# RESEARCH ARTICLE
# FLEXIBLE LABOUR AND INNOVATIVE PERFORMANCE[1]

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## Introduction

In recent years, studies on the determinants of innovative behaviour of firms in Europe have been encouraged by the increasing availability of firm-level data through the European Community Innovation Survey (CIS). The emerging literature has focused on determinants of innovation such as market structure, firm size, knowledge spillovers, R&D collaboration, conditions for the appropriation of innovation benefits, and others. This article will address a factor that has not been covered in these studies: what is the influence of the increased flexibility of labour on innovation? For this, the OSA database for the Netherlands has been used.

Over the last twenty years, many labour market economists have strongly recommended that high unemployment should be reduced by making European labour markets more flexible. An example is the OECD's Jobs Study (1994). Subsequent to the Jobs Study, a literature has developed that tries to substantiate that more flexible labour markets would not only be favourable for employment, but may also enhance higher economic growth and higher productivity growth (e.g. Nicoletti and Scarpetta, 2003). Nonetheless, flexible labour contracts as determinants of innovation or productivity growth are still underresearched. There are only few firm-level studies, including Laursen and Foss (2003), Michie and Sheehan (2003), Kleinknecht et al. (2006), Arvanitis (2005), and Lucidi and Kleinknecht (2009). This is regrettable, as labour relations and human resources have been suggested to have a significant impact on innovation through their influence on knowledge processes (Amabile et al., 1996; Guest, 1997; Trott, 1998).

The study, where this article is about, makes an empirical contribution to our sparse knowledge about the impact of flexible labour on innovation using firm-level data from several subsequent surveys with broad industry coverage in the Netherlands. The database covers a "direct" measure of innovation: sales performance of new or improved products, introduced during the past 2 years. We take advantage of the fact that there is a wide spectrum of typical labour contract patterns in the Netherlands. In most Dutch firms we find a combination of fairly rigid "Rhineland" labour relations and highly flexible "Anglo-Saxon" practices in hiring.

The wide variety of "Rhineland" versus "Anglo-Saxon" labour contracts in the Netherlands allows for a meaningful study of the possible impact of flexible labour on innovation performance.

## Patterns of flexible labour and innovation

Labour market flexibility can be subdivided into three types of flexibility: (1) numerical flexibility, (2) functional flexibility and (3) wage flexibility (e.g. Beatson, 1995). This paper concentrates on analyzing numerical and functional flexibility. Numerical (or "external") flexibility allows for easy hiring or firing of personnel, resulting in significant reductions of a firm's wage bill.[2] High numerical (or "external") flexibility is associated with an "Anglo-Saxon" model of labour relations.

Functional flexibility is the ability of firms to reallocate labour in their internal labour markets, relying on training that allows personnel to carry out a wider range of tasks (e.g. Beatson, 1995). Functional flexibility reflects the multiple competencies of workers, such as multi-skilling, multitasking, cooperation and the involvement of workers in decision making (Arvanitis, 2005). Functional (or "internal") flexibility is characteristic of the "Rhineland" model of labour relations, providing opportunities for long-term careers in the same firm. Such long-term commitments may be interpreted as an investment in the trust, loyalty and commitment of individuals.

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Many mainstream economists tend to be in favour of more flexible, "Anglo-Saxon" la-bour markets. In a traditional microeconomics view, markets can never be flexible enough. There are a number of detailed arguments in favour of more numerical flexibility. First, long tenured employees may become conservative, being attached to outdated products and processes, and reluctant to adapt to significant changes due to "lock-in" effects (Ichniowski and Shaw, 1995). Second, labour market rigidity may reduce the reallocation process of labour from old and declining to newly emerging industries and the difficulty of firing personnel might frustrate labour-saving process innovations (Bassanini and Ernst, 2002; Scarpetta and Tessel 2004; see also Nickell and Layard, 1999). Third, with strong protection against dismissal, labour may become too powerful, increasing the chance that monopoly profits from innovation will be (partly) absorbed through higher wage claims. Monopoly profits from innovation are a reward for taking innovative risks; such risk-taking would be discouraged if labour could claim part of the premium. Powerful labour, negotiating wage contracts at the firm level, could therefore "hold up" investments in innovation (Malcomson, 1997). Finally, one might add that higher flexibility would also allow for easier replacement of less productive personnel by more productive people and the threat of firing might prevent shirking. Easier hiring and firing could also help keep wages low, as is evidenced by estimates of wage equation.[3] Moreover, as has recently been emphasized by Arvanitis (2005), firms can more effectively fulfil their demands for specialized services by making use of temporary work.

