The Nordic Model as a Development Strategy

An empirical study of the Indian manufacturing sector

Pauliina Brynildsen

Master of Philosophy in Economics

Department of Economics

UNIVERSITY OF OSLO

MAY 2016

The Nordic Model as a Development Strategy

An empirical study of the Indian manufacturing sector

© Pauliina Brynildsen

2016

The Nordic Model as a Development Strategy

Pauliina Brynildsen

http://www.duo.uio.no/

Print: Reprosentralen, University of Oslo

Abstract

This thesis explores the feasibility of the Nordic model as a growth strategy for developing countries. Its empirical strategy is to use a panel of Indian states with data from the manufacturing sector to test key implications of the model. Based on the stylised presentation in Dølvik J.E. (2013), *Grunnpilarene i de nordiske modellene*, I consider the main elements of the Nordic 'triangle' model to be macroeconomic policy, labour regulation and the welfare state. The focus of the analysis is on one of the most important elements of the model, namely labour relations. In the Nordic model, labour relations are characterised by high union density and centralisation in wage bargaining. Theory developed by Barth, Moene, and Willumsen (2014) in the article "The Scandinavian Model – An interpretation" shows that an important result of this feature is wage compression. In my analysis I find some support for the implications that centralisation through unionisation leads to wage compression in the Indian manufacturing sector, as the empirical findings are to a certain degree consistent with the theoretical model.

In order to show how India can be a suitable testing ground for the theory, I give an account of its political and industrial institutions, and an overview of India's economic history. The empirical analysis is carried out using the EOPP Indian States database of the London School of Economics, consisting of a panel of Indian states with data from 1969 to 1995, which I have updated with data from printed and digital sources up to year 2010. The econometric analysis is carried out using Stata version 13.1.

The initial estimations indicate that union density in the Indian manufacturing sector, although noisily measured, could be causing wage compression. While statistically significant, the effect is relatively small in economic terms. The adjusted R^2 implies that around 85 % of the variation in the wage gap could be explained by the model.

When applying some modifications to the base line model, the results indicate that some sort of a shift may have occurred at the end of the 1970s. This could be explained by the beginning of the period of decreasing industry regulations in India in the 1980s, such that the

independent effect of union density may have started to impact the wage gap only in the subsequent period.

Based on assumptions made about the different types of trade unions by Bhattacherjee (2001), I modify the model by replacing one regressor with a related variable, the share of unions submitting returns out of the total number of unions. Given the validity of the assumptions, the results imply a wage dispersing effect of centralisation, contrary to expectation. But if valid, the effect is relatively small and has a very low significance. I also fit a model with lags of the dependent variable wage gap and find a correlation between the wage gap and its first two lags. The robustness of the effect of unionisation is thus challenged when the first two lags of the dependent variable are introduced into the model. The effect remains negative, as predicted by theory.

Considering the evidence, it does seem that the Nordic model is to a certain degree suitable as a development strategy outside of its original frame of reference. The effect of unionisation may be weaker in India than in the Nordic context, but it remains relatively robust when modifications to the base line model are made.

Preface

This thesis has been written with the financial support of the Centre for the Study of Equality, Social Organization and Performance (ESOP), at the Department of Economics, University of Oslo. ESOP has not only awarded me a scholarship, but also kindly provided me with office space and has covered expenses related to data collection, for which I am very grateful.

I wish to acknowledge the guidance of my supervisor Jo Thori Lind during the writing of this thesis, and thank him for the inspiration, encouragement and interesting conversations.

I also want to thank my husband Gaute for his unfailing and invaluable support throughout my studies and the process of writing of this thesis.

Table of contents

1 Introduction 1
1.1 The Nordic countries 1
1.2 The Nordic model as a development strategy 2
1.3 Related literature 4
2 The Nordic Model - main features 6
2.1 Historical background 6
2.2 Main features 7
3 Theory – The Scandinavian model 10
3.1 Introduction 10
3.2 Model 10
4 India 20
4.1 Republic of India - basic facts 20
4.2 The division of power: central and state governments 21
4.3 Economic history 22
4.4 Industrial relations 26
4.5 Comparing India and the Nordic countries 27
5 Data and variable description 29
5.1 The EOPP Indian States Database 31
5.2 Data characteristics 33
5.3 Summary statistics 41
6 Data analysis 43
6.1 Baseline model 44
6.2 Fixed effects within-estimation results 48
6.3 Modifications to the baseline 50
6.4 Summary of the results 56
7 Conclusion 58
References 60
Appendices 63

Table 1.1 Human Development Index ranking 2013 1
Table 4.1 World Development Indicators: India and the Nordic countries 20
Figure 4.1 GDP per capita growth 1960-2011 26
Figure 5.1 Map of India 2016 30
Table 5.1 Names of states and union territories 30
Table 5.2 Sources of updates 31
Figure 5.1 State wise correlation of number of unions and share of union members 38
Table 5.3 Summary statistics 42
Figure 6.1 Partial regression of wage gap and share of union members 46
Figure 6.2 Partial regression of wage gap and number of unions 46
Table 6.4 Correlation matrix of wage gap and its first two lags 55
Table B.1 OLS fixed effects estimations with share of unions submitting 65
Table B.2 Arellano-Bond GMM estimations 66

1 Introduction

1.1 The Nordic countries

The Nordic countries are known as egalitarian societies, in the sense that income and wealth differences are relatively smaller there than in most other countries. The United Nations' Human Development Index (HDI) reported in the *Human Development Report 2014* (United Nations Development Programme (UNDP), 2014), which is a summary measure of achievements in key dimensions of human development[1], rank the Nordic countries within the top 24 countries of the world in 2013, see Table 1.1.

Table 1.1 Human Development Index ranking 2013

Rank	Country	HDI value	Rank	Country	HDI value
1	Norway	0.944	**13**	Iceland	0.895
2	Australia	0.933	**14**	United Kingdom	0.892
3	Switzerland	0.917	**15**	Hong Kong	0.891
4	Netherlands	0.915	**15**	South Korea	0.891
5	United States	0.914	**17**	Japan	0.890
6	Germany	0.911	**18**	Liechtenstein	0.889
7	New Zealand	0.910	**19**	Israel	0.888
8	Canada	0.902	**20**	France	0.884
9	Singapore	0.901	**21**	Austria	0.881
10	Denmark	0.900	**21**	Belgium	0.881
11	Ireland	0.899	**21**	Luxembourg	0.881
12	Sweden	0.898	**24**	Finland	0.879

Source: United Nations Development Programme (UNDP), 2014

Many observers have traditionally been, according to Andersen et al. (2007), amazed that the Nordic economies are able to combine economic efficiency and growth with the presumably weak economic incentives of high taxes, a generous social security systems, egalitarian distribution of income, and a strong role played by labour unions. Like a bumble-

[1] The HDI is a summary measure of achievements in the following key dimensions: a long and healthy life, access to knowledge and a decent standard of living.

bee that flies, in plain disregard of accepted theory. In their paper, they argue that any losses of economic efficiency from the characteristic elements of the Nordic model are offset by other advantages of the same model.

They focus especially on those factors that are direct results of economic policies, like openness to trade and factor mobility – which in their view have been important in generating high productivity, and rising incomes. A tax system that is favourable to labour supply and encourages entrepreneurship, and well-developed infrastructure for transport and communication have also been essential. One important policy feature is the composition of public spending, of which a large part is directed at education, infrastructure, and active labour market policies (Andersen et al., 2007).

Other counterbalancing characteristics of the Nordic model are institutional factors, like political freedom and absence of corruption, clearly defined property rights and a reliable legal system. Finally, there are also exogenous factors, such as geographic location, climate, and natural resources that may have contributed to the economic success of the model, but which are not related to the economic system (Andersen et al., 2007).

1.2 The Nordic model as a development strategy

As the title communicates, the aim of the thesis is to investigate the possibility of applying elements of the Nordic model as a growth strategy for developing countries. Common features among the poorest developing countries are relatively high levels of inequality and widespread poverty. In the classic growth literature, it was common to find the concept of a conflict between the goals of growth and equality; the idea that one could not be achieved with the other. The Nordic model has made it possible for the Nordic countries to develop into highly industrialised countries while at the same time achieving low levels of inequality, and providing a social welfare system that affords income security to all inhabitants. From a human welfare perspective, it would be desirable for today's developing countries to be able to achieve something similar.

Considering all the characteristic elements of the model is far beyond the scope of this thesis, and I will in the following be looking more closely at one particular area. An important feature of the Nordic model is the nature of labour relations, which are characterised by

high union density and centralised wage bargaining. One result of this feature is a relatively large degree of wage compression, which will be shown in the following sections.

In exploring empirically the possibility of using this particular element of the Nordic model as part of a growth strategy, I will be using India as an example. India is the second most populous country in the world, with 17.8 % of the world's population in 2014 (The World Bank, 2016a), and widespread poverty. The possibility of identifying a viable growth strategy for a country like India could thus potentially impact a very large number of people.

In particular, I will be looking at the degree of unionisation across major Indian states, and across time. As Indian labour relations are characterised by a certain degree of centralisation, this feature could qualify India as a valid example, despite the major differences in geography, history, sizes, heterogeneity and numerous other factors that characterise India and the Nordic countries. The institution of tripartism with recognised roles for the workers' and the employers' unions as well as for the government is an important element in both Indian and Nordic labour relations, as is institutionalised multi-level bargaining.

Both India and the Nordics are also mixed economies, with a large public sector and a private sector. The Indian economy was closed to international trade until the 1980s, as opposed to the small open economies of the Nordic countries. This was changed in the 1980s and early 1990s, when the Indian economy was deregulated and opened up to foreign trade. But even though the Nordic countries were open in the areas of manufacturing industries and international trade, they have also had extensive regulation of labour markets, foreign exchange, finance and banking.

Another reason for choosing India for this purpose is that it is a large developing country that consists of many, partially autonomous states. By comparing Indian states, I may be able to avoid some of the issues concerning unobserved differences that could arise if I were to study a group of different developing countries, which have their own historical, political and cultural idiosyncracies[2]. Indian authorities have engaged in the collection of statistical data of considerable detail since the time of independence of British rule. This has made it

[2] This is not to say that no such variation exists across the different Indian states, but probably to a lesser degree than one would find across different countries.

possible for me to use and update a suitable panel of Indian data covering several decades. I will be using standard econometric methods to explore the question at hand.

This thesis is organised as follows: in the next subsection I will present some of the existing research on the main topic of the thesis. Section 2 gives a presentation of the main features of the Nordic model. Section 3 presents the theoretical model of Barth et al. (2014). Section 4 introduces India, and gives an account of its political and industrial institutions, and an overview of its economic history since 1914. The empirical data are presented in section 5, and the data analysis and its results follow in section 6. The econometric analysis is carried out using Stata, version 13.1. Finally, the thesis is summed up in the concluding section number 7.

Note on the use of "Scandinavian" and "Nordic"

Scandinavia is a name most commonly used for the three countries of Denmark, Sweden and Norway. The term "Nordic countries" refers to the group of countries consisting of the Scandinavian countries, plus Finland and Iceland. These terms are sometimes used interchangeably in the following text, as some sources for this thesis focus on the Nordics, while others only focus on the Scandinavian countries. This interchanging usage of terms should have no bearing on the main points or conclusions to follow.

1.3 Related literature

The topic of this thesis has mainly been inspired by the works of Barth et al. (2014) and Moene and Wallerstein (2006) which both deal with the feasibility of the Scandinavian model as a growth strategy for developing nations.

In the paper by Moene and Wallerstein (2006) the central claim is that it is the policy of wage compression, which is arrived at through highly centralised wage-setting institutions, which is the main feature of the Nordic social democratic model. The article uses a simple two-sector model with a modern and a traditional sector to illustrate its main point.

In their paper on the Scandinavian model, Barth et al. (2014) combine models of collective bargaining, creative job destruction, and welfare spending to provide a theoretical basis for

how the Scandinavian countries have achieved a combination of high productivity, low inequality, and a generous welfare state.

In a discussion paper with a related theme, Bigsten (2001) looks at the development experience of the Nordic countries, and especially that of Sweden from the 19th century, and discusses to which extent the observed patterns of development could have any relevance for Africa. The paper points to peaceful employer-labour relations and a "solidarity-based" wage policy as one out of many important institutions of the Nordic model.

I will be using the theory presented in Barth et al. (2014) as the theoretical basis for my empirical analysis. As far as I know, the empirical strategy of using Indian data for this kind of analysis has not been attempted earlier.

2 The Nordic Model - main features

There exist several presentations of the main elements of the Nordic model, one of the most recent ones being Dølvik (2013), *Grunnpilarene i de nordiske modellene*. This is a concise presentation of the Nordic model in a stylised form.

Even though they have many features in common, there are also a lot of differences between the Nordic countries. Certain elements of the Nordic model have also evolved over the past 60 decades. Dølvik gives a brief, but comprehensive description of the model focusing on the common factors and how it appeared at its height in the 1970s, when it had been well established over the two preceding decades in the post-war era.

2.1 Historical background

The historical development of the Nordic model of welfare and labour relations is, according to Dølvik (2013), best understood in light of the economic and social upheavals that were driven by the major technological and industrial changes around the turn of the previous century. This era was characterised by increasing rural to urban migration and a growing working class, as well as growing poverty and unrest. Along with industrialisation there was growing unionisation, both of workers and employers.

After waves of strikes, lock-outs and other industrial disputes in the 1930s, the first centralised agreements between certain trade unions and the employers' organisations were being signed. It was not only in the interest of the workers' unions, but also in the employers' organisations' interest to introduce collective agreements, to counteract domestic competition in wages and working conditions between their members. The Nordic governments also developed formal mechanisms for resolution of industrial disputes around the time of the First World War, often through wide ranging cooperation between the organisations.

The era of rapid growth of the 1950s and 60s saw a steady expansion of the education and welfare systems and a further development of the central mechanisms of coordination within the sphere of industrial relations. The major goals of high employment rates, income

security, equal opportunities, equal rights to higher education, gender equality, and the improvement of living conditions had won widespread support in the Nordic countries by the 70's, regardless of political standing. Differences in wages and income were also at a historical low.

2.2 Main features

Three equally important, interdependent components make up the Nordic 'triangle model': macroeconomic policy, labour regulation and the welfare state (Dølvik, 2013).

Macroeconomic policies

The main focus of macroeconomic policy was stability and the maintaining of low unemployment rates, and promoting investment and growth, through close alignment with labour policy. Traditionally monetary policies were based on politically fixed low interest rates and a system of state-run banks to support the rate of investments. International capital movements were also under state regulation.

