 1980s, which was characterized by high automation, low information costs, and a low rate of social conflicts. This suggests that certain forms of work organization should perform better in different frameworks.

The main limitation of this study stems from the lack of comparable alternatives in the industrial history of Western Countries. The Swedish plant cannot represent an alternative case study because it was shut down before reaching its optimal development. This means that we will never know whether Flexible Specialization would have had better results in the long term. German workers stress that their plant lost its peculiarities with time, and productivity did not further improve because of the ageing of the workforce. One might suppose that Flexible Specialization would have performed better in the long term, as it is thought to have been helpful to the older workers on the shop floor. But this remains a supposition in the absence of data on comparable factories over the long term, each employing one of the two work different organizations. We also cannot know what would have happened to the East German form of teamwork if the socialist government had continued.

There is reason to recommend to scholars, governments, companies, and unions that they do further research on the current work organization so as to understand better its strengths and weaknesses. We could suppose that the next dominant form of work organization will depend on characteristics of the society, such as customer preferences and technological development, as well as conflicts or accords between capital and labor, as was the case in the 1980s. This means that both

unions and managers need to study the past, present, and future of a form of work organization to seek the best production model. It is also important to study the factors that may bear on this question, such as technological changes.

In spite of the literature claiming that Lean Production represents the end of the history of forms of work organization, we have seen that history does not end with this. There are still a lot of unexplored possibilities in the field of the work organization, and sooner or later one of them will surely replace the Japanese model. And there are a number of possibilities worth considering that that may point elsewhere than to the continued reliance upon Lean Production.

Bibliography

Adler, P. S., 1998, in Landsbergis, P. A., "Lean Production and Worker Health: A Discussion", *New Solutions* 8 (4), 499-523.

Adler, P. S., Goldoftas, B., and Levine D. I., 1998, "Stability and Change at NUMMI", in Boyer, R., Charron, E., Jurgens, U., Tolliday, S., eds., *Between Imitation and Innovation: The Transfer and Hybridization of Productive Models in the International Automobile Industry,* London: Oxford University Press, 128-161.

Adler, P. S., 1999, "Teams at NUMMI." In Durand, J. P., Stewart, P, Castillo, J. J., eds., *Teamwork in the Automobile Industry: Radical Change or Passing Fashion?* London, England: Macmillan Press..

Adler, P. and Cole, R., 1995, "Designed for Learning: A Tale of Two Auto Plants," in Sandberg, Å., eds., "Enriching Production: Perspectives on Volvo's Uddevalla Plant as an Alternative to Lean Production," Aldershot: Avebury, England.

Akerlof, G. A., and Yellen, J. L., 1986, "Efficiency Wage Models of the Labour Market,", Cambridge University Press.

Akerlof, G. A., 1982, "Labour Contracts as Partial Gift Exchange," *The Quarterly Journal of Economics,* Vol. 97, No. 4, 543-569.

Akerlof, G. A., Rose, A. K., Yellen, J. L., Hessenius, H., 1991, "East Germany in from the Cold: The Economic Aftermath of the Currency Union," Brookings Papers on Economic Activity, Washington, DC: Brookings Institution, 1 (1991).

Amin, A., 1994, "Post-Fordism: Models, Fantasies and Phantoms of Transition," pp. 1-39 in *Post-Fordism: A Reader,* Hoboken, NJ: Wiley-Blackwell.

Annibaldi, C., and Berta, G., 1994, "Impresa, partecipazione, conflitto: Considerazioni dall'esperienza Fiat, Dialogo con Giuseppe Berta," [Enterprise, participation, conflict: considerations from Fiat experience: conversation with Giuseppe Berta] Venice: Marsilio.

Belussi F., 1992a, "La flessibilità si fa gerarchia: La Benetton," [Flexibility becomes hierarchy: Benetton] in Belussi, F., ed., *La grande trasformazione: La nascita di nuovi modelli organizzativi di impresa,* Milan: Franco Angeli.

