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The impact of the 2008 German corporate tax reform: A dynamic CGE analysis

Doina Radulescu [a,b,c,1], Michael Stimmelmayr [a,b,*]

[a] Center for Economic Studies, University of Munich, Schackstr. 4, 80539 Munich, Germany
[b] CESifo, Germany
[c] ETH Zurich, Weinbergstr. 35, 8092 Zurich, Switzerland

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ABSTRACT

In this paper we develop the dynamic CGE model, *ifo*Mod, which is designed to analyse the impact of fundamental tax reforms and in particular capital income tax reforms for Germany. The model is in line with neoclassical growth theory and features all important behavioural interactions between the four major building blocks of an economy including the firm and household sector, the government and the rest of the world. We consider firms of different legal forms which all face an intertemporal investment problem, a financing problem w.r.t. the optimal choice of debt and equity financing as well as a factor input problem when deciding on the optimal amount of different skill types of labour employed. We show the impact of different types of taxes on the behavioural margins of firms and households. The conducted simulation shows the impact of the latest German corporate tax reform of 2008 on the German macroeconomic variables such as investments, GDP, consumption and household's welfare.

1. Introduction

The effects of a comprehensive tax reform are manifold. Beside the more obvious first order effects economy-wide repercussions and second-order effects have to be considered, too, such that it has become a difficult task to evaluate and quantify the impact of comprehensive tax reforms. In this regard, computable general equilibrium (CGE) models have proved to be a straightforward instrument to assess the quantitative impact and relative efficiency of alternative tax instruments as well as the distributional, fiscal and allocative effects of various tax reform proposals.

Computable general equilibrium models are these days widely applied in various fields of economics and policy advice. The theoretical underpinning of CGE modelling has its seed in the Walrasian equilibrium (Walras, 1877) theory as well as the modern conception of the general equilibrium theory à la Arrow and Debreu (1954). The first numerical approaches in solving Arrow–Debreu general equilibrium system were pioneered by Scarf (1967) and his scholars Shoven and Whalley (1972, 1973) in the 1970s. The more recent CGE models have, however, advanced remarkably since then. Nowadays CGE models are marked by a high degree of complexity with regard to both the specification of the behavioural features of economic agents as well as sector and factor market linkages. These complex systems of quantitative linkages enable us to analyse not just the qualitative but also quantitative implications of comprehensive policy reforms. In detail, CGE models are built to shed light on the short and long-term repercussions of issues such as international trade agreements, like the Doha Trade Round, environmental issues such as climatic changes and the impact of pollution permits, scenarios of imperfect competition or public finance issues, i.e. pension funding in ageing societies or comprehensive tax reforms with dynamic features.[2]

In this paper we develop the dynamic CGE model, *ifo*Mod, which is designed to analyse the impact of fundamental tax reforms and in particular capital income tax reforms for Germany. Our model is in line with neoclassical growth theory and features all important behavioural interactions between the four major building blocks of an economy including the firm and household sector, the government and the rest of the world. In detail, we consider firms of two different legal forms, e.g. corporate and non-corporate firms which differ with regard to their tax treatment. Both types of firms face an intertemporal investment problem, a financing decision problem w.r.t. the optimal choice of debt and equity financing as well as the factor input problem when deciding on the optimal amount of different skill types of labour employed. The marginal investment is assumed to be partly debt and

* Corresponding author. Tel.: +49 89 2180 2087.
E-mail addresses: Radulescu@kof.ethz.ch (D. Radulescu), Stimmelmayr@lmu.de (M. Stimmelmayr).
[1] Tel.: +41 44 632 9334.

[2] One drawback of CGE models refer to their strict dependence on the functional forms considered and parameter values applied. These kinds of critique, however, applies to other forms of economic tools, as well and in particular to econometric models (Fossati and Wiegard, 2002).

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partly equity financed via new share issues and retained earnings, such that our model combines the 'Old View' and 'New View' of dividend taxation — even though the model is strongly biased towards the 'New View'.[3] This is the case, since the lion's share of investment funds stems from retained earnings.

On the household side, we apply the traditional Ramsey model (Ramsey, 1928) which, due to its dynastic linkage between generations, enables us to conduct a coherent welfare analysis for any kind of reform.[4] Our representative agent is endowed with three different skill types of labour and maximizes her life-time utility by choosing the optimal intertemporal pattern of consumption and optimal labour supply of each skill type. In addition, the agent has to solve a portfolio choice problem since *ifo*Mod features four different types of assets encompassing firm equity, firm bonds as well as domestic and foreign government bonds.

The government introduces various distortions on the behavioural margins of agents through taxation. In total, we consider seven different types of taxes including a corporate tax, a tax on profits of non-corporate firms (which is identical to the personal income tax of the firm proprietor), a tax on labour income as well as personal taxes on capital income such as interest income, dividends and capital gains (such that the taxation of the financial assets follows the residence principle of taxation). Finally, we also consider a value added tax (VAT). The governments's actions are restricted by the *European Stability and Growth Pact* which limits the government's budget deficit to 3% of GDP and the level of government debt to 60% of GDP. Last but not least, the Rest of the World (RoW) is modelled as a foreign economy which is about ten times larger than the home economy. Therefore, our framework can be regarded as a two country setting with little influential power of the home country. The foreign economy is, however, only roughly modelled and serves merely to complete the general equilibrium framework.