Labour market regulation and collective bargaining - tripartism

At the time of the worldwide economic depression of the thirties, there was mass unemployment and unrest. According to Dølvik, this is what brought on the central agreements of the national confederations of trade unions and of the employers' organisations. These settlements laid the ground rules of action in industrial relations and came to symbolise the reciprocal recognition of both sides of their interdependence and common interests. Thus developed a system of centralised collective bargaining, in a bargaining model in which industries that compete internationally bargain first. This was seen as vital in reducing the threat of inflation, securing the competitiveness of industries, inducing investments and keeping up demand for labour. This arrangement was supplemented by labour laws protecting workers' rights.

The tripartite system was characterised by a multilevel structure, where local and industry levels played an important part. Major issues were resolved at the central level,

leading to fewer conflicts at local level. Negotiations on improving enterprise productivity and securing the level of employment could be kept at the local level. Industry level federations played a mediating and coordinating role between the local and the central levels, providing open lines of communication between the two. There was also a certain degree of flexibility in the system by the provision of contractual freedom to deviate from central regulation.

In regards to productivity, the Nordic economies have been characterised by a great deal of restructuring and high labour mobility. These features have been supported by policies aimed at full employment and active labour market policies focused on retraining workers for new jobs. These policies were in turn important justifications for unions at local levels to be able to give their support to the restructuring of enterprises and job rationalisations.

The typical labour market institutions such as unionisation, coordinated wage bargaining, generous unemployment benefits and active labour market policies, can be interpreted as reflecting a consensus around the general idea of risk sharing.

The welfare state

In Dølvik's account, the aim of the Nordic welfare state is to provide tax financed income security, health security and a reduction of differences in living standards. An important element of the welfare state is the investments in free education to further growth, social mobility and equality. In the 1960s and 70s the educational systems and public services sector where greatly developed, and also became an important factor in increasing female work force participation (Dølvik, 2013).

Welfare policy was largely based on the premise of a so-called "work ethos"; unemployment benefits were for instance tied to a prerequisite that those beneficiaries with the capability of working should accept possible job openings. The universal income security benefits also meant sharing individual workers' risks associated with the restructuring of enterprises and the possibility of loss of work and income, and that a common reservation wage was established. This in turn strengthened the bargaining power of the workers (Dølvik, 2013).

The welfare state played a key part in the transition of the Nordic countries into post-industrial economies, working through a redistribution of demand through the tax and welfare systems, and offering employment at decent income terms and working conditions. In many other countries, the development of a private service sector would lead to lower wages and increasing inequality. Avoiding this possible conflict of equality and employment growth in the Nordic countries relied on wide public support for the welfare system and increasing taxes. The steady enlargements of the welfare system depended on economic policy and labour market policy to create enough growth, employment and tax income to balance welfare expenditures (Dølvik, 2013).

The importance of a high rate of labour force participation as a crucial element of the model is emphasised by Andersen et al. (2007). They also argue that the risk sharing mechanisms of the welfare system have been important for eliciting wide support for openness to free trade and to competition. This has been created by "... *a number of systems through which the winners from structural transformation at least to some extent compensate the losers*" (Andersen et al., 2007, p. 18)

Active labour market policies, redistribution of income, and generous unemployment schemes are among the important risk sharing mechanisms (Andersen et al., 2007). With public provision of many social services such as child care, education, hospital and other health services, and care for the elderly - provided for free, or at very low, subsidised prices – access to such welfare services was made independent of income and employment status. In their opinion, the interaction of openness and collective risk sharing in the Nordic model is its key feature. Even though the Nordic economies where open to international trade, they were still highly regulated in the 1950s, 60s and 70s in areas outside exports and the manufacturing industry. During the financial deregulations of the 1980s, macroeconomic policies became more norm-based, instead of active and discretionary, as they had been before. The aim of monetary policy became maintaining price stability in the medium term (Andersen et al., 2007).

3 Theory – The Scandinavian model

3.1 Introduction

To be able to look closer at the main issue of this thesis, I need to base my analysis on a formal economic model of the different elements of the Nordic model. In their paper, Barth et al. (2014) (referred to as BMW from now on), combine models of collective bargaining, creative job destruction, and welfare spending to provide a theoretical basis for how the Scandinavian countries have achieved a combination of high productivity, low inequality, and a generous welfare state.

Their claim is that a two-level bargaining system and a strong union involvement assist in enhancing productivity: the combination of worker efforts and capitalist dynamics leads to wage compression and efficiency. Further, there is a positive complementarity between this productivity enhancing wage compression and the political support for welfare spending.

The argument is that unionisation and wage compression lead to so-called creative destruction. The creative job destruction leads to increased (average) productivity, and this in turn leads to an increased average wage for a given employment level.

The welfare state is not just a system for redistribution, but an institution that provides goods and services (social insurance, health care and education) that are normal goods. According to BMW, with increasing average labour income of workers, demand for welfare spending increases. Small income differences and high productivity lead to increased political support for a large welfare state.

3.2 Model

Local level bargaining

The coordinated and centralised bargaining structure is essential to the Scandinavian model, as is the interaction between central and local level bargaining. The first element of the

model to be presented is the local level of the bargaining structure, keeping in mind that local bargaining actually follows when the central agreement is already in place.

During local bargaining, the effort level l and wage w are decided simultaneously. Let the utility of union members be $u(w, l)$, and the profits of the employer be $\pi(w, l)$.

In this model, effort and pay are determined as the solution to a bargaining problem which is maximising the joint surplus of the workers and the employer, or the Nash product that is

$$N = \pi(w, l)^{(1-\alpha)} u(w, l)^{\alpha}$$

where α is the bargaining power of the local union. In this generalised example we have a disagreement point of (0,0).

From the first order conditions of this maximisation we can see that if we are at a point where $\pi_w = -u_w$, where the marginal utility of the union of higher wages is equal to the costs of higher wages, then we also have that $\pi_l = u_l$, where the marginal benefit for the employer of the workers' effort l equals the marginal cost of effort for the workers. The important implication of this is that in the model, bargaining leads to worker efforts that are set at the socially efficient level.

Bargaining with restrictions on industrial actions on local level

In reality, the central coordination leads to restrictions on industrial actions at the local level, such that the disagreement point is not (0,0). The restrictions on industrial actions apply for both parties. This means that when a central agreement is in place, the workers are not allowed to go on strike, and the employers cannot use lock-outs in case of any conflict. Workers may only engage in *work-to-rule* action, which reduces their work effort to a proportion $(1 - \xi) < 1$ of the normal level, and reduces pay to the tariff wage q.

Let the total value added in each plant be collective effort l times the productivity of equipment f (productivity f is given at the beginning of local wage bargaining.) Assume that the cost of effort for workers v is increasing and convex in effort l. Let the local wage supplement be Δ.

We are assuming that the level of employment in each production unit is fixed.

$$u = \begin{cases} q + \Delta - v & \text{no conflict} \\ q - (1 - \xi)v & \text{conflict} \end{cases}$$

$$\pi = \begin{cases} lf - q - \Delta & \text{no conflict} \\ (1 - \xi)lf - q & \text{conflict} \end{cases}$$

The solution to the expanded version of the bargaining problem is again found by the first order conditions of the maximisation of the joint surplus:

$\Delta = \alpha\xi lf + \xi(1 - \alpha)v$ such that the wage is $w = \Delta + q = \alpha\xi lf + \xi(1 - \alpha)v + q$ and $\frac{dv}{dl} = f$

This implies that efforts are set at an efficient level, since the marginal increase in productivity, and thus revenue f, equals the marginal cost of effort dv/dl, even though it is the workers that carry the full cost of the efforts and receive only a part of the benefits of the higher efforts applied.

It also shows that high productivity firms pay higher wages and have higher profits, since the local wage supplement that is added to the tariff wage q depends positively on f.

The rest of BMW's presentation of the model uses a normalised simplification of wage w: $w = \alpha\xi f + q$.
This is the tariff wage q plus the local wage premium, and the local premium is only affected by the bargaining power of the unions and the local threat of industrial actions, in addition to productivity.

Central level bargaining

The next step is to look at the central/state bargaining level. One main assumption here is that the central negotiators set wages that are conducive to full employment. Another is that uType equation here.nions are assumed to have as their goal to compress wage distributions over the bargaining unit. This means that at the central level, their preference is a compressed distribution of tariff wages.

Creative destruction and wage compression

To describe the economic process that leads to productivity increases and wage compression in this setting, BMW set up a model of job creation where decision-making retains to the investing in new enterprises and the closing down of old ones. The entrance of new firms requires investments in new capital equipment. Equipment that belongs to newer vintages is more productive than equipment from older vintages, and new and old techniques co-exist.

Innovations and technologies exist in use as long as their resulting revenues cover their costs. Thus every period has a distribution of older technologies still in use. This results in wage differences across existing firms. When firms exit the industry it means that older plants close, and this results in an increase in the average productivity, as the oldest technologies are the least productive.

We are assuming a small open economy, meaning that output prices are considered as given. The sum of profits of the employer depends on the productivity over the lifetime of each job, which generates the total revenues, and on the total costs. The total costs in this model are the sum of the wages to workers over the lifetime of each job.

Let the economic lifetime of each job created at time t be $\theta(t)$, and the productivity of a job be $F(t)$, profits are thus

$$\pi = \theta(t)F(t) - \sum_{s=t}^{t+\theta(t)-1} W(s,t)$$

The wages, in turn, are the sum of the local wage premium, which remains constant over the lifetime of each job, and the tariff wage. The tariff wage changes as the aggregate productivity of the economy changes. Wages at time s are

$$W(s,t) = Q(s) + \alpha\xi F(t),$$

giving profits

$$\pi = (1-\alpha\xi)\theta(t)F(t) - \textstyle\sum_{s=t}^{t+\theta(t)-1} Q(s).$$

Free entry in job creation implies that there are zero profits in equilibrium, as total profits tend towards the cost of entry for the marginal firm. The cost of entry is assumed to increase with the size of the enterprise, which is the share of the workforce recruited in each period n, or in other words in the number of jobs created.

Free exit implies a termination of jobs at the time where the revenues equal the costs. The productivity of a job is determined by the available technology at the time of entrance of the new firm, and stays fixed over time. This productivity determines the revenues. The wage costs increase over time with the tariff wage, such that jobs are terminated when revenues no longer cover costs.

Free exit thus implies that

$$F(t-\theta(t)+1)-w(t-\theta(t)+1,t)=(1-\alpha\xi)F(t-\theta(t)+1)-Q(t)=0$$

Along a steady state path, the main parameters and variables of the model grow at a constant rate. This applies to the economic lifetime of a job, and the number of jobs created each period – or the share of the workforce recruited to each new vintage. The growth in the productivity of innovations, the growth rate of the tariff wage, and the growth rate of the cost of entry are also constant.

Central wage negotiators set tariff wages such that there is full employment. This assumption of full employment can be expressed as $\theta(t)n(t)=1$. The income of each vintage increases in the lifetime of each job. If we thus let the economic lifetime of investments be $\theta(t)\ =1/n$, which is declining in n, the total wage cost over the lifetime of an investment be $\widetilde{w}$, and the cost of entry $b(n)$, which is increasing in n, BMW show that the free entry condition of revenues minus costs can be expressed as $\left(\frac{1}{n}\right)f-\widetilde{w}=b(n)$. (See Appendix A .)

This expression can be written as:

$$\pi(n,\lambda)\equiv(1-\alpha\xi)\left[\left(\frac{1}{n}\right)-x\left(\frac{1}{n}\right)\right]f=b(n)$$

Here we let the average pace of technological change, which affects the tariff wages and thus workers lifetime income, be λ, and the income of each vintage be $x(\theta)=x\left(\frac{1}{n}\right)$. This

condition determines an equilibrium; a unique level of the share of the workforce recruited to each new vintage n. For a given level of technical change, the profits are decreasing in the share of the workforce n and the cost of entry on the right hand side is increasing in n. From this we can see how the profits are determined by the bargaining power of the unions and the threat of effort reduction in case of conflict. They are also determined by the economic lifetime of the enterprise and the income of the workers.

From the free exit condition above we can find the tariff wage $q = (1 - \alpha\xi)(1 + \lambda)^{1-\frac{1}{n}} f$ (See Appendix A.)

Wage inequality is then given by the gap between the highest and the lowest pay along the steady state path:

We see that the wage gap is increasing in the rate of technical change λ, and in the economic lifetime of a job θ.

$$\frac{\max w - q}{q} = \frac{\alpha\xi}{(1 - \alpha\xi)}(1 + \lambda)^{\theta - 1}$$

Four important results:

The above discussion gives four important results:

1) This model shows that we have what BMW call e*mployment-preserving wage compression*, through the effect of a lower threat of reduction in work effort ξ. In short:

   > … a lower ξ has a direct wage compressing effect that is strengthened by an increase in the share of the work force n in each vintage, and thus a higher concentration of workers in the most modern vintages, that further compresses the wage structure by raising the lowest (tariff) wage q. (Barth et al., 2014, p. 66)

   The point is that this happens because a low threat of reduction of effort coming from the restrictions on industrial disputes creates strong incentives for investments in new technologies. Relative to a steady state with a high ξ, a low ξ leads to lower expected wage costs, which in turn means higher expected profits over the lifetime of an investment. Higher investments increase the demand for labour, and the equilibrium level of wages goes up.

Higher investments mean that there are more jobs created in each vintage, and this means that workers are more concentrated in vintages where there is higher productivity. The process of creative destruction moves a larger share of the workforce to more productive jobs. We get a higher level of income per capita, larger vintages, a shorter economic lifetime (as the number of new jobs created is increasing), and a higher average wage compared to a state with a high ξ.

The reallocation of workers leads to wage compression. When investments go up, the lowest wage, which is the tariff wage, is increased without unemployment. A higher tariff wage benefits all workers. The low-paid workers and the employers benefit most, while the highest paid workers may get less than they would without the local bargaining restraint.

2) A higher level of basic productivity leads to wage compression.

   A higher level of productivity leads to higher tariff wages q, which lead to higher average incomes. A higher level of productivity also lowers economic lifetime since it increases wage costs, and it also leads to a higher concentration of workers in newer vintages. This again leads to further wage compression as the tariff wage goes up.

3) A higher rate of technological change increases the share of workers in each vintage in operation, by lowering the economic lifetime of each investment and increasing the share of workers in each remaining vintage (assuming full employment).

   As explained by BMW:

   > Speeding up the process of creative destruction implies that the distance in productivity between each vintage goes up, but that the distance in age between the least and the most efficient plant in use declines. As a result each vintage becomes fatter, and, as a consequence, the economy becomes more modernized with higher average productivity (Barth et al., 2014, p. 66).

4) To the extent that the rate of technological change is endogenous and depends on the share of workers in each vintage n, wage compression implies higher growth. BMW illustrate this point with an example where the rate of technological change is affected by the amount of resources invested in R&D.

