Investment and Taxation in Germany - Evidence from Firm-Level Panel Data *Discussion*

Bronwyn H. Hall

Nuffield College, Oxford University; University of California at Berkeley; and the National Bureau of Economic Research

1 Introduction

Several different factors have come together to make the topic of this conference, "Investing Today for the World of Tomorrow," a timely one for any developed economy, and particularly for Germany. Among them are increased global competition, a seemingly rapid pace of technological change, especially in information-based and network industries, and, in Germany, the need to absorb and restructure industrial firms in the former DDR. All of these factors imply an accelerated need for investments both to replace aging plant and equipment and in order to redirect activities from those subject to competition from regions with lower labor costs to those that are highly knowledge-intensive and more likely to support the relatively high wages that are the norm in developed countries. Fear that industry will not undertake the investment necessary to provide adequate job growth has frequently led governments to "subsidize" investment spending via the tax code.

In this paper, Harhoff and Ramb make an important contribution to our understanding of the magnitude and the extent of firm responses to the investment incentives put in place by the German government over the past ten years or so. In addition, they use their estimated investment equation to forecast the effects of some recent changes to the German tax law, in particular those introduced in the 2001 tax reform law.

Although the questions of interest here are aggregate or macro-economic in nature, being concerned with increasing investment across the economy, it is essential to base an analysis of the incentive effects of tax changes on data obtained at the level of the decision-maker and tax-paying unit, which in this case is the firm. At this level it is possible to use a behavioral economic model to describe the investment decision, and it is also possible to take account of the fact that firms are very heterogeneous both in their tax positions and in their investment needs and goals, rather than relying on "representative" firm behavior.

The authors are to be complemented on their efforts to obtain a dataset with very wide coverage, both with respect to sectors and to firm size, and for using estimation strategies that control both for permanent unobserved differences across firms, and for simultaneity in the choice of investment level, output level, and tax rate (which affects the cost of capital). The paper also provides a very useful discussion of the features of the German tax law as it affects business investment and incorporates these features in a tax-adjusted cost of capital based on the King-Fullerton methodology.

Because the authors have a much larger range of sizes and types of firms than previous studies using data from Germany and other European countries and because they are able to construct and use a firm-specific cost of capital, their results differ somewhat from those earlier results.[1] Sorting out which of these is the main cause of differences remains a topic for future research.

In this comment I first make some remarks about the econometric difficulties and results, and then discuss the tax policy experiment.

2 Econometrics

The authors present results for a distributed lag model of investment (ADL) using two panel data fixed effect estimators (Ordinary Least Squares with firm effects, either differenced or within, and Generalized Method of Moments on differenced data). Both of these estimators allow for permanent unobserved differences across firms, but only the second allows for endogeneity or simultaneity of the right hand side variables with the error term (unexpected or unexplained investment). This simultaneity can arise because output, cash flow, and some determinants of the cost of capital (in particular, the firm's tax position or depreciation rates) are chosen simultaneously with the investment level.

Given this discussion of the difference between OLS and GMM, it is instructive to compare the results in Tables 5 and 6 of the paper. First, there is relatively little difference between the "Within" and "First Differences" OLS estimates, which suggests that the bias arising from transitory measurement error in the right hand side variables is rather small. Second, the main difference between the OLS and GMM estimates is in the coefficient of the cost of capital, which is about 33 percent lower in the GMM results. The implication is that the simultaneity between investment and the cost of capital is fairly substantial, but that it probably

[1] For studies using large firms from Germany, France, Belgium, the United Kingdom, and the United States, and without a cost of capital, besides Bond, Harhoff, and van Reenen (1999), cited in this paper, see Bond et al (1997), Mairesse, Hall, and Mulkay (1999), and Mulkay, Hall, and Mairesse (this volume).

arises from the fact that firms respond fairly quickly to falls in the cost of capital (because unforecastable changes in the cost of capital are associated with investment in the same way as forecastable changes). Simultaneity due to the choice of tax parameters is less likely to be a transitory phenomenon that can be addressed by this type of instrumental variable estimation, except for that which arises through the choice of new equity financing for the investment, and this feedback effect has the opposite sign from that which was found.

