Research Policy 42 (2013) 823–830

Contents lists available at SciVerse ScienceDirect

Research Policy

journal homepage: www.elsevier.com/locate/respol

# Do R&D tax incentives lead to higher wages for R&D workers? Evidence from The Netherlands

Boris Lokshin[a,*], Pierre Mohnen[b]

[a] University of Maastricht, P.O. Box 616, 6200 MD, Maastricht, The Netherlands
[b] University of Maastricht, UNU-MERIT and CIRANO, P.O. Box 616, 6200 MD, Maastricht, The Netherlands

ARTICLE INFO

*Article history:*
Received 23 November 2010
Received in revised form 20 July 2012
Accepted 29 December 2012
Available online 14 February 2013

*JEL classification:*
O32
O38
H25
J30
C23

*Keywords:*
R&D wages
Tax incentives

ABSTRACT

This paper examines the impact of the Dutch R&D tax incentive scheme on the wages of R&D workers. We construct firm specific R&D tax credit rates that vary over time following variations in the Dutch R&D tax incentive program. Using instrumental variables we estimate a wage-sharing model with an unbalanced firm-level panel data covering the period 1997–2004. The elasticity of the R&D wage with respect to the fraction of the wage supported by the fiscal incentives scheme is estimated at 0.2 in the short run and 0.24 in the long run.



## 1. Introduction

Most OECD countries dedicate significant resources to support private R&D. Two main policy instruments are used for this: direct subsidies and tax incentives. R&D tax incentives seem to have gained in popularity recently. For instance, in 1996, 12 OECD countries offered R&D tax incentives, while in 2008 this number increased to 21 (OECD, 2009). This increase is partly due to the fact that the policy of fiscal incentives is more neutral compared to direct subsidies, in principle offering a tax relief to any eligible R&D expenditure.

The usefulness of R&D support programs in general has been traditionally challenged for two reasons: government supported R&D may crowd out private R&D funding or get dissipated in higher R&D wages instead of stimulating real private R&D spending. Many empirical studies have examined the first question and often concluded that there is some additionality, in the sense that firms increase their R&D spending by more than the money they get from government in support of R&D (see Arundel et al., 2008; David et al., 2000; Hall, 2002; Hall and Van Reenen, 2000 for reviews of empirical studies).

Surprisingly, the other key question, whether and to what extent government R&D support efforts dissipate into higher R&D wages as opposed to creating a R&D quantity effect, has remained largely unexplored. A number of papers on the effectiveness of R&D support programs have included a price effect in their analysis (e.g., Aerts, 2008; Lelarge, 2009; Haegeland and Møen, 2007; Wolff and Reinthaler, 2008), but most of these studies are concerned with direct R&D subsidies and not R&D fiscal incentives. Studies in labor economics have examined the effect of firm and employee characteristics on wages in general (e.g., Dobbelaere, 2004; Veugelers, 1989) but not specifically on the wages of R&D workers.

The contribution of this paper is to examine the magnitude of the effect of the Dutch R&D tax incentive program, known as WBSO,[1] on the wages of R&D workers. By studying the price effect of the R&D fiscal incentive program, we seek to contribute to the policy discussion on the effectiveness of R&D support. We borrow from the stream of literature in labor economics to inform us on the specification of the wage equation. In our empirical analysis we use an

[1] WBSO stands for "Wet Bevordering Speur en Ontwikkelingswerk", in full "Wet Vermindering Afdracht Loonbelasting en Premie Volksverzekering, Onderdeel Speur- en Ontwikkelingswerk" (see de Jong and Verhoeven (2007)), which translating literally means "Law for lowering wage taxes and social security contributions related to R&D activities". This Research and Development (R&D) Tax Credit Act provides fiscal incentives for companies, knowledge centers and self-employed persons who perform R&D work.

* Corresponding author. Tel.: +31 43 3883551.
*E-mail addresses:* b.lokshin@maastrichtuniversity.nl (B. Lokshin), p.mohnen@maastrichtuniversity.nl (P. Mohnen).

0048-7333/$ – see front matter © 2013 Elsevier B.V. All rights reserved.
http://dx.doi.org/10.1016/j.respol.2012.12.004

unbalanced firm-level panel dataset constructed from the annual R&D surveys and production statistics from the Central Bureau of Statistics of the Netherlands. The richness of the merged dataset allows us to construct detailed R&D tax disbursement as a function of R&D tax incentives, providing sufficient variation in both the cross-section and time dimensions to identify the effects of the tax incentive program on R&D wages.

Our main empirical finding is that there is a significant price effect of the R&D tax incentive program on the wages of R&D workers in Dutch firms. After allowing for individual heterogeneity, business cycle fluctuations and the endogeneity of R&D tax credits we obtain estimates of the elasticity of R&D wages with respect to tax disbursements that are significantly different from zero. The point estimates of this elasticity range from 19% to 24% depending on whether static or dynamic models, short-run or long-run estimates are considered.

The remainder of the paper is organized as follows. Section 2 provides an overview of the theoretical and empirical literature on wage determination and government R&D support. Section 3 lays out our empirical model relating wages to R&D tax incentives, describes our data set and explains how we constructed the variables used in the empirical analysis. Section 4 presents the empirical results and Section 5 summarizes and concludes.