   If the value in terms of profits of a productivity increase is $(1+\lambda)\pi - \pi = \lambda\pi$, and the rate of new technological ideas per unit of resources R invested in R&D is ρ, let the

production function of innovations be $\lambda = \rho R$. Profits in the research sector, which are the value of innovations minus costs, are thus $\pi\rho R - \left(\frac{a}{2}\right) R^2$, assuming quadratic costs and a given constant a. Maximising the profits and using the free entry condition then gives:

$$\lambda = \left(\frac{\rho^2}{a}\right) \pi(n, \lambda) = \left(\frac{\rho^2}{a}\right) b(n),$$

such that any change that increases the share of workers n would also increase the endogenous rate of technological change λ, as $b(n)$ increases in n.

Creative destruction with heterogeneous workers

BMW also extend their model to a situation with heterogeneous workers. If we allow for skill differences in the population of workers, the model of creative destruction is somewhat different to the one presented earlier. Here wage differentials are important for efficiency by sorting workers according to their productivity. In an efficient allocation the high skill workers are sorted to the high productivity jobs, and are in the most modern vintages. The low skilled workers occupy the rest of the jobs.

The wage premium paid to high skill workers must be high enough such that it is only profitable for the most productive firms to employ high skill workers. The least productive firm that employs high skill workers is on the margin indifferent between hiring a high skill or a low skill worker.

The wage differential along the steady state path is (see Appendix A):

$$\frac{W_H - W_L}{W_L} = \beta \frac{(p_H - p_L)}{p_L} (1 + \lambda)^{\theta_L},$$

where the high skill group has productivity p_H, the low skill group has productivity p_L, and where $\beta = 1$ when there is efficient sorting. In this case, the distribution of wages is more unequal than the distribution of worker productivity.

Concerning the wage gap in the case of skill differences, BMW infer that:

> The wage differences are higher the higher the rate of technological change λ, since a higher rate of technological change increases the productivity differences between each vintage. It is also clear that the wage differentials become smaller by increasing the fraction of high skilled workers (Barth et al., 2014, p. 67).

BMW also argue that wage compression in this case will distort the efficient allocation of workers. The efficiency loss can be quite small, as a reduction in the high skill wage only enables marginal firms with a bit lower productivity than the threshold of indifference to hire high skill workers while still making a profit.

As before, wage compression leads to higher investments, since expected costs are reduced. This means that wage compression increases productivity.

Public welfare spending and political competition

The third important mechanism of the Scandinavian model is described by BMW as a model of political competition between the right and the left over the level of public welfare spending. The aim is to show that wage compression changes individually optimal political choices, towards a more left-leaning electorate, and that political programs are also likely to change as a response to the new wage distribution.

The welfare state is thought of less as a tool for redistribution, and more as a provider of services. In this view, the welfare state renders public provisions of private goods. These have normal goods properties, such that demand increases with income. As the average wage increases with wage compression, support for welfare spending also increases.

An important part of the argument is that:

> Even though welfare spending is likely to be an inferior good as we move up the income distribution, changing both the income and risk of the voter, welfare spending is likely to be a normal good within each income class, as the preferred level of welfare spending goes up with the income of the voter for a given exposure to risks (Barth et al., 2014, p. 69).

Welfare spending is considered an inferior good across social classes that have different marginal benefits from public spending, but a normal good within social classes, for a given marginal benefit.

BMW present a model of political competition that shows that where there is wage compression, political parties may divert from their preferred policies and increase welfare spending. In this model, the policy platforms of political parties are the outcome of a simple game with probabilistic voting. The political parties want to win the elections, and will choose their proposed level of welfare spending to increase the probability of winning and gaining power.

With this model, they show that when there is wage compression, both political parties (left and right), may divert from their preferred policies and increase welfare spending. This is because for a given mean income, wage compression increases the income for a majority of voters, and with that, their demand for social insurance. An increase of the mean wage will have the same effect.

Conclusion

BMW show that the Scandinavian model can be described as a system with a political-economic equilibrium between 3 sets of mechanisms. First, there is two-level bargaining in the labour market with preferences for wage compression and full employment at the central level, and for microeconomic efficiency at the local level. Second, there is a mechanism of creative destruction that leads to more wage compression with increasing average wage. Thirdly, this increasing average wage leads to political support for increased welfare spending.

The authors even suggest that there might be a fourth mechanism of feedback going from welfare spending to productivity rise and further wage compression. This comes from the provision of the private goods of education and health services.

BMW also argue that the above shows that the combined effects of these mechanisms could not be achieved by a simple redistribution through the political system.

4 India

4.1 Republic of India - basic facts

Among the newly industrialised countries, India is a multilingual, and a multi-ethnic society. The republic consists of 29 states and 7 union territories (2016), the latest state formed in 2014. The subcontinent encompasses a large variety in geography, climate, and social, political, religious and cultural environments.

On the Human Development Index 2013, where the Nordic countries ranked among the very top, India is ranked at number 135, with a HDI value of 0.586 (United Nations Development Programme (UNDP), 2014). Even after a period of considerable growth in the last decades, India is still dealing with problems of poverty, inequality, corruption, malnutrition, and inadequate health care. Rates of adult illiteracy and child malnutrition remain high. Access to public services, especially those of basic medical health facilities, is low in many rural areas. Looking at a number of World Bank development indicators for 2011 in Table 4.1, this picture is confirmed (2016b).

Table 4.1 World Development Indicators: India and the Nordic countries

World Development Indicator 2011	India	Nordics*
Population, total	1 247 446 011	25 680 159
Surface area (sq. km)	3 287 260	1 319 988
Population density (people per sq. km of land area)	419,56	37,76
Life expectancy at birth, total (years)	66,9	81,1
Mortality rate, under-5 (per 1,000)	57,2	3,04
Adult literacy rate, population 15+ years, both sexes (%)	69,3	-
GDP growth (annual %)	6,6	1,9
GDP per capita, PPP (constant 2011 international $)	4 685,86	45 913,85
Exports of goods and services (% of GDP)	24,3	47,3
Imports of goods and services (% of GDP)	30,7	41,3
Poverty headcount ratio at $1.90 a day (2011 PPP) (% of population)	21,25	-
Income share held by lowest 10%	3,5	3,3
Income share held by highest 10%	30,0	22,0

Source: World Data Bank, World Development indicators, accessed February 2016
*Including: Norway, Sweden, Denmark, Finland and Iceland

While GDP growth is relatively high, the poverty headcount ratio shows that a sizeable share of the total population, 21.25 %, lived below the $1.90 poverty line in 2011. Life expectancy is well below those common in the developed countries, at 66.9 years. After decades of restrictions on international trade in the first decades after independence, Indian exports and imports levels in 2011 are comparable to the OECD averages in 2011, where exports were at 28.3 % and imports were 29.4 % of GDP (OECD, 2016).

4.2 The division of power: central and state governments

As a federal union, political power and governance in India is divided between the central - or union, and state governments. The different areas of legislative power are defined in Article 246 of the Indian Constitution under three separate and very detailed lists (*The Constitution of India*, 1950). The *Union list* defines the jurisdiction of central government, while the *State list* defines that of the individual state governments. In addition, there is a third list; the *Concurrent list* – this covers the areas where both union and state governments can pass legislation.

Among the areas reserved for central government are: defence, atomic energy, foreign affairs, railways, shipping, posts and telegraphs, currency, foreign trade, inter-state trade and commerce, banking, insurance, control of industries deemed of "public interest", income tax, custom and export duties, excise duties, corporation tax, taxes on capital value of assets, and estate duties. This means that rules and regulations on trade with both foreign countries and between states can vary over time but are common to all states. Income and corporation tax regulations are also common across all states.

Important elements on the Concurrent list are criminal procedure, contracts, bankruptcy and insolvency, civil procedure, economic and social planning, commercial and industrial monopolies, combines and trusts, trade unions, industrial and labour disputes, social security and social insurance, welfare of labour including conditions of work, and education, price controls, and factories. Included are also trade, commerce, production, supply, distribution, and imports of products of any industry declared to be of public interest. If there is a conflict between union and state law, the union law generally takes precedence

(Article 254). In all these matters, regulation can (but does not necessarily) differ between states in the cross-section, and within states over time.

Finally, some of the areas reserved for state government jurisdiction are: police, public health and sanitation, agriculture, land rights, industries not covered by the Union list (meaning industries not related to defence or of "public interest"), state public services, land revenue, agricultural taxes. The trade, commerce, production, supply and distribution of goods within the state (again, if non-public interest-goods) is also on this list.

This means that state policies concerning labour and unions may change over time and vary across states, but will be fixed across workers within states.

4.3 Economic history

The following account of the economic history of India is mostly based on Tomlinson (2013).

1914-1947

The key elements of Indian industrial policy of the 20th century right up until the 1980s can be summed up by the following components: import substitution, protectionism, tariffs and licensing.

According to Tomlinson, revenue tariffs gradually developed as an important source of income for the (colonial) Government of India during and after World War I as expenditures increased. Many consecutive increases of general tariff rates during the 1920s and 1930s also provided some protection for the domestic market. The general rate reached 31.25 % in 1931, while luxuries paid up to 75 % for (non-British) goods in 1933. The government also launched a policy of 'discriminating protection' of selected industries in the 1920s. Between 1923 and 1939 protection was given to iron and steel, cotton textiles, sugar, paper, matches, salt, heavy chemicals, plywood and tea-chests, sericulture, magnesium chloride, and gold thread, and also, under different criteria, to rice and wheat production (Tomlinson, 2013, p. 112).

During World War II, problems of food supply were experienced across all of India, and in trying to overcome this, the government introduced a system of rationing and official

procurement. This system was not removed after the war was over. The financing of military expenditure during the war also had serious consequences for the Indian economy. India was a major British military base and provided a large army paid for by Indian revenues, and these expenses were financed by currency issue, which led to inflation.

1947-1979

At the beginning of independence in 1947, India faced poverty and low levels of development, and average per capita foodgrain availability was about 400 g; the literacy rate was 17 per cent of those over the age of 10, and life expectancy at birth only 32.5 years (Tomlinson, 2013, p. 6). The economy was mainly based on agriculture, and more than four-fifths of the population lived in rural areas, and only about 10 per cent were working in manufacturing. The Republic of India was a diverse and poor country that inherited many economic problems from its colonial past. Under the federal constitution, control over economic policy was split between the central government in New Delhi and the state administrations.

According to Tomlinson, it was easy to explain all of India's economic difficulties in the light of British imperialism, which led to the understanding that the use of scarce national resources needed to be controlled and rationed more carefully in the future. This translated into an important role for the public sector in the ongoing industrialisation. The Industrial Policy Resolution issued in 1948 emphasised that India was to have a mixed economy in which private capital had an important place. Still, state ownership was imposed in railways, weapons and ammunition, and atomic energy, and the government reserved for itself the right to start new undertakings in coal, iron and steel, aircraft manufacture, shipbuilding, telephone and telegraph materials, and minerals.

The industrial policy of the 1950s was based on import-substituting industrialisation and the development of basic goods production by the public sector. The 1950s saw the beginning of the planning era, were the government's economic programmes were laid out in consecutive Five Year plans from 1951. Prime Minister Nehru announced in 1954 that the purpose of planning was "*the establishment of a socialistic pattern of society where the principal means of production are under social ownership and control*" (as cited in

Tomlinson, 2013, p. 146). Under the Second Plan (1956-61), industries were allocated between the public and the private sector, with 'basic and strategic' industries reserved for public investment. In seventeen strategic industries, including heavy electrical plant, iron and steel, heavy castings, and minerals, the state was to have a monopoly or an exclusive right to new investment. Existing private plants were given no guarantee against nationalisation.

The planning bureaucracy and the import licensing system imposed a strict test on imports. Imports were not permitted in goods that India was capable *in principle* of manufacturing, whether or not it did at the time. The result was a heavily protected domestic market to which entry was restricted by a complex system of licensing, capital issues control and import restrictions. This system had advantages for the established entrepreneurs, especially since licences were often issued on a 'first-come-first-served' basis: "*The conduct of the licence and permit systems also gave scope for corruption among businessmen and bureaucrats over access to both imports and supplies from public-sector enterprises*" (Tomlinson, 2013, p. 153).

According to Bhattacherjee (2001), the state-led industrialisation and import substitution strategy resulted in the establishment of large and employment-intensive public sector enterprises, mostly in the capital and intermediate goods sectors. High public sector employment led to the formation of large public sector unionism.

A short period of liberalisation in import licensing and export promotion accompanied a devaluation of the rupee in 1966, but this ended when in 1970, a new Industrial Licensing Policy was announced. It strictly limited the sectors of the economy in which large private companies could invest, restricting them for mostly to heavy industry which required substantial amounts of capital. The oil-price shock of 1973 coincided with a severe drought which affected the output in both agriculture and in industry. The price of foodgrains increased by 20 per cent in one year, and this led to price inflation elsewhere in the economy (Tomlinson, 2013, p. 178).

1980-2010

Economic growth in India accelerated notably from around 1980 and this growth has been continuing until the present without serious disruptions. The economy started slowly but gradually moving away from the import-substituting strategy towards strategies that encouraged both export promotion and domestic competition. Several economic liberalisations measures were implemented under the government of Rajiv Gandhi (1984-1989) (Tomlinson, 2013).

But, according to Bhattacherjee (2001), after 1988, the country experienced severe unrest and political instability as several governments collapsed. India was facing a full-scale macroeconomic crisis. In June 1991, a new government decided to adopt an IMF stabilisation and structural adjustment program. The rupee was devalued twice, import quotas were reduced, tariffs were lowered, and state monopoly on exports and imports ended and a statement on industrial policy aimed at lowering the fiscal deficit was presented (Bhattacherjee, 2001).

With the reduction of the state regulation and the high barriers to entry and to trade, and with increased privatisation and the encouragement of foreign investment, Indian economy has seen a considerable increase in private business enterprise, and a larger share of trade in national income. Tomlinson (2013) relates how the key questions of why and when a decisive shift occurred have been widely debated, and remain heavily contested. In some accounts of this period, the important shift occurred in 1991, while for others, the whole period from 1980 is decisive. High tariff levels were already being lowered in the 1980s. Restriction on foreign capital were also relaxed, especially in service industries, and in enterprises dedicated to the export market. Importantly, the licensing policies which had regulated industrial investment were being abandoned between 1985 and the early 2000s, and restrictions on the banking sector were relaxed. About a third of core industries were exempted from industrial licensing in the mid-1980s and most of the remainder in 1991.