Belussi, F., 1992b, "Nuovi modelli di impresa, gerarchie organizzative e imprese rete," [New enterprise model, organizational hierarchy and net companies] in Belussi, *La grande trasformazione.*

Berggren, C., 1992, "The Volvo Experience: Alternatives to Lean Production in the Swedish Auto Industry," Basingstoke, England: Macmillan.

Berggren, C., 1993, "Lean Production: The End of History?," *Work, Employment, & Society* 7(2): 163-188.

Berggren, C., 1995, "The Fate of the Branch Plants: Performance versus Power," in Sandberg, Å., eds., *Enriching Production: Perspectives on Volvo's Uddevalla Plant as an Alternative to Lean Production,* Aldershot: Avebury, England.

Berggren, C., 2000, “NUMMI vs. Uddevalla,” *Technology, Organizations and Innovation: Critical Empirical Studies* 3, 12-46.

Berta, G., and Michelsons, A., 1989, “Il caso Olivetti,” in Regini, M., and Sabel, C. F., eds., *Strategie di riaggiustamento industriale*, Bologna: Il Mulino, 133-170.

Berta, G., 1998, “Mirafiori”, Bologna: Il Mulino.

Berta, G., 2006, “La Fiat dopo la Fiat”, [Fiat after Fiat] Milan: Mondadori.

Benders, J., and Van Bijsterveld, M., 2000, “Leaning on Lean: The Reception of a Management Fashion in Germany,” *New Technology, Work, and Employment* 15(1), 50-64.

Blomquist, B., Engström, T., Jonsson, D., and Medbo, L., 2013, “Assembly Design and Work Organization within the Swedish Automotive Industry,” in Sandberg, Å., eds., *Nordic Lights: Work Management and Welfare in Scandinavia*, Studieförbundet Näringsliv och Samhälle (SNS) Förlag, Sweden.

Boglind, A., 2013, “Volvo and a Swedish Organisation and Management Model," in Sandberg, Å., eds., Nordic Lights: Work Management and Welfare in Scandinavia,” SNS, Förlag, Sweden.

Bolchini, P., 1985, “Il gruppo Pirelli Dunlop: Gli anni più lunghi, Pirelli 1914-1980”, vol. 2, [Pirelli-Dunlop group: the longest years (1914-1980)] Milan: Franco Angeli.

Bolchini, P., 1967, “La Pirelli: Operai e padroni,” [Pirelli: workers and managers] Rome: Samonà and Savelli.

Bonazzi, G., 1993, “Il tubo di cristallo: Modello giapponese e Fabbrica Integrata alla Fiat Auto”, [The crystal tube: Japanese model in Fiat Auto] Bologna: Il Mulino.

Bonazzi, G., 1997, “Tra tamponamento delle emergenze e miglioramento continuo: Capi UTE e tecnologi nella ‘Fabbrica integrata’,” [Between emergences' avoidance and continuous improvement] *Quaderni di Sociologia* 41(15), 117-138.

Bowles, S., 2009, “Microeconomics: Behavior, Institutions, and Evolution”, Princeton, NJ: Princeton University Press.

Brulin, G., 1995, “Sweden: Joint councils under strong unionism” in Roger, J., and Streeck, W., eds., *Works Councils: Consultation, Representation, and Cooperation in Industrial Relations*, Chicago: University of Chicago Press.

Butera, F., 1984, “L'orologio e l'organismo: Il cambiamento organizzativo nella grande impresa in Italia — cultura industriale, conflitto, adattamento, e nuove tecnologie”, [The clock and the System: organizational change in Italian big companies] Milan: Franco Angeli.

Camuffo, A., and Micelli, S., 1997, “Mediterranean Lean Production Supervisors, Teamwork and New Forms of Work Organization in Three European Car Makers.” *Journal of Management & Governance* 1 (1), 103-122.

Cattero, B., 1994, “’Partecipanti’ o ‘partecipati’? Lettera aperta al sindacato italiano sul caso tedesco,” [Can labor unions play an active role? Letter to the Italian unions referring to the German case] *Meridiana*, No. 21, 195-232, Italy.