As counterarguments against high numerical flexibility, we propose the following: high numerical flexibility may weaken a firm's historical memory and continuity of learning. A high external labour turnover rate may reduce employees' loyalty and commitment, resulting in easier leakage of knowledge to competitors; such externalities would discourage investment in R&D. The argument that high numerical flexibility will make it difficult for firms to store innovative knowledge is particularly relevant for firms that have a "routinized" Schumpeter II innovation regime (Kleinknecht et al., 2006). In a Schumpeter II regime, the path-dependent historical accumulation of knowledge is critical to superior product and process performance. Much of the accumulated knowledge is "tacit." Different from documented and codified knowledge, "tacit" knowledge is illdocumented and idiosyncratic, as it is based on personal experience (Polanyi, 1966). Accumulation of such knowledge is favoured by a longer tenure in the same firm.

Shorter job durations may also discourage investments in firm-sponsored training. In highly flexible labour markets, employees may be interested in acquiring general knowledge that increases their employability elsewhere, but they may be reluctant to acquire firm-specific knowledge (e.g., studying safety instructions) if they anticipate a short stay in the firm. Moreover, Nastepad and Storm (2006) have shown that (growing) flexibility in labour relations in OECD countries leads to a significant growth in management bureaucracies to control disloyal behaviour. While adherents of flexible labour markets emphasize that difficult firing of redundant personnel would frustrate labour-saving innovations, it can also been argued that personnel who are easy to fire have strong incentives to hide information about how their work can be done more efficiently. This can be damaging to productivity growth as far as the management is dependent on their personnel's "tacit" knowledge to efficiently implement process innovations (see also Lorenz, 1999). Finally, easy firing may change power relations in a firm. Personnel on the shop floor are less likely to criticize powerful (top) managers, and poor critical feedback from the shop floor may favour problematic management practices.

Given the opposing theoretical arguments pertaining to numerical flexibility, it is interesting to look at empirical findings. Two recent studies using UK firm-level data show a negative correlation between numerical flexibility and innovation (Michie and Sheehan, 1999, 2001). Similar results are reported by Chadwick and Cappelli (2002) from US data. Arvanitis (2005) reports mixed results.

Based on the theoretical and empirical literature, we arrive at the first hypothesis for our empirical investigation:

*Numerical flexible labour including external labour turnover and temporary work has a positive impact on a firm's innovation performance but the impact becomes negative beyond some optimal point.*

While the impact on innovation of numerical flexibility is doubtful, Arvanitis does find a positive impact on productivity and innovation for several of his indicators of functional flexibility. Similar results have been found by others (Michie and Sheehan, 1999, 2001; Chadwick and Cappelli, 2002; Kleinknecht et al., 2006). High func-

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tional flexibility in internal labour markets reflects a firm's ability to organize flexibly without destroying loyalty and commitment by firing. This is likely to reduce positive externalities through the exit of trained people or through disloyal behaviour (e.g., the leaking of trade secrets to competitors). Furthermore, high functional flexibility can reduce communication barriers between different departments. Better sharing and transfer of knowledge across departments can favour innovation. Given aforementioned arguments, the second hypothesis reads:

*Functional flexibility has a positive impact on a firm's innovation performance.*

## Data and econometric model

Both these hypotheses were tested using a combination of waves of the longitudinal OSA data. This enabled us to construct a longitudinal dataset that includes dependent variables in year t and lagged independent variables in year t-2, the latter coming from the previous survey. Our final dataset is confined to the period 1992-2000, as information from earlier surveys is not fully comparable.