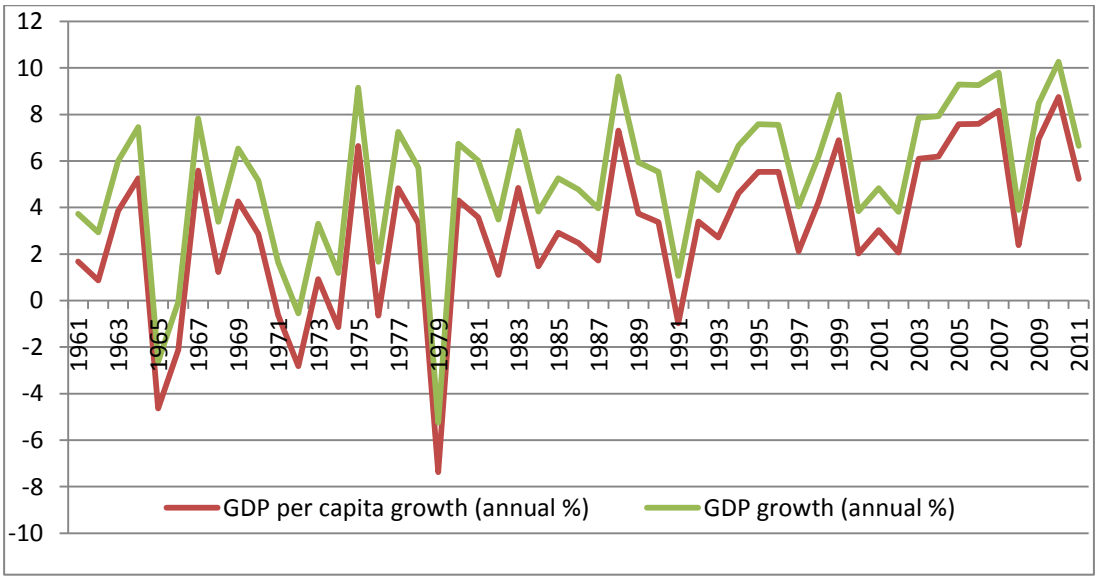
The period of 1999-2004 witnessed additional economic reforms at the national level. Major industries that had been reserved for the public sector since 1956, such as iron and steel, heavy plant and machinery, telecommunications and telecom equipment, were now opened to both private enterprise and foreign investment. Over the whole reforms period, there was

no large transformation of the Indian industry structure, which remained dominated by public and private firms that were in place at the start of the 1980s, who were in position to take advantage of the new manufacturing opportunities that were opened up (Tomlinson, 2013).

GDP per capita growth 1960-2011

The economic history of modern India can also be seen reflected in the movements of GDP growth and the growth of GDP per capita over the period of 1960-2011, see Figure 1.1.

Figure 4.1 GDP per capita growth 1960-2011



Source: World Data Bank, World Development Indicators, accessed February 2016

4.4 Industrial relations

According to Bhattacherjee (2001), Indian labour relations consist of a mix of three bargaining levels and a diversity of union structures:

Centralised union federations affiliated to political parties bargain with the state at the industry and / or at the national level in public sector enterprises. Central and state government employees in the service sector, such as transportation, postal services, banking and insurance, police and firefighters, have their (typically) politically-affiliated unions bargaining at the national and / or regional levels. The centralised structure was quite stable during the period of planned industrialisation (1950s to early 1980s), but came under

increasing pressure to decentralise from the mid-1980s, as the economy was gradually opened up to more domestic and international competition.

In the private sector, local level bargaining usually takes place with enterprise-based unions that may or may not be affiliated to political parties. The independent unions competing with the traditional party-affiliated unions in the major industrial centres increased in numbers and gained importance especially in the period from 1980 to 1991 (Bhattacherjee, 2001).

As mentioned above, both central and state governments can under the Indian Constitution pass legislation relating to industrial relations. One of the most important acts passed by central government concerning industrial disputes is the Industrial Disputes Act of 1947, meant to offer workers in the organised sector some protection against exploitation by employers. The act specifies procedures relating to cases of industrial disputes. This legislation has been widely amended by governments at state level since it was introduced, creating some variation in the industrial relations climates across states (Besley & Burgess, 2004).

4.5 Comparing India and the Nordic countries

An underlying premise of this thesis is that India is a relevant case when empirically investigating the suitability of the Nordic model as a growth strategy. There are clearly very large differences between the small Nordic nations and the vast subcontinent of India. Obviously they have very different histories, geographical locations, sizes and population densities, for starters. This fact kept in mind; it is also possible to find some similarities that may make the two entities worthy of comparison.

In the preamble to the Indian Constitution, India is declared to be a "*sovereign, socialist, secular, democratic republic*" (*The Constitution of India*, 1950). At least at the political level, both India and the Nordics place an importance on the pursuit of equality for its citizens. Democratic elections and freedom of speech are basic political institutions that have been shared by both in the whole of the post-Independence era.

As described earlier, the Indian post-Independence economy was more or less closed off to international trade until the 1980s, in contrast to the small open economies of the Nordic countries. In this period, there were also some restrictions to entry into manufacturing, and to inter-state trade. This changed only after the reform periods of the 1980s and early 1990s, when the Indian economy was gradually deregulated and opened up to foreign trade and investments. But even though the Nordic countries have for a long time been very open economies when it comes to manufacturing and international trade, they too have had widespread regulation of labour markets, foreign exchange, finance and banking. Both the Indian and the Nordics can be described as mixed economies, consisting of a large public sector in addition to private enterprise.

When it comes to industrial relations, the labour institutions of India can in some ways be compared to those of the Nordics. Since the passing of the Industrial Disputes Act, 1947, Indian workers have had the freedom to organise themselves in trade unions, and the right to have their unions be recognised by the employers. The system of tripartism, with recognised roles for the workers' and the employers' unions as well as for the government, is an important element in both India and in the Nordic countries. The same can be said for institutionalised multi-level bargaining. One important difference is of course that in the Nordic model, tariff wages are very much determined by considerations of the international competition faced by the export-oriented industries.

One of the important results of the BMW model concerning coordinated bargaining relates to the size or the level of the threat of reduction of worker effort. This threat is lower when bargaining is centralised, as union members at the local level are restrained by the central agreement. As Indian labour relations are also characterised by a certain degree of centralisation, this feature may justify using India as a testing ground for the BMW model.

In the end, it is difficult to ascertain *a priori* whether these similarities in political, economic and labour-related institutions provide a good enough basis to perform an analysis of the relevance and adaptability of the Nordic model outside of the Nordic context. This remains an empirical question, which I study in section 6 using econometric methods to be described in detail.

5 Data and variable description

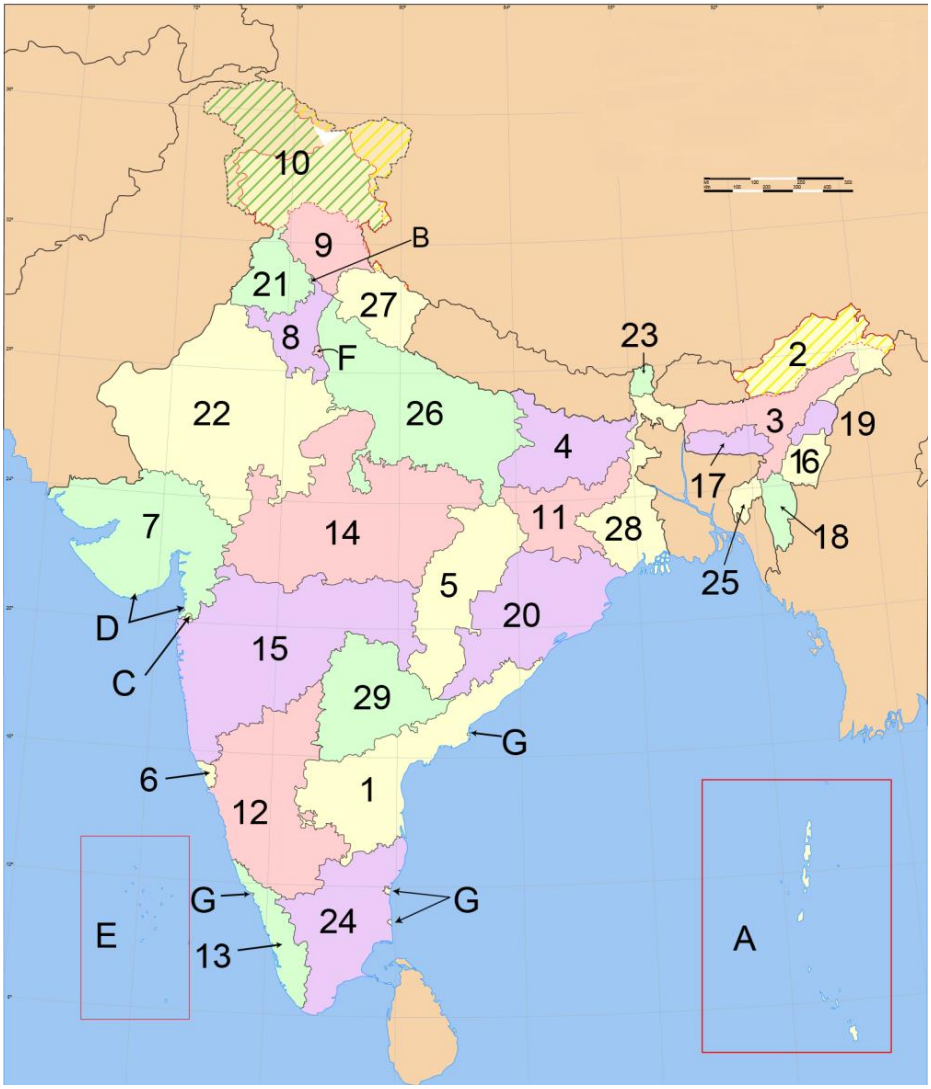
The empirical analysis of this thesis will be based on data from a panel of 16 major Indian states. The most relevant variables in this case have to do with the degree of unionisation, wage levels and employment. The various states in the panel, while experiencing much of the same overall macroeconomic conditions over time, exhibit differences in their levels of industrialisation, in their levels of unionisation and in employment and manufacturing output.

As described above, India has been characterised by central planning, a large public sector and a closed economy until the 1980s. Industrial relations have been characterised by multilevel bargaining institutions. The Indian manufacturing sector was thus highly protected from international competition from the time of independence from British rule in 1947 and up until the 1980s. Over this period there was a significant variation in the growth of manufacturing and other related outcomes across states. The cross-state variation in outcomes over this period cannot be explained by elements of central planning and trade protection.

In the following time period, the whole of the Indian economy, including the manufacturing industry, experienced wide ranging reforms to open up the previously closed, inward-looking economy. The reform period divides Indian economy into a before and after that is common to all states.

Both state and central governments control labour regulation as the states can add their own labour legislation to the central labour statutes. This feature results in both time series and cross-sectional variation which may be used to identify some effects of unionisation.

Figure 5.1 Map of India 2016



Source: Wikipedia, downloaded April 2016, from https://commons.wikimedia.org/wiki/File:India-states-numbered.svg

Table 5.1 Names of states and union territories

1. Andhra Pradesh	**10. Jammu and Kashmir**	19. Nagaland	28. Uttarakhand
2. Arunachal Pradesh	11. Jharkand	**20. Odisha**	**29. West Bengal**
3. Assam	**12. Karnataka**	**21. Punjab**	A. A. and N. Islands
4. Bihar	**13. Kerala**	**22. Rajasthan**	B. Chandigarh
5. Chhattisgarh	**14. Madhya Pradesh**	23. Sikkim	C. Dadra and Nagar H.
6. Goa	**15. Maharashtra**	**24. Tamil Nadu**	D. Daman and Diu
7. Gujarat	16. Manipur	25. Telangana	E. Lakshadweep
8. Haryana	17. Meghalaya	26. Tripura	F. N.C.T. Delhi
9. Himachal Pradesh	18. Mizoram	**27. Uttar Pradesh**	G. Puducherry

Note: States included in the panel in bold letters.

5.1 The EOPP Indian States Database

For this study, I use data from the EOPP Indian States data base[3], which has state level data from 16 major Indian states across the whole subcontinent from the period 1957-1995, compiled by Besley and Burgess (EOPP, n.d.). The 16 states are Andhra Pradesh, Assam, Bihar, Gujarat, Haryana, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha (previously named Orissa), Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, and West Bengal. Besley and Burgess ((2000) and (2004)) themselves use these data to investigate whether land reforms in India have had an impact on growth and poverty, and to develop an econometric analysis of whether the patterns of labour regulation can account for cross-state variation in patterns of manufacturing performance over time.

Sources of updates

For the purpose of this thesis, I have updated this database until 2010, with data from the following sources:

Table 5.2 Sources of updates

Available online:
Indian Labour Year Book, Labour Bureau, Ministry of Labour and Employment, Government of India; issue 2011-2012
Indian Labour Statistics, Labour Bureau, Ministry of Labour and Employment, Government of India; issues 2007-2008, 2009-2010, 2012-2013
Annual Survey of Industries, Central Statistical Office, Department of Statistics, Ministry of Statistics and Programme Implementation, Government of India; Issues 1998-1999, 1999-2000, 2000-2001, 2001-2002, 2002-2003, 2003-2004, 2004-2005, 2005-2006, 2006-2007, 2007-2008, 2008-2009, 2009-2010, 2010-2011.
Public Finance Statistics, Ministry of Finance, Government of India; issues 2004-2005, 2009-2010
Economic Survey 2013-2014; *Statistical Appendix***,** Ministry of Finance, Government of India

[3] The database is made publicly available by the Economic Organisation and Public Policy Programme (EOPP), London School of Economics

Proprietary data[4]:
Centre-wise Consumer Price Index Number (General) of Industrial Workers in India, Labour Bureau, Ministry of Labour and Employment, Government of India; series 1960-1969, 1970-1979, 1980-1988 (base 1960=100), series 1990-1997, 1998-2005 (base 1982=100), series 2006-2014 (base 2001=100)
Annual Survey of Industries, Central Statistical Office, Department of Statistics, Ministry of Statistics and Programme Implementation, Government of India; issues 1996-1997, 1997-1998
State-wise number and membership of trade unions in India, Labour Bureau, Ministry of Labour and Employment, Government of India; years 2006 and 2007.
Number and membership of trade unions in selected states India, Labour Bureau, Ministry of Labour and Employment, Government of India; (various states and years)
Available in print only:
Indian Labour Year Book, Labour Bureau, Ministry of Labour and Employment, Government of India; issues 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000-2001, 2002-2003, 2004, 2005-2006

Data validity

The World Bank carries out assessments of the capacity of developing countries' statistical systems. It is based on an assessment of the following areas: methodology; data sources; and periodicity and timeliness. Countries are scored against 25 criteria in these areas; the overall score is then calculated as a simple average of all three area scores, on a scale of 0-100. The score of the overall level of statistical capacity of India in 2011 was 76.7 (The World Bank, 2016b). Comparing this to scores of other rapidly developing countries often grouped with India, this is somewhat lower than the scores given to Brazil and South Africa the same year, which were 84,4 and 81,1, respectively. But India scores higher than China, with a

[4] Retrieved from the web site of Datanet India Pvt. Ltd., www.indiastat.com

score of 68.9. I infer from this that Indian statistical data are in general relatively credible, at least in the recent era.