Carlin, W., 1996, “West German Growth and Institutions, 1945-90,” in Crafts, N. and Toniolo, G., eds., *Economic Growth in Europe since 1945*. Cambridge, UK: Cambridge University Press.

Cascioli, A., 1981, “Lavorare diversamente. Organizzazione del lavoro per gruppi omogenei”, [Work differently. Work organization based on homogeneous teams] Milan: Franco Angeli.

Cavazzani, A., Fiocco, L., and Sivini, G., eds., 2001, “Melfi in time. Produzione snella e disciplinamento della forza lavoro alla Fiat.” *Quaderni del Consiglio Regionale della Basilicata* Vol. 6.

Cersosimo D., 1994, “Viaggio a Melfi. La FIAT oltre il Fordismo,” [Trip to Melfi. FIAT beyond Fordism] Donzelli Editore, Rome, Italy.

Cerruti, G., and Rieser, V.. 1991, “Fiat: qualità totale e fabbrica integrata”, [Fiat: total quality management and Computer Integrated Manufacturing] Rome: Ediesse.

Cerruti, G., 1994, “La fabbrica integrata.” [Computer Integrated Manufacturing]: *Meridiana*, 103-147.

Conti, R., Angelis, J., Cooper, C., Faragher, B., & Gill, C., 2006, “The Effects of Lean Production on Worker Job Stress”, *International Journal of Operations & Production Management*, 26 (9), 1013-1038.

Coriat B., 1991, Penser à l’envers, Paris: Christian Bourgois Editeur.

Cossavella, C., 2005, interviewed in Novara, F., Rozzi, R., and Garruccio, R., eds., *Uomini e lavoro alla Olivetti*, Paravia: Bruno Mondadori Editore.Damiano, C., and Pessa, P., 2003, “Dopo lunghe e cordiali discussioni: la storia della contrattazione sindacale alla FIAT in 600 accordi dal 1921 al 2003”, [After long and cordial discussions] Rome: Ediesse.

Cotesta, V., Montesperelli, P. and Pendenza, M., 2000 “La fabbrica integrata: cooperazione e conflitto alla FIAT di Melfi”, [Computer Integrated Manufacturing: Cooperation and Conflict in Fiat Melfi] Vol. 29. Rome: Meridiana libri.

Damiano, C., and Pessa, P., 2003, “Dopo lunghe e cordiali discussioni: la storia della contrattazione sindacale alla FIAT in 600 accordi dal 1921 al 2003”, [After long and cordial discussions] Rome: Ediesse.

Dealessandri, T., Magnabosco, M., Degiacomi, C., 1987, "Contrattare alla Fiat: Quindici anni di relazioni sindacali", [Bargaining in Fiat: Fifteen years of industrial relations] Rome: Edizioni Lavoro.

De Witt, G., and Butera, F., 2011, “Valorizzare il lavoro per rilanciare l'impresa”, [Appraise the work to revamp the enterprise] Collana di studi e ricerche dell’Associazione archivio storico Olivetti. Bologna: Il Mulino.

Donzelli Carmine, Annibaldi, C., Magnabosco M., 1994, “La Fabbrica di Melfi, col senno di poi una conversazione con Cesare Annibaldi e Maurizio Magnabosco e qualche commento” [The Melfi plant: conversation with Cesare Annibaldi and Maurizio Magnabosco and some comments] *Meridiana*, 19-33.

Duerr, E. C., Duerr, M. S., Ungson, G. R., Wong Y. Y., 2005, “Evaluating a Joint Venture: NUMMI at Age 20.” *International Journal of Business and Economy* 6 (1), 111-135.

Edin, P. A., and Holmlund, B., 1993, "The Swedish Wage Stucture: The Rise and Fall of Solidarity Wage Policy?" No. w4257. Cambridge, MA: National Bureau of Economic Research.