## 2. Previous literature

In this section, we briefly review the empirical literature on wage determination and the one on R&D government support. Empirical studies on the effectiveness of direct and indirect R&D support aim at finding out whether firms substitute private R&D financing by direct aid or tax support, i.e. whether there is additionality or crowding out. The literature largely abstracted from the question of how much of the additional R&D is due to a volume effect and how much is due to a wage effect.

Empirical studies that examine the price effects of government support programs are still scant. Wolff and Reinthaler (2008) on a panel of 15 OECD countries, Ali-Yrkkö (2005) for Finland, Üçdoğruk (2004) for Turkey, and Aerts (2008) for Flanders find evidence of a positive effect of direct R&D subsidies on R&D wages. As Aerts (2008) argues, this wage effect could be the result of an inelastic supply of R&D employees or the result of a skill upgrading, skilled workers earning higher wages than unskilled workers. The wage effect could even be higher for tax incentives that are based on R&D labor costs (as in the Netherlands), if firms try to maximize on R&D tax credits. Lelarge (2009) concludes for France that the Young Innovative Firms Program (JEI, "Jeunes Entreprises Innovantes"), which consists in payroll tax cuts for R&D workers in newly created SMEs, has a six times larger effect on wages than the conventional R&D tax credits. She explains this finding by the fact that young firms are more dynamic than other R&D-performing firms, and use these payroll tax rebates to retain their high-skilled researchers.

Goolsbee (1997) is the first to have examined the price effects of tax incentives but in the context of physical capital investment. He argues that the low price elasticities of physical investment that are often found in empirical research can be explained by the fact that the short-run increased investment induced by tax incentives is mainly due to increases in the price of capital goods rather than to increases in the quantity of investment. According to his estimates a 10% investment tax credit can increase the price of equipment by as much as 3.5–7% in the short run. The inelastic supply of R&D workers, which increases their leverage in negotiated wage settlements, suggests that the wage effect of government R&D support can also be substantial. Goolsbee (1998) has shown that these R&D wage effects are sizable. Using Current Population Survey data he estimates that a 10% increase in total federal R&D expenditure leads to a 3% increase in the wages of R&D workers in the US. He concludes that the price effects limit the efficacy of government intervention to stimulate private R&D in the United States. Romer (2000) argues that the US should worry about the supply of scientists and engineers rather than merely creating more demand for R&D, for instance by granting R&D tax credits. He illustrates why the supply elasticity to rising wages for scientists and engineers is not very high and therefore why the increased R&D expenditure resulting from demand shifters for R&D may increase R&D wages and not just the volume of R&D.

Marey and Borghans (2000) apply a co-integration analysis using sectoral data for the Netherlands and report an average elasticity of R&D wages with respect to total R&D expenditures of 0.52 in the short run and 0.38 in the long run. Haegeland and Møen (2007) estimate on Norwegian firm data that per Euro of R&D tax credit 33 Eurocent go into higher average wages for R&D personnel and that the wage effect is characteristic of SMEs.

The empirical literature on wage determination in labor economics argues that wages are at least in part determined by the sharing in rents generated by efficiency wages, the employer's ability to pay, features of the product market, trade liberalization and technological innovations (e.g., Abowd and Lemieux, 1993; Blanchflower et al., 1996; Hildreth and Oswald, 1997; Krueger and Summers, 1988; Van Reenen, 1996; Veugelers, 1989). Assuming risk-neutral preferences on the part of the employees, a version of the following reduced-form equation for the real wage rate $W$ is usually estimated:

$$W = f(R, \beta, \bar{w}, \mathbf{Z}) \quad \partial f/\partial R > 0, \partial f/\partial \bar{w} > 0, \quad 0 \le \beta \le 1, \tag{1}$$

where $R$ is a measure of rents to be shared, $\bar{w}$ is the alternative wage, Z is the vector of controls, and parameter $\beta$ ($0 \le \beta \le 1$) is the 'sharing' parameter to be estimated. It measures the fraction of the rent that accrues to workers in addition to their opportunity wage. If $\beta = 0$ the entire rent accrues to the firm. If, on the contrary, $\beta > 0$ 'sharing in rents' occurs that increases the wages.[2]

Previous studies have considered different measures of rents, such as profits per employee (Arai, 2003; Blanchflower et al., 1996), value added per employee (Dobbelaere, 2004), and Tobin's Q (Salinger, 1984; Van Reenen, 1996). Parameter $\beta$, as explained, can be considered as a constant to be estimated, but it can also be made heterogeneous and modeled to depend on variables such as sectoral unemployment rates, the price index, proxies for product market concentration (e.g., Dobbelaere, 2004; Veugelers, 1989). Van Reenen (1996) attributes rents to firms' innovation output and R&D input.

In summary, the literature on R&D support acknowledges that part of the effect of R&D government programs may get dissipated in R&D wages. However, the empirical evidence on the magnitude of the wage effect is still scant. In what follows, we explain how we quantify the wage effect of an R&D tax incentive program. The literature on wage determination provides a useful modeling framework to estimate the magnitude of the wage effect.

## 3. Model and data

Our hypothesis is that the R&D tax credits received from government partly accrues to R&D workers in the form of higher wages. There are various ways to justify such a price effect. Firms may share the R&D tax credits with their R&D personnel by offering higher wages to encourage their R&D department to apply for R&D tax credits. It may also reflect imperfections in the labor market for scientists and engineers, an inelastic supply on that market, the

[2] If $\beta = 1$ the worker would choose to set the wage rate equal to $R/L$, assuming the latter to be higher than the alternative wage.