According to Besley and Burgess (2004), the Annual Survey of Industries (ASI) data are likely to be more reliable than the Indian Labour Year Book data. The ASI covers all firms in the manufacturing sector, as those with more than 100 employees are completely covered, and those with less than 100 employees are captured by stratified sampling. The Indian Labour Year Book data relies on the compliance of registered factories in their collection of data on employment and earnings, which introduces some bias in the data.

5.2 Data characteristics

Annual Survey of Industries (ASI)

The data on the state wise number of workers, total number of employees, wages to workers, and salaries to employees used in the analysis below come from the ASI. The coverage of the ASI extends to the entire factory sector which comprises all industrial units called factories, registered under the Factories Act, 1948. A 'Factory', which is the primary statistical unit for the ASI, is defined as:

(i) factories using power and employing 10 or more workers on any working day of the preceding twelve months;

(ii) factories not using power and employing 20 or more workers on any working day of the twelve preceding months.

This means that even quite small manufacturing units are considered factories for this purpose and are covered in the data.

The ASI data cover the years 1969-2010, but there are no data for the years 1972, 1987, and 1989-1993.

Organised vs unorganised sector in India

The Unorganised Workers' Social Security Act 2008 (Ministry of Law and Justice, 2008), defines the following:

Unorganised sector: an enterprise owned by individuals or self-employed workers and engaged in the production or sale of goods or providing service of any kind whatsoever, and where the enterprise employs workers, the number of such workers is less than ten.

Unorganised worker: a home-based worker, self-employed or a wage worker in the unorganised sector.

As estimated in a survey of the National Sample Survey Organisation[5] of the employment and unemployment situation in India in 2009-10, total employment in both the organised and unorganised sectors in India was 465 million (as cited in Ministry of Labour and Employment, 2014, p. 3). Out of these, only about 28 million or 6 % were employed in the organised sector, the rest where in the unorganised sector. The above means that the data used in this study, which comes from the formal or organised sector, covers only a fraction of the workers of India and of the Indian economy, which should be kept in mind in the following.

Wage gap

One of the most important features of the BMW model is wage compression. This wage compression is a result of centralised bargaining between trade unions and employers and manifests itself as a lowering of the existing wage gap between the highest and lowest paid workers. In my empirical analysis, this wage gap needs to be measured in a meaningful but also operationalisable way. One measure commonly used in the income inequality literature is the 90/10 income inequality ratio. This is the ratio of the earnings of the 90th percentile to the 10th percentile. This is a measure of inequality used by Barth, Finseraas, and Moene (2015), among many others. The 90/10 ratio can say something meaningful about the level of inequality in society in general, as it compares the richest and the poorest individuals. In this case, I do not expect the workers of the Indian factory sector in general to belong to either the richest or the poorest segment of the population, but to be somewhere in

[5] A part of the Ministry of Statistics and Programme Implementation, Government of India

between the two. Likewise, a commonly used measure in the inequality literature is the Gini coefficient. While the available Gini data measure the state wise inequality in the distribution of consumption, the focus of this study is to compare wages, before any taxes and transfers.

Ideally, I would like to base my analysis of the Indian case on a measure of the wage gap between the highest paid and the lowest paid workers in the manufacturing sector, at the state level. This translates to comparing the wages of high skilled and low/unskilled workers. Data on the educational level of workers are not available within the Indian manufacturing industry data. The measures that are available in the dataset are the wages of factory workers[6], and the wages of all employees in the factory sector. Non-production employees are defined as those that have clerical, supervisory or managerial positions in administration, store keeping, welfare sections, sales or purchasing departments. I expect this to be a group with on average higher education levels than the group of manual workers. The non-production employees category can also include what is called "watch and ward staff", I interpret this to mean security personnel, who do not necessarily have any higher education. On average, this group is still likely to have higher skills than the group of production workers.

Having data on the total number of workers and the total number of employees, I have constructed the state level annual average wage of workers, and the annual average salary of employees, and the difference between these two is the corresponding wage gap:

(5.1) $Wage\ gap\ =\ average\ salary\ of\ employees\ \div\ average\ wage\ of\ workers$

This approach to calculating the wage gap in manufacturing is also followed by Ramaswamy (2008) in an empirical examination of wage inequality in Indian manufacturing. The approach is also used by Goldar and Sadhukan (2015) , in a study of trends in employment and wages in Indian manufacturing in the post-reform period. This procedure for calculating the skilled wage has a small upward bias, since it assumes that benefits other than wages, which are included in the total salaries-category, mostly are paid to the white-collar workers (Goldar & Sadhukan, 2015). Working with the ASI data, it is not possible to find a more precise way to compute the wage gap.

[6] Including those cleaning the machinery and premises.

In the dataset are also the data of per capita annual earnings collected by the states under the Payment of Wages Act, 1936[7]. Under this Act, data on workers with earnings below a specific ceiling are collected. At first sight, it seems that these data could be used as a measure of wages for "low skilled" or "low paid" workers in the factory sector. Examination of various issues of the Indian Labour Year Book reveals that the earnings ceiling has been raised several times, from INR 200 per month in 1958. In 1982, this level was set at INR 1 600 per month, in 2005 it was raised to INR 6 500 per month, and in 2007 to INR 10 000 per month. This means that from one year to the next, more workers were included in the statistics than the year before, at any time when the ceiling was raised.

Until 1963 the Act was applicable to all the factories as defined in the Factories Act, 1948, i.e. factories which employ 10 or more workers using power and 20 or more workers not using power. From 1964, the coverage of the Act was extended (to the factories under Section 85 of the Factories Act[8]), but due to incomplete response, these data could not be included in the statistics of earnings until the year 1982.

Because of these amendments to the Act, the data on earnings before and after 1982, 2005 or 2007 are not strictly comparable. If I wanted to use this variable to construct another measure of the wage gap in manufacturing, I would have to control for the period before or after 1982, and I would also need to consider the fact that the ceiling on earnings has been raised a number of times over the years. The data on employment and earnings are also considered less reliable by Besley and Burgess, as mentioned above. With all this in mind, I have decided against using this variable in the empirical analysis.

Degree of unionisation

The wage compression in the BMW model is a result of centralised bargaining. The extent of centralised bargaining in this context is related to the degree of unionisation across states. With higher union density, more workers are covered by a coordinated bargaining process, and with low union density, bargaining is more decentralised. In the perfect dataset, there

[7] Published in the Indian Labour Year Book.

[8] Under Section 85, the State Government is empowered to declare any establishment carrying out a manufacturing process to be a factory for the purposes of the Act even though it employs less than the prescribed minimum number of workers, provided that the manufacturing process is not being carried on by the owner only with the aid of his family.

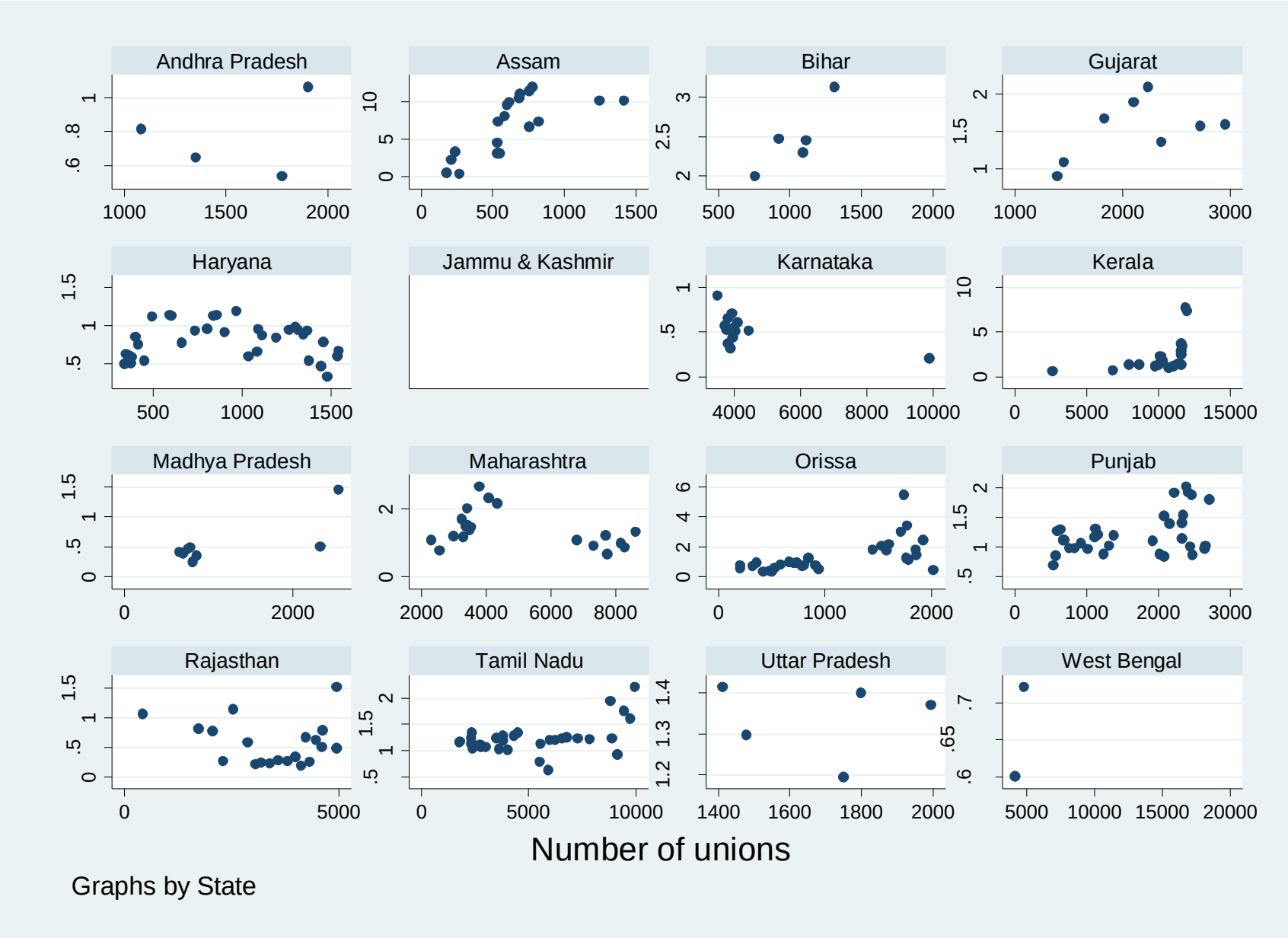
would be data on the number or share of all factory workers that are members of trade unions and thereby covered by centralised bargaining.

The data available on state wise levels of unionisation are the number of registered trade unions, the number of registered trade unions that are submitting returns[9] and the membership of those trade unions that are submitting. The data available for union density cover the period 1957-2010, with no data for any states for 1971. Examining the data, I also find that no data on trade unions have been reported from the state of Jammu & Kashmir for any year. The data themselves do not reveal whether there are any systematic differences between the unions that do and do not submit returns, but there is also no reason to assume there are no such differences. In Bhattacherjee and Chaudhuri (1994) and Bhattacherjee (2001) the assumption is put forward that the unions that do submit returns are likely to be the large, centralised, politically-affiliated unions, while those who do not are the usually smaller, local or plant-specific and independent ones.

Both the membership of unions and the number of registered unions are imperfect measures of union density, since we only get the membership numbers of a fraction of the unions, and since the number of unions does not reveal the size of these unions. If the union membership changes from one year to the other, it is not possible to find out if this is due to an actual change in membership numbers, or a change in the composition of the trade unions submitting returns, or a combination of the two. I have chosen to include number of registered unions and the ratio of union members to all factory employees in the analysis so that information from one can complement the other. At the very least, one would expect a degree of positive correlation between the two. The state wise correlations between registered unions and the share of unionised members[10] can be seen in Figure 5.1. Some states have very few observations which gives too little information to uncover any clear correlation between the two measures of union density. Some of the states that have more than 4-5 observations do display a positive correlation, while others display a more unclear pattern.

[9] Meaning unions reporting on membership numbers, income, expenditure, etc.
[10] The ratio of union members to all factory sector employees.

Figure 5.1 State wise correlation of number of unions and share of union members



Consumer Price Index for Industrial Workers

For the purpose of this thesis, I am using the variable wage gap as my dependent variable. The period of analysis covers four decades, over which period one would expect inflation to increase this wage gap, regardless of whether it increases in real terms or not. It is therefore necessary to evaluate this wage gap in real instead of nominal terms. On the other hand, one of the independent regressors that I will be using in the analysis is Per capita net state domestic product (NSDP). Over time, there have been nominal increases in NSDP due to inflation which not necessarily reflect real growth. In cases where this growth is larger than population growth, there is also nominal growth in the per capita NSDP.

To deal with this and to be able to calculate the wage gap and per capita NSDP into real terms, I have used the General Consumer Price Index for Industrial Workers (CPI-IW) that the Labour Bureau of the Ministry of Labour and Employment has published since 1957. The index is calculated for major cities or urban centres and a weighted average is calculated for all India. To be able to use this index I have calculated the index at state level using the supplied weights of each urban centre.

I have chosen to use this state level index over the All India consumer price index published by The Central Statistics Office, Ministry of Statistics and Programme Implementation. The latter covers both the rural and urban population, while the factory sector is likely to only be affected by price developments in the urban areas. Furthermore, I prefer to use the CPI-IW as there has been considerable variation in inflation across states as can be seen in the CPI-IW data in the cross-section.

After assembling the state wise data on the CPI-IW for the period 1960-2014, I have transformed the data that were originally in base year 1960=100 and base year 1982=100 into base year 2001=100 figures. Subsequently, I have recalculated the variables Wage gap and Per capita NSDP used in the analysis into comparable 2001 INR.

Population figures

The population census in India has been carried out every ten years, with census years so far being 1951, 1961, 1971, 1981, 1991, 2001 and 2011. The state wise population levels

obtained from the censuses have been linearly interpolated in between census years for the purpose of this analysis.

The creation of new states in year 2000

In 2000, three new Indian states were founded, carved out of three of the major states present in the data sample. These new states are Chhattisgarh, which was a part of Madhya Pradesh, Uttarakhand which was carved out of Uttar Pradesh, and Jharkhand, which was formerly a part of Bihar. These major divisions of territories affect in theory all the main variables of my analysis.