Ellegård, K., Jonsson, D., Engström, T., Johansson, M. I., Medbo, L., & Johansson, B., 1992, "Reflective Production in the Final Assembly of Motor Vehicles: An Emerging Swedish Challenge," *International Journal of Operations & Production Management*, 12(7/8), 117-133.

Ellegård, K., 1995, "The Creation of a New Production System at the Volvo Automobile Assembly Plant in Uddevalla, Sweden," in Sandberg, Å.. eds., "Enriching Production: Perspectives on Volvo's Uddevalla Plant as an Alternative to Lean Production." Aldershot: Avebury, England.

Ellingsen, T., and Johannesson, M., 2007, "Paying Respect," *The Journal of Economic Perspectives*, 135-150.

Engström, T., and Medbo, L., 1992, "Materials Flow Analysis, Sociotechnology, and Naturally Grouped Assembly Work for Automobiles and Trucks," in Pornschlegel H., eds., *Research and Development in Work and Technology: Proceedings of an European Workshop*. Dortmund, Germany, 23-25 October, 1990, Physica Verlag Heidelberg, Germany.

Engström, T., Johansson, J. Å., Jonsson, D., and Medbo, L., 1995, "Empirical Evaluation of the Reformed Assembly Work at the Volvo Uddevalla Plant: Psychosocial Effects and Performance Aspects," *International Journal of Industrial Ergonomics*, 16(4), 293-308.

Engström, T., Jonsson, D., and Medbo, L., 1998, "The Volvo Uddevalla Plant and Interpretations of Industrial Design Processes," *Integrated Manufacturing Systems* 9(5), 279-295.

Engström T., Jonsson, D. and Medbo, L., 2001, "The Method of Successive Assembly System Design: Six Case Studies within the Swedish Automotive Industry," in Gunasekaran, A., eds., Agile Manufacturing: The 21st Century Competitive Strategy: The 21st Century Competitive Strategy", Elsevier, Amsterdam, Netherlands.

Esposito, P., 2004, "L'esercizio del potere disciplinare: pressione e repressione", [The exercise of disciplinary power] in VV.AA., eds., *La primavera di Melfi: Cronaca di una lotta Operaia,* MIlan: Edizioni Punto Rosso.

Favero, G., 2005, "Benetton: I colori del successo", [Benetton: successful colors] Milan: EGEA.

Fiat Auto, 1994, "Fabbrica Integrata."

Follis, M., Pessa, P., Silveri, M., 1991, "Relazione di sintesi del settore auto: Progetto Force" working paper.

Freeman, C., and Louça, F., 2001, "As Time Goes By: From the Industrial Revolutions to the Information Revolution", Oxford, England: Oxford University Press.

Freeman, C., and Perez, C., 1988, "Structural Crises of Adjustment, Business Cycles, and Investment Behavior," pp. 38-66 in Dosi, G., Freeman, C., Nelson, R., Silverberg, G., Soete, L., eds., *Technical Change and Economic Theory*, London: Francis Pinter.

Frege, C. M., 2002, *Social Partnership at Work: Workplace Relations in Post-unification Germany*, London, England: Routledge.

Freyssenet, M., 1998a, "Reflective Production: An Alternative to Mass Production and Lean Production?," *Economic and Industrial Democracy*, vol. 19, n°1, pp. 91-117.

Freyssenet M., 1998b, "Renault, from Diversified Mass Production to Innovative Flexible Production", in Freyssenet M., Mair A., Shimizu K., Volpato G. (eds), *One Best Way? The Trajectories and Industrial Models of World Automobile Producers*, Oxford, New York, Oxford University Press, pp. 365-394.

Freyssenet, M., 2012, "The Intellectual Division of Labour: A Stake in the Current Crisis?" Thirtieth International Labour Process Conference, Stockholm, March 27-29 2012.