We use as dependent variable, a "direct" indicator of product innovation; i.e., sales of new (or significantly improved) products and/or services. These new or improved products/services are 'new to the firm' and can therefore be regarded to include "imitative" innovations as opposed to "real" innovations that are 'new to the market'. Innovation performance in the OSA database is measured by asking respondents to subdivide their present product range into three types of product:

1. Products that remained largely unchanged during the past two years;
2. Products that were incrementally improved during the past two years;
3. Products that were radically changed or introduced as entirely new products during the past two years.

Our most important independent variables are numerical flexibility (NFL) and functional flexibility (FFL). We use two indicators of numerical flexibility: Annual external labour turnover (i.e., percentages of people that joined or left the firm during the last year) and percentages of people on fixed-term contracts (hired directly by the firm). Our indicator of functional (or "internal") flexibility is measured by the percentage of employees that changed their function and/or department within the firm during the past year. We expect functional flexibility to have a positive impact on innovation performance.

Also, an extensive set of control variables (Con) is included in the model (firm size, firm age, R&D intensity, export intensity, average new product sales in its sector of principal activity, human capital variables,) which then looks the following:

$$y_{i,t} = \alpha + \beta_1 NFL_{i,t-2} + \beta_2 FFL_{i,t-2} + \beta_3 Con_{i,t-2} + \beta_4 Years_t + \varepsilon_{i,t-2}$$

This empirical model is tested in four different specifications on pooled longitudinal data: an OLS model, a Tobit model, a Heckman model and a Heck-tobit model.

## Results

The four regression models produce fairly consistent results. It is reassuring that the coefficients proved robust to tentative inclusion or exclusion of various independent variables. As expected, R&D intensity has highly significantly positive effects on innovative output in all four models. The positive effect of export intensity on innovation performance is also highly significant in all versions. It is no surprise that an individual firm's new product sales are heavily related to the average new product sales in its sector of principal activity. Including industry average new product sales implies that our model explains deviations of an individual firm's new product sales from its industry average. The two indicators of human capital (educational achievements and training) have positive impacts on a firm's innovation performance (significant at the 5% level in all four models). This reconfirms the importance of qualified human capital to the innovation process.

As expected, high rates of individual changes in function or department within the firm ("functional flexibility") contribute positively to new product sales, being significant at 5% level in all four models in both samples. This underlines the importance of "insider-outsider" labour markets for keeping knowledge in the firm and investing in the loyalty and commitment of employees while allowing for flexibility.

Finally, all four models in both samples indicate that a high external labour turnover has no impact on innovation. In three out of four models, however, high shares of employees on temporary contract seem to have a positive impact on innovation performance (significant at the 5% level in the SME sample and at the 10% level in the total sample). This finding supports the argument by Ichniowski and Shaw (1995) discussed earlier, but is hard to reconcile with recent firm-level studies in the Netherlands (Kleinknecht et al., 2006) and in Italy (Lucidi and Kleinknecht, 2009) that find a negative impact of numerically flexible labour on labour productivity growth. It is important to keep in mind that two studies using UK firm-level data also show a negative correlation between numerical flexibility and innovation (Michie and Sheehan, 1999, 2001), and that similar results are reported by Chadwick and Cappelli (2002) from US data. As mentioned above, Arvanitis (2005) reports mixed results on the topic.

## Conclusions and discussion

This paper makes an empirical contribution to the sparse knowledge about the impact of flexible labour on innovation, using new product sales as a direct measure of innovation and controlling for factors such as human capital, R&D intensity, export intensity, firm size and age, and industry average new product sales. Not surprisingly, R&D intensity, export intensity and HRM variables (levels of education and training) all contribute positively to new product sales. As expected, an individual firm's new product sales are heavily related to average sales in its sector of principal activity.

We find weak evidence that larger and older firms have higher new product sales than their young and small counterparts. It seems as if the (dis)advantages of a firm being small or big or being old or young almost cancel each other out. We conclude that the advantages typical of small and young firms, such as little bureaucracy and short communication lines, dedicated management by the owners or the ability to occupy market niches that are less interesting for big firms, seem to be compensated (or perhaps slightly over-compensated) by the advantages enjoyed by bigger and older firms, such as the ease of financing of innovations due to some monopoly power, the exploitation of strong marketing functions and brand names, accumulated knowledge and experience from (the management of) earlier innovations, or the diversification of risks through a large portfolio of innovation projects.