The division of a state can substantially change population figures, the size of the economy, the number of workers, and number of unions including their membership, such that the post-2000 figures are no longer directly comparable to those before of the preceding years. To not have this confound my analysis, I would in theory need to perform it conditional on the period before/after year 2000. As it turns out, after inspecting my data, there is no need to control for before/after year 2000 in practice. None of the three mentioned states have submitted figures on trade unions and their membership since 2000, such that these figures will not be in the sample when performing the analysis.

This event also means that the interpolated figures for state wise population for these three states are less likely to represent the true population figures for the years in between census years 1991 and 2001. If the calculated population figures deviate from their true sizes, then per capita net state domestic product, which I am going to use as an independent variable of the analysis, is likely to be less precise in these states for these years as well.

5.3 Summary statistics

The wage gap between workers and employees that I have calculated using the procedure I have described above turned out negative for two states in the first part of the period covered by the dataset. There is no way of correcting this with the information at hand, and I have had to remove the relevant observations before performing any part of the empirical analysis. The removed observations are for Gujarat in 1969-1985 and Karnataka in 1969-1986. Descriptive statistics for the most important variables in the remaining sample are summarised in Table 5.3.

Table 5.3 Summary statistics

Variable		Mean	Std. Dev.	Min	Max	Observations
Wage gap*	overall	59624.61	37399.95	11088.5	204422.8	N = 527
	between		18422.16	36693.22	98290.46	n = 16
	within		33759.52	-6021.53	199775.8	T = 32.94
Membership of unions**	overall	641.76	649.78	35	3437	N = 254
	between		474.441	142.15	1684.35	n = 15
	within		420.632	-288.59	2812.072	T = 16.93
Number of registered unions	overall	3066.47	3086.26	176	18824	N = 261
	between		2920.41	609.15	9719.2	n = 15
	within		1636.7	-4058.73	12626.13	T = 17.4
Number of unions submitting	overall	781.25	831.88	30	3962	N = 254
	between		623.34	165.37	2556.5	n = 15
	within		339.99	-675.25	2186.75	T = 16.93
Workers**	overall	374.627	303.149	11.914	1592.571	N = 527
	between		280.396	23.690	920.603	n = 16
	within		126.248	-44.554	1129.836	T = 32.94
Employees**	overall	482.702	393.966	15.196	1943.319	N = 527
	between		366.585	30.164	1274.863	n = 16
	within		161.253	-51.362	1383.106	T = 32.94
Per capita NSDP*,**	overall	14.162	8.444	4.618	53.46	N = 527
	between		5.229	7.097	23.513	n = 16
	within		6.883	1.985	45.808	T = 32.94
Population**	overall	49051.19	33953.34	4405.8	196450.6	N = 527
	between		30604.16	7978.63	133946.8	n = 16
	within		14783.49	-3787.58	111555	T = 32.94

* INR in 2001, ** in thousands

N = number of observations, n = number of states, T = average number of years per state

6 Data analysis

In my analysis, I am primarily interested in investigating whether some of the implications of the centralised bargaining structure of the Nordic model, as formalised by BMW, can be of relevance to the Indian economy, or, more specifically, to the Indian manufacturing sector. One of the oldest questions in labour economics is the connection between union membership and wages (Angrist & Pischke, 2008). There are many studies of this effect on the individual level. In this thesis, I am looking at the possible effect of the state wise degree of unionisation on the average wage gap between factory workers and other employees in the factory sector.

I do not expect the degree of unionisation to be the only thing that affects the wage gap between workers and employees in manufacturing. For one, the size of the economy of the state will have an effect on the level of wages and hence the wage gap. The size of the manufacturing sector can also impact the level of wages. These are factors that need to be controlled for in the analysis.

Having panel data, I can in theory also control for unobserved but time-invariant omitted variables that vary across states and that affect the wage gap in an OLS regression. Both random and fixed effects models can be used in this respect. A random effects model assumes that any unobserved individual effects are uncorrelated with the regressors of the model. These individual effects become a part of the residual when performing random effects estimations. If these variables are correlated with any of the regressors, the residuals of each entity become correlated.

The structure of the manufacturing sector, and any number of historical factors are some of the unobserved variables that can affect the observed wage gap, and that are fixed (or vary little) over time within states but may vary across sates. These are also likely to be correlated with the size of the manufacturing sector, and the size of the local economy. With this in mind, I opt for the fixed effects model[11]. With panel data, I can also control for unobserved factors that vary over time but not across states using time effects.

[11] This choice is supported by a Hausman test, but the test can only be performed when data are not clustered.

6.1 Baseline model

The model that I want to estimate can be expressed as

(6.1) $Y_{it} = \alpha_i + \lambda_t + U'_{it}\beta + X'_{it}\delta + \varepsilon_{it}$

where Y_{it} is the wage gap in state i in year t, α_i is the individual effect of state i, λ_t is the time effect at time t, U_{it} is a vector of variables measuring union density, X_{it} is a vector of control variables, and finally the error term is ε_{it}.

The assumption of conditional mean zero may be too strong an assumption considering the data at hand. I will apply the assumption of conditional mean independence in stead,

(6.2) $E(\varepsilon_{it}|U_{it}, X_{it}, \alpha_i, \lambda_t) = E(\varepsilon_{it}|\, X_{it}\,, \alpha_i, \lambda_t)$.

This assumption implies that when controlling for other factors that can influence the wage gap, I can estimate the causal effect of union density on the wage gap (Stock & Watson, 2011). Under the conditional mean assumption, the control variables remain correlated with the error term, and do not have a causal interpretation.

The individual effects are fixed at state level, and year dummies are used in all versions of the regression equation to control for time effects. As measures of the degree of unionisation U_{it}, I have included both (a) the ratio of unionised workers to total number of employees in the factory sector, and (b) the total number of registered unions. To control for the variation in the size of the factory sector I also include the total number of employees. As a proxy for the (bargaining) strength of workers I have included the share of workers out of the total number of employees. To control for variation in the size of the economy, and also to control for possible macroeconomic shocks at state level, I include the variable Per capita net state domestic product (NSDP).

In the framework of this analysis, it may be important to control not only for the size of the factory sector and the size of the economy, but also for the size of the population. This is a factor which varies a lot, both in the cross-section and over the time period of study. An increase in population size may increase the number of people supplying labour and, as economic theory implies, this may reduce the wages to workers.

I cannot be certain that the variance of the error terms is constant over the time period of study, as they capture all other factors affecting the size of the wage gap in the factory sector aside for those already controlled for. These factors could be individual state effects that can change more or less over time, like levels of education, state-specific policies and regulation, or economic shocks affecting manufacturing industries. These are not captured by the individual effects or the time effects of the regression equation. If unadjusted, the standard errors may be underestimated.

This problem can usually be solved by computing heteroskedasticity-robust standard errors. In the fixed effects model, the standard errors are adjusted by clustering at entity level. In my data set, I have 15 states to cluster on, which is considered a low number of clusters. According to Angrist and Pischke (2008), one should be careful when clustering on less than 42/50 entities. Because there could be a problem due to the low number of clusters, I present both the non-robust and the robust standard errors[12].

A partial regression plot of the wage gap and share of union members indicates a non-linear relationship between the two, see Figure 6.1. For this reason, I have also included the square of share of union members in the base model. An F-test of the share of union members and its square reported in the next section indicates that they are jointly significant. To check for a possible overall U shaped relation between wage gap and share of union members, I have also performed a U test (Lind & Mehlum, 2016), which did not support the hypothesis of a U shaped relation.

A partial regression plot of wage gap and number of unions indicates that the relationship between these two is linear, see Figure 6.2.

[12] There exist some techniques designed to deal with the problem of few clusters, but as my main results remain similar when clustering, I have decided to present both robust and non-robust versions together instead of applying such techniques.

Figure 6.1 Partial regression of wage gap and share of union members

Figure 6.2 Partial regression of wage gap and number of unions

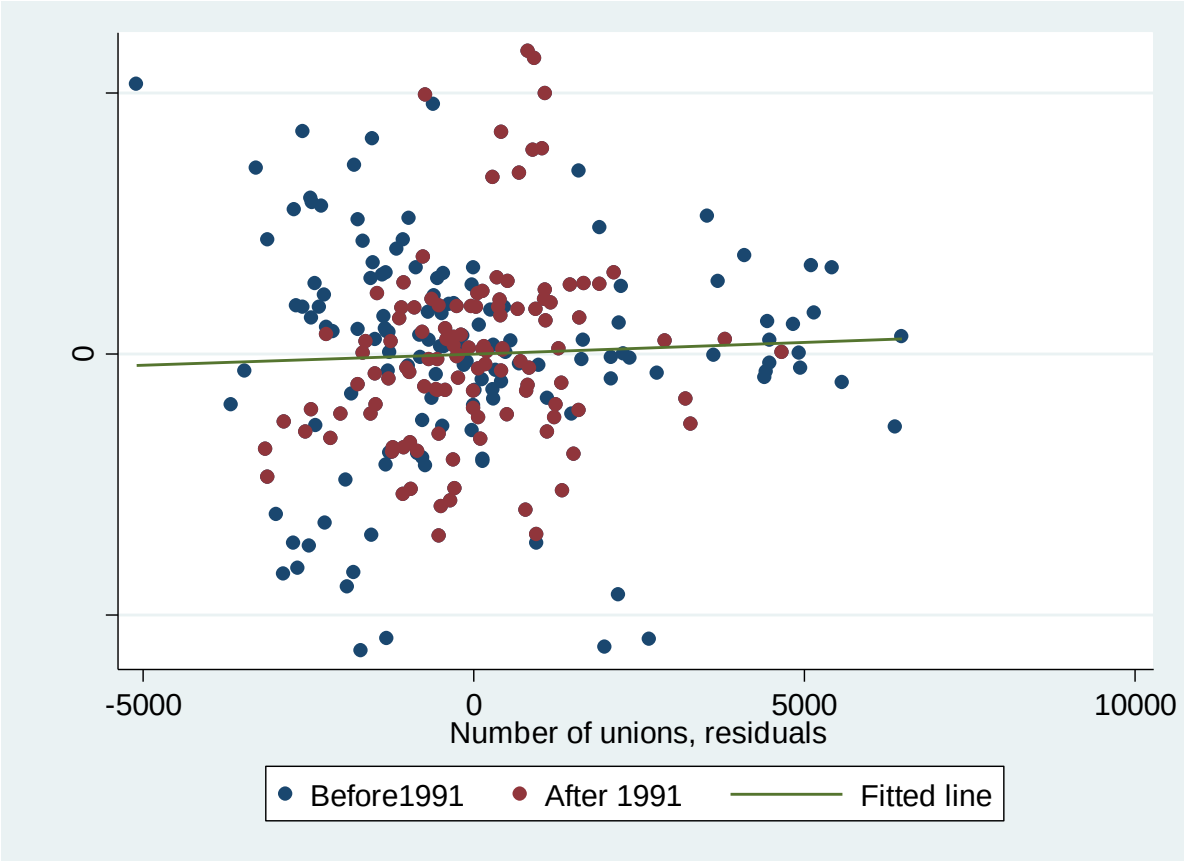


Table 6.1 OLS Fixed effects estimations

	(1)	(2)	(3)	(4)	(5)	(6)
Share of union members	-2337.3*	-5555.0**		-6098.6***	-5555.0**	-5555.0***
	(-2.00)	(-2.80)		(-3.73)	(-2.80)	(-2.71)
Number of registered unions	0.996	0.831	0.173		0.831	0.831
	(0.65)	(0.53)	(0.10)		(0.53)	(0.80)
Share of workers	369452.2***	368969.2***	355016.4***	362963.6***	368969.2***	368969.2***
	(4.83)	(4.79)	(4.06)	(4.52)	(4.79)	(10.28)
Total no. of employees (ln)	-35317.8***	-36393.3***	-18983.8*	-36480.1***	-36393.3***	-36393.3***
	(-3.51)	(-3.88)	(-1.92)	(-4.02)	(-3.88)	(-5.60)
Per capita NSDP (ln)	44874.7**	44352.2**	40550.1**	43657.2**	44352.2**	44352.2***
	(2.74)	(2.73)	(2.50)	(2.64)	(2.73)	(4.24)
Population (ln)	61989.4***	52118.9*	50246.3**	41971.3**	52118.9*	52118.9**
	(3.18)	(2.07)	(2.36)	(2.23)	(2.07)	(2.32)
Share of union members sq.		288.4*		336.2**	288.4*	288.4*
		(1.80)		(2.21)	(1.80)	(1.71)
After 1991					34398.8	34398.8
					(0.87)	(1.26)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	252	252	261	254	252	252
Adjusted R^2	0.852	0.854	0.838	0.854	0.854	0.843
Clustered standard errors	Yes	Yes	Yes	Yes	Yes	No

t statistics in parentheses. The dependent variable is wage gap (INR, 2001-adjusted). Share of unionised workers is the ratio of union members to all employees in the factory sector. The share of workers is the share of factory workers out of the total number of factory sector employees. Per capita NSDP is Per capita net state domestic product. All specifications include individual and time effects. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

6.2 Fixed effects within-estimation results

Performing fixed effects OLS regression on the baseline model (equation (6.1)) above, the initial results indicate that there does seem to be a correlation between the wage gap and the share of union members, but less so between the wage gap and the number of unions, see Table 6.1, specification (1). The coefficient on the share of union members is negative, which is the direction that I would have expected; an increase in unionisation should according to the theory lead to wage compression and thus reduce the wage gap. The potential effect of the number of unions on the wage gap is low and positive. This would indicate that as the number of unions increases, holding population size and all else constant, there is less coordination and more competition among the unions, and as a result, greater wage dispersion.

An F-test of the share of union members and it square indicates that they are jointly significant, with a p-value of 0.0194. The overall R^2 increases from 0.875 to 0.877 when the squared term is included, while the adjusted R^2 increases from 0.852 to 0.854. When both the share of union members and its square are included in column (2), they are significant at the 5 and 10 % levels, respectively. The positive coefficient on the square implies that the wage compressing effect is lower as the share of union members increases, all else kept constant. But, if there indeed is an effect, it is quite small, since the combined effect of an increase in the share of union members by 1 % reduces the wage gap by only INR 66. Comparing this to the 2001-adjusted average wage of workers, which is almost INR 40.000, we see that this effect is at least not economically substantial.

