



# Labour adjustment costs: Estimation of a dynamic discrete choice model using panel data for Greek manufacturing firms

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## ABSTRACT

In this paper we estimate a dynamic structural model of employment at firm level. Our dataset consists of a balanced panel of 2790 Greek manufacturing firms. The empirical evidence of this dataset stresses three important stylized facts: (a) there are periods in which firms decide not to change their labour input, (b) there are periods of large employment changes (lumpy nature of labour adjustment) and (c) the commonality is employment spikes to be followed by smooth and low employment growth periods. Following Cooper and Haltiwanger [Cooper, R.W. and Haltiwanger, J. "On the Nature of Capital Adjustment Costs", *Review of Economic Studies*, 2006; 73(3); 611–633], we consider a dynamic discrete choice model of a general specification of adjustment costs including convex, non-convex and "disruption of production" components. We use a method of simulated moments procedure to estimate the structural parameters. Our results indicate considerable fixed costs in the Greek employment adjustment.

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## 1. Introduction

Labour market rigidities are typically believed to be a particularly appealing explanatory factor of relatively high European unemploy-

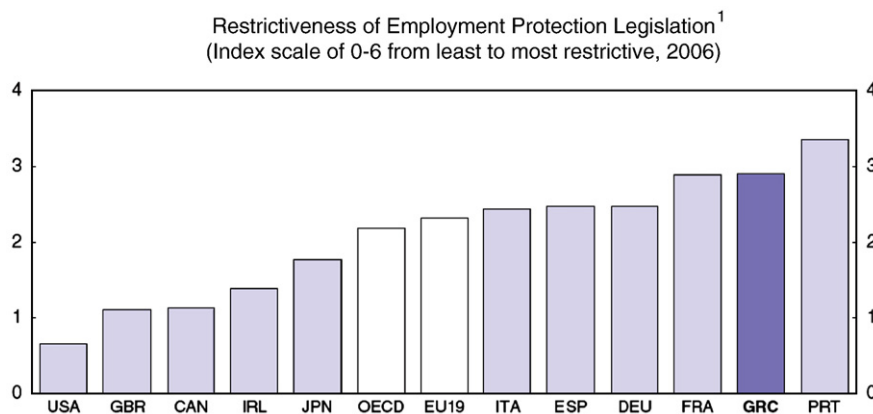
ment.<sup>2</sup> Exogenous factors like the oil shock in the early and late 1970s, a productivity slowdown in the 1980s and 1990s as well as international competition from newly developing countries may all have had a negative impact on European labour markets but most of these factors also affected the United States where the increase of unemployment has by no means reached the intensity observed in Europe. Thus, consistent with the *Euroclerosis* hypothesis and unlike the United States, it seems that the European labour market does not have the mechanisms and the

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<sup>2</sup> Many studies have tried to establish a universal explanation for the significant increase and persistence of European unemployment. Commonly referred to as the *Euroclerosis* problem (a term introduced by Giersch, 1985), researchers have mainly focused on (a) the degree of labour market rigidities (Hopenhayn and Rogerson, 1993; Siebert, 1997; Nickell, 1997); (b) differences in taxes (Prescott, 2002; Rogerson, 2008); and (c) unemployment benefits (Ljungqvist and Sargent, 1998; Atkeson and Lucas, 1992; Hopenhayn and Nicolini, 1997; Shimer and Werning, 2008). Although all these explanations seem to be plausible, their quantitative importance is still debatable.



**Fig. 1.** Restrictiveness of Employment Protection Legislation<sup>1</sup>. (Index scale of 0–6 from least to most restrictive, 2006). 1. The OECD and EU19 aggregates are unweighted averages; OECD excludes Iceland. EU19 covers all EU members that are also OECD members. Source: OECD (2007), *Going for Growth*, Economic Policy Reforms, OECD, Paris.

flexibility to absorb shocks as the above-mentioned and quickly respond to new circumstances. In contrast, it is observed that the labour market responds more slowly than the shocks to labour demand/supply warrant. This is attributed to European labour regulations which affect firms' ability to fire and hire workers and many economists indicate adjustment costs to be accountable for this. Labour regulations, the argument goes, increase the cost of doing business (increase adjustment costs), lead to sclerosis of the economy, and to high unemployment.<sup>3</sup>

Labour adjustment costs are a simple and intuitive way of capturing a number of frictions and inflexibilities in labour markets. These frictions can vary from institutional, legislative, informational, political economy, etc. Thus, although adjustment costs of the type studied here, as well as by most of the related literature, are "as if" mechanisms that can be associated with a number of non-identified frictions, they can at least provide a measure of the composite cost arising from the decision to adjust the labour factor of production and hence a good argument for liberalizing reforms in the labour market.