The positive impact of functional flexibility is significant in all four models of both samples and is consistent with previous results by Michie and Sheehan (1999, 2001); Chad-wick and Cappelli (2002) and Arvanitis (2005). Our findings confirm the important role of functional flexibility in reducing barriers to knowledge sharing and building multiple competencies of employees in internal labour markets. Functional flexibility in "insider-outsider" labour markets allows for flexibility while being socially responsible towards a firm's personnel. The latter might be interpreted as an investment in trust, loyalty and commitment. Such investment is likely to economize on supervision and monitoring costs and reduces the leaking of a firm's knowledge to competitors.

Our model is remarkably robust to changes in specifications and in sample size. This also holds for inclusion of non-linear terms of numerical flexibility variables. Specifications with non-linear terms are not documented in this paper, as these terms all proved insignificant. Intuitively, one might have expected that there is some optimum level of numerical flexibility that would enhance innovation and that beyond the optimum point, flexibility becomes counter-productive. However, the data do not support this.

We find mixed results on numerical flexibility. While one of the proxies of numerical flexibility, external labour turnover, is insignificant in all four models, another proxy, tem-porary work, has a positive effect on innovation performance, or, being more precise, on "imitative" ("new to the firm") products. Most of our new product introducers are market followers rather than market leaders, i.e., they introduce products that are "new to the firm" rather than products "new to the market." Many of these firms are likely similar to what Pavitt (1984) named "supplier-dominated innovators," i.e., firms that innovate mainly by adopting (and creatively using) new equipment from suppliers. Such adoption may be favoured by carefully screening the right personnel. An important motive behind using temporary contracts is personnel screening. Typically, young university graduates are hired under a probationary period and can expect tenure if they perform well. Such temporary contracts seem to be positively related to "imitative" innovations.

Further explorations suggest, however, that the probability of having products "new to the market" (rather than "new to the firm") is negatively influenced by high shares of tem-porary workers. Hence, the minority of R&D intensive market leaders tends to rely sig-nificantly less on flexible work, which is consistent with the findings of Arvanitis' (2005) study on data from Switzerland. It also underlines the arguments by Lucidi and Kleinknecht (2009) about the need for the continuous accumulation of (tacit) knowledge that is favoured by longer commitments of workers to their firms. It appears that the much criticized "rigidity" of insider-outsider labour markets is favourable to R&D intensive market leaders, while the larger stream of imitators and market followers prefer using temporary contracts to try out new people with fresh ideas, which may favour technology adoption.

Finally, our results warn against the unconditional plea by mainstream economists for the deregulation of labour markets (see e.g. the OECD's Job Study, 1994). It seems that the "rigidity" of insider-outsider labour markets also has advantages, as it allows for "functional" flexibility. The often criticized protection of "insiders" can be interpreted as an investment in the loyalty and commitment of workers. Moreover, functional flexibility on internal labour markets has advantages for the continuity of (organizational) learning, and strengthens the historical memory of firms. Neoclassical economists should note that temporary contracts might have advantages for imitative firms, but definitely are not an option preferred by market leaders who seem to have a greater need for continuity in learning and in preventing knowledge from leaking to competitors.

## References

*1. This article is an abridged version of Zhou, H; R. Dekker & A.H.Kleinknecht, "Flexible labor and innovation performance: Evidence from longitudinal firm-level data", Industrial and Corporate Change, 20 (3), pp.941-968. For complete literature references we refer to the original article.*

*2. For evidence from the OSA database on the wage-reducing effects of flexible work, both at the firm and the individual levels see Kleinknecht et al. (2006).*

*3. Kleinknecht et al. (2006) give evidence from individual-level as well as firm-level wage equations that flexible personnel earn lower hourly wages, and that firms with high shares of flexible personnel pay lower wages. Similar evidence from individual-level wage equations has been reported by Booth et al., 2002, McGinnity and Mertens 2004; Sànchez and Toharia 2000, or Ségal and Sullivan, 1995.*