Also reported in Table 6.1 are versions of the base model with only one each of my two union density measures, specifications (3) and (4). These only confirm the impressions from above; the potential effect of the number of unions is still positive, but not significant in a regression on its own without the share of union members. The effect of the share of union members is a little stronger when registered unions are not included, but it does not change considerably. The result of using the non-robust standard errors (not adjusted by clustering) can be seen in column (6). The effects of the share of union members and its square remain significant, while the number of unions is still insignificant. Also tested, but not reported, is

that all time effects (year effects) are jointly significant (both in the robust (5) and the non-robust (6) standard errors versions). An F-test of the joint significance of the individual state effects calculated for the non-robust version indicates that heterogeneous effects are present.

The share of workers, the total number of employees, per capita NSDP and population size all seem to matter more than the number of unions in terms of the wage gap, and their effects appear to be going in the expected directions.

Given that there is some degree of negative correlation between my dependent variable and the share of union members, I need to consider whether the causality could actually be going in the opposite direction of what I am basing my empirical strategy on. Equation (6.1) is modelled on the assumption that the increasing organisation of workers in unions leads to wage compression through coordinated bargaining. Could it be that it is wage compression or wage dispersion that affects the degree of unionisation instead? One could imagine that workers experiencing the wage gap widening might be disillusioned with their unions and decide to leave; this would also produce a negative relationship between union membership and the wage gap. An observed lower wage gap could also motivate more workers to join successful unions to benefit from being union members. This possibility must be kept in mind when interpreting the results.

I must also consider the fact that there may exist some exogenous factor(s) that may be affecting both the share of unionised workers and the wage gap, in opposite directions. This could be the case for all, or only some parts of India. Unemployment in urban areas is one factor that could impact the wage gap, and one could imagine that increased fear of job-loss might reduce the real wages of both production and non-production workers proportionally, such that the wage gap would be reduced. At the same time, high unemployment could induce more workers to join unions in seeking employment protection, giving a negative relationship between the two. The time effects of the model would in some degree control for unemployment levels in any particular years, but not if they differ widely between regions. I believe one possible improvement to the model could be the inclusion of data on state levels of unemployment, if they were available.

6.3 Modifications to the baseline

Subsample: pre and post 1991

Not having any unemployment data, I can still modify the model in an attempt to test the robustness of the base model. A lot of policy changes have been made over the economic history of India during the period 1969-2010 which can affect the outcome of my analysis. An especially important event was the economic liberalisation program in 1991, when the rupee was devalued, import quotas and tariffs were reduced, and the state monopoly on exports and imports was put to an end. This event is likely to have impacted on employment, output and wages. Simply running the fixed effects OLS regression above while including a dummy variable for the period after 1991 does not change the size or direction of the effects of my two measures of union density (Table 6.1, columns (5) and (6)). Wishing to investigate further, I run two separate fixed effects regressions for the periods before and after 1991, with the same control variables as above, using the following equations:

(6.3) $Y_{it} = \alpha_i + \lambda_t + U'_{it}\beta + X'_{it}\delta + \varepsilon_{it}$ for all $t \leq 1991$

(6.4) $Y_{it} = \alpha_i + \lambda_t + U'_{it}\beta + X'_{it}\delta + \varepsilon_{it}$ for all $t > 1991$

The results indicate that the share of union members had an overall positive effect pre 1991, and an overall negative effect post 1991, when adding up the effects of the share of union members and its square. But in the period before 1991, only the share of workers seems to have any significant explanatory power on the wage gap, see Table 6.2. Using cluster-adjusted standard errors does not change these results. In the post-1991 period, the situation is somewhat different. The share of union members has a significant, negative effect.

Table 6.2 Fixed effects, before and after 1991

	(1) Pre 1991	(2) Post 1991	(3) Pre 1991	(4) Post 1991
Share of union members	-945.5	-7248.8***	-945.5	-7248.8**
	(-0.10)	(-2.65)	(-0.15)	(-2.37)
Share of union members sq.	1007.6	523.0**	1007.6	523.0**
	(0.36)	(2.52)	(0.83)	(2.28)
Number of registered unions	0.391	0.370	0.391	0.370
	(0.14)	(0.23)	(0.29)	(0.15)
Share of workers	262334.7***	481710.4***	262334.7***	481710.4***
	(4.58)	(9.66)	(3.65)	(5.70)
Total no. of employees (ln)	-15777.2	-30996.1**	-15777.2	-30996.1*
	(-1.33)	(-2.18)	(-1.09)	(-2.02)
Population (ln)	-63018.4	109696.8*	-63018.4	109696.8
	(-0.90)	(1.78)	(-1.23)	(0.90)
Per capita NSDP (ln)	25962.7	66383.1***	25962.7	66383.1*
	(1.38)	(4.51)	(1.10)	(1.97)
Time effects	Yes	Yes	Yes	Yes
Observations	117	135	117	135
Adjusted R^2	0.141	0.853	0.261	0.866
Clustered standard errors	No	No	Yes	Yes

t statistics in parentheses
The dependent variable is wage gap (INR, 2001-adjusted). Share of union members is the ratio of union members to all employees in the factory sector. The share of workers is the share of factory workers out of the total number of factory sector employees. Per capita NSDP is Per capita net state domestic product. All specifications include individual and time effects.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Subsample: pre and post 1978

By running separate regressions for the two periods, the initial results of the base line regressions are being somewhat challenged, especially the changing of the sign of the effect of the share of unions members. Seeing this change of direction, I have run the same regression including interaction terms for share of union members and year, to try to uncover when this change happens. I found that the coefficients on the interaction terms are positive in the most of the 1970s, up to 1978. This also corresponds to a break in Indian

economic history, where India had experienced uneven GDP growth in the 1970s, and negative GDP growth at the end of that decade (see Figure 1.1). The period from 1979 and beyond shows an upward trend in GDP-growth, except for the year 1991.

Choosing the year 1978 as a break instead of 1991, the signs of the coefficients on the share of union members change direction from before 1978 to after 1978, see Table 6.3. I also obtain a higher adjusted R^2 when choosing 1978. The combined effect of the share of union members is positive until the break in 1978, and negative after. The sizes of the effects are also larger than in Table 6.2, in both subsamples. The period up until the end of the 1970s was a time of strict industry regulation, such that the positive relationship between wage gap and union density could be due to exogenous factors such as extensive government planning, affecting both. One possible explanation for what we are seeing here is that with decreasing industry regulation in the 1980s, the independent effect of union density is starting to impact the wage gap.

Whether choosing 1978 or 1991 as a break, the effect of the number of unions is positive in both periods. The effect is small, and insignificant, even when the share of union members is not included in the regression (Table 6.3, columns (5) and (6)).

Table 6.3 Fixed effects, before and after 1978

	(1) Pre 1978	(2) Post 1978	(3) Pre 1978	(4) Post 1978	(5) Pre 1978	(6) Post 1978
Share of union members	19285.9	-8368.9***	20449.2*	-8566.8***		
	(1.71)	(-4.23)	(1.99)	(-5.03)		
Share of union members sq.	-3915.3	545.4***	-4131.4	575.6***		
	(-1.42)	(3.41)	(-1.63)	(3.72)		
Number of registered unions	2.865	0.191			7.221	0.994
	(0.52)	(0.10)			(1.39)	(0.56)
Share of workers	255547.4***	417225.9***	252417.2***	417864.0***	267356.1***	407884.8***
	(3.68)	(4.91)	(3.84)	(4.89)	(3.74)	(4.73)
Total no. of employees (ln)	-8568.9	-52862.8***	-9028.7	-52012.0***	-9700.1	-39098.4***
	(-0.45)	(-5.59)	(-0.47)	(-5.26)	(-0.48)	(-3.83)
Per capita NSDP (ln)	47280.8	48687.3*	48330.5*	46932.3*	47261.5*	46444.3*
	(1.70)	(1.89)	(1.81)	(1.80)	(1.85)	(2.03)
Population (ln)	72256.8	41784.7	45684.3	39097.2	125319.9	77757.7**
	(0.55)	(0.99)	(0.44)	(1.30)	(1.33)	(2.45)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	64	188	64	190	68	193
Adjusted R^2	0.337	0.874	0.349	0.876	0.316	0.863
Clustered standard errors	Yes	Yes	Yes	Yes	Yes	Yes

t statistics in parentheses

The dependent variable is wage gap (INR, 2001-adjusted). Share of union members is the ratio of union members to all employees in the factory sector. The share of workers is the share of factory workers out of the total number of factory sector employees. Per capita NSDP is Per capita net state domestic product. All specifications include individual and time effects.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Share of unions submitting

As mentioned earlier in section 4, it is possible to argue that the number of registered unions that submit returns can be thought of as proxying for the large, politically-affiliated unions, while those that do not submit returns can be used as proxy for decentralised, plant-specific unions (Bhattacherjee, 2001). Given these assumptions, I may investigate whether increases in the wage gap could be explained by increasing decentralisation in the union structure across states. If I were to find such a correlation, it would be in line with the theory of BMW above.

I exchange the number of unions with the variable share submitting in the regression based on the equation (6.1). In a regression with the share of union members (Appendix B, Table B.19, column (1)) the share submitting has a positive coefficient, contrary to expectation, but it seems to have a very low impact on the wage gap as it is relatively small and has very low significance. In a regression without the share of union members (column (2)), the coefficient has the expected negative sign. It is likely that the share of unions submitting is just picking up the effect of the excluded share of union members in this case. The overall fit of the specification in column (2) is lower, according to the adjusted R^2.

I also run separate regressions for the subsamples before and after 1978. Share submitting has a positive, non-significant coefficient in both cases, implying that as the share of large, centralised unions increases, the wage gap is increased. This is not in line with theoretical assumption of the effect of unionisation on wage compression. It may be that the variable is unsuited as a measure of centralisation. The overall results from the earlier regressions are otherwise more or less replicated with this new variable included. The share of union members still seems to have a significant effect on the wage gap.

The Arellano-Bond estimator

Having obtained these results, I explore another possibility to test the robustness of the model. There may exist further observable variables influencing my variable of interest, the wage gap in manufacturing. It is likely that the wage gap in one year is correlated to the wage gap in the year before. For the within-estimation to yield unbiased and consistent

estimators, the error terms should not be correlated over time. If the size of the wage gap in period t is correlated with the wage gap in period $s \neq t$, without this being controlled for, this leads to autocorrelation of the error terms.

A correlation matrix of the first and second lags of wage gap shows that there is a high correlation between the wage gap and its first 2 lags.

Table 6.4 Correlation matrix of wage gap and its first two lags

Correlation matrix	Wage gap	1. lag	2. lag
Wage gap	1.0000		
1. lag	0.9004	1.0000	
2. lag	0.8770	0.8966	1.0000

The conditions for consistent estimation of a model with both fixed effects and lagged dependent variables are more demanding than for a model with only fixed effects or lagged dependent variables. The Arellano-Bond estimator is a consistent generalised method of moments estimator that may be used in this case. To investigate the effects of including lags of the wage gap, I apply the Arellano-Bond estimator. In addition to all the independent variables that have been included in the earlier regressions, I also include the first and second lags of the wage gap. The modified model can be expressed as:

(6.5) $Y_{it} = Y_{it-1} + Y_{it-2} + \alpha_i + \lambda_t + U'_{it}\beta + X'_{it}\delta + \varepsilon_{it}$

As above, I compute both the robust and the non-robust standard errors of the estimates. I find an indication of a significant correlation between the wage gap and its first two lags, when clustering on states, see Appendix B, Table 6.2, column (2). The effect is small and positive.

The two measures of union density do not seem to have a significant effect on the wage gap when the first two lags of the wage gap are kept constant, except for number of unions in the pre-1978 sample in column (3). But this sample has only 18 observations and an average of 2.25 observations per state, which is relatively low compared to the other samples. The share of union members behaves qualitatively as in the earlier results, meaning it has an overall negative effect. The number of unions now has a negative coefficient, except for

column (3). When including lags of the wage gap, the share of workers, the total number of employees and state output per capita seem to be more important than union density.

6.4 Summary of the results

The initial within-estimations seemed to indicate that union density in the Indian manufacturing sector, as measured by the share of unionised members, could indeed be causing some wage compression. While statistically significant, the effect of the share of unionised members was relatively small in economic terms. These results seemed to confirm the theory that increased unionisation leads to wage compression, and to lend support to the suitability of the BMW model in the Indian context. The estimated effect of the number of unions was on the other hand positive, but low and insignificant in all specifications. The adjusted R^2 implied that around 85 % of the variation in the wage gap could be explained by this model (Table 6.1, column (2)).

Splitting the data into pre and post 1991 subsamples, which was a year where Indian economy experienced fundamental changes, and running separate within-estimations on the subsamples, gave a slightly different picture. The results seemed to indicate that the share of union members had a positive effect before and a negative effect after 1991.

Finding that a shift in fact seemed to have occurred in 1978, I still found the same type of pattern; a positive effect of share of union members before the break, and a negative effect after. One possible explanation for this could lie in the fact that the period until the end of the 1970s was characterised by tight industry regulation that could be affecting both the level of wages and labour relations. The unexpected positive relationship between wage gap and union density could be caused by exogenous factors such as extensive regulation and government planning. With decreasing industry regulation in the 1980s, the independent effect of union density may have started to impact the wage gap.

Wishing to investigate the implications of assumptions put forward in Bhattacherjee (2001), I tried replacing the number of unions with a related variable; the share of unions submitting returns. The estimation results implied that the share submitting had a positive effect, contrary to expectation, but it seemed to have a very low impact on the wage gap as the effect was relatively small and had a very low significance. The share of union members, the

share of workers, the total number of employees, per capita NSDP and population size seemed to matter more for the wage gap.

Finally, I fitted a model with lags of the wage gap with the same control variables as earlier. I found an indication of a strong correlation between the wage gap and its first two lags. The effects were very small, but significant and positive. None of the two measures of union density seemed to have a significant effect on the wage gap with the first two lags of the wage gap kept constant. The share of union members still had an overall negative effect. The control variables share of workers, total number of employees and state output per capita seemed to be more important than union density.

7 Conclusion

The aim of the thesis has been to study the possibility of applying the Nordic model as a growth strategy for developing countries, using a panel of Indian states covering the years 1969-2010. The focus of the analysis was on one of the important main features of the Nordic model, the nature of labour relations. Labour relations in the Nordic model are characterised by high union density and centralised wage bargaining. Theory developed by Barth, et al. (2014), shows that an important result of this feature is wage compression.

In my analysis I have found some support for the theory that centralisation through unionisation leads to wage compression in the Indian manufacturing sector. The formal analysis relies on the assumption that the wage gap is endogenous, while the union density variables are exogenously determined. It must be noted that the causal relation could also be running in both directions, or they could both be determined by a third factor.