Fortunato, V., 2007, "Lavorare in Fiat Sata: Relazioni Industriali e Condizioni di Lavoro, dalla Fabbrica Integrata alla World Class Manufacturing", [Work in Fiat SATA: Industrial Relations and Working Conditions] Rapporto di Ricerca per la FIM-CISL nazionale, Rionero in Vulture (PZ).

Garrahan, P. and Stewart, P., 1992, "The Nissan enigma: Flexibility at work in a local economy", London: Mansell.

Giugni, G., 2006, "Diritto Sindacale", [Trade Unions' Law] Cacucci Editore, Bari, Italy.

Guidi, M. E. L., 1996, "Lavoro e relazioni industriali nella produzione snella. Considerazione di uno storico del pensiero economico in margine a una ricerca empirica" [Work and Industrial Relations in Lean Production] Seminar Social Studies Department, University of Brescia, Italy.

Gallino, L., and Ceri, P., 2001, "L'impresa responsabile: Un'intervista su Adriano Olivetti", [The Responsible Enterprise] Turin: Edizioni di Comunità.

Giuri, P., Ploner, M., Rullani, F., and Torrisi, S., 2010, "Skills, Division of Labor, and Performance in Collective Inventions: Evidence from Open Source Software," *International Journal of Industrial Organization* 28(1), 54-68.

Grijuela, F., 2005, interviewed in Novara, F., Rozzi, R., and Garruccio, R., *Uomini e lavoro alla Olivetti*, Turin: Paravia - Bruno Mondadori Editore.

Haasen, A., 1996, "Opel Eisenach GMBH: Creating a High-productivity Workplace," *Organizational Dynamics*, 24(4), 80-85.

Hancké, B., and Rubinstein, S., 1995, "Limits to Innovation in Work Organization? An international comparison: Volvo Uddevalla and GM Saturn," in Sandberg, Å., eds., *Enriching Production: Perspectives on Volvo's Uddevalla Plant as an Alternative to Lean Production*, Aldershot: Avebury, England.

Harbour Consulting, 1997, "The Harbour Report. Manufacturing Analysis, Company by Company, Plant by Plant, North America.", MI: University of Michigan Press.

Herod, A., 2000, "Implications of Just-in-Time Production for Union Strategy: Lessons From the 1998 General Motors-United Auto Workers Dispute", *Annals of the Association of American Geographers* 90 (3), 521-547.

Hirst, P., and Zeitlin, J., 1992, "Specializzazione flessibile e post-fordismo: Teorie, realtà e implicazioni politiche," [Flexible Specialization and Post-Fordism] in Belussi, F., eds., *La grande trasformazione: La nascita di nuovi modelli organizzativi di impresa*, Milan: Franco Angeli.

Holmlund B., 2006, “The Rise and Fall of Swedish Unemployment,” in Werding, M., eds., *Structural Unemployment in Western Europe: Reasons and Remedies*. Cambridge, MA: MIT Press.

Inkpen, A. C., 2008, “Knowledge Transfer and International Joint Ventures: The Case of NUMMI and General Motors,” *Strategic Management Journal* 29(4), 447-453.

Jonsson, D., Medbo, L., and Engström, T., 2004, “Some Considerations relating to the Re-introduction of Assembly Lines in the Swedish Automotive Industry,” *International Journal of Operations & Production Management* 24(8), 754-772.

Jürgens, U., Dohse, K., and Malsch, T., 1984, “New Production Concepts in West German Car Plants,” in Tolliday, S. and Zeitlin J., eds., *Between Fordism and Flexibility: The Automobile Industry and Its Workers*, Cambridge: Polity, 258-81.

Jürgens, U., 1995, “Group Work and the Reception of Uddevalla in the German Car Industry,” in Sandberg, Å., eds., *Enriching Production: Perspectives on Volvo’s Uddevalla Plant as an Alternative to Lean Production*. Aldershot: Avebury, England.

Jürgens, U., 1997, “Germany: Implementing Lean Production,” in Kochan, Thomas A., Lansbury Russell D., and Macduffie, J. P. , eds., *After Lean Production: Evolving Employment Practices in the World Auto Industry*, No. 33. Ithaca, NY: Cornell University Press.