From an empirical point of view, models that ignore labour adjustment costs or assume quadratic adjustment costs only, are unable to match the firm-level infrequent and lumpy dynamic pattern of employment activity being found in most empirical studies. Therefore, many researchers have pointed out the importance of non-convexities in adjustment costs. However, much of the earlier empirical work on employment dynamics at the firm level using panel data has not provided with direct estimates of adjustment costs. Rather in the early work the emphasis was on the dynamics of employment where in the estimates of the dynamic employment regressions it was impossible to retrieve the structural adjustment cost parameters.<sup>4</sup>

<sup>3</sup> The OECD Jobs report (1994) argues that, in an environment in which structural change and adaptation of firms is increasingly important, countries with high labour market rigidities perform poorly and are associated with higher unemployment. Siebert (1997) places the entire blame for high unemployment in Europe on labour market rigidities. Botero et al. (2004) investigate the regulation of labour markets through employment, collective relations and social security laws in 85 countries and show that heavier regulation of labour is associated with lower labour force participation and higher unemployment, especially of the young. Also, econometric evidence seems to suggest that employment adjusts more slowly in countries with high labour market rigidities (with high labour adjustment costs). For instance, Alogoskoufis and Manning (1998), in their comparative study of wage-setting in the G-5, find higher levels of persistence in the underlying dynamic labour demand schedules in Europe than in Japan and the United States. Their results suggest that high labour adjustment costs are a more important source of unemployment persistence than slow wage adjustment due to insider membership dynamics. Hopenhayn and Rogerson (1993) explore the various implications of labour adjustment costs for employment and unemployment. In particular, they state that the effect of firing costs on unemployment depends on the nature of the microeconomic shocks affecting individual firms' employment decisions. Hence, the evaluation of how microeconomic shocks affect the structure and the size of adjustment costs, which in turn, affect individual firms' employment decisions, is an empirical matter.

<sup>4</sup> See for example Arellano and Bond (1991), Nickell and Wadhvani (1991) and Bresson et al. (1992).

The aim of this paper is to go beyond these studies by estimating labour adjustment costs within a fully specified dynamic structural model at micro level.<sup>5</sup> The target is to look at the dynamic nature of labour adjustment costs that Greek firms face when they decide to hire/fire employees. We first monitor if the Greek micro data supports the presence of both convex and non-convex components of adjustment costs, and more specifically we find the structural estimates of these components that are consistent with micro-evidence. Our work is more than a country study. In particular, we use the estimation approach of Cooper and Haltiwanger (2006) to study employment, rather than investment, in an attempt to relate the findings back to the discussion of how European labour regulations affect firms' ability to hire and fire workers. Based on the evidence of our dataset, we introduce a dynamic discrete choice model with a general specification of adjustment costs including both convex and non-convex components. The firm has to hire/fire employees in complete units and therefore the model is not differentiable in employment and has to be solved numerically. This is done by implementing a numerical method, the Value Function Iteration method, which is summarized in a subsequent section. In order to estimate the structural parameters of the model, we use a simulated moments procedure. The method of simulated moments essentially estimates the structural parameters of the model by matching the moments of the data with the moments of the model.<sup>6</sup>

We find that slow adjustment is generated –and can be explained– by costs associated with changing the number of workers employed.<sup>7</sup> Adjustment costs are found to be statistically important, thus firms change their demand for labour more slowly than the shocks to labour demand warrant, due to the interference of these costs. As far as the structure of the costs is concerned, the estimation results indicate that a model, which mixes both convex and non-convex (particularly fixed, linear and disruption) costs, fits the micro patterns of employment adjustment best. Thus, adjustment costs are not characterized by a symmetric quadratic structure as is usually assumed. Finally, with regard to the size of the adjustment costs, our findings indicate

<sup>5</sup> Two other papers that estimate a fully structural model on US data are Cooper et al. (2004) and Cooper and Willis (2004). Their analysis however relies on aggregate observations of employment and includes plant-level hours growth. This paper remains in the spirit of the dynamic labour adjustment literature and focuses on the adjustment in number of employees and not in hours, maintaining the common assumption that labour input into the production can be proxied by the number of employees. This is because hours data at the firm level are not available for Greece.

<sup>6</sup> The moments to be matched should capture the key features of the behaviour of employment adjustment at the firm level and identify the adjustment cost parameters. Details are given in Section 5.2.

<sup>7</sup> Precisely speaking, we assume and verify that the reason for slow adjustment (once expectations about shocks are accounted for) is the costs associated with altering the number of workers employed.

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