The initial estimations indicated that union density, as measured by the share of unionised members, could be causing some wage compression, even though the effect was relatively small. The share of union members variable is calculated based on membership numbers from those unions that have submitted returns. It is likely that this is a noisy estimate of the variable I am really interested in, the union density, which I cannot measure more accurately since I cannot access the membership numbers of all unions. A noisy predictor variable can lead to attenuation bias (Angrist & Pischke, 2008). If present, it leads to a bias of the estimated coefficient towards zero, giving a too low estimate of the effect. The results seemed in any case to confirm the theory that increased unionisation leads to wage compression.

When looking at subsamples before and after 1978, the expected negative effect of unionisation was seen to appear only after 1978. These results were more or less replicated when including the share of unions submitting. One possible explanation could be that an exogenous, third factor was at work in the period before 1978, but that the effect of this factor was lower in the post 1978-era. Severe industry regulation could potentially be such a third factor.

The robustness of the effect of share of union members was challenged when the first two lags of the dependent variable were introduced into the model, using the Arellano-Bond estimator. Even though no longer significant at 10%, the effect was still negative, as predicted by theory. Considering the evidence above, it does seem that the Nordic model is to a certain degree suitable as a growth strategy outside of its origins. The effects of unionisation may be weaker in India than in the Nordic context, but they remain relatively robust even when modifying the base line model.

In this thesis, I have taken several steps in order to strengthen the internal validity of the analysis, like including control variables to deal with possible omitted variable bias and comparing different functional forms of the base specification. I have also computed heteroskedasticity-robust estimators. Other potential threats to the internal validity, such as possible measurement error or simultaneous causality, are factors that cannot as readily be mitigated, at least not with the limited set of data at my disposal.

The data used in this thesis originates from the organised manufacturing sector of India, and it is important to emphasise that the results of the analysis relate to a limited part of the Indian economy. The unorganised sector of the Indian economy consists of small-scale enterprise and self-employed workers, in which case centralisation is not a meaningful concept. This is a major difference between India and other developing countries on one hand, and the highly industrialised Nordic countries that only have “organised” manufacturing sectors on the other. The external validity of the analysis outside the formal sector in India may thus be limited. The external validity may be higher for manufacturing sectors of other comparable developing countries, provided they have similar institutions, but only further study of the effect of centralisation on the wage gap in developing countries can really answer that question.

For further studies of this topic, more reliable data on union density could give more precise estimations of the effect of unionisation on wage compression in India. Data on the levels of human capital and the profitability of firms may also provide an improvement to the model as determinants of the wage gap.

References

Andersen, T. M., Holmström, B., Honkapohja, S., Korkman, S., Tson, S. H., & Vartiainen, J. (2007). The Nordic Model. Embracing globalization and sharing risks. *ETLA B.*

Angrist, J. D., & Pischke, J.-S. (2008). *Mostly harmless econometrics: An empiricist's companion*: Princeton University Press.

Barth, E., Finseraas, H., & Moene, K. O. (2015). Political Reinforcement: How Rising Inequality Curbs Manifested Welfare Generosity. *American Journal of Political Science, 59*(3), 565-577. doi:10.1111/ajps.12129

Barth, E., Moene, K. O., & Willumsen, F. (2014). The Scandinavian model—An interpretation. *Journal of Public Economics, 117*, 60-72. http://dx.doi.org/10.1016/j.jpubeco.2014.04.001

Besley, T., & Burgess, R. (2000). Land reform, poverty reduction, and growth: Evidence from India. *Quarterly journal of Economics*, 389-430. Retrieved from http://www.jstor.org/stable/2586998

Besley, T., & Burgess, R. (2004). Can Labor Regulation Hinder Economic Performance? Evidence from India. *The Quarterly Journal of Economics, 119*(1), 91-134. doi:10.1162/003355304772839533

Bhattacherjee, D. (2001). The evolution of Indian industrial relations: a comparative perspective. *Industrial Relations Journal, 32*(3), 244-263. doi:10.1111/1468-2338.00196

Bhattacherjee, D., & Chaudhuri, T. D. (1994). Unions, wages and labour markets in Indian industry, 1960–86. *The Journal of Development Studies, 30*(2), 443-465. doi:10.1080/00220389408422323

Bigsten, A. (2001). Relevance of the Nordic model for African development. *WIDER Discussion Papers//World Institute for Development Economics (UNU-WIDER),* (2001/131). doi:http://hdl.handle.net/10419/52861

The Constitution of India. (1950). New Delhi: Government of India, Ministry of Law and justice, Legislative Department.

Datanet India Pvt. Ltd. (n.d.). Socio-Economical Statistical Infomation about India. Retrieved 2016 http://www.indiastat.com/default.aspx

Dølvik, J. E. (2013). Grunnpilarene i de nordiske modellene. *Et tilbakeblikk på arbeidslivs-og velferdsregimenes utvikling NordMod2030. Oslo: Fafo, rapport*(13).

Economic Organisation and Public Policy Programme (EOPP). EOPP Indian states Data. Retrieved January 2016, from London School of Economics http://sticerd.lse.ac.uk/eopp/_new/data/Indian_Data/default.asp

Goldar, B., & Sadhukan, A. (2015). Employment and wages in Indian manufacturing: Post-reform performance *Employment Working Paper No. 185*. Geneva: International Labour Office.

Lind, J., & Mehlum, H. (2016). UTEST: Stata module to test for a U-shaped relationship. Retrieved from http://EconPapers.repec.org/RePEc:boc:bocode:s456874

Ministry of Labour and Employment. (2014). *Labour and Employment statistics*. Paper presented at the 21st Conference of Central and State Statistical Organisations, Panjim, Goa. http://mospi.nic.in/Mospi_New/upload/cocsso_data/agenda2_21cocsso_23jan14.pdf

Ministry of Law and Justice. (2008). *The Unorganised Workers Social Security Act*. New Dehli: Government of India. Retrieved from http://labour.nic.in/sites/default/files/TheUnorganisedWoekersSocialSecurityAct2008_0.pdf.

Moene, K. O., & Wallerstein, M. (2006). Social democracy as a development strategy. In P. K. Barhan, S. Bowles, & M. Wallerstein (Eds.), *Globalization and Egalitarian Redistribution* (pp. 148-168): Princeton University Press.

OECD. (2016). Indicator: Trade in goods and services [Custom selection]. doi:10.1787/0fe445d9-en

Ramaswamy, K. (2008). Wage inequality in Indian manufacturing: Is it trade, technology or labour regulations? *Working Paper 2008-021*. Mumbai: Indira Gandhi Institute of Development Research.

Stock, J. H., & Watson, M. W. (2011). *Introduction to Economterics* (3rd ed. ed.). Boston: Addison-Wesley.

The World Bank. (2016a). *Population ranking table, 2014*. Retrieved from: http://data.worldbank.org/data-catalog/Population-ranking-table

The World Bank. (2016b). *World Development Indicators* Retrieved from: http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators

Tomlinson, B. R. (2013). *The economy of modern India : 1860 to the twenty-first century* (2nd ed. ed. Vol. III). Cambridge: Cambridge University Press.

United Nations Development Programme (UNDP). (2014). *Human development report 2014: Sustaining human progress: Reducing vulnerabilities and building resilience.* New York.

Wikipedia The Free Encyclopedia. (n.d.). [Search words: Administrative divisions India] [Adapted map]. Retrieved from https://commons.wikimedia.org/wiki/File:India-states-numbered.svg

Appendices

Appendix A

Model of creative destruction and wage compression

Let cost of entry is B, which is increasing in n.

Free entry in job creation implies:

$$\Pi(t,t) = B(t, n(t))$$

Free exit implies a termination of jobs of age $\theta(t)$:

$$F(t-\theta(t)+1) - w(t-\theta(t)+1, t) = (1-\alpha\xi)F(t-\theta(t)+1) - Q(t) = 0$$

Central wage negotiators set tariff wage Q such that there is full employment,

$$\theta(t)n(t) = 1$$

If we let the average pace of technological change be λ, along a steady state path we get:

$$\theta(t) = \theta, \qquad n(t) = n, \qquad F(t) = (1+\lambda)^t f, \qquad Q(t) = (1+\lambda)^t q$$

$B(t,n) = (1+\lambda)^t b(n)$, where $b(n)$ is increasing in n

$Q(s) = (1+\lambda)^s q$, where q is endogenous, and $\sum_{s=t}^{t+\theta(t)-1} Q(s) = \frac{(1+\lambda)^\theta - 1}{\lambda} q(1+\lambda)^t$

Income per vintage, at time s, is denoted as $x(\theta)$, increasing in θ, and implicitly defined by

$$\sum_{\tau=s-(\theta-1)}^{s} (1+\lambda)^\tau f \equiv \chi(\theta)(1+\lambda)^s f$$

When all expressions are normalised by $(1+\lambda)^{-t}$, this gives:

- Economic lifetime of investments $\theta = \frac{1}{n}$, declining in n
- Average income per capita is then $\frac{1}{\theta}x(\theta)f = nx\left(\frac{1}{n}\right)f$, increasing in n
- From the free exit condition $(1-\alpha\xi)(1+\lambda)^{1-\frac{1}{n}}f - q = 0$ we get the tariff wage $q = (1-\alpha\xi)(1+\lambda)^{1-\frac{1}{n}}f$, increasing in n
- Average wage per worker $\overline{w} = q + \alpha\xi nx\left(\frac{1}{n}\right)f$, increasing in n
- Thus, total wage cost over the lifetime of an investment is:

$\widetilde{w} = \left(\frac{1}{n}\right) \alpha\xi f + (1 - \alpha\xi) x \left(\frac{1}{n}\right) f,$ declining in n

- And the free entry condition $\left(\frac{1}{n}\right) f - \widetilde{w} = b(n)$ can be expressed as:

$$\pi(n, \lambda) \equiv (1 - \alpha\xi) \left[\left(\frac{1}{n}\right) - x \left(\frac{1}{n}\right)\right] f = b(n)$$

Model of creative destruction with heterogeneous workers; high skill vs low skill

- *High skill group*: a productivity of p_H, representing a fraction γ of the work force.
- *Low skill group*: a productivity of p_L, representing a fraction $(1 - \gamma)$ of the work force.

In an efficient allocation the high skill workers are sorted to the high productivity jobs, and are in the $\theta_H$most modern vintages, such that $\theta_H n = \gamma$. The low skilled workers occupy the rest of the jobs, such that $\theta_L n = 1 - \gamma$.

The wage premium paid to high skill workers must be high enough such that it is only profitable for the most productive firms to employ high skill workers.

The least productive firm that employs high skill workers (vintage $t - \theta_H$) is on the margin indifferent between hiring a high skill or a low skill worker (Barth et al., 2014):

$$p_H F(t - \theta_H) - W_H(t) = p_L F(t - \theta_L) - W_L(t)$$

The low skill wage just clears the market, such that: $W_L(t) = p_L F(t - \theta_H - \theta_L)$

Wage in period s is:

$W_S(t) = W_S(1 + \lambda)^t$, for $S = H, L$, where parameters W_S are endogenous.

The efficient wage premium is given by:

$W_H - W_L = \frac{(p_H - p_L) f}{(1+\lambda)^{\theta_H}}$ and by $W_L = \frac{p_L f}{(1+\lambda)^{\theta_L + \theta_H}}$,

such that the wage differential along the steady state path becomes:

$\frac{W_H - W_L}{W_L} = \beta \frac{(p_H - p_L)}{p_L} (1 + \lambda)^{\theta_L}$, where a $\beta = 1$when there is efficient sorting.

Appendix B

Table B.1 OLS fixed effects estimations with share of unions submitting

	(1)	(2)	(3) Pre 1978	(4) Post 1978
Share of unions submitting	457.0	-12308.9	3055.7	4403.8
	(0.04)	(-1.43)	(0.27)	(0.39)
Share of union members	-5918.0***		19412.9*	-8781.6***
	(-3.46)		(1.95)	(-4.46)
Share of union members sq.	301.9**		-3888.3	562.5***
	(2.17)		(-1.63)	(3.78)
Share of workers	363593.6***	355450.8***	255986.1***	413731.3***
	(4.68)	(4.25)	(4.26)	(5.07)
Total no. of employees (ln)	-37572.8***	-31172.0***	-10070.2	-53491.7***
	(-4.58)	(-3.40)	(-0.49)	(-5.64)
Per capita NSDP (ln)	45533.9**	44856.9**	48022.9*	48834.0*
	(2.79)	(2.84)	(1.80)	(1.86)
Population (ln)	43549.8**	57105.3***	48539.6	38092.9
	(2.42)	(3.29)	(0.48)	(1.22)
Time effects	Yes	Yes	Yes	Yes
Observations	252	252	64	188
Adjusted R^2	0.853	0.846	0.336	0.874
Clustered standard errors	Yes	Yes	Yes	Yes

t statistics in parentheses

The dependent variable is wage gap (INR, 2001-adjusted). Share submitting is the share of trade unions submitting returns out of the total number of unions. Share of unionised workers is the ratio of union members to all employees in the factory sector. The share of workers is the share of factory workers out of the total number of factory sector employees. Per capita NSDP is Per capita net state domestic product. All specifications include individual and time effects.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B.2 Arellano-Bond GMM estimations

	(1) Non-robust	(2) Robust	(3) Pre 1978	(4) Post 1978
L.Wagegap	0.114*	0.114**	-0.143**	0.122***
	(1.87)	(2.14)	(-2.04)	(2.69)
L2.Wagegap	0.102	0.102**	-0.129	0.103**
	(1.63)	(2.54)	(-1.02)	(2.48)
Share of union members	-2441.7	-2441.7	-15747.1	-2112.4
	(-0.92)	(-0.94)	(-1.17)	(-0.98)
Share of union members sq.	214.1	214.1	3798.0	185.3
	(1.15)	(1.16)	(0.63)	(1.20)
Number of registered unions	-0.288	-0.288	69.43**	-0.319
	(-0.21)	(-0.15)	(2.37)	(-0.17)
Share of workers	488981.1***	488981.1***	39432.5	513163.3***
	(12.88)	(7.78)	(0.67)	(8.43)
Total no. of employees (ln)	-37528.3***	-37528.3***	-100726.9**	-48305.8***
	(-2.80)	(-4.42)	(-2.37)	(-5.43)
Per capita NSDP (ln)	49371.3***	49371.3***	96148.2**	56818.3***
	(4.01)	(6.18)	(2.04)	(5.08)
Population (ln)	69199.4	69199.4	2226144.0**	17716.0
	(1.02)	(0.70)	(2.24)	(0.16)
Time effects	Yes	Yes	Yes	Yes
Observations	157	157	18	139
Clustered standard errors	No	Yes	Yes	Yes

t statistics in parentheses

The dependent variable is wage gap (INR, 2001-adjusted) Share of unionised workers is the ratio of union members to all employees in the factory sector. The share of workers is the share of factory workers out of the total number of factory sector employees. Per capita NSDP is Per capita net state domestic product.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$