Jürgens, U., 1998, “Implanting Change: The Role of ‘Indigenous Transplants’ in Transforming the German Productive Model.” in Boyer, R., Charron, E., Jurgens, U., Tolliday, S., eds., *Between Imitation and Innovation. The Transfer and Hybridization of Productive Models in the International Automobile Industry*, London: Oxford University Press, 319-341.

Landsbergis, P. A., Cahill, J., Schnall, P., 1999, “The Impact of Lean Production and Related New Systems of Work Organization on Worker Health”, *Journal of Occupational Health Psychology* 4 (2), 108.

Lewchuk, W., Stewart, P., and Yates, C., 2001, “Quality of Working Life in the Automobile Industry: A Canada- UK Comparative Study.” *New Technology, Work and Employment* 16 (2), 72-87.

Loubet, J. L., 2000, “Lorsque Peugeot rencontre Ford, Sloan, et Toyota,” in Freyssenet, M., Mair, A., Shimizu, K. and Volpato, G. eds. *Quel modèle productif? Trajectories et modèles industriels des constructeurs automobilis mondiaux*, La Découverte, Paris, 369-403.

MacDuffie, J. P., 1995, “"Human Resource Bundles and Manufacturing Performance: Organizational Logic and Flexible Production Systems in the World Auto Industry”, *Industrial and Labor Relations Review*, 197-221.

Mas-Colell, A., Whinston, M. D., and Green, J. R., 1995, “Microeconomic Theory”, Vol. 1. Oxford, England: Oxford University Press.

Martinez, L. M., Stewart, P., 1997, “The Paradox of Contemporary Labour Process Theory: The Rediscovery of Labour and the Disappearance of Collectivism.” *Capital & Class* 21 (2), 49-77.

Müller-Jentsch, W., 1995, “Germany: From Collective Voice to Co-Management” in Roger, J., and Streeck, W., eds.,

Works Councils: Consultation, Representation, and Cooperation in Industrial Relations, University of Chicago Press.

Murakami, T., 1999, "Works Councils and teamwork in a German car plant," *Employee Relations*, Vol. 21, No. 1, pp. 26-45.

Musso, S., 1999, "Le relazioni industriali della Fiat," [Fiat Industrial Relations] in Annibaldi, C., and Berta, G., eds., "Grande impresa e sviluppo italiano: Studi per i cento anni della Fiat," Bologna: Il Mulino.

Musso, S., 2002, "Storia del lavoro in Italia: Dall'Unità a oggi" [History of Work in Italy] Venice: Marsilio.

Nardin, G., 1987, "La Benetton: Strategia e struttura di un'impresa di successo", [Benetton: Strategy of a successful company] Rome: Edizioni Lavoro.

Negrelli, Serafino, 1989, "Il caso Italtel," [The Italtel Case] pp. 171-206 in Regini, M. and Sabel, C. F., *Strategie di riaggiustamento industriale*, Bologna: Il Mulino.

Nilsson, L., 1995, "The Uddevalla Plant: Why Did it Succeed with a Holistic Approach and Why Did It Come to an End?" in Sandberg, Å, eds., *Enriching Production: Perspectives on Volvo's Uddevalla Plant as an Alternative to Lean Production*, Aldershot: Avebury, England.

Novara, F., 1973, "Job Enrichment in the Olivetti Company," *International Labour*, 108 (4), pp.12, 283.

Novara, F., Rozzi, R., "Una guida ai temi e agli argomenti del volume," [A guide of the topics of the volume] in Novara, F., Rozzi, R., and Garruccio, R., eds., *Uomini e lavoro alla Olivetti*, Turin: Paravia - Bruno Mondadori Editore.

Ohno, T., 1988, "Toyota Production System: Beyond Large-Scale Production", New York, NY: Productivity Press.