Altogether, the model mimics every important behavioural margin at the firm and household level that is strongly sensitive to the effects of capital income taxation. Furthermore, the model does not only compute the economy's new steady state solution under the new tax rules as it is the case in any static analysis. Since our model is a fully dynamic, micro based macro model it additionally accounts for the behavioural reactions of agents and features the whole path of equilibria from the initial to the final steady state equilibrium. This is in particular important for the savings and investment decisions which are by nature forward looking and thus are marked by important tax capitalization effects. For instance, each single change in any capital income tax triggers an adjustment in the firm's financial behaviour, like a reshuffle of the firm's source of finance and use of funds, which in turn influences the resulting cost of capital and therewith the firm's investment decision and its accumulation of capital. The capital intensity of each representative firm affects the demand for the different skill types of labour and thus has a major repercussion on household income and consumption. In addition, our model offers information on the marginal excess burden of each particular tax considered. The conducted welfare analysis is based on the equivalent variation.[5]

*ifo*Mod was appreciated by the German Council of Economic Advisors (GCEA, 2005) as being "a state-of-the-art model and one of the most developed and advanced CGE models of the type which can be used to simulate capital income tax reforms for Germany. It has a sound theoretical foundation such that one can also draw on the underlying core economic model to explain the simulation results." The model was also applied to quantify the complex effects of introducing a Dual Income Tax in Germany for the GCEA (2006).

Among comparable CGE models which are predominantly dedicated to tax analyses in European economies we can count the model by Fehr (1999), Keuschnigg (2004) and Dietz and Keuschnigg (2003, 2004, 2007) and Sørensen (2001) for example. The model by Fehr (1999) uses a dynamic simulation model of the Auerbach and Kotlikoff (1987) type featuring intragenerational heterogeneity. The focus of this model is on distributional and efficiency aspects of different fiscal reform packages including proposals to reform the German pension system. The *IFF Tax Model* is also a dynamic CGE model developed by Keuschnigg (2004) and Dietz and Keuschnigg (2003, 2004, 2007) and was built to evaluate fundamental tax reforms for the Swiss economy. Finally, OECDTAX, developed by Sørensen (2001), is intended to describe the international cross-border effects resulting from national tax policies via the world capital market as well as international tax coordination within the OECD countries.[6]

The present paper is structured as follows: the first part introduces the model with a detailed description of its four building blocks. Within this section, special attention is paid to the financing and investment decision of the different firm types. The second part presents the simulation analysis conducted which focuses on the latest German corporate tax reform which became effective as of the 1st of January 2008.

2. The Model

2.1. Production and Investments

The most important building block of our model is the intertemporal investment model with convex adjustment costs in the spirit of Tobin's (1969) *Q-Theory* of investments.

Both the corporate and the non-corporate sector draw on a basic neoclassical, linearly homogenous *Constant Elasticity of Substitution* (CES) production technology, $F(\cdot)$ to produce a uniform, tradeable output good, Y. The price of the output good is normalized to one and the firms in each sector are distinguished by the superscript $f \in \{C, N\}$.

$$\begin{aligned} Y^f &= F(\overline{L}^f, K^f, E^f) \\ &= A^f \left[d^f \overline{L}^{f,-\frac{1-\sigma}{\sigma}} + (1-d^f) K^{f,-\frac{1-\sigma}{\sigma}} + E^{f,-\frac{1-\sigma}{\sigma}} \right]^{\frac{-\sigma}{1-\sigma}} \end{aligned} \tag{1}$$

$$\text{with} \qquad F(0) = 0;\ F' > 0;\ F'' < 0.$$

Labour, $\overline{L}$, capital, K, and a sector specific fixed factor, E, serve as input factors.[7] The elasticity of substitution between input factors is denoted by σ while d denotes a preference parameter.

The variable, $\overline{L}$, resembles a labour composite in the form of a CES preference function consisting of low-, L_l, medium-, L_m, and high-skilled labour, L_h. The optimal composition of the different labour skill

[3] A focal issue in the literature is whether investments are financed by new equity issues or retrained earnings at the margin. The former is referred to as the Old View of dividend taxation, while the latter is referred to as the New View of dividend taxation. The New View was first published by King (1974, 1977), Auerbach (1979) and Bradford (1981). See e.g. Sinn (1991a) for an illustration of the two views.

[4] Contrary to that, in an overlapping generations (OLG) framework which is also frequently applied in CGE modelling, new generations virtually 'drop from heaven' and it is unclear how to account for their welfare gain or loss resulting from policy reforms.

[5] A detailed discussion of the model is found in Radulescu (2007) or Stimmelmayr (2007).

[6] The model considers a detailed private portfolio composition, foreign direct and foreign portfolio investments, a housing market, endogenous corporate financial policies as well as a labour market with structural unemployment. This richness of details implies, however, that one has to cut back somewhere else on the modelling side such that OECDTAX is static describing only a stationary long-run equilibrium.

[7] The fixed factor can be interpreted as a sector specific rent which assures the existence of some firms in the corporate and non-corporate sector even if the tax system heavily discriminates against one of these two legal forms.