The authors also present results for an error-correcting version of their distributed lag model (ECM). As Mairesse, Hall, and Mulkay (1999) discuss, the ADL and the ECM versions of the investment equation, although superficially alike, have very different dynamic properties. The differenced ADL removes all information about levels of investment, output, and prices from consideration, and treats the firm effect as representing differences in the growth rates of capital and output. The ECM retains information about the levels of capital and output and the firm effects correspond to different capital-output ratios for different firms. Thus the ECM is able to describe the long run equilibrium from shocks to output or the cost of capital, while the ADL is primarily suitable for measuring a quasi-short run elasticity of investment with respect to the cost of capital. Although possibly less informative, it is also less restrictive (since in effect, it has been differenced one additional time).

Because the ECM is conceptually a somewhat better model that is able to deliver long run as well as short run behavior, it is useful to compare its results to those from the ADL. Table 7 shows that these results differ somewhat from those obtained for large firms in Germany and OECD economies by previous authors (including one of the present authors). The most important differences are that the lagged dependent variable has a positive coefficient (which is theoretically unattractive), that output growth enters negatively rather than positively, and that the error-correcting term has a very small estimated coefficient. For example, Bond, Harhoff, and van Reenen (1999) obtain –0.085 (0.055) for this coefficient using data on approximately 200 large German firms, whereas the coefficient estimate here is –0.028 (0.013).[2] Because of these somewhat unsatisfactory results, the authors focus on the ADL estimates in performing their tax reform scenario computations.

As mentioned earlier, it is unclear whether these differences arise because the cost of capital is included in the equation or because the sample is much larger and includes many smaller firms. Based on the estimates, I hypothesize that most of the explanation is the latter. The positive coefficient on lagged investment, the negative coefficient on output (unlike estimates using larger firms, which usually

[2] Other estimates in the literature are –0.141 (0.052) for the UK (Bond, Harhoff, and van Reenen 1999), -0.091 (0.061) for the United States, and –0.109 (0.034) for France (Mulkay, Hall, and Mairesse, this volume).

are nearly constant returns), and the limited error-correction behavior all suggest that these firms have a variety of growth paths and are not yet in a stable equilibrium. This would explain why the ADL specification, which allows for firm-specific growth rates, is somewhat more satisfactory than the ECM, which does not. It also suggests that a richer model of investment that incorporates differences across sectors or firms sizes might be appropriate and informative. I hope that in future work, the authors will be able to undertake this.

3 Cost of Capital and Tax Reform

To understand how changes in the tax system impact the cost of capital in the Harhoff-Ramb framework, it is useful to look more closely at equations (2.1) and (2.6), taking into account the features of the tax system that they use. Taking the logarithm of the user cost variable, we obtain the following expression:

$$\log J_{it} = \log p_{jt} + \log (1-A_{it}) + \log (\rho_t'+\delta_{jt}^{e}) - \log (1-\tau_t^{re})$$

where j denotes sector specific variables, i denotes firm specific variables, and I have suppressed to source of finance subscript f. From Table 2, we can see that, except for the cost to institutional investors of issuing new equity, the required rate of return for internal finance is simply r, and for external finance, r times $(1-\tau^{cr})$.

The main impacts of the tax system in this equation are therefore threefold: 1) A_{it} (the depreciation allowances available), τ_t^{re} (the tax rate on retained profits including business tax), and τ_t^{cr} (the tax rate on retained profits). Reductions in the latter two rates have offsetting effects: the required rate of return for new debt and/or equity increases, but the pre-tax cost required to get a given post-tax return decreases (the last term in J). The latter effect will dominate in the cost of capital formula because the first is mediated by the interest rate (which is small).

However, the effect of reducing depreciation allowances is direct and increases the cost of capital. Harhoff and Ramb find that the proposed changes in the 2001 Act are dominated by this term and that the overall cost of capital may therefore increase. To this one might add that it is possible that economic depreciation (δ^e) may be increasing over time, at least for equipment investment, because of rapid technological change in the equipment sector, which implies that the cost of capital may also be increasing for this reason. A second look at the design of depreciation allowances may be desirable for both these reasons.

References

Bond, S. R., J. A. Elston, J. Mairesse, and B. Mulkay. 1997. Financial Factors and Investment in Belgium, France, Germany, and the UK: A Comparison Using Company Panel Data. National Bureau of Economic Research, Working Paper No. 5900.

Mairesse, J., B. H. Hall and B. Mulkay. 1999. Firm-Level Investment in France and the United States: An Exploration of What We Have Learned in Twenty Years. *Annales d'Economie et de Statistiques* 55-56, pp. 27-67.

Mulkay, B., B. H. Hall and J. Mairesse. 2000. Investment and R&D in France and the United States. This volume.