Parker, S. K., 2003, "Longitudinal Effects of Lean Production on Employee Outcomes and the Mediating Role of Work Characteristics", *Journal of Applied Psychology* 88 (4), 620.

Parker, M., Slaughter, J., 1990, "Management- by- Stress: The Team Concept in the US Auto Industry", *Science as Culture* 1 (8): 27-58.

Perez, C., 1983, "Structural Change and Assimilation of New Technologies in the Economic and Social Systems", *Futures*, 15 (4) (October), 357-375.

Perez, C., 1985, "Microelectronics, Long Waves, and World Structural Change: New Perspectives for Developing Countries: *World Development*, 13 (3), 441-463.

Perez, C., 1986, "The New Technologies: An Integrated View", The Other Canon - Telemark University College Working Paper No. 19, in *Technology Governance and Economic Dynamics*, The Other Canon Foundation, Norway and Tallinn University of Technology, Tallinn, Estonia.

Pero, L., 1° Stesura 14/12/1996, "Progetto Leonardo: Fabbisogno Formativo per le Commissioni Congiunte. Report preliminare sul caso Italiano: Il sistema di Partecipazione alla Fiat-Sata di Melfi", [Leonardo Project: Training for the Joint Committees] Working Paper (Unpublished).

Pessa, P. and Sartirano L., 1993, “Fiat Auto: ricerca sull’innovazione dei modelli organizzativi.” [Fiat Auto: Research on the work organization innovation] Fiom Piemonte, Turin.

Regalia, I., 1995, “Italy: The Costs and Benefits of Informality.” in Roger, Joels and Streeck, Wolfgang, *Works Councils: Consultation, Representation, and Cooperation in Industrial Relations*, University of Chicago Press, 217-242.

Rieser, V., 1997, “Lavorare a Melfi: inchiesta operaia sulla fabbrica integrata Fiat”, [Work in Melfi] Rionero in Vulture (PZ): Calice.

Robertson, D., Rinehart, J., and Huxley, C., 1992, “‘Team Concept and Kaizen’: Japanese Production Management in a Unionized Canadian Auto Plant,” *Studies in Political Economy*, 39.

Roth, S., 1997, “Germany: Labor’s Perspective on Lean Production,” Cornell International Industrial and Labor Relations Reports 33, 117-136.

Sabel, C., and Piore, M., 1984, “The Second Industrial Divide: Possibilities for Prosperity”, New York: Basic Books.

Salop, S. C., 1979, “A Model of the Natural Rate of Unemployment,” *The American Economic Review*, 117-125.

Sandberg, Å., 1995, “The Uddevalla Experience in Perspective,” in Sandberg, Å., eds., *Enriching Production: Perspectives on Volvo’s Uddevalla Plant as an Alternative to Lean Production*. Aldershot: Avebury, England.

Sandberg, T., 1995, “Volvo Kalmar: Twice a Pioneer,” in Sandberg, Å., eds., *Enriching Production: Perspectives on Volvo’s Uddevalla Plant as an Alternative to Lean Production*. Aldershot: Avebury, England.

Schlicht, E., 1978, “Labour Turnover, Wage Structure, and Natural Unemployment,” *Zeitschrift für die gesamte Staatswissenschaft/Journal of Institutional and Theoretical Economics*, June, No. 134, 337-346.

Sewell, G., 1998, “"The Discipline of Teams: The Control of Team-Based Industrial Work Through Electronic and Peer Surveillance.” *Administrative science quarterly*: 43 (2), 397-428.

Sewell, G., 2001, “Controllo, Resistenze e Soggettività”, [Control, Resistances and Subjectivity] in Cavazzani, A., Fiocco, L. and Sivini, G., eds., *Melfi in time. Produzione snella e disciplinamento della forza lavoro alla Fiat" Quaderni del Consiglio Regionale della Basilicata*, vol. 6, 217-228.

Shah, R. and Ward, P., 2007, “Defining and Developing Measures of Lean Production”, *Journal of Operations Management* 25 (4), 785-805.

Shapiro, C., and Stiglitz, J. E., 1984, “Equilibrium Unemployment as a Worker Discipline Device,” *The American Economic Review*, Princeton University, April, 433-444.

Skans, O. N., Edin, P. A. and Holmlund, B., 2009, “Wage Dispersion between and Within Plants: Sweden, 1985-2000,” in Lazear, E. P., and Shaw, K. L., eds., *The Structure of Wages: An International Comparison*. Chicago, IL: University of Chicago Press, 217-260.

Sloan, A. P., 1957, “My years with General Motors,” New York, NY: Basic Books.

Solow, R. M., 1980, “Another Possible Source of Wage Stickiness,” *Journal of Macroeconomics* 1(1), 79-82.

Soskice, D., and Schettkat, R., 1993, "West German Labor Market Institutions and East German Transformation," in Ulman, L., Eichengreen, B. J., Dickens, W. T., eds., *Labor and an Integrated Europe*. Washington, DC: Brookings Institution Press, 102-27.

Springer, R., 1999, "The End of New Production Concepts? Rationalization and Labour Policy in the German Auto Industry," *Economic and Industrial Democracy* 20(1), 117-145.

Stephenson, C., and Stewart, P., 2001, "The Whispering Shadow: Collectivism and Individualism at Ikeda-Hoover and Nissan UK." *Sociological Research Online*, 6 (3).

Stewart, P., 2001, "L'operaio Collettivo e la Produzione Snella" [Collective Worker and Lean Production] in Cavazzani, A., Fiocco, L. and Sivini, G., eds., *Melfi in time. Produzione snella e disciplinamento della forza lavoro alla Fiat*, Quaderni del Consiglio Regionale della Basilicata vol. 6, 229-237.

Streeck, W., 1985, "Industrial Relations and Industrial Change in the Motor Industry: An International View," Public Lecture, Warwick, England: University of Warwick.

Streeck, W., 1996, "Lean Production in the German Automobile Industry: A Test Case for Convergence Theory," in Berger, S., and Dore, R. P., eds., *National Diversity and Global Capitalis*. Ithaca, NY: Cornell University Press: 138-170.

Thompson, P., and Ackroyd, S., 1995, "All Quiet on the Workplace Front? A Critique of Recent Trends in British Industrial Sociology." *Sociology* 29 (4), 615-633.

Turner, L., 1995, *Social Partnership in the Global Economy: Crisis and Reform in Unified Germany*, Ithaca, NY: Industrial and Labor Relations (ILR) Press/Cornell University Press.

Volpato, G., 1996, "Il caso Fiat: Una strategia di riorganizzazione e rilancio," [The Fiat Case] Turin: Unione Tipografico-Editrice Torinese Libreria.

Wergin, N. E., 2003, "Teamwork in the Automobile Industry: An Anglo-German Comparison," *European Political Economy Review* 1(2), 152-190.

Westney, E., 1989, "Internal and External Linkages in the MNC: The Case of R&D Subsidiaries in Japan," in Bartlett, C.A., Doz, Y., and Hedlund, G., eds., *Managing the Global Firm*. London, England: Routledge.

Wickens, P., 1987, *Road to Nissan*, London: Macmillan Press.

Wild, R. 1975, "On the Selection of Mass Production Systems, *The International Journal of Production Research* 13(5), 443-461.

Williams, K., Cutler, T., Williams, J., and Haslam, C., 1992, "La produzione di massa è davvero finita? Alcune note critiche sul modello della 'specializzazione flessibile' di Piore e Sabel", [Does Mass Production really come to an end?] in Belussi, F., ed., *La grande trasformazione: La nascita di nuovi modelli organizzativi di impresa*, Milan: Franco Angeli.

Womack, J., Jones, D. and Roos, D., 1990, *The Machine that Changed the World*, Rawson Associates, New York, NY.

Young P. H., 1998, “Individual Strategy and Social Structure: An Evolutionary Theory of Institutions”, Princeton, NJ: Princeton University Press.